The Price of War

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Abstract

We assemble a new data set spanning more than 150 years and 60 countries to study the economic impact of interstate war. The economic costs of war are not confined to the war site, where output on average declines by 20 percent and inflation increases persistently by almost 10 percentage points. There are strong spillovers to nearby countries which decline with geographic distance—both for belligerent and third countries. We rationalize these patterns in an international business cycle model: As war destroys the productive capacity of the war site, trade with nearby economies collapses, generating an endogenous supply-side contraction abroad.

JEL Classification: E30, F40, F50

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*We wish to dedicate this paper to Philippe Martin who discussed it at the Kiel-CEPR Geoeconomics Conference in Berlin before his untimely death in December 2023. Federle: Kiel Institute (email: jonathan.federle@ifw-kiel.de); Meier: Tudor Capital Europe LLP (email: Andre.Meier@alumni.eui.eu); Müller: Department of Economics, University of Tübingen, CEPR and CESifo (email: gernot.mueller@uni-tuebingen.de). Mutschler: Department of Economics, University of Tübingen, and Dynare Team (email: willi@mutschler.eu). Schularick: Kiel Institute, Sciences Po, and CEPR (email: moritz.schularick@sciencespo.fr). Mutschler acknowledges financial support from the Deutsche Forschungsgemeinschaft (DFG) through Grant No. 411754673. We thank our discussants Alessandra Bonfiglioli, Luca Dedola, Philippe Martin, Valerie Ramey, and Ansgar Rannenberg, as well as Yuriy Gorodnichenko, Ralph Luetticke, Thierry Mayer, Timothy Meyer, Mathias Thoenig, and Christian Wolf for very helpful comments. Sven Eis, Kevin Klein, Teun de Koning, Maximilian Reinhard, and Georg Roesel provided excellent research assistance. The ususal disclaimer applies.

You may not be interested in war, but war is interested in you.
Leon Trotsky

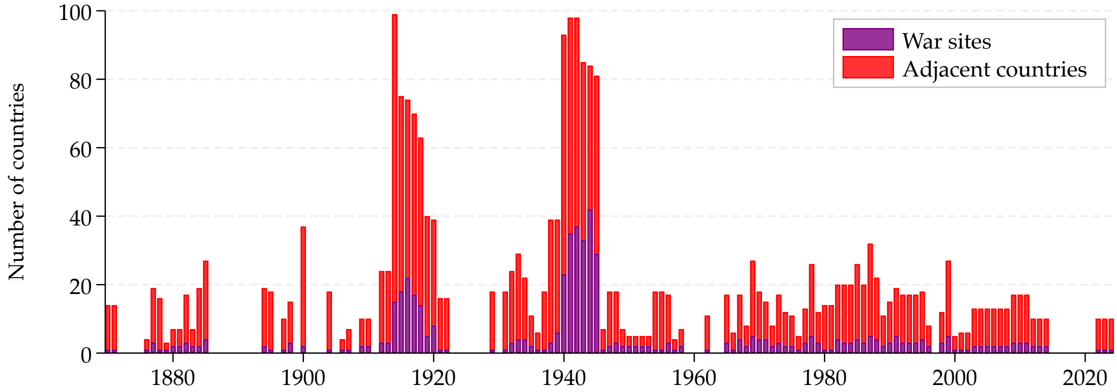
1 Introduction

The global political and economic landscape is undergoing profound changes. Geopolitical tensions are rising and military conflicts are recurrent events. Wars cause death and destruction, disrupt trade, and wreak havoc on public finances. They also affect the macroeconomy at large: Many of the large economic disasters during the last century are related to wars on a country's own soil (Barro, 2006). However, as we show in this paper, the adverse economic impact of war is not confined to the war site. The economies of other belligerent countries and, importantly, those of third countries are affected by war, too.

To establish this result, we put together a new data set that spans 150 years and observations for 60 countries. It contains information on wars, including the war sites, but also key macroeconomic indicators. We estimate local projections to quantify the impact of the *average* war in our sample. It lowers output by 20 percent and raises inflation by almost 10 percentage points in the *war-site* economy. To estimate economic spillovers of war on other economies, we condition on geographic distance and the size of the war site. In *third* countries that are close to a war site, output falls by about 1 percent for each percent of world output located in the country that is the war site. For instance, if the war site economy accounts for 5 percent of global output, the economies of its neighbors shrinks by about 5 percent and inflation increases by 8 percentage points. These spillovers decline sharply with geographic distance. For *belligerent* countries, the effects are similar, but the output effects can even turn positive if the distance from the war site is large.

We rationalize these patterns in a multi-country business cycle model which accounts for distance by allowing for different levels of trade integration among countries. In the model, war destroys productive capacity and triggers a military buildup in the war-site economy. The calibrated model successfully replicates the key patterns in the data and offers a plausible account of how the economic impact of war spreads across the globe. A key insight is that the exogenous supply-side disruption in the war site endogenously generates a supply-side contraction abroad. Belligerent countries, if far away from the war site, enjoy a boom due to increased military spending. In the model, monetary policy accommodates the war shock, thus contributing to its inflationary impact.

Figure 1: War sites and adjacent countries



Source: Correlates of War Project (Stinnett et al., 2002), classification based on 2016 borders.

Understanding the global economic repercussions of war is important because while war on a country's territory is a rare event, economies are frequently exposed to the negative spillovers from war in their neighborhood. Figure 1 illustrates this basic fact. It shows that in our sample, the frequency with which a country is a war site in a given year is very low at 2.4%. In contrast, the frequency with which a country is adjacent to a war site is much higher at 11.4%, and more than twice as high as the (unconditional) frequency of financial crises (Schularick and Taylor, 2012). Exposure to war occurs almost at business cycle frequency but remains an understudied source of shocks in the international economy.

Our data set brings together data from the *Correlates of War* (COW) project and macroeconomic time series from the *Jorda-Schularick-Taylor Macrohistory Database* (Jordà, Schularick and Taylor, 2017), augmented in Funke, Schularick and Trebesch (2023). We add to these data, as we geolocate 224 country-year observations for war sites, based on granular battle-level data. Both the classification of countries as war sites and the macroeconomic indicators are based on today's borders. We further distinguish spillovers from the war site to belligerent and third countries. For both we show how their strength and, in case of belligerents, even their sign depends on geographic distance.

While we consider the impact of war on a range of macroeconomic indicators, we take a business-cycle perspective and focus on GDP and inflation. Yet we acknowledge that these are incomplete measures for the economic costs of war and its implications for human welfare. We neglect, for instance, the fiscal burden of war and, because we lack sufficiently granular data, we cannot explore how the composition of GDP changes in wars and how private consumption—arguably a better measure of economic welfare—is affected.

We show that our results are robust along a number of dimensions and provide further evidence that is suggestive of the transmission channels through which war impacts the global economy. In particular, we show for the war site that war reduces the capital stock, lowers productivity substantially, and raises military expenditures. Moreover, it induces a severe trade contraction in the war site and in third countries. In particular, third countries close to the war site see their imports and exports contract by several percentage points of pre-war GDP.

We argue that the empirical patterns that we document support a causal interpretation. We narratively identify, in each individual case and based on a variety of sources, the *casus belli*, or the primary causes and motives behind a given war. The overwhelming majority of wars are linked to nationalist, ideological, or historical causes that are plausibly exogenous to the state of the business cycle. We also acknowledge that specific economic factors may play a role in the decision to go to war—for instance, disputes over natural resources or wars in the context of colonial expansion, as famously argued by Lenin (1917). Yet even then, these economic motivations appear largely orthogonal to the (short-term) business cycle, considering that they concern medium- to long-run objectives and that the outcome of war is typically uncertain. We also verify that economic growth in the war-site economy is neither systematically lower prior to the start of the war nor correlated with its military strength. We are thus confident that the strong decline in output that we document for the war-site economy is indeed caused by the war and does not reflect a selection effect due to an increased likelihood of being attacked as the economy weakens.

To provide a structural interpretation of our empirical results, we set up a business-cycle model of the global economy, building on earlier work by Gopinath et al. (2020) and Eichenbaum, Johannsen and Rebelo (2021). Its multi-country structure permits us to study the impact of war in the war-site economy, but also in third countries, distinguishing further between *Nearby* and *Distant*. These differ in terms of their trade integration with the *War site*, a proxy for geographic distance. To specify the war shock, we draw on earlier work on rare disasters (Gourio, 2012). Specifically, we assume that the war shock destroys a part of the capital stock, lowers productivity, and prompts an increase of military spending in the war-site economy—and only there. Monetary policy accommodates the war shock by increasing the money supply. To pin down parameter values, we match the impulse response functions using a Bayesian approach.[1]

[1]As a technical contribution, we extend the method-of-moments toolbox in Dynare to include

The model provides a quantitatively successful account for the adjustment dynamics, also for those variables that are not targeted. According to the model, spillovers operate through trade and depend on the degree of trade integration. The war-site economy suffers from a large supply-side contraction which spills over to *Nearby* because, as *War site*'s goods become scarce and expensive, *Nearby* reduces imports from *War site* considerably. The use of intermediate goods, which feature a sizeable import component, cannot be maintained, and as a result, production in *Nearby* also declines. In addition, the capital stock in the nearby economy declines endogenously. The resulting supply-side contraction, both in the war-site and the nearby economy, together with the monetary accommodation of the war accounts for the surge of inflation.

The adverse spillovers are weaker in *Distant* because there is much less trade with the *War site* to begin with. For an extended version of the model that includes belligerent countries alongside third countries, we show that increased military spending explains the output expansion observed in belligerent countries that are far away from the *War site*. Overall, we find that the model offers a credible explanation for the war's impact on the *War site* and the spillovers to other countries. It not only offers additional insights into the transmission mechanism but also serves as a useful plausibility check for our empirical results, even from a quantitative point of view.

The paper is structured as follows. In the remainder of this section, we discuss the related literature and clarify the contribution of our paper. Section 2 details the construction of our data set, notably the specification of war sites and the classification of the casus belli. Section 3 introduces our empirical framework and presents results. In Section 4, we outline our business cycle model, describe its calibration, and report simulation results. Section 5 concludes.

