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Abstract

We report estimates of the fiscal multiplier for interwar Britain based on quarterly data, time-series econometrics, and 'defense news'. We find that the government expenditure multiplier was in the range 0.3 to 0.8, much lower than previous estimates. The scope for a Keynesian solution to recession was less than is generally supposed.   We find that rearmament gave a smaller boost to real GDP than previously claimed.   Rearmament may, however, have had a larger impact than a temporary public works program of similar magnitude if private investment anticipated the need to add capacity to cope with future defense spending.

Keywords: defense news; multiplier; public works; rearmament

JEL Classification: E62; N14

Introduction

The financial crisis of 2008/9 and the difficulties in escaping from recession since the crisis have re-awakened interest in Keynesian economic policies. This suggests that the time is right for a reappraisal of the British experience in the 1930s. This is a period with considerable relevance for today, in particular because after 1932 nominal interest rates were very low both during an initial phase of fiscal consolidation and a later one of rearmament financed partly by borrowing. More generally, much of the interwar period saw considerable slack in the British economy. The size of the fiscal multiplier in such conditions is of obvious interest to today's policymakers, just as it has been to economic historians working on the macroeconomics of interwar Britain.

The British experience of downturn and recovery is reported in Table 1. A fall in GDP, which was very modest compared with the United States, was followed by a strong recovery in the years after 1933. Before 1935, insofar as this recovery was the result of policy, it had to come from monetary stimulus. Fiscal policy only began to play a role after 1935 when rearmament provided a de-facto Keynesian stimulus.

It has been a widely-held belief among British economic historians that rearmament delivered a powerful stimulus in the late 1930s (Robertson, 1983, p. 280). In taking this position they echo the comment of *The Economist* of 22 April 1939 that "Britain's rearmament programme is the greatest public works programme ever devised in time of formal peace". A paper by Mark Thomas (1983) is the only serious attempt to quantify the impact of rearmament on economic activity. His method was based on an input-output table and a social accounting matrix and he found that the multiplier was 1.64 in 1935 and 1.60 in 1938. This generated an estimate that rearmament produced over a million jobs by

1938 by which time the increase of £204 million in defense expenditure since 1934 would have raised GDP by £326 million or 6.5 per cent. As Roger Middleton has noted in a recent literature survey, Thomas's results have been much cited and provide "a quantitative demonstration that at least military Keynesianism worked" (2011, p. 14).

Thomas's finding that the government-expenditure multiplier was about 1.6 is within the range of 1.25 to 1.75 thought plausible by Timothy Hatton (1987) in an influential review of estimates made in the 1980s which still comprise almost all the literature available today. Even so, this estimate may not be reliable since it assumes away any crowding out and may therefore be too large leading to an exaggeration of the impact of rearmament. Much of the historiography focuses on the possible impact of public expenditure proposals to reduce unemployment made by John Maynard Keynes and Hubert Henderson. These proposals were taken up by the Liberal Party under David Lloyd George at the 1929 general election. T. Thomas (1981) estimated the government-expenditure multiplier to be 0.98 in the short-run and 1.44 in the long-run using a simulation of a Keynesian macro-econometric model. Stephen Broadberry's (1986) estimation of an IS-LM model gave a value of 1.22 for the fiscal multiplier. More recently, Nicholas Dimsdale and Nicholas Horsewood (1995) incorporated aggregate supply with a high degree of nominal inertia as well as aggregate demand into a macro-econometric model for the interwar period. They, conclude that the short run multiplier was about 1.5 and the long run as much as 2.5. All of these authors explicitly or implicitly conclude that the impact of government expenditure on employment would have

been considerably lower than claimed by Keynes and Henderson. Low enough that that Lloyd George 'could not have done it'.[1]

The methods employed in these papers to obtain estimates of the multiplier are open to challenge and are not those which would be used by macroeconomists today. The models they rely upon basically embody Keynesian ideas in their specification with a traditional consumption function and may not adequately reflect crowding out, with the implication that the estimated multipliers are too large. For example, models in either the modern neoclassical or new Keynesian traditions which embody optimizing behavior by forward-looking households typically expect consumer expenditure to fall rather than increase in response to an increase in government expenditure - in other words: the multiplier may be less than 1.[2] If these models of a more recent vintage were applicable to the 1930s, then the strong likelihood is that the conventional wisdom that rearmament had a big impact on GDP would be incorrect. This suggests that a fresh look at the size of the multiplier in 1930s' Britain using modern techniques is desirable.

Given that theoretical predictions are model-dependent it is important to let the data speak and, since the seminal paper by Olivier Blanchard and Roberto Perotti (2002), vector autoregression (VAR) techniques have often been used to estimate multipliers from quarterly macroeconomic time series, although many economists prefer to base their ideas of the value of the multiplier on the results of calibrations of dynamic stochastic general equilibrium (DSGE) models, where an interesting aspect is how far these may vary according

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[1] This is a reference to the title of the pamphlet published by Keynes and Henderson, *Can Lloyd George Do It?* This claimed that a public works program of £100 million for 3 year would reduce unemployment by 500,000, a claim that quantitative economic historians reject.
[2] For a convenient summary of predictions from a variety of macroeconomic models see Hebous (2011).

to the state of the economy.[3] The big problem in estimating multipliers using VARs is the validity of the identification assumptions that are made, in particular whether government expenditure can be treated as exogenous and unanticipated.[4] It is fair to say that the use of these techniques has produced quite a wide range of estimates of the size of the government-expenditure multiplier ($\Delta Y/\Delta G$) for the post-war American economy, with a recent authoritative survey concluding that it probably lies between 0.8 and 1.5.[5]

Building a convincing DSGE model for the interwar British economy would be an ambitious undertaking. However, it is now possible to revisit the question of the size of the fiscal multiplier using time-series econometrics rather than relying on a traditional macroeconomic model, as has been the practise hitherto, thanks to the development of a quarterly series for real GDP for the interwar UK economy by James Mitchell, Solomos Solomou and Martin Weale (2012).[6] This is our focus. In undertaking this task, we make use of Valerie Ramey's approach to resolving the endogeneity of government expenditure using announcements of new expenditures (2011a). She argues for the use of changes in the present value of expected future defense spending and both she and Robert Barro and Charles Redlick (2011) have implemented this approach in recent papers. Their estimates of the multiplier vary a bit according to the sample period used but for the postwar era both papers suggest a range of 0.6 to 0.8. We construct a defense-news variable from contemporary sources and develop a similar analysis to estimate $\Delta Y/\Delta G$ for interwar Britain.

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[3] For a recent example of a DSGE model where the multiplier is much higher when nominal interest rates are at the lower bound because fiscal stimulus lowers real interest rates, see Christiano et al. (2011).

[4] See the discussion in Ramey (2011b).

[5] Ibid., p. 683; i.e., an increase of $100 in government spending raises GDP by between $80 and $150 depending on which estimate one prefers.

[6] These estimates are derived using data on annual GDP, quarterly industrial production and monthly economic indicators published in *The Economist*. An econometric technique is then deployed to obtain monthly GDP from these ingredients. The approach does not provide estimates of the components of national expenditure.

We use the results to provide a reappraisal of the claims in the historiography relating to the possible impact on real GDP both of the hypothetical Lloyd George fiscal stimulus, or 'the Keynesian solution', and of the actual rearmament program.

1. Defense News

The aim of 'Defense News' is to reflect changes to planned government defense expenditure previously unanticipated by the public. More precisely, the aim is to chronicle changes in the information set available to an informed member of the public and calculate their implications for the expected present value of future defense expenditure. This variable can be thought of as capturing exogenous shocks to a key component of government spending.

The series for changes in the expected present value of government expenditure on defense for the United Kingdom in the interwar period has been constructed using a similar method to that employed by Ramey (2009) who mainly used information from *Business Week*.[7] Our key source is *The Economist* magazine, which was published weekly through the interwar period. This source gives details of defense estimates, which were usually published in government papers in February and March each year, but there were sometimes also supplementary estimates. *The Economist* gave a detailed yearly account of actual spending at the time of the annual budget in April. It also published quarterly running totals at the beginning of January, April, July and October each year, and from time to time provided commentary on the prospects for defense spending in editorials and in featured news items.

In order to construct the series for 'Defense News', we examined every issue of *The Economist* from 1919 through 1938 and compiled a complete log of all entries relating to

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[7] The estimates made there are used in Ramey (2011a) for her method of estimating the fiscal multiplier.

defense expenditure. The relevant material includes reports of defense estimates, announcements of policy changes with possible spending implications, special reports such as those on air-force and naval expenditure in February 1936, commentaries on the credibility of government estimates and announcements, and predictions of future developments. Most of these items lend themselves to straightforward quantification. Wherever *The Economist* provides a clear indication as to its expectation of the likely course of future defense expenditure we have accepted that as part of the public's information set. The volume of material varies considerably over the years; for example, there are many entries for the late 1930s but few for the late 1920s. Statistical information obtained from *The Economist* has been cross-checked against the detailed descriptions of British budgets provided by Bernard Mallet and Oswald George (1929, 1933) and by Basil Sabine (1970).

