

## **WARFARE, ECONOMIC PERFORMANCE AND THE STRUGGLE FOR THE WORLD HEGEMONY IN THE EARLY MODERN PERIOD. GUNS VERSUS BUTTER IN EIGHTEENTH-CENTURY BRITAIN AND SPAIN**

To test the existence of budgetary trade-offs in eighteenth-century Britain and Spain can contribute to resolve the debate on the economic impact of warfare and its relationships with the military potential of nations and the struggle for the world supremacy during the early modern period. We have constructed several empirical models to search for trade-offs in order to show what country had the drop in achieving its military and economic objectives. Britain was ahead Spain due to several reasons. Britain was more efficient in deploying the available resources because she built an effective national bureaucracy. Furthermore, the institutional reforms made from the seventeenth century onwards increased the level of resources through enhancement of British economy.

Keywords: Economic impact of warfare; guns versus butter in eighteenth-century Britain and Spain; military spending; war, public investment and economic growth

JEL Codes: H56, N43

### **INTRODUCTION**

One of the most significant topics in the eighteenth-century economic history research is the impact that warfare had on economic performance and its relationships with the military potential of countries and the struggle for the world hegemony. A main reason offered in the academic literature to assert that wars were favourable for economic growth in the Early Modern Europe is that mercantilist states achieved that warfare was a growth-enhancing force. Some scholars have claimed that wealth and power were looked on as identical aims by mercantilists because they thought that national strength presupposed economic affluence (Magnusson, 1994). Mercantilist states had used its military resources to achieve economic wealth and, hence, power, reason for which warfare can be seen as a useful activity to increase wealth. From this have been inferred that war was the best way to enlarge markets and to conquer spaces in which the state's authority and law's power made possible the expansion of market forces. According to Kuznets (1948), the maintenance of internal peace and external security are a condition of economic production, military expenditures being intermediate costs. In Britain the Army and Navy could provide those essential preconditions for a sustained economic growth (external security, political stability, internal order and effectively protected property rights), Industrial Revolution being "to

perhaps some significant degree” the result of aggressive and successful mercantilism (O’Brien, 2006, pp. 13-17).

However, other authors doubt or not believe that warfare and mercantilism were growth-boosting forces. Military spending means salaries, bonuses, and contracts to individuals and enterprises, but the recipients of these disbursements could invest it in ways productive or in other non-productive uses (Lane, 1975, p.13). Warfare is costly for the countries in conflict but “is no way to credibly determine... whether the gains outweigh the losses for both the winner and the loser from a particular fight” (Nye, 1997, p. 128). Several scholars have claimed that war and mercantilism were growth-hindering in nature, rather than growth-enhancing forces. In their view, mercantilism was little more than a rent-seeking society whose purpose was individual gain –using the patronage and protection of the state- without benefit to society (Ekelund and Tollison, 1981; Craig and Fisher, 2000). In addition, mercantilist state taxed heavily to wage war. But “although average tax rates may have been low”, “the effect that taxes had at the margin” made that “the fiscal regime ended up hurting the economy”, distorting incentives and undermining growth (Hoffman and Rosenthal, 1997, pp.34-35). In the Early Modern France, the way taxes were levied caused havoc in trade and agriculture. The seizure of livestock when taxes fell in arrears was devastating for agriculture; even the entire village economy could collapse when peasants were imprisoned due to they did not pay taxes (Hoffman, 1996, p. 185).

Another argument argued in favour of warfare as a beneficial factor for the European preindustrial economies is that supply and demand was rocketed by the expansion of the Army and Navy. According to Sombart (1913), warfare made it necessary to assemble large amounts of capital and led to the development of big commercial, industrial and financial enterprises. Nevertheless, large establishments as arsenals were set up “in connexion with a number of industries, such as salt making, which thrived mainly not on war but on peace”, and the contribution of warfare to the growth of large markets and to large scale commercial enterprise “was more than offset through the harm done to both by fighting, pillaging by troops, and by the fear and uncertainty which the movements of armies created” (Nef, 1942, pp. 23-24). As for demand, military spending “was an important factor behind the increase in demand which was one of the preconditions behind the industrial take-off of Britain” (Magnusson, 2009, p.84). Military outlays boosted demand in several war-related economic sectors. For example, the Atlantic warfare required a growing supply of many

naval stores. The state response was an increase of public investment in mining, munitions and shipbuilding on a great scale. As regards trade, “the state support provided by (British) naval power... allowed oceanic commerce to flourish in an era of international warfare” (Morgan, 2002, p. 167). Nevertheless, it seems that without so many wars European countries of the early modern period would have had more economic growth than they did. Williamson (1984) calculates that without wars Britain’s aggregate real income growth per year would have been higher by almost 1 per cent from the 1760s to the 1810s, manufacturing output would have grown more than 2 per cent faster and the workers’ living standards would have risen by 65 per cent. We must take into account that war and more generally political instability were the main cause of market disintegration and the most important source of economic regression in the early modern period (Epstein, 2000). The evidence suggests that the negative war’s impact was considerable. The area in which the war is fought could suffer economic disruption and the destruction of local infrastructure, circumstances that typically lead to a reduction in output and trade. Two of the disruptions were the confiscation of output by military authorities and the conscription of farm labour, which reduced current civilian consumption, the incentive for production and the capacity of manpower. Taken together, these negative effects on agriculture and trade could lead to famine and reduced capacity for work and consumption, all of which lowered output as well. It is thus not difficult to understand why in some regions of France, for example the Paris Basin, agricultural TFP decreased by perhaps 25 per cent in the 1590s, the worst period of anarchy and plunder of the Wars Religion (Hoffman, 1996, pp. 100-101).

As regards the manufacturing sector, there was a lively military demand for iron and shipbuilding, but it is doubtful whether this demand was sufficient to stimulate any industry as a whole. The military supplier and the arms manufacturer suffered from government interference and indebtedness in the same way as the farmer. The state attempts to promote expansion and self-sufficiency in the state-controlled arms industries, but these were undermined by the very processes of state intervention. Worse still were the consequences for financial capital. With warfare, expenses shot skyward, and because taxes never kept pace, states had to borrow to meet the costs of war, most of the European countries defaulting at war’s end. If creditors subsequently refused to lend, states resorted to a variety of expedients such as sale of government offices and manipulation of the currency. As a result, investors shunned long-term contracts; the price for crippling financial markets will be paid in long-term investment. Lastly,

growing military outlays made that Britain and other European countries become increasingly protectionist during the eighteenth century (Crafts, 1996, p.199; Craig and Fisher, 2000, pp.120-121; Hoffman and Rosenthal, 1997, pp. 36-37; Thompson, 1992, pp. 269-270).

Also has been mooted in favour of warfare as an enhancing-growth factor that military conflicts were financed by a large issue of government debt. The increase of public debt “probably stimulated the establishment of a more modern banking and credit system”(Magnusson, 2009, p. 85). In Britain, “high levels of government bond issuance widened and deepened the capital market”, showing that “institutions that initially to serve the state by financing war also fostered the development of the economy as a whole" (Ferguson, 2001, pp. 16-17). In addition, on the basis of Ricardian Equivalence, the issuance of government debt would generate an equivalent amount of private saving in anticipation of future taxes (Barro, 1990). This is, however, a controversial matter. Increased military expenditures might drive up interest rates and reduce investment. During wartime available output falls, but since people expect to be richer again in future they try to borrow to smooth consumption, hence driving up interest rates, fact that will lead to lower levels of private investment (Clark, 2001, p. 425). In brief, given that warfare generated important negative economic effects, including the reduction of investment, it was doubtful, at least, that mercantilists achieved the aim that they pretended through the increase of wealth: more powerful nations in order to maintain its status of great power and to fight for the world supremacy.

