Paris School of Economics

Master Thesis Dissertation

Public Debt And Its Unequalizing Effects.

Explorations from the British Experience in the Nineteenth century

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Abstract

This master thesis argues that public debt may cause non-negligible income transfers between social classes in a closed economy where public debt is not uniformly held in the population, and where debt interests are financed using a non-progressive tax system. I illustrate this with the example of Great Britain in the ninteenth century. Indeed, after one century of accumulation of public debt, used to finance the wars, public debt amounted to more than two years of national income in Great Britain after the Battle of Waterloo. Then, the stock of public debt has been stabilised in nominal terms and large interest charges have been paid during the whole nineteenth century. Because of the observed concentration of wealth, I argue that public debt was held by a minority of wealthy creditors, whereas interest charges were financed by a tax system essentially based on consumption taxes. In comparison to a sovereign default in 1820 (or equivalently, to an *ad hoc* wealth tax), and using a pure dynastic model to generate saving rates by classes and income distribution, I argue that public debt interests may have caused a transfer from working and middle classes (the bottom 90% of income) equivalent to 2,2% of the annual income of the mean household, which benefited to a a wealthy class (the top 1% of income), adding around 5% to the mean household's annual income of that class. In other words, the mean household of the bottom 90% of income has worked during slightly less than 2 years (in 80 years) to pay interest charges to the top 1% of income. This transfer has been partly saved by capitalists, therefore contributing slightly to the increase in total private wealth that is observable during the century.

—— The public debt becomes on of the most powerful levers of primitive accumulation. As with the stroke of an enchanter's wand, it endows barren money with the power of breeding and thus turns it into capital, without the necessity of its exposing itself to the troubles and risks inseparable from its employment in industry or even in usury. [...] Modern fiscality, whose pivot is formed by taxes on the most necessary means of subsistence (thereby increasing their price) [...] exercices [a] destructive influence on the condition of the wage labourer [...] [and] forcible expropriation [...] of peasants, artisans, and in a word, all elements of the lower middle class.

Karl Marx, *Capital*, Vol. 1, Chapter 31

1 Introduction

The current levels of public debt, especially in European countries, are legitime causes of concern, especially since the tensions on international markets in 2011. However, the treatment of this highly important question can be regarded as unsatisfactory. More precisely, only two questions arise in the political and economic debate. First, can large levels of public debt (with respect to GDP) be sustained? Second, does public debt have an impact on the economic activity? Moreover, the answers to those questions are however more often implicitly assumed than demonstrated: large public debt can become quickly unsustainable, and public debt may possibly harm growth. The misuse of Reinhart and Rogoff's (2010)[1] study, by politicians, essayists or even economists, may be viewed as a symptom the automaticity of the answers to such questions. The corollary of such answers being that public debt should be reduced as fast as possible and by all means (i.e. cutting government spendings and/or augmenting taxes) - with all the negative social and economic consequences we observe in Europe today - one may expect a serious treatment of this subject.

Thus, the following research tries to adopt a different perspective about the question of public debt. The contribution of this research aims to be twofold.

Firstly, by studying the striking case of Great Britain in the nineteenth century, this research tries to explain how large levels of public debt could historically be sustained. Indeed, after one century of public debt accumulation, public debt amounted at the end of the 1810s (after the Battle of Waterloo) to more than 250% of GDP. How did Great Britain pay its debt without defaulting? In 1900, the debt/GDP ratio had diminished to 30% of GDP. How did this ratio decrease? This research tries to provide a synthetic view of the history of public debt during the eighteenth and nineteenth centuries: how debt was created, how it reached the exceptional level - with respect to the historical record - of more than 250% of GDP, and how this ratio decreased after.

[1] i.e. the use of a correlation - as stated by Reinhart and Rogoff before it was argued that their results were dubious - as an "evidence" of a threshold upon which public debt may become growth harming

Secondly, we focus on the *unequalizing* consequences of this large public debt, by building a counterfactual scenario - in which the State would have defaulted on its entire debt in 1820.

What this research underlines is that the payment of large interest charges on previously accumulated public debt in the particular case of Britain was not simply an *effort* equally distributed in the society, but has constituted a non-negligible transfer from popular classes (working and middle classes) to dominant classes, who owned public debt. Public debt - in a closed economy - may have had unequalizing[2] ("antiredistributive") effects, i.e. transferring money from the poor to the rich classes. Thus, we will try to quantify the "antiredistributive" transfer from poor classes to rich classes that public debt may have constituted. As will be exposed below, the magnitude of the transfer depends on several assumptions - because of a lack of existing data about the British economy in the nineteenth century.

The main result of this "counterfactual history" is that the inherited public debt in 1820 may have had a non-negligible effect on public on total income inequality between classes: public debt may have represented a transfer of 2,2% of the mean household's annual income of the bottom 90% of income distribution to the top 1%. In the top 1%, the mean household would have gained - in turn - around 5% of its income by holding public debt. During the years 1820-1840, when debt charges were still very high in proportion of GDP, and when taxation seems to have been quite regressive, the transfer may have amounted to 10% of annual income of the mean household for the top 1%. Looking at different scenarios - especially, if debt holding had been less concentrated - leads to smaller but non-negligible effects: 1,3% of taken from the annual income of the mean household of the bottom 90%, which would have benefited to the P90-P99 class (1,75% of the mean household's income) and to the top 1% (0,85%).

This master thesis is organized as follows. Section 2 sets our work in the state of the existing literature on public debt, public finance in history, political economy and macroeconomics. Section 3 is a synthesis of the history of public finance in Great Britain and in the United Kingdom in the 18th and 19th centuries. Section 4 presents our estimation strategy (especially the assumptions we have been obliged to make - dealing with a lack of data for the century) and the results obtained. Section 5 presents directions for future research and section 6 concludes.

[2]One has to keep in mind that I interpret the term "inequality" in a pure economic way - by considering only that a situation is more unequal if different groups have different resources. Thus, I will not consider in this study how public debt may have had effects upon "inequality of chances", "inequality of capabilities" or other - very interesting - concepts of what *inequality* means. Inequality is taken in its simplest sense

2 Related Literature

2.1 Literature on the history of public debt

Many useful informations about public debt can be found in the existing literature.

First, contemporaries (classical economists) have largely written about public debt. A. Smith devotes the last pages of his *Wealth of Nations* (1776) to the question of public debt - especially to the debt issued during the War of American Independence. The *Essay on the Funding System* (1820) by Ricardo is also a very useful piece of information about the history of public debt, and about the state of economical debates at the time[3]. Other (numerous) works (including Malthus, Hamilton, McCulloch, Mill) are presented in Section 4.

More recently, the work by E.L. Hargreaves - an Oxford professor - *National Debt* (1930) provides a useful synthesis of public debt in Britain from early times until the 1930s. However, in order to gather more details about the *birth* of public debt, the seminal book by P.G.M. Dickson, *The Financial Revolution in Britain* (1967) is certainly - even 50 years after its publication - the most detailed study we could find about this subject. This "Financial Revolution" has inspired many comments - especially about the role of institutions on the development of public debt: the well-known article by North and Weingast (1989) underlines that the control of the Executive by the Legislative after the "Glorious Revolution" of 1688 was a major cause in the rise of the *credibility* of the State. However, as Sussman and Yafeh (2006) have argued, these potential "institutional" effects have taken time, so that the "pure" impact of institutions on the development of public credit might be somewhat dubious.

Another useful and well-known study is the study of the links between the wars and public debt (more generally, between wars and public finance) in Britain, written by J. Brewer (*Sinews of Power* (1990)). One may also mention the book by James MacDonald, *A Free Nation Deep in Debt* (2006).

Especially, MacDonald provides an interesting view on the famous episode of the South Sea Bubble of 1720. Another specific episode interesting to study is the method by which the British State financed the highly expensive wars with France at the end of the eigtheenth century. O'Brien (2008) details this episode and provides a useful explanation of a striking fact: the continuation of a system in order to redeem public debt (i.e. to buy it on the secondary market back), while the State was borrowing on a large scale on the other side.

Lastly, one study by Chamley (2011) has studied in details the mechanisms of reduction of interest rates on public debt during the eigtheenth century, by explaining why the attempt of

[3]For details about Ricardo's views about public debt, see N. Churchman, *Ricardo on Public Debt* (2001)

conversion of debt from 4 to 3% failed in 1737, but succeeded ten years later.

2.2 Literature on the history of public revenue

The History of Public Revenue in Britain has also been treated many historians and economists.

For the eigtheenth century, one has surely to mention the works by Mathias and O'Brien (1976) and O'Brien (1988) who have shown that Britain was heavily taxed - in comparison to other European countries (especially France) but that this system was well-organized so that it provoked less resentment than in other countries (again, esp. France). Again, Brewer (1990) also analyzes the system of taxation in Britain in that period and compares it to other tax systems (France, Netherlands...)

For the nineteenth century, the book by M. Daunton, *Trusting Leviathan* (2001) clearly describes how the "Leviathan" (i.e. the fiscal-military State) had been "retrenched" after the Napoleonic Wars, i.e. how public revenue decreased from 20% of national income after Waterloo to less than 10% at the end of the century. Daunton especially provides useful informations about the state of political and intellectual debate of that time.

Finally, Mitchell and Deane's *Abstract of British Historical Statistics* (1962) provides data about the amounts of several direct taxes and indirect taxes for the whole nineteenth century, by compiling primary sources (especially British Parliamentary Papers). However, especially for consumption duties, Mitchell and Deane do not provide detailed amounts of the kinds of goods which were taxes. To differentiate between different types of goods, the study of S. Dowell, *A History of Taxation and Taxes in England* (1888) was certainly useful, but only provides detailed amounts of different taxes for several years.[4]

2.3 Literature about wealth inequality in Great Britain

Wealth inequality in Britain has been a vast subject of research, especially since the 1980s. Primary sources are to find in the "Social Tables", i.e. imperfect studies by different authors who tried to gather informations about the wealth of different classes. Such studies include the work by Colquhoun (1815) for 1801-3, D. Baxter (1868) for 1867. The social tables have been harmonized by Lindert (1986, 1987) and Lindert and Williamson (1983a, 1983b)[5]. Data about wealth inequality at the beginning of the century have been collected by Atkinson and Harrison

[4]Essentially because of a lack of time, I could not use directly British Parliementary Papers to find, year by year, how consumption duties could hit different social classes, but there is little doubt that such data could be collected

[5]Especially, one can note that Lindert provide all the data he has collected on his webpage, http://lindert.econ.ucdavis.edu/data-and-estimates

(1978). Existing data about wealth inequality in Britain have been synthesized by Lindert (2000) and by Waldenström (2009). Finally, Piketty (2013) have made some adjustments about Lindert's data, in order to find orders of magnitude which are more comparable with other European countries.

Data about *national* wealth have been widely and extensively collected by Piketty and Zucman (2014), who provide a very useful database for our estimates about national wealth and national income, and about their evolution (and many other informations, which are not at the heart of our study).

2.4 Earnings Inequality and the Standard of Living Debate

This research has also been inspired by the Standard of Living Debate, which took place mainly during the 1980s and the 1990s. Two questions were at the center of this debate. Did British capitalism increase inequality between lower and higher classes? Did the *absolute* standard of living of workers decrease?

These issues has been widely commented as soon as in Marx (1867), Engels (1845), who found that capitalism in Britain led to an unequal development. The debate over the condition of the working class has been re-opened by Hobsbawm (1957) who found an *absolute* decrease in the standard of living of the working classes - essentially due to pressure on wages, and to urbanization, which lead to a deterioration of the quality of life. In the following decade, Soltow's "maintained hypothesis" (1968) claimed in turn that inequality has remained roughly constant during the nineteenth century.

Exploiting the data collected in the "Social Tables", the debate has really been relaunched by Lindert and Williamson (1983), who found that inequality of income had increased during the first stage of industrialization (from 1750 until the 1860s) but had decreased after. However, the real wage had increased - "even doubled" (i.e. increased by 84%) - between 1820 and 1850, essentially because the cost of living had decreased. This "optimist" thesis has however been challenged. For example, the cost of living index has been - in turn - widely criticzed by N.F.R Crafts (1984), who found an increase in real wages of 62% between 1819 and 1851. The debate went further with the publication of the book by J. Williamson, *Did British Capitalism breed inequality?* (1985), which defended the "optimist" position: income inequality increased during the first stage of the industrialiation, but decreased after. However, C. Feinstein (1988) has challenged the data used by Williamson - especially showing that the observed movements in inequalities were due to a very small number of professions (such as barristers) and that excluding these occupations lead to different (quite opposite) conclusions.

The lack of data has led many authors to use "proxies" for measuring the standard of living. Joel Mokyr (1988) found - for example - that per capita consumption of sugar, tea, and tobacco did not rise during the century. According to him, since those goods were widely consumed by the rich and not by the poor, this stability showed that the standard of living of working classes did not improve during the century. Height has also been used to measure the improvement of standard of living, exhibiting reverse trends in comparison with Lindert and Williamson's series (height was increasing while real wages were supposed to decline, and declining while real wages were supposed to increase) (Floud *et. al.* (1990)). Mortality rates have also been studied (Szreter and Mooney (1998)), exhibiting a "sharp deteriotation".

Finally, micro data at the household level have been collected by Horrell (1996) and Horrell and Humphries (1992), and seem to confirm the increasing trend in the standard of leaving - however depending on Lindert and Williamson's index of cost of living. Instead, generating a different cost of living index has lead Feinstein (1998) to find a slightly increasing trend in real earnings during the century.

Therefore - essentially due to the lack of data - the debate is not closed.

More recently (2009), R. Allen has made an interesting attempt to build a model explaining what he calls "Engel's pause", i.e. a pause in real wages between 1760 and 1840, and why real wages grew with the rest of the economy after 1840: according to Allen, the increase in productivity growth due to technological progress has led to a rise in inequality, i.e. to a rise in the share of profit in national income, which, in turn, has increased savings and investment and allowed output to growth, in turn, increasing real wages (following roughly a "balanced growth path").

2.5 Literature about the dynamics of wealth and income inequality

The dynamics of wealth and income inequality also constitute a vast field of study. A simple version of a dynastic model - i.e. a "fixed" model of income inequality - has been used in this research. This model have essentially been built in opposition to the Modigliani life-cycle model of inequality (where income inequality simply arises from differences of position in the lifecycle). However, a vast literature on income inequality has led to consider "intermediary" models, introducing random shocks, such as primogeniture shock (Stiglitz, 1969), family size (Cowell, 1988), or shocks on productivity. Nirei (2009) for example, shows that any random multiplicative shock leads to a distribution of wealth following a Pareto distribution for upper tails. Those "random-shocks" models are interesting intermediary points between totally fixed

models of inequalities (i.e. on one side, the lifecycle model where inequality is only a question of age, and on the other side, the dynastic model where inequality is only determined by birth).

2.6 Literature about the links of public debt and inequality

Contrarily to the nineteenth century, the links between public debt and inequality have not been widely studied in the modern macroeconomy. Williamson (1985) only mentions the possible link in his study of the crowding-out due to public debt, since debt has transferred money from low-saving classes to high-saving classes. One recent study - by Bilbiie *et. al.* (2013) - shows however in a heterogeneous agent model (due to borrowing constraints), that public debt can have redistributive effects, depending if prices are flexible (in that case, Ricardian equivalence globally holds) or sticky (in that case, public debt may have redistributive effects, benefitting to borrowing constrained classes. In that model - with sticky prices - public debt (used to finance tax cuts) has redistributive effects, as well as expansionary effects for the whole economy.

To my knowledge, even macroeconomics with heterogenous agents (*à la* Aiyagari and McGrattan (1998)) do not clearly take the redistributive issue of public debt into account - but explore the effects of public debt on *global* welfare (including effects of welfare due to redistribution). However, Mankiw (2000) shows that public debt may have unequalizing effects in a simple "savers/spenders" model (with only one category of agents saving), especially since - with a stabilised Debt/GDP ratio in steady state - distortionary taxation reduces the real interest rate, hence reducing the private capital (crowding out effect), marginal productivity of labor and therefore real wage.

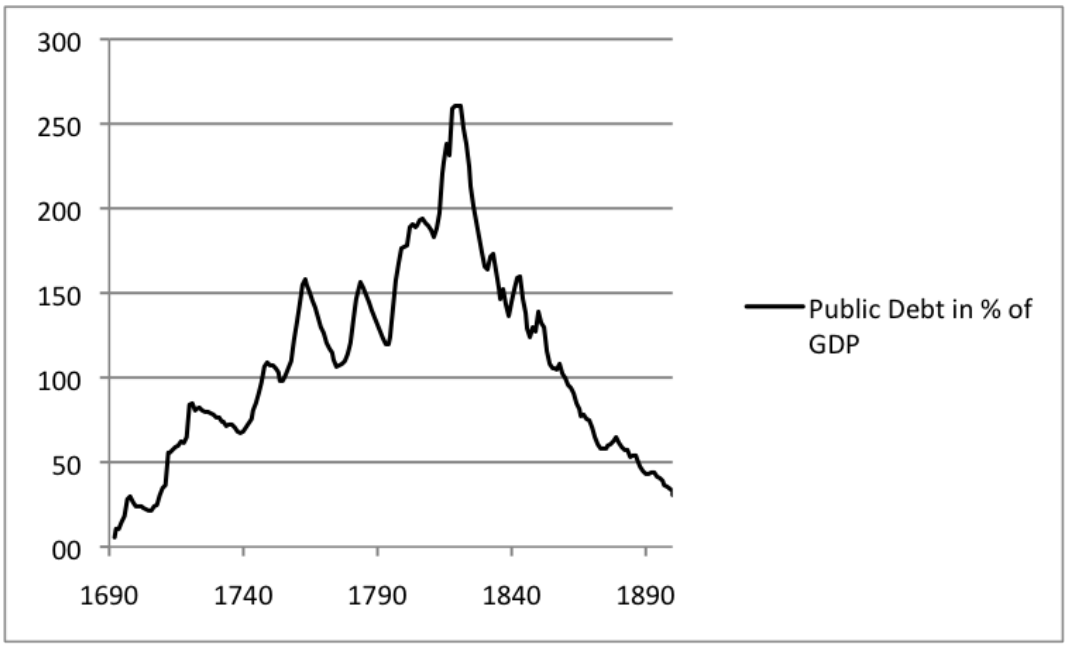
Therefore, our "dynastic" model - which is certainly a simplified view of the reality - should be considered as a first attempt to deal with these issues, in opposite to a pure representative-agent model. However, the reality is certainly something in between, and introducing random-shocks instead of "fixed" dynasties would certainly be an improvement of this analysis.

3 Historical Background: Public Debt in Britain during the 18th and 19th centuries

– *"A British Chancellor of the Exchequer might well feel himself to be engaged in a Sisyphean labour."* E.L. Hargreaves, *The National Debt* (1930)

This section describes the evolution of public debt during the eighteenth and nineteenth

Figure 1: Public Debt in % of GDP, 1692-1900



Source: Reinhart and Rogoff (2009), *This Time is Different* Database

century, showed on Figure 1[6] above[7].

As shown in greater detail below, public debt is entirely linked to wars, hence financing unproductive spendings.

"Public" debt appeared during the 1690s - during the War of the League of Augsburg (1688-1697). Then, public debt been has been gradually accumulated during the whole eighteenth century along with the successive wars: the War of Spanish Succession (1701-1714), the War of Austrian Succession (1740-48), the Seven Years War (1756-63). Finally, the explosion of public debt occurred during the War of American Independence (1775-1783) and - above all - during the Wars with France (the War against Revolutionary France from 1793 to 1802 and with Napoleon from 1803 to 1815).

After the wars of the eighteenth century, public debt has been stabilised in nominal terms - hence decreasing in terms of national income. One can mention the last increase of public debt (in nominal terms) during the Crimean War (1853-1856). Finally, at the end of the century only, public debt has been reduced in nominal terms - especially since fears were expressed about the

[6]The sources of Reinhart and Rogoff are the following: Nominal Stock of Debt is to find in Mitchell and Deane, *Abstract of British Historical Statistics*. Historical sources for GDP are not really indicated by Reinhart and Rogoff and certainly come from ukpublicspending.co.uk. However, taking other sources for GDP would globally show the same trend of increase in terms of GDP until 1815 and decrease after

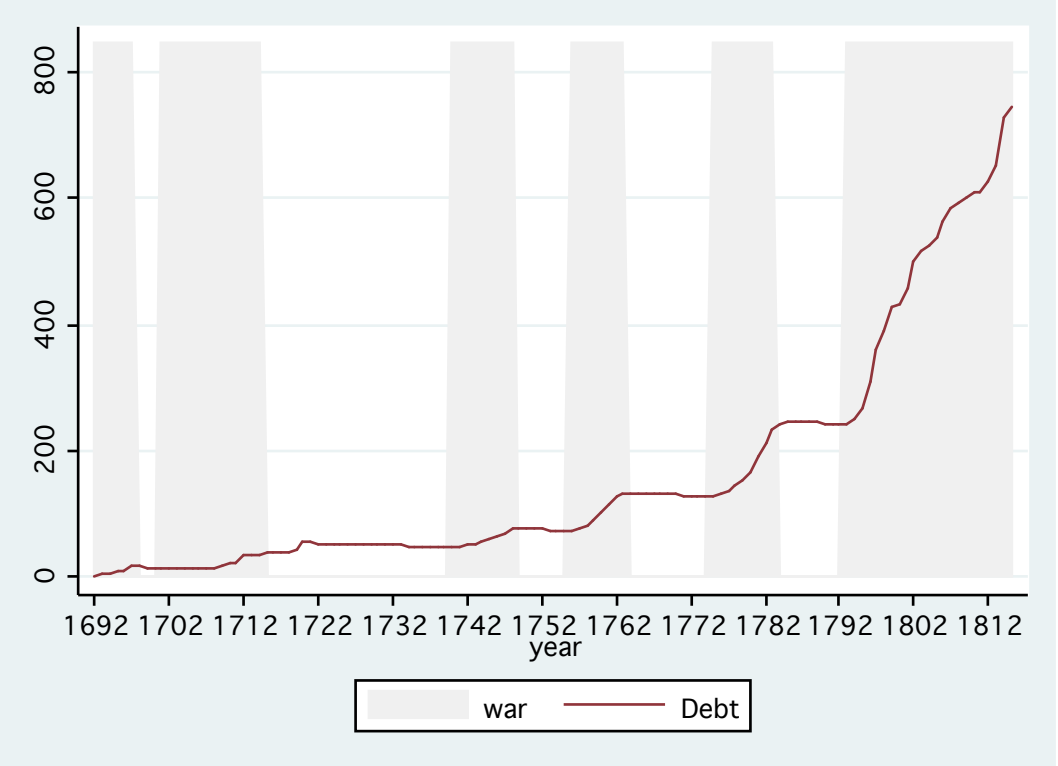
[7]Once the following introductory summary has been read, the details of the history of public debt are not necessary *per se* for the main point of our study, i.e. the impact of the public debt about inequalities from 1820 on. However, I have decided to include this section here since determining *why* public debt in Britain was actually used and how it was managed, was an important part of my research. Moreover, this section provides - I think - a useful synthetic view of this episode

durability of wealth in Britain. Therefore, to claim that Britain reimbursed its debt during the nineteenth century is not exact: debt diminished in nominal amount at the end of the century only, and was not certainly not fully repaid (the total stock did not decrease to zero). However, in terms of national income, public debt gradually decreased since national income increased a lot. In fact, the history of public debt - as will be exposed below - is also the history of the failure of successive plans to reduce the nominal size of the public debt.

3.1 From the "Glorious Revolution" to the end of the Napoleonic Wars: the Birth, The Rise and the Explosion of Public Debt

3.1.1 General Overview, 1692-1815

Figure 2: Public Debt in Nominal Amount, 1692-1815 (in current £ millions)



Source: Mitchell and Deane (1962), *Abstract of British Historical Statistics*, pp. 401-403

Figure 2 below illustrates the general evolution of public debt in nominal terms from its birth to its peak in 1815[8]. As this graph indicates, public debt grew along with wars (represented by shaded areas). This is due to the fact that the State has bigger and immediate financial needs during wars, which can only be met by public debt, whereas - since the State never defaulted on its debt - its credibility was also growing during the eigtheenth century. Thus, public borrowing

[8]in reality, the peak was attained just after the war - in 1816 - because of tax relief immediately after the war

was necessary and possible during wars. On the contrary, this figure also shows that wars were followed by periods of stabilisation or even of reduction of the size of the debt[9].

