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Rearmament to the Rescue? New Estimates of the Impact of 'Keynesian' Policies in 1930s' Britain

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Rearmament to the Rescue?
New Estimates of the Impact of 'Keynesian' Policies in 1930s' Britain

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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 0.5 to 0.8, much lower than previous estimates. The scope for a Keynesian solution to recession was much lower than is generally supposed. We do find that rearmament gave a substantial boost to real GDP after 1935 but this was because the private sector responded to news of massive future defense spending and does not imply that the multiplier effect of temporary public works programs would have been large.

Keywords: defense news; multiplier; public works; rearmament

JEL Classification: E62; N14

1. 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 from 1932 onwards it was an era of very low nominal interest rates, during which an initial phase of fiscal consolidation was superseded by rearmament financed partly by borrowing. 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 existing literature on this issue dates mainly from the 1980s. Much of the historiography focuses on the issue of the possible impact of public expenditure proposals made by Maynard Keynes and Hubert Henderson with a view to reducing unemployment, which were taken up by the Liberal Party under David Lloyd George at the 1929 general election.[1] Estimates of the government-expenditure multiplier of 0.98 in the short-run and 1.44 in the long-run were obtained by T. Thomas based on a simulation of a Keynesian macro-econometric model, and Stephen Broadberry's estimation of an IS-LM model gave a value of 1.22 for the fiscal multiplier.[2] Mark Thomas looked at the impact of rearmament using an approach based on an input-output table and a social accounting matrix which assumes no crowding out and concluded that the government expenditure multiplier was 1.64 in 1935 and 1.60 in 1938.[3] Timothy Hatton surveyed this literature and based his analysis of the Keynes-Henderson proposals on a range of values between 1.25 and 1.75 for the multiplier.[4] A later contribution by Nicholas Dimsdale and Nicholas Horsewood, which incorporated aggregate supply with a high degree of nominal inertia as well as aggregate demand into a macro-econometric model for the interwar period, concludes that the short run multiplier was about 1.5 and the long run as much as 2.5.[5] All of these authors explicitly or implicitly conclude that Lloyd George could not have done it, i.e., that the impact of government expenditure on employment would have been considerably lower than claimed by Keynes and Henderson. On the other hand, Mark Thomas argued that additional defence expenditures produced over a million jobs in 1938 compared with 1935.[6]

For all these papers a key issue is the size of the fiscal multiplier. Yet the methods they employed 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 neoclassical or new Keynesian traditions which embody optimizing behaviour by forward-looking

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[1] Keynes and Henderson, *Can Lloyd George Do It?*; Liberal Party, *We Can Conquer Unemployment.* The Liberal Party did not win the election and the proposals were not implemented.
[2] Thomas, "Aggregate Demand"; Broadberry, *British Economy between the Wars.*
[3] Thomas, "Rearmament".
[4] Hatton, "Outlines of a Keynesian Solution".
[5] Dimsdale and Horsewood, "Fiscal Policy".
[6] Thomas, "Rearmament".

households typically expect consumer expenditure to fall rather than increase in response to an increase in government expenditure and envisage that the multiplier may be less than 1.[7]

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, 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 to the state of the economy.[8] 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.[9] 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 for the post-war American economy, with a recent authoritative survey concluding that it probably lies between 0.8 and 1.5.[10]

Seeking to build 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.[11] This is the focal point of the present paper. In undertaking this task, we make use of a new idea proposed by Valerie Ramey to address the potential endogeneity of government expenditure.[12] 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 have implemented this approach to estimating the government-expenditure multiplier in recent papers.[13] Their estimates 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 for interwar Britain. 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.

2. Defense News

The aim of 'Defense News' is to reflect changes to planned government defense expenditure previously unanticipated by the public. 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

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[7] For a convenient summary of predictions from a variety of macroeconomic models see Hebous, "The Effects of Discretionary Fiscal Policy".

[8] Blanchard and Perotti, "Empirical Characterization". 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., "When is the Government".

[9] See the discussion in Ramey, "Can Government Purchases".

[10] Ibid., p. 683.

[11] Mitchell et al., "Monthly GDP Estimates".

[12] Ramey, "Identifying Government Spending Shocks".

[13] Ibid., Barro and Redlick, "Macroeconomic Effects".

been constructed using a similar method to that employed by Ramey.[14] The key place from which information was taken 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 and published quarterly running totals at the beginning of January, April, July and October each year, and it also regularly commented on the prospects for defense spending in editorials and in featured news items.

The statistical information obtained from *The Economist* has been cross-checked against the detailed descriptions of British budgets provided by Bernard Mallet and Oswald George and by Basil Sabine.[15] Interpretation of the commentary of *The Economist* has been facilitated by the accounts in the major historical studies of military policy such as those of John Ferris and George Peden.[16] The general pattern of the news is quite clear but, of course, there is a margin of error in the details. At times, there was considerable uncertainty, not simply for agents in the private sector but also among policymakers, as to what would happen both with regard to magnitudes and timing, especially in the early 1920s and the late 1930s, and judgment calls are unavoidable. Expected values have been calculated at 1938 prices for a horizon of five years using a discount rate of 5.1 per cent.[17]

Estimates of 'Defense News' are reported in Table 1. A full discussion of how the 'defense news' variable was constructed can be found elsewhere.[18] Here we provide the context, comment on the main developments, and describe an example of a key episode to give an idea of how the approach was implemented.