Related literature. Our paper relates to several strands of the literature. First, there is work on the economic impact of war on countries that are directly involved. Economic historians, in particular, have studied the inflationary impact and the economic damage caused by specific wars, as well as the human and economic costs of sustaining the war effort in the belligerent countries (e.g., Oliver, 1941; Harrison, 1998; Davis and Weinstein, 2002; Tooze, 2006). Interestingly, the literature has struggled to document an adverse effect of war on growth (Barro

formal Impulse Response Matching capabilities as per Christiano, Trabandt and Walentin (2010). This feature is part of the 6.0 release of Dynare (Adjemian et al., 2024).

and Lee, 1994; Acemoglu, Johnson and Robinson, 2005).[2] The expansion of GDP in the U.S. and U.K. during both world wars has been attributed to the strong increase in military expenditures (Braun and McGrattan, 1993; Ilzetzki, 2024). Limiting the analysis to belligerent countries, Caplan (2002) distinguishes the growth effect of domestic and foreign wars, the latter being defined as wars that are fought abroad: domestic wars lower growth, while foreign wars are mildly expansionary. Likewise, Chupilkin and Kóczán (2022) document that wars on a country's territory reduce economic activity. Auray and Eyquem (2019) estimate a DSGE model on time series data for the two World Wars. What sets our paper apart from these papers is our focus on the macroeconomic spillovers of war.

In this regard, a second strand of the literature is relevant. It investigates the adverse impact of war on trade and production networks (Glick and Taylor, 2010; Qureshi, 2013; Couttenier, Monnet and Piemontese, 2022; Korovkin and Makarin, 2023). Our results are consistent with the findings of this literature, although our perspective is broader. Ex ante, we do not constrain spillovers to operate only via trade. Complementary work connects the probability of conflict with trade and trade agreements (Martin, Mayer and Thoenig, 2008, 2012), while Konrad and Morath (2023) emphasize in their theory of alliance formation that the collateral damage of war is greatest in front-line states—those most at risk of becoming war sites. Third, the role of geographic distance as a determinant of conflict spillovers has been highlighted in earlier work, though with a distinct focus on civil war and ethnic conflict (Murdoch and Sandler, 2002, 2004; Mueller, Rohner and Schönholzer, 2022).

Fourth, the market response to conflict has been analyzed in some detail, also with a view to the role of geographic distance (Leigh, Wolfers and Zitzewitz, 2003; Guidolin and La Ferrara, 2007; Zussman, Zussman and Nielsen, 2008; Verdickt, 2020; Caldara and Iacoviello, 2022; Federle et al., 2022). Our analysis differs from these latter studies because we study the macroeconomic ramifications of actual wars. Last, we build on earlier efforts to model rare disasters (including wars) already referenced above. In this regard, we share the open-economy perspective of Farhi and Gabaix (2016). In contrast to them, we bring to the fore what determines the economic spillovers of wars on countries that are not war sites but potentially exposed via close geographic proximity.

[2]There is consensus about the negative growth effects of conflict more generally (see, for instance, Abadie and Gardeazabal, 2003; Novta and Pugacheva, 2021; de Groot et al., 2022), or for global and very large wars (Rasler and Thompson, 1985; Thies and Baum, 2020). Blomberg and Hess (2012) document that consumption drops strongly in response to small wars, whether initiated at home or abroad.

2 Data, basic facts, and identification

In this section, we introduce our data and present some basic statistics. We also narratively classify the wars in our sample according to their *casus belli*.

2.1 War sites

Our sample covers annual observations for the period 1870–2023 for an unbalanced panel of 60 countries. The beginning of the sample period is constrained by the availability of comprehensive time-series data for macroeconomic outcomes.

To identify wars for our sample, we build on the *Correlates of War* (COW) project (Sarkees and Wayman, 2010). COW provides data on interstate wars for the period from 1816 to 2007. These wars are defined as "sustained combat involving regular armed forces on both sides and at least 1,000 battle-related fatalities among all of the system members involved". For the more recent years within our sample period, we note that there were no interstate wars that meet this criterion between 2008 and the Russian invasion of Ukraine in 2022. We verify this using the database of the *Uppsala Conflict Data Program* (UCDP), see Gleditsch et al. (2002); Davies, Pettersson and Öberg (2022).[3]

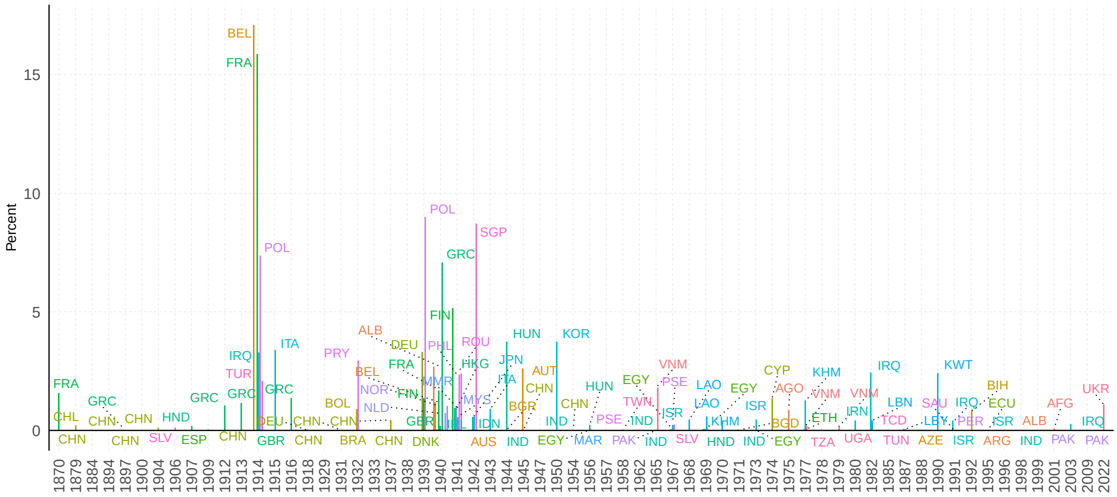
Our analysis is centered around the notion of "war sites"; that is, countries that experience military action on their own soil. Further, we allow for the possibility that the economic impact of war may not be confined to the war site. This leads us to classify, in a first step, other countries in their relation to the war as either "Belligerent" or "Third" countries: belligerent countries participate in the war without being a war site, while third countries are not party to the war at all. In a second step, we determine the geographic distance of these countries from the war to study spillovers systematically.

The COW project does not provide information on where a given war takes place. In order to identify war sites, we consult additional sources and determine the geographical location of the military action. Again, we proceed in two steps. First, we disaggregate wars to the battle level based on information in the warfare encyclopedia by Clodfelter (2017). As a result, we are able to identify 1,625 different battles for which we code the geolocation.[4] Using the

[3]The definition of war according to UCDP is somewhat more restrictive: It classifies as wars all conflicts with at least 1,000 battle-related deaths in a given year, as opposed to deaths over the course of the entire war as in COW. We note, however, that all wars in the COW data set that lasted longer than a year also caused more than 1,000 battle-related deaths per year.

[4]In some instances, the available information is less granular than what we would ideally like to have. For instance, for the Kargil war, we only have aggregate numbers of casualties for the

Figure 2: The casualties of war



Note: Total casualties (dead, missing, wounded, prisoners of war) aggregated over battles to country level, measured in percent of pre-war population of war site; associated with the start of the war. Sample restricted to 112 war sites for which pre-war population data available in Maddison Project database (Bolt et al., 2018).

same sources, we obtain—for each battle—estimates for the number of casualties. Casualties include the number of dead, missing, wounded, and prisoners of war captured in the battles. The largest battle in our sample is the Brusilov Offensive during World War I, which is associated with more than 1 million casualties. Other well-known battles, such as the Battle of Wuhan and the Battle of Verdun, also rank among the bloodiest in our sample.

We aggregate the casualties for each battle to the country level to locate the war sites in our sample.[5] The number of casualties in a war—once measured in terms of the pre-war population of the war site—provides us with a quantitative measure of the severity of the war. Figure 2 illustrates how this variable evolves over time for the countries in our sample for which population data are available. Unsurprisingly, the most severe cases are clustered around the two world wars. The single most severe war according to this measure starts in 1914 in Belgium, which suffered massive destruction and loss of life during World War I as French and German armies were engaged in a war of attrition. Other particularly severe cases include France in World War I and Poland in World War II. As a caveat, we note that the number of human casualties, like other candidate statistics, is an imperfect measure of the destructive force of war. As the nature of warfare keeps changing over time, the association between casualties and the overall severity of

border area of Pakistan and India.

[5]In case a battlefield extends over the territory of several countries, we assign the casualties in equal shares to all countries.

Table 1: Summary statistics for war sites

Wars	Casualties		Length		Macro time series for...		
Total	Min	Mean	Mean	Median	Sites	Belligerents	Third
224	2	220,134	2.5	2	86	122	2,525

Note: Length is duration of war in years. Macro time series refers to availability of inflation data in years of war onsets across sites, belligerents, and third countries. For coverage of other variables, see Table A.3 in the appendix.

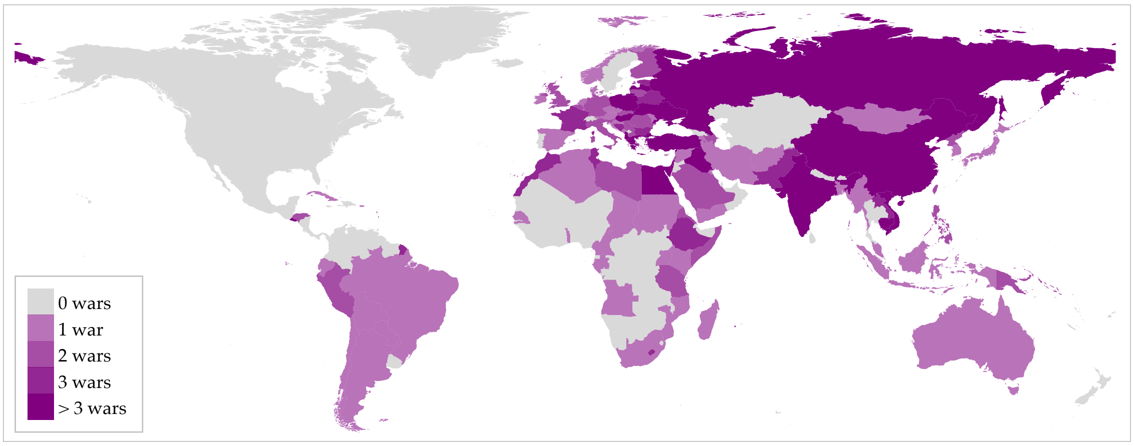
war is also subject to change. In our baseline specification, we therefore do not attempt to account for the severity of the war via casualty numbers but merely use them to identify war sites. Nevertheless, as we illustrate below, the casualty measure can provide valuable information as we gauge the economic impact of war.