Before going into the details of this increasing trend, some distinctions and definitions for our whole study are worth to notice.

Some useful definitions (1): Funded vs. Unfunded Debt Two distinctions are worth noting about public debt. The first one is the distinction between short-term ("unfunded") and long-term ("funded") debt. *Unfunded* - or floating[10] - debt is the part of debt which is issued in anticipation of a tax. The different instruments of unfunded debt were at that time Exchequer Bills, Tallies, and Navy, Transport and Victualling Bills. The majority of unfunded debt was indeed issued to finance the military emergency spendings. *Funded* (or consolidated) debt was on the contrary a long-term debt, with defined taxes to finance the *interest charges* (hence, the word "funded", since each loan had a "fund" attached to finance the interst charges).

Some useful definitions (2): Forms of Funded Debt - Tontines, Lotteries, Self-expiring Annuities, Perpetual Annuities. Lastly, we recall the main instruments for the issuance of funded debt. During the first years of the system of public credit, "Tontines" and lotteries were largely used.

A Tontine (denominated after the name of its founder, the Neapolitan banker Lorenzo Tonti) is a scheme, in which the participants receive interest payments in proportion of their initial investment, but also of the number of participants alive. When a stockholder died, his (or her) share was divided amongst the survivors, until the last one. Thus, a Tontine was attractive for investors, who could invest a relatively small sum and gain large dividends or interest payments if they were among the last survivors. The first long-term loan in 1692-1693 was floated using a tontine.

Lotteries (where some tickets gained particularly high sums of money) were also highly appreciated at the time: lotteries responded to a general taste for gambling, since large sums could be gained by holding funded debt.

As the State became credible, "normal" forms of funded debt became prominent[11]: either

[9] One could wonder why we do not talk only about volume estimates - i.e. deflating our estimates. This is because - until the end of the century - the value of money did not move because of the Gold Standard, so that inflation was low. Moreover, while looking at the debates at the time, I have remarked that amounts were always expressed in current pounds, because this had a clear signification to the contemporaries because of the stability of the currency

[10] The terms are not directly equivalent, but this distinction does not clearly matters for our purpose and is more technical than economical

[11] However, *douceurs* were still used during the century

self-expiring annuities (i.e. life annuities[12] or annuities for terms of years), or perpetual annuities.

Perpetual annuities were bonds, which beared a regular interest until the State had reimbursed the principal. Those kinds of annuities - which became quickly the main instrument of funded debt - could be redeemed by the State at its discretion, whereas investors could not claim for reimbursement (bonds could however sell the bond on the secondary market).

Now that such definitions have been made, we turn to the details of the history of public debt in Britain.

3.1.2 The Birth of Public Debt in three phases: 1693-1756

First phase: from floating debt to funded debt, 1693-1710.

Shortly after the Stop of the Exchequer of 1672 (the last default on debt in history of Great Britain, under the reign of Charles II), it was not easy for the new political regime (after the Glorious Revolution of 1688) to build a credible funding system in Britain. The first long-term loan was successfully floated in 1692 (using a Tontine).

Since the State was engaged in a costly War - the War of the League of Augsburg - the supply of public bonds was rather inelastic. On the other side, investors demanded a large risk premium, so that interest rates were large (in mean, superior to 8%). Because of those unfavorable terms for the State, and since loans were mostly short-term loans, the State had some difficulties to reimburse them. For example, in 1697, the State needed the help of the newly created Bank of England to postpone the repayment of short-term loans. Long-term loans, such as the "Malt lottery" of April 1697 when only 1,763 on 140,000 tickets were sold according to Dickson (1967, Table 2 p. 48-49), were also difficult to float. Thus - according to Dickson's study of the *Financial Revolution in Britain* (1967) (i.e. of the birth of a long-term borrowing system), only one tenth of the total war expenditures between 1688 and 1702 were financed through long-term loans (£7 millions upon £72m). Some loans, such as the lotteries in February and March 1694, were even floated 14% interest rates. On the contrary, short-term loans (bearing also high interest rates) were more widely used to finance emergency spendings only.

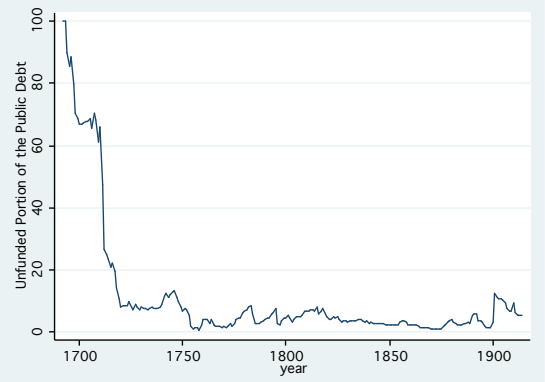
After the peace of 1697, and after the first approximations of the system, long-term loans became however easier to float. "Institutional" effects (such as stated by North and Weingast (1989)) may have played a role, but - at least in practice - the creations of the Bank of England (1694) and of the East India Company (1698) were highly important. A bit later, the establishment of the well-known South Sea Company (1711) closed the triptych of the funding system

[12]Life annuities could however be set on other people's head: this is the famous example of the "Trente Demoiselles de Genève": annuities on the head of thirty young ladies, reputed to be biologically stronger

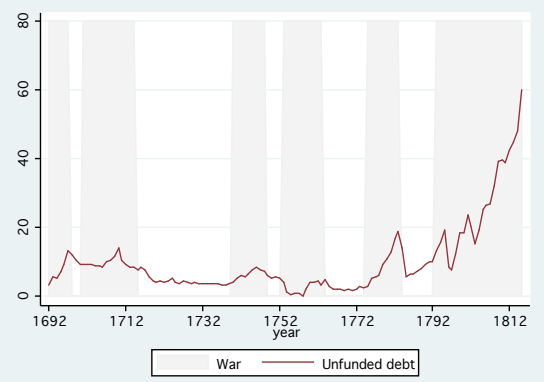
through *monied companies*. These monied companies received some privilege at the time of their creation (banking privilege for the Bank of England, trading privileges for the trading companies), in exchange of the money they lent to the State. For this purpose, the Bank of England had been created in 1694 after a loan of £1,2 millions - receiving a perpetual annuity of £100,000 (8%)- reimbursable from 1706 on, and had the privilege of creation of money. In 1698, the New East India Company was created, lending £2m to the State (at 8%) and receiving privileges on the trade with India.

These companies were largely trusted by investors, so that the system of borrowing *through* monied companies began to be implemented. The mechanism was the following: those companies lent to the State by augmenting their capital, and the creditors (the holders of short-term loans) were proposed to be incorporated into the capital of those companies. The dissentients could be reimbursed but - in general - the majority of creditors accepted the offer since they could have a claim on profits of the company, which was a strong incentive to accept the offer. On the other side, the company (or the Bank) received a perpetual annuity from the State. Therefore, this system was indeed a sort of securitization mechanism. Using those *monied comanies*, the *structure* of public debt was modified in the 1700s (see Fig. 19a). Floating debt was reduced both in absolute and relative terms during the 1700s, whereas funded debt grew in parallel. The system was achieved by the creation of the South Sea Company in 1711[13], whose capital amounted to £9,2m.

Figure 3: Unfunded debt in the 18th century



(a) Share (in %) of unfunded debt in total public debt



(b) Nominal amount of unfunded debt, 1692-1815, in £m

Source: Mitchell and Deane, *op. cit.*, pp. 401-403

This securitization system was certainly - as Dickson explains - a key element in the development of the funding system. Without such a system, the State "would have been obliged

[13]At the time of the creation of the South Sea Company, the interest rate had raised to 9% - Dickson (*op. cit.*, p. 63)

to promise repayment in a limited number of years - and to keep this promise. This would have effectually stopped it from borrowing on the scale it needed"(Dickson, *op. cit.*, p. 457). Thus, the cost of borrowing decreased for the State. The "Glorious Revolution" of 1688, and the establishment of a constitutional monarchy have certainly played a role in the lessening of the borrowing constraints of the State - as North and Weingast (1989) have argued (i.e. fiscal policy was now in the hands of Parliament, and the Sovereign had no incentive to default since he would face the risk of a Revolution). However, the details of the history of public debt shows that the credibility of the State did not arise just after the installation of new institutions - time was necessary (as Sussman and Yafeh (2006) have argued), and intermediary institutions such as the system of borrowing through monied companies were highly important.

All in all, the debt was successfully *funded* during the 1700s: in 1714, just after the Peace of Utrecht after the War of Spanish Succession (1713), floating debt amounted to only 23% of total public debt. However, short-term debt did not disappear in nominal amount - especially during wars (Figure 19b). Moreover, a substantial part of the debt - not borrowed to *monied companies* was still constituted by life annuities or annuities for terms of years. This was in large part due to the fear of the State to be stuck into a system of "perpetual" debt, instead of relying on a "self-expiring" scheme, and to the fact that creditors wanted to hold a annuity for a fixed number of years (or for life), which was the guaranteee of a sure revenue during numerous years.

Thus, in 1714, slightly less than one third of the total funded debt was constituted by self-expiring annuities (£12,5m out of total of £40,3m). Another 39% (£15,75m) were due to the monied companies. The mean interest rate [14] had decreased and stood now around 6% - i.e. a rate comparable to the maximum usury rate on the private market.

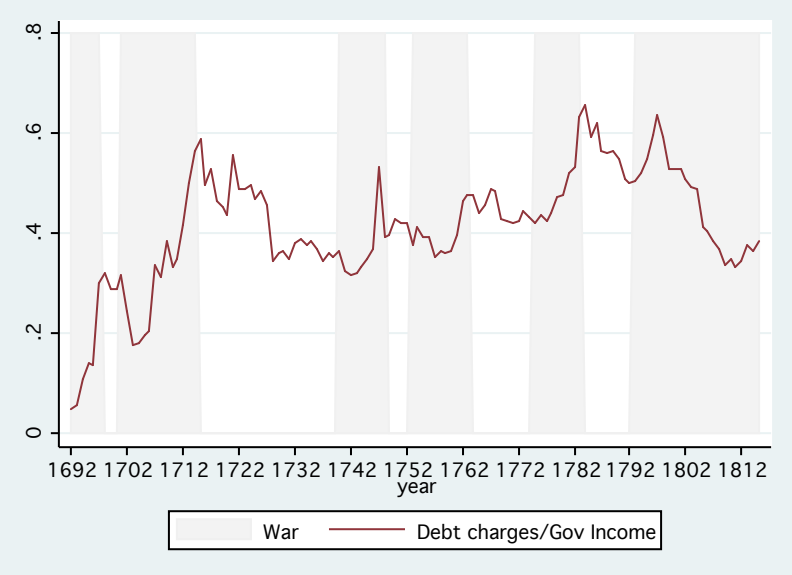
Second phase: the rise of perpetual annuities (1710-1721) - First conversions of public debt to lower denominations - The South Sea Scheme (and its failure).

During and shortly after the War of Spanish Succession (1701-1714), short-term public debt was succesfully transformed into long-term loans: the State gained in credibility, the creditors trusted it, and the system of intermediaries of monied companies offered incentives to creditors to accept that their short-term loans were transformed into long-term loans. However, the system of raising money by long-term loans was not fully satisfactory at that time, since interest rates were still relatively high, and since interest payments represented more than 50% of the total

[14] calculated by dividing the annual debt charges by the total stock of debt

income of the State (Fig. 4[15]). This was especially due to former loans (dating from the 1690s), which the State could not reimburse until their expiration date, and which were still paid at 8 or 9% (or even at higher rates).

Figure 4: Total interest payments in proportion of Government Net Income, 1692-1815



Source: Mitchell and Deane, *op. cit.*, pp. 386-391. I just divided total interest charges by Government Net Income to obtain the Figure above

There was only one way to decrease the interest rate on some long-term loans without defaulting: if conditions were favorable for the State (i.e., if on the secondary market, the price of bonds were above the par), and if debt could be reimbursed ("redeemed"), the State could reimburse that debt (or only threat the creditors to do so) and could borrow after at a lower denomination. The best way to do so was to use perpetual annuities (recall that such annuities could be reimbursed at the discretion of the State). With perpetual annuities, the State could therefore benefit from reductions in the interest rate demanded by the creditors, i.e. if the interest rate on the secondary market (the coupon relatively to the price) was sufficiently low. If the threat was credible, creditors could fear a further reduction on interest rate on the secondary market - and hence, could accept the offer of the State. There were possibly multiple equilibria (Chamley, 2011), depending on the coordination of expectations of the creditors: if everybody thought that the other creditors would accept the offer, then everybody accepted the offer, and if everybody thought that other creditors would reject the offer, then the offer was rejected.

However, in 1710, since a large part of titles were self-expiring annuities, the State could only partly benefit from a possible reduction in the interest rate on such annuities since such bonds were not redeemable. Thus, two simultaneous operations occurred during the 1710s: the

[15]see also J. Brewer, *Sinews of power, p. 122*

transformation of "Irredeemables" into "Redeemables" (i.e. self-expiring annuities into perpetual annuities), and the *conversion* of "redeemables" into titles of lower denomination.

Moreover, the usury law of 1714 had reduced the upper limit of interest to 5% on the private funds market. The consequence was that public debt was highly demanded by investors - since the interest rate was still large - so that the price of debt was high. Therefore, the existing "Redeemables" were converted by Sir Robert Walpole (Chancellor of the Exchequer) in 1717, who passed three Conversion Acts.

The first Act converted the lotteries of 1711-12 and other annuities (the "Bankers' Annuities") to a 5% denomination. Creditors who did not accept the offer were reimbursed - so that this conversion operation was not a default. Moreover, a "Sinking Fund" was created by Walpole. This fund[16] was indeed financed through the money gained from conversion operations, and should be integrally devoted to the redemption of redeemable stocks. Thus, the more debt the fund would redeem, the more the price of bonds would increase, so that larger and larger sums could be saved by converting existing stocks into stocks of lower denomination.

The two other Acts converted the debt owed to the South Sea Company and to the Bank of England. Arrangements were complex and do not need to be detailed. To sum up, the interest rate was also reduced to 5% on debt owed to the Bank. The South Sea Company had also obtained a stability of the rate during five years (i.e. the guarantee that no further conversion would be made).

All in all, Walpole's conversion Acts of 1717 reduced the size of the floating debt, and the annual interest payments by about 13% (£325,876), whereas a Sinking Fund had been established to reimburse the debt. These operations had been successful: investors felt that the principal was more secure than ever[17], and interest payments were reduced for the State (Figure 4).

However, the large part of the debt constituted by "Irredeemables" could not be converted into a stock of lower denomination, since, by definition, it was "irredeemable". Since creditors were well aware that if they accepted to convert their life annuities or annuities for terms of year[18] into perpetual ones, they would be exposed to the risk of conversion. Thus, the State had to give them incentives to do so.

Again, the State used the *monied companies*. The newly created South Sea Company, (created in 1711 for the consolidation of short-term Navy and Ordnance bills), which received now

[16]This fund was constituted by the surplus of the three funds upon which interests were charged: the South Sea Fund, the Aggregate Fund and the General Fund, as explained by Ricardo (1820)

[17]Sir James Bateman, Governor of the Bank of England, told to Lord Stanhope, the Chancellor of the Exchequer, that "he was glad that this resolution had been taken; because tho' his interest diminished, [he] should think [his] principal [was] more secure than ever", quoted in Dickson, *op. cit.*, p. 87

[18]7% Annuities should expire between 1702 and 1807, and 9% should expire in 1742

an annuity of 6%, was also promised to a great future after having received a trading privilege claimed to be similar to the privilege of the East India Company, but on the trade with South America (arising from the Treaty of Utrecht of 1713). In reality, instead of large ships full of slaves, one ship only was effectively sent to the South Seas (MacDonald, 2006, pp. 205-219).

A first pilot plan was rather successfully enterprised in 1719-20, where £1,8m[19] were added to the capital of the South Sea Company. The largest part of the plan was however implemented after a long political battle with the Bank of England in 1820 (see, for example, MacDonald, 2006, *loc. cit.*), gained by the South Sea Company [20]. The South Sea Act of June 1720 entitled the South Sea Company to convert Irredeemables to Redeemables by increasing its capital. After that conversion, the Company would receive a 5% perpetual annuity which had to decrease to 4% in 1727. The former annuitants would now be stockholders of the powerful Company. Interestingly, the Scheme[21] was designed to avoid a zero-sum game: everybody should gain from that scheme. First, the Company's shareholders, since for each converted (from Irredeemable to Redeemable) pound, the Company was allowed to add two pounds to its capital. The Company could sell directly those additional titles on the market - at the market price (hence, the Company had an incentive for the market price to increase). Second, annuitants (creditors of the State) gained from itbecause of the expected fantastic profits promised by the South Sea trade[22]. Finally, the State gained from it by reducing the total interest payments.

The maximum amount that could be converted into South Sea stock was about £15,5m: life annuities and annuities for terms of years, but also - thus outside the initial framework - some perpetual annuities. The operation was a great success: £14m out of those £15,5m were converted (according to Hargreaves (1930), p. 29). The total public debt due to the South Sea Company amounted now to £37,8m (including debt owed before 1720), i.e. a total charge of £1,86m for the State. Moreover, the Company - in rivalry with the Bank of England - planned to float one million Exchequer Bills (short-term debt) for seven years.

However, the terms of the operation were far too advantageous for the Company's stockholders - since for each pound converted, one additional pound could be sold. Thus, a speculative bubble (the famous "South Sea Bubble") occurred in 1720-21, during which the price of the stock rose from £128 to £950 on the secondary market. After the burst of the bubble, a large part of stockholders were ruined, and the State was accused to be corrupted[23], so that the State's

[19] out of a total attempt of £2,5m

[20] After an intense lobbying - with suspicions of corruption, and the offer of paying £7,5m against the "privilege of making an offer the the State creditors"

[21] also inspired by the Mississipi Scheme, i.e. the "Système de Law"

[22] Even if the Trade was considerably reduced by the Madrid Treaty as soon as 1713

[23] From the Bubble, it followed a dissolution of the Parliament in 1721, the emprisonment of the Director of the Company, John Blunt

credibility needed a long time to recover from this episode.

However - purely regarding to the public finances - the operation had permitted to transform 80% of the "Irredeemables" into Redeemables, upon which interest was reduced to 4% in 1727. Paradoxically, the failure of the South Sea Scheme, even if it had had political and economic consequences during the 1720s, was after all a good operation for public finances.

Third phase: After the South Sea Bubble (1720-21), recovery and development of the funding system, until the final Consolidation of 1752

The collapse of the South Sea Scheme was however a serious handicap for the credibility of the State. The 1720s and the subsequent decades were therefore devoted to the recovery of the system - and to its final installation by the "Great Consolidation" of 1752.

First, the system had to recover from the failure of the South Sea Scheme. Sir Robert Walpole - Chancellor of the Exchequer from 1721 to 1742 - played a major role in this initiative. He firstly aimed to reduce the size of the capital of the South Sea Company. In 1724, the capital had decreased from £37,5 to £34m (by converting around £4m of South Sea Stocks into Bank of England's property titles). Finally, in 1723, the capital of the Company was divided in two equal parts: the "South Sea Annuities" (bearing fixed interests- and the "Trading Capital", which also paid dividends on the trading activity of the Company. However - as it was largely expectable from the beginning[24] - the trading activity of the Company decreased gradually so that the importance of the "trading capital" decreased until the 1750s.

Moreover, the nominal stock of public debt was slightly reduced during the 1720s (by about £2,6m), using the newly instituted "Sinking Fund" of 1717. The reduction of the debt continued during the 1730s (until 1738), since the total size of the debt diminished by £6,5m between 1728 and 1738. Under Walpole (Chancellor of the Exchequer and "Prime Minister" from 1721 to 1742), the size of the debt decreased by around £6,2m (i.e. 11% of the debt in 1720)[25]. The system of the Sinking Fund was efficient since creditors did not want to be reimbursed, now that the risk of default was very low, so that they were disposed to accept further reduction of interest rates. Walpole wrote in 1735: "The Sinking Fund was now grown to a great maturity, and produced annually by about £1,2m and was become almost a Terror to all the individual Proprietors of the Publick Debt" (*Some Considerations Concerning the Publick Funds, the Publick Revenues, and the Annual Supplies Granted by Parliament*, p. 56)[26]. However, the attempt of conversion

[24]since there was no real possible trade with South America

[25]Dickson, *op. cit.*, p. 209, Table 23

[26]One has to remark that creditors did not want to be reimbursed! Since public debt beared a regular and rather high interest, they had no interest in being reimbursed

of debt to 3% titles in 1737 (following a proposition by Sir J. Barnard) was a failure (Chamley (2011) shows that the coordination of expectations explains the failure of that operation).

However, since the size public debt had diminished, some politicians advocated for a reorientation of the Fund towards tax relief since taxation was heavily felt in Britain (see Mathias and O'Brien, (1976) and O'Brien (1988) for general descriptions of the tax system in Britain). Thus, in 1730, salt taxes were repealed, directly lowering the resources available for the Sinking Fund. Those taxes were however reintroduced two years later - but to fund newly issued debt (i.e. interest payments derived from these taxes). In 1733, Walpole needed £500,000 to pay the interest (after having reduced the Land Tax from 20% to 5%) and decided to take the sum from the Sinking Fund. In 1734, £1,2m were again taken from the Fund. Thus, the Sinking Fund was gradually diverted from its initial use: now, part of the fund was used as an ordinary budgetary resource. Some loans were even charged upon the Sinking Fund itself.

Hence, the redemption policy was not abandoned in the mid-1730s, but this policy was no more automatic. Since the Sinking Fund was no other obligation than a "moral" obligation for a Chancellor, the temptation of "raiding the Fund" was high in bad times.

After the (relative) decrease of the size of public debt during the 1720s and 1730s, public debt increased again during the War of Austrian Succession (1740-1748), especially after 1744. According to Mitchell and Deane[27], between 1739 and 1743, public debt rose only from £47m to £53,5. But between 1744 and 1748, it rose to £76m. Moreover, public debt was issued (in mean) at a (small) discount: between 1744 and 1748 (at 1,04[28].

Shortly after the war, the new Chancellor of the Exchequer - Sir Henry Pelham - got involved in the reduction of debt charges and of the size of the debt. Above all, Pelham drew up a plan to reduce the interest rate from 4% to 3% in two years on the majority of debt (more than 80% of the total debt[29]). Pelham's plan was accepted by Parliament and by the King at the end of the year, and the negotiations began with the Bank of England and the other monied companies. Among others, Pelham received the help of Sir John Barnard in 1750[30] , who published the *Considerations on the Proposal for Reducing the Interest on the National Debt* (insisting on the fact that the reimbursed creditors would have difficulties to buy annuities again at the same denomination). The Bank of England finally accepted the plan, so that, in February 1750, £38,8m out of £57,7m could be converted into titles at 3,5% and 3% after one year. In May 1750, Pelham tried to convince the dissentients by offering an interest rate of 3,5% during five years (before the final reduction to 3%). The East India Company finally accepted on April 25th.

[27] *op. cit.*, p. 402

[28] i.e. the government owed in reality £1,04 for each £

[29] £57,7m out of a total of £70,4m

[30] Sir Barnard was an influent Member of Parliament who had proposed the conversion to 3%'s in 1737

At the end of May, only £7m still remained unconverted (essentially South Sea Annuities). 88% of the debt was gradually converted to 3% Annuities, reducing total interest payments by 12% directly, and by 23% from 1757 on.

The last step of Pelham's plan was to convert the remaining £7m, i.e. to convince the South Sea Company to accept the plan. Moreover, the Company had to accept two additional elements: the end of the trade with the New World (because of the new peace treaty with Spain), and the abandonment of the claims of reparation against Spain[31]. After numerous debates, the shareholders of the Company accepted those two proposals against £100,000, and a reduction of interest rate from 4 to 3% in 1757[32]. Thus, in 1750-1, the South Sea Company had been forced to stop what remained from its trading activity. The Company was now akin to a department of the Treasury.

Finally, the State borrowed at 3% (by a lottery and an subscription) to reimburse the £2,3m which were unsubscribed by South Sea annuitants during the conversion operation. The interests of this new "South Sea Stock" (created in 1751) were charged upond the Sinking Fund.