The interwar period started with disarmament in the context of fiscal consolidation to address issues of fiscal sustainability following the explosion of the public debt during and immediately after World War I. In 1919, the government set out its view that 'normal expenditure' on the fighting forces would be £93.5 million per year.[19] This was on the basis of the '10-Year Rule' that no expeditionary force would be required for a great war in that time. The interpretation of this rule was, however, disputed in the context of budget planning, with one interpretation being that each service had to be ready for a major conflict by 1929 or, alternatively, that preparations could not begin 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.[20]

During this first phase, the main news was as follows. In the spring of 1920, the defence estimates seem to be on track to reach the stated normal peacetime figure of £93.5 million by fiscal year

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[14] Ramey, "Defense News Shocks". The estimates made there are used in Ramey, "Identifying Government Spending Shocks" as a key ingredient for her method of estimating the fiscal multiplier.

[15] Mallet and George, *British Budgets, 1913-14 to 1920-21* and *British Budgets, 1921-22 to 1932-33*; Sabine, *British Budgets*.

[16] Ferris*, Men, Money, and Diplomacy*; Peden, *British Rearmament*.

[17] Figures in current prices have been converted to constant 1938 prices using the monthly retail price index in Capie and Collins, *The Interwar British Economy*, Table 2.13 and the discount rate is 1.25% per quarter.

[18] Crafts, "UK Defence News".

[19] British Parliamentary Papers, Cmd. 376. All figures for defence spending have been converted to 1938 prices. Fiscal years then, as now, began in April each year.

[20] The dispute between the Treasury and the armed forces over the interpretation of the 10-year rule is reviewed in Ferris, *Men, Money, and Diplomacy*.

1921/22 but in 1920_{Q4} a supplementary estimate was announced. In February 1921, *The Economist* forecast that for next year defence spending, in real terms, would remain at the level of the second half of 1920/1 but it expressed scepticism that the government had the will to reduce rapidly defence spending in the face of resistance by the military. The April budget confirmed these predictions for fiscal year 1921/2. The defence news shock in 1921_{Q1} is based on the assumption that further cuts would be postponed until 1922/3 and would be implemented slowly thereafter, reaching the £93.5 million target only at the end of fiscal year 1925/6. However, in August 1921, the Lloyd George government appointed the independent Geddes Committee with a mandate to find £100 million, at current prices, in budget cuts. *The Economist* immediately predicted both that the vast majority would fall on defence and that the politicians would not go through with the full £100 million (as happened when the Committee reported six months later). The defence news shock in 1921_{Q3} assumes that the post-Geddes settlement is predicted at that point with the steady-state of £93.5 million now expected for 1924/5. The positive defence news shock of 1923_{Q2} reflects the new defence estimates, which were seen to reflect a slowing of the cutbacks as new equipment programmes were approved by the new Baldwin government for the Air Force and the Navy, which had successfully argued for speeding up preparations for the next major conflict. Two years later, the defence estimates appeared to have abandoned any intention to cut further and a new investment programme for cruisers for the Navy was expected.

The second phase covers the period through 1934. Until 1932 there is little to report, but then the 10-Year Rule was cancelled in March following the invasion of Manchuria and the attack on Shanghai by Japan. The defence estimates for 1932/33 were £115 million and new naval construction is on the agenda, while Neville Chamberlain (Chancellor of the Exchequer) was contemplating a rise of defence expenditure of a further 10 per cent by 1935.[21] In 1933_{Q2} the defence estimates further increased in the context of a new naval construction programme and *The Economist* regretted the 'retrograde tendency' that it detected towards an increase in defence expenditure. By 1934, there were the first signs of fears about Germany and in 1934_{Q2} the cabinet announced new squadrons for the Air Force with a 5-year programme of spending on new aircraft. So, the end of this second phase saw the still modest beginnings of a new military build-up. The positive defence news shock of 1932_{Q2} assumes that Chamberlain's expectation was shared by the public.

The third phase was one of vigorous rearmament with Britain moving to a quasi-war footing from 1937 onwards. The new policy was announced, but with no spending commitments, in the Defence White Paper of March 1935.[22] This statement simply said that additional expenditure on the armaments of the defence services could no longer safely be postponed. The quarterly spending numbers did not reflect this until 1935_{Q3} when spending surged to be 31 per cent above the level of a year earlier, as reported in *The Economist* of October 5, 1935.

This is a good opportunity to consider an example with regard to the news of an increase of £178.2 million (1938 prices) reported for 1935_{Q2} in Table 1 using text from the working paper, as follows:[23]

" **March 16, 1935**: *The Economist* reviews the future of defence spending in a lead editorial following Defence Estimates and a Defence White Paper of March 11, 1935 (Cmd. 4827). This paper has

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[21] Peden, *British Rearmament*, p. 67.
[22] British Parliamentary Papers, Cmd. 4827.
[23] Crafts, "UK Defence News".

announced a new policy of rearmament but with no spending commitments. It simply said that additional expenditure on the armaments of the defence services could no longer safely be postponed. *The Economist* thinks that this will entail a change of gear such that 'it is certain that the Defence Vote will show a further big increase next year'.

April 13, 1935: The budget plans envisage total estimated expenditure on defence of £124.2 million, equivalent to £136 million at 1938 prices, as noted already. The outturn is £136.9 million as spending jumps in 1935_{Q3}.