In aggregating to the country level, we follow the approach of Conte et al. (2022) and code according to the country definitions provided by the CIA World Factbook. That is, we rely on today's borders so that we can study macroeconomic outcomes associated with a war in a geographically consistent manner. To exemplify the issue, consider the Italian-Turkish War of 1911. It was fought between the Ottoman Empire and Italy but major warfare mostly took place in modern-day Libya rather than in Turkey or Italy. Since our macroeconomic indicators consistently refer to modern-day national borders, we code Libya as the war site and modern-day Italy and Turkey as belligerents. The U.S. also experienced combat on its own soil during World War II: there were several battles on the Aleutian Islands, a group of islands belonging to Alaska, Guam as well as the Japanese attack on Pearl Harbor in Hawaii, and combat on Guam, a U.S. territory in the Pacific. These isolated incidents illustrate that military action does not, in all cases, cause meaningful economic effects. In our baseline, we thus drop all naval battles as well as those taking place on remote islands. In this way, we focus on those countries experiencing material destruction on their core territory. Table A.1 in the appendix lists the war sites in our sample.

We further cross-check our war-site coding by consulting GPT-4. As a large language model, it is trained on huge corpora of texts, including historical accounts of wars. We leverage this fact and systematically consult the GPT-4 API to identify the countries in which major battles took place and compare the outcomes with our own coding.[6] The Pearson correlation with our coding is 0.72

[6]For each war, we ask GPT-4 "*Which countries suffered major battles on their own territory during the war '*' which started in *? Consider modern-day borders. Specifically, even if a state did not exist at*

Figure 3: Geographical distribution of war sites



Note: Colors indicate number of wars that took place on a country's soil for the period 1870–2023.

and highly significant (p-value < 0.001). In total, GPT-4 identifies 60 countries as war sites that we had not previously identified among the 224 countries in our coding. Because large language models tend to hallucinate, we systematically search for corroborating evidence on these countries and are able to find some documentation of actual fighting in five of the proposed additional war sites. We include these countries in our war-site coding, see Table A.2 for an overview.

Table 1 provides summary statistics. For the period 1870–2023 we end up with 224 country-year observations for when a war starts on a country's soil, with an average duration of 2.5 years and an average number of casualties of 220,000. Given data availability constraints, this translates into 86 country-year observations (sites), along with 122 corresponding observations for belligerents and 2,525 for third countries. Table A.3 in the appendix provides details on how the data coverage varies across variables.

The map in Figure 3 shows the geographical distribution of war sites in our sample: the darker a country is shaded, the more often it has experienced a war on its own soil. We observe war sites to be distributed across the world, with some clustering in Europe, the Middle East, and Asia. In our formal analysis below, we relate the spillover effects of war on other countries to their geographic distance from the war site. Drawing on Mayer and Zignago (2011), we define the distance in kilometers between the most populated cities across any two countries, again in terms of today's borders. The largest distance between

the time of the war, refer to it by its current name within today's borders. For example, if there was a war in 1870 within modern-day Libya, please refer to it as having taken place in Libya instead of referring to it as the Ottoman Empire. It is crucial that you only provide the ISO-3 codes of the countries and nothing else, as your response is being parsed as a CSV." Parameters of GPT-4 requests were: temperature (0), max_tokens (256), top_p (1), frequency_penalty (0), presence_penalty (0).

two economies in our sample is 19,930 km, which corresponds to the distance between Paraguay and modern-day Taiwan during the 1932 Chaco war.

2.2 Time-series data

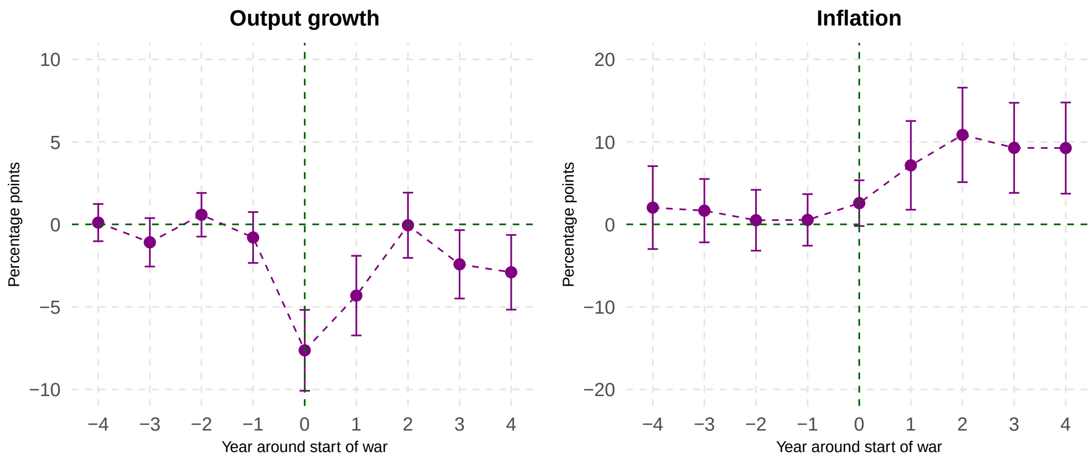
We obtain time-series data for output and inflation from the *Macrohistory* database, which covers 18 advanced countries starting in 1870 (Jordà, Schularick and Taylor, 2017). This database, in turn, is constructed from a number of sources, including Bolt and van Zanden (2014). These sources typically make adjustments for changing borders so that the data refer to current borders; see, for instance, Maddison (1995). We complement the *Macrohistory* database with time series for additional countries from various sources (World Bank, 2022; Funke, Schularick and Trebesch, 2023) which, in turn, build on Ursùa and Barro (2010) and Bolt et al. (2018). These sources provide us with data for GDP in per capita terms. For our analysis, we compute an aggregate output measure to account for changes in the population during wars. In so doing, we rely on population data for the territories that define countries today (Bolt and van Zanden, 2014).[7] The same sources provide us with a measure of consumer price inflation. We also obtain data on total factor productivity, labor, and capital stocks from the Long-Term Productivity Database (Bergeaud, Cette and Lecat, 2016). Data on military expenditure, employment in the military, and a composite index of military strength are provided by the COW project (Singer et al., 1972; Singer, 1988).[8] Lastly, we source bilateral trade data from Barbieri, Keshk and Pollins (2009) and Barbieri and Keshk (2016). Table A.4 offers an overview of the times-series data, our sources, and basic transformations of the data.

Figure 4 shows the average economic performance in war sites in an eight-year window centered around the start of the war in the war site. In the left panel, we display output growth, measured in differences relative to a country's average. We find that output growth falls short of the average by 7-8 percentage points in the year the war starts. In the following years, there is still a significant growth shortfall. Prior to the war, output growth is not systematically lower. We show data for inflation in the right panel of the same figure. Again, there is no systematic deviation from average inflation prior to the start of the war. But once the war starts, inflation is systematically higher. Overall, the data do not point to

[7]Although Bolt and van Zanden (2014) mostly refer to 1998 boundaries, these have only changed to a small extent since (Schvitz et al., 2022).

[8]COW documents variables for historically existing states. In the few cases where states have dissolved into multiple other states, we assume the numbers pertain to its largest successor.

Figure 4: Economic performance in war sites around start of war



Note: Sample period 1870–2023. Average output growth and inflation in the war site around the start of war (in the war site), measured in percentage-point deviations from country means. Whiskers indicate 90% confidence intervals.

sizeable anticipation effects, consistent with Ferguson (2008). Taking a financial markets perspective he illustrates the difficulties of investors to anticipate (the economic impact) of the world wars.

2.3 The casus belli: a narrative classification

In the empirical analysis below, we seek to identify the macroeconomic effect of wars at a business cycle frequency. For this purpose, we assume that wars are largely exogenous to the business cycle. A similar assumption is typically invoked for military spending in the literature on the fiscal transmission mechanism (see, for instance, Barro and Redlick, 2011; Ramey, 2011; Miyamoto, Nguyen and Sheremirov, 2019). It is also consistent with theories in political science which discuss the causes of war in terms of power struggle or power transition (for instance, Organski and Kugler, 1980; Lebow, 2010). The business cycle does not feature in these accounts. However, there is some specific evidence for the U.S., whereby U.S. presidents have been more likely to deploy military force in times of "economic misery" (Ostrom and Job, 1986) and during recessions—provided they were up for reelection (Hess and Orphanides, 1995), notably in the post-WW2 period. For the purposes of our exercise, we may disregard this evidence because the U.S. never became a war site during this period. Still, we need to consider the possibility of short-term cyclical considerations driving decisions to go to war and investigate how representative the available U.S. evidence may be. To this end, we use narrative records to classify the apparent *casus belli* for all the

Table 2: Reasons for going to war

Reason	Explanation	# Wars
Nationalism	Creation of own sovereign state, wars for independence, imperialism	46
Power Transition or Security Dilemma	A rising power challenges a dominant one. Classic examples of the security dilemma in action are situations, where measures taken by one country to increase its security lead others to feel less secure and to take countermeasures, resulting in increased tensions that can lead to war.	33
Religion or Ideology	Deep-rooted disagreements over religious beliefs or ideologies (e.g., communism)	23
Border Clashes	Unclear borders or intensifying border clashes	15
Economic, Long-Run	States might go to war to gain control over trade routes, markets, or valuable resources; economic rivalry and protectionism	10
Domestic Politics	Leaders may use foreign war to distract from domestic political issues or to rally their population around a common cause	8
Revenge/Retribution	Wars can be initiated in response to perceived wrongs or to regain lost honor, even if there's no tangible gain to be had	3
Economic, Short-Run	The economy is in a severe recession (e.g., unemployment is high)	2

Note: Some wars have multiple causes, which is why sum of war reasons in table exceeds total number of wars in our sample. Reasons were identified using various sources; see Table D.1.

wars in our sample.

To classify wars, we use categories from the warfare encyclopedias by Clodfelter (2017) and Sarkees and Wayman (2010), while also cross-referencing numerous other sources for verification, see Table D.1 for additional details. Countries go to war for a variety of reasons, and we do not restrict them to be mutually exclusive. As we try to determine the reasons for going to war, our reading of the historical records results in an average of two main reasons per war. Table 2 lists the results of our classification based on eight distinct categories. In the right-most column, we report the number of wars which fall into each category.