The last achievement of Pelham (before he died in 1754) was the "Great Consolidation" of 1752: before that date, existing public bonds were denominated in nine different sort of stocks (at 3%), six of them were managed by the Bank, and three were managed by the Exchequer. The "Consolidation" was indeed the creation of two different types of bonds: the "Reduced Threes" (i.e. the former titles at 4%, reduced to 3%) - sightly less than £18m - and the "Consols" (for the other bonds at 3%) - slightly more than £9m. The different funds upon which the interest payments of previous stocks were charged were now mergedinto the Sinking Fund - which became therefore a fund for interest payments, and not for debt redemption anymore.

The Consolidation of 1752 can therefore be seen as the final achievement of the institution of a credible and developed system of long-term borrowing, i.e. of the "Financial Revolution". During the first half of the eighteenth century, the structure of the public system had been transformed, and the system of public credit was now durably instituted. As we have stated, this processus has taken time - and was not an immediate consequence of the changing nature of the institutions (see Sussman and Yafey (2006) against North and Weingast (1989)), but much more of the system of borrowing through monied companies. Interestingly, the initial mission of the *monied companies* seemed now to come to the end: with the creation of Consols and of Reduced Threes, and after the failure of the South Sea Scheme, the system was gradually reoriented towards a system of direct subscriptions.

[31]The Company demanded £1,4m to Spain as war damages

[32]Hence, obtaining no intermediary reduction to 3,5%

3.1.3 Public Debt after 1756: the final explosion

The Seven Years War (1756-1763)

Since the size of public debt had increased a lot, war after war, during the first half of the century, and after, the nature of the problem had gradually changed. At the beginning of the century, or even in 1720, public debt was low rather in terms of national wealth (or national income). Before the War of Spanish Succession, public debt amounted to around 70% of GDP (according to our estimates). Now, on the eve of the Seven Years War, debt amounted to more than 100% of GDP. Therefore, a rapid reimbursement of the stock was not conceivable anymore: what mattered was to maintain a credible and not too expensive system of public credit - especially to be able to borrow in subsequent wars.

During the Seven Years War (1756-1763), £58m of new debt were succesfully issued[33], whereas the liabilities of the State increased by £59m (i.e. a 77% increase). Therefore, debt was issued roughly at par, and the mean interest rate in that period was around 3,2%. To obtain such low rates, the government used again lotteries (and even forbade private lotteries[34]). Long annuities (until 1860) were also added to some loans (especially after 1860), with parcimony (for example, in 1761, £12m were borrowed, with an annuity of £600,000 attached to it).

After the Seven Years War, public debt amounted to more than £120m. Again, in peacetime (between 1763 and 1775), £5,5m were reimbursed - now a negligible amount regarding the huge accumulated stock.

The American Independence War

The American Independence War (1775-1783) was a decisive episode in the final explosion of public debt. Contrarily to the Seven Years War, public borrowing was difficult and costly during that war: borrowing was often made below par (at a discount): according to E.L. Hargreaves[35], the sums lent to the State amounted to £92m during that war, but the volume of liabilities increased by £115m. This is because loans were largely issued using Consols or "Reduced Threes", i.e. using 3% perpetual annuities, which were below par at that time. The State widely used the method of joining additional annuities to issue loans - contrasting with the parcimony by which this method had been used during the Seven Years War. For example, in 1782, for a loan of £13,5m, each subscriber received £100 in Consols (at 3%) and £50 in 4% annuities for each

[33]See A. Hamilton (1814), *An Inquiry Concerning the National Debt.* We also find £58m augmentation in Mitchell and Deane, *op. cit.*, p. 402

[34]Hargreaves, *op. cit.*, p. 62

[35]*op. cit.*, p.

£100. Finally, short-term loans were also again widely used - again, contrasting with precedent wars of the mid-eighteenth century (Fig. 19b)

Financing the American Independence War was therefore particularly costly. At that time - also forced by the *monied men* who refused to borrow to 5% at par - the Prime Minister (Lord North) was much more concerned by the amount of annual charges than by the amount of the total stock. Therefore, Smith, devoting the last pages of his *Wealth of Nations* to public debt to the question of public debt, wrote that "The rulers of Great Britain have, for more than a century past, amused the people with the imagination that they possessed a great empire on the west side of the Atlantic. This empire, however, has hitherto existed in imagination only. It has hitherto been, not an empire, but the project of an empire; not a gold mine, but the project of a gold mine; a project which has cost, which continues to cost, and which, if pursued in the same way as it has been hitherto, is likely to cost, immense expense"[36]. He therefore recommanded that "Great Britain should free herself from the expense of defending those provinces in time of war, and of supporting any part of their civil or military establishment in time of peace; and endeavour to accommodate her future views and designs to the real mediocrity of her circumstances". About the costs of the American Independence War, about which he wrote in 1776, one can say that he was largely right.

The New Sinking Fund of 1786

After the end of the war, new efforts were again made to reduce the size of the national debt. The main innovation of that period was the renewal of the Sinking Fund in 1786 by William Pitt the Younger, who was Prime Minister since 1783.

Pitt's idea was to follow the principle of the "compound interest". He was influenced by an essayist of that time, the Dr R. Price (see Cone (1951)), who had published a *Treatise on Reversionary Payments* in 1771 or *An Appeal to The Public, on the Subject of the National Debt* in 1772. According to Price, the principle of the "compound interest" could allow to reimburse £100m of public debt in 40 years, with an initial Sinking Fund of £1m per year only, by adding each year the sums saved by debt redemption. This idea was not new: if savings on interest payments were used to back public debt on the secondary market, then the savings each year would follow a geometrical sum of reason equal to the interest rate. However, Price had a great influence at that time, and was a good writer, "showing" that the size of a Sinking Fund grew "naturally". For example, he wrote that "Money bearing compound interest increases at first

[36]Smith (1991), p. 598 in the French edition, p. 785 in an online edition, http://www2.hn.psu.edu/faculty/jmanis/adam-smith/wealth-nations.pdf

slowly. But, the rate of increase being continually accelerated, it becomes in some time so rapid, as to mock all the powers of the imagination. One penny, put out at our Saviour's birth to 5 per cent compound interest, would, before this time, have increased to a greater sum, than would be contained in a hundred and fifty millions of earths, all solid gold. But if put out to simple interest, it would, in the same time, have amounted to no more than seven shillings and four pence half-penny" [37].

Moreover, Price advocated for a conversion of public debt to an *upper* denomination (4 or 5%), because - according to his theories - the higher interest you paid, the faster you could reimburse the debt since larger sums could be saved for each pound of reimbursed debt.

Pitt did however not include this upper conversion in new plan of 1786 - directly inspired by Price's ideas[38]. In 1786, Pitt established a Sinking Fund, which resources came from an annual budgetary surplus of £1m[39]. Each year, £1m of debt could be reimbursed and the "compound interest" would allow the fund to grow to £4m per year in 1814 because of the sums which could be saved each year. Then, the fund should be stabilised and the savings should be devoted to tax reliefs.

However, the main problem of a Sinking Fund was that no Chancellor could be obliged to respect the "systematic" surplus of £1m per year: without any enforcement mechanism, a Chancellor could succumb to the temptation of "raiding the fund" - as in the 1730s. Pitt tried therefore by all possible means to bind the hands of future Chancellors or Prime Ministers. To this purpose, he created the body of "National Debt Commissioners"[40], who held the debt, received the £1m per year, and should rebuy the debt - according to the initial plan. However, to let the principle of compound interest play, those Commissioners would *not* cancel the public debt they would have bought, but would keep this public debt in their "portfolio" to receive the interest payments each year and hence to buy new debt. Pitt (quoted in Ricardo (1820)) thought that he had found - by this mean - a form of debt reduction plan, which was as close as possible to a *legal contract*, hence not depending on the political context: since Commissioners

[37]Richard Price, *An Appeal to the Public on the Subject of the National Debt*, 2nd ed., London, 1774, p. 19, quoted in Marx's *Capital*, Vol. III,; Part V, Chapter 24, found on https://www.marxists.org/archive/marx/works/1894-c3/ch24.htm#r1. Marx denounces the "fabulous fancies" of Price, which were largely believed at the time, even by *The Economist*

[38]According to Cone (1951), or to Hargreaves, *op. cit.*, p. 93, Pitt had asked Price to prepare three plans. The plan, which was preferred by Price, was plan I, i.e. a surplus of one million per year, augmented by savings on interest payments each year, and by the conversion of £60m of debt from 3 to 4%. New interests (£600,000) should have been paid with new taxes

[39]the actual surplus was around £900,000. To reach the £1m surplus, Pitt added taxes on spirits, powder, perfume

[40]constituted by the Chancellor of the Exchequer, the Governor and Deputy Governor of the Bank of England, the Speaker of the House of Commons, the Master of the Rolls, the Accountant General of the Court of Chancery

really held public debt, the State was forced - by contract - to pay them interest charges. The debt should not be cancelled by the Commissioners until the whole amount of public debt had been rebought on the secondary market.

One caveat of this plan was however the probable increase in the price of bonds on the secondary market due to the buybacks of public debt, which would increase the demand for public bonds. Thus, repayment of public debt would be more and more expensive, since the stock of public debt in circulation would decrease. However, the question of the price of debt was twofold: in wartime, it was better for the State to borrow at a low cost, i.e. to have bonds slightly below par (or even above), whereas in peacetime, to reimburse debt, it was better for the State to have bonds at a lower price to buy it cheaper back. Especially, the price of Consols was around 70 at that time, so that borrowing at that price would have been costly. One can therefore interpret the efforts made during that time to deliberately *increase* the price of Consols to prepare the probable wars with France (O'Brien, 2008).

During 1786 and 1793, the Sinking Fund worked rather well: around £10,2m of 3% were bought back, by paying only £8,1m. The annual interest payments were reduced by around £300,000. As it was expectable, the price of Consols had increased to 96 in 1792, whereas 4% annuities were already *above* par.

Finally, in 1792, an additional Sinking Fund was instituted: for each new loan, 1% of the capital should be added to that new fund. It was calculated that each new loan issued could be reimbursed in 45 years with that new sinking fund - even with higher prices. With lower prices (*e.g.* 60), each new loan could be reimbursed in 39 years. Moreover, £400,000 were further added to the first fund (the sum decreasing to £200,000 after, each year).

Therefore, Pitt's Sinking Fund, i.e. the systematic repayment of an increasing sum of public debt each year worked rather well in peacetime.

The Final Explosion: Wars with France (1793-1815) .

However, war broke out again in 1793. During the first phase of the war (until the Peace of Amiens in 1802), public debt increased from around £243m in 1793 to more than £500m (i.e. public debt doubled in less than ten years). Then, from 1803 to 1815, public debt increased to £745m (+50%): the increase was controlled, essentially since taxation increased a lot (hence explaining the declining in the ratio between debt charges and tax revenue on Figure 4). Finally, the public debt increased again in the post-war years to £844m (in 1819, according to Mitchell and Deane). All in all, from 1793 until the postwar years, nominal debt and total debt charges

(which grew from £9m in 1793 to £33m in 1817) were multiplied by roughly 3,5 [41].

The debt policy at the time consisted essentially in debt issuance at a low denomination (3% Consols or Reduced 3's), hence at a discount ("aggregating" titles of debt, as it had been made during the American Independence War), instead of issuing stock at 4 or 5% denomination. Hargreaves notes that public liabilities increased from more than £330m between 1793 and 1802, whereas only £223m were actually lent to the State.

An example of the difficulties for the State to borrow cheaply is the "Loyalty Loan" of 1796: £18m issued in a 5% stock, at a price of £112 for each £100 lent to the State. After the Peace of Amiens (1802), subscribers of the Loyalty Loan could - in theory - claim for reimbursement in cash or in 3% Consols (£100 in cash, or £133 6s 8d in Consols). However, since the State could not reimburse its creditors at that time, it made a new offer: in 1804, the creditors of the Loyalty Loan could receive £100 in 5% and a value (at the market price) of £100 in Reduced 3's for £100 of the Loyalty Loan. For dissentients, 10s per £100 pound were further offered. Thus, borrowing was costly and rather tight at the time.

This costly policy has been largely criticised at the time, and after (for example, by Ricardo (1820)): Pitt has been accused to let the debt stock grow without considering the size of the principal, and simply trying to obtain as low charges as possible. However - as O'Brien (2008) points out - one has to keep in mind that the government has made efforts to influence the state of the market. One example is the suspension of the suspension of Specie Payment in 1797 (i.e. the suspension of the gold standard) so that the State could reimburse debt by issuing money. Moreover, the State often faced hostility of *monied men*, i.e. small groups of creditors, who held the majority of the debt by the system of *competitive tender* (i.e. dealing with small groups of creditors in competition between eachother). Finally, since the price of Consols (less than 50 in April 1797 according to Hargreaves) had fell, it was difficult for the State to borrow on a large scale, without depressing the price further. Hence, new systems of *open subscriptions* began to be experimented[42] to increase the demand for public bonds.

The biggest paradox of the time was not that borrowing was costly, but that, the Sinking Fund (i.e. the policy of buying public debt on the secondary market) was maintained in the same time as public debt was issued. Thus, at the same time, the State borrowed and reimbursed public debt - and the size of the Sinking Fund (its annual amount) was still increasing. Between 1793

[41] One can note some differences between sources for the exact amount of public debt: Hargreaves (*op. cit.*, p. 109) indicates £521m for public debt in 1802 (for the whole United Kingdom), whereas Mitchell and Deane (again, for the UK) indicate slightly less than £500m. This may be due to a pure "calendar" effect, i.e. sums are not recorded at the same date. However, the global trend remains identical whatever the source

[42] In fact, some open subscriptions had already taken place during the War of Austrian Succession, i.e. in the 1740s

and 1815, according to Hargreaves, the National Debt Commissioners bought £176m on the secondary market, whereas £447m of new debt were issued.

Why did Pitt maintain the Sinking Fund in wartime? One reason is ideological: since Pitt had committed himself to maintain the Fund at all cost, he did not accept to abandon his plan. However, the maintain of the Sinking Fund was also rational. For example, Richard Price, thought that the savings made by a Sinking Fund would be always bigger in wartime than in peacetime, since interest rates rose (hence increasing the savings each year). However, the main reason for the maintain of the sinking fund was certainly - as O'Brien (2008) explains - a*political* reason. With a Sinking Fund, both taxpayers and creditors accepted the idea that public debt should be reimbursed after the war: if the Sinking Fund had been abandoned during the war, it would have be much more difficult to convince taxpayers to establish a similar fund after the war. On the contrary, taxpayers were aware that they would have to continue their efforts after the war, whereas creditors were assured to be paid after the end of it. Thus, maintaining the Sinking Fund was a mean for the State to be credible with its creditors - and therefore to reduce the cost of borrowing or even to permit it. The maintain of the Sinking Fund was not a pure accounting operation: it may have had a cost if debt was not bought by the Commissioners at the same price to the price of issuance (because of the timing, for example). Even if public debt was not issued at 50 and bought at 100 (the policy would have been ruinous), for example (Hargreaves, *op. cit.*, p. 111) debt could be issued at 72 and bought at 77 - hence a cost in terms of relative price for the State (indeed, debt was sometimes issued to pay the Commissioners). Thus, that financial policy was not totally irrational from a political viewpoint, but was a costly policy.

Large borrowings were therefore possible but costly for the State. In 1792, the share of taxation in total expenditure was equal to 69%, whereas it had decreased to 34% in 1802. Facing a costly borrowing, Pitt tried to reduce the systematic use of borrowing by increasing taxation Pitt. He introduced the "Triple Assessment" in 1798 and finally, the war "Income and Property Tax" in 1799. This tax was a slightly progressive (see Table 17 for the structure of the tax) because of multiple abatements and exemptions - even if the *rate* was proportional.

The Income Tax was really effective after its re-establishment in 1803 by Prime Minister Henry Addington (the tax had been previously abolished after the Peace of Amiens in 1802), who differentiated different sources of income (but applied a single rate to those forms). In parallel, the amount of taxes collected by additional excise and customs duties increased a lot. Thus, in 1815, the share of expenditure financed by debt had been decreased to 55%[43].

Moreover, some infringements were made to the rules which had been defined before the

[43]Daunton (2001), p. 185

war. For example, the rule of the "New" Sinking Fund of 1792 (according to which 1% of each additional loan should be collected in that new fund) was violated in 1798, 1799 and 1800 (Ricardo, 1820). However, the system was not abandoned: in 1802, both Sinking Funds (the Old one and the New one) were unified by Addington, and this new unified fund grew far above the initial £4m upper limit (which did not take the new loans into account). Thus, the amount of the Sinking Fund was £5,3m in 1803, and £13,5m in 1813.

The biggest infringement to the system of the Sinking Fund was made by Chancellor Vansittart in 1813 (under the Ministry of Lord Liverpool). Since the Sinking Fund grew more and more, it demanded indeed large *borrowings* to pay the required annual debt charges to it. To reduce this additional charge, Vansittart decided to reduce the size of the Sinking Fund for the first time since its creation. To do that, Vansittart decided to force the Commissioners to *cancel* a part of the debt. However, according to the initial rule of 1786, reaffirmed in 1792 and 1802, no debt should be cancelled by the Commissioners until the whole amount of the debt had been bought. Therefore, Vansittart tried to prove that the initial debt of 1786 had already been repaid - to claim that he did not break the faith with creditors, and that he respected the original spirit of Pitt's plan (Pitt had died in 1806). Thus, according to Vansittart, since the Commissioners had bought £238,4m of debt back, and since £200m of additional taxes had been collected for wartime expenditure, the initial debt had been paid two times - hence "allowing" for cancellation of public debt. Vansittart obtained from Parliament the cancellation of the debt *held by the Commissioners* of an equal amount to the size of the debt in 1786. In practice, this reduced the capacity of the Fund since it received by this operation less interest than before.

Hence, the limit of the initial plan had been reached: even if Commissioners received interest payments according to a debt contract (i.e. *once* they held public debt, the State was *forced* to pay interest on it), the amount of public debt held by them was *after all* determined by the Parliament. Therefore, even if the "moral contract" made it difficult to break, the existence of Commissioners or the amount of debt they held depended finally on the political will of political leaders.

However, while diminishing its magnitude, Vansittart showed that he did not aim to abandon the policy of debt redemption. He added a clause stipulating that the Commissioners should always have a sum which could allow them to reimburse the debt in 45 years. Thus, the amount of debt held by the Commissioners had a lower bound relative to the total size of public debt. However, above this limit public debt could now be cancelled at the discretion of the Chancellor and of the Parliament. Thus, in 1814, £117m were cancelled, and in 1817, more than £255m were cancelled.

Vansittart's decision - even if he maintained the official will to reimburse debt in 45 years - was widely criticized, for example by Huskisson (Member of Parliament, often presented as "Pitt's executor"), who thought that war taxes should be maintained even after the war, to pay interest charges to the Commissioners, in order to reimburse the debt as fast as possible. According to Huskisson, public debt was not different from a long annuity of 45 years at the date of issuance, so that the State should continue to repay it even in case of new borrowings. This point of view may be seen a good summary of the financial policy during the wars with France - until Vansittart's policy: previously issued debt should be reimbursed and one should not allow "old" debt to accumulate.

The Post-War Years: Debt against Taxes

Immediately after the War, the economic and political situation was bad - even with the defeat of Napoleon. Two important decisions were taken. Firstly, debt should be repaid in gold - now that the gold standard had been established again. Secondly, war taxes were abolished in 1816 (including the income tax or the malt tax), leading to a net loss of tax revenue £18m per year (i.e. around 23% of total government net income[44]). Hence the State borrowed large sums by Exchequer Bills (i.e. short-term Bills) in 1816/7, before consolidating it in 1820, and also issued funded debt.

According to Mitchell and Deane, the entire debt (funded and unfunded) reached its maximum in 1819 - at £844,3m (i.e. 260% of GDP).

Thus, one can sum up the whole century as we did in introduction: the alternance of wars increasing debt and of plans to reduce its size in peacetime, especially using Sinking Funds (hence, budgetary surpluses). However, those systems were unsufficient and had intrinsic defaults (i.e. for the enforcement of the mechanism) to avoid the huge accumulation of public debt that we have observed during the eighteenth century.

[44]Mitchell and Deane, *loc. cit.*

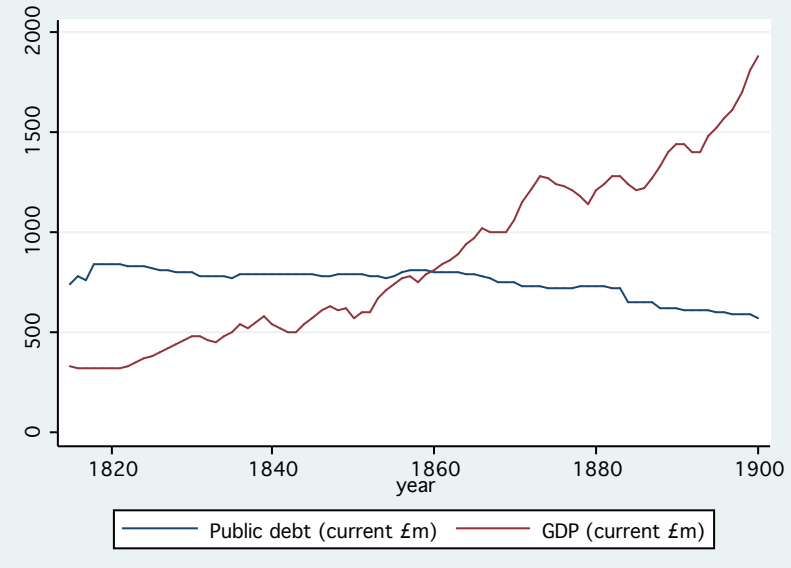
3.2 From 1820 to 1900: De-escalation - or the Decrease of the *Importance* of Public Debt

— "The stupendous inventions and discoveries of Watt, Arkwright, Crompton, Wegdwood and others, have hitherto falsified all the predictions of those who anticipated national ruin and bankruptcy from the rapid increase of the public debt" - J.R. McCulloch, in *Treatise on the Principles and Practical Influence of Taxation and The Funding System*, 1863(ed. (2013), p. 435)

3.2.1 Debt Stabilisation and Increase of National Income (1820-1900)

The public debt/GDP ratio during the nineteenth century (Fig 1) clearly exhibits a decreasing trend (from 260% of GDP in 1820 to 30% in 1900), which one may interpret as a "reimbursement" of public debt. However, as Figure 5 illustrates, only part of the whole stock of debt was effectively reimbursed during the century. In fact, debt has been stabilised in nominal amount during the first half of the century. Then, after a slight increase due to the Crimean War (1853-1856), debt finally decreased in nominal amount by around 30% (from slightly more than £800m after the Crimean War to £570m in 1900). Thus, two points have to be explained: why did debt stabilise in nominal amount and did not decrease before the 1860s? Why did it decrease (in nominal amount) when its relative weight in the economy was lower than what it had ever been since the War of Spanish Succession?

Figure 5: Nominal Debt and Nominal GDP in current £ millions, 1815-1900



Source: GDP: Reinhart/Rogoff, *op. cit.*; Public debt: Mitchell and Deane, *op. cit.*

3.2.2 The Abandonment of the Sinking Fund during the 1820s

It is not difficult to understand why debt did not increase after the Napoleonic Wars: since peace was established, and since there were concerns about the size of the national debt (for example, Ricardo (1820)), further borrowings were neither needed, nor wanted by the political leaders. However, public debt did not decrease in nominal amount after a (slight) decrease immediately after the 1820s?

The principal reason of this stabilisation is the abandonment of the main instrument of debt reimbursement, i.e. of a systematic Sinking Fund, from 1828 on. However, that decision was the result of a gradual mistrust of the Fund.

The first criticism of the fallacious reasonings about the Fund were made during the war, in a book of Robert Hamilton in 1812, [45]. Hamilton explained that any pound given for the Sinking Fund was taken from a budgetary surplus. The resources for the Sinking Fund did not come from nowhere - as it was the case in Price's ideas. Even if all resources came from redeemed debt, a Sinking Fund had an opportunity cost in terms of tax reliefs, since the sums saved from debt redemption could have been used to decrease taxation.