Using the log we made an estimate of the present discounted value of defense expenditure for 1920 quarter1 and then updated it each quarter until 1938 quarter 4. In moving forward through time, for each quarter we compiled a present value figure based on the information set available in the previous quarter and one using the current information. The difference between the two estimates is 'Defense News' for the quarter. Expected values were calculated at 1938 prices for a horizon of five years using a discount rate of 5.1 per cent.[8] Much of the time there was no news, i.e., the information set was the same as in the previous quarter. Estimates of 'Defense News' are reported in Table 2.

We rely on the major historical studies of military policy, such as those of John Ferris (1989) and George Peden (1979), to interpret the commentary of *The Economist*. The former fills

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[8] Figures in current prices have been converted to constant 1938 prices using the monthly retail price index in Capie and Collins (1983, Table 2.13) and the discount rate is 1.25% per quarter. We have experimented with several other values reflecting rates on government bonds in different years and found that the 'Defense News' series and the multiplier estimates are not sensitive to this choice.

in valuable background on the 'Ten-Year Rule' (see below) and the latter reports archival information that bears out some claims relating to rearmament made by *The Economist*. Indeed, the main difficulty in constructing the Defense News series concerns the period after the policy of rearmament was announced in the 1935 Defense White Paper (Cmd. 4827). The White Paper made clear that there would be substantial additional defense expenditure in future but offered no details as to magnitudes or timing.

A full discussion of how the 'Defense News' variable was constructed can be found elsewhere (Crafts, 2012). Here we provide some context and briefly discuss the two episodes which require careful interpretation because government policy was in flux.

The interwar period started with fiscal consolidation following the explosion of the public debt during and immediately after World War I; for defense this meant disarmament. In 1919, the government set out its view that 'normal expenditure' on the fighting forces would be £93.5 million per year (BPP, 1919).[9] The plan was based on the assumption that no expeditionary force would be required for a great war in the next decade: the '10-Year Rule'. The interpretation of this rule was, however, disputed in budget planning discussions, with each service arguing that it had to be ready for a major conflict by 1929 while the Treasury wanted to delay the start of such preparations until 1929 at the earliest. The struggle between the Treasury and the armed forces lasted until 1927, when spending reached a steady-state level of £108 million.[10]

The second phase covers the period from 1927 through 1934. Until 1932, defense policy was quite settled but then the 10-Year Rule was cancelled in March following the invasion of

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[9] All figures for defense spending have been converted to 1938 prices. Fiscal years then, as now, began in April each year.
[10] The dispute between the Treasury and the armed forces over the interpretation of the 10-year rule is reviewed in Ferris (1989).

Manchuria and the attack on Shanghai by Japan. The next 3 years show modest increases in defense expenditure related first to a new naval construction program in 1933 and then to new squadrons for the air force in 1934. Already in 1932, Neville Chamberlain (Chancellor of the Exchequer) was contemplating a rise of defense expenditure of a further 10 per cent by 1935 (Peden, 1979, p. 67). In 1934/35, defense expenditure was £124.7 million.

The third phase was rearmament. The new policy was announced, but with no spending commitments, in the Defense White Paper of March 1935 (BPP, 1935). This statement simply said that additional expenditure on the armaments of the defense services could no longer safely be postponed. In late 1935, the Cabinet agreed a total program of £1075 million over the period 1936-40 (Peden, 1979, p. 77). The pace of rearmament was further intensified when the Defense White Paper of February 1937 (BPP, 1937) stated that it would be imprudent to contemplate total expenditure of less than £1500 million over the next five years, while expenditure over the next two or three years would be greatly increased. This announcement of a greatly enhanced military build-up was accompanied by the Defense Loans Act, which gave specific approval for £400 million of this to be financed by borrowing. Finally, in the run up to and immediate aftermath of the Budget of 1938 it became clear that spending would be ahead even of the 1937 program at least during the two years 1938/9 and 1939/40.

The first period that deserves some comment covers 1920 to 1922. This includes the episode of the Geddes Committee, appointed in August 1921 to advise the government on spending cuts, which published its report in February 1922. The prelude to this committee was a big Supplementary Estimate in December 1920 and then a full year Defense Estimate of £138.7 million in April 1921, which showed that the 'normal year' of £93.5 million would

not be achieved in 1921/22. The Geddes Committee was established with a mandate to propose budget cuts of £100 million at current prices. At the time, *The Economist* predicted that defense would bear the brunt and that the government would shrink from implementing the full amount of the cuts. It turned out that the Geddes proposal of a defense cut of £58.5 million was scaled back to £38 million.

These developments are reflected in the 'Defense News' estimates reported in Table 2. We assume that the extra defense spending announced in early December 1920 is new information for the public in 1920 quarter 4. The Christmas Day issue of *The Economist* in 1920 forecast very accurately the Defense Estimate for 1921/22 so we assume that, in effect, this became known to the public for the first time at the start of 1921 quarter 1. At the same time, given the weak state of public finances with the large public debt overhang from World War I, it was clear that the Treasury could not afford to allow this extra military spending to become permanent, so we assume that the 'normal year' was regarded by the public as postponed but not indefinitely, and we take the subsequent establishment of the Geddes Committee as support for this view.   Given that the outcome of the Geddes Committee deliberations was basically predicted by *The Economist,* we assume that well-informed agents would have received this news at its inception in 1921 quarter 3 rather than 1922 quarter 1.[11] In making these estimates of 'Defense News', we have, of course, made assumptions but have primarily relied on changes in the information available to the public as reflected in spending announcements and commentary on them by *The Economist*.

The second period to be reviewed covers the move to rearmament during the years 1935 to 1937. In the last year before the new policy of rearmament, 1934/5, defense expenditure

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[11] Details of the calculations of changes in the expected present value of defence expenditure are reported in Crafts (2012).

was £124.7 million. Following the publication of the 1935 White Paper, the April 1935 Budget confirmed that defense spending in 1935/6 was expected to be £136 million. However, *The Economist* of 5 October, 1935 reported that spending in quarter 3 had exceeded that of the same period in the previous year by 31 per cent and the outturn for 1935/6 was eventually £148.7 million. During February and March 1936, *The Economist* ran a series of editorials and special reports which suggested that expectations of future defense spending should be greatly increased. The Defense Estimate for 1936/7 was £167.7 million but the 1936 Defense White Paper, published on March 3, indicated that the government had plans of unspecified cost for major re-equipment of all three armed forces, which *The Economist* (March 7 and 14) suggested would imply additional defense expenditure of at least £25 million and possibly £40 million or even £80 million, during 1936/7. On 28 November, 1936, *The Economist* reported on a brokers' circular which predicted that the Defense Estimate for 1937/8 would be £220 million and described this as 'not prima facie unreasonable'. On 20 February, 1937, *The Economist* noted that the Defense White Paper expected defense spending of at least £1500 million over 5 years and on 24 April, 1937 reported that defense spending in 1937/8 was expected to be £278.3 million, of which £80 million would be met by borrowing.

These developments inform the large values for 'Defense News' for 1935_{Q2}, 1936_{Q1} and 1937_{Q1} in Table 2. We assume that by 1935 quarter 2 the public expected a substantial and sustained increase in defense expenditure. Given that *The Economist* of 16 March, 1935 commented that the White Paper implied that in future spending would show a big increase over the estimate for 1935/6, we assume that at this point the actual 1935/6 spending was anticipated and expected to be the normal level in future. We believe that the public's

expectations of future defense expenditure were raised again in the light of the next White Paper and Defense Estimates in March 1936. The Defense Estimate for 1936/37 published in March 1936 was £168 million (compared with £136 million a year earlier) but a big supplementary estimate was generally expected, which would push expected spending to well over £200 million according to *The Economist*. The press was, in effect, largely correctly anticipating what we now know the Cabinet had agreed, namely, a total program of £1075 million over the period 1936-40 (Peden, 1979, p. 77). We assume that at this point the public expected defense expenditure of £212 million per year for the next 5 years. We also assume that the public's expectations were ratcheted up again in early 1937. Specific commitments were made in the Defense White Paper and the Defense Loans Act underpinned the credibility of this announcement. We assume that in 1937 quarter 1 the public expected future expenditure to be £300 million per year through 1942 to match the Defense White Paper plans which *The Economist* of March 20 thought would be carried out.

