The impact of American and British involvement in Afghanistan and Iraq on health spending, military spending and economic growth

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Abstract

Had there been no involvement in Afghanistan and Iraq, how much lower would military and health spending have been in the US and the UK? And what is the total effect of war on real output variations as compared with its counterfactual? We use a synthetic control method and find that while the UK and the US have experienced similar relative increases in health spending, especially towards the end of the 10-year window, the effect on military spending is much more pronounced in the US. We find that the combined cumulative costs amount to more than 17% of the US GDP and more than 9% of the UK GDP. Moreover, there are no robust signs of a convergence between the true and counterfactual levels of military spending while health spending shows a level shift in the last five years in both countries. Finally, there is no evidence of changes in the national income following the sharp increase in defense spending.

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1 Introduction

The wars in Afghanistan and Iraq are the longest in the US history. Not surprisingly, the calculation of the associated economic cost has attracted a considerable attention by a number of economists. Stiglitz & Bilmes (2008) estimate that the total cost of the war in Iraq is $3 trillion, $415 billion of which is the uncompensated social economic cost associated with injuries and death. Few months before the invasion of Iraq, Nordhaus (2002) gave *ex ante* estimates of the undiscounted sum of direct military and macroeconomic costs, which ranged between $99 billion and $1.9 trillion depending on the quality of the war outcome. Bilmes (2013) indicates that the US engagements in Afghanistan and Iraq have resulted in the most expensive wars in US history, totaling somewhere between $4 to $6 trillion. Likewise, Brück *et al.* (2011) estimate that the economic costs of the German involvement in the war in Afghanistan ranges between 26 and 47 billion Euro. A large portion of costs is attributable to budgetary costs, in particular military expenditure, and social economic costs, borne by individual veterans, as a consequence of physical and mental suffering. Edwards (2010) includes also macroeconomic effects such as the diversion of savings toward the war industry and the fiscal stimulus associated with government spending.

De Groot *et al.* (2012) discuss methods and purposes in the calculation of war costs and claim that the lack of a coherent framework of analysis prevents comparison. Most studies use cost accounting procedures, which simply add up the value of direct and indirect costs. While this procedure is relatively straightforward and can fit multiple scenarios, it can result in double counting and preclude statical inference (see Gardeazabal, 2010). More importantly, even accounting procedure require a counterfactual (see Smith, 2013). What are the extra costs caused by the intervention above the normal costs which would have to be paid in any case? Both operations could have had military costs even if they had not occurred because of the expenditure incurred either in anticipation of the war or in the hope of deterring the conflict. Similarly, while there is strong evidence of an association between military service and adverse health (Dobkin & Shabani, 2009), a large component of publicly provided health benefits for veterans is the routine health care associated with aging. Had the veteran not served, most of the routine costs would have been borne by the public in any event (see Edwards, 2010).

We investigate the economic effects of the Afghanistan and Iraq wars on military and health spending of the US and the United Kingdom, the latter being the second largest contributor to both operations. In fact, while much has been written about the costs to the US of the conflicts in Afghanistan and Iraq, similar studies for the UK have been lacking. We also explore whether increased public spending has a net stimulative effect on the economy, which is crucial given the current dispute among economists about the size of the multiplier for temporary defense and non-defense spending (Barro & Redlick, 2011; Aksoy & Melina, 2012) and the possibility of a crowding-out effect of military spending (e.g. Dunne *et al.* , 2005).[1] Our aim is to compare the observed post-intervention macroeconomic data with an hypothetical counterfactual in which the US and the UK did not intervene. The fundamental problem is that in any period we either observe intervention or not, never both, and specifying a plausible scenario for what would have happened in the absence of the intervention requires very delicate choices. Pesaran & Smith (2012) discuss *ex ante* and *ex post* counterfactual analyses in the case of macroeconometric applications where a single unit is observed before and after a given policy intervention and introduce new methods. To establish our counterfactuals, we use a novel and transparent methodology for case studies, the synthetic control method, developed by Abadie & Gardeazabal (2003) and extended by Abadie *et al.* (2012), and compare the post-intervention outcome trajectories of UK and US with the trajectories of combinations of similar but unexposed countries. This is the issue considered next.