To test the existence of trade-offs between guns and butter can contribute to resolve this fascinating and controversial debate on the economic impact of wars and its relationships with the potential of nations and the struggle for the world hegemony. The theory guns vs. butter models the relationship between a country's investment in military and civilian goods. A nation has to choose between two options when spending its finite resources. It will have to decide which level of military and civilian goods best fulfil its needs, with its choice being partly influenced by the military spending and military stance of potential opponents. The possibility and the economic and social impact of a guns vs. butter dilemma during the twentieth century has received substantial coverage in the academic literature. Early studies of this subject, made in the 1960s and the 1970s, report the existence of a trade-off between guns and butter (Russet, 1969; Hartman, 1973; Benoit, 1973; Wilensky, 1975; Smith, 1977).

Nevertheless, from the middle of the 1970s onwards the majority of the scholarly literature published finds no evidence for trade-offs guns vs. butter. This was due to several reasons. First, the studies made from the mid-1970s onwards use more detailed and complete specifications and more sophisticated methodologies than the early studies. And second, they exclude the impact of World War Second and include data for the periods of large growth in social spending (for example, the 1970s). Caputo (1975) finds a positive and significant relationship between defence expenditure and health spending. Clayton (1976) concludes that in the United States there is not a significant correlation between defence and social welfare spending since the Korean conflict. Peroff and Podolak-Warren (1979) affirm that in the United States from 1929 to 1974 the evidence points to no tradeoff between federal health and defence in allocations or final expenditures during war or peace. Kelleher, Domke and Eichenberg (1980), Russet (1982) and Domke, Eichenberg and Keleher (1983) assert that military outlays and spending on welfare are unrelated. Some scholars, however, found evidence for the existence of relationship between military and social expenditures. Mintz (1989) reports limited tradeoffs when the data and budgetary items are disaggregated. Berry and Lowery (1990) also find limited empirical support for the domestic-defence trade-off (i.e., guns versus butter trade-off) and the transfer-consumption trade-off. Mok and Duval (1992) find fairly strong evidence for the existence of certain tradeoffs between defence and several civil programs, but these relationships are not systematic. Mintz and Huang (1991) report a systematic negative indirect impact of military expenditure on economic growth and, then, on education spending.

As far as we know, there are no studies about the existence of guns vs. butter tradeoffs during the eighteenth century. With this article we pretend to prove if there were tradeoffs between military and civil spending in eighteenth-century Britain and Spain. And if tradeoffs exist, we expect to show if they favoured Britain or Spain in the pursuit of their economic and military objectives. What country achieves better results in spending the government money? To answer this question, following the introduction, in the second section we develop an empirical model to adapt the basic models used to search for tradeoffs in the twentieth century to the characteristics of government spending in the eighteenth century. With this model we pretend to know which country had the drop in achieving its military objectives. In the section three, we aspire to show whether Britain was ahead Spain in achieving its economic objectives or vice versa. First, we study the relationships between military spending, investment and

economic growth, and, then, we make an empirical exercise to test the existence of tradeoffs between military spending and public investment. So, we expect to know better the relationships between the economic impact of warfare, the military potential of nations and the struggle for the hegemony in eighteenth-century Europe. In the section fourth, we summarize the main findings and their implications for future research.

### **BRITAIN AND SPAIN AT WAR OR PREPARING FOR WAR. WHICH COUNTRY HAD THE UPPER HAND?**

A regression model frequently used in applied ‘guns vs. butter’ trade-off research in the twentieth century is:

$$\frac{Mil_t - Mil_{t-1}}{Mil_{t-1}} \times 100 = \beta_0 + \beta_1 \frac{[Tot_t - Tot_{t-1}]}{Tot_{t-1}} \times 100 + \beta_2 \frac{[Soc_t - Soc_{t-1}]}{Soc_{t-1}} \times 100 + \varepsilon_t \quad (1)$$

where *Mil* represents Military Outlays, *Tot* represents Total Public Spending, *Soc* is spending for Social or Welfare Programs, and the error term  $\varepsilon$  is the part of the military outlays growth rate that cannot be explained by the growth rates of *Tot* and *Soc*.

This model has been criticized from several points of view. Berry and Lowery (1990, pp. 673-674) have classified these regressions as ROCOA (Regression of One Category On Another) models and suggested that it cannot capture the trade-off because they fail to consider the nature of the trade-off process. According to these authors, regressing one category of spending on another, in the best case, can only lead to a description of the magnitude of the trade-off present. They also say that finding a substantial negative coefficient tells us nothing about the factors that determine how much one category is rewarded in the budgetary process at the expense of another.

From an econometric point of view, one must also be aware that the levels of the variables in model (1) are related by an exact identity:

$$Tot_t \equiv Mil_t + Soc_t \quad (2)$$

which implies that the first explanatory variable in (1) is endogenous. As a consequence, least squares estimates of model (1) would be inconsistent because it is correlated with the error term. Furthermore, building on (2) it is easy to prove that the variation rates in (1) are related by an exact linear equation with time-varying coefficients. Then, model (1) would be just a fixed-parameter approximation to a trivial exact relationship and is therefore useless to model expenditure trade-offs.

Other trade-off models have been formulated to solve the guns versus butter dilemma during the twentieth century. Some of them (Russet, 1982; Mintz, 1989) build on a basic regression that can be described as:

$$\frac{D_t - D_{t-1}}{D_{t-1}} \times 100 = \beta_0 + \beta_1 \frac{C_t - C_{t-1}}{C_{t-1}} \times 100 + \varepsilon_t \quad (3)$$

where  $D_t$  and  $C_t$  represent some measure of ‘defense’ and ‘civil’ public expenditure at time  $t$ . The constant term,  $\beta_0$ , is the expected increase in defense expenditure if civil expenses remain constant and the slope,  $\beta_1$ , measures the expected change in defense outlays if civil expenditure increases by one point percent. A negative value of this parameter would confirm a trade-off between both types of expenditure. Finally, the error term  $\varepsilon_t$  is the part of military outlays growth rate that cannot be explained by the civilian expenditure growth rate. Note that total expenditure is not included as explanatory variable, thus avoiding problems such as endogenous regressors or exact relationships.

Most applied papers on trade-off analysis enhance model (3) by adding other explanatory variables such as: economic growth, private investment, GDP, unemployment, party-in-power, etc. Moreover, research on this topic focuses on the public expenditure of developed countries during the XX century and considers welfare expenditures to be the endogenous variable, affected by exogenous military outlays. This is an adequate assumption for XX century nations, as their budgetary priorities are typically economic and social, but not so much for the European countries during the eighteenth-century. In this century, and in the whole of the early modern period, the main function of states was military, nor civil. Army and Navy spending absorbed most of the budget, and almost all the civil expenditure was allocated to fund debt repayment, the Royal Household, and central administration. Governments did not spend yet in the

social programs which are usual in the western countries for decades: welfare, public pensions, unemployment compensation, etc. According to Lindert (2004, pp. 7-9), in the eighteenth century the modern age of social spending had not yet dawned. For these reasons, we specify military outlays to be the dependent variable, explained by civil expenditure. On the other hand, many explanatory factors frequent in this literature, such as, e.g., GDP, are available only for limited time spans during the eighteenth century.

We will now test the ‘guns-versus-butter’ hypothesis. To this end, we will use a dataset taken from Mitchell and Deane (1962) and Jurado-Sánchez (2006), providing time series for: (a) Total Military Outlays in Great Britain and in Spain, from 1714 to 1800, as well as the corresponding values of (b) Debt Repayment and (c) the Other Civil Items. In the source, all the values are corrected for inflation and expressed in national currency. Finally, we transformed the British series to millions of *reales de vellón* using the exchange rates published in *The Course of the Exchange*. Appendix 1 provides further insight about this dataset.

Figures 1 and 2 show, respectively, the profile of the military outlays series and the ratio between the Great Britain and Spain military expenditure. Note that military outlays in both countries display certain stability up to 1739. From 1740 onwards the British military expenditure reaches a remarkable level, much higher in any case than that in Spain, showing also sharper fluctuations.

(Please, place figures 1 and 2 near here)

Table 1 describes the structure of spending in both countries, as well as the relative value of different items. The obvious conclusion is that the British economy and tax system was able to fund a government expenditure that was five times higher than that of Spain. Appendix 2 provides a more detailed breakdown of these figures.