In Table 2, the observations for 'Defense News' in 1935 through 1937 are abnormally large. We have constructed them on the basis of a careful and thorough reading of *The Economist*.[12] Nevertheless, there must have been considerable uncertainty at the time both about the detail of the government's plans and the extent to which they would be implemented. This could lead to downward-biased estimates of the normal government expenditure multiplier either because the 'Defense News' numbers are outliers or if they are unreliable. Accordingly, in what follows we present results both for a full interwar sample period and also for a period truncated at 1934_{Q4} which omits the potentially problematic years at the end.

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[12] Details of the calculations of the expected value of future defense expenditure can be found in Crafts (2012).

2. Econometric Modeling

The defense news variable that we use in our econometric modeling, *news*, is, following Ramey (2011a), the series given in Table 2 divided by the one-quarter lagged value of real GDP; *news* is shown in Figure 1. We begin by employing an approach similar to that of Barro and Redlick (2011).[13] This has the following general specification:

$$\nabla y_t = \alpha_0 + \sum_{i=0}^{4} \beta_{1i} news_{t-i} + \sum_{i=1}^{4} \beta_{2i} \nabla D_{t-i}/GDP_{t-1-i} + \text{lagged controls} + u_t \qquad (1)$$

D_t is the level of defense spending while $\nabla y_t = \log(GDP_t/GDP_{t-1})$ is quarterly real GDP growth. The sample period runs from the first quarter of 1922 to the end of 1938. Starting in 1922 avoids the immediate aftermath of World War 1, which is known to have produced a shift in the process generating GDP.[14] The lag length was set at 4 to model any seasonality present in the data (seasonally unadjusted data was used throughout). The contemporaneous term of *news* was included but all other variables were lagged to avoid problems of endogeneity. The control variables included were lags of export growth, changes in the money multiplier, consol yields and the tax rate, and the unemployment rate. Growth rates and changes were used to ameliorate problems caused by the non-stationarity of many of the variables when expressed as levels. The error term u_t is specified as the ARCH(1) process $u_t^2 = \delta_0 + \delta_1 u_{t-1}^2$, which effectively models the volatility of GDP growth during 1926 and 1927 and precludes the need for lagged values of GDP growth to be included as regressors: including such lags with u_t assumed to be homoskedastic leads

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[13] These authors employed per cent changes of variables, rather than first differences of logarithms, to model growth rates. Because quarterly data is used here no differences in estimates are found if per cent changes are used.

[14] See, for example, Mills (1991).

to a significant deterioration of fit. Figure 2 clearly shows the volatility of GDP growth in the boom and bust after World War 1 and during 1926 and 1927.[15]

In each case we reports estimates based on a final specification, in which insignificant variables have been deleted (see Table 3). For the estimated coefficients of the included control variables see Table A1 column (1). Throughout we use standard errors robust to possible residual autocorrelation and heteroskedasticity, all included variables are significant and the reported equation passes a variety of standard tests for misspecification. The *news* variable is significantly positive at lags of one and two quarters with coefficients estimated to be, with one-standard error bounds, 0.0325 ± 0.0025 and 0.0179 ± 0.0039.

Barro and Redlick's multiplier definition is based on using annual data with single lags of the regressors. Our quarterly counterpart $m=16\sum_{i=1}^{4}\beta_{1i}+\sum_{i=1}^{4}\beta_{2i}$. Given the estimates in Table 2 the multiplier is $m=0.45\pm0.13$. For the period truncated at 1934Q$_4$, the estimated multiplier is $m=0.81\pm0.37$.

Since the fit of this equation is not particularly good, with an R^2 of just 0.19, we tried moving to a more general model specification. To this end we relate changes in output growth, ∇y_t, again to lags of $news_t$, but now to lags of government spending growth disaggregated into defense and non-defense spending, ∇d_t and $\nabla non-d_t$, and lags of non-government spending (private expenditure on consumption, investment and net exports) growth, ∇n_t, all growth variables again being defined as one-quarter changes in the logarithms:

$$\nabla y_t = \alpha_0 + \sum_{i=1}^{4}\beta_{1i}news_{t-i} + \sum_{i=1}^{4}\beta_{2i}\nabla d_{t-i} + \sum_{i=1}^{4}\beta_{3i}\nabla non-d_{t-i} + \sum_{i=1}^{4}\beta_{4i}\nabla n_{t-i}$$

$$+ \text{lagged controls} + u_t$$

(2)

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[15] 1926 and 1927 were affected by the General Strike and its aftermath.

Table 4 gives reports our estimates based on a final specification, in which insignificant variables have been deleted. For the estimated coefficients of the included control variables see Table A1 column (2) [16] All included variables are highly significant and the reported equation passes a variety of standard tests for misspecification. The *news* variable is again significantly positive at lags of one and two quarters with coefficients estimated to be 0.0154 ± 0.0044 and 0.0380 ± 0.0031. The sum annualized of these coefficients (0.213 ± 0.025), may be regarded as an estimate of the 'direct' multiplier of defense news on GDP[17] The second model offers a superior fit to the Barro and Redlick model, with a much improved R^2 of 0.46 and a regression standard error some 20% lower.

However, there may also be 'indirect' effects because *news* may have influence on other various categories of spending that also matter to GDP growth. Regressions of the form $\nabla z_t = \gamma_0 + \sum_{i=1}^{4} \gamma_i \nabla z_{t-i} + \sum_{i=1}^{4} \theta_i news_{t-i} + v_t$ were therefore estimated for *z respectively defined as* ∇d, $\nabla non-d$ and ∇n, these being reported in Columns (2)-(4) of Table 4. These were then inserted into equation (2) to obtain a set of indirect multipliers and an overall multiplier, defined as the sum of the direct and indirect multipliers: the time path of the direct and the total overall multipliers are shown in Figure 3. The total overall multiplier is

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[16] Because the contemporaneous *news* regressor was found to be insignificant in (1), this was omitted from the specification of (2).

[17] The reasoning behind this statement is as follows. If defense news is denoted *X*, then $news_t = X_t / GDP_{t-1}$ and the long-run relationship between GDP growth and *news* is

$$\nabla y_t = \log(GDP_t / GDP_{t-1}) \approx \nabla GDP_t / GDP_{t-1} = (0.0154 + 0.0380) X_t / GDP_{t-1} = 0.0533 X_t / GDP_{t-1}$$

so that $\nabla GDP = 0.0533 X$ is the long-run relationship.

then 0.34 on an annualized basis. It is effectively reached after three years.[18] For the truncated period ending at 1934Q$_4$ we obtain an annualized total multiplier of 0.76.

Two additional points are worth noting. First, the equation in column (2) shows that defense news does indeed predict subsequent defense expenditure. Second, it should be remembered that ending the sample period at 1934Q$_4$ excludes the defense news data which are subject to relatively large margins of error. This implies that finding a multiplier well below 1 is robust to excluding the largest and least certain values for defense news.

The clear implication is that there was some crowding out of private expenditure even in a 'depressed economy'. This issue can be explored using an approach recently proposed by Ramey (2012). In the current context, Ramey's equation may be specified as

$$\frac{\nabla N_t}{GDP_{t-1}} = \beta_0 + \sum_{i=1}^{4} \beta_{1i} \frac{\nabla N_t}{GDP_{t-1-i}} + \sum_{i=1}^{4} \beta_{2i} \frac{\nabla G_t}{GDP_{t-1-i}} + \sum_{i=1}^{4} \beta_{3i} news_{t-i} + lagged\,controls + error$$

where N_t and G_t are the levels of non-government (private) and government expenditure respectively. This equation was estimated for both sample periods and the results are reported in Table 5. Government expenditure has an overall negative effect on private expenditure, with the total impact estimated to be −0.23 for the full sample and −0.28 for the shorter sample.[19] This confirms that the multiplier, ΔY/ΔG, is < 1 with implied values of 0.77 for the full sample and 0.72 for the shorter sample.

3. The Impact of Rearmament on GDP

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[18] As the analytical form of the total multiplier is a highly non-linear function of the coefficients of the various regressions only asymptotic standard errors can be calculated via the 'delta' method, which may be rather unreliable here. However, we conjecture that it is in the region of that calculated for the Barro-Redlick multiplier, i.e., in the region of 0.1 on an annualized basis.

[19] These total impacts were calculated in the usual fashion as $\sum_{i=1}^{4} \beta_{2i} \Big/ \left(1 - \sum_{i=1}^{4} \beta_{1i} \right)$.

We can use our estimates of the multiplier to examine the impact of rearmament on economic recovery in Britain in the 1930s and compare our findings with those of the best-known paper on this topic by Thomas (1983). The simplest approach is to take the estimates of the government-expenditure multiplier obtained for the period 1922-1934 and apply them to the increase in defense expenditure of £204 million in 1938. Our multiplier estimate of 0.8 gives a rearmament contribution of about £160 million or 3.3 per cent of GDP in 1938. This is half the estimate based on Thomas's method with a multiplier calculated as 1.6.

