The Displacement Hypothesis and Government Spending in the United Kingdom: Some New Long-Run Evidence

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Abstract

This paper presents new evidence on the ability of Peacock and Wiseman's displacement hypothesis to explain temporal increases in the ratio of government expenditure to GDP in the United Kingdom. Using univariate modelling techniques that are robust to structural changes in the underlying data generating process and a data set extending back to 1836, we find four instances where displacement may be said to have occurred.

JEL classification numbers: E62, H50
Key Words: displacement hypothesis, government expenditure, structural breaks

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1 Introduction

In this paper, we present new evidence on the ability of Peacock and Wiseman's (1961) displacement hypothesis to explain temporal increases in the ratio of government expenditure to GDP in the United Kingdom. Peacock and Wiseman argued that government spending in the United Kingdom did not follow a smooth trend but instead appeared to jump upwards at discrete intervals. They associated these jumps with major social events, singling out World War II for particular attention, arguing that broader social expenditures displaced military expenditure once hostilities had ended.

Underlying the hypothesis is the notion of tolerable taxation levels. According to this view, voters' conception of what is a fair or just amount of tax places a ceiling on the maximum amount of income that can be diverted to the government in the form of tax revenue. However, in times of national emergency, such as war, voters become more accepting of tax increases. After a period of exposure to the new tax regime, the maximum tolerable taxation level is raised as voters become increasingly familiar with the new arrangements. The government is then able to maintain expenditure at historically high levels even though the period of emergency or crisis has passed.

Peacock and Wiseman did nor present any formal statistical tests of the displacement hypothesis, relying instead on visual inspection of plots of government expenditure against GDP. Since then, a variety of formal testing procedures have been used in order to assess the validity of the hypothesis. The most common approach has been to look for evidence of instability in regression equations based on Wagner's Law. These analyses can be regarded as joint tests of the displacement hypothesis and the hypothesis that the share of national income devoted to government spending increases with income (Gupta 1967, Diamond 1977, Nomura 1991, 1995).

An alternative approach is to examine the univariate properties of government expenditure for evidence of displacement. An example is the paper by Goff (1998) who fitted a univariate model to government expenditure, and used impulse response functions calculated from an ARIMA specification, and non-parametric persistence measures, to show that government spending changes exhibit persistence in the face of temporary shocks. Goff's (1998) methodology has the advantage of allowing inferences to be made which are independent of whether or not a bivariate specification based on Wagner's Law is appropriate to capture the dynamics of government spending. However, it is not obvious that the use of impulse responses and persistence measures are relevant for tests of the displacement hypothesis (Bohl 1999). The issue is whether displacement is best thought of as occurring at infrequent intervals (i.e., representing a significant structural change in the underlying data generating process) or whether displacement is consistent with frequent permanent shocks to government expenditure, as might occur if the data generating process is stable, but characterised by a stochastic trend.

In this paper, we take the former view, believing it to be more consistent with Peacock and Wiseman's original hypothesis. Nevertheless, our approach is univariate, thus avoiding the problems associated with the testing of joint hypotheses. Essentially, we examine the data for evidence of signi¯cant shifts in the ratio of government expenditure to GDP. We do so using time series techniques that are suitable for the univariate modelling of data subject to structural instability. In contrast to previous studies, for example, the paper by Diamond (1977), our approach is entirely objective as to the dating of breaks in the data. Moreover, unlike studies such as that by Nomura (1991), our methodology is capable of identifying multiple breaks in the data without the need for abritrarily sub-dividing the sample.

The paper is organised as follows. The data are described in section 2. This is followed, in section 3, by a discussion of our econometric methodology and a presentation of the results. A short conclusion follows.

2 The Data

The expenditure data are annual and cover the period from 1836 to 1995, and are net of interest payments. For the period from 1836 to 1980, the data come from Mitchell (1988). From 1980 onwards, the data come from the Annual Abstract of Statistics (Great Britain Central Statistical O±ce, various issues).[1]

The ratio of government expenditure to GDP, $g_{t,}$ is graphed in Figure 1. Since the raw data appear to exhibit an exponential trend, we work with the log of the government expenditure/GDP data.

Insert Figure 1 here

>From the historical record, we know that U.K. government spending has undergone several distinct phases. For example, expenditure changes in the nineteenth century were predominantly the result of frequent wars which, as noted by Barro (1987), were largely ¯nanced by peacetime budget surpluses.[2] In the twentieth century, the dominant ¯scal events were the two World Wars. The ¯rst World War saw a signi¯cant increase in tax rates, made easier by the introduction of progressive income taxes by Lloyd-George in 1909. Consistent with the displacement hypothesis, these income taxes remained in e®ect through the 1920s, and the de¯cits that marked the beginning of the Depression were met with increases in indirect taxes, particularly tari®s. Military expenditures began to rise in 1936, and World War II saw further substantial increases in tax rates and budget de¯cits. The post war period has been characterised by further increases in government

[1] These data have also been used to test the tax smoothing hypothesis by Crosby and Olekalns (1999). The discussion of British ¯scal policy which follows is based on material in that paper.