This being said, Hamilton insisted on the cost of the Sinking Fund: according to him in the third edition of his book in 1818), a net amount of £16,5m had been issued to respect the mechanism of the Sinking Fund[46]. This very popular book was the trigger of a serie of criticisms upon the Fund during the 1820s. In this vein, William Cobbett - at that time a radical pamphleeter[47] had declared in 1810: "There is something so consumately ridiculous in the idea of a nation's getting money by paying interst to itself upon its own stock that the mind of every rational man naturally rejects it"[48]

Another popular criticism was made later by D. Ricardo in his *Essay on the Funding System* of 1820. In this essay, Ricardo clearly indicated his preference for taxation instead of public debt - since he thought that public debt would make people feel wealthier than what they really were (hence, a Ricardian non-equivalence - see O'Driscoll (1977)). Ricardo wrote that « It would be difficult to convince a man possessed of 20,000l., or any other sum, that a perpetual payment of 50l. per annum was equally burdensome with a single tax of 1000l. [...] if an individual were called upon to pay 1000l. to the income-tax, he would probably endeavour to save the whole of

[45] *An Inquiry concerning the Rise and Progress, the Redemption and Present State, and the Management of the National Debt in Great Britain and Ireland*

[46] between 1793 and 1817, £874m of debt had been issued. Without the fund, the increase would only have been an increase of £573,4m. Since the amount of redeemed debt was equal to £284m, one finds that £589,9m were not reimbursed. Hence, the difference (589,9-573,4), i.e. £16,5m is equal to the net cost of the fund

[47] He became Member of Parliament in 1832 when he was elected to the Commons

[48] Paper against Gold (Letter VI), p. 95

it from his income ; he would do no more if, in lieu of a war-tax, a loan had been raised, for the interest of which he would have been called upon to pay only 50l. income tax. The war-taxes, then, are more economical, for when they are paid an effort is made to save the amount of the whole expenditure of the war, leaving the national capital undiminished. In the other case [financing through debt] an effort is made to save the amount of the interest of such expenditure, and therefore the national capital is diminished in amount ». However, Ricardo mistrusted the Fund since it depended on durable political will. Ricardo - contrarily - advocated for a one-shot *capital levy* in order to decrease the nominal stock of debt.

These criticisms were therefore causes and consequences of a general mistrust of the Sinking Fund. This mistrust had also political causes: in 1819, Chancellor Vansittart (the same who had changed of policy in 1813) decided - following a Resolution in the House of Commons - to achieve a real budgetary surplus of £5m - or even, if possible, £8m. However, since the actual surplus was no larger than £2m, Vansittart proposed to increase taxes by £3m. Thus, the Sinking Fund became a synonym of tax increase. Step by step, some previous advocators of the Sinking Fund became opponents to this system, such as Ricardo himself[49] or Lord Grenville, who published a very popular essay in 1827 (*Essay on the Supposed Advantage of the Sinking Fund*).

In parallel, the efficiency of the Fund decreased, so that it became less and less credible to the people. In 1822, the "dead-weight annuities", i.e. annuities created to smooth the cost of the pensions of militaries over time, in order to achieve an additional surplus of £2m, could not be sold. In 1823, Chancellor Robinson (Vansittart's successor) even installed a new Sinking Fund of £5m per year instead of £1,2m. But the budgetary surplus could not be achieved so that - once again - the government should borrow to reimburse its debt.

The inefficiency and the unpopularity of the Fund caused his death in 1828: the Select Committee of Public Finance proposed the abandonment of *fixed* payments each year. This was the end of a genuine Sinking Fund. This was accepted in 1829: the Sinking Fund would now receive only "accidental" surplus and no previously fixed sum each year. It was clear that no Chancellor would try to achieve a discretionary surplus at that time.

Therefore, the Sinking Fund had become at that time as unpopular as he had been praised and even fetishized during the first years of its existence. The last years of the Sinking Fund had however allowed to decrease the nominal stock of debt by around £40m. Vansittart could also convert 5% annuities into 4% stock in 1822 (£150m of debt), which represented a saving of £1,2m on debt charges. in 1824, Robinson converted in the same way more than £76m of 4% annnuities in 3,5% stock.

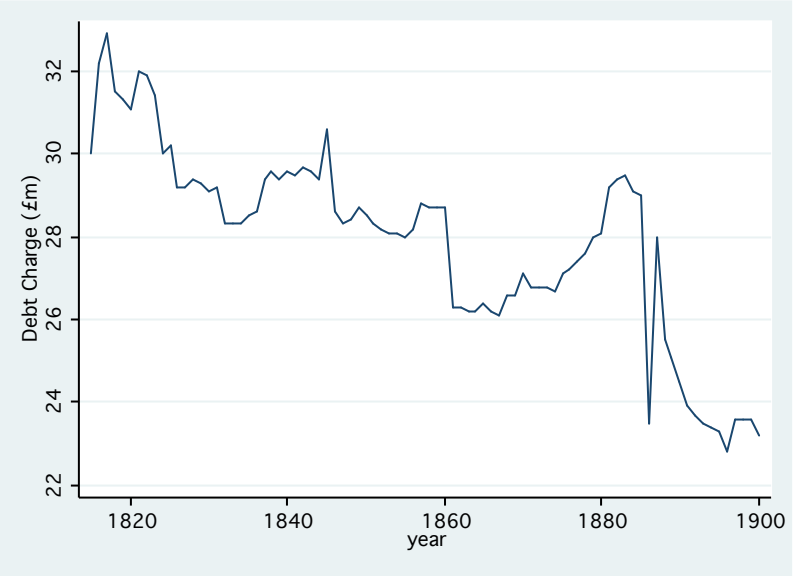
[49]Ricardo had declared in 1816 that the Sinking Fund was the "general saving bank of the nation"

3.2.3 1830-1853: how the problem of public debt "disappeared"

After the abandonment of the Sinking Fund, it was clear the public debt would not decrease in nominal terms anymore. However, the importance of the problem of public debt gradually decreased. In 1830, public debt stood around 160% of GDP. Moreover, the demand for tax cuts was bigger than ever - and it was believed at the time (under the influence of Radicals) that a good policy was to " [leave] the amount of the taxes in the pockets of the people" (as said Lord Althorp, Chancellor from 1830 to 1834).

However, if the question of the total amount of public debt disappeared, the question of the reduction of its charge was still important in the political life of the time (Figure 6 illustrates the fact that - despite the stabilisation of the principal of the debt - debt charges did decrease from about £6m between 1820 and 1860). Thus, in 1830, Chancellor Goulburn succesfully converted £153m 4% annuities into 3,5% (£150m) and 5% annuities (at a lower price), for 0,5m. The annual saving was about £750,000.

Figure 6: Total Interest Payments, 1815-1900, £ current millions



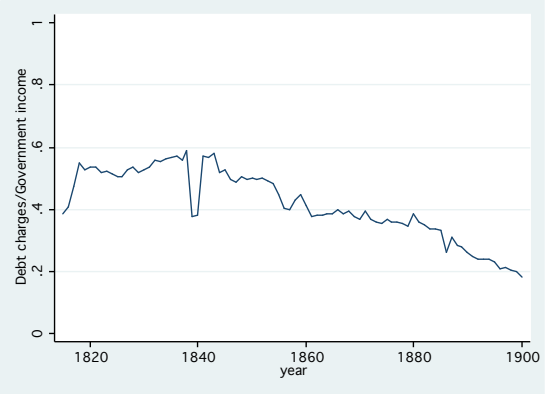
In 1834, his successor (Lord Althorp) attempted to make a further conversion from 4 to 3,5%. annuities, but only achieved a £53,000 saving each year. Another - and more successful - conversion was achieved by Goulburn in 1844, who converted slightly less than £250m stock from 3,5% to 3%, hence achieving an annual saving of more than £600,000[50]. A last conversion attempt - made by Gladstone in 1853 on South Sea annuities - was less successful because of the

[50]Goulburn was indeed a bit lucky in this conversion operation: the price of Consols was superior to 97 at then end of 1844, during the conversion, but had fell to less than 92 in december 1845: in that case, the conversion of 3,5% annuities to Consols would have been more costly - see Hargreaves, *op. cit.*, p. 162

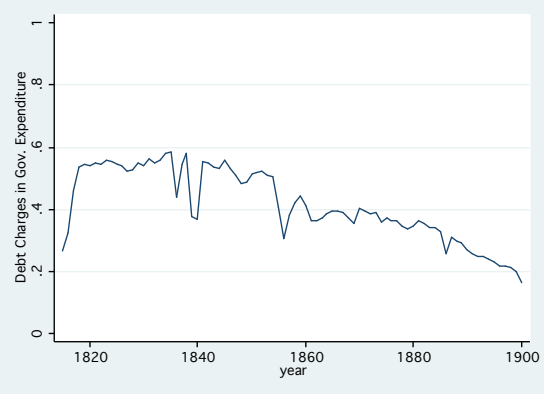
fall in the price of Consols between the beginning and the end of the operation. Thus, Gladstone could only save £7,300 each year.

Between 1830 and 1853, the amount of debt charges paid each year (Fig. 6) was succesfully decreased by £1m[51]. In parallel, the size of the debt decreased by £20m or £30m (according to Mitchell and Deane or to Hargreaves). Thus, the ratio between debt charges and the size of total debt (i.e. the mean interest rate on funded debt) had diminished between 1820 and 1850/60. Thus, the weight of the debt upon public finance had decreased (Fig. 7a and 7b), and the savings made upon debt charges were mostly used as tax reliefs (explaining why debt charges did not decrease that much in proportion of total government income during those years, Fig. 7a)

Figure 7: Debt Charges in Public Finance, 1815-1900



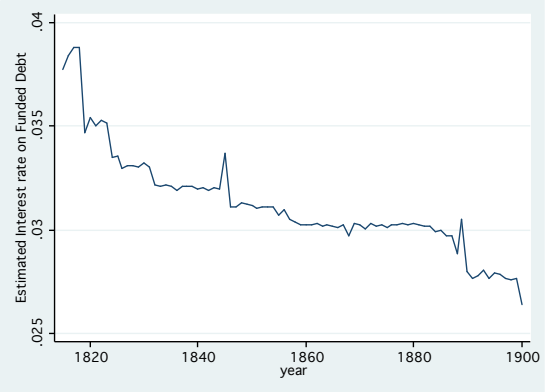
(a) Debt Charges over Total Tax Revenue



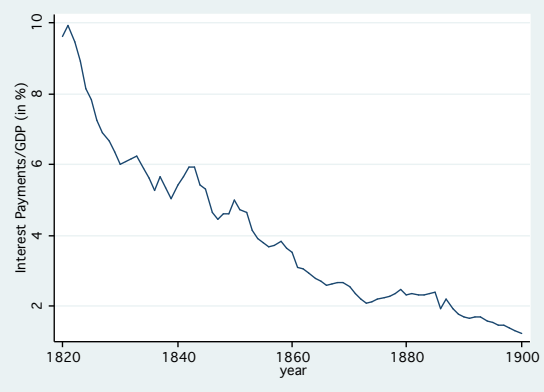
(b) Share of Debt Charges in expenditure

Source: Mitchell and Deane, *op. cit.*, pp. 401-403

Figure 8: The Decrase of the Weight of Debt Charges, 1815-1900



(a) Debt Interest on Total funded debt



(b) Share of Debt Charges in % of GDP

Source: Mitchell and Deane, *op. cit.*, pp. 401-403, Reinhart & Rogoff, *This Time...*

However, maintaining a high debt was dangerous in case of unexpected events. This was the case in 1835 and 1836, when slavery was abolished (in 1833), and when slaveowners obtained a

[51] £29,1m in 1830 and £28,1 in 1853) according to Mitchell and Deane

monetary compensation. This led to an increase in the stock of debt of £20m and to an increase in total interest payments of more than £730,000[52].

Above all, the Crimean War demanded - as in the preceding century - further borrowings. This war, often presented as using the best financing methods (see Hirst (1915)), increased public debt against the will of the Chancellor of the time - William E. Gladstone - who had declared that he would borrow as less as possible (Anderson (1963)). According to Gladstone, "the expenses of war are the moral check which it has pleased the Almighty to impose upon the ambition and the lust of conquest that are inherent in so many nations" (Budget speech of 1854). Therefore, he said, "higher taxes were an incentive to conclude peace". Thus, Gladstone doubled the rate of the income tax (see Table 17) (from 2,9% to 5,8%) in 1854. However, his successor at the Exchequer - G.C. Lewis - argued that conditions were good to borrow - underlining that public debt was issued for freedom (since the Crimean War was a "free-trade war"[53], in order to respect the "liberal" ideas of the time). Thus, a £15m loan was successfully floated in 1855 in 3% plus an annuity.

At the end of the War (1856), Lewis estimated that public debt had increased by more than £30m, whereas debt charges had increased by more than £1,4m. Thus, Lewis maintained the unpopular income tax at the same rate until 1859 to be paid into a "genuine" Sinking Fund of £1m per year . When Disraeli (a Conservative) came to power in 1858, he diminished however the rate to 2,1%, whereas Lewis' Sinking Fund was abandoned.

This reduction of income tax instead of maintaining a Sinking Fund is emblematic of the public finance policy of the period: because of the increase in the wealth of the nation, which was globally perceived, public debt was not considered a a danger anymore, but even (during the Crimean War) as an instrument of liberty.

Therefore, why did debt suddenly decrease from the 1860s on? (Fig. 9)

3.2.4 1860-1900: The gradual and partial decrease of the stock of public debt

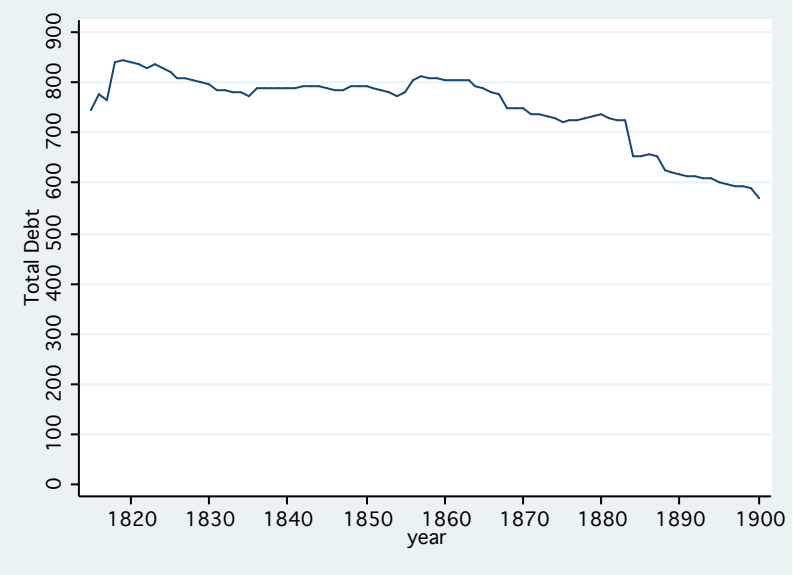
Two main reasons can be given to explain why debt began to decrease in nominal terms during the 1860s.

The first one is the fear that national wealth would decrease in the future. The publication of Stanley Jevons' popular *Coal Question*, in 1865, had a notable influence. For him, since the wealth of Britain rested on coal, i.e. an extinguishable resource, then the wealth of the

[52]According to Hargreaves, *op. cit.*, p. 168. According to Mitchell and Deane, *op. cit.*, p. 406, one finds a net increase of £17,3m in 1836 in the stock of debt. Mitchell and Deane also indicate an increase of £900,000 in the debt charges

[53]Daunton (2001), p. 119

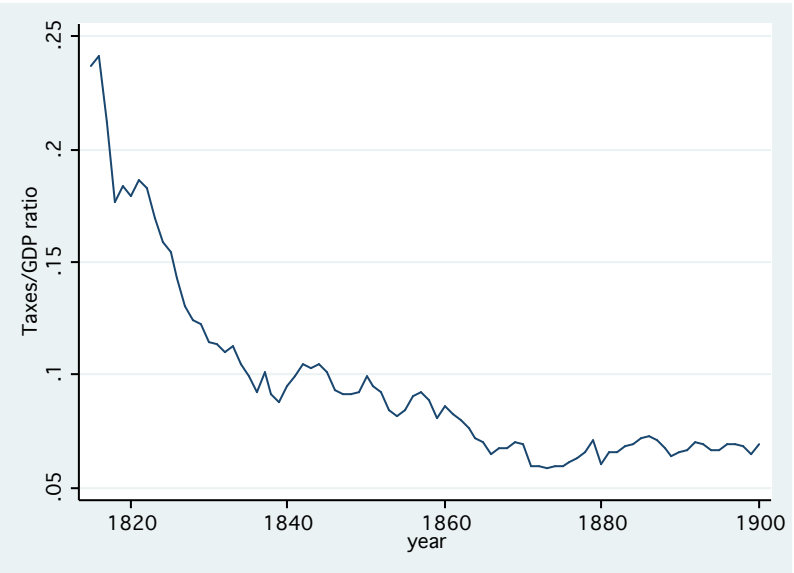
Figure 9: Nominal Debt in current £ millions, 1820-1900 - A decrease from the 1860s on



Nation could *decrease* once the coal resources would be exhausted. Therefore, the country should reimburse its debt while it was still possible and relatively easy - what Gladstone exposed in his Budget Speech of 1866[54]

The second reason is that taxes had decreased during the century - in per capita terms and in proportion of national income (see Fig. 10). Therefore, the goal of "retrenching the Leviathan" had roughly been achieved (Daunton (2001), p. 120): corn laws had been repealed in 1846, a free-trade treaty had been signed with France (the Cobden-Chevalier agreement in 1860). Contrarily, the treatment of the question of public debt appeared to be unsatisfactory.

Figure 10: Total government net income in proportion of GDP, 1815-1900



[54]St John (2010), p. 105

However, the task was complicated. One solution - experimented earlier - was to convert perpetual annuities to terminable annuities (i.e. "self-expiring" annuities). In other words, to undo what had been done at the beginning of the eighteenth century. However - as it can be well understood - investors did not want to be reimbursed, and thus would not agree to hold self-expiring annuities.

A partial solution was first to transform the public debt that the different departments depending on the State held. For example, the Trustee and Savings Bank (since 1817) and the Post Office Savings Bank (since 1861) were public banks, and held in turn public debt. Thus, in 1863, £5m stocks held by the Trustee Savings Bank were changed into a terminable annuity of £315,017, expiring in 1885. Hence, the annual charge increased by £165,017.

Gladstone went further in his Budget Speech of 1866, by underlining the impossibility for the State to conduct a war without borrowing further. Thus, it was important to reduce the size of national debt to ensure that borrowing would possible in case of need. Other European States had also a lower public debt (the second indebted State was France - with public debt representing half of the size of the British one). Thus, Gladstone presented a plan in two parts. Plan A consisted in the transformation of the whole debt held by the Trustee Savings Bank (£24m) into a terminable annuity expiring in 1885 - increasing the total charge by £1m per year. Plan B consisted in the buy-back of all annuities to transform them into terminable annuities. However, the plan was criticized, and when Disraeli replaced Gladstone at the Exchequer (in 1866), Disraeli only kept the "plan A".

All in all, the question of public debt had reappeared in the political debate of the time. R. Giffen (1867) apologized for a reduction of £220m of the size of public debt, which would - according to him - not harm prosperity. In 1868, the idea of a Sinking Fund reappeared in W.L. Sargant's *Apology for Sinking Funds*. Finally, Dudley Baxter (*National Debts*, 1871) also proposed the establishment of a Sinking Fund.

Finally, public debt was decreased in nominal terms under the Tory Chancellor Stafford Northcote - which came to power in 1875 (under the Ministry of Disraeli). Northcote proposed the establishment of a new genuine Sinking Fund. He underlined that only £40m had been reimbursed by the "Sinking Fund" after 1829 (i.e. after it became discretionary), whereas £120m had been reimbursed using terminable annuities. However, he thought that the method of using terminable annuities was a bit dubious since - once the annuity had expired - the government could be tempted to reduce taxation instead of transforming *new* perpetual annuities into self-expiring annuities. Hence, the redemption policy was seen as "spasmodic"[55]. Moreovere, since

[55]Hargreaves, *op. cit.*, p. 185 and Daunton, *op. cit.*, p. 120

£73m had been further borrowed, the total reduction of the size of the national debt, in more than 45 years, was about £87m.

Northcote's plan was the following: he fixed the *total* debt charge to £28m per year. Each year, the difference between *real* debt charges and that sum would be used to redeem debt. For example, in 1875, since the actual debt charge was of £27,1m, £900,000 should be devoted to debt redemption. The main difference with Pitt's Sinking Fund of 1786 was that *total* debt charges were fixed - and not the sum allocated to debt redemption.

In the following year, Northcote proved his political will: because of the Anglo-Zulu war in 1879, and of the "Great Depression" which happened in Europe, the income of the State was reduced. Thus, he increased the income tax. In 1885, a large part of terminable annuities had to expire - henceforth potentially reducing the debt charge by £5m. Childers - the new Chancellor - decided to renew them, i.e. to allow the funds to the transformation of *other* annuities into terminable annuities. Thus, £40m of the "Chancery Stock" (out of a total of £61m) would be converted in an anuity of 21 years, whereas £30m (out of £50m) of the Savings Bank stock would be converted in three different annuities of three, ten and fifteen years. The original annuities expiring in 1885 would be converted in a £684,000 annuity expiring in 1903. This should lead to a reduction of the debt charge, which would serve the Sinking Fund.

However - as any other redemption schemes - this one was fallible. Childers himself, in 1885, had to face a budget deficit of £14,9m, which he paid off by raising taxes (£7,9m) and by taking £7,6m in the annuities he had created himself - by prolongating them for one year. When the Tories came back to power in 1886, Northcote's Sinking Fund was temporarily suspended. Again, when the Liberals came back next year, Chancellor Harcourt paid off a deficit of £0,5m by taking the money in the Sinking Fund.

The violation of Northcote's scheme did not stop and was even accelerated. In 1887 and 1889, Chancellor Goschen (Tory) decreased the fixed charge from £28m to £26m and then to £25m - arguing that possible riots against taxes could happen.

All in all - and even taking violations of the system into account - public debt decreased in the last third of the century by about 30% - which was not negligible - especially by the use of terminable annuities and by the Sinking Fund, established in 1875. However, debt - now relatively low in terms of GDP (around 30% in 1900) - was still large in nominal amount and should rapidly increase again: because of the Boer war, and after, because of the First World War.

3.3 Partial Conclusion: What The Historical Record Shows

E.L. Hargreaves, declaring that the reduction of public debt was a "Sisyphean labour", was therefore correct. Public debt grew during the whole eigtheenth century - directly because of the numerous wars. Then, every attempts of reducing the size of such an enormous debt failed, after all. Such plans failed because unexpected events (wars) led governments to borrow again. However, the lack of contractualization of such plans - which depended after all on political will - was also a caveat of such plans (regarding to public finance). Debt policy was however useful - especially to reduce interest rates, and therefore total interest payments. A large public debt was maintained (in nominal amount) during the whole nineteenth century - only decreasing in terms of GDP because of the large increase in GDP observed during the century.

Therefore, this study has shown two things. Firsty, except for the 30% decrease at the end of the century, public debt in Britain has not been reimbursed by the State. Secondly, public debt was large - even in terms of GDP during the largest part of the nineteenth century. Public debt amounted indeed more than 100% of GDP until the 1850s. Therefore, since interest payments were large (in terms of GDP) and paid by a tax system which was not progressive in its principle, public debt may have had possibly large social and economic effects - especially on income and wealth distributions.

4 Modelling Unequalizing Effects of Public Debt

We now aim to quantify the unequalizing effects that this huge public debt may have had during the nineteenth century. Since we cannot find real counterfactuals in history (we are not in the world of controlled experiments), we have to "build" our counterfactual. This counterfactual has to be interpreted not as a scenario, which we would advocate for, but as a "thought experiment" to see how the situation could have been different during the century.

4.1 Building a counterfactual scenario: a sovereign default in 1820

Our counterfactual scenario is the following: what would have happened on inequality (*ceteris paribus*) if Prime Minister Lord Liverpool and Chancellor Vansittart had defaulted on the entire debt of Great Britain in 1820? An exactly equivalent scenario (if debt - as it seems to be the case - was held by domestic agents) would have been a capital levy (as advocated by Ricardo (1820)) exactly proportional to the volume of debt holdings by each individual (hence, a tax on

creditors[56]).