Nationalism and power transitions rank among the top reasons for going to war. Importantly, although we find that countries also pursued economic objectives in several wars, these pertain mostly to long-run outcomes, such as gaining control over trade routes or securing natural resources. Such long-run objectives should be largely orthogonal to the business cycle, as has been similarly argued in the influential study on the effects of tax shocks by Romer and Romer (2010). In our sample, we identify only two wars in which short-term economic factors seem to have played a key role. These are the Boxer Rebellion of 1900 and the

Italo-Turkish War of 1911. In the first case, religion and nationalism were key aspects, but so were adverse economic conditions. Likewise, in the second case, nationalism or, more specifically, colonialism was key. However, dire economic conditions in Italy, as reflected in mass emigration in the decade prior to the war, were arguably also conducive to the war. Hence, we drop both of these wars from our sample.

One additional potential concern needs to be addressed, as we seek to estimate the business-cycle impact of war on the war site: Whether a country becomes a war site or not might also depend on its own economic performance; and to the extent that a weaker economy is more likely to be attacked, our estimates might be biased by a selection effect. We make two observations on this concern. First, the business cycle is a weak correlate of a country's military strength. To elucidate this point, we regress the log of military strength on the log of output and on output growth, respectively, while accounting for both country and year fixed effects. We find the correlation of military strength with output to be significant, whereas the correlation with output growth is not.[9]

Second, if, nonetheless, an economy's cyclical weakening—say, because of an ongoing war or for other reasons—might represent a factor favoring an attack from abroad, we should expect to see some evidence of such weakening in the data preceding the attack. Our data do not support this hypothesis, as can be seen from the left panel of Figure 4 above: Output growth is not systematically lower in war sites before the start of the war. Importantly, this applies even with respect to some of the largest wars in history where military and economic success might be regarded as closely intertwined. For instance, Japan, which entered World War II in 1940, did not experience a major growth slowdown until 1944, when it became a war site. Germany, in turn, experienced above-average growth up until 1944.[10]

[9]This matches our prior that business cycle fluctuations are unlikely to be significant enough to affect an adversary's calculation on the odds of success of a military campaign. We report these results in Table A.5. In our robustness analysis below, we also explicitly control for military strength and find the results basically unchanged with respect to our baseline specification.

[10]According to our definition, Germany became a war site in 1939 because the first casualties on German soil are recorded in 1939 as part of several partisan campaigns; in 1940 the British air force bombed Berlin in response to the Battle of Britain.

3 The macroeconomic consequences of war

In this section, we establish the consequences of war for the war-site economy. In addition, we document sizeable macroeconomic spillovers to other countries. We first introduce our empirical framework and then present the results for a range of variables and a number of specifications.

3.1 Empirical framework

We take a business cycle perspective and focus on how war affects output and inflation. In terms of identification, we rely on the notion—established via narrative analysis above—that the wars in our sample are exogenous to the business cycle. Importantly, we seek to identify the effect of the *start* of the war and how this effect plays out over time. In this context, we think of the onset of war as a *shock* to the economy. Recall from Section 2.2 that there is indeed little evidence that wars are anticipated via early moves in either growth or inflation. By focusing on the dynamic effects of (or impulse responses to) the initial war shock, we do not rule out possible feedback effects from the macroeconomic consequences of the war to the ability of the warring parties to mobilize the necessary resources to keep the war going. Similarly, we do not rule out that war alters long-term economic prospects. Our identification strategy only requires the start of the war to be exogenous to the business cycle of the war-site economy.[11]

Based on these considerations, we estimate a set of local projections as in Jordà (2005) to trace the macroeconomic effects of war over time. We first contrast the effect in the war-site economy and in third countries. We show that geographic distance is a key determinant of the spillovers from the former to the latter. Second, we establish that a similar pattern applies to belligerent countries, too.

Linear specification Formally, using i to index countries and h the number of years since the start of the war in year t, we let $x_{i,t+h}$ denote a generic outcome variable and estimate the following "linear specification":

$$x_{i,t+h} - x_{i,t-1} = \alpha_{i,h} + \gamma_h Site_{i,t} + \psi_h Third_{i,t} + \zeta_h' Controls_{i,t} + u_{i,t+h} \,. \tag{3.1}$$

$Site_{i,t}$ is a dummy variable that assumes a value of 1 if country i turns into a war site in year t such that the coefficients γ_h capture the effect of the *average* war

[11]This assumption does not conflict with the evidence put forward by Ostrom and Job (1986) and Hess and Orphanides (1995) for the U.S. since it has never been a war site.

on the war-site economy at horizon $h = 0, 1, \ldots$ since the start of the war. Note that our specification is agnostic about the duration of the war. It recovers the average effect over time of a war which starts in year t, that is from year t to year $t + h$.

$Third_{i,t}$, in turn, measures the economic exposure of country i to wars that take place elsewhere and in which it is not involved. It depends on the economic size of the war site(s), measured in terms of world output, $\varepsilon_{j,t} \equiv GDP_{j,t-1}/GDP_{world,t-1}$,[12] such that:

$$Third_{i,t} = \sum_{j \in T_{i,t}} \varepsilon_{j,t},$$

where $T_{i,t}$ is the set of all countries that in year t become war sites of a war to which country i is a third party. Coefficients ψ_h in specification (3.1) capture how the effect of war plays out in third countries, since we control for belligerent countries. That is, our set of control variables includes, in addition to four lags of the dependent and the independent variables, a variable defined analogously to $Third_{i,t}$ but for countries that are party to the war without being a war site ($Belligerent_{i,t}$). $Site_{i,t}$ and $Third_{i,t}$ are not mutually exclusive because several wars may take place at the same time: A country may become a war site and, at the same time, be exposed to spillovers from another war. Our specification accounts for this possibility and imposes the domestic effects of different wars to be additively separable.

Specification (3.1) features country fixed effects, $\alpha_{i,h}$, but does not include time fixed effects because we want to capture the full impact of the war that starts in year t. Instead, if we were to include time fixed effects, our estimates would only pick up the effect in the war-site economy and in third countries relative to the average effects of war. In the specification above, $u_{i,t+h}$ denotes the error term. The dependent variable is specified in differences relative to the pre-war level to account for the possibility that wars have permanent effects on the outcome variables (Stock and Watson, 2018; Ben Zeev, Ramey and Zubairy, 2023). We find that our results are robust to excluding this possibility.

Baseline specification While the distinction between war sites and third countries is central to our analysis, so too is the notion that the economic spillovers on third countries may vary in their distance from the war site. To account for

[12]We proxy $GDP_{world,t-1}$ by the output of the 24 countries for which we have complete data coverage.

this possibility, we depart from specification (3.1) and allow spillovers on third countries to differ in a non-linear way—depending on the distance from the war site. In what follows, we put forward the following smooth-transition model as our "baseline specification":

$$x_{i,t+h} - x_{i,t-1} = \alpha_{i,h} + \zeta_h' Controls_{i,t} + \gamma_h Site_{i,t} \\ + \psi_{D,h} F(i,t) Third_{i,t} + \psi_{N,h} \left[1 - F(i,t)\right] Third_{i,t} + u_{i,t+h} \,. \quad (3.2)$$

Here the response of the outcome variable may differ at each horizon h across limiting cases "D" (Distant) and "N" (Nearby), with the ψ-coefficients indexed accordingly. Observations are weighted based on the function $F(i,t)$. As in Born, Müller and Pfeifer (2020) we use an in-sample criterion to determine this weighting function, namely the GDP-weighted average distance from all foreign war-site economies in year t:

$$F(i,t) = \sum_{j \in T_{i,t}} \frac{\varepsilon_{j,t}}{\sum_{k \in T_{i,t}} \varepsilon_{k,t}} \left[\frac{\ln(1 + d_{i,j})}{\ln(1 + d^{\max})} \right],$$

where $d_{i,j}$ is the distance between country i and war site j, measured in thousand kilometers, and $d^{\max}$ is the largest distance between any pair of war sites and third countries in our sample.[13]

Casualty specification Wars differ in many dimensions and our baseline specification does not attempt to account for these beyond the economic importance of war sites. Next to the economic significance of the war site, the *severity of the war* is probably one of the key factors governing the economic impact of war. We therefore consider a variation to our baseline specification where we proxy the severity of the war with the number of casualties and let $Site_{i,t}$ measure the total number of casualties in a war site relative to country i's pre-war population. Likewise, we redefine the shock measure which underlies the construction of $Third_{i,t}$ as follows:

$$\varepsilon_{j,t} \equiv \frac{Casualties_{j,t}}{Population_{j,t-1}} * \frac{GDP_{j,t-1}}{GDP_{world,t-1}}, \quad (3.3)$$

where $Casualties_{j,t}$ is the total number of casualties in war site j and $Population_{j,t-1}$ is its pre-war population.

[13] In both instances we normalize the distance by subtracting the minimum distance between any two countries in our sample such that $F(i,t) \in [0,1]$.

3.2 Results

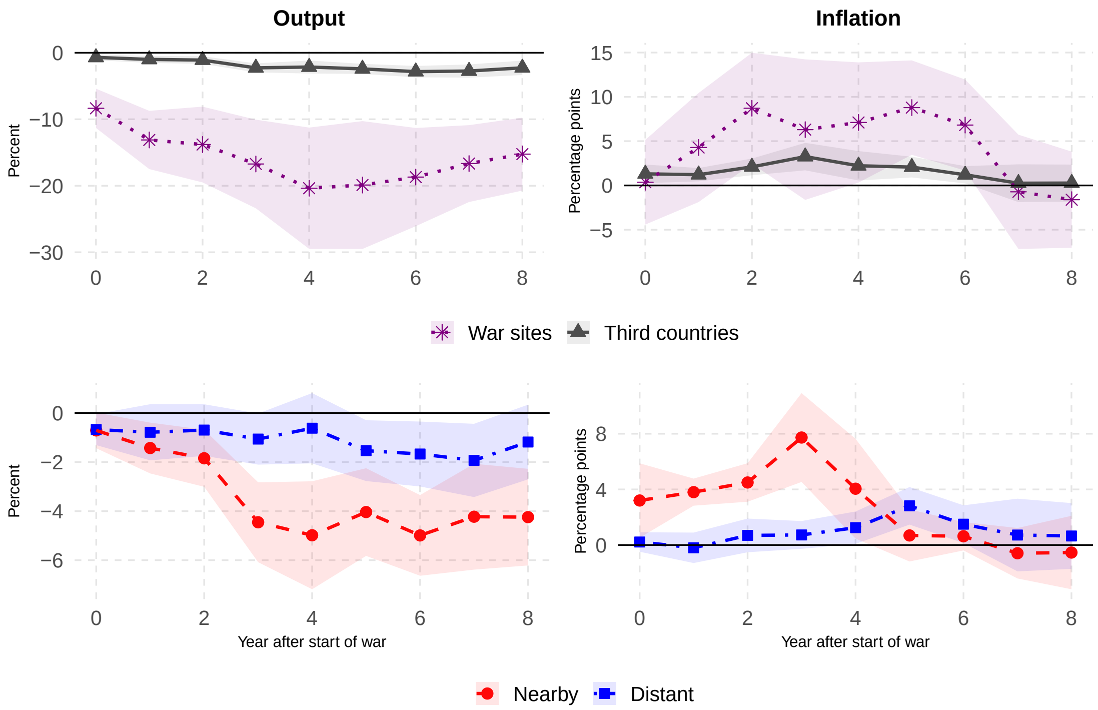
We now turn to our results. They are based on our sample of annual observations for the period 1870–2023. For now, we estimate the responses of two outcome variables, $x_{i,t}$, in war sites and third countries: the log of real GDP, from which we remove a linear country-specific time trend prior to the estimation, and inflation, measured in terms of consumer price indices.