The idea of 'defense news' is that it contains information relevant to private sector decisions. A credible commitment to *future* defense spending might well stimulate investment by businesses to meet the anticipated demand for military equipment, munitions, etc. Such investment would amount to an element of 'crowding in', and is an example of what the economics literature on the fiscal multiplier what call an anticipation effect.[20]

Some years ago, A.J. Robertson (1983) argued that the main initial effect of rearmament was to encourage growth in the construction industry as armaments manufacturers scrambled to add capacity. Robertson drew attention to the impact of works and buildings expenditures in stimulating economic activity and which sustained a vigorous expansion in construction output even as private house-building stalled. Robertson based this argument on the contribution of William Hornby (1958) to the official UK *History of the Second World War*. Hornby details the build-up of activity to add capacity especially from 1936 onwards.

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[20] Anticipation effects are well documented in studies of the effects of fiscal policy changes, cf., Mertens and Ravn (2012), and are a well-known complication in seeking to estimate multipliers as Ramey (2011b, p. 680) makes clear. In the context of government expenditure, anticipation effects occur when the private sector spends more now not as a result of today's government expenditure but only because future spending is confidently expected. The latter is not part of the conventional multiplier concept.

The push included a notable surge in investment for aircraft production and the formation of three important new armaments manufacturing companies. David Chambers's recent compilation of data on all interwar IPOs shows that 20 of the 27 aircraft manufacturing ventures were launched between $1934Q_3$ and $1936Q_2$, when the increase in actual defense spending was still relatively small.[21]

Robertson' view suggests we can use our defense news methodology, which was really designed to facilitate an estimate of the multiplier, to simulate the impact of rearmament on GDP. In principle, the overall multiplier time path from our preferred specification could be used to compute the estimated monetary impact on GDP of defense-news shocks as in Figure 4, which uses a five-year horizon on the basis of a multiplier of 0.34.[22] The Figure clearly shows the rapid increase in this impact after 1934, driven by the very large defense-news shocks starting in 1935. Table 6 sets out in more detail the simulated impact of defense news on GDP during the recovery period and also reports actual defense expenditure. Based on the total multiplier (including the direct and indirect components) for the full period, this impact averaged 5.1 per cent of GDP in 1938 and amounted to £246.2 million (at 1938 prices) for the four quarters.

One must be careful not to put too much weight on these estimates because the defense news shocks in these years were very large. For example, the defense news shock in $1937Q_1$ is estimated as £393 million on the basis of the Defense White Paper stating that total defense expenditure over the next five years would be at least £1500 million. The 1937 announcement was huge compared with the defense news from 1922 to 1934 and

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[21] See the discussion of the impact of rearmament on IPOs in Chambers (2010); additional data kindly supplied by the author.

[22] These impacts were computed in the following way. If m_i is the ith period overall multiplier, then Figure 3 shows the five-year (20-quarter) impact computed as $\sum_{i=0}^{20} m_i X_{t-i}$

compares with actual defense spending in 1936/7 of about half that amount (£194.6 million). Clearly, an impact of 5.1 per cent of GDP would entail a very substantial boost to investment from the anticipation effect and is perhaps best regarded as an upper bound estimate since the increase in investment in manufacturing sectors relevant to the war effort was £57.9 million (at 1938 prices), only £16.5 million more than in 1934.[23]

Overall rearmament provided a significant stimulus to recovery in the late 1930s. That said, the evidence points to a smaller impact than is found (or implied) by the earlier literature on fiscal multipliers in 1930s' Britain. All this suggests considerable caution before accepting without qualification Thomas's often cited conclusion that "the success of rearmament in creating employment ... leads us to view the eschewment of fiscal policy in the thirties as a missed opportunity" (1983, p. 571). Our results suggest that, if it is believed that rearmament had a substantial impact, this would be on the basis of the implications of massive future spending plans rather than because there was a large fiscal multiplier. The implication is that a conventional temporary program of expenditure on public works of similar magnitude to the actual increase in defense spending between 1934 and 1938 would have had a much smaller impact on GDP than Thomas's model seems to imply.

4. Discussion

Both of our econometric models imply that the government expenditure multiplier in interwar Britain was well below 1. A reasonable conclusion from our estimations is that the government expenditure multiplier was between 0.3 and 0.8. This is much lower than the estimates in the historiography reviewed earlier; these ranged between 1.2 and 2.5. As we noted, however, those multipliers were not obtained using modern methods and are clearly

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[23] Derived from Feinstein (1965) based on his sectors 8.21, 8.22, 8.23, 8.24, 8.25, and 8.41.

questionable. On the other hand, our estimates are quite similar to those found for the United States using a defense-news approach.

There are two reasons as to why the multiplier may have been quite modest even in the 1930s. First, new-Keynesian models predict a large multiplier when interest rates are at the 'zero lower bound.' In these circumstances a deficit-financed increase in government spending leads expectations of inflation to increase and the stimulus comes through a fall in the real interest rate. In 1930s Britain, the decline in real interest rates was far less dramatic than in the post-gold standard United States.[24] Second, the legacy of World War I meant that the ratio of public debt to GDP remained above 140 per cent and peaked at nearly 180 per cent in 1933 (Middleton, 2010). Economists have found that, once the level of government debt is over 100 per cent of GDP, the response of output to government spending shocks is very small even in deep recessions (Auerbach and Gorodnichenko, 2011). A theoretical reason for this result is that expectations of large tax increases are high when the debt to GDP ratio is high (Perotti, 1999). There seems to be stronger modern evidence for consumption reductions stemming from 'Ricardian-equivalence' offsets when the debt to GDP ratio is above 100 per cent (Rohn, 2010).

As Roger Middleton (1985, ch. 8) noted, in the 1930s the balanced-budget orthodoxy was strong and extra government spending that threatened fiscal rectitude led to expectations of proximate tax increases. Any reader of *The Economist's* features on public finances and commentary on taxes required to balance the budget would have been painfully aware of the need to raise tax revenues in these circumstances and there were regular changes in

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[24] According to estimates made by Jagjit Chadha and Nicholas Dimsdale (1999) the ex-post real long rate fell by a little over 3 percentage points between 1934 and 1937, whereas in the United States the fall from 1933 to 1936 was over 11 percentage points.

income tax rates to this end.[25]   Indeed, in the debate on the budget in 1933, the Treasury

publicly maintained that any possible expansionary effects from an unbalanced budget

might be vitiated by expectations of future tax increases and that the strong public

commitment to the balanced budget rule by government ministers meant that any

suggestion of a deficit would lead to expectations of higher taxation.

So some private-expenditure offset to increased defense spending through Ricardian

equivalence would not seem unreasonable, especially in a highly unequal economy where

income-tax paying classes accounted for a large share of consumption.[26] The suggestion that

news of future defense spending might work to reduce consumption through negative

wealth effects is bolstered by Broadberry's (1988) estimates of the aggregate consumption

function. He finds a significant role for wealth effects. One should not however jump to the

other extreme and conclude that the 1930s recovery in Britain was triggered by the

expansionary effects of a fiscal contraction initiated to rescue teetering public finances from

the damage of the world economic crisis.[27]   On the contrary, our estimates point to a

positive fiscal multiplier, albeit smaller than those of other scholars. They do have the nice

property that they echo the views of the British Treasury at the time, namely, that the

multiplier was positive but less than 1 (Middleton, 1985, p. 163).

So where did recovery come from? Insofar as it was stimulated by policy, the initial phase

was based on leaving the gold standard and 'cheap money'. The policy stance was

developed quite fully by late-1932. It entailed low nominal interest rates and a commitment

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[25] Sabine (1970) records that the standard rate of income tax was changed 7 times (6 up, 1 down) in the 1930s. Overall, it rose from 20 per cent at the start to 35 per cent at the end.
[26] The top 20 per cent had 46 per cent of disposable income in 1937 while those paying income tax with incomes above £125 per year accounted for about 2/3 of consumption according to estimates by Barna (1945).
[27] Middleton's (2010) estimates show an increase in the constant-employment budget surplus of about 4 per cent of GDP between 1929/30 and 1933/34.

to raising the price level, underpinned by an exchange-rate target of a 25 per cent nominal devaluation compared with the gold-standard parity, which was enforced through intervention in the foreign exchange market (Howson, 1975, 1980). In terms of the overall expansion of real GDP (25.8 percent between $1932Q_2$ and $1938Q_4$), our estimates indicate a contribution from rearmament of at most 20 per cent, building up mainly after 1935.[28]

The optimism of Keynes and Henderson of the impact of a late-1920s public works program on unemployment has not been shared by quantitative economic historians. They have regarded the claim that a £100 million program for three years would have cut unemployment by 500,000 as implausible. In particular, as Middleton (2010) noted, this is mainly because estimates of the multiplier have been lower than those of early Keynesians like Richard Kahn (1931), whose best guess was 1.88, and Keynes himself (1933), who favored a range of 2 to 3. For example, Thomas (1981), whose estimate of the long-run multiplier was 1.44, concluded that by the third year real GDP would be increased by £120 million and unemployment reduced by 329,000. Dimsdale and Horsewood (1995) did support the idea of a relatively large multiplier but their more detailed treatment of the labor market led them to conclude that even though the Keynes-Henderson stimulus would have raised real GDP by £182-£202 million by year 3, unemployment would have been reduced only by 302,000-333,000. Given that to reduce unemployment to 'normal levels' in 1932 would have entailed cutting it by close to three million, there is a consensus that at that point there was no possibility of a Keynesian solution to unemployment.