In what follows, we assume that a default on public debt in 1820 would have had no consequence on long-term trends of capital accumulation, or on economic growth, interest rates... In particular, a default would have had no trend consequence on demography, technological progress, or on the rythm of capital accumulation. This assumption is a *ceteris paribus* assumption: this allows us to focus directly on the subject of that work: income and wealth inequalies generated by a large accumulated public debt.

Moreover, we also assume that proportional tax reliefs would have replaced interest payments (in the budget constraint of the government). In other words, each pound of interest payments would have been transformed into one pound of tax relief. We further assume that this pound of tax relief would have been divided proportionally between all types of taxes. Thus, since (in mean) interest payments represented roughly 30% of tax revenue during the century, each tax rate would have been reduced (in mean) by 30%.

The assumption of tax relief seems historically plausible since there was a large demand for retrenchment of the State (the "Leviathan")[57] during the nineteenth century, which explains the general decrease of observed taxes or government spendings relatively to national income. One could object that the tax cuts might have benefited to specific groups of population. Since we could not "guess" the tax rates which would have been cut in priority, we choosed to make the reasonable assumption of a proportional global tax cut.

4.2 Estimation Strategy

4.2.1 The Intuition

Our idea (which follows classical economists such as David Ricardo (1820) or John Stuart Mill (1848)) is that public debt in a relatively closed economy may constitute a transfer from one part of the population (that part which did not hold public debt) to the other one (the creditors) [58].

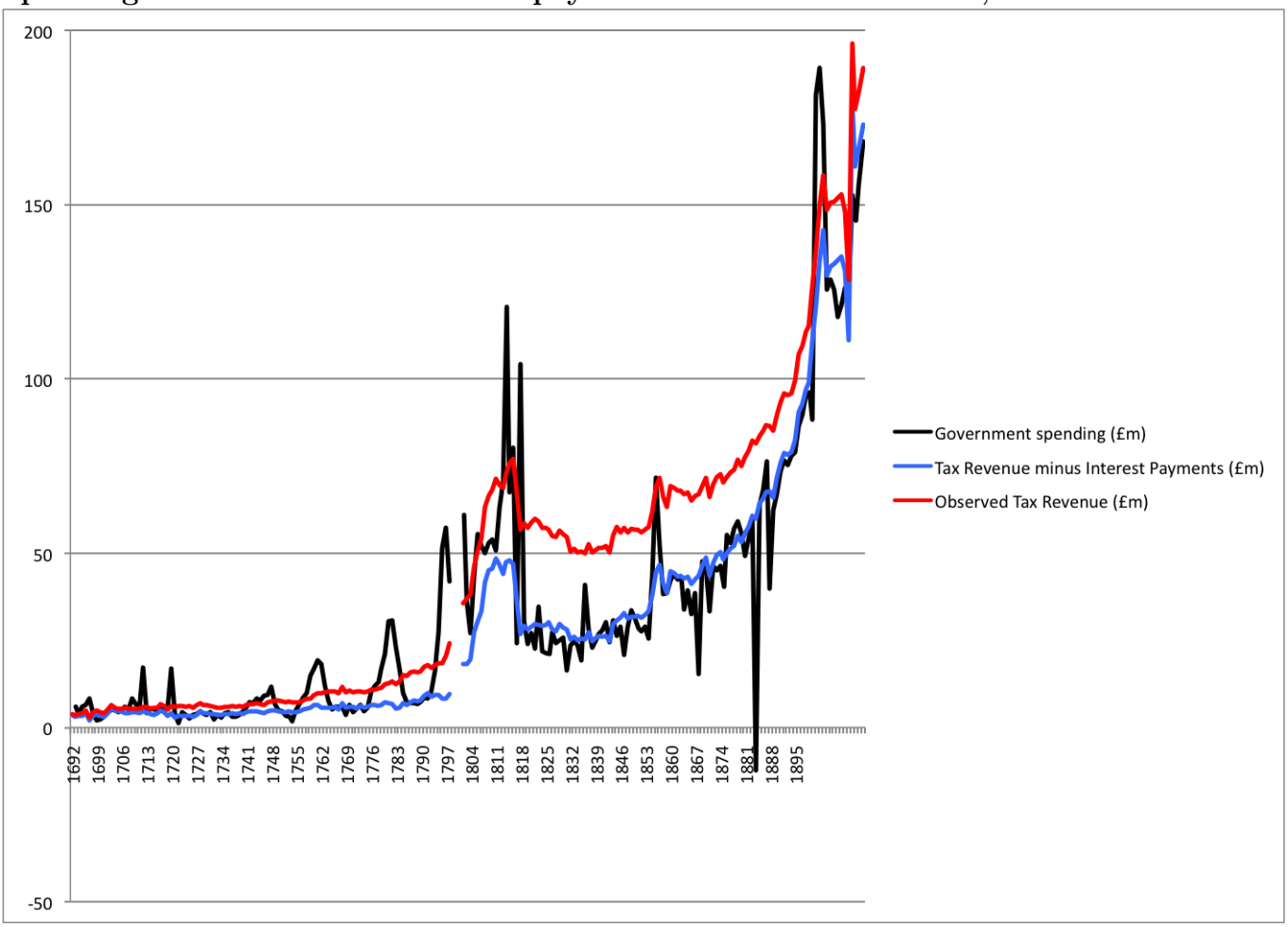
[56]However, Ricardo advocated for a general capital levy and not for a tax on creditors only

[57]See Daunton (2001) for a precise and very interesting description of the general movement for retrenchment of the fiscal-military state, leading to what he calls the "Gladstonian fiscal constitution" in the 1850's

[58]Ricardo and Mill - following Smith - did not consider that public debt was *simply* a transfer from one part of the population to another, but that it might have (bad) consequences for the economy as a whole. However, they did take this element into account. For example Mill (1848), Book V, Chap. VII, §2: "It is true that the payment of the interest, when the creditors are members of the same community, is no national loss, but a mere transfer. The transfer, however, being compulsory, is a serious evil, and the raising a great extra revenue by any system of taxation necessitates so much expense, vexation, disturbance of the channels of industry, and other mischiefs over and above the mere payment of the money wanted by the government, that to get rid of the necessity of such taxation is at all times worth a considerable effort". However, Mill did not advocate for a default or for a tax on creditors, but for a gradual repayment of the debt. Smith (1776) did not properly focus on redistribution due to public debt

Figure 11:

Taxes, Government Spendings and Taxes minus interest payments in current £ millions, 1692-1914



As it is shown on Figures 12 and 13 (see below), personal estate as well as total wealth became more and more concentrated during the 18^{th} and 19^{th} century. The share of total wealth held by the top 1% (of households) increased from less than 40% in 1700 to 69% on the eve on the First World War, whereas income inequality - even if data are missing - appears to have been quite large. Of course, the main explanation for this increasing inequalitarian trend is certainly the development of British *private* capitalism, which can be regarded as an unequal process - at least at the beginning [59]. However, *public* debt may have played a non-negligible role, especially after having seen the huge amounts of public debt (and hence of debt charges) in 1820 - inherited from the eigtheenth century wars.

As it is observable on Figure 11, the discrepancy between the observed tax revenue and tax

since "the idea that the right hand which pays the left [... and that] debt is only a part of the revenue of one set of the inhabitants which is transferred to another; and [that] the nation is not a farthing the poorer, [is] founded altogethr on the sophistry of the mercantile system

[59] both Kuznets (1955) and Williamson (1985) recognize that capitalism can be during the early stages of its development, an unequal process

revenue minus interest payments (i.e. if public debt had disappeared) reaches its maximum in absolute amount for the period 1820-1900 - i.e. when the ratio debt/GDP was decreasing but still very high (superior to 200% at the beginning, gradually decreasing to 30%). Therefore, we will choose the 1820-1900 period for the scope of our study, by asking us: which unequalizing effects the *public* debt inherited from the Napoleonic (and preceding) Wars may have had from 1820 to 1900?

If creditors had been randomly distributed in the population, public debt would have played no macroeconomic and macrosocial role in the distribution of incomes (and wealth), but would have only constituted a transfer between random individuals. However, if creditors mostly came from specific social groups ("dominant" classes), then public debt may have constituted a transfer from one class to another. On the other side, the spendings financed by public debt were - as explained in the previous section - essentially military spendings, which were unproductive, at least in the long-run (in opposition to investment in schools, roads, etc.). Moreover, after 1820, this stabilised public debt did therefore not finance any additional spending, so that the effect of that debt upon the economy were limited.

We will consider in this section different groups of wealthowners, depending on the data we can exploit: Top 1%, P90-P99 and bottom 90% of wealth. For the sake of simplicity, we will omit the question of social mobility between those classes. We will also omit potential differential of fertility: each dynasty will reproduce itself at rate (1+n) in each period, where (1+n) is the mean population growth rate in the society. Therefore, each dynasty i will be (relatively) the same in 1820 than in 1910. Obviously, these assumptions are somehow simplistic. But - on the one hand - one can think that social mobility was rather low in Britain (school was less developed than today, fiscal policy was essentially due to finance basic public spending). On the other hand, we can notice that representative agents models are widely used in macroeconomics. Since such models omit redistributive issues between social classes, these models are at the opposite extreme of our "cast" model. It should be clear that, in our point of view, the reality is something inbetween: there is certainly social reproduction but there is no pure cast system in the majority of societies, in particular in the nineteenth century Britain. Introducing social mobility would certainly be an improvement of our model, but as a starting point of our research, we have chosen to leave this question aside.

4.2.2 A 100% transfer?

A first interesting thought experiment is to ask the following question: under which conditions would public debt constitute a pure transfer from noncreditors (i.e. non savers) to creditors? The answer is simple: this is when the society is divided between savers and spenders (*e.g.* Williamson (1985) imagines a 50/50 division), when all taxes fall on nonsavers and when public debt is entirely held by savers so that debt charges constitute a pure transfer from the consumption of the bottom x% to the top (1-x)% of income distribution. In that case, public debt is a *pure* transfer from noncreditors to creditors.
Therefore, why is it not the case?

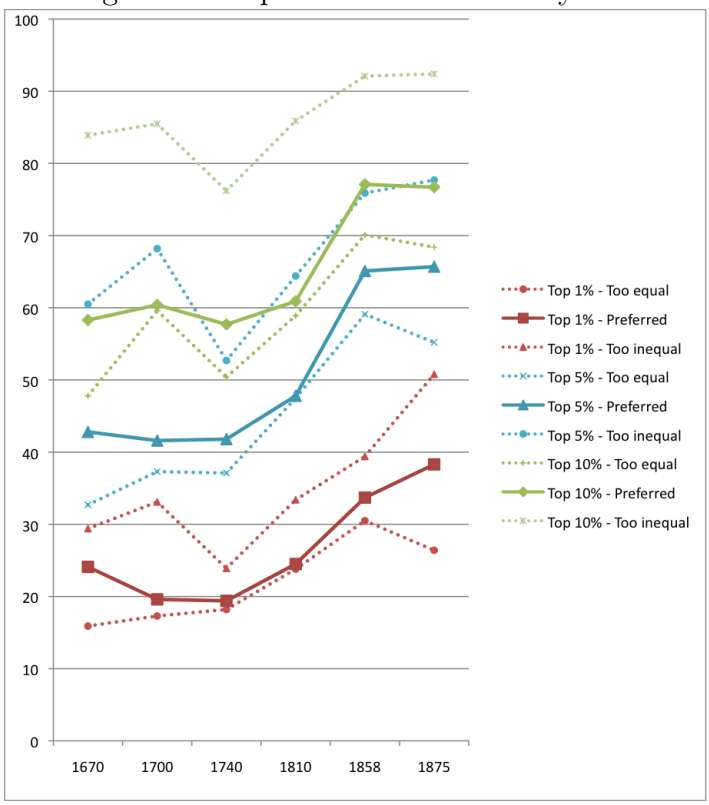
4.2.3 The variables

Debt holding First, public debt may have been held by various groups of populations. There is so far a lack of study about the ownership of public debt in the nineteenth century. To our knowledge, the only estimates are these by Dickson (1967, pp. 249-303) for the 18$^{\text{th}}$ century, who shows that public debt was largely held by a "ploutocracy": a small number of rich creditors held the majority of debt, whereas other numrous individuals or institutions held small amounts of public debt. Therefore, according to Dickson, during the establishment of the British public borrowing system, public debt was highly concentrated, especially due to political proximity between institutions (because of the system of funding debt through "monied companies"), the State, political influence... Unfortunately, Dickson stops his analysis on the eve of the Seven Years War (in 1756) and we were not able to find equivalent studies for the 19$^{\text{th}}$ century. Certainly, a work similar to what Dickson did until 1756 could to be done for the rest of the period - especially for debt issued during the Napoleonic Wars - to find who did held public debt in Great Britain. It might be the case that holding debt became a more popular practice as the State became more and more credible, as interest rates were lower, and as the amount of the needs of public finance increased. Without having more precise informations, we have made the assumption that debt holding mirrored total wealth holding. We can also notice that public debt (today, a rather prudent investment) bore larger interests than today (between 3 and 3,5% in mean, and 4 or 5% during the wars), so that public debt was an attractive and secure investment.

One could also use (if available) the data about personal estate holdings as a proxy for the concentration of debt holding. However, Lindert's estimates about personal estate holdings are imperfect: since data on global wealth inequality are imperfect, distinguishing between real estate (land, housing) and personal estate is even more difficult. Especially, there is no obvious

Figure 12:

Personal Estate concentration
Estimated percentage share of personal estate held by each class, 1670-1875



Source: Lindert (1986). Dotted lines are confidence intervals exhibited by Lindert.

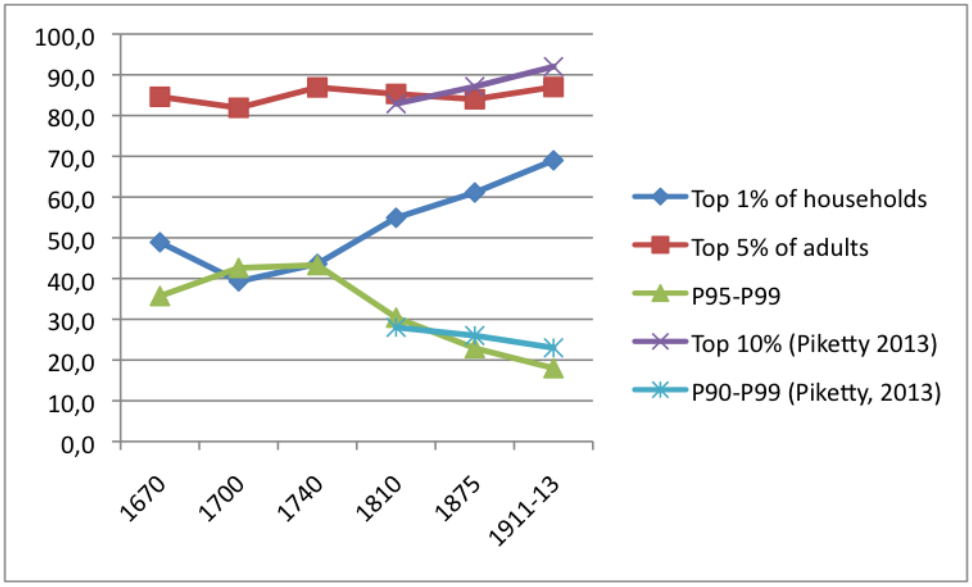
reason justifying why personal estate would be much less concentrated than real estate[60] and why more people should have access to financial markets than to housing market. Therefore, one can use data about total wealth concentration which seems - globally - historically more plausible estimates. We will however also consider the alternative case where public debt would have mirrored personal wealth concentration.

The pattern of taxation On the other side, all taxes have not been paid by the bottom group since there were no privileges akin to the French situation. Therefore, we have to take into account in our analysis the fact that creditors pay on one hand part of what they receive on the other hand. Of course, the design of the tax system clearly matters: the more progressive the tax system is, the less unequalizing effects public debt has. As Williamson (1985) points out, income and land taxes mostly fall (due to a particular tax base) on high incomes. On the contrary, he made the assumption (p. 177) that all indirect taxes fell on the bottom 50% of income. As we have described above, indirect taxes (customs and excise) were a mix between quasi lump-sum

[60]The inverse is true today

Figure 13:

Total Wealth concentration (including Real Estate).
Estimated percentage share of total wealth held by each class, 1670-1911



Source: Lindert (2000), Piketty (2013)

taxes (such as beer taxes) and other taxes on luxury goods (spirits, french wines, calicoes).

These two variables determine the magnitude of the *monetary* transfer from one class to another. Then, the saving rates of different classes determine how this transfer had been used.

We can firstly see (Figure 11 and 7a below) that debt charges and debt reductions represented a large share (more than 30%) of total taxation in the 19$^{\text{th}}$ century. Since we see that the gap between observed and counterfactual (global) taxation is the largest between 1820 and 1900, we will mainly focus on this period. [61]

Saving Rates The different saving rates of each class determine how much public debt could constitute a transfer, say, from the consumption of the ones to the savings of the others. Public debt after 1820, by its effect on disposible income of each class, may have had an additional effects on private wealth.

Finally, one last element is to take into account the share of public debt held by non-residents

[61] Sources are from Mitchell and Deane (1962). We used the fact that

$$T_t + (D_t - D_{t-1}) = G_t + r_t D_{t-1}$$

to draw our curves. In practice, the black curve figure was obtained by substracting from observed taxes the debt charges of the year and by adding the difference between the debt of the former year and the debt of the new year (= the deficit created). For the blue, we just substracted interest payments from total taxes.

(especially Dutch). To simplify our study, we will make the assumption that public debt is entirely held by residents. Even if this assumption is certainly a bit simplistic, there are good reasons to think that only a small (and negligible) fraction of public debt was held by foreigners. Especially, British trade has been opened during the last third of the nineteenth century (Cobden-Chevalier Agreement in 1860), i.e. when Debt/GDP ratio was lower. During the eighteenth century, the proportion of foreigners holding public debt was never superior to 10% of the total stock, according to Dickson (*op. cit*, p. 304).

What would have happened to private capital with a default in 1820? In case of a default in 1820, private capital would have decreased by the amount of debt upon which the State would have defaulted[62]. The main question arising in case of a default in 1820, is however the question of crowding-out: if public debt had crowded-out private investment during the nineteenth century, then, would a default in 1820 have *increased* indeed, private capital available for private production? In that case, private wealth would have gradually recovered from the default of 1820, and - therefore - income inequality would have been (after a certain number of years) comparable to what was observe in case of public debt.

The question of crowding-out in Britain has been largely debated between different authors (see section 5.3.), but we will consider here that - in case of a default in 1820 - private investment (and therefore, national income) would not have been affected by this default.

Why? First, in 1820, private capital would have been diminished by the exact amount of public debt on which the State would have defaulted. However, this would not have reduced the private capital available for private production since, by definition, this capital was invested in public debt. Then, after 1820, moreover, we have seen that public debt was stabilised or had even decreased (after the 1860s) - with the exception of the debt issued during the Crimean war. Since no new debt has been issued, then, a default in 1820 would only have changed something to the *stock* of private capital but not to the *flow*, i.e. to private investment, hence, not changing anything to private capital available for private production. Theoretically, a basic savers/spenders model *à la* Mankiw shows that - if a constant Debt/output ratio is maintained in steady state - then debt will crowd-out some private capital. However, if the debt/output ratio is constant, then, in a growing economy, it follows that *new* nominal debt is issued, whereas, in our case, no additional debt has been issued during the nineteenth century.

Therefore, our idea is that the part of private capital which was devoted to public borrowing was independent from the other part of private capital, which was devoted to private production,

[62]However, national capital would have been kept constant since public net wealth would have increased - in turn - from the amount of debt upon which the State would have defaulted

after 1820. Before that date, since debt was continuously increasing, it may have been the case that public debt crowded out private investment (and therefore, private capital). However, after that date, since debt was not increasing in nominal terms anymore, private capital has increased independantly from public debt.

Finally, we will see that a transfer from consumption to one class to the savings of another class may occur in case of public debt in our framework. However - as it is illustrated on Figure 20 [63] by the difference between the green curve and the blue one - this effect is low relatively to the size of total private wealth, so that it can be left aside. Had this effect been larger, one should have taken the impact of this increase of private capital (possible *crowd-in* of capital) due to public debt into account, especially on real wage (since it would have increased the marginal product of labour).

4.3 The Data

Our database uses various sources. A very useful compilation of data is to find in Piketty and Zucman (2014) (especially their table UK.xls, which contains lots of informations about public finance, national incomes, prices, interest rates, wealth/income ratios). The sources they used are detailed in their Appendix. We simply recall here the main sources we used for our study.

Hence, data about national wealth directly come from Piketty and Zucman (2014), who used the national wealth estimates reported by earlier sources such as Giffen (1889), Craigie (1902) and Campion (1939). One can notice that Piketty and Zucman take distance with earlier estimates by Feinstein (1972) or Goldsmith (1985). The detail of these adjustments is given in their Appendix: in short , they do not trust the definition of "capital" by Feinstein which excludes capital gains and is subject to measurement errors, and they contest the pricing method used by Goldsmith.

Other sources than Piketty and Zucman's database have been widely used and are detailed below.

Firstly, data about public finance mostly come from Mitchell and Deane (first published in 1962, reedited and augmented in 1988 and in 2011). Mitchell and Deane have collected and compiled data from various sources for public finance, especially for public debt and public taxation from Parliamentary Reports. Therefore, they provide the detailed amount of interest charges, government liabilities, other government expenditures and government income detailing

[63] At the end of the paper

for sources of income. However, since Mitchell and Deane do not show the details of different consumption taxes (they only show aggregate amounts of customs and excise duties), we have tried to classify consumption tax on which the goods by using details of the budgets in Dowell (1888) for various years [64]

Secondly, data about Wealth Inequality have been widely collected and studied by Piketty (2013), who uses the data by Lindert (1986, 1987, 2000) until 1875. We have also used the data directly collected by Lindert, who distinguishes between personal and real estate concentration during the nineteenth century, until 1875. Since these estimates are imperfect (because of the lack of primary sources), one has to keep in mind that these data (and therefore our analysis) could be improved by firmer estimates. Since orders of magnitude of wealth inequality were comparable to the data found in France and in other European countries (see the survey of Waldenström (2009)), we think that global data (on total wealth inequality) can be used as an approximation to generate rough orders of magnitude of the impact of public debt on economic inequality. Finally, data for 1911 are given by Atkinson and Harrison (1978, table 6.1.), using the data from the "super-tax" introduced in 1910 ("The People's Tax"), *i.e.* the introduction of a progressive tax on global income. All these informations and are reproduced in Lindert (2000).

Finally, we had more difficulties to find reliable estimates for total income inequality: the subject of income inequality has been widely discussed (see Section 2) , and especially the studies of Williamson (1980, 1985) using inhabited house duties to generate permanent income inequalities have been extensively (and rightly - in our point of view) by Feinstein (1988). Lindert (2000) has made an interesting attempt to describe nominal income inequality at the household level as well as real income inequality using different consumption bundles (and movements in relative prices) for the top 20% and the top 5% for the years 1759, 1801/3, 1867, and 1911. As explained below, we have generated mean incomes and income inequality between classes by using plausible assumptions for the year 1911 and by extending it to the rest of the nineteenth century.

4.4 The Monetary Transfer

4.4.1 Debt Holding

As noted above, since we do not have precise data about the identity (and social rank) of debt holders after 1756 (the end of the work by Dickson), we will make the reasonable (in our point of

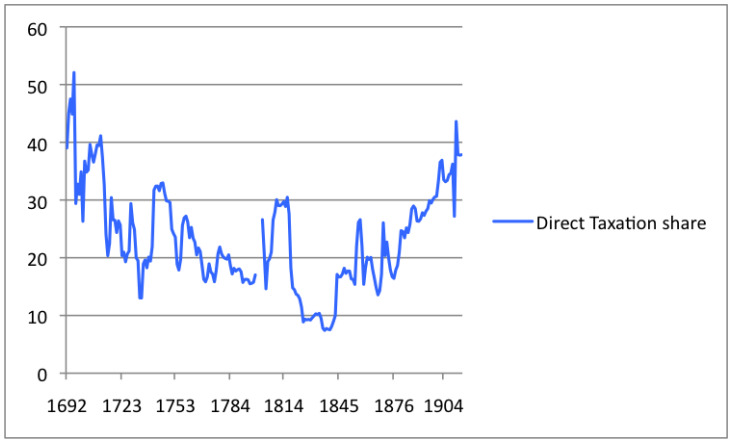
[64] Dowell gives firm estimates for the years 1815 and 1885. For having a global pattern, we have calculated different tax shares by using observations given by Dowell for each taxes for various (but close enough) years

view) assumption that the distribution of debt holdings mirrored either the distribution of total wealth as traced in Figure 13 or the distribution of personal wealth (Fig. 12).