2 Empirical Strategy

Consider $t = 1, 2, \ldots, T$ time periods, where a war involvement occurs at time T_0, with $1 < T_0 < T$ and $i = 0, 1, 2, \ldots, G$ with an intervention occuring in

[1] The relation is not clear-cut and Kalaitzidakis & Tzouvelekas (2011) find an inverse U-shaped pattern between the share of military spending and the growth rate. Similarly, for the case of Guatemala, Reitschuler & Loening (2005) find that military spending has no positive effect on growth after it has surpassed a low threshold.

country 0. Then, denote by $D_{0t} = 1$ the treatment status, i.e. war involvement. The treatment effect for country 0 at time t on the outcome of interest Y_{0t}, i.e. military and health spending in % of the GDP and GDP per capita, is defined as follow:

$$\alpha_{0t} = E[Y_{0t}|D_{0t} = 1] - E[Y_{0t}|D_{0t} = 0] \qquad \text{for } t = T_0 + 1, \ldots, T \tag{1}$$

The potential outcome for the post-treatment period in the absence of the treatment is estimated as a weighted average of periods $t = T_0 + 1, \ldots, T$ outcomes in the $i = 1, 2, .., G$ control groups,

$$E[Y_{0t}|D_{0t} = 0] = \sum_{i=1}^{G} \lambda_i \bar{Y}_{it} \tag{2}$$

where $\bar{Y}_{it}$ is a generic linear combination of pre-treatment outcomes and λ_i are weights, satisfying $\sum_{i=1}^{G} \lambda_i = 1$ and $\lambda_i \geq 0$, to prevent extrapolation outside the support of the data. The weights are chosen to make the weighted control country resemble the treatment country prior to the treatment. That is, the estimation problem amounts to choosing the vector of weights that minimizes the difference between the treated country and the λ-weighted average of the control countries over the period in which none of them had been exposed to the treatment, i.e.

$$\left\| \begin{array}{c} Y_{0t} - \sum_{i=1}^{G} \lambda_i \bar{Y}_{it} \\ \cdot \\ \cdot \\ Y_{0T_0} - \sum_{i=1}^{G} \lambda_i \bar{Y}_{iT_0} \end{array} \right\|$$

where $\|\|$ denotes a measure of distance. We also add group level covariates - i.e. predictors of the outcomes of interest - to the criterion to determine the weights. In fact, as in Abadie & Gardeazabal (2003), we use an algorithm that minimizes the distance both in terms of pre-treatment outcomes and predictors of the outcomes. Specifically, let X_1 be the $(k \times 1)$ vector of preintervention characteristics for the treated country and X_0 be the $(k \times i)$ matrix that includes the same variables for the unaffected countries; also, let V be a $(k \times k)$ diagonal matrix with non-negative entries measuring the relative importance of each predictor. Conditional on V, the optimal vector of weights, $\Lambda^*(V) = (\lambda_1, \ldots, \lambda_G)'$, must solve

$$\min(X_1 - X_0\Lambda(V))'V(X_1 - X_0\Lambda(V)) \tag{3}$$

subject to $\lambda_i \geq 0$ and $\sum_{i=1}^{G} \lambda_i = 1$. The vector of weights $\Lambda^*(V)$ defines the combination of untreated control countries which best resembled the UK and the US in economic growth as well as military and social spending determinants before the intervention. We then select V such that the mean squared prediction error of pre-treatment outcomes is minimized i.e.,

$$\frac{1}{T_0} \sum_{t \leq T_0} (Y_t - \sum_{i=1}^{G} \lambda_i^* Y_{it})^2 \tag{4}$$

When the number of pre-intervention periods in the data is large, as in our case, matching on pre-intervention outcomes helps control for the unobserved factors affecting the outcome of interest. Once it has been established that the unit representing the case of interest and the synthetic control unit have similar behavior over *extended* periods of time prior to the war involvement, a discrepancy in the outcome variable following the intervention is interpreted as produced by the intervention itself. The idea is that the future path of the synthetic control group, consisting of the λ-weighted average of all the control groups, mimics the path that would have been observed in the treatment group in the absence of the treatment.