Figure 5 shows the estimated impulse responses, tracing the macroeconomic consequences of war over time, beginning with the start of the war ($h = 0$). In each panel, the horizontal axis measures the time in years since the start of the war. In the left panels, we measure the percentage deviation of (detrended) output from its pre-war level against the vertical axis. In the right panels, we measure the effect of war on inflation in percentage-point deviations from the pre-war inflation rate norm. In the top panels, we show results for the linear specification (3.1). The dotted lines show the responses in the war-site economy, obtained by specifying $Site_{i,t}$ as a dummy variable.[14] They thus represent the effect of the average war in our sample. The solid lines show the estimated spillovers to third countries, based on the normalization that the economic size of the war site amounts to 5% of world GDP, that is, we plot responses for $Third_{i,t} = 0.05$. Here, and in what follows, shaded areas indicate 90% confidence intervals, computed using standard errors that are robust with respect to heteroskedasticity as well as serial and cross-sectional correlation (Driscoll and Kraay, 1998).

We observe an adverse effect of war on output in the war site that gets stronger over time, reaching a maximum effect four years after impact. At this point, war has reduced output by 20 percent. What's more, the subsequent recovery is rather slow. In year $h = 8$, output is still reduced by about 15 percent, and even after 16 years the recovery is incomplete, as we show in our robustness analysis below. This is also noteworthy in light of the fact that the mean (median) duration of wars is 2.5 (2) years. Clearly, based on our estimates, we cannot rule out that war has a permanent effect on the war-site economy. Turning to the top-right panel of Figure 5, we also observe a strong inflationary impact: Inflation increases for several years following the start of the war, exceeding its pre-war rate by almost 10 percentage points. It converges back to the pre-war level in year seven only.

[14]Considering proxy VAR models, Boer and Lütkepohl (2021) find that quantitative proxies do not necessarily outperform qualitative measures. We report results for the casualty specification below.

Figure 5: The macroeconomic impact of war

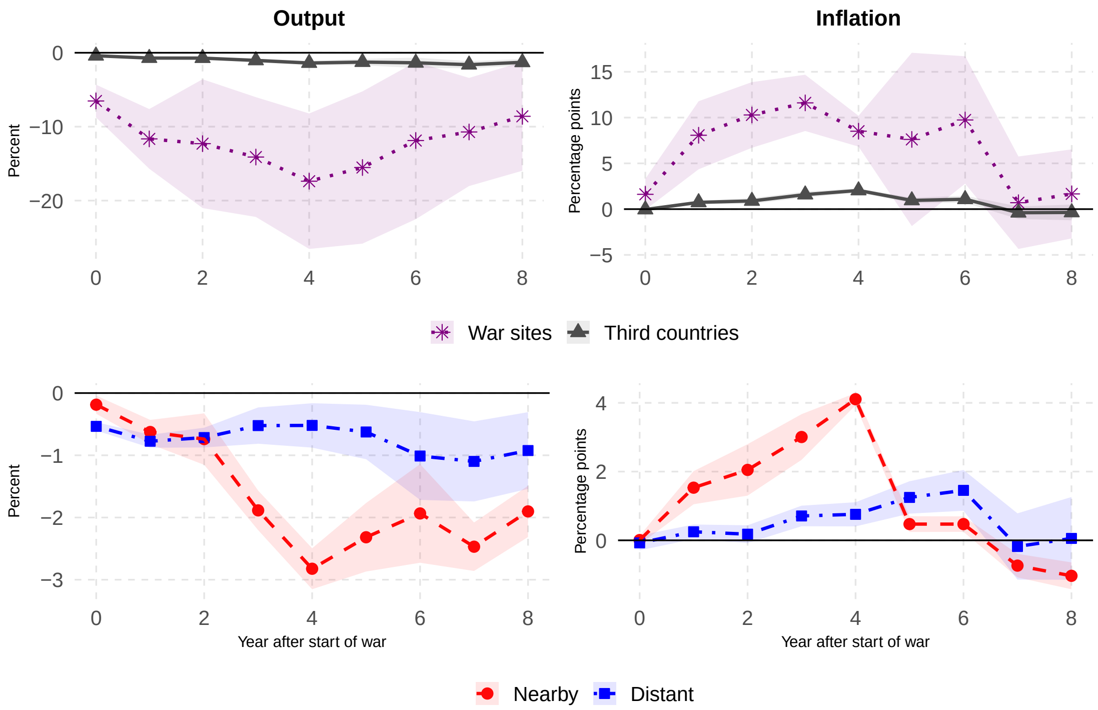


Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries. Shaded areas indicate 90% confidence bands.

The solid lines in the top panels of the figure show that there are only moderate spillovers to the *average* third country. In fact, output initially responds very little and tends to decline moderately some 3 years after the start of the war. However, the average effect masks sizeable heterogeneity across countries. To see this, consider the bottom panels of Figure 5, which show results for the baseline specification (3.2), allowing spillovers to vary with a country's distance from the war site. In the panels, the dashed line corresponds to case N, showing the spillovers for countries that are direct neighbors to the war ($F(i,t) = 0$).[15] The dash-dotted line, in turn, corresponds to case D, representing the spillovers to a country as distant as possible from the war site ($F(i,t) = 1$). There is a sizable difference across these scenarios. Output declines strongly in nearby economies only. Four years after the start of war, output is reduced by about 5 percent compared to the pre-war level. At the same time, inflation increases considerably, by up to 8 percentage points in year 3. For distant economies, we also find some output decline but the effect is much delayed and only marginally significant.

[15]Figure B.1 shows the cumulative distribution of the weighting function.

Figure 6: Casualty specification

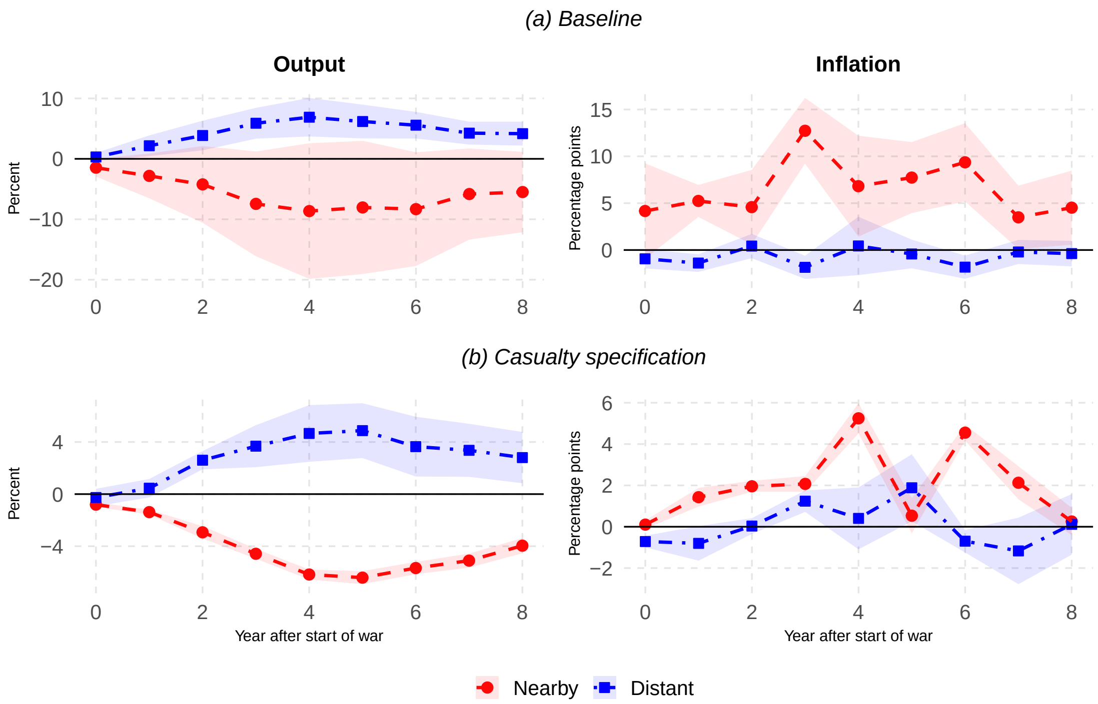


Note: Left panels show deviation of (detrended) output from pre-war level, right panels show deviation of inflation from pre-war rate. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2) with shock measure based on casualties. Shock size: $Site_{i,t} = 0.03$ (casualties amount to 3% of population in war site) and $Third_{i,t} = 0.03 * 0.05$. Shaded areas indicate 90% confidence bands.

Likewise, the inflation response is also delayed and much weaker.