Based on an estimate of 0.8 for the government expenditure multiplier, we are considerably more pessimistic about the impact of the Keynes-Henderson program; Lloyd George would

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[28] The increase in real GDP is based on the estimates in Mitchell et al. (2012).

have been hard pressed to cut unemployment by much more than 200,000. So we share the consensus view that it would be unwise to have expected too much from fiscal stimulus in the early 1930s. Moreover, insofar as there were risks that the viability of the cheap money policy could be threatened by announcing a fiscal stimulus which might trigger a rise in risk premia, our results suggest that this gamble was less worth taking than has hitherto been believed.[29]

5. Conclusions

We have developed a new approach to estimating the government expenditure multiplier for interwar Britain using quarterly data, time series econometrics, and defense news announcements. This gives very different results from those found by previous researchers who may not have fully captured the crowding out of private by public expenditure. Our estimates suggest a value in the range 0.3 to 0.8 after three years compared with at least 1.2 in the earlier literature. Evidently, our estimates for the multiplier suggest that there was less scope to use public works to raise GDP and reduce unemployment than has generally been supposed by economic historians and by the early Keynesians. This means that we are in full agreement with earlier writers that 'Lloyd George could not have done it', i.e., that a £100 million pounds program of public works annually for three years would not have reduced unemployment by 500,000 but by 200,000 or less.

Given the circumstances of the early 1930s, we think contemporaries were right to worry that a significant fiscal stimulus would have pushed interest rates up and undermined the cheap money policy which helped to promote recovery in Britain after 1932. If there was

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[29] Middleton (2010, p. 436) sets up the government's policy options in exactly this way.

such a trade-off between using fiscal or monetary policy to stimulate the economy at that time, then our results tilt the balance further towards relying on monetary policy.

Macroeconomists have become more aware that the magnitude of the multiplier may vary according to the state of the economy.[30] In that respect, we conjecture that a small multiplier in interwar Britain may reflect the high ratio of public debt to GDP and the worries of private agents that increased government spending might imply large future taxes given the fragility of public finances.

Nevertheless, we find that rearmament delivered a valuable, if limited, stimulus after 1935. Our estimate is that, in the absence of the rearmament program, real GDP in 1938 would have been, at most, 5 per cent lower. It is important, however, that for such a large impact to play out would require a large private-sector response to news of massive future defense expenditure rather than coming from a big fiscal multiplier. If a similar amount to that disbursed on defense had been spent on a temporary public works program in the mid 1930s, then based on a multiplier of ≤ 0.8 the boost to real GDP would probably have been no more than a little over 3 per cent and the impact on unemployment would have been relatively modest.

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[30] See, for example, Auerbach and Gorodnichenko (2011) and Ilzetzki et al. (2010).

References

Auerbach, Alan J. and Yuriy Gorodnichenko. "Fiscal Multipliers in Recession and Expansion." NBER Working Paper No. 17447, Cambridge, MA, September 2011.

Barna, Tibor. *Redistribution of Incomes through Public Finance in 1937*. Oxford: Clarendon Press, 1945.

Barro, Robert J. and Charles J. Redlick. "Macroeconomic Effects from Government Purchases and Taxes." *Quarterly Journal of Economics* 126, no. 1 (2011): 51-102.

Blanchard, Olivier and Roberto Perotti. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." *Quarterly Journal of Economics* 117, no. 4 (2002): 1329-1368.

Boyer, George R. and Timothy J. Hatton. "New Estimates of British Unemployment, 1870-1913." Journal of Economic History 62, no. 3 (2002): 643-675.

British Parliamentary Papers. *Memorandum by the Chancellor of the Exchequer on the Future Exchequer Balance Sheet*. Cmd. 376, 1919.

British Parliamentary Papers. *General Annual Report on the British Army for the Year Ending 30th September, 1920*. Cmd. 1610, 1922.

British Parliamentary Papers. *General Annual Report on the British Army for the Year Ending 30th September, 1921*. Cmd. 1941, 1923.

British Parliamentary Papers. *Statement Relating to Defence*. Cmd. 4827, 1935.

British Parliamentary Papers. *Statement Relating to Defence*. Cmd. 5374, 1937.

Broadberry, Stephen N. *The British Economy between the Wars: a Macroeconomic Survey*. Oxford: Basil Blackwell Ltd., 1986.

Broadberry, Stephen N. "Perspectives on Consumption in Interwar Britain." *Applied Economics* 20, no. 11 (1988): 1465-1479.

Capie, Forrest H. and Michael Collins. *The Interwar British Economy: a Statistical Abstract*. Manchester: Manchester University Press, 1983.

Capie, Forrest and Webber, Alan. *A Monetary History of the United Kingdom, 1870-1982*, vol. 1. London: George Allen and Unwin, 1985.

Chadha, Jagjit S. and Nicholas H. Dimsdale. "A Long View of Real Rates." *Oxford Review of Economic Policy* 15, no.2 (1999): 17-45.

Chambers, David. "Going Public in Interwar Britain", *Financial History Review* 17, no. 1 (2010): 51-71.

Christiano, Lawrence J., Martin Eichelbaum and Sergio Rebelo. "When is the Government Spending Multiplier Large?" *Journal of Political Economy* 119, no.1 (2011): 78-121.

Crafts, Nicholas.   "UK Defence News, 1920-1938: Estimates based on Contemporary Sources." University of Warwick CAGE Working Paper No. 104, October 2012.

Dimsdale, Nicholas H. and Nicholas Horsewood. "Fiscal Policy and Employment in Interwar Britain: Some Evidence from a New Model." *Oxford Economic Papers* 47, no. 3 (1995): 369-396.

Feinstein, Charles, H. *Domestic Capital Formation in the United Kingdom, 1920-1938*. Cambridge: Cambridge University Press, 1965.

Feinstein, Charles H. *National Income, Expenditure and Output of the United Kingdom, 1855-1965*. Cambridge: Cambridge University Press, 1972.

Ferris, John R. *Men, Money, and Diplomacy: the Evolution of British Strategic Policy, 1919-26*. Ithaca, NY.: Cornell University Press, 1989.

Hatton, Timothy J. "The Outlines of a Keynesian Solution." In *The Road to Full Employment*, edited by Sean Glynn and Alan Booth, 82-94. London: Allen & Unwin, 1987.

Hebous, Shafik.   "The Effects of Discretionary Fiscal Policy on Macroeconomic Aggregates: a Reappraisal." *Journal of Economic Surveys* 25, no. 4 (2011): 674-707.

Hornby, William. *Factories and Plant*. London: HMSO, 1958.

Howson, Susan. *Domestic Monetary Management in Britain, 1919-1938*. Cambridge: Cambridge University Press, 1975.

Howson, Susan. *Sterling's Managed Float: the Operations of the Exchange Equalisation Account, 1932-1939*. Princeton, NJ.: Princeton University Press, 1980.

Ilzetzki, Ethan, Enrique G. Mendoza, and Carlos A. Vegh. "How Big (Small?) are Fiscal Multipliers?" NBER Working Paper No. 16479, Cambridge, MA, October 2010.

Kahn, Richard F. "The Relation of Home Investment to Unemployment." *Economic Journal* 41, no. 2 (1931): 1173-198.

Keynes, J. Maynard. *The Means to Prosperity*. London: Macmillan, 1933.

Keynes, J. Maynard and Hubert D. Henderson. *Can Lloyd George Do It? The Pledge Re-examined*. London: The Nation and Athenaeum, 1929.

Liberal Party. *We Can Conquer Unemployment*. London: Cassell, 1929.

Mallet, Bernard and C. Oswald George. *British Budgets, 1913-14 to 1920-21*. London: Macmillan, 1929.

Mallet, Bernard and C. Oswald George. *British Budgets, 1921-22 to 1932-33*. London: Macmillan, 1933.

Mertens, Karel and Merton O. Ravn. "Empirical Evidence on the Aggregate Effects of Anticipated and Unanticipated US Tax Policy Shocks." *American Economic Journal: Economic Policy* 4, no. 2 (2012): 145-181.