In terms of time frame, we use as many pre-intervention years as possible to calibrate the synthetic control - depending on the data availability. Our treatment starts in 2001, as the American and British invasion of Afghanistan, called "Operation Enduring Freedom", was launched in October 2001 and the invasion of Iraq started 16 months later, in March 2003. We use 10-year post-intervention observations as the operation in Iraq ended officially in December 2011 (although the withdrawal slowly began in late 2009) while in 2011 the operation in Afghanistan was still ongoing. Ten years offer a reasonably large span to estimate the effect of intervention. The pool of potential comparison economies is made up by OECD countries which have not participated in the war in Iraq and Afghanistan. Given the large number of participants in the ISAF operation (48 countries), we also included countries with a nominal participation of less than 500 soldiers such as Sweden and

Belgium.[2] When the algorithm selects these countries in the control group, and we expect some significant effect in the same direction, the gap between treated and untreated would tend to be downwards biased. This approach does a better job at reproducing the characteristics of intervened countries than any single comparison country alone and makes explicit the contribution of each comparison unit to the counterfactual of interest.

The data on military spending are from SIPRI and cover the period 1988-2012. The data on public health spending, only available from 1994, per capita GDP as well as the remaining data, are taken from the World Bank. The demand for military spending is a function of its lagged values, the log of the total population, the log of per capita GDP, an indicator of total natural resource rents in % of GDP[3] and the rate of unemployment. The effect of population on the share of military expenditure in GDP is included as larger countries tend to be regional or global power and require larger defence forces (see e.g., Hewitt, 1992). GDP per capita is a measure of wealth and is expected to be positive as a state's capacity to tax and borrow increases with the level of development (see e.g., Albalate *et al.* , 2012). The unemployment rate captures the influence of the domestic business cycle. Finally, a number of recent studies have found that in some countries proceeds from oil and gas exploitation have boosted government revenues and freed up funds for military spending (Perlo-Freeman & Brauner, 2012; Cotet & Tsui, 2013). Given the small or absent within variation in institutional characteristics across countries over the period of interest, we refrain from including them. Likewise, we rely on the related literature on public health expenditure (see Potrafke, 2009), which takes into account the general economic situation, the situation of the labor market, and the demographic development. Therefore health expenditure can be explained by its own lags, the log of population, the log of per capita GDP, the age dependency ratio - which measures the burden of the non-productive population on the productive one - the fertility rate and the unemployment rate. In particular, the unemployment rate, the dependency ratio, the fertility rate and the size of the population measure social support requirements resulting from changes in population, in its age structures and in the labour market.

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[2] Notice that 500 is 0.6% of total US troops and 5% of the British contingent. Moreover, according to `iCasualties.org`, which is based on press releases from the US Department of Defense, these countries have not sustained any casualty.

[3] Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.

Finally, in order to construct a good synthetic trajectory of the per capita GDP we use its own lags, the gross fixed capital formation in % of GDP, which is a proxy for capital, the log of population and the percentage of labor force holding a tertiary education degree as indicator of human capital, the industry and services shares in total GDP, the unemployment and inflation rate, and a measure of total natural resource rents in % of GDP. This is a fairly standard set of economic growth predictors, which follows previous studies by e.g., Mankiw *et al.* (1992) and Abadie *et al.* (2012), but includes natural resources rent and the unemployment rate.