We next turn to our quantitative measure of the "war shock". Using the number of casualties in the war site as a proxy for the severity of the war, we investigate whether severity matters for the economic impact of war—both in the war site and in third countries. When it comes to third countries, we allow spillovers to depend on both the severity of the war and, as before, the economic size of the war site (see again the shock measure introduced in equation (3.3) above). After reestimating specifications (3.1) and specification (3.2) with the casualties-based shock measure, we compute responses to a war shock that is normalized to one standard deviation in terms of casualties (which amounts to about 3% of the population in the war site). Formally, we set $Site_{i,t} = 0.03$ and $Third_{i,t} = 0.03 * 0.05$, that is, we continue to normalize the economic size of the war site to 5% of world GDP. We show results in Figure 6, organized in the same way as Figure 5. While the general pattern of adjustment is very similar in both figures, confidence bands are now considerably tighter. That is, the more

Figure 7: Belligerents

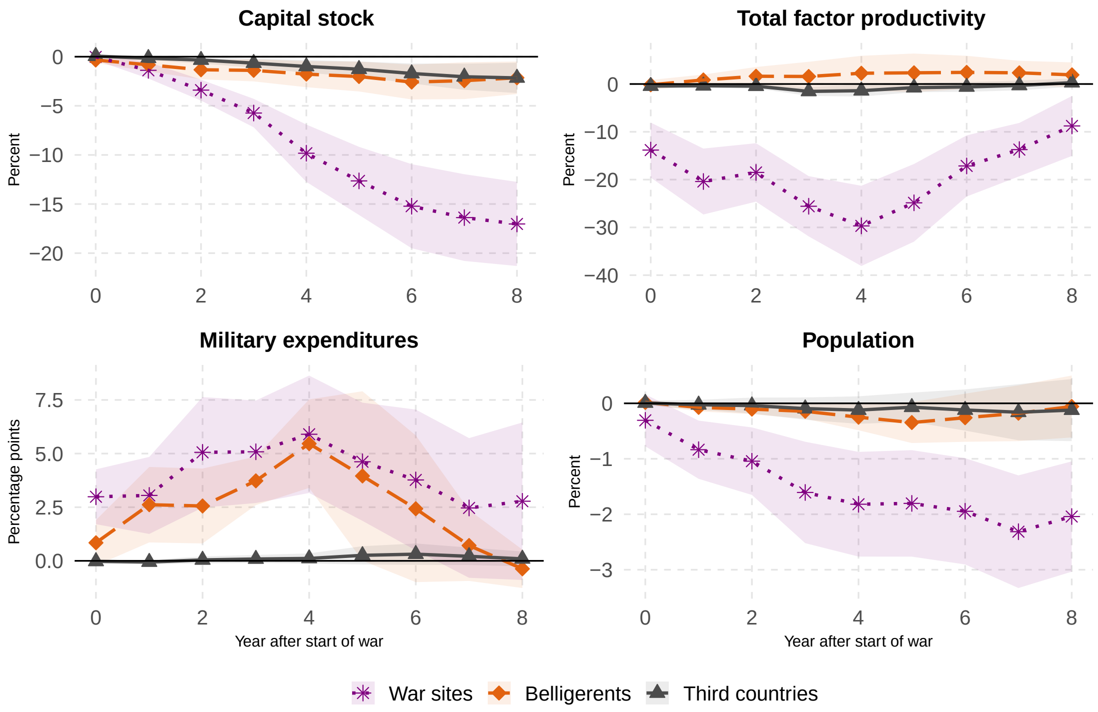


Note: Left panels show deviation of (detrended) output from pre-war level, right panels show deviation of inflation from pre-war rate. Belligerent countries are party to war without being a war site; $Belligerent_{i,t}$ defined analogously to $Third_{i,t}$ and included in the set of controls throughout in specification (3.2). Shock size: $Belligerent_{i,t} = 0.05$ (top) and $0.03 * 0.05$ (bottom). Shaded areas indicate 90% confidence bands.

granular shock measure allows us to estimate the effect of war more precisely.

The estimates reported so far pertain to the effects of war in war sites and third countries. Now we also put a spotlight on the intermediate case, namely the economies of *belligerent* countries (countries that are party to the war without being a war site). Overall, our sample comprises 122 country-year observations that qualify as belligerents according to COW. Specification (3.2) includes in the set of controls a variable $Belligerent_{i,t}$ that is defined analogously to $Third_{i,t}$. Figure 7 displays the corresponding impulse response estimates, once for the baseline (top panels) and once for the casualty specification (bottom panels). In both instances, we obtain very similar patterns, while estimates for the casualty specification are again more precise. The spillovers to belligerent countries depend even more on their distance from the war site than in the case of third countries. In fact, we find that output *increases* after the start of the war in belligerent countries, provided they are distant from the war site. By contrast, output declines strongly in belligerent countries if they are nearby—just like in

Figure 8: Domestic variables



Note: Results based on linear specification (3.1), using baseline shock measure. Outcome variables are measured in percentage deviation from pre-shock level, except for military expenditures (percentage points of pre-war GDP). Shock size: $Site_{i,t} = 1$ and $Third_{i,t} = Belligerent_{i,t} = 0.05$. Shaded areas indicate 90% confidence bands.

the case of third countries. For the nearby belligerents, we also detect a strong inflationary impact of the war, which is absent in belligerent countries that are distant from the war site. In what follows, we present evidence on the adjustment of some additional variables which goes some way toward rationalizing these patterns.

3.3 Further evidence

In this section, we move beyond output and inflation and first zoom in on other domestic variables to inform our understanding of the direct economic impact of war (see again Table A.4 for data sources and definitions). Second, we study how external trade flows—arguably key for spillovers—adjust to war.

A salient feature of war, in addition to human casualties, is physical destruction. Indeed, as we estimate the response of the capital stock to war, we find that it declines significantly in the war-site economy. Results are shown in the top-left panel of Figure 8, not only for the war site (dotted lines) but also for belligerent (long dashed lines) and third countries (solid lines). In the war site, the capital stock declines by more than 15 percent within eight years from the start of the war. In contrast, it declines only very mildly in the two other groups of countries. In the absence of physical destruction, a decline of the capital stock would reflect a reduction of investment—a plausible response to the war even in countries not directly exposed to fighting on home soil.

To inform our analysis further, we also estimate the response of total factor productivity (TFP). We find that TFP declines strongly and almost immediately in the war site, testifying further to the destructive nature of war. This finding is also consistent with the notion that a shift of employment to the military sector lowers the productive capacity of the economy, as documented in the classic study of Ramey and Shapiro (1998). Yet we find this TFP decline only in the war-site economy, not for belligerent or third countries.

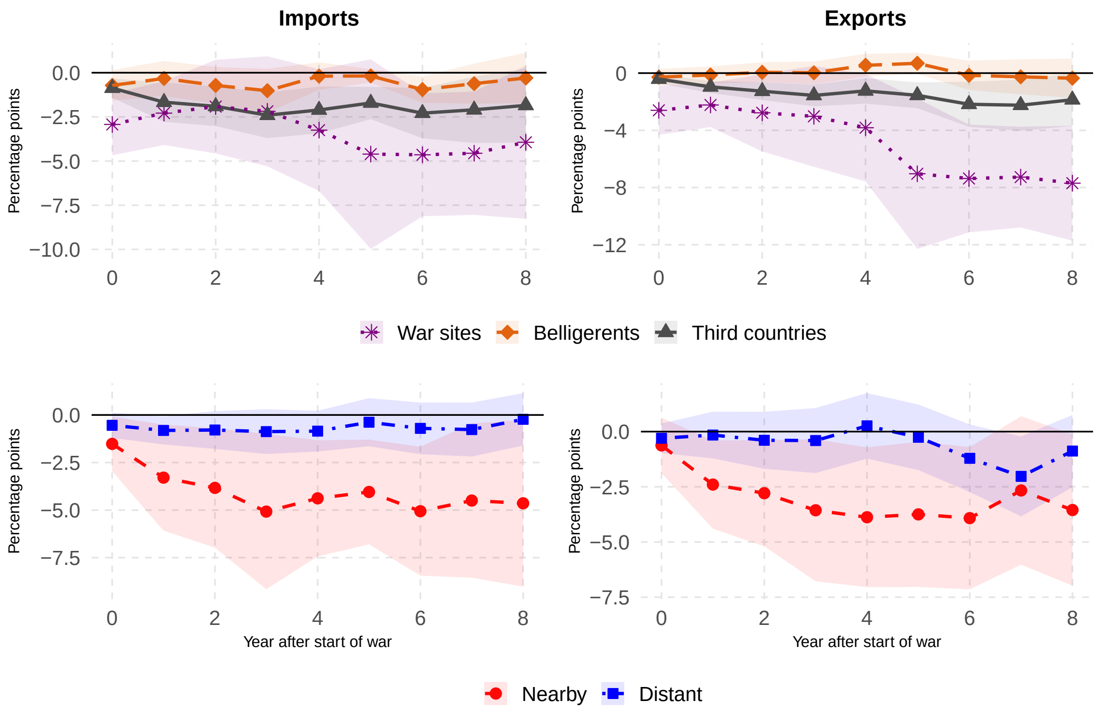
The lower-left panel of Figure 8, in turn, looks at military expenditures which are known to increase strongly during wars (Barro, 1987; Ramey, 2011). Our results align with this stylized fact: military expenditures, measured in percentage points of pre-war GDP, increase strongly and persistently in response to war both in war sites and belligerent countries.[16] We find no comparable effect in third countries.

In terms of population size, we find a moderate impact of wars. As can be seen in the bottom-right panel of Figure 8, the population shrinks somewhat in the war site, with a maximum effect of about 2 percent seven years after the start of the war. Meanwhile, there is no significant response in the two other sets of countries. In light of these results, we will abstract from changes in population size in our further analysis below. We acknowledge, however, that further work on this aspect, especially a systematic analysis of war-related migration flows, based on more granular data than we have available, holds promise.

Figure 9 turns to trade flows, setting the stage for our structural account in which spillovers from war operate chiefly via trade. We consider imports (left) and exports (right), both measured in terms of pre-war GDP. Both aggregates decline strongly in the war site and increasingly so over time. Five years after the start of the war, both a war site's imports and, in particular, exports are very much reduced. The effect on third countries is more moderate and absent for belligerents. These results are based on the linear specification (3.1). In the bottom panels, we also show results based on baseline specification (3.2),

[16]Consistent with the increase in military spending during wars, we find that the fraction of the population employed in the military increases significantly, see Figure B.2. Again, the effect is strongest for war sites and belligerents, where the share of people employed in the military increases by 1.5 percentage points, measured in terms of the pre-war population.

Figure 9: Trade flows



Note: Panels show response of imports (left) and exports (right), measured in percentage points of pre-war GDP. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ and $Third_{i,t} = 0.05$ for war site and third countries, respectively. Shaded areas indicate 90% confidence bands.

distinguishing between distant and nearby third countries. As expected, the adverse impact on trade flows is much stronger in nearby countries. Imports (left), in particular, decline by up to five percentage points of pre-war GDP. For exports the effect is still strong, if somewhat less pronounced. There is no comparable effect for distant countries.

Taken together, our estimates underscore that (i) the spillovers from war on third countries depend on their distance from the war site and that (ii) trade flows respond more strongly to the war in nearby countries. These patterns align with the notion that distance matters via trade, as posited by the gravity concept (Head and Mayer, 2014). In Appendix B.2, we consider an alternative to our baseline specification in which we no longer condition on distance but on trade exposure as we estimate the spillovers of war on third countries. We find consistently that spillovers are stronger (weaker) for countries that have greater (smaller) trade exposure to the war site.