4.4.2 Taxation in Britain - Who paid for debt interests?

Taxation in Britain is not an easy variable to account for, for two main reasons. Firstly, the British tax system was a mix between indirect and direct taxes. In practice, indirect and direct taxes (especially income tax) do not fall upon the same categories of people with the same weight. The relative weight of both types of taxation is certainly something to take into account (see Figure 14), even if direct taxes have never been the majority of taxes collected until the twentieth century.

Figure 14: The Share of Direct Taxes in Total Taxation, 1692-1914



Secondly, successive governments have certainly tried to apply the first maxim of taxation of Smith (1776, Book V, Chapter 2), *i.e.* that "The subjects of every state ought to contribute towards the support of the government, as nearly as possible, in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the state.", [65]. Thus, most of tax rates were proportional (rates of consumption taxes, of income tax), but different tax bases could make a tax either lump-sum (tax on candle, tax on salt), or proportional (proportional taxes on "pure" normal goods with an income elasticity of 1 for every individual), or progressive (income tax upon a certain threshold, taxes on luxury goods).

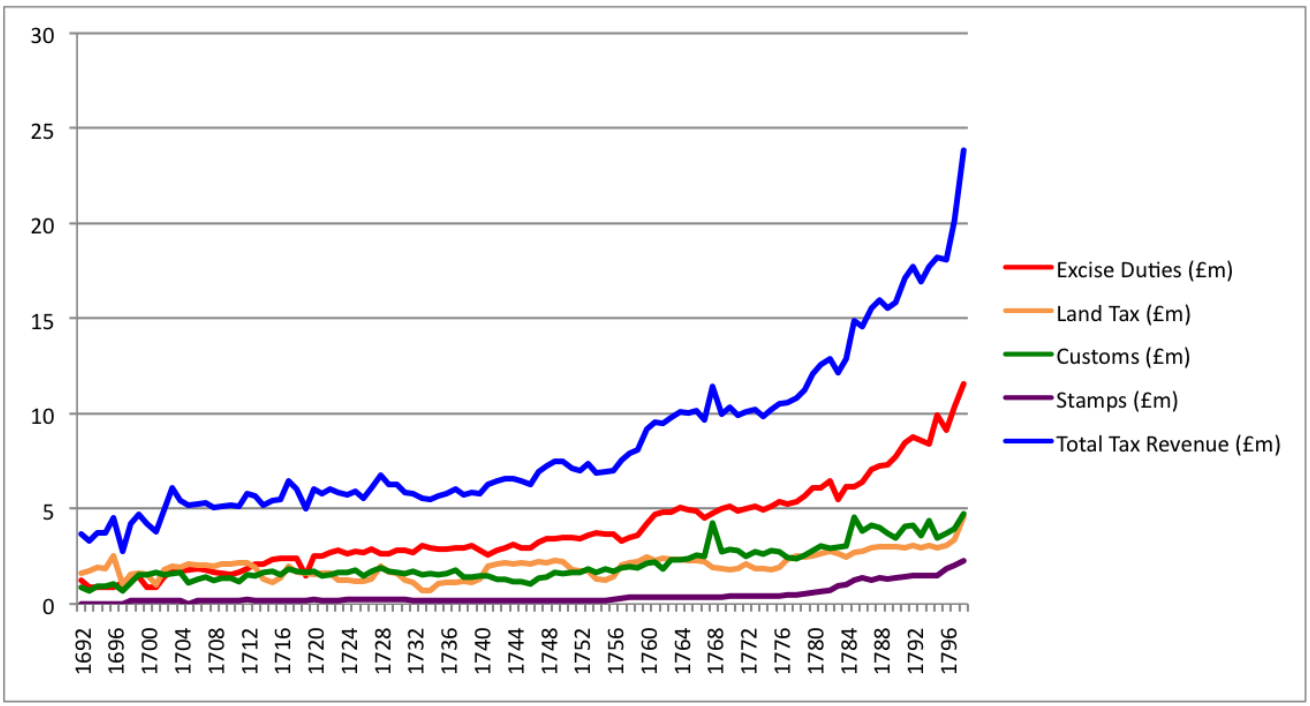
How can we estimate the relative share of income paid by households of each dynasties in taxes? Did everybody pay 7,67% of its income in taxes between 1820 and 1900 (the mean

[65] in that quote, two mentions are difficult to interpret: the idea of "abilities" and the idea of "protection of the State": a simple proportion rule of taxation (*i.e.* a flat tax) can be viewed as a reductory interpretation since everybody does not enjoy the same protection of the State.

taxation rate relative to national income in this period)? Which classes were heavier taxed in proportion of their income?

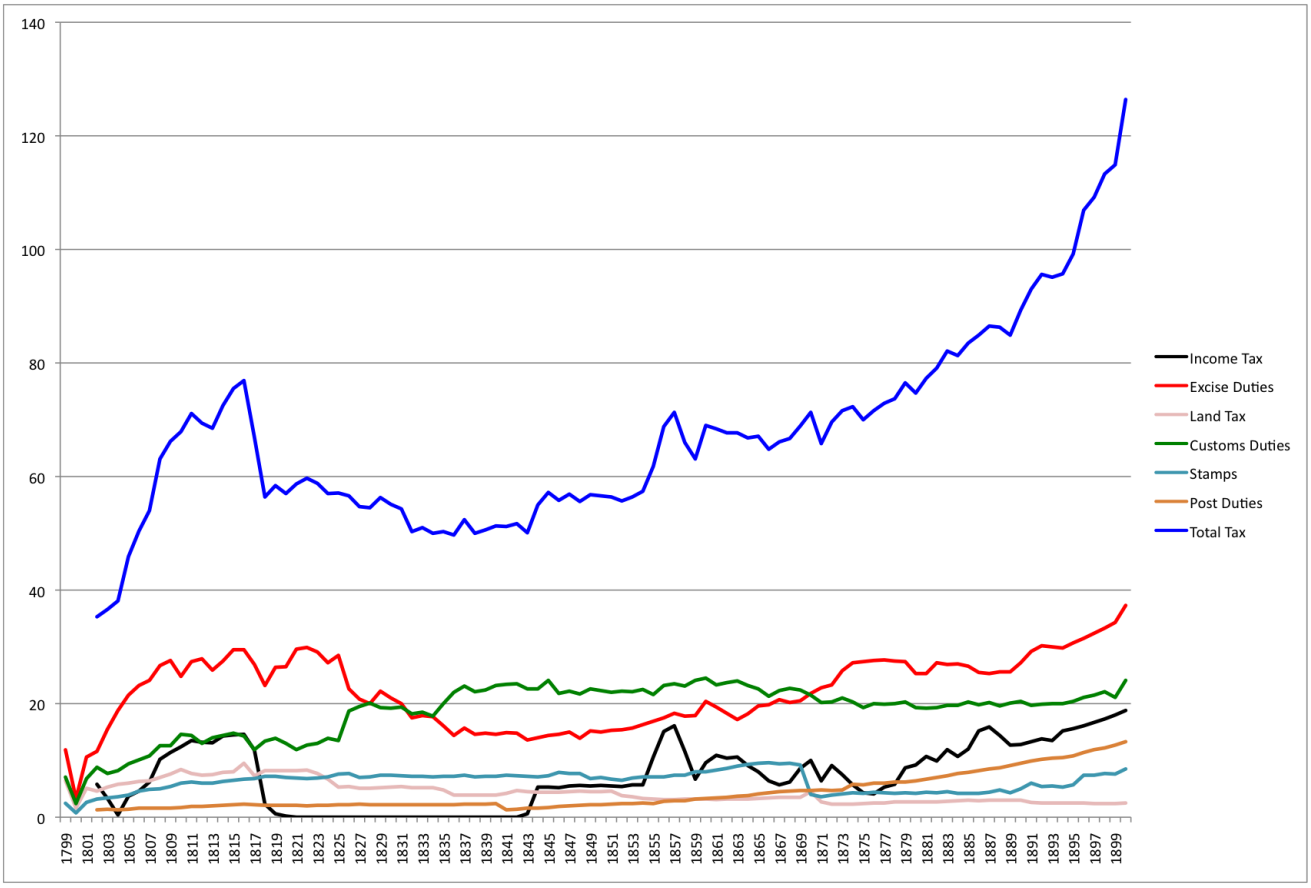
First, one can see that consumption duties represented the largest part of taxation (see Fig. 15 for the eighteenth century and 16 for the nineteenth century). In what follows, we have tried to divide those consumption duties into taxes on necessities, taxes on "pure" normal goods (with income elasticity equal to 1) and on luxuries to approximate the relative weight of each type of taxation between social groups. Then, assuming a 100% repercussion on prices, we assume that taxes on luxuries are lump-sum taxes (hence, paid by each social group in proportion of its relative weight in the population), whereas taxes on decencies ("pure" normal goods) are assumed to be proportional. Finally, taxes on luxuries are assumed to be paid by the top 1% at 50%, by the P90-P99 share at 40% and by the bottom 90% at 10%.

Figure 15: Main Taxes in current £ millions, 1692-1798



Source: Mitchell and Deane, *Abstract...*

Figure 16: Main Taxes (in current £m), 1799-1900



Source: Mitchell and Deane, *Ibid.*

Direct Taxes

A brief history of the British Income Tax The "Property and Income Tax" has been introduced for the first time in Britain in 1799 during the War against Revolutionary France, by William Pitt the Younger. The rate was initially a 10% rate, with multiple abatements. Above all, a global exemption for all incomes below 60*l.* (a year). Then, incomes between 60*l.* and 200*l.* were taxed at various rates. Therefore, the rate of 10% of income was fully charged for incomes superior or equal to 200*l.* only (i.e., mostly, rich individuals). Other kinds of abatements were allowed , especially for repairs of buildings, for children, for charities, or for life insurance premiums.

Pitt's initial tax was abolished after the Peace of Amiens in 1802. However, the Income tax was reintroduced immediately after the beginning of the War against Napoleon by Henry Addington. The innovation of Addington's Scheme was the taxation of different incomes regarding to different sources of income. Whereas Pitt imposed the whole (global) income, the renewed Property and Income Tax was charged upon different "Schedules": Schedule A was for the owners of land (including houses), Schedule B for farmers (incl. owners of land in occupa-

tion), Schedule C for fundholders (creditors of the State - with an exception for "nonresidents"), Schedule D for all other incomes and finally, Schedule E for persons deriving income from public office, employment anf profit (incl. persons receiving annuity, pension or stipend) [66]. Again, a full exemption was made for all incomes below 60*l.* (aggregating all sources of income). Between 60*l.* and 150*l.*, the tax was nonlinear and varied between 3 and 11*d* in the *l.* (i.e. from 1,25% to 4,6%). For incomes superior or equal to 150*l.*, the full rate was 1*s* in the *l.*, i.e. 5%.

During the War against Napoleon, the Income Tax was further modified in 1806 by Lord Henry Petty, who diminished the exemption threshold from 60 to 50*l.* and limited it to labour incomes. Moreover, Petty introduced an linear abatement of 1s each 20s (5%) for all incomes below 150*l.*. Petty also introduced a new system of abatements for children, differentiated by income (from 4% for each child aged more than two, and for incomes below 400*l.*, until 1% above 5000*l.* incomes). Other minor adjustments were made, especially for the direct taxation of creditors (Schedule C) - the amount of taxes being retrenched from the dividends, with possible reimbursement after (especially for foreigners).

After the War, the unpopular Income Tax was abolished by Chancellor Vansittart in 1816. It is only in 1842 (26 years later) that the Income tax reappeared under Peel's administration, globally following the same scheme as Lord Petty's Tax. However, the global exemption (whatever the source of income) was reintroduced for all incomes below 150*l.*. The tax was not introduced in Ireland (since tax collection was not possible because of the lack of institutions). The general rate (again, with exemptions and abatements) was of 7d in the *l.* (2,9%). At the time, the "sublime rule of proportion" - considered as the perfect application of the Smithian First Maxim of Taxation - was of the highest importance, and effective different tax rates according to the amount of income were presented as abatements and exemptions, i.e. as exceptions.

Peel's Income Tax was introduced as a provisory tax. However, the tax was renewed for three years in 1845, and again in 1848 and in 1851, and became - in practice - permanent.

William Gladstone - pursuing Peel's policy - obtained in 1853 from the Parliament the renewal of the tax for seven years at a rate of 7d in the *l.* (2,9%) for the first two years, decreasing to 6d for the two following years (2,5%) and to 5d for the three remaining years (2,1%) . The tax was now also collected in Ireland. The new exemption limit - with this limited rate - was decreased to 100*l.* with an abatement (an effective rate of 5d) between 100 and 150*l.*. However, the Crimean war obliged the government to raise the rate from 7d to 1s 2d (5,8%) in 1854, and further to

[66] For a closer description of the income tax, see Dowell (1888, pp. 99-101)

1s 4d in 1855 (6,7%). In 1858, the rate was lowered to 7d, and finally to 5d in 1859. However, for the following year, the rate was raised to 9d (3,75%) - a rate maintained in 1862 and 1863. During the 1863-1864 year, the rate was reduced to 7d, the abatement threshold was extended from 100*l.* to 200*l.* with a new form of abatement: for incomes below 200*l.*, the taxable income was reduced by 60*l.*.

Further tax rates until 1884 (and after) are detailed in the Table 17 below (at the end of the paper). Other important changes were the changes of abatement thresholds: in 1873, the abatement threshold was raised from 200 to 300*l.*, and the amount of the abatement was raised from 60*l.* to 80*l.*. Again, in 1876, the exemption threshold was raised to 150*l.* (against 100*l.* before), the abatement threshold was raised from 300 to 400*l.*, and the amount of the abatement from 80 to 120*l.*.

What do the Exemption thresholds mean? Using imperfect data, we however find that those thresholds (with the exception of 1806) roughly mean that only rich people paid the income tax. Again, without perfect data, we can only exploit studies at the microlevel. Especially, Horrell (1996) provides detailed data for some households by occupation during the 1790s, the 1810s, the 1820s, the 1830s and the 1840s.

- **The Exemption Threshold of 1799 (£60)**. First, using Horrell's Data (especially Table 1 p. 568), we can see that the 60*l.* threshold is well above the annual male earnings in the agricultural (labourers) sectors (£22 p.a. for high-wage male earners, and £18 for low-wage during the 1787-1796 period). The threshold is also well above the mean wages of male earners in industrial sectors (mining, factory, outworkers, trades, which are all below or just above £30).

- **The Threshold of 1806 (£50)**. The 50*l.* threshold for exemption introduced in 1806, however, may have led some workers to pay the income tax. Unfortunately, Horrell does not provide data on this precise period, but on the 1810-1817 period, we can state that both male earnings and average household expenditure (it seems that the tax unit is the individual and not the household) of some industrial workers are above 50*l.*, *e.g.* for minors and for trade workers. Therefore, the working class could have paid the income tax - however at a lower rate (9,5% including the 5% linear abatement).

- **The Threshold of 1842 (£150)**. In 1842, the threshold was fixed to 150*l.*. According, again, to Horrell's microlevel data, the workers in the laboring class are well below the threshold during the 1840-1854 period (the richest workers - i.e. factory workers - are reaching half of the threshold). Therefore, one could reasonably think that the renewed

income tax excluded working classes from its tax base at the beginning. Using another dataset at the microlevel (Horrell and Humphries, 1992) also supports our claim that working classes were excluded from the income tax at the beginning. Horrell and Humphries (Table 1, p. 855) exhibit again average earnings of the head of the household per annum which are largely below the 150*l.* threshold: wages are ranked between £17,4 p.a. for outworkers and £49,4 p.a. for factory workers in the 1841-1845 period (even if sample sizes are low). Lindert and Williamson's (1983b) estimates, often classified as "optimists" about the Standard of Living of working classes, find nominal estimated wages far below the 150*l.* threshold for the majority of the Working Class: farm labourers earn on average 29£, traders around £60-75 p.a. (Table 2 p. 5). Even schoolmasters only earn £81 p.a. in 1851. Oppositely, engineers (£479 p.a.), doctors (£201 p.a.), solicitors and barristers (£1837 p.a.), clergymen (£267 p.a.), clerks or government high-wage employees certainly paid the income tax.

- **The Threshold of 1853 (£100)**. Under Gladstone, the exemption threshold was decreased to 100*l.* p.a.. This threshold was, for Gladstone, the 'dividing line ... between the educated and the labouring part of the community' (in Daunton, 2001, p. 152).

  Horrell and Humphries only provide data for 33 households in 1850-1855, in the trades sector, whose average (male) earnings are £53,3 p.a., again below the threshold. In the 1860-1865 period, other sectors (agricultural wage earners, outworkers) are again largely below the threshold.

  Williamson (1985) exhibits detailed estimated earnings for a large portion of the active male population (around 80% of the active adult male population) for 1827 and 1851 (Williamson, 1985, pp. 9-10). In these tables, it is clear that in 1851, the blue-collar workers (i.e. approximatively the bottom 95% of the distribution of earnings, earnings less than 74% of the total), were just below the threshold of exemption (earning in the maximum £98 p.a. for "aristocratic" laborers, i.e. skilled manual workers). The mean wage of blue-collar workers was at that time about £52.62, i.e. approximatively half of the threshold.

  Thus, only white-collar workers (messengers, clergy, barristers, teachers, clerks) paid the income tax at that time. Hence, Gladstone was globally right.

- **The Threshold of 1876 (£150)**. The new threshold was again fixed to 150*l.*. Williamson(s estimates (1985, table 2.11) from 1851 to 1911 shows - for adult males - that in 1881, all low-skilled workers and much of the high-skilled manual workers were largely below the

£150 threshold. The nominal "pessimist" estimates by Feinstein (1998, Tables 2 and 3) for 1911 (i.e. more than 30 years of economic growth after, often described - by Williamson (1985) and others - as benefitting to the working class) also exhibits numbers of average earnings - on the basis of full employment - largely below the threshold: from 39£ p.a. in the agricultural sector to £86 p.a. in the coal sector.

- **Other Thresholds - 1890, 1894, 1898** Other minor adjustements did occur at the end of our period (before the introduction of the differentiated income tax in 1907, which became progressive in 1909). In 1890 (fiscal year 1890-91), the abatement was increased to £120 for incomes between £150 and £400. In 1894 (fiscal year 1894-1895), the exemption threshold was increased to £160, and the amount of abatement was £160 for incomes below £400 and £100 for incomes between £400 and £500. Finally, in 1898 (fiscal year 1898-9), the abatement thresholds were £400 (abatement of £160 between £160 and £400), £500 (abatement of £150), £600 (abatement of £120) and £700 (abatement of £70) (Daunton (2001), Table 6.2. p. 160)

Therefore, we have good reasons to think that - even with the growth of the economy during the second half of the 19th century, the working class (which ranges from the "Lumpenproletariat" to the more-skilled working class) did not pass the threshold to pay the income tax and did therefore only pay (in mean) indirect taxes - with the (notable) exception of the 1806-1815 period where some microlevel data (from Horrell (1996)), as well as more general data (Williamson (1985), Table 2.4. p. 12) could indicate that some workers [67] did pass the 50*l.* threshold. Since we mostly focus on the 1820-1900 period, this exception is not under the object of our study.

However, as it is clear on Figure 16, the Income Tax as well as the Land Tax (charged on Land) did not represent a major part - even being non negligible. Hence, even those taxes were "progressive" with respect to their tax base, which is a non-negligible element in the tax system, their share in the total tax system show that they were not predominant. What we will assume is that the income tax was paid by the top 10% of incomes only, proportionally to their average earnings (hence, we do not account for abatements, which were rather low in percentage points).

Indirect Taxes A global history of all indirect taxes in Britain would be far too long and far beyond the scope of this study. What we aim to define is whether taxes on consumption - assumed to have a 100% repercussion on consumption prices [68]

[67] Police, guards, miners, messengers, government low-wages, shipbuilding and engineering trades, cotton spinners, printing trades, building trades.

[68] It is clear that this assumption is a simplifying assumption since the effective fiscal incidence depends on relative price-elasticities of supply and demand. However, without data - especially on supply elasticity,

We would like to differentiate the different sources of consumption duties by duties on necessaries, which were consumed similarly in all classes in the population (hence these duties were similar to a lump-sum tax), duties on normal goods (consumed proportionally to income), and duties consumed by the richest part of the population (hence a progressive tax).

We have found imperfect data in Dowell (1888) for the 1815-1885 period. Even if detailed budget is only available for the years 1815 and 1885, we have tried to reconstruct the structure of the Excise and Customs taxes for some years, using approximatively constructed values for missing observations.

For the next calculations, we will assume the classification of consumption taxes detailed in Table 1.

Table 1: Assumptions regarding the structure of consumption duties

Lump-sum tax (necessities)	Proportional tax ("pure" normal goods)	Progressive Tax (luxuries)
Salt, Corn, Beer and Malt, Starch, Leather, Bricks, Coal, Iron, Timber, Wool	Tea, Coffee, Sugar, Soap, Candles, Butter, Cheese, Raisins, Currants, Orange, Paper, Newspapers (and Advertisements), Glass, Cotton Wool, Hemp, Others	Olive oil, Spirits (British, Colonial, Foreign), Wine, Printed Goods (calicoes...), Plates, Silk.

This distinction is certainly a bit arbitrary. For lots of goods (such as butter), the amounts of taxes collected are so low that this distinction does not really matter. For other goods (such as salt, candles, leather), the classification as "necessaries" seems quite undoubtful. For other goods, especially beer (and malt), sugar, tea, soap, the distinction between necessities, decencies and luxuries is much more debatable. Moreover, one has to distinguish between "objective" necessities and non-necessary goods but consumed by the poor exactly in the same way as by the rich. For example, Smith (1776) distinguishes the necessaries and the luxuries consumed by the poor. In Horrell's estimates (1996), dinstinguishing between goods with income elasticities inferior to 1 (necessities), equal to 1 ("pure" normal goods) and superior to 1 (luxuries) indicates that soap and candles were almost necessary goods (elasticity of 0.92), as Sugar (0.95). Tea has an income elasticity slightly superior to 1 (1.26). However, the rather low number of observations

we have chosen to make this assumption for all goods, even if - in partial equilibrium - taxes on necessities (with a lower price-elasticity of demand) should have been (in effect) more frequently paid by consumers than taxes on luxuries or on normal goods. Moreover, this implicit assumption has been made by Mathias and O'Brien (1976) on their study on taxation in the 18^{th} century. Finally, the question of fiscal incidence clearly matters, but if suppliers paid some part of the consumption taxes, they could distribute less wages or less capital interest, the total effect depending on which tail of the distribution of wages was hit.

(total sample size is 254) and the problem of possible sample selection obliges us to make such assumptions.

However, we tried to build these assumptions as the most realistic assumptions. For example, tea is certainly not a pure luxury good as if it were only consumed by the rich: per capita consumption indicates that consumption should have trickled down into the lower masses of consumer [69]. Beer was widely consumed by manual workers (E.P. Thompson (2012), p. 419) so that malt and beer taxes were highly unpopular [70]. Similarly, tea became more and more considered as a necessity. [71] With our assumptions the different tax shares write

Table 2: Estimated Pattern of Consumption Taxes

% in Total Consumption Duties / year	1815	1827	1859	1877	1885
Lump-Sum Taxes	37,8 %	22,1%	19%	19,9%	19,9%
Proportional Taxes	36,3%	48,8%	48,1%	31,4%	33,6%
Progressive Taxes (Luxuries)	25,9	29,2%	32,8%	48,7%	46,5%

For the years after 1885 (1886-1900), since we did not find event regarding indirect taxation justifying a change in the pattern, we predicted the values by a linear OLS regression from the trend between 1877 and 1885.