To see how the synthetic control method replicates the treated regions very closely in terms of initial outcomes and their main predictors, Tables 1-6 show the pre-treatment characteristics in the US and the UK, and in the corresponding synthetic controls during the sample period of our study. The notes of Tables also display the weight of each control country in the synthetic US and UK, according to the outcome of interest. For example, the weights reported indicate that the military burden in the US prior to the intervention is best reproduced by a combination of Israel (0.14), South Korea (0.55) and Norway (0.30). All other states in the donor pool are assigned zero weights. Only countries that are similar in both observed and unobserved determinants of the outcome variable as well as in the effect of those determinants on the outcome variable should produce similar trajectories of the outcome variable over extended periods of time.

Table 1. US military expenditure predictor means.

	USA	
Variables	Real	Synthetic
Average Military Expenditure (% GDP)	4.13	4.14
Log Population	19.35	16.56
Log per capita GDP	10.24	9.37
Natural rents	1.83	3.56
Unemployment rate	6.31	4.22
MSPE		0.28

NOTE: Control countries used for constructing the synthetic USA are Israel (0.14), South Korea (0.55) and Norway (0.30). All variables except lagged military expenditure are averaged for the 1988-2001 period.

Table 2. US public health expenditure predictor means.

Variables	USA	
	Real	Synthetic
Average Health Expenditure (% GDP)	5.96	5.96
Log Population	19.34	15.58
Log per capita GDP	10.24	9.86
Age dependency ratio	51.55	54.50
Fertility rate	1.94	1.86
Unemployment rate	6.31	7.88
MSPE		0.07

NOTE: Control countries used for constructing the synthetic USA are Finland (0.32), Ireland (0.23) and Sweden (0.44). All variables except lagged health expenditure are averaged for the 1995-2001 period.

Table 3. US per capita GDP predictor means.

Variables	USA	
	Real	Synthetic
Average per capita GDP	28262.26	28216.67
Log Population	19.34	15.50
Investment share	19.03	23.71
Industry share	28.00	34.20
Services share	70.01	61.13
Inflation	4.17	7.55
Labor force with tertiary education	34.30	28.08
Unemployment rate	6.31	3.78
Natural Rents	1.83	4.92
MSPE		387.07

NOTE: Control countries used for constructing the synthetic USA are Iceland (0.20), Japan (0.21), Norway (0.42) and Sweden (0.16). All variables except lagged per capita GDP are averaged for the 1980-2001 period.

Table 4. UK military expenditure predictor means.

Variables	UK	
	Real	Synthetic
Average Military Expenditure (% GDP)	3.16	3.19
Log Population	17.90	15.60
Log per capita GDP	9.88	9.95
Natural rents	2.52	6.19
Unemployment rate	8.43	5.53
MSPE		0.09

NOTE: Control countries used for constructing the synthetic UK are Belgium (0.22), Israel (0.11), Norway (0.54) and Portugal (0.12). All variables except lagged military expenditure are averaged for the 1988-2001 period.

Table 5. UK public health expenditure predictor means.

	UK	
Variables	Real	Synthetic
Average Health Expenditure (% GDP)	5.54	5.51
Log Population	17.846	15.00
Log per capita GDP	9.88	9.63
Age dependency ratio	53.70	50.85
Fertility rate	1.76	1.66
Unemployment rate	8.43	6.10
MSPE		0.09

NOTE: Control countries used for constructing the synthetic UK are Estonia (0.11), Greece (0.37), Luxembourg (0.20), Norway (0.23) and Slovak Republic (0.08). All variables except lagged health expenditure are averaged for the 1995-2001 period.

Table 6. UK per capita GDP predictor means.