3.4 Robustness

Lastly, we summarize the results of several robustness checks, with the corresponding figures provided in Appendix C. First, we consider the conjecture that economic weakness might systematically precede military weakness and hence countries becoming war sites, turning the dynamics we have been describing on their head. Our narrative analysis in Section 2.3 above argues against this conjecture. We conduct a further robustness test by adding an index of military strength as a control variable in our empirical specification. Our results remain unchanged upon the inclusion of this variable. Second, we consider several additional specifications to assess how the economic effects of war play out over time. In our baseline, the start of the war is defined as the year when military action starts in the war site. Yet, in the case of long wars engulfing multiple countries over time, it is possible that the start of fighting in a given war site might be anticipated to some extent. To address this issue, we consider an alternative specification where we define the start of the war as the year when the broader war starts—even though there might not yet be military action in the future war site. Under this specification, we find similar results as under the baseline, except that it takes longer for the full economic effect of war to materialize—a natural finding if there is indeed a causal link from concrete physical disruption in the war site to the country's economic performance.

Next, using again the same definition of war as in the baseline, we consider longer time horizons and document that even 16 years after the onset of war, the adverse effects have not been completely reversed in the war-site economy. We also verify that results are robust to expressing the dependent variables in levels rather than in changes relative to the pre-war period. Finally, we conduct a series of tests where we condition our sample of war sites on the duration of the wars. This involves generating two separate sets of projections: one for a sample of wars with a duration below or equal to the median duration of wars in the entire sample, corresponding to two years or less; and one for the sample of wars that last more than two years. Across both sets, we observe that our results do not change significantly. Even short wars with a duration of at most two years have a sizeable effect on output and inflation similar to what we find under the baseline, and the effect is still manifest some eight years after the beginning of the (short) war. Finally, we exclude the U.S. from our sample and confirm that this does not influence our results.

4 Structural interpretation

We now employ an international business cycle model to offer a structural interpretation of the evidence. The model features four countries: the *War site*, two third countries—*Nearby* and *Distant*—and a *Rest of the World*.[17] This framework allows us to simultaneously account for differences in the degree of trade integration among countries—their distance—as well as their size, both key aspects for the economic spillovers of wars according to our empirical analysis. In terms of features, our model synthesizes recent work by Eichenbaum, Johannsen and Rebelo (2021) and Gopinath et al. (2020) to account for the use of both intermediate goods and capital in production as well as nominal and real rigidities, familiar from empirically successful accounts of the international business cycle.[18]

We devise a war-shock scenario building on earlier work on rare disasters (Gourio, 2012). Specifically, we posit a "war shock" ω_t which (i) destroys a portion of the capital stock, (ii) lowers total factor productivity, and (iii) triggers an increase of military expenditures. Importantly, these aspects of the war shock are limited to the *War site*. A fourth aspect, instead, extends beyond the *War site* to third countries: monetary policy may accommodate the war by altering the money supply, although to a different degree across countries. We show that, under these assumptions, the model is able to provide a quantitatively successful account of the economic impact of the war—not only in the *War site* but also in third countries. Trade integration proves to be key for the economic spillovers of war as stressed by Martin, Mayer and Thoenig (2008). However, we pivot the focus toward the role that trade relationships have on the transmission of war shocks, rather than the impact of trade on the likelihood of war. In what follows, we first outline the model structure and our calibration strategy, which relies on matching impulse response functions. We then use the model to inspect the mechanism through which a war shock affects the global economy.

[17] In what follows, we abstract from belligerents to keep the analysis focused. However, in Appendix E we show results for an extended version of the model that features belligerents in addition to third countries. Under the assumption that military expenditures increase in belligerent countries, the model is able to account for the evidence in Figure 7, notably for the positive output effects in distant belligerents.

[18] Our model simulations use adaptable code in Dynare's macro-preprocessing language, allowing to switch between different pricing regimes (DCP, PCP, LCP as in Georgiadis and Schumann (2021)), modify aggregation technologies, adjust the number of countries and add or remove model features. The original models of Eichenbaum, Johannsen and Rebelo (2021) and Gopinath et al. (2020) are nested and can be accessed as special cases.

4.1 Model outline

We keep the exposition brief, using index $j \in \{S, N, D, R\}$ to denote countries, and relegate all derivations to a full model documentation available in the replication files. The size of the world economy is normalized to unity, $\sum_j n_j = 1$, where $n_j = |\mathcal{N}_j|$ represents the proportion of both the population as well as firms residing in each country j, distributed over distinct masses $\mathcal{N}_j$ along the unit interval. Countries are isomorphic and differ in three key aspects only: their size, their trade integration, and the way in which they are exposed to the war shock.

Within each country, a generic household $h \in \mathcal{N}_j$ chooses consumption, supplies labor, invests in physical capital and trades financial assets. At an international level, we restrict financial trade to a non-contingent bond issued in the *Rest of the World*'s currency. Within countries, by contrast, financial markets are complete such that household heterogeneity due to sticky wages is largely immaterial (Erceg, Henderson and Levin, 2000). In what follows, uppercase letters represent individual choices made by households or firms, while lowercase letters denote variables in per-capita terms. Throughout, variables without time-subscript refer to steady-state values.

The expected lifetime utility of household h depends on consumption $C_{j,t}(h)$ and labor $L^s_{j,t}(h)$:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{1}{1-\sigma^C} \Big(C_{j,t}(h) - \phi^C c_{j,t-1} \Big)^{1-\sigma^C} - \frac{\chi^L}{1+\sigma^L} (L^s_{j,t}(h))^{1+\sigma^L} \right\},$$

where β is the discount factor, σ^C represents the inverse of the intertemporal elasticity of substitution, σ^L the inverse of the Frisch elasticity of labor supply, and χ^L is a parameter that normalizes hours worked in steady state. The parameter ϕ^C captures the degree of external habits, governed by the previous period's per-capita consumption, defined as $c_{j,t-1} = 1/n_j \int_{\mathcal{N}_j} C_{j,t-1}(h)dh$. Households own an internationally immobile capital stock, $k_{j,t}$, which evolves according to:

$$k_{j,t} = \left((1-\delta^K) k_{j,t-1} + \Phi^K \left(\frac{i_{j,t}}{k_{j,t-1}} \right) k_{j,t-1} \right) e^{-\Delta^K_j \omega_t}.$$

Here, δ^K denotes the rate of capital depreciation, $i_{j,t}$ represents investment, and

Φ^K is an adjustment cost function parameterized by ϕ^K:

$$\Phi^K\left(\frac{i_{j,t}}{k_{j,t-1}}\right) = \frac{i_{j,t}}{k_{j,t-1}} - \frac{\phi^K}{2}\left(\frac{i_{j,t}}{k_{j,t-1}} - \delta^K\right)^2.$$

ω_t is the war shock, which—akin to the rare disaster in Gourio (2012)—destroys a fraction $\Delta_S^K > 0$ of the capital stock in the *War site*. Letting η_t denote the innovation that takes a value of one at the onset of war, the war shock follows an AR(2) process with persistence parameters ρ_1^ω and ρ_2^ω:

$$\omega_t = \rho_1^\omega \omega_{t-1} + \rho_2^\omega \omega_{t-2} + \eta_t.$$

Recall that households trade a full set of state-contingent securities domestically. They are in zero net supply and, hence, we omit these, as we state the period budget constraint in real per-capita terms:

$$\begin{aligned} c_{j,t} + i_{j,t} + \mathcal{E}^r_{Rj,t} b_{Rj,t} + \frac{\phi^B}{2}\left(\mathcal{E}^r_{Rj,t} b_{Rj,t}\right)^2 + \tau_{j,t} \\ = \frac{1}{n_j}\int_{\mathcal{N}_j} \frac{W_{j,t}(h) L^s_{j,t}(h)}{P_{j,t}} dh + r^K_{j,t} k_{j,t-1} + \mathcal{E}^r_{Rj,t} \frac{R_{R,t-1}}{\Pi_{R,t}} b_{Rj,t-1} + \sum_i div_{ji,t}. \end{aligned}$$

Here $P_{j,t}$ is the price index for final goods and $\Pi_{j,t} = P_{j,t}/P_{j,t-1}$ denotes inflation. $\mathcal{E}^r_{Rj,t} = \mathcal{E}^n_{Rj,t} P_{R,t}/P_{j,t}$ is the real exchange rate, where the nominal exchange rate, $\mathcal{E}^n_{Rj,t}$, is defined as the price of currency R expressed in units of currency j. $b_{Rj,t}$ denotes the holdings of the international bond, expressed in real per capita terms of country j. It yields a gross nominal interest rate of $R_{R,t}$. ϕ^B parameterizes bond carrying cost. This reflects, albeit in a stylized manner, financial frictions as in García-Cicco, Pancrazi and Uribe (2010) and—more technically—ensures a stationary solution (Schmitt-Grohé and Uribe, 2003). $r^K_{j,t}$ is the real rental rate of capital that is leased to firms. Furthermore, households receive income from dividends, $div_{ji,t}$, and $\tau_{j,t}$ represents taxes.

Households provide differentiated labor types that are aggregated into homogeneous labor services. Like capital, these services are not traded across borders. The demand for labor types is given by: $L^d_{j,t}(h) = (W_{j,t}(h)/W_{j,t})^{-\epsilon^W} l_{j,t}$, where $l_{j,t}$ are labor services in per-capita terms and $\epsilon^W > 1$ measures the elasticity of substitution between distinct labor types. $W_{j,t}$ is the aggregate wage index and $W_{j,t}(h)$ is the wage of household h which is adjusted infrequently: In each period, a randomly selected fraction of households $1 - \theta^W$ may adjust its wage.