Finally, death duties were recorded in Mitchell and Deane after 1870, so we included it in our analysis as proportional taxes on total wealth holding, whereas Stamps and Post Duties were assumed to be lump sum.

4.4.3 The monetary transfer

Between date t and t+1 (assume a discrete time model), each dynasty i receives interest payments from public debt, according to the volume of public debt it held during the year (assuming a discrete time). In the scenario of a default in 1820, each dynasty would have gained - in turn - tax reliefs proportionally to what it paid in taxes. Thus, tax reliefs for each dynasty would have been equivalent to the amount of interests payments of the year multiplied by the share of taxes they paid. Thus, the monetary gain (denoted MT for monetary transfer) or loss for each

[69] De Vries (2008), p. 160, indicates that the consumption of tea in Great Britain was the highest in Europe in the 1780s, as well as sugar - two times the p.c. consumption in the Netherlands. John Styles (in Brewer and Porter, 1993), indicates that lots of household goods had spread among middling goods in the 18th century

[70] E.P. Thompson, p. 419 in the French edition, says that "Supprimez la taxe sur le malt, disait un magistrat du Hampshire en 1816, et l'ouvrier ira, plein d'entrain, accomplir sa tâche quotidienne et travaillera avec énergie et plaisir"

[71] Thompson reports that some too poor workers begged their neighbours for already used tea leaves.

dynasty i is equal to:

$$MT_t^i = \underbrace{\left(\frac{D_t^i}{D_t} - \frac{T_t^i}{T_t}\right)}_{\substack{\text{Debt share of i} \\ \text{minus} \\ \text{Tax relief share if default}}} \cdot \underbrace{[r_t D_t - (p_{t+1} D_{t+1} - p_t D_t)]}_{\substack{\text{Interest} \\ \text{payment} \\ \text{of the year}}} \underbrace{\substack{\text{minus} \\ \text{Newly issued} \\ \text{Debt} \\ \text{Between} \\ \text{t and t+1}}}_{} \quad (1)$$

where $\frac{D_t^i}{D_t}$ denotes the share of total debt held by dynasty i, and $\frac{T_t^i}{T_r}$ denotes the proportion of taxes that dynasty i paid. This equation simply means that the net monetary transfer from public debt is what one creditor receives minus how much he pays for it. p_i is the market value of debt at date i, which measures if debt is bought or sold by the government at a premium or at a discount. For simplicity, we will assume that debt is roughly constant, and that

$$p_{t+1} D_{t+1} - p_t D_t = 0$$

In fact, this is quasi-exactly the pattern that debt followed during the first part of our period (say, 1820-1855 See above, Fig. 5). Moreover, debt did decrease over the total period (from around £200m) so that this assumption will create a (small) downward bias in our results (since creditors gained more while debt was reimbursed than if debt was just constant). However, since this reimbursement only represents a small amount with regard to debt interests given by the State to its creditors, we will leave it aside. Finally, this allows to avoid the question of relative price of debt reimbursement with respect to debt issuance - which is certainly also something in favor of creditors (debt was very cheaply emitted during the Napoleonic Wars and reimbursed at a higher price).

Thus, following Eq. (1), and since we assumed $p_{t+1} D_{t+1} - p_t D_t = 0$, we have the nominal transfer equation given by:

$$MT_{t,t+n}^i \equiv \sum_{k=t}^{t+n} MT_k^i = \sum_{k=t}^{t+n} r_k D_k \left(\frac{W_k^{p,i}}{W_k^p} - \frac{T_k^i}{T_k}\right) \quad (2)$$

4.4.4 Generating saving rates by classes

According to our dynastic framework, we try to generate saving rates by classes to see what type of transfer the monetary transfer was: was it a wealth transfer, a consumption transfer between social classes? Global private saving rates (for the whole population) have already been calculated by different authors, using the identity

$$I_n = S_n$$

i.e. national investment (domestic investment plus net foreign investment) equals national savings (private savings plus government budget surplus or minus government deficit). For example, Williamson (1985, Table 11.3 p. 173, p. 178) finds high mean gross saving rates: between 17.1 and 18.1 per cent (in mean) during the period 1760-1820. Dividing the society in two classes, and assuming a 0 savings rate for the bottom 50% of the scale of income, this implies a saving rate around 35% for the top 50%, which is high. To generate the mean saving rate, Williamson uses the sum of gross domestic saving in reproducible capital (divided by national income at constant prices) and of net increase (or decrease) in government debt (divided by national income at constant prices). His sources are to find in Feinstein (1978a), and Deane and Cole (1962). Piketty and Zucman (2014, Table UK.5d) find a mean net private saving rate of (roughly) 10,4% for the period. The main difference is that Piketty and Zucman take capital depreciation [72] and capital gains (relative price effect) into account. Since Piketty and Zucman are able to reproduce the dynamics of wealth extremely well with their methodology, we will consider their study as a benchmark for our estimates.

However, recall that our goal is not to generate mean saving rates for the whole population, but by classes of creditors. Since we do not have sufficient data (for example at the household level) to compute saving rates by family and by class, we will firstly generate global savings (in volume) and then we will divide it by an estimate of income of each class.

Volume of Savings. The accumulation equation of wealth for each dynasty i in a two-goods model writes

$$W^i_{t+1} = W^i_t(1 + q_t) + S^i_t \tag{3}$$

where W^i_j means wealth of dynasty i at date j, S are savings and q_t are capital gains (inflation of housing price, of asset price, relatively to the consumption price). One can notice that we will use volume estimates (deflating by Consumer Price Index) of private wealth to generate our class savings. Finally, there is certainly a large share of the population whose private wealth was (approximatively) 0, i.e. whose savings were 0. Approximatively, the bottom half of the income distribution, or even the bottom two thirds of the distribution (the working class, the paupers) should have very low wealth - but since we do not know where the dividing line is, we will consider the bottom 90% as a whole - hence receiving some capital income and saving.

Thus, to generate the volume of savings of each dynasty i during year t, one has just to sub-

[72] which they assume to be around 3% in the second half of the 18^{th} century and 4% after - cf. their Appendix, p. 188, ft 317

stract from wealth at year t+1 the wealth of the preceding year multiplied by an approximation of capital gains. We will assume that capital gains - estimated by Piketty and Zucman (2014) - are uniformly distributed in the population, so that each dynasty has the same rate of capital gains:

$$\text{For each dynasty i, } S_t^i = W_{t+1}^i - W_t^i(1+q_t) = \frac{W_{t+1}^i}{W_{t+1}^p}W_{t+1}^p - \frac{W_t^i}{W_t^p}(1+q_t)W_t^p \tag{4}$$

By this simple accounting method, we are able to generate volume of savings for each class, given our data about wealth concentation ($\frac{W_j^i}{W_j^p}$ where the uperscript p denotes private wealth in the whole society).

To generate saving rates, we now need estimates of incomes by classes. However, we cannot rely on precise estimates for income distribution since there does not exist really firm and reliable data about income distribution before the twentieth century- despite a huge debate about the question of standard of living. More reliable data come from the "People's Tax" of 1911, analyzed by Atkinson and Harrison (1978). Lindert and Williamson have made interesting attempts to revise and to expand existing data from the "Social Tables" (*e.g.* Colquhoun (1815) for 1801-1803, Baxter (1868) for 1867, Bowley (1920) for 1911, but their estimates still remain imperfect and debatable.

Table 3: Data available on Total income inequality in Britain in the 19$^{\text{th}}$ century

	1801/03	1867	1911
Top 0,1%	3,8%	13,9 %	11,1%
Top 1%	14,6 %	28,5 %	21,9%
⇒*incl. P99-P99,9*	*10,8%*	*14,6%*	*0,8%*
Top 5%	39,3%	41,1 %	
⇒*incl. P95-P99*	*24,7%*	*12,6 %*	*16,8%*
Top 10%	48,8 %	48,5 %	47,2%
⇒*incl. P90-P99*	*34,2 %*	*20%*	*25,3%*
⇒*incl. P90-P95*	*9,5 %*	*7,4%*	*8,5%*
Top 20%	63,2%	55,6%	55,2%
⇒*incl. P80-P90*	*14,4%*	*7,1%*	*8%*
Bottom 90%	51,2 %	51,5%	52,8%
Bottom 80%	44,1%	44%	44,8%

Sources: 1801-03: Colquhoun (1815), revised by Lindert (1988, rev. 1997). 1867: Baxter (1868), revised by Lindert. 1911: Bowley (1920), revised by Atkinson and Harrison (1978), from Piketty (2013)

Income distribution We have to be careful by comparing the data, which are of course incomplete and certainly not definitive: the main problem is that observations are too limited to have a global pattern for the whole century. Moreover, there is a problem of comparison

between Social Tables, which were not constructed with modern standard methods. Thus, the huge increase in income share of the top 0,1% between 1801 and 1867 (multiplied by more than 3,5) is a bit suspect - so as for the whole top 1%.

Therefore, we have constructed estimates from the data of 1911, which are more reliable (since they are based on income tax data), and we compare them with data about wealth distribution - which are also imperfect - to "build" patterns of income distribution for the rest of the nineteenth century. This method is certainly imperfect - but one has to keep in mind that our goal is not to make a real contribution to the history of income inequality in Britain, but to generate plausible income distribution in order to have our saving rates.

In 1911, since the top 1% of wealth holds 69% of it and since the capital income share is about 38%, then the top 1% of wealth should have earned 26,2% of income. Thus, we find a (rather small) incoherence between the income of our top 1% of wealth given our capital shares, and our top 1% of total income. This incoherence is certainly due to imprecisions in data sources and to imprecisions in the database. For example, for our 69% share, Atkinson and Harrison (1978) warn themselves about the uncertainty on wealth concentration data. Lindert and Williamson (1983b) find that the top 1% of wealthowners at death hold about 60% of wealth. Therefore, either our capital share is too large (it should be 31,7%), or total income inequality is too low (the top 1% should receive 26,2% of total income), or wealth concentration should be lower (the top 1% should hold 57,6% of wealth).

Unfortunately, we do not have perfect data about detailed composition of households' incomes or precised distribution of labor income by classes of wealth, which would help us to build a coherent view of the British society and of its evolution during the nineteenth century. Therefore, we have to make some assumptions to be coherent with the few data we have. Of course, these assumptions are likely to diminish the precision of this research.

Assumption 1: the top 1% of income is identical to the top 1% of wealth. This top 1% of distribution earns capital income only during the whole nineteenth century.
Assumption 2: Labor income and capital income are perfectly correlated for the P90-P99 class
Corollary: the bottom 90% earns the residual of labor income. For example in 1911, since the P90-P99 class earns 23% of capital income, it will earn the same share of labor income - according to Assumption 2, thus the bottom 90% will earn 77% of labor income.
Assumption 3: Total Income inequality in 1911 is assumed to be slightly larger than in Piketty (2013). For simplicity, we have chosen to deal with this issue since the other ones - really low capital share with respect with observed data for the rest of the century, or really lower wealth concentration - appeared to be more unplausible than the assumption of larger income inequality.
Assumption 4: The income inequality structure we generated to match (roughly) observed data in 1911 is extended to the whole nineteenth century

- **Assumption 1.** This assumption is certainly our most extreme assumption: 1% of the (active) population would earn capital income only: the share of "rentiers" in the British society would be exceptionnally high at the beginning of the 20th century. We have made this assumption by stating that multiplying the (estimated) wealth share of the top 1% of wealth by the capital share in the economy was already generating too large income inequality (before adding any labor income). The corollary of this assumption is that the top 1% is identical to the top 1% of income, which is of course not frequent.

Is this assumption plausible - regarding to the historical record? Piketty (2001, 2013) has shown that the share of capital income in total income of individuals was generally increasing along with the income distribution. Piketty (2001) provide detailed estimates for the French situation, which shows that in 1917, the top 1% of *total* income gained 54% of its income through labor income (Piketty, 2001, Graph. 2-1 p. 98). However, the capital share (27% in 1917) in France was historically lower than in Britain (Piketty and Zucman, 2014) so that capital income was not sufficient for the P99-P100 class to reach the observed levels of top income share. Furthermore, we see for France that the top 1% of top incomes could not have been the same as the top 1% of wealth. Otherwise this "big" top 1% of income would have gained 14,9% by their capital income (55% of total wealth according to Piketty (2001) times the capital share 27%), so that their total income would be around 32,4 % [73], which is far too large in comparison to

[73]
$$32,4\% = \frac{12,4}{0,46}$$

the existing data on total income inequality [74]. Therefore, there must have existed people in France in 1917 who work less (or have a lower wage) while they hold large wealth. This supports our implicit assumption that labor income and capital income are inversely correlated above a certain threshold. In the British case - in 1911 - this threshold would be (approximatively) the top 1% of wealth.

Denoting with an uperscript "K" the pure capitalists, and denoting by N the size of a population, we therefore assume that

$$N_{1910}^{K} = \frac{1}{100} N_{1910}$$

Denoting by Y the income of an individual, of a class or of the country (with different uperscripts), it follows that:

$$\frac{Y_t^{\text{Top 1\%}}}{Y_t} = \alpha_t \frac{W_t^{\text{Top 1\%}}}{W_t} \tag{5}$$

where α_t is the capital share in national product in year t.

- **Assumption 2.** This assumption has been made since it seemed to match the existing income and wealth shares data for the P90-P99 class in 1911. Moreover, it seems plausible that this class gained a perfectly mixed income, reflecting the whole economy (38% of its income from capital, and 62% from labor income). For 1911, this assumption leads to a total share of income for the P90-P99 class of 23% (by definition, since its capital is about 23% of total private capital). The data from Piketty (2013, Table 9.) shows that the P90-P99 class earned about 25,2% of total income, i.e. something close to what we find.

Therefore, denoting with an underscript L the labor income, and with an uperscript (P90-P99 or B90%) the dynasty we refer to, our assumptions write:

$$\underbrace{\frac{Y_{L,t}^{P90-P99}}{Y_{L,t}}}_{\substack{\text{Share of Labor income of P90-P99 in total labor income of year t}}} = \underbrace{\frac{Y_{K,t}^{P90-P99}}{Y_{K,t}}}_{\substack{\text{Share of capital income of P90-P99 in total capital income of year t}}}$$

[74] Around 20% for the top 1% in 1917 according to Piketty (2013), Graph. 10.1

And,

$$\underbrace{\frac{Y_t^{P90-P99}}{Y_t}}_{\substack{\text{Total Income Share}\\ \text{of the}\\ \text{P90-P99 class}}} = (1-\alpha_t)\frac{Y_{L,t}^{P90-P99}}{Y_{L,t}} + \alpha_t \frac{Y_{K,t}^{P90-P99}}{Y_{K,t}} = \frac{Y_{K,t}^{P90-P99}}{Y_{K,t}} = \underbrace{\frac{W_t^{P90-P99}}{W_t}}_{\text{Observable Wealth share of P90-P99}} \tag{6}$$

Finally, for the bottom 90%,

$$\begin{aligned}\underbrace{\frac{Y_t^{B90\%}}{Y_t}}_{\substack{\text{Total Income Share}\\ \text{of the}\\ \text{bottom 90\%}}} &= \underbrace{\alpha_t}_{\substack{\text{Capital Share}\\ \text{in the economy}}} \underbrace{\left(1 - \frac{Y_{K,t}^{P90-P99}}{Y_{K,t}} - \frac{Y_{K,t}^{\text{Top 1\%}}}{Y_t}\right)}_{\text{Remaining Capital income}} + \underbrace{\left(1 - \frac{Y_{L,t}^{P90-P99}}{Y_{L,t}}\right)}_{\text{Remaining Labor income}} \underbrace{(1-\alpha_t)}_{\substack{\text{Labor Share}\\ \text{in the economy}}} \\ &= 1 - \frac{Y_t^{P90-P99}}{Y_t} - \alpha_t \frac{W_t^{\text{Top 1\%}}}{W_t}, \text{ according to our preceding assumption}\end{aligned} \tag{7}$$

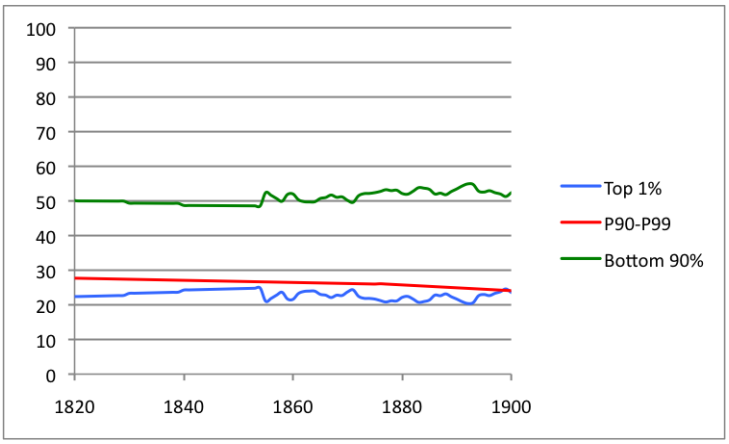
- **Assumption 3.** This assumption has been made since it was (in our sense) the most realistic (more realistic than lower capital shares and lower debt holding). However, the magnitude of the gap is not likely (in our sense) to be a strong problem.
- **Assumption 4** This assumption generates - in consequence - a relative stability in total income inequality during the nineteenth century since capital shares and wealth inequality varied over the century - but less than labor income inequality. However, comparing with existing estimates show that our method generates plausible orders of magnitude so that we think that our estimates of incomes of the mean household (in current pounds) during the century are plausible as a whole.

In 1911, we generated the income distribution in Fig. 4. Then, we have used the same repartition method to generate total income inequality for the rest of the nineteenth century (by classes of creditors. In our case, the top 1% of income distribution is also equivalent to the top 1% of wealth distribution. One caveat is certainly that this generates too stable income inequality during one century, whereas in reality, total income inequality might have increased during the century (see the Williamson (1985)/Feinstein (1988) controversy).

Table 4: Income distribution(s) in 1911

	Capital Income share in National Capital Income, 1911	Labor income share in National Labor Income, 1911	Total income share in National Income, 1911
Top 1%	69%	0%	26,2%
P90-P99	23%	23%	23%
Bottom 90%	8%	77%	50,8%

Figure 18: Simulated income inequality, 1820-1900



We are well aware that our assumptions can be certainly considered as somehow arbitrary. However, dealing with the lack of data about total income inequality and composition of top incomes during the nineteenth century, we have tried to build plausible orders of magnitude in 1911 and to extend it during the century to see the orders of magnitude of the antiredistributive transfer related to public debt. Therefore, our quantitative estimates are not firm quantitative estimates. Recall that our estimates are attempts to quantify the impact of debt on inequality, i.e. according to various categories of stockholders (i.e. of wealthowners), relating it to the global distribution of incomes in the society.

Then, we put the orders of magnitude of global transfers that we find in perspective by expressing it in percentage of the (generated) income of the mean household of each class. To determine this mean household's income, we simply divide the estimated total income of the class (generated according to the assumptions above) by the number of households in the class, i.e. in general, the total number of adults in the class divided by two (husband and wife). For example, for the top 1%, we have (in a given year t)

$$\text{Number of households of the top 1\%} = \frac{1}{100} \times \frac{\text{Total number of adults in the whole country}}{2} \tag{8}$$

Estimates for the number of adults in the whole country come from Piketty and Zucman's (2014) database.

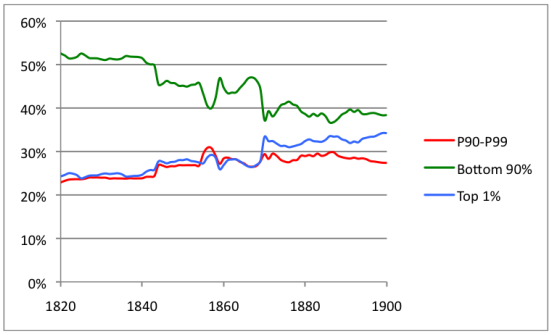
Dividing estimated savings each year by estimated income leads to the following saving rates by dynasties.

Table 5: Saving Rates by Dynasties

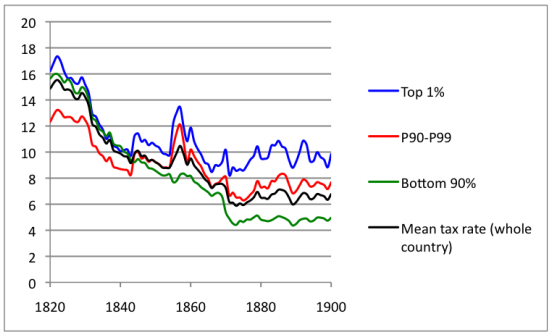
Class	1810-1910	1810-1855	1856-1910
Top 1%	32,5%	22,5%	35,2%
P90-P99	8,1%	7%	8,4%
Bottom 90%	0,8%	1,5%	0,6%
Global saving rate (for the whole population)	10 %	7,9%	10,5%
Comparison: Piketty and Zucman's estimates	10,4%	8%	11,1%

Finally, dividing the estimated taxes paid by each class by the estimated revenue of each class leads to the repartition of taxation shown in Figure 19

Figure 19: Estimated weight of taxation by class, 1820-1900



(a) Estimated share (in %) of total taxation paid by each class, 1820-1900



(b) Estimated tax rate for each class (% of estimated revenue), 1820-1900

4.5 Results

4.5.1 Total Transfer

If Debt mirrored Total Wealth concentration Our first estimates rest on the assumption that the concentration of public debt holdings mirrored the concentration of total wealth. As we have explained above, this assumption is made since data on total wealth concentration

appears to be historically more plausible than data on personal estate only. In that case, we find a rather high monetary transfer from public debt:

Table 6: Direct Transfer If Debt Holding Mirrored Total Wealth Holding

Class	Total class effect in current £ millions per year	**Mean Effect per household, 1820-1900**	*incl.* 1820-1840	*incl.* 1840-1870	*incl.* 1870-1900
Top 1%, in £	8,5	**106,3**	150,5	118,2	82,6
in % of total mean household income		***4,9***	*9,86*	*5,46*	*2,8*
P90-P99, in £	- 0,4	**-0,23**	1,9	-0,26	-0,98
in %		***0***	*1*	*-0,1*	*-0,26*
Bottom 90%, in £	-7,9	**- 1,14**	-1,87	-1,28	- 0,82
in %		***-2,2***	*-5,1*	*-2,5*	*-1,1*

Our central scenario shows therefore non-negligible effects of public debt in terms of transfer between classes: in mean, during the century, public debt represented a transfer of more than 2% of income *each year* from the bottom 90% in the direction of the top 1%, which gained *annually* 5,5% of its income through public debt interests. The effect was even larger in the first two decades following the Treaty of Vienna since public debt was a sort of additional tax of more than 5% of income for the mean household of working classes, which was then used as a transfer of around 10% of the annual income of the mean "rich" household. This large effect is due to the fact that debt charges represented a rather large share (8,5%) of national income (larger than during the rest of the century) and of total taxation (55%). Moreover, the income tax had not been introduced, whereas consumption duties rested more on necessities than during the rest of the century. This last element may have been a bit overestimated, but one has to recall that taxes on beer, candles, salt were not abolished until the end of the 1820s.

This scenario rests on our three major assumptions: about debt holding, about income distribution, and about total taxation pattern. Changing the variables could lead to a lower result. However, the orders of magnitude are significantly larger than 0 so that we have good reasons to think that - even with our imperfect data and estimates - public debt did have a significant effect on income inequality.

If Wealth concentration mirrored Personal Estate concentration Since - according to Lindert - personal wealth was not much concentrated at the beginning of the century, and according to our imperfect estimations of total income of each class of creditors, we explore as an alternative scenario the counterfactual scenario of a default in 1820 with public debt mirroring personal estate concentration.