	UK	
Variables	Real	Synthetic
Average per capita GDP	19929.76	19718.27
Log Population	17.86	16.55
Investment share	17.90	22.63
Industry share	33.75	33.52
Services share	64.57	61.10
Inflation	3.10	9.82
Labor force with tertiary education	23.27	25.50
Unemployment rate	8.43	6.95
Natural Rents	2.52	1.92
MSPE		397.0

NOTE: Control countries used for constructing the synthetic UK are Finland (0.16), Ireland (0.24), Japan (0.20), Mexico (0.15) and Sweden (0.24). All variables except lagged per capita GDP are averaged for the 1980-2001 period.

3 Results

Graphical evidence on the effect of war involvement is shown in Figure 1. In both countries the synthetic controls provide a very good fit. The only exception is in the US military spending in the period 1988-1992, where the military restructuring coinciding with the end of the Cold War makes it difficult for the algorithm to find a perfect counterfactual. Yet, on average, over the entire pre-intervention period, there is no divergence between the US and its synthetic. The magnitude of the impact on military spending is quite large. Panels (a) and (b) display a clear divergence: the difference between solid and dotted lines grows towards the end of the sample period with a slight sign of convergence in the US from 2010 on. In the US the military burden after 10 years is nearly 63% higher than its synthetic counterpart while in the UK the difference is smaller (i.e. 24% higher).Note that, despite the withdrawal of military forces from Iraq began in June 2009, there are not considerable reductions in military spending from 2009 to 2011. This is not surprisingly as military spending generally shows great inertia and reacts very slowly to changing strategic circumstances. Nordhaus *et al.* (2012) offer a number of explanations for this inertia, including the difficulties of downsizing or dismantling a system with a large overhead.

Interestingly, panels (c) and (d) on health spending reveal a slightly different path, which resembles a level shift from 2007 onward. In both countries, health spending at the end of the decade is about 15% higher than what it would have been in absence of a conflict. As pointed out in Table 7, it is not only the gap between the solid and the dotted line (i.e. the counterfactual) at the end of the decade that is the actual cost, but the cumulative stream of gaps. If we sum up the distances in military and health spending (in % of the GDP) between the US and its counterfactuals, we obtain a cost of 17% of the US GDP. This amounts to approximately $1.9 trillion when it is multiplied by the the post-treatment averaged GDP (in constant 2000$). In the UK the cumulative cost is little over 9% of the GDP, or $156 billion. Finally, we find a slight negative effect on per capita GDP in the US in the last three years, while the UK per capita income over the pre and post-intervention years is virtually identical to the artificial path.

One valid concern in the context of this study is the potential existence of spillover effects, in particular the possibility that the US involvement in the war had a substantial effect on the GDP of unexposed countries.[4] In particular, if the US military intervention had negative spillover effects on the per capita GDP of the countries included in the synthetic control, then the synthetic control would provide an underestimate of the counterfactual per capita GDP trajectory for the US in absence of war involvement. In this case, the negative effect of the US involvement on US per capita GDP would be mitigated. On the other hand, if US intervention had a positive effect in the economies included in the synthetic control, this would overestimate the (negative) effect of our estimates. Yet, as Abadie *et al.* (2012) point out, the limited number of countries in the synthetic control makes it possible to evaluate both the existence and the very direction of potential biases created by spillover effects. A visual inspection of the time series of per capita GDP of countries included in the synthetic control indicates that our finding with respect to US per capita GDP is likely to be an underestimation of the real impact of the intervention. Since war had a number of negative macroeconomic consequences such as increasing oil prices, the small impact we find on the GDP in the US might be the result of an underestimation of the artificial post-intervention outcome trajectory.