(Please, place table 1 near here)

The profile of Figure 1 indicates that these series are probably nonstationary. Table 2 provides formal evidence of this by giving the values of the ADF (Dickey and Fuller, 1981) and KPSS (Kwiatkowski et al.) test statistics, which consistently point out that both series have unit roots. This is an important

conclusion, as it provides a statistical validation to perform the analysis with the growth rates of the original variables, as assumed in models (1) and (3). We also tested for co-integration between the levels of the variables in (4) using the Johansen test (Johansen, 1991). As one could guess from the profile of the ratio series in Figure 2, we clearly rejected the co-integration hypothesis for the whole sample and not-so-clearly for the previously mentioned 1714-1739 period which, in any case, covers only a small part of the sample.

(Please, place table 2 near here)

Figure 3 shows the profile of the annual growth rates implied by the military outlays series. They are stationary and therefore, in absence of co-integration, adequate for further statistical analysis and modeling.

(Please, place figure 3 near here)

Table 3 provides the basic descriptive statistics for the military expenditure growth rates. Note that: (a) the measures of central tendency (mean and median) consistently point out that the growth of British expenditure was three times faster than that of Spain, (b) volatility measures for Great Britain (standard deviation and maximum-minimum range) are also much higher than those of Spain and (c) these series show evidence of non-normality and weak correlation. As we will see later, the latter features are explained by the presence of outliers.

(Please, place table 3 near here)

Our basic regression is then set as follows. Let  $i$  and  $t$  be, respectively, the indexes denoting the  $i$ -th country ( $i = \text{GB}, \text{SP}$ ) and the  $t$ -th year. The basic ‘guns-versus-butter’ model for our dataset is:

$$m_t^i = \beta_0^i + \beta_1^i c_t^i + \beta_2^i d_t^i + \varepsilon_t^i \quad (4)$$

... where  $m_t^i$ ,  $c_t^i$  and  $d_t^i$  denote, respectively, the annual percent growth rates of: military outlays, expenditure in other civil items and debt repayment, being all these variables referred to the  $i$ -th country during the  $t$ -th year.

Fitting model (4) to our dataset provided poor results, as the model only accounted for 5-6 per cent of the variances of the endogenous variables. Besides this shortcoming, model (4) is too rigid, as it does not allow for: 1) different parameters in peace and wartime, 2) correlations between British and Spanish error terms and 3) outliers.

It seems reasonable to assume that the guns vs. butter trade-offs is likely differ in different international circumstances, especially in wartime. Periods of warfare should entail probably greater trade-offs between military and civil expenditures than occur in peacetime. In the eighteenth century there were many wars involving Britain, Spain and other countries. According to Tilly (1990), there were seventeen wars during the eighteenth century. This was due to the great complexity of the international situation of the period, in which while certain former great powers like Spain were falling into the second rank, there steadily emerged several major states. The European states system was becoming one of five Great Powers -Britain, France, Russia, Austria and Prussia- which came to dominate the eighteenth-century world and to engage in a series of lengthy coalition wars punctuated by swiftly changing alliances, as well as lesser countries like Savoy and declining states as the Netherlands. In addition, we must bear in mind the expansion of Europe both eastward and westward. During most of the eighteenth century, all these powers were at war or preparing for war as a result of a sort of the arms race in which competition for military supremacy produced large numbers of weapons and great armies (Kennedy, 1987; Kamen, 2002). For this reason it seems reasonable to assume different trade-off parameters when Spain and Britain were at each one of these situations. The model:

$$m_t^i = \beta_0^i + \beta_1^i c_t^i + \beta_2^i d_t^i + \delta_0^i war_t^i + \delta_1^i war_t^i \cdot c_t^i + \delta_2^i war_t^i \cdot d_t^i + \varepsilon_t^i \quad (5)$$

... allows for a limited change in the parameters governed by the qualitative variable  $war_t^i$ , which value is one if the  $i$ -th country in the  $t$ -th year is involved in a war or preparing for it, and zero otherwise. Table 4 defines the dating of periods with a wartime spending pattern.

(Please, place Table 4 near here)

To see how this variable allows for a change in parameters, note that when  $war_t^i = 0$ , model (5) simplifies to:

$$m_t^i = \beta_0^i + \beta_1^i c_t^i + \beta_2^i d_t^i + \varepsilon_t^i \quad (6)$$

... while if  $war_t^i = 1$  the relationship becomes:

$$m_t^i = (\beta_0^i + \delta_0) + (\beta_1^i + \delta_1) c_t^i + (\beta_2^i + \delta_2) d_t^i + \varepsilon_t^i \quad (7)$$

... so the ‘beta’ parameters in (6) can be interpreted as the slopes corresponding to peacetime, while ‘delta’ values would be changes in the corresponding ‘beta’ due to wartime, see equation (7).

Military efforts are affected by the international political climate, which would influence all the concerned countries at the same time. Therefore, unexpected changes in the military expenditure in different countries should be correlated. These correlations are relevant and can be included in the regression through an extension known as ‘Seemingly Unrelated Regression’ or SUR (Zellner, 1962). If we extend model (5) to allow for cross-correlated errors, we would obtain the following system:

$$m_t^{GB} = \beta_0^{GB} + \beta_1^{GB} c_t^{GB} + \beta_2^{GB} d_t^{GB} + \delta_0 war_t^{GB} + \delta_1 war_t^{GB} \cdot c_t^{GB} + \delta_2 war_t^{GB} \cdot d_t^{GB} + \varepsilon_t^{GB} \quad (8)$$

$$m_t^{SP} = \beta_0^{SP} + \beta_1^{SP} c_t^{SP} + \beta_2^{SP} d_t^{SP} + \delta_0 war_t^{SP} + \delta_1 war_t^{SP} \cdot c_t^{SP} + \delta_2 war_t^{SP} \cdot d_t^{SP} + \varepsilon_t^{SP} \quad (9)$$

... with  $\text{cov}(\varepsilon_t^{GB}, \varepsilon_t^{SP}) = \sigma_{GB,SP}$ .

Table 5 displays the ‘guns-versus-butter’ coefficients in the SUR model both before and after pruning insignificant coefficients. These values are displayed in the panels ‘Full model’ and ‘Simplified model’, respectively. Our remarks will always be referred to the ‘Simplified model’ values.

(Please, place Table 5 near here)

As noted before, constant terms measure the expected annual growth of military outlays if the total effect of the other explanatory factors was zero. There are two main conclusions resulting from these coefficients. First, constants corresponding to Britain and Spain in peacetime are -8.35 and -1.44, respectively. These values indicate that: (a) in peacetime military outlays typically decrease in both countries and (b) the adjustment of expenditure in Britain was sharper than in Spain. Second, in wartime periods these base values are corrected by the wartime addends, 24.10 (Britain) and 13.41 (Spain). These values indicate that military expenditure shows a remarkable increase during wartime in both cases, being sharper this adjustment, once again, in Britain.

On the other hand, the coefficients corresponding to 'The Other Civil Items' and 'Debt Repayment' measure the expected change in the growth of military spending if the corresponding factors were increased by one percentage point. The slopes corresponding to 'The Other Civil Items' are positive both, in Spain and Britain, so this dataset rejects the 'guns-versus-butter' hypothesis in favor of the 'guns-and-butter' alternative. The British coefficient of 'The Other Civil Items' (.22) is not significantly affected by peace or wartime. In Spain this relationship weakens in wartime periods, so the relationship between both variables weakens in Spain during wartime.

In Britain, the coefficient of 'Debt Repayment' is negative (-.52) in peacetime, so a higher debt repayment tends to decrease the military expenditure. The high and positive value of the wartime addend (1.41) means that this trade-off fades during wartime. The corresponding coefficients in Spain are small and not very significant, meaning that the relationship between debt repayment and military outlays, if any, was very weak. This effect confirms the trend of government expenditure in both countries. In Britain debt repayment increased towards the end of wars and exceeded military spending during the peacetime, while in Spain government debt spending never exceeded military outlays (Jurado-Sánchez, 2009).