Table 7: Direct Transfer If Debt Holding Mirrored Personal Estate

Class	Total effect at the class level (in current £ millions)	**Transfer (gain or loss) for the mean household of each class, per year, in current £ and in percentage, 1820-1900**	*incl.* 1820-1840	*incl.* 1840-1870	*incl.* 1870-1900
Top 1%, in £	1,7m	**£19,9**	17,8	22,1	18,9
in % of total mean household income		***0,85***	*1,14*	*1*	*0,64*
P90-P99, in £	3,2m	**£7,5**	6		2,16
in %		***1,75***	*3,73*	*2,22*	*0,72*
Bottom 90%, in £	- 4,83	**-0,67**	-0,95	- 0,84	-0,48
in %		***-1,27***	*-2,59*	*-1,66*	*-0,61*

In that case, we find smaller orders of magnitude, however indicating that debt might have had antiredistributive effects from the bottom 90% to the rest of the population. In mean, during 80 years, the top 1%'s mean household would have gained less than 1% of supplementary income each year, whereas the bottom 90% would have lost ca 1,3% of its (pre-tax) income each year. However, the effects were larger during the 1820-1840 period, with effects amounting to more than 2,5% for the bottom 90%. One has also to notice that the P90-P99 non-negligibly gained from public debt in that scenario (1,75% in mean, including 3,7% during 1820-1840).

Of course, debt holding explains this discrepancy between both scenarios: in the second case - which is not totally unplausible - public debt might have constituted a transfer of about 10% of its income for the mean male of the top 1%. Moreover, since debt is (in that case) extremely

concentrated in the hands of the top 1%, public debt becomes an antiredistributive transfer for the whole bottom 99%. In 1820, public debt is assumed to be held at 26,5% by the top 1% (in Table 7) or at 56% (in Table 6) whereas the taxation pattern does not change [75]

4.5.2 Wealth accumulation and wealth concentration due to public debt

We now turn to the analysis of the use of the monetary transfer: this monetary transfer has been taxed (for a negligible part) to finance ordinary government spendings, whereas the rest of the disposible income (which includes the monetary transfer) has been either consumed or saved. Since this transfer was made from low-saving classes to high-saving classes, assuming that this saving rate would have been kept constant, the monetary transfer could have played a role in the accumulation of private wealth we observed during the century.

Thus, in case of a default in 1820, for each dynasty i, we have, in 1820

$$\underbrace{W_{1820}^{i,\bar{D}}}_{\substack{\text{New Wealth}\\ \text{of dynasty i}\\ \text{in case of default}}} = \underbrace{W_{1820}^{i,D}}_{\text{Observed Wealth}} - \underbrace{D_{1820}^{i}}_{\substack{\text{Amount of Debt}\\ \text{held by i in 1820}\\ \text{Depending on Assum-}\\ \text{ptions about}\\ \text{Debt holding}}} \tag{9}$$

And for subsequent years, the law of motion of wealth of dynasty i writes:

$$\begin{aligned} \underbrace{W_{t+1}^{i,\bar{D}}}_{\substack{\text{Wealth in t+1}\\ \text{if default in 1820}}} &= \underbrace{W_{t}^{i,\bar{D}}}_{\substack{\text{Wealth in t if}\\ \text{default in 1820}}} (1+q_t) + S_t^i \\ &= W_t^{i,\bar{D}}(1+q_t) + \underbrace{s_t^i}_{\substack{\text{Observed}\\ \text{saving rate}}} (Y_t^{i,\bar{D}}) \\ &= W_t^{i,\bar{D}}(1+q_t) + s_t^i(Y_t^{i,D} - MT_t^i) \end{aligned} \tag{10}$$

[75] One could wonder why the monetary transfer in the second scenario is not simply half of the monetary transfer of the first scenario, even if wealth concentration is reduced by 2. This is because each year, the monetary transfer of class i is

$$r_k D_k \left(\frac{D_k^i}{D_k} - \frac{T_k^i}{T_k}\right)$$

. Then for each class, "small" differences in the fraction of debt holding are amplified. For example, if $\frac{D_k^i}{D_k}$ is multiplied by 2, then the new monetary transfer (MT2) is

$$2r_k D_k \frac{D_k^i}{D_k} - r_k D_k \frac{T_k^i}{T_k}$$

i.e.

$$MT2 = MT1 + r_k D_k \frac{D_k^i}{D_k}$$

In other words, monetary transfer is a function of debt holding that is not homogenous in the debt share

Thus, by a simple recursive operation[76]

$$\forall t > 1820, \quad \underbrace{W_t^{i,\bar{D}}}_{\substack{\text{Wealth in t}\\ \text{in case of}\\ \text{a default in 1820}}} = \underbrace{W_t^{i,D}}_{\substack{\text{Observed Wealth}\\ \text{of i in t}}} - \underbrace{D_{1820}^i}_{\substack{\text{Debt held}\\ \text{by dynasty i in 1820}}} - \underbrace{\sum_{k=1820}^{t-1} s_k^i MT_k^i}_{\substack{\text{Sum of the savings}\\ \text{of class i}\\ \text{arising from}\\ \text{successive Monetary transfers}}} \tag{13}$$

For simplicity, one will consider in this part the case where debt holding in 1820 mirrored total wealth concentration (i.e. scenario 1). Other scenarios could be explorated - but the main lessons would remain the same.

The previous equation shows that - with constant saving rates and constant labor and capital income in case of a default, the wealth of dynasty i in case of a default would have been equal to the observed wealth of that dynasty minus what has been saved on the previous monetary transfer that class i has received (or paid), minus the initial losses arising from a default in 1820.

Since total private wealth is the sum of wealth of each dynasties, total private wealth arising from a default would have changed according to the different saving rates of each dynasty. More precisely, transferring wealth from low-saving dynasties to high-saving dynasties could have had

[76]The proof is the following: in 1821,

$$\begin{aligned} W_{1821}^{i,\bar{D}} &= W_{1820}^{i,D}(1+q_t) + S_t^{i,\bar{D}} \\ &= W_{1820}^{i,D}(1+q_t) - D_{1820}^i) + s_t^i(Y_t^{i,D} - MT_t^i) \\ &= W_{1821}^{i,D} - s_t^i MT_t^i - D_{1820}^i \end{aligned} \tag{11}$$

where we have assumed (for simplicity) that capital gains rates where 0 on public debt (in fact, our capital gains factor should be interpreted as a vector of capital gains). If capital gains were not 0 on public debt of 1820, one has to multiply the last term by $(1 + q_t)$. Thus, the proposal is true in 1821 (simply, the sum is only a sum of one term).

Finally, assuming that in t,

$$W_t^{i,\bar{D}} = W_t^{i,D} - D_{1820}^i - \sum_{k=1820}^{t-1} s_k^i MT_k^i$$

it follows that

$$\begin{aligned} W_{t+1}^{i,\bar{D}} &= W_t^{i,\bar{D}}(1+q_t) + S_t^i = W_t^{i,D}(1+q_t) - D_{1820}^i - \sum_{k=1820}^{t-1} s_k^i MT_k^i - s_t MT_t^i \\ &= W_{t+1}^{i,D} - D_{1820}^i - \sum_{k=1820}^{t} s_k^i MT_k^i \end{aligned} \tag{12}$$

i.e. if the formula is true in t + 1 if it is true in t. Thus, the proof is complete.

an impact both on wealth concentration and on total private wealth.

$$\begin{aligned} \underbrace{W_t^{\bar{D}}}_{\substack{\text{Total Private}\\ \text{Wealth if}\\ \text{Default in 1820}}} &= \sum_i W_t^{i,\bar{D}} = \sum_i W_t^{i,D} - D_{1820}^i - \sum_{k=1820}^{t-1} s_k^i MT_k^i \\ &= \underbrace{W_t^D - D_{1820}}_{\substack{\text{Observed private wealth}\\ \text{minus initial impact of the default}}} - \underbrace{\sum_i \sum_{k=1820}^{t-1} s_k^i MT_k^i}_{\substack{\text{Effect arising}\\ \text{from the}\\ \text{Difference in saving rates}}} \end{aligned} \tag{14}$$

What we find is that public debt did not change the global pattern of wealth inequality during the century. Of course, a default would have changed the nominal amount of private wealth in the country. However, additional effects (transfer from low-saving classes to high-saving classes) matter less than what one could expect. This is because the effect of the monetary transfer - how large it may have been - would have been attenuated by low saving rates of popular classes, and because the generated saving rates of dominant classes were also not so large.

Moreover, the effect on total wealth concentration would have been further attenuated because of the decrease in private wealth arising from a default in 1820 and from the the negative effect on private wealth of letting money in the pocket of low savers instead of giving it to high-savers.

The biggest effect on private wealth would mostly arise from a default in 1820, as Figure 20 shows. On that graph (at then end of the paper), we have differentiated the effects on private wealth arising from the initial default in 1820 (the $-D_{1820}$ part of the equation) and from the differences of wealth accumulation due to the differences in saving rates (i.e. the $\sum_{k=1820}^{t-1} s_k^i MT_k^i$). The difference between the curve in green (only taking - for each year - the observed private wealth minus the debt on which the State would have defaulted in 1820. The blue curve is - instead - the curve taking all effects (i.e. initial effect plus effects arising from different savings) into account. As we may see, the additional effect due to the differences in saving rates is not equal to 0, but negligible with respect to the total effect. Since - especially at the end of the century - the blue curve is always below the green one, this indicates - as expected - a *negative* effect of a default in 1820 on private wealth accumulation (or equivalently, a positive effect of public debt in comparison to a default) due to the transfer from low-saving to high-saving dynasties that public debt constituted.

This explains the difference of private wealth between the observed situation and the situation where the State would have defaulted in 1820 tends to decrease in percentage (see Figure 21): the importance of the initial schock would have tended to decrease with the accumulation

of private wealth, whereas the additional effect (transfers between classes with different saving rate) was negligible in comparison to total private wealth.

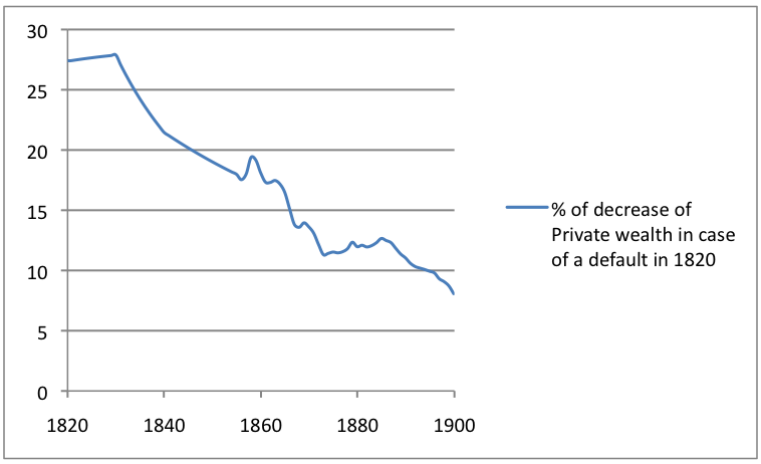


Figure 21: Decrease in Private Wealth in case of a default in 1820, in % of observed Total private Wealth per year

Finally, the magnitude of both effects can be calculated using a simple percentage decomposition: the relative weight of the initial default in the difference between the simulated simulation and the observed simulation (i.e. between the default and non-default situation). Figure 22 illustrates this decomposition. As it was expectable, the relative importance of the initial default (the decrease in private wealth arising from the sudden default) matters much more for the decrease in total wealth than the increase of private wealth (in comparison to a default) due to the transfer from low-saving dynasties to high-saving dynasties that public debt represents. However, as time passes, since the *absolute* amount of difference between the observed situation (with debt) and the counterfactual situation (a default) increases. Since the initial impact remains constant, its relative importance decreases as time passes. However, in the same time, the *relative* difference between observed and counterfactual situation decreases (Fig. 21)

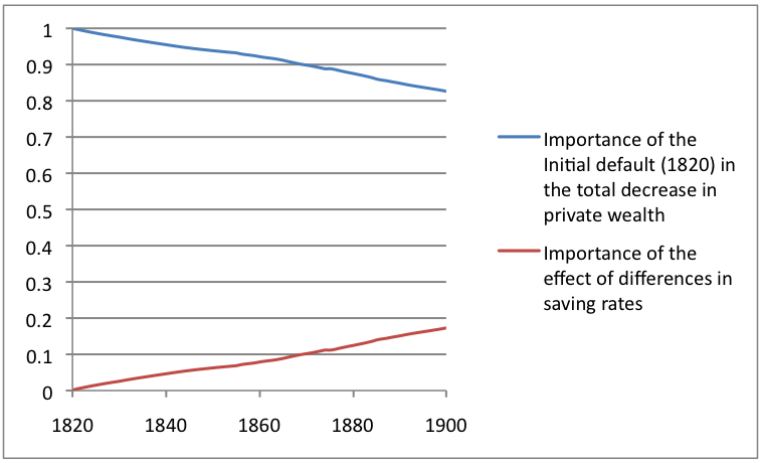


Figure 22: Relative importance of the initial effect (the default *per se*) and of the additional effect (transfer by public debt from low-saving dynasties to high-saving dynasties) in the total absolute effect

Therefore, whatever the distribution of debt holding in 1820, the biggest part of the effect of a default on total wealth accumulation is due to the initial default (more than 80% even in 1900).

In our point of view, Marx was partly right and partly wrong when he wrote that public debt was "one of the most powerful levers of primitive accumulation". Partly right because a default in 1820 instead of the stabilisation of (nominal) public debt, would have certainly decreased private wealth. However, this is mostly the *default per se*, which would decrease total private wealth and not the transfer between dynasties due to public debt charges (from low-savers to high-savers). Thus, Marx is partly wrong since the "pure" private wealth accumulation due to public debt, which transfers income from low-saving classes to high-saving classes is rather low in comparison to the total private wealth accumulation: even in 1900, since the inter-class transfer represents 17% of the total effect of a default in 1820 on private capital accumulation, which is equal itself to 8% of observed private wealth, this leads to an effect of 1,36% increase on private wealth due to the transfer between classes with different saving rates.

4.5.3 Consumption inequality due to public debt

Since the monetary transfer *itself* has not played a great role in capital accumulation, it must have played a role on consumption inequality in the nineteenth century.

In the first scenario, one finds that - since savings are assumed to be linear (and equal to the mean saving rate) the effect on consumption inequality is by definition proportional to the effect on income inequality, exposed in the previous subsection.

5 Possible Extensions and Directions for Future Research

5.1 Data improvement

5.1.1 Debt holding

Certainly, one crucial variable to determine the amount of the monetary transfer between classes in our framework is the distribution of debt and its relation to the distribution of wealth. Therefore, a serious work should be done for the structure of debt holding in the nineteenth century - equivalent to what Dickson (1967) has done for the eighteenth century. Our intuition is that - following what Dickson discovered - since interest rates on public debt were not that small in comparison to observed mean interest rates and since - on the primary market - debt issuance was a political task, it was a reasonable assumption to assume that debt holding concentration mirrored private wealth concentration. Thus, we have made the assumption that public debt holding was perfectly correlated with private wealth concentration. However, public debt may have been less or more concentrated than private wealth - hence leading to lower or bigger effects on income inequality.

Since Dickson found detailed informations about public debt issuance in the eighteenth century, one might suppose that further informations for subsequent years are possible to find. However, one should also deals with the problem of the exchange of public debt on the secondary market, which could also change the *real* distribution of debt holding.

Equivalently, one should make further researches about the share of debt held by foreigners - which we assumed to be negligible.

5.1.2 The pattern of taxation

Another crucial variable is the share of taxes effectively paid by each class to finance interest charges. As we have underlined, we had to made assumptions about the taxation pattern. However, since British Parliamentary Papers (and other sources) have been collected since the eighteenth century, one should be able to improve our assumptions about tax shares paid by each class.

5.1.3 Income Inequality

We have made several assumptions about income distribution, which generated plausible orders of magnitude for total income inequality. However, one should be able to generate more realistic

income distributions - and especially about the link between debt holding and total income inequality. Generating different correlations between debt holding and total income inequality - as well as finding more reliable data about total income inequality - could certainly improve our analysis.

5.2 Social Mobility

One possible caveat of our study - which should be considered as a first approach of the very wide subject of unequalizing impact of public debt - is that we omit the question of social mobility: as assumed above, each dynasty is a "pure" dynasty. Even if social mobility was certainly lower in nineteenth-century Britain than today, Britain was certainly not a "pure" cast society. Therefore, one should find a way to account for social mobility, in order to deal with the fact that - if there is social mobility - the transfers induced by public debt are spread out in the population and could be more difficult to identify. The opposite of our framework would be a pure mobile society, so that public debt holding - even inherited between generations - would change from social groups every time, so that public debt would not have unequalizing effects on the economy as a whole (since, in fact, "classes" would not exist).

5.3 Taking possible crowding-out into account

A counterfactual history shall include what would have happened without public debt. One key - and largely debated - question in the history of economic thought and of economic history, is whether public debt crowds out private investment, i.e. if one pound of public debt replaces one pound of private fresh capital.

Since, by definition, in a closed economy with a government, $Y_t = C_t + S_t + T_t = C_t + I_t + G_t$, we have

$$S_t = I_t + (G_t - T_t)$$

This accounting identity simply shows that national savings - i.e. the sum between private savings and public savings (= the opposite of public deficit) are equal to private investment. Then, if the amount of private savings are constant in a given year t, an increase in public debt (i.e. a decrease in "public savings"), i.e. a decrease in national spendings will be matched exactly by the same amount the private investment (hence a crowding-out of private investment).

However, it is not sure that private savings do not react to public debt. If people do anticipate that taxes will increase in the future - and if they want to smooth consumption (as predicted by the basic macroeconomic theory)- they will internalize those interest payments from the date of

issuance of public debt. Especially, tax cuts has no effect (even in the short run) when taxes are non-distorsionary (lump-sum taxes). This is the basis of the so-called "Ricardian" equivalence (even Ricardo was certainly not Ricardian in that sense), modelized by Barro (1974). Other constraints may justify that people do not increase their savings in response to public debt: either financial constraints (people who cannot save more), or lifetime constraints (in an OLG model *à la* Diamond (1965)/Samuelson(1958) or a model *à la* Blanchard (1985)), where debt can crowd out private investment. Finally, pure "myopic" agents could simply not have internalized public debt but they could have saved more by seeing that - with a higher interest rate - there was some good deal to make with public debt.

Especially, Williamson (1985) has thought that crowding-out could have been of the order of 100%. Barro (1987) himself calculated that interest rates (on public debt) had increased with military spendings during the eighteenth century - so that there would have been some crowding-out. On the other side, Heim and Mirowski (1987) have claimed that regressing real interest rates on public debt issuance (i.e. on debt evaluated at its market value and deflating by price indexes) showed no increase in real interest rates. More recently, Clark (2001), by looking at consequences (on rent price, for example) that crowding-out could have had, concludes that crowding-out did not happen during the eighteenth century. According to Clark, the only credible explanation to this was "excess saving" before public debt, matched by an increase in public debt. More recently, Temin and Voth (2005), looking at microlevel data from the Hoare's Bank have concluded that there is some evidence of crowding-out in the banking sector.

The question of crowding-out (or increased savings) of public debt certainly matters and has received no definitive answer yet. However, let us imagine a 100% crowding-out by the permanent debt in the nineteenth century. If debt was fully held by a class of people (the rich) and crowded-out private capital, then, with a default, the rich would have invested in private capital by the same amount, which would have led (in turn) the same interest as public debt (possibly lower, however, because public debt had in that case increased interest rate). However, this interests would not have been taken at the expense of spenders (which did not own public debt in the reality).

As we have previously argued, we have considered the fact that no crowding-out would have occur during the nineteenth century. However, even with crowding-out, one has to keep in mind that public debt would have had direct antiredistributive effects. In fact, the main difference between private debt (private investment) and public debt is that public debt did not create wealth [77] so that - even in the case of durable crowding-out [78], debt would certainly have had an

[77] However, it has allowed the United Kingdom to defeat Napoleon, which is certainly non negligible

[78] Recall that we do not focus on the possible crowding-out during the different wars, i.e. before the

antiredistributive effect. Moreover, either by increasing the (private) interest rate r or decreasing the growth rate (because of credit rationing) g would have increased the difference r-g, which is certainly an unequalizing factor in the economy (Piketty (2013)).

6 Conclusion

This research aimed to describe the evolution of public debt Great Britain during the eighteenth and nineteenth centuries, and its link to the globally increasing trend in inequality that we observe during the nineteenth century.

First, we have stated that the British State lived with a very high public debt (superior to 100% of GDP) during the first half of the nineteenth century. Only growth could make the problem disappear - however not by permitting a reimbursement of perpetual annuities (which was partly made, indeed), but by decreasing the *importance* of public debt with respect to other economic variables. Moreover, every successive plans to reduce its nominal size have failed after a certain number of years, because of the problem of enforcement of those plans.

About the link of public debt with inequality, and depending on the assumptions I have detailed, especially on taxation pattern and on debt holding, I find a non-negligible transfer from the bottom 90% of the income distribution (in mean, more than 2% of the annual income of the mean household) to the top 1% (in mean, 5% of annual income of the household). However - more than public debt *per se* - the causes of this unequalizing transfers, are to find in the huge expenditures related to wars, which have been indeed financed by using a non-progressive tax system. Contrarily, the effects would have been much different if wars had been financed *ex post* by a tax on wealth (i.e. - in our framework - a default on public debt). However, dealing with a lack of data leads us to consider these results with caution.

Finally, our conterfactual experience is to interpret as follows: in reality, this is not public debt *itself* that represented a large unequalizing factor. Public debt was only the "smoothing" of inequality that *wars* did - all in all - represent, because of the unprogressivity of the tax system. Had public debt *not existed*, then huge war taxes would have been levied, certainly using an unprogressive tax system, increasing *immediately* post-tax income inequality. One can also think that such taxes would have been impossible to levy, so that Britain would have lost the war against Napoleon. Thus, public debt is not *per se* a instrument of inequality, but - with respect to a default - the payment of the interest charges was the result of the postponement of smoothing of government spendings. Contrarily, a default in 1820, in our point of view, could

1820's

have been a mean of forcing the rich classes to pay the war *ex post*.

Which lessons could one draw from this? First, one has to be careful by comparing this situation with the actual situation: today, a large part of public debt is held by foreigners, and - for "sure" countries (France, Germany) - interest rates are so low that public debt is often perceived as a safe asset, which could be therefore more largely held by small savers (the middle class), hence the transfer might be made in the directon of the middle class. Moreover, the tax systems are more progressive than what they were in the nineteenth century (even if the progressivity of the tax system - for example in France - has been questioned by Landais, Piketty and Saez in 2012), so that debt charges are also charged upon the top tails of the distribution of incomes. However, those potential transfers between classes of population should not be ignored - whatever the sense of the transfer.

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Figure 17: The British Income Tax - Summary Table of the Scheme

Year	Rate	Exemptions/Abatement
1799-1802	10%	Full exemption below 60*l.* Abatements between 60 and 200 *l.*. Abatements for children
1803-1805	5%	Full exemption below 60*l.*. Abatements from 60 to 150*l.* (rates between 1,25% and 4,6%)
1805	5,25%	Idem plus 0,25 points for all rates.
1806 (Battle of Austerlitz)	10%	
1806-1815		Exemption below 50*l.*, only for labourers or wage earners. 5% linear abatement from 50 to 150*l.*.
1842-1853	2,9%	Exemption below 150*l.* (whatever the source)
1853		Exemption below 100*l.*, supplementary abatement between 100*l.* and 150*l.* (for the rate not to exceed 5d, i.e. effective rate of 2,1%)
1854 (Crimean war)	5,83%	
1855-1858	6,67%	
1858	2,9%	
1859	2,1%	
1860-1861	4,2%	
1862-1863	3,75%	
1863-1864	2,9%	Exemption below 100*l.* Abatement between 100 and 200 *l.* (diminution of taxable income of 60*l.*
1865-1873	2,5%	
1873		Abatement until 300*l.*, raised from 60 to 80*l.*
1874	1,25%	
1875-1876	0,8%	
1876	1,25%	Exemption raised to 150*l.*. Abatement threshold raised from 300 to 400 *l.*, amount of the abatement raised from 80 to 120*l.*
1879-1880	2,08%	
1881	2,5%	
1882	2,08%	
1883	2,8%	
1884	2,08 %	
1885	2,5%	
1890		Abatement of £120 for income between £150 and £400
1894		Exemption threshold: £160. Abatement of £160 for incomes between £160 and £400. Abatement of £100 between £400 and £500
1898		Abatement of £160 between £160 and £400. Abatement of £150 between £400 and £500. Abatement of £120 between £500 and £600. Abatement of £70 between £600 and £700

Figure 20: Total Wealth accumulation with debt or with a default