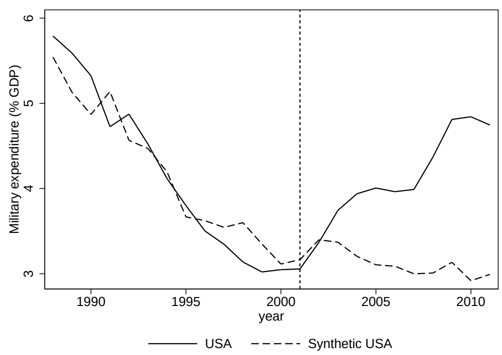
The synthetic control method enables us to conduct falsification exercises, the so-called "placebo studies", a permutation technique to make inference. The confidence on our estimates would be undermined if we obtained estimated impacts of similar or greater magnitudes in cases where the intervention did not take place. We sequentially apply the synthetic control algorithm to every country in the pool of potential controls and compare the placebos with the baseline results. Figure 2 shows placebo runs while leaving out countries with a MSPE greater than two times the MSPE of the treated country. The grey lines represent the gap associated with each of the runs of the test, i.e. the gap in military or health spending between each country in the donor pool and its synthetic version. The superimposed black line denotes the gap estimated for the US or the UK. As the figure makes apparent, the estimates for the US and the UK are large relative to the effects for countries chosen at random. None of the fake experiments in the potential controls is above US military spending, while only one permutation (out of 12) - that is Finland - is above UK military spending 10 years after the treatment. Placebo studies for health spending show that less than 10% of the permutations are above

[4] This issue is much less relevant for the the UK per capita GDP, if one considers the UK a small open economy.

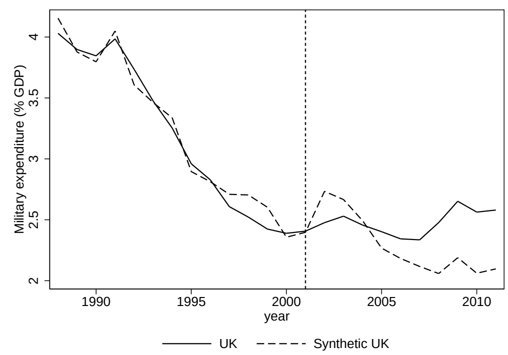
the treated countries. The test validates the robustness of our results (see Billmeier & Nannicini, 2013, for a recent application).

However, the effect on the GDP is not particularly robust to placebo testing, as most of the permutations are either above or almost identical with the baseline effect in both countries. This may suggest either multiplier close to zero i.e. the military expenditure crowds out other components of GDP (see Smith, 2013) or positive fiscal multipliers offset by negative war effects such as increased oil prices. While Barro & Redlick (2011) find a multiplier of 0.7 on average, our result are in line with Aksoy & Melina (2012) who do not find any Granger causality between defense spending and real output variations in US data. To further exclude the possibility of a significant effect of war involvement on US per capita GDP, we perform two additional inferential exercises. We look at the distribution of the ratios of post/pre-intervention mean squared prediction error for the US and a number of unexposed countries and perform a Chow test on the difference between the actual and synthetic GDP time series over the treatment period. These results are available upon request and show no evidence of a significant impact of war on US GDP.[5]

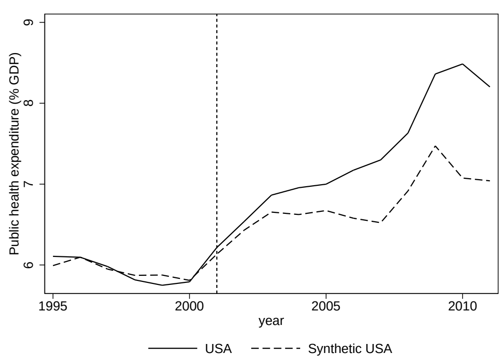
[5] In fact, the distribution of the ratios post/pre-intervention MSPE shows that the ratio for the US is smaller than the ratios of other control countries i.e., if one were to assign the war involvement at random in the data, it is very likely to find a post/pre intervention MSPE ratio at least as large as that of the US. Moreover, the Chow test suggest that we can reject the null hypothesis of no impact only in 2007 and 2008, although it is difficult to claim that this is solely due to the intervention.