Middleton, Roger. *Towards the Managed Economy*. London: Methuen, 1985.

Middleton, Roger. *Government versus the Market*. Cheltenham: Edward Elgar, 1996.

Middleton, Roger.   "British Monetary and Fiscal Policy in the 1930s." *Oxford Review of Economic Policy* 26, no. 3 (2010): 414-441.

Middleton, Roger. "Macroeconomic Policy in Britain between the Wars." Economic History Review 64, V1 (2011): 1-31.

Mills, Terence C. "Are Fluctuations in UK Output Permanent or Transitory." *Manchester School* 59, no.1 (1991): 1-11.

Mitchell, James, Solomos Solomou, and Martin Weale. "Monthly GDP Estimates for Inter-War Britain." *Explorations in Economic History* 49, no. 4 (2012): 543-556.

Peden, George C. *British Rearmament and the Treasury: 1932-1939*. Edinburgh: Scottish Academic Press, 1979.

Perotti, Roberto. "Fiscal Policy in Good Times and Bad." *Quarterly Journal of Economics* 111, no. 4 (1999): 1399-1446.

Ramey, Valerie A. "Defense News Shocks, 1939-2008: an Analysis Based on News Sources," 2009.http://econ.usd.edu/˜vramey/research/Defense_News_Narrative.pdf

Ramey, Valerie A.   "Identifying Government Spending Shocks: It's all in the Timing." *Quarterly Journal of Economics* 126, no. 1 (2011): 1-50.

Ramey, Valerie A. "Can Government Purchases Stimulate the Economy?" *Journal of Economic Literature* 49, no. 3 (2011): 673-685.

Ramey, Valerie A. "Government Spending and Private Activity." NBER Working Paper No. 17787, Cambridge, MA, January 2012.

Robertson, A.J. "British Rearmament and Industrial Growth, 1935-1939." *Research in Economic History* 8 (1983): 279-298.

Rohn, Oliver. "New Evidence on the Private Saving Offset and Ricardian Equivalence." OECD Economics Department Working Paper No. 762, Paris, May 2010.

Sabine, Basil E.V. *British Budgets in Peace and War, 1932-1945*. London: George Allen and Unwin, 1970.

Thomas, Mark. "Rearmament and Economic Recovery in the late 1930s." *Economic History Review* 36, no. 4 (1983): 552-579.

Thomas, T.J. "Aggregate Demand in the United Kingdom, 1918-1945." In *The Economic History of Britain since 1700*, vol. 2, edited by Roderick Floud and Donald McCloskey, 332-346. Cambridge: Cambridge University Press 1981.

Table 1. Real GDP, Annual Growth Rates and Unemployment in the United Kingdom, 1929-1938.

	GDP (£mn. 1938 prices)	Real GDP (1929 = 100)	% change in GDP since last year	Unemployment Rate (%)
1929	4216	100	+2.4	8.0
1930	4210	99.9	-0.1	12.3
1931	3980	94.4	-5.5	16.4
1932	4008	95.1	+0.7	17.0
1933	4046	96.0	+0.9	15.4
1934	4334	102.8	+7.1	12.9
1935	4496	106.6	+3.7	12.0
1936	4633	109.9	+3.1	10.2
1937	4834	114.6	+4.3	8.5
1938	4985	118.2	+3.1	10.1

Sources:

Real GDP at factor cost: Feinstein (1972,Table 5).

Unemployment: Boyer and Hatton (2002).

Table 2. Defense News: Estimates of Changes in Net Present Value of Expected Defense Expenditure (£ million, 1938 prices).

1920_{Q1}		1927_{Q1}		1934_{Q1}	
1920_{Q2}		1927_{Q2}	+2.2	1934_{Q2}	
1920_{Q3}		1927_{Q3}		1934_{Q3}	+44.3
1920_{Q4}	+36.0	1927_{Q4}		1934_{Q4}	
1921_{Q1}	+112.4	1928_{Q1}		1935_{Q1}	
1921_{Q2}		1928_{Q2}		1935_{Q2}	+178.2
1921_{Q3}	-36.7	1928_{Q3}		1935_{Q3}	
1921_{Q4}		1928_{Q4}		1935_{Q4}	
1922_{Q1}		1929_{Q1}		1936_{Q1}	+160.0
1922_{Q2}		1929_{Q2}		1936_{Q2}	
1922_{Q3}		1929_{Q3}		1936_{Q3}	
1922_{Q4}	-10.9	1929_{Q4}		1936_{Q4}	
1923_{Q1}		1930_{Q1}		1937_{Q1}	+393.0
1923_{Q2}	+72.4	1930_{Q2}		1937_{Q2}	
1923_{Q3}		1930_{Q3}		1937_{Q3}	
1923_{Q4}	-0.9	1930_{Q4}		1937_{Q4}	
1924_{Q1}		1931_{Q1}		1938_{Q1}	
1924_{Q2}	-22.1	1931_{Q2}	+7.0	1938_{Q2}	+98.8
1924_{Q3}		1931_{Q3}		1938_{Q3}	+29.1
1924_{Q4}		1931_{Q4}		1938_{Q4}	
1925_{Q1}		1932_{Q1}			
1925_{Q2}		1932_{Q2}	+52.0		
1925_{Q3}		1932_{Q3}			
1925_{Q4}		1932_{Q4}			
1926_{Q1}		1933_{Q1}			
1926_{Q2}	+0.9	1933_{Q2}			
1926_{Q3}		1933_{Q3}			
1926_{Q4}		1933_{Q4}			

Source: own calculations, see text.

Table 3. Barro and Redlick Specification Estimates

	1922Q$_1$ to 1938Q$_4$	1922Q$_1$ to 1934Q$_4$
	(1)	(2)
	∇y_t	∇y_t
constant	−0.0062 [4.2]	−0.0086 [4.2]
$news_{t-1}$	0.0325 [10.7]	−0.0248 [1.4]
$news_{t-2}$	0.0179 [4.6]	0.1246 [3.9]
$\nabla D_{t-2}/GDP_{t-3}$	−0.1076 [3.0]	−0.1354 [3.5]
$\nabla D_{t-3}/GDP_{t-4}$	−0.2544 [5.7]	−0.4297 [5.8]
$\nabla D_{t-3}/GDP_{t-4}$	–	−0.2221 [4.7]
R^2	0.19	0.12
SE	0.0168	0.0208

Note: Figures in parentheses are robust t-ratios. *SE* is the regression standard error. The estimates for the ARCH(1) error specification for the equation in column (1) are $\hat{\delta}_0 = 9.31 \times 10^{-9}$[297.5] and $\hat{\delta}_1 = 1.7016$[4.2] and are $\hat{\delta}_0 = 5.98 \times 10^{-9}$[241.0] and $\hat{\delta}_1 = 2.0891$[3.7] for the equation in column (2).

Table 4. Regression Estimates: Preferred Specification

(a) Sample period: 1922$_{Q1}$ to 1938$_{Q4}$

	(1) ∇y_t	(2) ∇d_t	(3) $\nabla non{-}d_t$	(4) ∇n_t
constant	0.0025 [2.6]	–	–	0.0127 [2.3]
$news_{t-1}$	0.0154 [3.5]	–	–	–
$news_{t-2}$	0.0380 [12.2]	–	–	–
$news_{t-3}$	–	0.9524 [3.4]	–	–
$news_{t-4}$	–	1.4360 [5.3]	0.3414 [1.4]	−0.2016 [2.0]
∇d_{t-1}	–	−0.8194 [9.3]	–	–
∇d_{t-2}	–	−0.5053 [5.0]	–	–
∇d_{t-3}	−0.0086 [2.7]	−0.2587 [2.7]	–	–
∇d_{t-4}	0.0062 [2.5]	0.2806 [3.3]	–	–
$\nabla non{-}d_{t-1}$	0.0095 [6.0]	–	−0.3989 [4.0]	–
$\nabla non{-}d_{t-2}$	−0.0208 [8.6]	–	−0.2899 [2.8]	–
$\nabla non{-}d_{t-3}$	−0.0166 [5.0]	–	−0.2672 [2.6]	–
$\nabla non{-}d_{t-4}$	–	–	0.5353 [5.7]	–
∇n_{t-1}	−0.1376 [14.0]	—	–	−0.5373 [4.6]
∇n_{t-2}	–	–	–	−0.2426 [2.2]
∇n_{t-3}	−0.1190 [11.4]	–	–	–
∇n_{t-4}	−0.0417 [6.1]	–	–	–
R^2	0.46	0.78	0.86	0.28
SE	0.0143	0.1128	0.1056	0.0423

Note: . Figures in parentheses are robust t-ratios. *SE* is the regression standard error. The estimates for the ARCH(1) error specification for the equation in column (1) are $\hat{\delta}_0 = 2.37 \times 10^{-7}$ [322.0] and $\hat{\delta}_1 = 1.5905$ [5.6].

Sample period: 1922_{Q1} to 1934_{Q4}

	(1) ∇y_t	(2) ∇d_t	(3) $\nabla non{-}d_t$	(4) ∇n_t
constant	0.0077 [5.7]	–	–	0.0112 [1.6]
$news_{t-1}$	–0.0198 [1.6]	–	–	–
$news_{t-2}$	0.0833 [4.3]	–	–	–
$news_{t-3}$	–	3.3568 [3.5]	–	–
$news_{t-4}$	–	2.3323 [3.5]	1.5458 [2.2]	–0.4718 [1.5]
∇d_{t-1}	–	–0.8235 [7.8]	–	
∇d_{t-2}	–	–0.5645 [4.2]	–	
∇d_{t-3}	–0.0047 [1.8]	–0.3403 [2.7]	–	
∇d_{t-4}	0.0108 [5.1]	0.2045 [2.1]	–	
$\nabla non{-}d_{t-1}$	0.0138 [15.2]	–	–0.4437 [3.9]	
$\nabla non{-}d_{t-2}$	–0.0264 [9.1]	–	–0.3048 [2.6]	
$\nabla non{-}d_{t-3}$	–0.0310 [8.0]	–	–0.2682 [2.3]	
$\nabla non{-}d_{t-4}$	–	–	0.5021 [4.8]	
∇n_{t-1}	–	–	–	–0.3682 [3.1]
∇n_{t-2}	–0.1739 [12.1]	–	–	–0.2145 [1.7]
∇n_{t-3}	–0.1945 [21.7]	–	–	–
∇n_{t-4}	–0.0282 [5.0]	–	–	–
R^2	0.45	0.83	0.86	0.21
SE	0.0172	0.1043	0.1156	0.0507

Note: Figures in parentheses are robust t-ratios. *SE* is the regression standard error. The estimates for the ARCH(1) error specification for the equation in column (1) are $\hat{\delta}_0 = 1.61 \times 10^{-8}$ [244.9] and $\hat{\delta}_1 = 1.9243$ [2.7].

Table 5. Estimating the Effect of Government Expenditure on Private-Sector Spending

	1922_{Q1} to 1938_{Q4} $\nabla N_t/GDP_{t-1}$	1922_{Q1} to 1934_{Q4} $\nabla N_t/GDP_{t-1}$
constant	0.0265 [3.6]	0.0266 [3.1]
$\nabla N_{t-1}/GDP_{t-2}$	0.2753 [3.5]	0.3342 [2.3]
$\nabla N_{t-2}/GDP_{t-3}$	−0.9327 [8.2]	−1.0242 [8.6]
$\nabla N_{t-3}/GDP_{t-4}$	−0.1826 [2.6]	−0.1144 [1.2]
$\nabla N_{t-4}/GDP_{t-5}$	−0.1767 [2.5]	−0.1928 [2.2]
$\nabla G_{t-1}/GDP_{t-2}$	0.9017 [6.2]	0.9066 [4.9]
$\nabla G_{t-2}/GDP_{t-3}$	−0.8394 [4.7]	−0.9516 [4.7]
$\nabla G_{t-3}/GDP_{t-4}$	−0.1494 [1.2]	−0.1252 [0.8]
$\nabla G_{t-4}/GDP_{t-5}$	−0.3739 [3.3]	−0.3974 [3.0]
$news_{t-3}$	−0.0435 [3.5]	−0.1296 [1.5]
$news_{t-4}$	−0.0692 [3.8]	0.1286 [1.2]
R^2	0.95	0.95
SE	0.0115	0.0121

Note: Figures in parentheses are robust t-ratios. *SE* is the regression standard error.

Table 6. Simulated Impact of Defense News Shocks on Real GDP (£million, 1938 prices)

	GDP Impact from Defense News	*Impact as % Real GDP*	*Defense Expenditure*
1932_{Q1}	0.56	0.06	27.92
1932_{Q2}	0.37	0.04	28.38
1932_{Q3}	1.19	0.12	28.03
1932_{Q4}	3.30	0.33	26.89
1933_{Q1}	3.38	0.34	30.34
1933_{Q2}	3.41	0.34	28.43
1933_{Q3}	3.56	0.35	28.22
1933_{Q4}	4.49	0.43	27.81
1934_{Q1}	5.08	0.48	34.76
1934_{Q2}	5.34	0.50	28.35
1934_{Q3}	5.17	0.48	29.59
1934_{Q4}	5.64	0.52	31.33
1935_{Q1}	7.37	0.68	36.25
1935_{Q2}	7.54	0.68	30.49
1935_{Q3}	10.24	0.91	32.91
1935_{Q4}	17.03	1.50	39.50
1936_{Q1}	17.85	1.56	44.78
1936_{Q2}	20.29	1.74	40.27
1936_{Q3}	27.18	2.30	43.69
1936_{Q4}	30.25	2.56	49.48
1937_{Q1}	32.06	2.69	61.14
1937_{Q2}	35.05	2.90	47.13
1937_{Q3}	52.50	4.31	58.35
1937_{Q4}	53.61	4.40	66.61
1938_{Q1}	54.40	4.46	89.45
1938_{Q2}	55.71	4.59	65.43
1938_{Q3}	63.86	5.26	92.52
1938_{Q4}	72.22	5.91	80.18

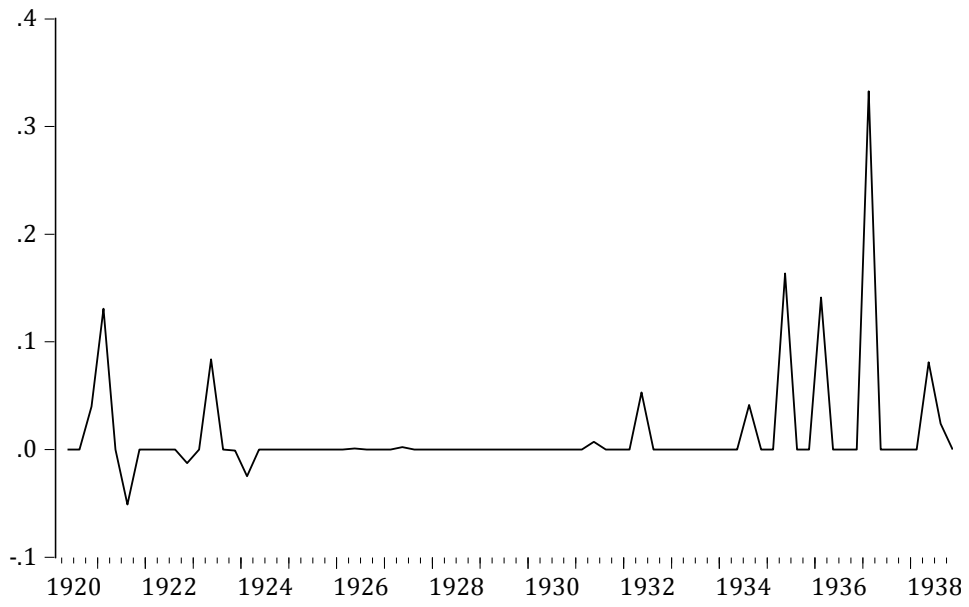*Sources*: own calculations, see text, and data appendix for GDP and defense expenditure

Figure 1   Defense news divided by lagged real GDP: 1920_{Q2}-$1938_{Q\$}$.
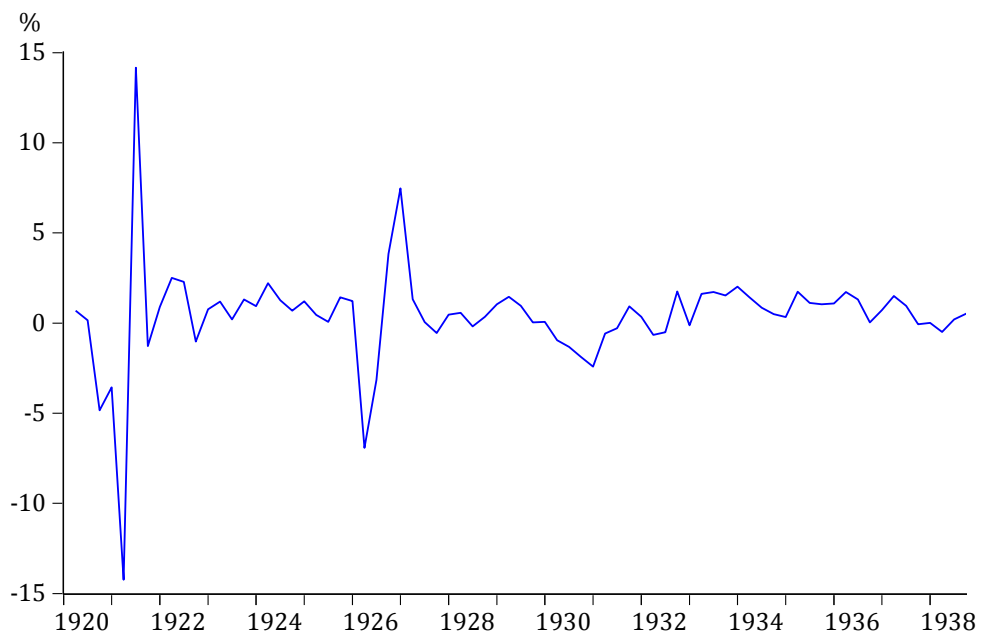
Figure 2   Quarterly growth of real GDP: 1920_{Q2}-1938_{Q}$.

.10

.08

.06

.04

.02

.00

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
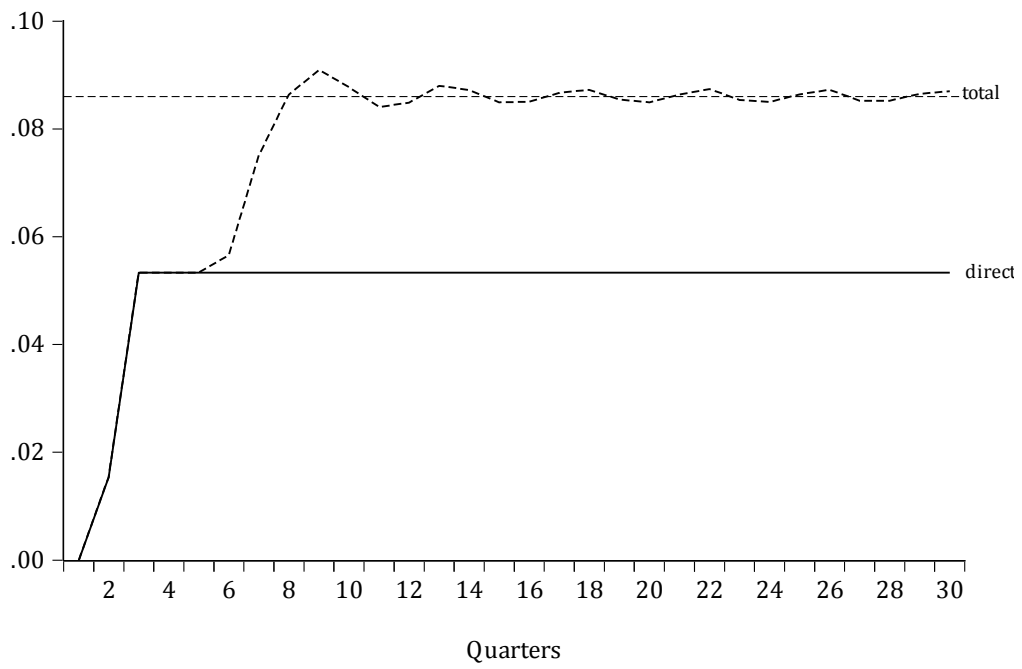
total

direct

Quarters

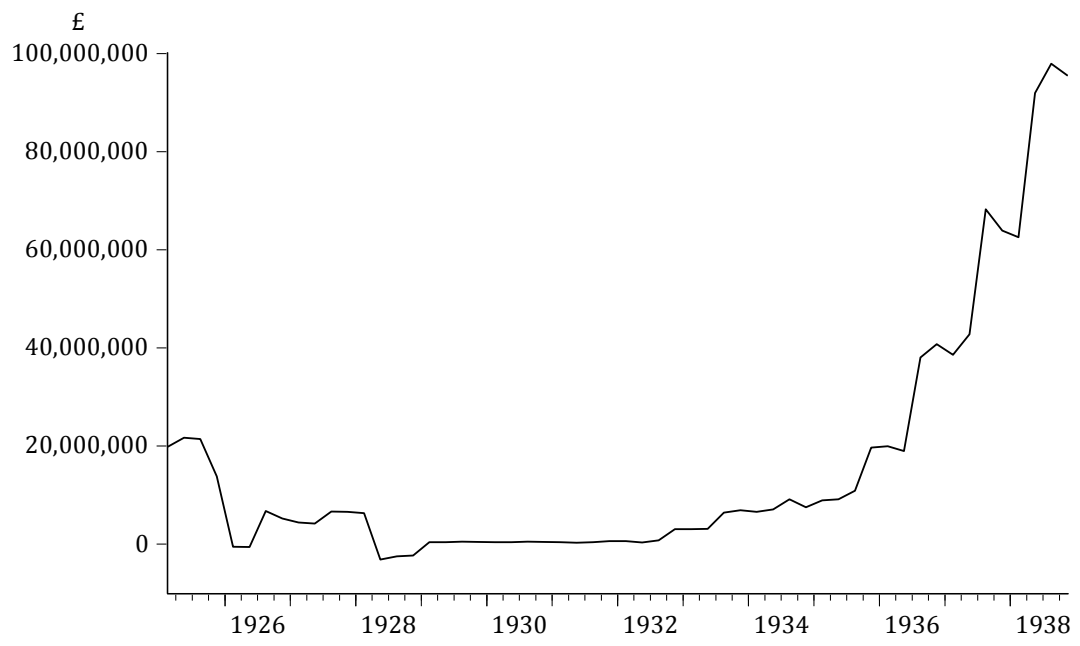Figure 3   Defense news multipliers.

Figure 4   Simulated effect of defense news shocks on GDP using a five-year horizon.

Appendix

We report in this appendix the data sources that we used for the econometric analysis together with the estimated coefficients on the control variables for equations (1) and (2).

Data

The data sources for the variables used in the regressions are as follows:

Real GDP at 1938 prices: Mitchell et al. (2012, Table 2b).

Government expenditure on goods and services and on defense: as reported in *The Economist* on a quarterly basis at current prices in the first issue of January, April, July and October each year, converted into 1938 prices using the retail price index from Capie and Collins (1983, Table 2.14). Before 1921_{Q2}, defense expenditure was inferred using the annual total reported in Feinstein (1972, Table 33) allocated to quarters based on army numbers taken from BPP (1922, 1923) for years ending 30 September 1920 and 1921.

Defense News: derived as explained in Crafts (2012).

Exports: Capie and Collins (1983, Table 5.8) converted into 1938 prices.

Tax Rate: total tax revenues/GDP from Middleton, *Government versus the Market*, Tables AI.1 and AI.2

Unemployment: Capie and Collins (1983, Table 4.5).

Money Multiplier: M1/monetary base from Capie and Webber (1985, Table I.2). Before 1922_{Q1} M1 was estimated as M3/1.33 from Howson (1975, Appendix 1, Table 1).

Yield on Consols: Capie and Webber (1985,Table III.10).

Table A1. Control Variable Estimates from Equations (1) and (2).

(a) Sample: 1922_{Q1} to 1938_{Q4}

	(1)	(2)
∇ex_{t-2}	0.0468 [5.9]	0.0530 [8.9]
∇ex_{t-3}	0.0253 [5.9]	–
∇ex_{t-4}	−0.0167 [4.9]	–
∇mm_{t-3}	0.0398 [6.7]	0.0412 [8.5]
∇mm_{t-4}	0.0818 [21.8]	0.0548 [9.6]
∇tax_{t-1}	−0.0112 [18.4]	−0.0088 [13.2]
∇R_{t-1}	−0.0079 [4.6]	−0.0155 [11.3]
un_{t-1}	–	−0.0039 [15.8]
un_{t-2}	0.0014 [4.9]	0.0041 [17.1]
un_{t-3}	−0.0008 [2.7]	–

(b) Sample: 1922_{Q1} to 1934_{Q4}

	(1)	(2)
∇ex_{t-2}	0.0442 [7.9]	0.0834 [25.5]
∇ex_{t-3}	0.0234 [4.0]	–
∇ex_{t-4}	−0.0059 [1.4]	–
∇mm_{t-3}	0.0332 [4.9]	0.0240 [5.2]
∇mm_{t-4}	0.0792 [8.1]	0.0274 [4.7]
∇tax_{t-1}	−0.0046 [8.3]	−0.0064 [15.4]
∇R_{t-1}	−0.0011 [0.5]	−0.0167 [17.1]
un_{t-1}	–	−0.0048 [16.3]
un_{t-2}	0.0001 [0.4]	0.0048 [14.3]
un_{t-3}	0.0006 [2.2]	–

Note: ∇ex_t is export growth, ∇mm_t is the change in the money multiplier, ∇tax_t is the change in the tax rate, ∇R_t is the change in the consol yield, and un_t is the unemployment rate. Figures in parentheses are robust t-ratios.