In a given sample, an outlier is an observation that is numerically distant from the rest of the data. As military effort depends on unstable international political situations, the corresponding outlays will typically be very volatile and prone to show outlying values. The presence of such outlying values is evident in Figure 3, where one

can see that the growth rate of military outlays shows highs and lows in the order of +120 per cent to -65 per cent, in the British case, while the same values for the Spanish series are +90 per cent and -55 percent (see also the maximum and minimum values in Table 3).

Modeling such erratic variables is difficult and tends to yield large fitting errors in specific years. Fortunately, outliers are relatively easy to detect and can be treated by including in the model some intervention variables designed to capture them (Box and Tiao, 1975). In the case of our dataset all these variables are associated to 'impulse' type effects, i.e., positive or negative fluctuations that last for a single year. The coefficients of these variables can be interpreted as estimates for the magnitude of the corresponding effects. These coefficients are associated to the 'impulse' variables in Table 5. Note that: (a) positive impulse values take place mostly in years in which both Spain and Britain were at war or preparing for it, (b) British series are always positive, while the Spanish series displays positive and negative values, and (c) British outliers are typically larger in absolute value than those of Spain. These features show again that Britain was able to adapt military expenditure with faster and sharper increases in military expenditure.

The positive impulse values took place mostly in years in which both Spain and Britain were at war or preparing for war. The British impulse of 1718 is due to the War of the Quadruple Alliance. In this year, British fleet defeat Spanish Navy at the Pessaro Cape Battle and attacked Spanish North coast, taking the towns of Vigo and Pontevedra. The years between 1721 and 1739, in which Britain was governed by the isolationist Walpole, was a relative peacetime for this country as a result of the Anglo-French thaw of 1715. Therefore, Britain did not participate in any war which generated the impulse of 1721. However, it is possible that this country still was paying the expenses of the War of the Quadruple Alliance. The causes of the British impulse of 1734 are not clear, but they must be related to the changing pattern of international relations, the War of the Polish Succession, and the colonial conflicts with Spain. In 1733, the French declared the Austrian war. The British, still in *détente* with France and much more concerned at the conflicts with Spain in the western hemisphere, preferred not to intervene, ignoring their old allies on the continent. Therefore, it is possible that the impulse of 1734 was due to British government increased military spending to prepare its involvement in the

War of the Polish Succession and in any quarrel with Spain in the Atlantic, but finally it believed that the course of the events made not necessary to intervene. The Spanish impulse of 1759 was probably a consequence of the involvement of Spain in the Seven Years War. It is true that she entered in this war two years later, after it made a pact with France. However, Spanish government was preparing its participation in it several years before. The increases in British military outlays corresponding to the impulses of 1776 and 1794 were due to two military conflicts. The former was caused by the American War of Independence (1776-83), a conflict that was very costly for Britain due to the logistical problem. British had to transport across 3,000 miles of ocean every man, weapon and biscuit. As for the impulse of 1794, Britain was at war with France continuously from 1793 to 1802, a conflict which formed part of the French Revolutionary Wars. As for the causes of the Spanish impulse of 1799, a new stage of the Spanish foreign policy began from 1796 onwards. It was characterized by a friendly relationship with France and rivalry with Britain, which meant war between this country and Spain in America and Europe during the next years (Kennedy, 1987; Kamen, 2002).

The profile of the residuals displayed in Figure 4 show that, even after outlier correction, the volatility of Britain outlays is larger than that of Spanish residuals (see also the residual standard errors in Table 5). This result confirms that the British Crown had more capacity to modulate its military expenditure than its Spanish counterpart. On the other hand, correlations between these residual series reveal other interesting features. First, the instantaneous sample correlation between both residual series is .21. For this sample size, any correlation larger than .20 is significant with a 95 per cent confidence so the unexplained changes in military outlays in both countries moved in the same direction. This fact, besides justifying the estimation of both models as a SUR system, indicates that both countries reacted to common external stimuli, probably derived from the international political climate. Second, there is a significant correlation (.26) between the Spanish residuals in year  $t$  and the Britain residuals in year  $t+3$ . This indicates that Britain reacted with a three year delay to increases or decreases in Spanish military spending, while there is no significant reaction of Spanish expenditure to past British changes in military outlays.

(Please, place figure 4 near here)

Why Britain was more able to adapt government expenditure to circumstances than Spain? There is a consensus among historians that Britain built a larger and efficient national administrative and military apparatus backed up by a far-reaching fiscal and financial system. This made possible that Britain mobilized faster and more efficiently her fiscal resources, won wars and obtained world hegemony. It seems that the other European countries were not capable of imitating Britain. Spain would have not been able of mobilizing fiscal resources due to lack of an effective bureaucratic framework. For example, the Spanish military structures were more rigid than the British ones, being incapable to respond to unsettle warfare situations. Military expenditure, especially in the Army, responded more to vested interests than to the needs of war (Andújar, 2004).

### **EXPLORING GUNS VERSUS INVESTMENT TRADE-OFFS. THE ECONOMIC ADVANTAGE OF BRITAIN**

Britain had the drop on Spain not only by the fact that she had a bureaucratic apparatus more efficient in mobilizing the available resources but also she increased the level of resources through several reforms which enhanced investment and growth. There exist a broad academic consensus regarding private and public investment, trough various mechanisms, increases the rate of economic growth. A rise in the capital stocks is a major source of economic growth and requires, in turn, increases in saving and investment. Diverse economic growth models (mainly, supply-side and demand-side) show that private investment is crucial to growth (Abramovitz, 1956; Solow, 1956; Romer, 1986; Jorgenson, 1988; De Long and Summers, 1990). The impact of investment in economic growth during the Modern Age has been estimated in several studies. In one of them has been calculated that the average annual growth rate of the U.S. economy from 1929 to 1982 was 2.9 per cent, investment contributing almost one-fifth to the increase (Denison, 1985, pp. 30-32).

On the other hand, has been shown that military spending and investment compete for the non consumption portion of the total productive capacity of the economy, reason for what increased levels of military spending crowd out investment, which, in turn, may have a dampening effect on growth (Huisken, 1982; Rasler and Thompson, 1988). It has been estimated that in the United States of the 1960s an extra billion dollars of defence in one year reduced investment by \$292 million. Given that

the marginal productivity of capital was between 20 and 25 per cent, the level of output in the economy would be permanently diminished by on the order of \$65 million per year (Russett, 1969, p. 418). Increased levels of defence demand may entail higher taxes or government borrowing in the capital markets, funds that otherwise might have gone to investment. These results can therefore slow down economic growth, which, in turn, can reduce the spending levels of civil items of budget, especially investment. The existence of an indirect link between military and civil spending (through investment) in twenty-century USA has been studied by Mintz and Huang (1991). They affirm that military expenditure had an indirect, negative effect on social spending, since increased levels of military spending may crowd out investment, which in turn may impede economic growth, thereby reducing the ability of government to increase welfare spending.

For the moment and due to lack of data on GDP, private investment and other variables it is not possible to apply the twenty-century empirical model of Mintz and Huang to the eighteenth century. Nevertheless, some studies about the economic effects of war in the early modern period come to similar conclusions. Williamson (1984) affirms that British economic growth and industrialization was slow between the 1760s and the 1820s due to low capital formation shares in national income, low rates of accumulation, and thus little change in the capital-labour ratio. He argues that the answer to the modest investment rates is to be found in the enormous government debt issued to fund warfare, since it crowded out civilian accumulation and inhibited growth. The size of Britain's National Debt jumped from around one million pounds in 1688 to 244 million pounds sterling in 1790, when it reached the level of 200 per cent of GDP (Macdonald, 2006, p. 235; Ferguson, 2001, p. 129). Other authors agree with Williamson on warfare generated the crowding-out effect and cut the rate of economic growth. Temin and Voth (2005, p. 333 and 346), using a model of credit rationing rather than a methodology focused on interest rates, affirm that if "had wars not interfered, British Economic growth might have been more rapid in the late 18<sup>th</sup> and early 19<sup>th</sup> centuries", since it "was hit by a sequence of negative, war-related shocks that reduced aggregate demand". They argue that private investment could have been reduced because "higher wartime borrowing simultaneously increased the availability of liquid government debt and raised the price of borrowing". Crafts (1996, p. 199) believes that during the Napoleonic Wars the "main impact on investment was probably the crowding-out effect of public spending". Craig and Fisher (2000, p. 120) affirm that

“almost inevitably” wars produced, a negative effect on investment spending by means of crowding-out, by which “the private capital shock is smaller than it otherwise would have been”. Clark (2001, p. 428) states that warfare and government debt, as deferred military spending, may have crowd out private investment through the decline of rental income. He shows that interest payments on government debt increased from 3 per cent of GDP by 1700 to 7.5 per cent by the 1820s, and that rents from land and housing, due to British population was growing rapidly, declined from 27 per cent of GDP to 18 per cent.