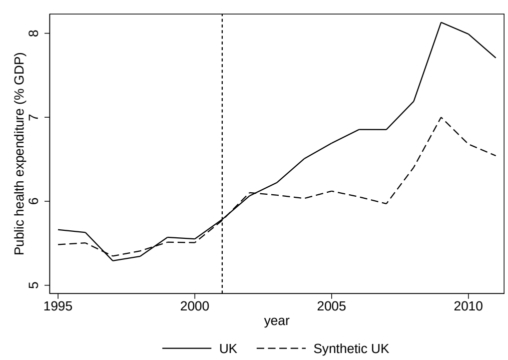
(a) US Military Spending



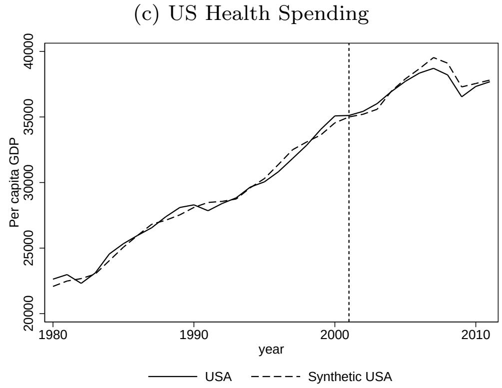
(b) UK Military Spending



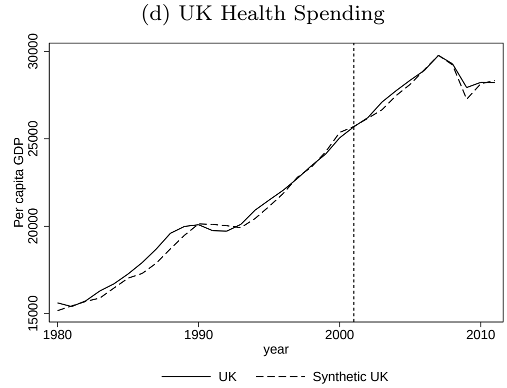
(c) US Health Spending



(d) UK Health Spending

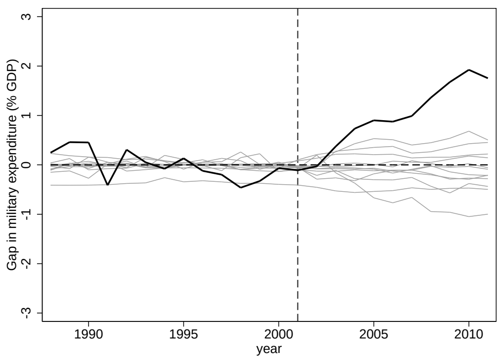


(e) US Per Capita GDP

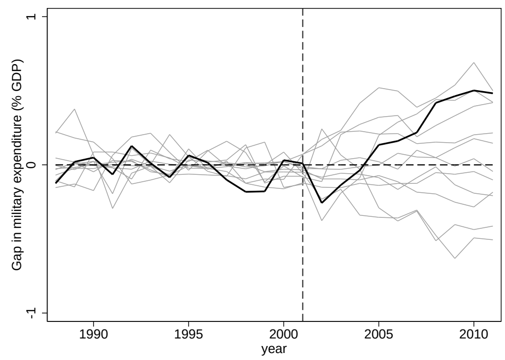


(f) UK Per Capita GDP

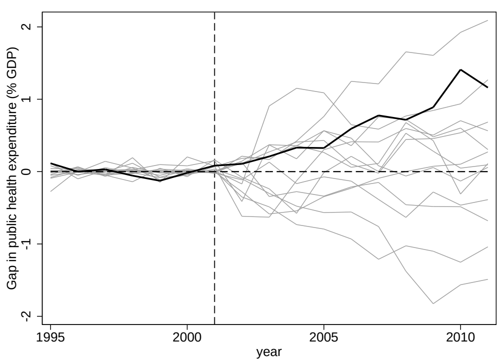
Figure 1. Macroeconomic Trends: Treated Country vs. Synthetic Control