[2] The British experience stands in marked contrast with the 19th century experience of France, where war de¯cits were ¯nanced by occasional repudiations of debt (Sargent and Velde (1995)).

expenditure although, as the graph indicates, the upward trend has been far from smooth.

The question we focus on in this paper is whether the temporal increase in the government expenditure/GDP ratio observed in ¯gure 1 has been associated with signi¯cant structural changes to the underlying data generating process and if so, when did these changes occur?

3 Econometric Methodology and Results

We ¯rst test the data for evidence of unit root non-stationarity. It is important to establish that the data are not characterised by a unit root, since underlying the displacement hypothesis is the notion that permanent shocks to government spending are infrequent. Finding evidence of a unit root would make it di±cult to distinguish infrequent displacement shocks from the other more frequent permanent shocks responsible for the stochastic nature of the trend.

However, it is not possible to use the standard Dickey-Fuller approach to testing for unit root non-stationarity, given the low power of the test in the presence of structural breaks (Perron 1989, 1997, Zivot and Andrews 1992). Therefore, we use the test for a unit root in the face of an unknown structural break devised by Perron (1997). The Perron test has an advantage over other unit root tests which allow for structural breaks, such as the test devised by Zivot and Andrews (1992), by not requiring the end points of the sample to be trimmed. Furthermore the Perron test allows for a break under both the null and alternative hypotheses.

The first model considered by Perron allows for a gradual change in the intercept. This model is referred to as the innovational outlier model or IO(1) model. The test is based on the regression

$$g_t = \mu + \theta DU_t(\psi) + \beta t + \gamma D_t(\psi) + \alpha g_{t-1} + \sum_{i=1}^{k} \delta_i \Delta g_{t-i} + u_t; \qquad (1)$$

where u_t is a white noise error term. Here $DU_t(\psi) = 1$ if $t < T\psi$; and 0 otherwise; and $D_t(\psi) = 1$ if $t = T\psi + 1$ and 0 otherwise.

Under the second model, IO(2), a change in the intercept and slope are allowed for at time $T\psi$. The test is based on the regression

$$g_t = \mu + \theta DU_t(\psi) + \beta t + \gamma D(\psi) + \lambda DT_t(\psi) + \alpha g_{t-1} + \sum_{i=1}^{k} \delta_i \Delta g_{t-i} + u_t \qquad (2)$$

with $DU_t(\psi)$ and $D_t(\psi)$ as before and $DT_t(\psi) = t - T\psi$ if $t > T\psi$; and 0 otherwise.

The third test is referred to as the additive outlier or AO model. Here the break is in the slope of g_t and is assumed to occur rapidly. The AO test is performed in two steps. The first step is to detrend the data using

$$g_t = \mu + \beta t + \lambda DT_t(\psi) + \tilde{g}_t. \qquad (3)$$

The AO test is obtained from

$$\tilde{g}_t = \alpha \tilde{g}_{t-1} + \sum_{i=1}^{k} \delta_i \Delta \tilde{g}_{t-i} + u_t.$$

All of the tests are based on the t-statistic for ® = 1 in the respective regressions. The break date in the Perron test is selected using the maximum of the absolute value of the statistic associated with the change in the intercept in model IO(1) and the change in the slope in models IO(2) and AO. The use of the maximum value of the t-statistic imposes no a priori view on the sign of the change.

- Insert Table 1 here -

Table 1 presents the results of the Perron unit root tests. The null hypothesis of a unit root is rejected strongly at the 5% level for the IO (1) and IO (2) tests: In the case of the AO test there is very marginal support at the 5% level, however the null of non-stationarity is rejected at the 10% level. We therefore conclude that government expenditure is not characterised by a unit root.

Perron's approach allows for a break under the alternative hypothesis and can be used to date any such breaks; therefore, it allows a preliminary investigation to be made of the possibility that the upward trend in the government expenditure/GDP ratio is due to displacement. The estimated break dates are reported in the table. The break dates in the IO(1) and IO(2) tests di®er from the date estimated in the AO model. Given that the various regressions are conditioned for di®erent types of break, this suggests that there may be multiple breaks in the data and that the nature of the individual breaks may di®er across time.