Regarding public investment, scholar interest about the relationships between public capital and economic growth began from Galbraith’s reflection about the importance of public infrastructure (Galbraith, 1958). In the early 1970s some theoretical and empirical works studied the relationship between public investment and economic growth (Arrow and Kurtz, 1970; Pestieau, 1974). However, the interest in this topic strongly increased with the Aschauer’s work (Aschauer, 1989). This author conclude that public capital was more productive than private capital and labour in the US, that the most productive types of public investment was infrastructure, and that additional spending by governments for non defence capital goods apparently had a very large positive effect on private productivity and, hence, output. For this reason, he also points out that the slowdown in the growth of productivity in the USA during the 1970s and the 1980s was due to the decrease in the stock of public capital. Since publication of Aschauer’s article, a great number of studies have examined whether there exist a positive impact of public investment on the US economic activity, most of them showing a positive correlation between output and public investment. Public services can be considered initially as an input to private production. It is this productive role that creates a potentially positive linkage between government and growth. (Barro, 1990; Munnell, 1990; Ford and Poret, 1991. Public capital adds to an economy’s capital stock so that its effects are felt over a longer time period (Mintz and Smart, 2006). Productive government spending would include, in addition to the resources devoted to activities that enter directly into production functions, those allocated to property rights enforcement, e.g. maintenance of law and order, national security, and help to sustain property rights. Therefore, the measures took by the British governments from the seventeenth century onwards, and probably earlier, in order to ensure the property rights and the commercial interests of the growing middle class, improved the economic performance (North and Weingast, 1989; Clark, 1996). British

economic prosperity provided a growing tax base to be tapped by Parliament and the Crown to wage and win wars and to gain world supremacy.

The performance of Spain show that without political and institutional changes, as those made in England, are not possible to achieve the military and economic results obtained by Britain. Spain did not able to spend a lot of money in war because she did not have an economy that yields the needed resources for mercantilist wars. The aggressive tax campaigns of Spanish government in New Spain were not sufficient, although it increased notably fiscal income (Marichal, 2007). If Spain wanted to fight for the world supremacy she must to carry out indispensable changes that enhanced its economy and to expand the tax base in order to obtain enough revenues. Spain must to eliminate feudalism and all privileges which it had established during centuries and that prevent to increase farm yields and commerce and to propel technical development. We are referring to the system of landlord and tenant farming, the special treatment received by the *Mesta*, the monopolies granted to guild... Nevertheless, the money spent by the Spanish state during the eighteenth century in mining industries and public infrastructures should to propel economic growth. The enlightened governments promoted the building of roads and canals for navigation and irrigation. The Aragon and Castile Canals generated a beneficial impact in agriculture, industry and commerce of these regions, and the network of roads built to link Madrid with the rest of the peninsula increased trade and market integration. On the contrary, it seems that the efforts made by State in establishing royal manufactures to encourage industry failed.

Due to the potential of private and public investment to increase economic growth, the exam of investment is an useful method to determine what country, Britain or Spain, favoured the existence or non-existence of guns versus butter trade-offs in the pursuit of their economic objectives. For this reason, we believe that it is appropriate to make an empirical exercise to test the existence of a trade-off between guns and investment in the eighteenth century. Unfortunately, we have only at our disposal figures on public investment for Spain, so we can not make this estimate for Britain. Our regression relates military outlays and investment, in a similar way to the ‘guns-versus-butter’ model (5):

$$m_t^{SP} = \alpha_0 + \alpha_1 i_t^{SP} + \gamma_0 war_t^{SP} + \gamma_1 war_t^{SP} i_t^{SP} + v_t \quad (10)$$

Here  $m_t^{SP}$  and  $i_t^{SP}$  denote, respectively, the annual percent rates of growth of military outlays and investment in Spain at time  $t$ , and  $war_t^{SP}$  is a binary variable which value is one if, in the  $t$ -th year, Spain was involved in a war or preparing for it, and zero otherwise. As in section 2, we augmented this formulation with some impulse-type variables that account for outliers. The main least squares estimation results for model (10) are summarized in Table 6. Note that: (a) investment has a positive and significant effect over the growth of military outlays, (b) the difference between wartime and peacetime values is small (and in fact not significant) and (c) the model achieves a moderate fit, as the  $R^2$  statistic indicates that it captures a 52 per cent of the variance of the endogenous variable. Parameter estimated indicates that an additional percent point of investment growth increases the expected growth of military outlays by .35 and .26 points. Therefore, military outlays and investment tend to increase in the same years, a conclusion that we will maintain until we obtain more and better data on these variables, allowing us to confirm or reject it.

(Please, place Table 6 near here)

#### 4. CONCLUSIONS

As it occurred in the majority of studies on guns vs. butter tradeoffs during the twentieth century, we found no evidence for a military-civil trade-off two centuries earlier if total military and civil outlays are considered. But if this question is examined at a less aggregated level and total civil spending is substituted by repayment debt and other civil items, then a trade-off between these categories of expenditure appears. In addition, it reports interesting findings on deployment of resources in Britain and Spain in order to achieve their economic and military objectives. This trade-off reveals the trend and structure of government expenditure in both countries and the benefits that they brought Britain. British debt repayment exceeded military spending in peacetime, while in Spain military expenditure was always larger than debt repayment. As a result of the commitment of state to defray government debt, Britain could borrow a significant part of its war spending at relatively low interest rates, this being one of the main factors of the British world supremacy. Also it contributed to Britain achieved its military objectives that her state was more flexible and dynamic in deploying the available resources. The British Exchequer increased military outlays in wartime and

reduced it in peacetime, this adjustment being sharper than that of its Spanish counterpart. Britain also was more flexible in reacting to external threats. She responded to changes in the level of military outlays in Spain, while there is not significant reaction of this country to similar changes in British military spending.

As for the pursuit of the economic objectives, Britain also was ahead Spain. It seems that in Britain the heavy taxation and the great increases in public expenditures occurred at the same time that population and output grew and integration of markets accelerated. It is possible, however, that without so many wars Britain's aggregate real income growth per year would have been higher by almost 1 per cent from the 1760s to the 1810s. The British case seems shows that the factors that broke the Malthusian ceiling and caused the Industrial Revolution were not warfare and mercantilism but a novel and large innovation and the institutional and political changes made from the seventeenth century onwards in order to protect property rights and ensured the commercial interests of the growing middle class. These changes propelled technical development and increased productivity. Had Spain choose between guns and butter? Had Spain grew more without so many wars? In this country total public spending and military outlays also increased considerably between 1714 and 1800, while agrarian and industrial production and commerce grew over the several decades after the War of Spanish Succession. Nevertheless, Spanish economy would have grown more if governments had implemented political and institutional reforms as those made in Britain. Without these reforms are not possible that Spain achieved the economic results obtained by Britain. In addition, in Spain military outlays and public investment tend to increase in the same years, so, in this case, there was no "guns-versus-public investment" trade-off. For the moment, and until we have at our disposal more and better data on GDP and investment which allow to improve empirically and methodologically the model, we are no able to find trade-offs between guns and investment. For this reason, it goes without saying that this topic will require additional efforts in the future.

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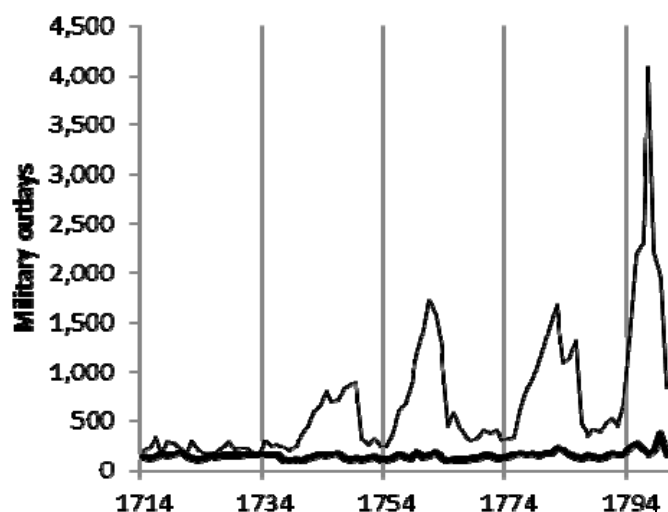


Figure 1 Military outlays in Great Britain (thin line) and Spain (thick line) in millions of constant *reales* of *vellón*, 1714-1800

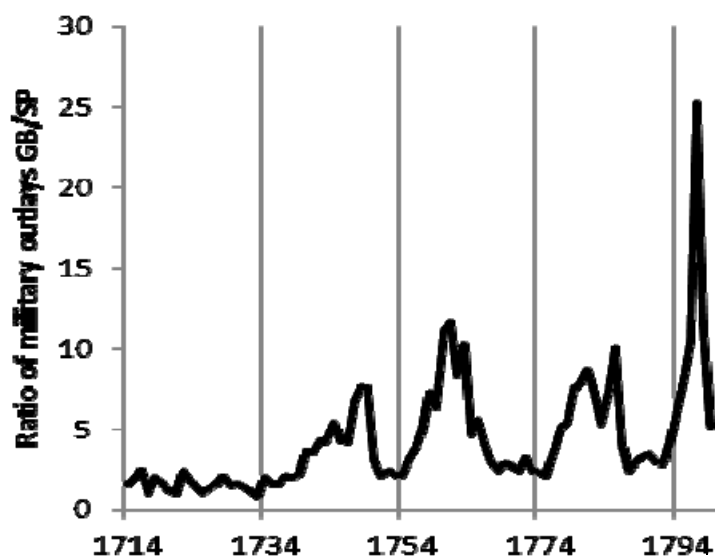


Figure 2 Ratio of military outlays in Great Britain over those in Spain.

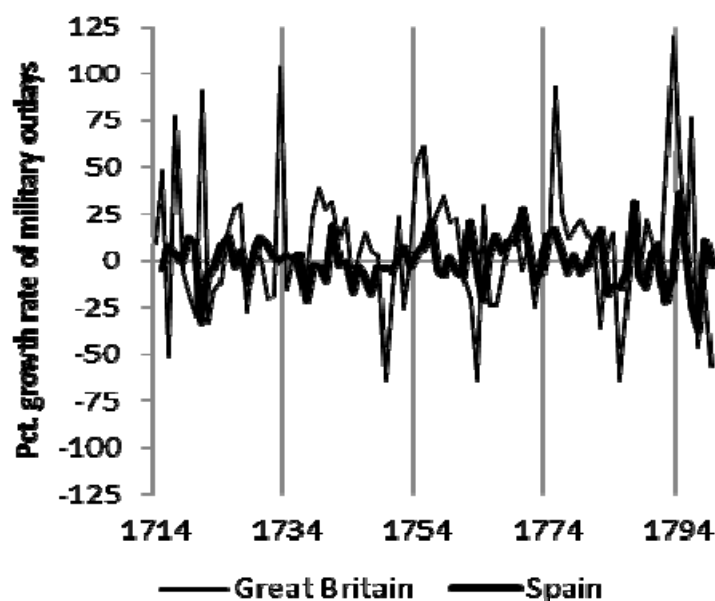


Figure 3 Annual percent growth rates of military outlays in Britain and Spain

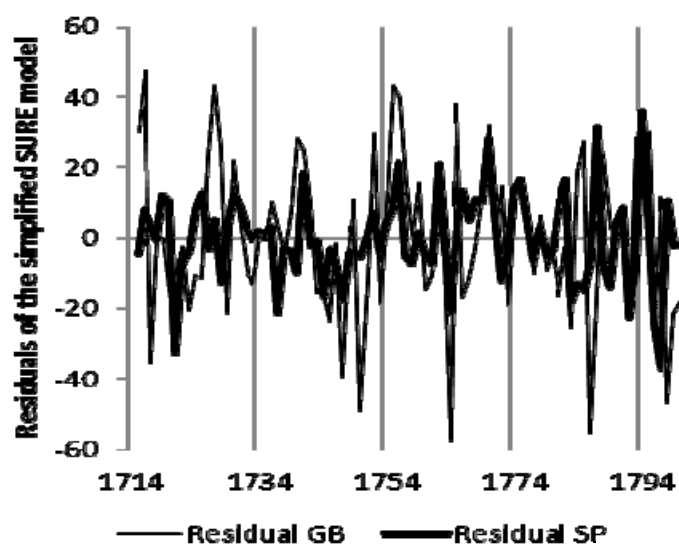


Figure 4 Residuals of the 'Guns-versus-butter' simplified SURE models for Britain and Spain

Table 1 Structure of public spending in Great Britain and Spain\*

	Great Britain	%	Spain	%	GB/Spain
<b>Public spending (A)+(B)</b>	1,205	100.0%	237	100.0%	5.1
<b>Military outlays (A)=(C)+(D)</b>	652	54.1%	149	62.8%	4.4

- Army (C)	346	28.7%	99	42.0%	3.5
- Navy (D)	306	25.4%	49	20.7%	6.2
<b>Civil spending (B)=(E)+(F)</b>	<b>553</b>	<b>45.9%</b>	<b>88</b>	<b>37.2%</b>	<b>6.3</b>
- Debt Repayment (E)	438	36.4%	17	7.1%	26.0
- Other civil items (F)	115	9.5%	71	30.1%	1.6

\*Annual averages in millions of *reales* of *vellón* computed over the whole sample period. See Appendix 3 for a more detailed breakdown of these figures.

Table 2 Unit roots and co-integration tests for the (log-transformed) military outlays series

	<b>Great Britain</b>	<b>Spain</b>
ADF <sup>1</sup>	-2.535	-2.695
KPSS Test <sup>2</sup>	1.546	0.705

<sup>1</sup>Augmented Dickey-Fuller statistic computed with three lags. The critical 1% and 5% values are, respectively, -3.510 and -2.896. The null of this test (the series has a unit root) is NOT rejected.

<sup>2</sup>Kwiatkowski-Phillips-Schmidt-Shin test statistic with a bandwidth of 2, fixed using Bartlett kernel. The null of this test is that the series is stationary. The critical 1% and 5% values are, respectively, 0.739 and 0.463. The null is rejected with a 5% significance in both cases.

Table 3. Descriptive statistics of the growth rates of military outlays.

<b>Statistic</b>	<b>Great Britain</b>	<b>Spain</b>
Observations	86	86
Mean	7.68	2.27
Median	6.75	2.01
Maximum	119.53	91.44
Minimum	-64.08	-56.07
Std. Dev.	35.59	20.80
Skewness	0.64	0.85
Kurtosis	4.07	6.37
Jarque-Bera <sup>1</sup>	9.91	51.19
Correlation		0.18

<sup>1</sup>Jarque and Bera test for the null of normality. Values larger than 6 reject normality with less than 5% significance (Jarque and Bera, 'Efficient tests').

Table 4 Dating of wartime spending years<sup>1</sup>

<b>Significant Dates</b>	<b>Remarks</b>	<b>Years with <math>war_t^i = 1</math></b>	
		<b>Britain</b>	<b>Spain</b>
1740-1748	Austrian Secession War	1739-1748	1741-1746

1756-1763	Seven Years War	1755-1761	1759-1762
1776-1783	American War of Independence	1776-1782	1780-1782
1792-1800	Colonial and First Napoleonic Wars	1790-1800	1790-1799

<sup>1</sup>These periods have been chosen heuristically, to include years with a strong increase in military spending situated immediately before or during a war.