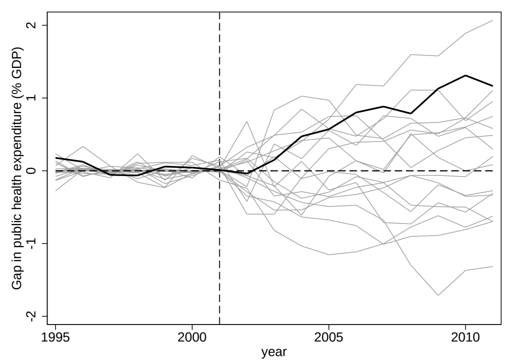
(a) US Military Spending



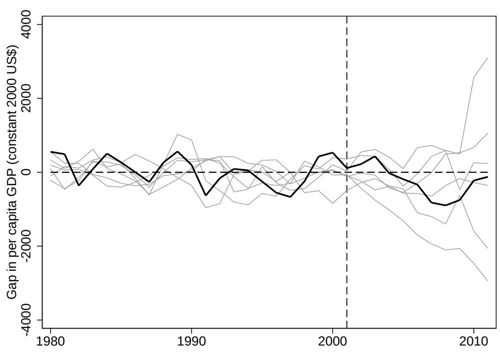
(b) UK Military Spending



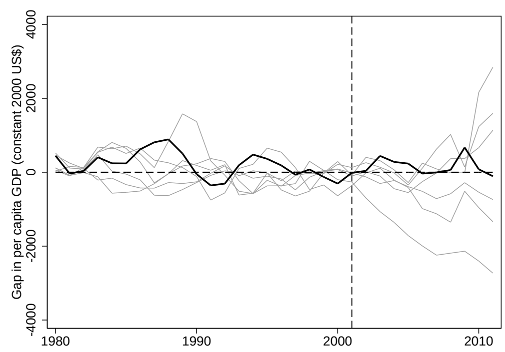
(c) US Health Spending



(d) UK Health Spending



(e) US Per Capita GDP



(f) UK Per Capita GDP

Figure 2. Placebo Experiments

Table 7. Average and cumulative costs in % of GDP.

	USA		UK	
	Military exp	Health exp.	Military exp.	Health exp.
2001	-0.1	0.1	0.0	0.0
2002	0.0	0.1	-0.3	0.0
2003	0.4	0.2	-0.1	0.1
2004	0.7	0.3	0.0	0.5
2005	0.9	0.3	0.1	0.6
2006	0.9	0.6	0.2	0.8
2007	1.0	0.8	0.2	0.9
2008	1.4	0.7	0.4	0.8
2009	1.7	0.9	0.5	1.1
2010	1.9	1.4	0.5	1.3
2011	1.8	1.2	0.5	1.2
Sum	10,5	6,6	2,0	7,2
Average	0,9	0,6	0,2	0,7

Source: Authors' own calculations.

4 Conclusions

Wars have important macroeconomic dimensions. To quantify the military and social costs of the American and British intervention in the war in Afghanistan and Iraq one must estimate the difference between future military spending that would occur anyway due to perceived threats and those costs resulting from the deployment. Similarly, routine health care costs or business cycles in government spending should not be counted as part of war costs because they would have occurred in any event. We construct the counterfactual as a linear combination of countries that are similar to the UK and US along pre-intervention realizations of the outcomes and traditional covariates. Three results emerge: while the UK and the US have experienced similar relative increases in health spending, especially towards the end of the 10-year window, the effect on military spending is much more pronounced in the US. We find that the combined cumulative costs amount to more than 17% of the US GDP and more than 9% of the UK GDP. Second, there are no robust signs of a convergence between the true and counterfactual levels of military spending while health spending shows a level shift in the last five years in both countries. Third, there is no evidence of changes in the national income following the sharp increase in government spending.

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