In light of this prima facie evidence in favour of multiple structural breaks, we implement a recent technique devise by Bai and Perron (1998) which enables estimates to be made of multiple break points. The technique involves estimating m single equations allowing for, respectively, l, l + 1, . . . l + m possible structural breaks. The estimated sum of squared residuals are then compared across the regressions and the global minimum value is established. If this value is sufficiently small relative to the estimated sum of squared residuals with fewer structural breaks, then that specification becomes the preferred model.[3] This technique is sufficiently flexible that it can accommodate structural changes involving all of the estimated parameters or just a subset of the parameters.

We use the following specification to implement the test;

$$g_t = \alpha + \delta t + \sum_{i=1} \gamma_i g_{t-i} + \epsilon_t; \qquad (4)$$

and look to instability of α and δ as being indicative of, respectively, a mean and a trend shift. We also estimate a partial structural change model (holding δ fixed), to see whether mean shifts ever occurred independently from a trend shift.

- Insert Table 2 here -

The results are in Table 2. Considering first the mean and trend shift

[3] Bai and Perron (1998) provide asymptoticly valid critical values for inferring the number of structural breaks.

tests, the test statistics uniformly reject the null hypothesis of structural stability. The minimum value of the Schwarz Bayesian information criterion, which can be used to give an indication of the number of structural breaks, identifies 4 possible break dates. These correspond to breaks in respectively 1870, 1915, 1941 and 1965.

All of these years represent significant milestones in the United Kingdom's fiscal history. The year 1870 ushered in the peak years of the British empire and saw military (primarily naval) expenditure begin to increase to unprecedented levels in the interests of "flag - and - sabre rattling". 1870 was also the year in which the British government first became a significant contributor to the public education system (social expenditure having previously been negligible). (Hobsbawn 1999 Chapter 12).

The war years, 1915 and 1941, hardly need comment. As seen in Figure 1, they represent extraordinary fiscal episodes in British history.

The final break, in the mid-1960s, coincides with the election of a Labour Government committed to large increases in public expenditure. For example, in February 1965, the Chancellor announced that public expenditure was forecast to increase in real terms by 4.5 per cent per annum for a period of six years. This strategy was part of an overall "National Plan" designed to deliver a 25 percent boost to national output by 1970 (Cairncross 1995, Chapter 4).

Turning now to the evidence regarding individual mean and trend shifts, it is apparent that it was only in World War I that the traditional displacement hypothesis (i.e., that displacement represents a jump to a new plateau of spending), can be detected in the data. All the other breaks consisted of simultaneous trend and mean shifts.

What emerges from these results is evidence in favour of the displacement hypothesis; at the very least, it seems clear that the world wars had permanent e®ects on government spending. The results also highlight that major social upheavals are not necessary for a displacement-like shift in government expenditure to occur. The structural breaks in 1870 and 1965 were not the result of major wars, or depression or some such equally calamitous event. Instead, each was associated with a particular set of events conducive to the government taking a more active role in the economy. For 1870, this involved the need to defend and expand the empire, though it also needs to be remembered that the 1860s were a period in which the franchise was extended to the working class (Checkland 1883, Chapter 8). The interests of the median voter (as shown by the government's preparedness to ¯nance a public education system) may well have led the government to choose a more activist stance. The structural break in the 1960s came at a time when a new government was elected, committed to long-term planning and high levels of public expenditure. This was seen at the time as an attempt to stem the United Kingdom's relative economic decline.

Finally, it should be noted that one drawback the Bai and Perron (1998) techniques used in this paper is the requirement that the sample be trimmed. We have followed the convention of using a trimming factor equal to 0.15. This means that we have had to exclude at least one period where, on a priori grounds, a structural change seems likely to have occurred. This is the period of Margaret Thatcher's time in office, when, if anything, a negative displacement effect is likely to be found. This can be seen in Figure 1 where a flattening of the time profile of government expenditure during the 1980s is apparent.

4 Conclusions

This paper has presented new evidence on the question of whether government expenditure in the United Kingdom accords with the displacement hypothesis. Using long-run data and univariate techniques that are appropriate when the data may be subject to structural breaks, we find four instances in which displacement may be said to have occurred. However, only two of these breaks coincide with the major social upheavals originally identified by Peacock and Wiseman as being the cause of displacement.

Table 1

Perron Unit Root Tests

	IO(1)	IO(2)	AO
	-6.051	-6.029	-4.637
Date	1913	1913	1870

Notes: The 5% critical values are, respectively, -5.70 (IO(1)); -6.21 (IO(2)) and -4.65 (AO). The corresponding 10% critical values are -5.10, -5.55 and -4.38.