Table 5 Estimates for SURE model coefficients

	Full model		Simplified model	
	Britain	Spain	Britain	Spain
Constant	-8.32 <sup>**</sup> (3.18)	-1.44 (1.66)	-8.35 <sup>**</sup> (3.18)	-1.44 (1.63)
Other Civil Items	0.17 (0.20)	0.42 <sup>**</sup> (0.09)	0.22 <sup>*</sup> (0.13)	0.42 <sup>**</sup> (0.09)
Debt Repayment	-0.51 (0.34)	2.6x10 <sup>-5</sup> (2.5x10 <sup>-3</sup> )	-0.52 <sup>*</sup> (0.30)	---
Constant ( $war_t^i = 1$ )	24.11 <sup>**</sup> (4.97)	13.41 <sup>**</sup> (3.39)	24.10 <sup>**</sup> (4.97)	13.41 <sup>**</sup> (3.38)
Other Civil Items ( $war_t^i = 1$ )	0.09 (0.30)	-0.32 <sup>**</sup> (0.12)	---	-0.32 <sup>**</sup> (0.12)
Debt Repayment ( $war_t^i = 1$ )	1.35 <sup>**</sup> (0.51)	-0.05 <sup>**</sup> (0.01)	1.41 <sup>**</sup> (0.46)	-0.05 <sup>**</sup> (0.01)
Impulse 1718 <sup>1</sup>	78.91 <sup>**</sup> (23.20)	---	79.45 <sup>**</sup> (23.13)	---
Impulse 1722 <sup>1</sup>	94.99 <sup>**</sup> (22.52)	---	93.76 <sup>**</sup> (22.15)	---
Impulse 1734 <sup>1</sup>	106.14 <sup>**</sup> (22.17)	---	105.83 <sup>**</sup> (22.15)	---
Impulse 1759 <sup>1</sup>	---	46.48 <sup>**</sup> (12.88)	---	46.59 <sup>**</sup> (12.88)
Impulse 1763 <sup>1</sup>	---	-42.15 <sup>**</sup> (12.80)	---	-42.24 <sup>**</sup> (12.80)
Impulse 1776 <sup>1</sup>	75.47 <sup>**</sup> (21.92)	---	75.76 <sup>**</sup> (21.91)	---
Impulse 1794 <sup>1</sup>	83.54 <sup>**</sup> (22.59)	---	82.52 <sup>**</sup> (22.34)	---
Impulse 1799 <sup>1</sup>	---	77.47 <sup>**</sup> (13.32)	---	77.47 <sup>**</sup> (13.32)
Impulse 1800 <sup>1</sup>	---	-57.70 <sup>**</sup> (12.79)	---	-57.81 <sup>**</sup> (12.78)
R-squared	0.61	0.62	0.61	0.62
Residual standard error	23.51	13.58	23.36	13.49
Jarque-Bera test	0.46	2.35	0.40	2.35

$Q(10)$ statistic <sup>2</sup>	6.11	21.88	14.14	21.87
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The 'simplified model' just adds some exclusion constraints to the 'full model'.

\* Means that the estimate is statistically significant with a 90% confidence or better.

\*\* Means that the estimate is statistically significant with a 95% confidence or better.

<sup>1</sup> The 'impulse' variables have a unit value in the year indicated by its name and zero otherwise.

<sup>2</sup> Ljung and Box  $Q$  test, computed with ten lags of the residual autocorrelation function (Ljung and Box, 1978)

We have used the datasets constructed by Mitchell and Deane (1962) for Britain and by Jurado-Sánchez (2006) for Spain.

Table 6 Results of the 'Guns vs. Investment' regression for Spain<sup>1</sup>

Variable	
Constant	-4.03* (2.34)
Annual pct. growth rate of investment ( $i_t^{SP}$ )	.35** (.10)
Constant ( $war_t^{SP} = 1$ )	14.55** (4.23)
Annual pct. growth rate of investment ( $war_t^{SP} = 1$ )	-.09 (.18)
Impulse 1759	38.95** (16.75)
Impulse 1763	-35.28** (16.15)
Impulse 1799	73.01** (17.15)
R <sup>2</sup> statistic	52.30%
Residual standard error	15.97
Jarque-Bera test	0.11
$Q(10)$ statistic	13.54

<sup>1</sup> We have used the government investment dataset constructed by Jurado-Sánchez (2006), which includes in the government investment a number of payments made by the Exchequer in order to fund several production and building activities, i.e, royal manufactures, government and court buildings, mining, roads, canals, foundation of new towns to put an end to the system of landlord and tenant farming...

\* Means that the estimate is statistically significant with a 90% confidence or better

\*\* Means that the estimate is statistically significant with a 95% confidence or better

Figures in parentheses are the standard errors of the corresponding estimates

The endogenous variable of this model is the annual percent rate of growth of military outlays

## Appendix 1 Reliability of data and currency conversions

If primary source material is consulted to research in economic history, it is crucial to carry out the source criticism to check into its reliability and suitability for the investigation in question. As for Great Britain, the estimates of public income and expenditure made by Mitchell and Deane (1962) have been extensively used and generally considered reliable and plausible. These authors explain in their book (pp. 381-385) the shortcomings and advantages of the sources used. Regarding Spain, there are four types of archival sources containing data to estimate the volume and structure of government spending during the eighteenth century: 1) Reports on the situation of National Treasury made by the senior officials of the Exchequer; 2) Financial summaries, statements and estimates issued by several fiscal bodies; 3) The accounts of the *Tesorería General* and the *Tesorería Mayor*, the central treasuries of the Exchequer which managed and centralised revenue and expenses; 4) The accounts of the *Tesorería General* and the *Tesorería Mayor* supervised by the *Contaduría Mayor de Cuentas*, the auditing body of the State Treasury which was under the obligation to give the accounts the final approval. Sources 3 and 4 present great advantages over the others for estimating the annual public outlays. Firstly, they contain reliable yearly data pertaining to the whole of the eighteenth century which were generated by the same fiscal body for the same aim, i.e. to present public accounts. The other sources only contain data for some periods of this century and were generated by diverse institutions for various purposes. Secondly, sources 3 and 4 contain records of actual expenditures, while the other sources contain estimates of spending. Finally, source 4 presents a valuable additional advantage in relation to the source 3: the revisions by the *Contaduría Mayor de Cuentas* were final and settled the accounts. Sources 1 to 4 have been used by a number of scholars to estimate the volume of Spanish public expenditure. The most plausible of the estimates were made between 1969 and 2006, when several Treasury scholars published seven series of statistics (Kamen, 1969; Ozanam, 1978; Merino, 1981, 1987; Barbier and Klein, 1985; Pieper, 1988; Jurado-Sánchez, 2006). In our view until this work was published there were no acceptable statistics which would allow us to know with a degree of certainty the volume and the structure of Spain's Treasury spending and its fluctuations, to analyse its economic effects, and to carry out international comparisons for the whole of the eighteenth century like those made in this work. Considered jointly, the other six estimates leave much to be desired. Their authors have not calculated figures for thirty years of the first half of the century and statistics made for the second half present generally very different results. If we take as an example 1760, we can see that for this year four estimates have been made and all of them present large differences. The figure calculated by Merino (1987) is three times greater than that of Ozanam and one and half times more than that presented by Barbier and Klein and Pieper. The same it can be said as for other years. These enormous differences are due to several factors: difficulties in the use of archival materials, the diverse primary sources upon which estimates are based, inadequate data processing and the fact that five sets of data have been constructed at current prices and only one at constant prices. Therefore, the abovementioned six series are very different estimates which cover various periods of the eighteenth century, are not comparable and it is very difficult to integrate them into a single homogeneous series. There is no doubt that estimates made by Jurado-Sánchez markedly improve the statistics of Spanish public spending at our disposal. There are several powerful reasons for choosing his statistics in order to achieve the aims of this work. Firstly, it is the only series which covers practically all the eighteenth century. The other estimates cover only a part of the

century, that of Merino (1987), which is the longest, includes data for 48 years. In the second place, Jurado-Sánchez has used the optimal archival source: the accounts of central treasurers of the Exchequer audited by the *Contaduría Mayor de Cuentas*. It is true that Kamen, at least in part, and Pieper have used this source, but only to estimate public spending for 16 and 28 years of the century respectively. In addition, the series by Jurado-Sánchez has been compiled with adequate data processing and has been deflated with the optimal index prices. Barbier and Klein also have constructed their series at constant prices and with adequate data processing, but their estimate only covers 29 years of the century.