It seems to be rearmament ... but it is unclear as to how much and how soon? It is difficult to believe that anyone could at this stage be sure of the massive additional defence spending that would occur by 1938 but, equally, everyone should be expecting a considerable increase during the next fiscal year that will be sustained rather than transitory. David Chambers underlined the importance of rearmament for IPOs in aircraft manufacturing at this time.[24] On previous assumptions, in 1935_{Q2} the projection was a constant expenditure of £34.0 million at 1938 prices with an NPV of 606.2. By 1935_{Q3} defence spending at current prices is running at an annual rate of about 30% higher than a year ago (and this carries on to the end of the fiscal year). It is apparent that rearmament will be a lengthy process – say, at least 5 years. In the light of *The Economist's* commentary it does not seem excessive to suppose that agents expect the 1935/6 increase at this point and believe it will be maintained for the forecast horizon even though actual spending does not yet reflect the new policy stance. So, the expected sequence of defence expenditure at 1938 prices in **1935_{Q2}** is taken to be £44.0 million each quarter over the horizon with an **NPV = 784.4 so the news is +178.2**."[25]

This example reflects a judgment call in putting precise numbers on defense spending plans, but there is no doubt that large future increases were anticipated even though nothing had happened yet. Failing to recognize this could undermine traditional methods of inferring the value of the fiscal multiplier.

The defence 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 programme of £1075 million over the period 1936-40.[26] It is clear that by 1936_{Q1} expectations about defence spending were vastly different from a year earlier and this is reflected in a second large positive shock. The ante was upped considerably a year later as Table 1 reports the biggest single shock. The event was a new Defence White Paper in February 1937, which 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.[27] This was accompanied by the Defence Loans Act, which gave specific approval for £400 million of this to be financed by borrowing and added credibility to the programme, which otherwise might seem to have stretched Britain's taxable capacity. *The Economist* saw this programme as certain to happen. Finally, in the run up to

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[24] Chambers, "Going Public".
[25] Crafts, "UK Defence News", pp. 9-10.
[26] Peden, *British Rearmament*, p. 77.
[27] British Parliamentary Papers, Cmd. 5374.

and immediate aftermath of the Budget of 1938 it became clear that spending would be ahead even of the 1937 programme at least during the two years 1938/9 and 1939/40.

3. Econometric Modeling

The defense news variable that we use in our econometric modeling, *news*, is the series given in Table 1 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.[28] 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 defence spending while $\nabla y_t = \log\left(GDP_t/GDP_{t-1}\right)$ is quarterly real GDP growth. The sample period was selected to be 1922_{Q1} to 1938_{Q4}, so avoiding the volatility of the aftermath of World War 1, which is known to have produced a shift in the process generating GDP.[29] 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 to a significant deterioration of fit. The volatility of GDP growth in the boom and bust after World War 1 and during 1926 and 1927 is clearly shown in Figure 2.[30]

Estimates of the finally chosen specification, in which insignificant variables have been deleted, are shown as Table 2 (the estimated coefficients of the included control variables are shown in the Appendix as column (1) of Table A1). Using 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 a lag of two quarters with a coefficient estimated to be, with one-standard error bound, 0.0416 ± 0.0025.

Barro and Redlick obtain an estimate of the defense-expenditure multiplier by taking defense news to have an annual expenditure flow equivalent of $1/4^{th}$ and so multiply β_1 by 4 and add this value to β_2. Their definition is based on using annual data with single lags of the regressors, so its (dynamic and annualized) quarterly counterpart here would be $16\sum_{i=1}^{4} \beta_{1i} + \sum_{i=1}^{4} \beta_{2i}$. The estimate of this multiplier obtained from the estimates shown in Table 2 is 0.52 ± 0.06.

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[28] Barro and Redlick, "Macroeconomic Effects". 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.

[29] See, for example, Mills, "Fluctuations in UK Output".

[30] 1926 and 1927 were affected by the General Strike and its aftermath.

An attempt was then made to investigate how this multiplier might change within the sample period. Attempts to re-estimate equation (1) for the post-1932 sub-period in order to investigate whether the multiplier is higher for the era where interest rates were close to the zero lower bound (ZLB) were unsuccessful, but truncating the sample period at 1932_{Q2} yielded a higher multiplier of 0.8, which seems contrary to this hypothesis.

Since the fit of this equation is not particularly good, with an R^2 of just 0.19, it was thought that we might do better by moving to a more general model specification. To this end a specification was developed which relates ∇y_t again to lags of $news_t$, but now to lags of government spending growth disaggregated into defence and non-defence spending, ∇d_t and $\nabla non-d_t$, and lags of non-government spending 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)

Estimates of the finally chosen specification, in which insignificant variables have been deleted, are shown as column (1) of Table 3 (the estimated coefficients of the included control variables are shown in the Appendix as column (2) of Table A1).[31] Again using standard errors robust to possible residual autocorrelation and heteroskedasticity, all included variables are highly significant and the reported equation passes a variety of standard tests for misspecification. The *news* variable is significantly positive at a lag of two quarters with a coefficient estimated to be 0.0430 ± 0.0083. This coefficient may be regarded as an estimate of the 'direct' multiplier of defense news on GDP, which on an annualised basis is thus 0.172 ± 0.033.[32] The chosen specification of (2) offers a superior fit to the Barro and Redlick model, with a much improved R^2 of 0.51 and a regression standard error some 20% lower.

However, there may also be 'indirect' effects present via the possible influence of *news* on the various categories of spending that also influence 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 ∇d, $\nabla non-d$ and ∇n, these being reported in Columns (2)-(4) of Table 3. 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

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

[32] 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

$$\nabla y_t = \log \left(GDP_t / GDP_{t-1} \right) \approx \nabla GDP_t / GDP_{t-1} = 0.0430 X_t / GDP_{t-1}$$

so that $\nabla GDP = 0.0430 X$ is the long-run relationship.

direct and the total overall multipliers are shown in Figure 3. The total multiplier is calculated to be 0.130 (0.52 annualized) which is effectively reached after three years.[33]

The overall multiplier time path may be used to compute the monetary impact on GDP of defense news shocks. Figure 4 shows the overall monetary impact of defense news shocks from 1925 onwards using a five-year horizon.[34] By the end of 1938, defense news shocks had produced an increase in GDP of £95 million, the rapid increase since 1934 being clearly seen.

To ascertain how the multiplier may have altered throughout the sample period, the specification shown in column (1) of Table 2 was re-estimated using samples ending in 1932_{Q2} and 1934_{Q4}, with the multipliers being recalculated. These produced annualized overall multipliers of 0.82 and 0.67, respectively. Again, this offers no support to the proposition that the fiscal multiplier increased during the cheap-money period. It should be noted that ending the sample period at 1934_{Q4} excludes the defense news data which are subject to relative large margins for error. This implies that finding a multiplier well below 1 is robust to excluding the largest and least certain values for defense news; the estimate of 0.67 for this sample period is not much above the 0.52 found for the whole period.

The equations in columns (2) and (4) are informative also in other respects. The former shows that defense news does predict subsequent actual defense spending. The latter shows that defense news has a negative effect on non-government spending which is indicative of crowding out. There are no quarterly data on components of national expenditure but from 1932 there are estimates of retail sales which can be used as a proxy for consumer expenditure. The estimates of an equation relating defense news to retail sales are shown in Table 4. The results suggest that consumer expenditure was reduced by expectations of future defense spending, which would be consistent with neoclassical or new-Keynesian predictions based on negative wealth effects. Models of this kind also predict an increase in labour inputs, which also helps generate the increase in output. We ran regressions which showed that the rate of both 'whole' and 'temporary' unemployment had a negative but not quite statistically significant relationship with defense news.[35]

4. Results

In this section we use the estimates of our preferred specification relating defense news to the growth of real GDP to examine the impact of rearmament on economic recovery in Britain in the 1930s. We also compare the implications of our methodology with those of the best-known paper on this topic by Thomas.[36]

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[33] As the analytical form of the total multiplier is a highly non-linear function of the coefficients of the various regressions no standard error can be calculated. However, we conjecture that it is in the region of that calculated for the Barro-Redlick multiplier, i.e., less than 0.1 on an annualized basis.

[34] 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 $\sum_{i=0}^{20} m_i X_{t-i}$

[35] The p-values were 0.12 and 0.17, respectively. The issue here may well be that there was a lot of short-time working in interwar Britain which was quite responsive to economic conditions but not very well captured by official statistics; see Bowden et al., "A Very Peculiar Practice". An implication is that output might increase through unmeasured reductions in 'underemployment'.

[36] Thomas, "Rearmament".

Table 5 sets out in more detail the estimated impact of defense news on GDP during the recovery period already graphed in Figure 3 and also reports actual defense expenditure. Based on the total multiplier (including the direct and indirect components), this impact averaged 7.1 percent of GDP in 1938 and amounted to £347.8 million (at 1938 prices) for the four quarters. Clearly, this estimate is subject to a health warning because, as noted in section 2, there is some uncertainty about the magnitude and, especially, the precise timing of defense news – although the numbers are clearly very big - during the rearmament phase.[37] Our analysis undoubtedly points to a substantial positive impact of rearmament on real GDP by 1938 even if the exact amount cannot be known with precision.

Nevertheless, our best-guess impact is actually quite similar to the £326.4 million increase in output implied by Thomas's approach on the basis of a multiplier of 1.6 times the additional defense expenditure of £204 million in 1938 compared with 1934. The difference is, of course, that our estimate is based on a much smaller multiplier, 0.52, but takes into account the news of very large defense spending plans for the future. The main implication of our analysis is that the observation of a large increase in output at a time of increased defense expenditure should probably not be interpreted as a large Keynesian multiplier but as largely reflecting firms gearing up for anticipated future increases in government spending.[38]

Is it plausible that the announcement of ambitious rearmament plans did elicit this response from the private sector? In fact, a well-informed interpretation along similar lines already exists in the historiography. Some years ago, A.J. Robertson argued that the main initial effect of rearmament was to encourage growth in the construction industry as armaments manufacturers scrambled to add capacity.[39] Robertson drew attention to the impact of works and buildings expenditures in providing demand, which sustained a vigorous expansion in construction output even as the impetus given by private house-building stalled. In turn, Robertson drew on the contribution of William Hornby to the official UK *History of the Second World War*.[40] Hornby details the build-up of activity to add capacity especially from 1936 onwards, notably in aircraft production but also entailing the formation of three important new armaments manufacturing companies. Subsequently, Chambers's recent compilation of data on all interwar IPOs shows that 20 of the 27 in aircraft manufacturing were launched between 1934_{Q3} and 1936_{Q2} when the increase in actual defense spending was still relatively small.[41]

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".[42] Our results suggest that the reason rearmament had a big impact was because the future spending plans were massive rather than because there was a large fiscal multiplier. The implication is that a conventional temporary

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[37] We have experimented with variants of the time path of the build up of defense news during 1935 and 1936 and found that the estimated total multiplier and impact are quite similar to those reported in the text.

[38] A similar suggestion is made by Ramey, "Can Government Purchases", p. 680, in her discussion of claims that American rearmament had big multiplier effects in the run-up to World War II.

[39] Robertson, "British Rearmament".

[40] Hornby, *Factories and Plant*.

[41] See the discussion of the impact of rearmament on IPOs in Chambers, "Going Public"; additional data kindly supplied by the author.

[42] Thomas, "Rearmament", p.571.

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.

5. Discussion

The results of our econometric modelling are that the government expenditure multiplier in interwar Britain was well below 1. This was found using the Barro and Redlick formulation as well as our preferred specification. Moreover, we did not find any evidence of a high value for the multiplier during the 'cheap-money' period of very low nominal interest rates. A reasonable conclusion from our estimations is that the government expenditure multiplier was between 0.5 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 questionable. On the other hand, our estimates are quite similar to those found for the United States using a defense-news approach.

Two reasons why the multiplier may have been quite modest even in the 1930s are the following. First, the reason that new-Keynesian models predict a large multiplier when interest rates are at the ZLB is that a deficit-financed increase in government spending leads expectations of inflation to increase and provides a stimulus through falls in the real interest rate. In 1930s Britain, the decline in real interest rates was much less dramatic than in the post-gold standard United States.[43] Second, the legacy of World War I meant that there was a high ratio of public debt to GDP. Between the late 1920s and the late 1930s this was never less than 140 per cent and peaked at nearly 180 per cent in 1933.[44] Empirically, econometric evidence for the recent past finds 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.[45] Theoretically, the reason for this result may be that expectations of large tax increases are raised by the fragility of the public finances when the debt to GDP ratio is high.[46] There seems to be stronger modern evidence for consumption reductions stemming from 'Ricardian-equivalence' when the debt to GDP is above 100 per cent.[47]

As Roger Middleton has stressed, contemporaries, including key officials in HM Treasury, thought in terms of 'psychological crowding out', in the context of deficit-financed public works programs, through adverse effects on business confidence which might undermine investment, as a major reason to believe that the multiplier effects would be small.[48] Middleton also noted that, 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.

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[43] According to estimates made by Jagjit Chadha and Nicholas Dimsdale 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; see their paper, "A Long View".

[44] Middleton, "British Monetary and Fiscal Policy".

[45] Auerbach and Gorodnichenko, "Fiscal Multipliers".

[46] Perotti, "Fiscal Policy in Good Times".

[47] Rohn, "New Evidence".

[48] Middleton, *Towards the Managed Economy*, ch. 8.

So some offset through Ricardian equivalence would not seem unreasonable, especially in an economy in which a great deal of consumer expenditure was by the income-tax paying classes in an economy characterized by high income inequality.[49] The suggestion that news of future defense spending might work to reduce consumption through negative wealth effects also gains credence from estimates of the consumption function which find a significant role for wealth effects.[50] None of this, however, should be taken to imply that the 1930s recovery in Britain was triggered by an expansionary fiscal contraction in the context of the fiscal tightening that took place in the early 1930s' policy response to the deterioration in public finance promoted by the world economic crisis.[51] The evidence points to a positive fiscal multiplier, albeit smaller than has been generally believed; in fact, our estimates echo the views of HM Treasury at the time, namely, that the multiplier was positive but less than 1.[52]

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 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.[53] In terms of the overall expansion of real GDP (25.8 percent between 1932_{Q2} and 1938_{Q4}), our estimate indicates a contribution from rearmament of about 30 per cent, building up mainly after 1935.[54]

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 noted, this is mainly because estimates of the multiplier have been lower than those of early Keynesians like Richard Kahn, whose best guess was 1.88, and Keynes himself, who favoured a range of 2 to 3.[55] For example, Thomas, 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.[56] Dimsdale and Horsewood did support the idea of a relatively large multiplier but their more detailed treatment of the labour 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.[57] Given that to reduce unemployment to 'normal levels' in 1932 would have entailed cutting it by close to 3

[49] 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 Tibor Barna, *Redistribution of Incomes*.

[50] For evidence of strong real balance effects on consumption in 1930s Britain, see Stephen Broadberry, "Perspectives".

[51] Middleton's estimates show an increase in the constant-employment budget surplus of about 4 per cent of GDP between 1929/30 and 1933/34; see his "British Monetary and Fiscal Policy".

[52] Middleton, *Towards the Managed Economy*, p. 163.

[53] The development and implementation of this policy is well documented by Susan Howson, *Domestic Monetary Management* and *Sterling's Managed Float*.

[54] The increase in real GDP is based on the estimates in Mitchell et al., "Monthly GDP Estimates".

[55] Middleton, "British Monetary and Fiscal Policy"; "Kahn, "The Relation of Home Investment"; Keynes, *The Means to Prosperity*.

[56] Thomas, "Aggregate Demand".

[57] Dimsdale and Horsewood, "Fiscal Policy".

million, there is a consensus that at that point there was no possibility of a Keynesian solution to unemployment.

Even our highest estimate of 0.8 after about three years for the government expenditure multiplier means that we would be considerably more pessimistic about the impact of the Keynes-Henderson program; Lloyd George would 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.[58]

6. Conclusions

We have developed a new approach to estimating the government expenditure multiplier for interwar Britain using quarterly data, time series econometrics and the concept of defense news. This gives very different results from those found by previous researchers. Our estimates suggest a value in the range 0.5 to 0.8 after three years compared with at least 1.2 in the earlier literature. The methods used hitherto to estimate Keynesian multipliers for this period may not have fully captured the crowding out of private by public expenditure.

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 million – indeed, we believe the effect would have been much smaller than this.

In the circumstances of the early 1930s, we think contemporaries were right to worry that attempting a significant fiscal stimulus could trigger adverse reactions which would have raised interest rates and undermined the cheap money policy which helped to promote recovery in Britain in the years after 1932. If there was 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.

Nevertheless, we find that rearmament delivered a substantial stimulus that promoted economic recovery after 1935. Our estimate is that, in the absence of the rearmament program, real GDP in 1938 would have been about 7 per cent lower. It is important, however, to recognize that this estimate of a large impact is based on the private sector's response to news of large future defense expenditure rather than on 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, the impact on real GDP and unemployment would have been relatively modest.

Finally, we note that macroeconomists have become more aware that the value of the multiplier may vary according to the state of the economy. In that respect, we conjecture that a small

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[58] Middleton sets up the government's policy options in exactly this way, see "Monetary and Fiscal Policy", p. 436.

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.

References

Auerbach, Alan J. and Yuriy Gorodnichenko. "Fiscal Multipliers in Recession and Expansion." NBER Working Paper No. 17447, 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): 1329-68.

Bowden, Sue, David Higgins, and Chris Price. "A Very Peculiar Practice: Underemployment in Britain during the Interwar Years." *European Review of Economic History* 10, no. 1 (2006): 89-108.

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.

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. *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.

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

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.

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.

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 Interwar Britain." Cambridge Working Paper in Economics no. 1155 (2011).

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.

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, 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.

Table 1. Defence News: Estimates of Changes in Net Present Value of Expected Defence 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 2. Barro and Redlick Specification Estimates

	∇y_t
constant	-0.0081 [6.1]
$news_{t-2}$	0.0416 [16.5]
$\nabla D_{t-2}/GDP_{t-3}$	-0.0787 [2.4]
$\nabla D_{t-3}/GDP_{t-4}$	-0.1607 [5.6]
$\nabla D_{t-4}/GDP_{t-5}$	0.0919 [2.7]
R^2	0.19
SE	0.0172

Note: Sample period is $1922_{Q!}$ to 1938_{Q4}. Figures in parentheses are robust t-ratios. *SE* is the regression standard error. The estimates for the ARCH(1) error specification for equation (1) are $\hat{\delta}_0 = 3.37 \times 10^{-9}[195.3]$ and $\hat{\delta}_1 = 2.1797\ [4.6]$.

Table 3. Regression Estimates: Preferred Specification

	(1)	(2)	(3)	(4)
	∇y_t	∇d_t	$\nabla non{-}d_t$	∇n_t
constant	0.0027 [2.3]	–	–	0.0126 [2.3]
$news_{t-2}$	0.0430 [5.2]	–	–	–
$news_{t-4}$	–	1.3880 [4.7]	0.3416 [1.4]	-0.1952 [1.9]
∇d_{t-1}	-0.0077 [4.6]	-0.7720 [8.2]	–	–
∇d_{t-2}	–	-0.4766 [4.4]	–	–
∇d_{t-3}	–	-0.3022 [2.0]	–	–
∇d_{t-4}	0.0114 [3.7]	0.3589 [4.0]	–	–
$\nabla non{-}d_{t-1}$	0.0203 [9.2]	–	-0.3991 [4.0]	–
$\nabla non{-}d_{t-2}$	-0.0321 [15.2]	–	-0.2906 [2.8]	–
$\nabla non{-}d_{t-3}$	-0.0247 [12.2]	–	-0.2678 [2.6]	–
$\nabla non{-}d_{t-4}$	–	–	0.5359 [5.7]	–
∇n_{t-1}	-0.2224 [32.1]	—	–	-0.5375 [4.6]
∇n_{t-2}	–	–	–	-0.3433 [2.2]
∇n_{t-3}	-0.1696 [21.9]	–	–	–
∇n_{t-4}	-0.0613 [8.5]	–	–	–
R^2	0.51	0.73	0.86	0.28
SE	0.0137	0.1223	0.1056	0.0424

Note: Sample period is $1922_{Q!}$ to 1938_{Q4}. Figures in parentheses are t-ratios. *SE* is the regression standard error.   The estimates for the ARCH(1) error specification for equation (1) are $\hat{\delta}_0 = 1.37 \times 10^{-9}[209.4]$ and $\hat{\delta}_1 = 2.2023[4.6]$.

Table 4. Retail Sales Equation

	∇r_t
constant	0.0109 [3.8]
$news_{t-1}$	-0.0842 [2.1]
∇r_{t-3}	0.3243 [2.7]
R^2	0.33
SE	0.0115

Note: Sample period is $1933_{Q!}$ to 1938_{Q4}. Figures in parentheses are t-ratios. *SE* is the regression standard error.

Table 5. Estimated Impact of Defense News Shocks on Real GDP (£million, 1938 prices)

	GDP Impact from Defense News (Total Multiplier)	Impact as % Real GDP	Defense Expenditure
1932_{Q1}	5.73	0.06	27.92
1932_{Q2}	3.01	0.03	28.38
1932_{Q3}	7.13	0.07	28.03
1932_{Q4}	3.04	0.31	26.89
1933_{Q1}	3.01	0.30	30.34
1933_{Q2}	3.07	0.31	28.43
1933_{Q3}	6.38	0.63	28.22
1933_{Q4}	6.86	0.66	27.81
1934_{Q1}	6.55	0.62	34.76
1934_{Q2}	7.05	0.66	28.35
1934_{Q3}	9.10	0.84	29.59
1934_{Q4}	7.49	0.69	31.33
1935_{Q1}	8.86	0.81	36.25
1935_{Q2}	9.13	0.82	30.49
1935_{Q3}	10.82	0.97	32.91
1935_{Q4}	19.66	1.73	39.50
1936_{Q1}	19.93	1.74	44.78
1936_{Q2}	18.96	1.63	40.27
1936_{Q3}	38.04	3.22	43.69
1936_{Q4}	40.75	3.45	49.48
1937_{Q1}	38.56	3.24	61.14
1937_{Q2}	42.72	3.54	47.13
1937_{Q3}	68.24	5.60	58.35
1937_{Q4}	63.88	5.24	66.61
1938_{Q1}	62.51	5.13	89.45
1938_{Q2}	91.91	7.58	65.43
1938_{Q3}	97.89	8.06	92.52
1938_{Q4}	95.48	7.82	80.18

Sources: own calculations, see text, and data appendix for GDP and defense expenditure
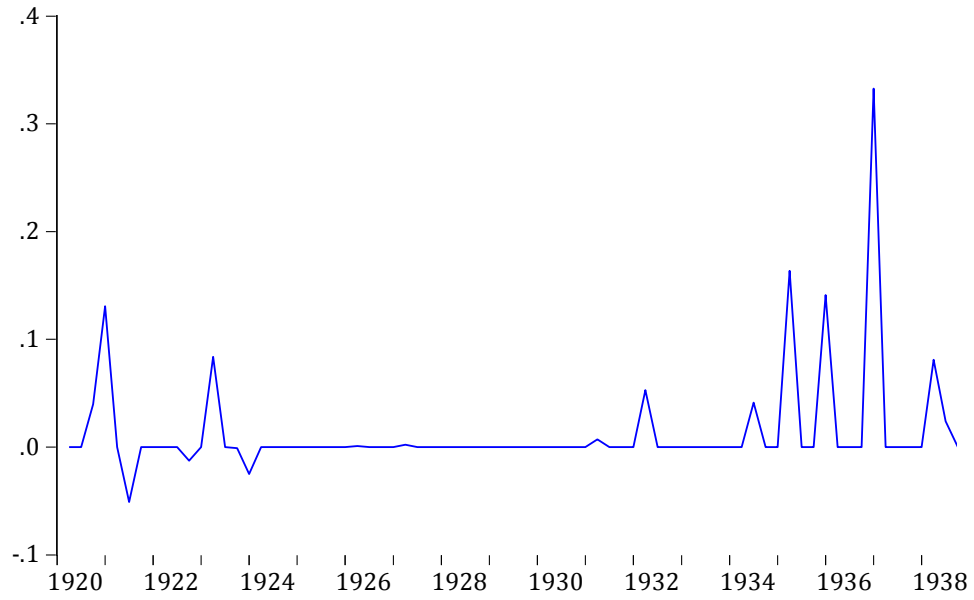
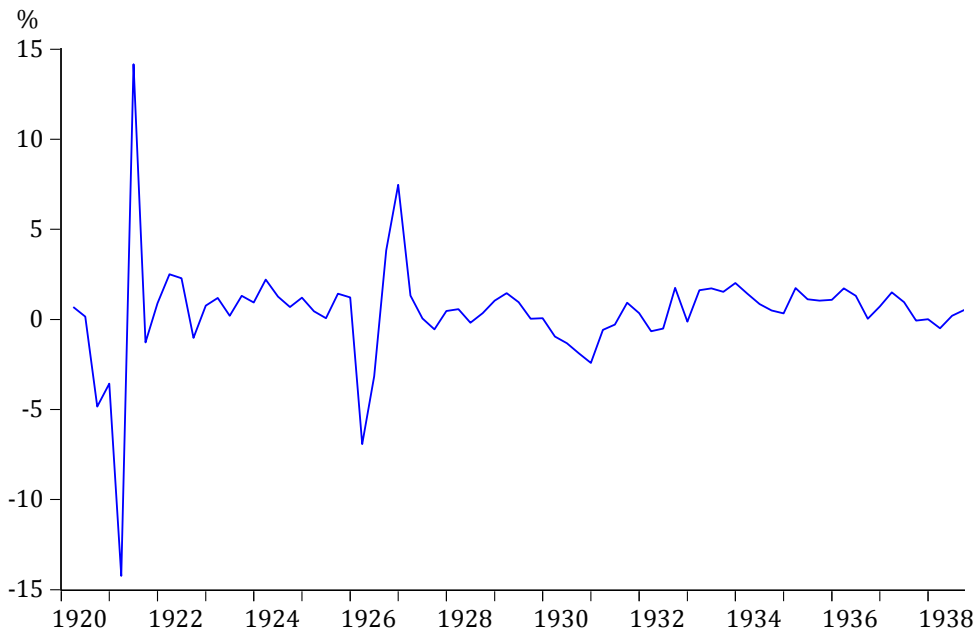Figure 1   Defense news divided by lagged real GDP: 1920_{Q2}-$1938_{Q\$}$.

Figure 2   Quarterly growth of real GDP: 1920_{Q2}-$1938_{Q\$}$.
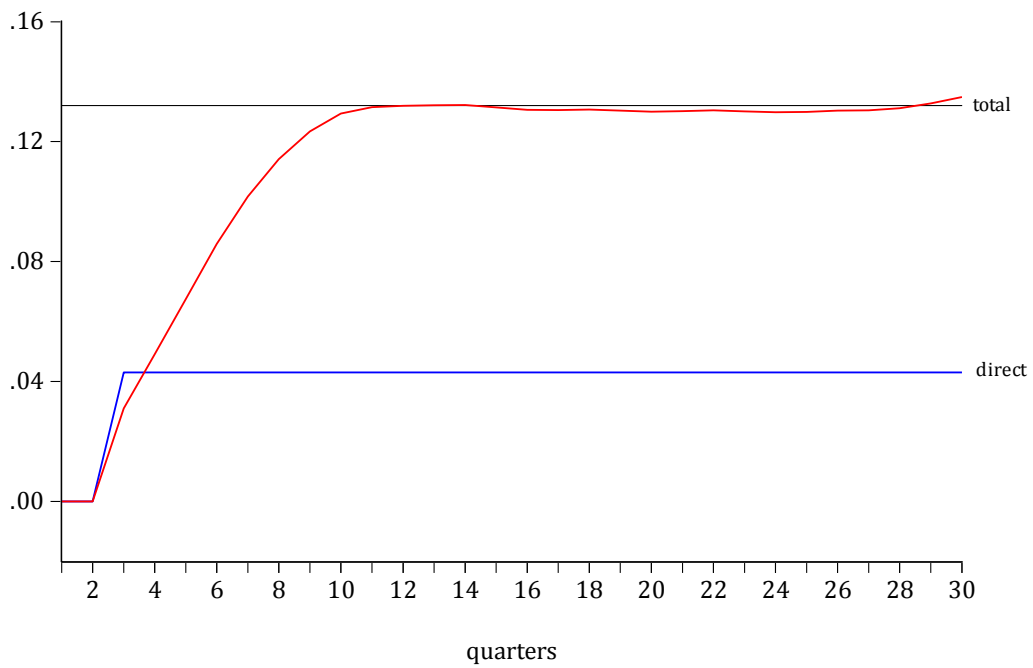
Figure 3   Defense news multipliers (total multiplier smoothed to remove seasonal variability).
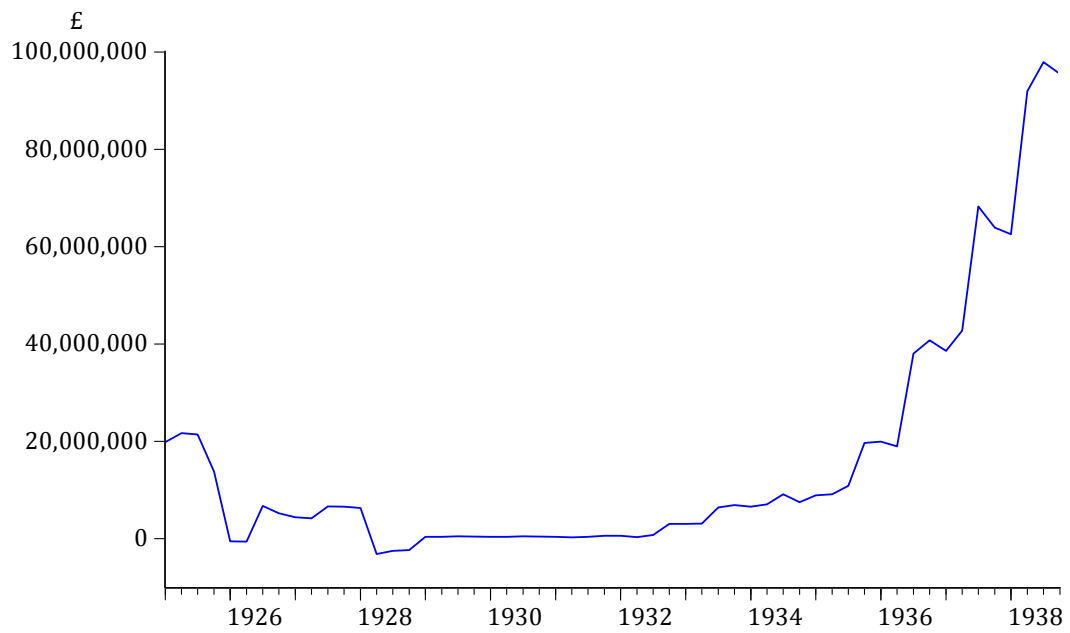

Figure 4   Effect of defence news shocks on GDP using a five-year horizon.

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., "Monthly GDP Estimates", Table 2b.

Government expenditure on goods and services and on defence: 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, *The Interwar British Economy*, Table 2.14. Before 1921_{Q2}, defence expenditure was inferred using the annual total reported in Feinstein, *National Income*, Table 33, allocated to quarters based on army numbers taken from *General Annual Report on the British Army* for years ending 30 September 1920 and 1921.

Defence News: derived as explained in Crafts, "UK Defence News".

Exports: Capie and Collins, *The Interwar British Economy*, 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, *The Interwar British Economy*, Table 4.5.

Money Multiplier: M1/monetary base from Capie and Webber, *A Monetary History*, Table I.2. Before 1922_{Q1} M1 was estimated as M3/1.33 from Howson, *Domestic Monetary Management*, Appendix 1, Table 1).

Yield on Consols: Capie and Webber, *A Monetary History*, Table III.10.

Retail Sales: Capie and Collins, *The Interwar British Economy*, Table 2.22.

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

	(1)	(2)
∇ex_{t-2}	0.0453 [7.1]	0.0889 [17.4]
∇ex_{t-3}	0.0299 [7.0]	–
∇ex_{t-4}	-0.0249 [6.4]	–
∇mm_{t-3}	0.0331 [6.5]	-0.0402 [7.3]
∇mm_{t-4}	0.0747 [13.8]	0.0514 [8.4]
∇tax_{t-1}	-0.0118 [10.3]	-0.0090 [27.6]
∇R_{t-1}	-0.0066 [3.2]	-0.0077 [6.2]
un_{t-1}	–	-0.0053 [12.7]
un_{t-2}	0.0013 [5.0]	-0.0056 [13.4]
un_{t-3}	-0.0005 [2.0]	–

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. Figure in parentheses are robust t-ratios.