Table 2

Multiple Structural Changes

	Mean and Trend Shift	Mean Shift
	® and ± varianble	± ¯xed
UDMax	17.357	14.617
WDMax	21.799	15.018
SupF(0j1)	16.164	14.617
SupF(0j2)	17.357	11.800
SupF(0j3)	15.116	9.916
SupF(0j4)	13.655	8.319
SupF(0j5)	10.632	6.844
# of Breaks (BIC)	4	1
Break Dates	1870	1915
	1915	
	1941	
	1965	

Notes: UDMax and WDMax are tests of the null hypothesis of no structural change against the alternative of some unknown number of break points. The 5% critical values are, respectively, 8.880 and 9.910. SupF(0ji) is a test of the null hypothesis of no structural change against the alternative of i structural changes. The 5% critical values for i = 1, 2, . . . , 5 are respectively, 8.580, 7.220, 5.960, 4.990 and 3.910. # of Breaks (BIC) identi¯es the number of breaks that minmises the value of the Schwarz information criterion.

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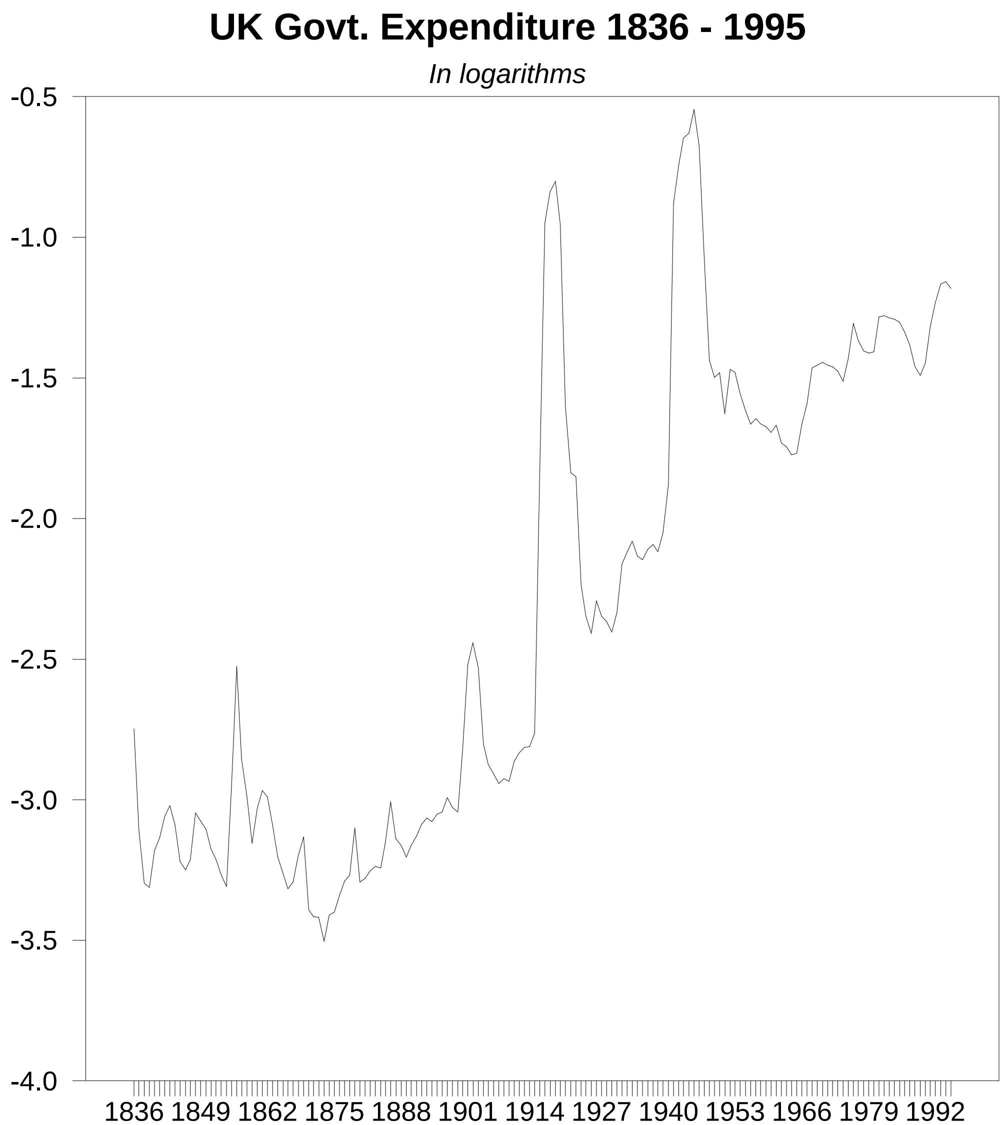
UK Govt. Expenditure 1836 - 1995
In logarithms
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
1836 1849 1862 1875 1888 1901 1914 1927 1940 1953 1966 1979 1992

Figure 1: