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On the relationship between defense and non-defense spending in the U.S. during the world wars ☆

Roel M.W.J. Beetsma [a,*], Alex Cukierman [b], Massimo Giuliodori [c]

[a] *University of Amsterdam, Tinbergen Institute, CEPR and CESifo, The Netherlands*
[b] *Tel Aviv University and CEPR, Israel*
[c] *University of Amsterdam, The Netherlands*

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Abstract

We show that U.S. defense and non-defense expenditures were positively correlated during World War I and negatively during World War II. We rationalize this pattern in a model with falling spending complementarities and rising marginal tax distortions as government grows.

Keywords: Defense expenditures; Non-defense expenditures; World Wars; Correlation; Taxation

JEL classification: H56; N42; E62

1. Introduction

We show that defense and non-defense expenditures in the U.S. were positively correlated during World War I (WW-I) and negatively correlated during World War II (WW-II). This letter seeks to rationalize this striking pattern of correlations using a model with a welfare maximizing social planner

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* Corresponding author. Mailing address: Department of Economics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands. Tel.: +31 20 5255280; fax: +31 20 5254254.
E-mail address: R.M.W.J.Beetsma@uva.nl (R.M.W.J. Beetsma).

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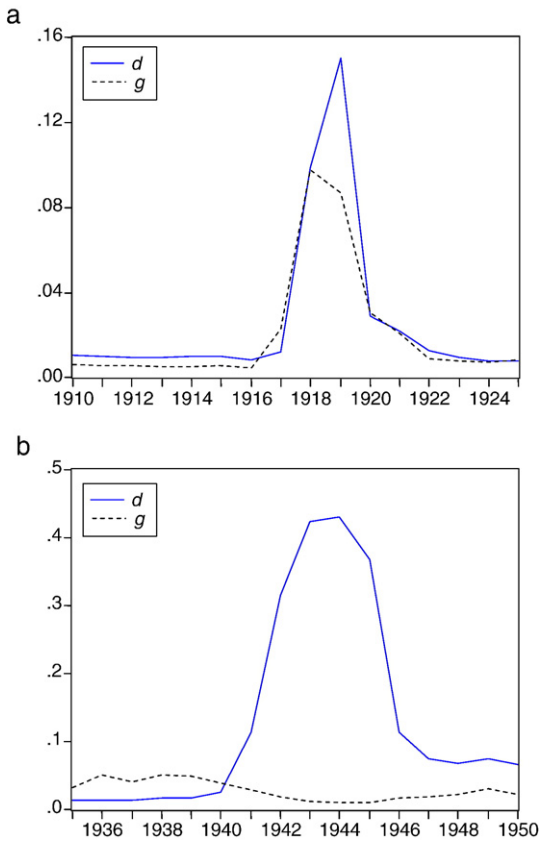

Fig. 1. a: Defense (d) and non-defense (g) government purchases during and around World War I. b: Defense (d) and non-defense (g) government purchases during and around World War II.

in which defense spending and civilian public spending are positively correlated when the size of the government is small and negatively correlated for large government. The following basic assumptions suffice to reach this conclusion. First, when a war (threat) arises, the marginal utility of defense expenditures goes up. Second, at low levels of government, defense and civilian expenditures complement each other in the sense that the marginal utility of each type of expenditure goes up when the quantity of the other rises. The idea is that the effective control of a large war machine by civilian authorities requires a certain minimal level for the size of the civilian public sector (for example, administrative bodies and investment in physical infrastructure). By contrast, at high levels of government, the marginal utility of each type of expenditures is independent of the quantity of the other type.[1] Finally, the rate at which marginal tax distortions increase with taxes is positive only above a certain threshold size of government. Below this threshold the marginal tax distortion is constant.

[1] Further discussion of this assumption in the historical context of the world wars appears in the Conclusion.

2. Defense and civilian spending during the wars

Data are taken from the U.S. Census Bureau (2006) and from the National Income and Product Accounts (NIPA) available from the Bureau of Economic Analysis (2006). In addition, we use GDP data from Johnston and Williamson (2006) for the pre-1929 period and data on interest payments from Bohn (2005). Fig. 1a depicts defense expenditures as a share of GDP (d) jointly with federal non-defense expenditures excluding veteran benefits and interest payments as a share of GDP (g) over the period 1910–1925. Both series make use of data from the U.S. Census Bureau (2006). The netting out of interest payments and veteran expenditures from non-defense spending is motivated by the question we seek to answer, which concerns the effect of changes in defense spending on the *net* relative size of civilian government. Since both veteran benefits and interest on the public debt are, for the most part, lagged consequences of wars, we subtract them from non-defense expenditures in order to isolate the effect of changes in defense spending on the net size of the non-defense (non-transfer) governmental sector.[2] We observe also that in the period before the Great Depression, the bulk of transfers was to war veterans, so that the series g is a good approximation of non-defense government purchases. Clearly, the two variables move up and down together during and around WW-I (1917–1918).

Fig. 1b depicts government defense purchases as a share of GDP (d) jointly with federal government non-defense purchases as a share of GDP (g) over the period 1935–1950. These series make use of the NIPA data. The series g thus excludes all transfer payments. We see that the series move in opposite directions during and around the second World War. In fact, the correlation coefficient between the series g and d drops from 0.92 over the earlier period to -0.76 over the later period. These correlations differ from each other at a 1% level of statistical significance.[3]

As a final input for our formal argument, we notice that, using the data from the U.S. Census Bureau (2006), federal government spending as a share of GDP has risen from 2.1% in 1915 to 9.8% of GDP in 1940. That is, from the eve of WW-I to the eve of WW-II, the relative size of government increased almost five-fold.

3. The model

We use a representative agent model that abstracts from distributional considerations of the type surveyed in Persson and Tabellini (2000) and Drazen (2000). In the context of allocating resources between defense and civilian public goods in the face of a national emergency such a simplification may not be unreasonable. One reason is that, in the presence of a common external danger, internal differences are largely put aside. The advantage of the unitary agent framework is that it makes it possible to focus clearly on a political decision making mechanism that is likely to be present in more realistic but more complex frameworks. Let d' be the fraction of per capita defense spending per unit of per capita income and let g' be the fraction of per capita civilian public expenditures per unit of per capita income. Utility of the representative individual is given by $u\,(ad', g')$ where a is a shock affecting the marginal utility from

[2] For interest on the public debt, this is the case mainly prior to 1950.

[3] In Beetsma et al. (2005) we regress changes in g on changes in d over the first three decades of the 20th century as well as over the remaining decades, while controlling for the phase of the cycle. Those regressions confirm that the relation between d and g is positive and significant over the first subperiod, but negative and significant over the second subperiod.

defense spending (a war or the threat of a war would classify as an increase in a). The utility function may be rewritten as[4]

$$u(ad, g). \tag{1}$$

We assume that $u_d>0$, $u_g>0$, $u_{dd}<0$, $u_{gg}<0$ and that $u_{gd}\geq 0$. Here, subscript d (g) denotes the partial derivative with respect to the first (second) argument. We ignore transfers. Hence, civilian spending is the non-defense part of what the standard macroeconomics textbook calls "government purchases". Defense spending and civilian public spending are financed by either current or future taxes (via debt). Let t be the fraction of per capita current and future taxes (in present value terms) required to finance total current defense and civilian expenditures per unit of (current) per capita income. Government's budget constraint implies

$$g + d = t. \tag{2}$$

Taxes lead to losses that are described by a distortion function

$$c(t), \tag{3}$$

with a positive and (weakly) increasing marginal distortion rate as in Barro (1979); i.e, $c'>0$ and $c''\geq 0$.[5]

The government's objective is to maximize u $(ad, g)-c$ (t) subject to the budget constraint (2). Substituting constraint (2) into (1), the government's problem is to choose d and t so as to maximize:

$$V(d,t)\equiv u(ad, t-d)-c(t).$$

The first-order conditions for an internal maximum are:

$$V_d(d,t)\equiv a u_d(ad, t-d)-u_g(ad, t-d) = 0, \tag{4}$$

$$V_t(d,t)\equiv u_t(ad, t-d)-c'(t) = 0. \tag{5}$$

The second-order conditions for an internal maximum are

$$V_{dd}(d,t)\equiv a^2 u_{dd}-2a u_{dg} + u_{gg}<0,$$
$$W\equiv V_{dd}V_{tt}-(V_{dt})^2>0,$$

where V_{tt} $(d, t)=u_{gg}-c''$ and V_{dt} $(d, t)=a u_{dg}-u_{gg}$.

We now formulate the assumptions presented at the outset more precisely.

[4] By definition, per capita magnitudes are obtained by dividing the total values of defense and civilian expenditures by population, and per capita income is, similarly, obtained by dividing total income by population. Since it appears in both the numerators and the denominators of all those expressions, population drops out so that $d=d'$ and $g=g'$.

[5] However, here the increasing marginal distortion rate is assumed to apply to the sum of current taxes and the present value of future taxes required to finance current government expenditures, rather than to only the current tax component.

Assumption 1. The marginal utility of defense is positively affected by the shock a or, more formally,

$$\frac{\mathrm{d}(au_{\mathrm{d}})}{\mathrm{d}a} = u_{\mathrm{d}} + adu_{\mathrm{dd}} > 0. \tag{6}$$

Assumption 2. There are sufficiently strong positive complementarities in utility between defense and civilian expenditures at relatively low government ($g+d$ is small), and no utility interactions between them at relatively large government ($g+d$ is large). Formally,

$$\begin{aligned} &u_{\mathrm{gd}} > 0 \text{ at small government,} \\ &u_{\mathrm{gd}} = 0 \text{ at large government.} \end{aligned} \tag{7}$$

Assumption 3. Below a certain positive threshold, the marginal tax distortion is constant. Formally,

$$c'' = 0.$$

Next, we evaluate the effect of the war shock on d and g by performing a comparative statics experiment with respect to a and using the three assumptions above. Totally differentiating the first-order conditions with respect to a, we obtain after some algebra

$$\frac{\mathrm{d}d}{\mathrm{d}a} = \frac{1}{W}[du_{\mathrm{gd}}(au_{\mathrm{gd}} - c'') + (c'' - u_{\mathrm{gg}})(u_{\mathrm{d}} + adu_{\mathrm{dd}})], \tag{8}$$

$$\frac{\mathrm{d}g}{\mathrm{d}a} = \frac{1}{W}[du_{\mathrm{gd}}(c'' - a^2u_{\mathrm{dd}}) + (au_{\mathrm{gd}} - c'')(u_{\mathrm{d}} + adu_{\mathrm{dd}})]. \tag{9}$$

When government is large, the second part of Assumption 2 implies that these equations reduce to

$$\frac{\mathrm{d}d}{\mathrm{d}a} = \frac{1}{W}(c'' - u_{\mathrm{gg}})(u_{\mathrm{d}} + adu_{\mathrm{dd}}) > 0, \tag{10}$$

$$\frac{\mathrm{d}g}{\mathrm{d}a} = -\frac{1}{W}c''(u_{\mathrm{d}} + adu_{\mathrm{dd}}) < 0, \tag{11}$$

where the inequalities follow from Assumption 1 and the fact that $W>0$ by the second-order condition. Consequently, at relatively large levels of government, defense and civilian expenditures are negatively correlated, as was the case during WW-II when government was relatively large.

When government is sufficiently small, Eqs. (8) and (9) reduce to

$$\begin{aligned} \frac{\mathrm{d}d}{\mathrm{d}a} &= \frac{1}{W}[adu_{\mathrm{gd}}^2 - u_{\mathrm{gg}}(u_{\mathrm{d}} + adu_{\mathrm{dd}})] > 0, \\ \frac{\mathrm{d}g}{\mathrm{d}a} &= \frac{1}{W}[-a^2u_{\mathrm{dd}}du_{\mathrm{gd}} + au_{\mathrm{gd}}(u_{\mathrm{d}} + adu_{\mathrm{dd}})] > 0. \end{aligned}$$

The inequalities are implied by the three Assumptions, the fact that $W>0$, and the fact that the marginal utilities of civilian and defense expenditures are both decreasing in the shares of those variables. Those arguments provide a proof to the following summary proposition.

Proposition 1. *Given* 1–3 *above, when the size of government is sufficiently small, both defense spending and civilian public spending are increasing in the war shock, a, and are, consequently, positively related. When the size of government is sufficiently large, civilian public spending is decreasing in the war shock, a, while defense spending is still increasing in it, implying that civilian public spending and defense spending are negatively related.*

4. Conclusion and discussion

This letter documents a striking change in the pattern of correlations between defense and non-defense U.S. government spending between WW-I and WW-II and attempts to provide conceptual underpinnings for it. The explanation relies on the view that, during national emergencies, internal differences in interests are largely put aside and political authorities allocate outlays between civilian and defense expenditures so as to maximize the welfare of a representative individual. Our argument relies on a falling complementarity between the shares of the two types of spending when their sum rises, combined with increasing tax distortions when the relative size of government increases.

While the second hypothesis is well accepted in the political economy and macro literature, the first has not (to our knowledge) previously appeared. It therefore deserves some discussion. Economic historians like Higgs (in press) report that, during both world wars, the Federal government got involved in the operation of civilian activities that in peace time are normally left to the private sector. A notable example during WW-I is the Emergency Fleet Corporation that started operations in 1917 and was heavily involved in the acquisition, construction and operation of merchant vessels. During both world wars draft boards were operated by civilians. Higgs and others report that, in addition to its increase in the share of the Federal budget induced by the involvement in the war, government's role in the economy grew enormously during the wars through a maze of regulations, direct instructions issued to private firms regarding "what to produce", requisition of some industries and price controls.

Those activities required expansion of both defense and non-defense budgets. Due to the legacy of the Great Depression (and of WW-I before it) the larger civilian component of the budget already had some of those in place at the eve of WW-II but not at the eve of WW-I. As a consequence, the creation and operation of a war "command economy" required an expansion of the relative share of civilian Federal outlays along with defense outlays during WW-I but less so, during WW-II. In addition, since total government at the eve of WW-I was small the impact of a simultaneous increase in the shares of both civilian and defense outlays on the marginal tax distortion was small. By contrast, during WW-II the dominant influence on civilian expenditures was the high and rapidly rising marginal tax distortion which induced government to reduce the share of civilian expenditures in parallel with the increasing share of defense.

We expect our argument to carry over to situations in which individuals have different incomes and additional objectives (in particular, about redistribution) as long as the common objective assumed here enters with a sufficiently large weight in the preference functions of individuals.

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