In order to compare accurately the level of military and civil items of Great Britain and Spain, the accounting units of both countries were unified using eighteenth century rates of exchange for the pound sterling and the *real* of *vellón*. Purchasing power parity (PPP) states that the exchange rate between two currencies should be that which would equate the relative national prices if expressed in a common currency (Sarno and Taylor, 2002). It is true that the empirical evidence in favour of PPP is not very strong, and there is research reporting that this method fails to hold. Several explanations for this apparent failure have been offered. Some of them stem from economic considerations, some stem from the difficulties in the empirical analysis and others from policy variables (Officer, 1982; Rogoff, 1996). In spite of these difficulties, PPP has been used fruitfully in both theoretical and empirical research on exchange rates since it was hinted at in the sixteenth century and formally stated in the two following centuries. Additionally, we have at our disposal a reliable source, *The Course of the Exchange* (see references), a periodical which offers plentiful financial and commercial data, and for this reason has been used by numerous scholars to study many issues related to eighteenth century finance and commerce.

## Appendix 2 Statistics of military and civil spending

TABLE A  
EXPENDITURE BREAKDOWN, 1700-1800

	Army				Navy				Debt Service				The other civil items			
	Britain		Spain		Britain		Spain		Britain		Spain		Britain		Spain	
1700-1710	2,51	35.73	---	---	1,81	28.89	---	---	1,36	21.22	---	---	0,74	11.58	-	---
1711-1720 <sup>1</sup>	1,74	23.65	132,03	69.85	1,62	21.17	16,32	8.63	2,80	39.99	1,03	0.55	0,85	11.99	39,64	20.97
1721-1730	1,19	19.72	120,86	59.38	0,98	15.81	14,81	7.28	2,83	46.51	11,57	5.69	1,04	17.71	56,30	27.65
1731-1740	1,35	22.51	107,86	52.09	1,27	20.50	29,53	14.26	2,36	39.12	17,72	8.56	0,94	17.36	51,97	25.09
1741-1750	3,52	33.64	68,35	30.28	3,13	29.92	67,89	30.08	2,65	25.62	23,04	10.21	0,96	9.93	66,42	29.43
1751-1760	3,43	29.62	82,58	37.40	2,65	24.31	51,23	23.20	3,03	29.55	4,36	1.98	1,11	11.28	82,63	37.42
1761-1770	4,03	26.74	82,40	34.09	3,21	23.03	44,91	18.58	4,60	35.25	11,84	4.90	1,16	8.76	102,57	42.43
1771-1780	3,81	27.79	94,03	40.12	2,83	21.99	58,94	25.15	4,36	34.99	10,99	4.69	1,23	8.75	70,41	30.04
1781-1790	3,85	20,54	85,39	32.82	4,78	24.99	69,78	26.82	7,25	41.45	30,17	11.60	1,47	6.98	74,84	28.76
1791-1800	8,00	31.25	131,44	39.44	6,51	24.77	78,47	23.54	8,13	33.92	36,41	10.92	1,35	5.64	86,95	26.10
1700-1800 <sup>2</sup>	3,34	29.95	99,46	42.03	2,88	25.40	49,08	20.74	3,94	34.75	16,88	7.13	1,07	9.43	71,24	30.10
R	1,29		-0.15		1,43		1.84		1,60		2.17		0,46			

Sources: The author's own calculations based on Mitchel and Deane (1962) and Jurado-Sánchez (2006)

Notes: Left row of each country, expenditure in millions of pounds sterling (Britain) and millions of *reales* of *vellón* (Spain) at constant prices. Right row of each country, percentages of total expenditure

<sup>1</sup> 1714-1720 for Spain. <sup>2</sup> 1714-1800 for Spain.

R: cumulative growth rate

**TABLE B**  
BREAKDOWN OF SPANISH CIVIL ITEMS, 1714-1800

	RH	%	DR	%	CA	%	I	%	P	%	ECE	%
1714-1720	10,37	5.49	1,03	0.55	10,47	5.54	0,15	0.08	4,11	2.18	14,53	7.69
1721-1730	20,24	9.94	11,57	5.69	14,35	7.05	3,99	1.96	3,07	1.51	14,64	7.19
1731-1740	17,60	8.50	17,72	8.56	12,33	6.15	6,41	3.10	5,22	2.52	10,01	4.83
1741-1750	23,66	10.48	23,04	10.21	20,19	8.95	6,27	2.78	3,24	1.44	13,06	5.79
1751-1760	19,15	8.67	4,36	1.98	17,39	7.88	14,08	6.38	7,10	3.22	24,91	11.28
1761-1770	22,82	9.44	11,84	4.90	15,07	6.23	12,10	5.01	5,18	2.14	47,39	19.60
1771-1780	20,55	8.77	10,99	4.69	15,28	6.52	13,29	5.67	5,24	2.23	16,04	6.84
1781-1790	18,86	7.25	30,17	11.60	14,54	5.59	16,24	6.24	4,71	1.81	20,48	7.87
1791-1800	17,93	5.38	36,41	10.92	15,45	4.64	9,87	2.96	5,59	1.68	38,11	11.43
1714-1800	19,32	8.16	16,88	7.13	15,21	6.43	9,47	4.00	4,85	2.05	22,39	9.46
R	0.25		2.17		0.16		1.40		0.85		0.96	

Sources: The author's own calculations based on Jurado-Sánchez (2006)

Left row of each budget item, expenditure in millions of *reales* of *vellón* at constant prices. Right row: percentages of total expenditure. R: cumulative growth rate

RH: Royal Household. DS: Debt Repayment. CA: Central administration. I: Investment. P: Pensions. ECE: Extraordinary Civil Expenses.

**TABLE C**  
TOTAL EXPENDITURE, MILITARY SPENDING AND THE DEBT REPAYMENT, 1714-1800

	Total Expenditure		Spain/ Britain <sup>1</sup>	Military Spending		Debt Repayment		Spain/ Britain <sup>2</sup>	
	Britain	Spain		Britain	Spain	Britain	Spain		
1714-1720	663.97	189.02	28.46	247.40	148.35	319.30	1.03	59.96	0.32
1721-1730	592.79	203.54	34.34	210.85	135.67	276.92	11.57	64.34	4.18
1731-1740	558.38	207.08	37.08	243.03	137.39	218.60	17.72	56.53	8.11
1741-1750	1062.45	225.70	21.24	684.28	136.24	272.46	23.04	19.91	8.46
1751-1760	1050.29	220.80	21.02	621.66	133.80	310.28	4.36	21.52	1.40
1761-1770	1335.41	241.72	18.10	741.74	127.31	470.50	11.84	17.16	2.52
1771-1780	1239.44	234.37	18.91	658.77	152.97	434.64	11.00	23.22	2.53
1781-1790	1797.25	260.18	14.48	882.00	155.17	748.77	30.17	17.59	4.03
1791-1800	2854.13	333.27	11.68	1730.43	209.90	931.65	36.41	12.13	3.91
1714-1800	1259.19	236.66	18.79	683.44	148.54	446.82	16.88	21.73	3.78
R	2.01	0.46							

Sources: The author's calculations based on Mitchell and Deane (1962), Jurado-Sánchez (2006), and the rates of exchange published in *The Course of the Exchange*

Note: British and Spanish figures in millions of *reales* of *vellón* at constant prices

<sup>1</sup> Spanish total expenditure as percentage of British'

<sup>2</sup> Left column, Spanish military spending as percentage of Britain's. Right column, the Spanish Debt service as percentage of British's

R: cumulative growth rate