Households consume final goods, which are also used for investment, government spending, and as intermediate inputs in production. Formally, the final good $y_{j,t}$ is an aggregate, composed of bundles of domestically produced goods, $y_{jj,t}$, and imported goods, $y_{ij,t}$, where $i \neq j$ specifies the country of production:

$$y_{j,t} = \left(\gamma_{jj}^{\frac{1}{\sigma}} \left(y_{jj,t}\right)^{\frac{\sigma-1}{\sigma}} + \sum_{i \neq j} \gamma_{ij}^{\frac{1}{\sigma}} \left(\varphi_{ij,t} y_{ij,t}\right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}.$$

Here, σ is the elasticity of substitution in the terms of trade, while the term

$$\varphi_{ij,t} = 1 - \frac{\phi_{ij}^{IM}}{2} \left(\frac{y_{ij,t}/y_{jj,t}}{y_{ij,t-1}/y_{jj,t-1}} - 1 \right)^2$$

captures adjustment costs that effectively reduce the price elasticity of imports in the short run. γ_{ij} is the weight of country-i goods used in the production of final goods in country j and determines the degree of trade integration in steady state. We set $\gamma_{ij} = \gamma_{ji}$ and $\gamma_{jj} = 1 - \sum_{i \neq j} \gamma_{ij}$ such that trade is balanced in steady state (for which we assume relative prices to be unity). We parameterize these weights according to $\gamma_{ij} = \Omega_{ij}\, n_i$, where the "home bias" parameter $0 < \Omega_{ij} \leq 1$ controls the degree of trade integration beyond economic size n_i. In the limiting case where $\Omega_{ij} = 1$, imports from country i simply reflect its size in the world economy. By varying home bias we may—in the spirit of gravity—account for other factors that determine trade integration, in particular geographic distance (Head and Mayer, 2014).

The term $y_{ji,t}$ represents an aggregate of country-specific varieties, which are produced under monopolistic competition. We assume that prices are sticky à la Calvo: In each period a randomly selected fraction of firms $1 - \theta^P$ is permitted to reset its price in its own currency. The law of one price holds at the level of varieties and a generic producer m in country j faces the demand function $Y_{ji,t}^d(m) = \left(\mathcal{E}_{ji,t}^n P_{ji,t}(m)/P_{ji,t}\right)^{-\epsilon^P} \frac{n_i}{n_j} y_{ji,t}$. Here, $P_{ji,t}(m)$ is the price set by firm m in its local currency j for goods sold to country i. $P_{ji,t}$ is the producer price index in country i and ϵ^P denotes the elasticity of substitution between varieties. Production of varieties adjusts to meet demand at posted prices from all destinations and is Cobb-Douglas:

$$\sum_i Y_{ji,t}^d(m) = A_{j,t} \left(X_{j,t}^d(m)\right)^{\alpha^X} \left(\left(K_{j,t}^d(m)\right)^{\alpha^K} \left(L_{j,t}^d(m)\right)^{1-\alpha^K} \right)^{1-\alpha^X},$$

where $X_{j,t}^d(m)$, $K_{j,t}^d(m)$, and $L_{j,t}^d(m)$ represent the amounts of intermediate inputs, capital, and labor employed by firm m in country j. The parameters α^X and α^K determine the corresponding factor shares and $A_{j,t}$ denotes TFP, which follows an AR(1) with persistence parameter ρ^A and may change in response to the war:

$$\log(A_{j,t}) = \rho^A \log(A_{j,t-1}) - \Delta_j^A \omega_t.$$

Importantly, we assume that the war shock impacts TFP only in the war-site economy, $\Delta_S^A > 0$, consistent with the evidence presented in Figure 8 above.

Bond market clearing requires that $\sum_j n_j b_{Rj,t} = 0$ for the internationally traded bond. Market clearing for final goods implies:

$$y_{j,t} = c_{j,t} + i_{j,t} + x_{j,t} + \frac{\phi^B}{2}\left(\mathcal{E}_{Rj,t}^r b_{Rj,t}\right)^2 + \frac{P_{jj,t}}{P_{j,t}} g_{j,t},$$

where $g_{j,t}$ is real government spending, which consists solely of domestically produced varieties. We assume that government spending increases in response to the war in the *War Site* only, reflecting the increase of military spending documented in Figure 8 above:

$$\frac{g_{S,t}}{gdp_S} = \frac{g_S}{gdp_S} + \Delta_S^G \, \omega_t,$$

where $\Delta_S^G > 0$. Instead, in third countries, government spending remains constant.[19] $gdp_{j,t}$ is per-capita GDP, measured in value-added terms by subtracting intermediate inputs from total output. The government's nominal budget constraint is given by:

$$P_{jj,t} g_{j,t} = P_{j,t} \tau_{j,t} + \frac{1}{n_j} \int_{\mathcal{N}_j} \left(M_{j,t}(h) - M_{j,t-1}(h)\right) dh,$$

where $M_{j,t}(h)$ are money holdings by household h. We postulate a simple money demand function, $M_{j,t} = P_{j,t} y_{j,t}$ and assume that monetary policy potentially engages in "war financing" by adjusting the growth rate of money supply:

$$\left(\frac{M_{j,t}}{M_{j,t-1}}\right) = (1 - \rho_j^M)\Pi_j + \rho_j^M \left(\frac{M_{j,t-1}}{M_{j,t-2}}\right) + \Delta_j^M \omega_t$$

where ρ_j^M captures persistence. We do not restrict the response of money supply to the *War site*, but allow for some monetary accommodation of the war in third

[19]We simulate an extended version of the model for which we consider belligerent countries as well. In this case, military spending also increases in response to the war, see Appendix E.

countries, too: $\Delta_j^M > 0$, $j \in \{S, N, D\}$.[20] Finally, exchange rates adjust freely to clear the foreign exchange market.[21]

4.2 Model calibration and validation

We solve the model based on a first-order perturbation and compute the impulse response to an innovation to the war shock η_t. To calibrate the model and the war-shock scenario, we target the empirical response functions of GDP and inflation in the *War site*, *Nearby* and *Distant*, as shown in the four panels of Figure 5 above. Specifically, we pin down key parameters by matching these impulse response functions. The other parameters are fixed at conventional values prior to the matching exercise. We validate the calibrated model by confronting its predictions for the responses of the capital stock, total factor productivity, and military expenditures in the *War site* with their empirical counterparts.[22]

Fixed parameters. Parameter values are identical across countries, except when noted otherwise. A period in the model represents one year, with the time-discount factor β set to $1/1.04$. The parameter capturing the cost of holding international bonds is $\phi^B = 0.001$, capital depreciation is $\delta^K = 0.10$ and adjustment costs are $\phi^K = 16$. We set the elasticities of substitution both for labor types (ϵ^W) and product varieties (ϵ^P) to 11. The preference parameters σ^C and σ^L are 2, and we fix ϕ^C at 0.50. χ^L is determined to normalize labor supply in steady-state to 1. The same normalization applies to the targeted gross inflation rate, $\bar{\Pi}_j = 1$. θ^P and θ^W are both 0.15, such that wages and prices are reset approximately after 1.2 years, on average.[23] We set α^X to 0.45 and α^K to 0.40 (Bouakez, Rachedi and Santoro, 2023) and the trade-price elasticity σ to 0.9 (Heathcote and Perri,

[20] If we assume interest-rate rules rather than money supply rules the model is also able to account for the evidence, as we show in Appendix E.

[21] If we assume that the countries maintain a fixed exchange rate (peg) with the *Rest of the World*, there would be significantly fewer inflationary spillovers, see Appendix E.

[22] Alternatively, we may target the latter variables to calibrate the model and use its prediction for output and inflation for evaluation purposes. Yet, since these variables are arguably less prone to measurement problems and benefit from more extensive and broader data availability, we consider them more suitable calibration targets.

[23] Given recent estimates by, for instance, Hazell et al. (2022), this is a moderate degree of nominal stickiness, consistent with the notion that nominal wages, in particular, have become less flexible over time only (Chernyshoff, Jacks and Taylor, 2009). Note also that concerns about counterfactual predictions of the basic New Keynesian model pertain to the markup response to demand shocks (Nekarda and Ramey, 2020). Instead, our war-shock scenario is first and foremost a supply shock. And, indeed, we show in Appendix E that a version of the model without nominal rigidities is also able to capture key aspects of the adjustment to the war shock.

2002; Corsetti, Dedola and Leduc, 2008). Import adjustment costs ϕ^{IM} between the *War site*, *Nearby*, and *Distant* are uniformly set to 5.

For the steady state we assume that trade is balanced and all relative prices as well as exchange rates are equal to unity. In terms of size, we assume—as above—that the *War site* represents 5 percent of the world economy. Similarly, *Nearby* and *Distant* each account for 5 percent of the world economy, while the remaining 85 percent is represented by the *Rest of the World*. In our sample, the degree of openness varies considerably across countries and over time. We set the share of imports to 25 percent of GDP in steady-state: $1 - \gamma_{jj} = 0.25(1 - \alpha^X(\epsilon^P - 1)/\epsilon^P)$ for $j \neq R$. The *War site* and *Nearby* are fully integrated with each other, $\Omega_{SN} = \Omega_{NS} = 1$, whereas trade with *Distant* is rather small, $\Omega_{DS} = \Omega_{SD} = \Omega_{DN} = \Omega_{ND} = 0.1$. The assumptions of symmetry and balanced trade pin down the parameters in the *Rest of the World*. Lastly, we set the level of government spending to 20% of GDP in steady state.

IRF matching. We determine key parameters by matching impulse response functions based on a Bayesian procedure, as suggested by Christiano, Trabandt and Walentin (2010). In this way, we treat the empirical impulse responses as data and select parameters to ensure that the model impulse responses closely mirror their empirical counterparts. Specifically, we target the responses of GDP and inflation in the *War site*, *Nearby* and *Distant* from years 0 to 8. In line with standard practices, we employ a diagonal weighting matrix, with the diagonal elements set to the inverse of the squared standard error of the respective empirical impulse response, see Meier and Müller (2006) for an early discussion.

Table 3 reports our priors and the parameters that are selected by the matching procedure. We start from the premise that the war shock affects all margins in a sizeable and persistent way. Parameters controlling the impact effects of the war shock are assumed to follow an Inverse Gamma prior (InvGamma), while persistence parameters are assigned a Beta prior distribution. Regarding the incidence of shocks, we posit that capital destruction, productivity disturbances, and military expenditures occur exclusively in the *War site* ($\Delta_S^K > 0$, $\Delta_S^A > 0$, $\Delta_S^G > 0$). The corresponding prior mean values are motivated by the calibration of Gourio (2012) and the estimates of Auray and Eyquem (2019). We allow for a money supply response to the war in all countries, except for the *Rest of the World*, but to a different degree. Instead of directly estimating the coefficients ρ_1^ω and ρ_2^ω of the second-order autoregressive process which governs the dynamics

Table 3: War-shock scenario—priors and posteriors

	Prior				Posterior			
	Distribution	Mean	Stdev	Bounds	Mode	Mean	5%	95%
Δ_S^A	InvGamma	0.050	0.150	[0; 0.10]	0.0463	0.0471	0.0396	0.0551
Δ_S^G	InvGamma	0.050	0.150	[0; 1.00]	0.0196	0.0233	0.0122	0.0340
Δ_S^K	InvGamma	0.025	0.150	[0; 0.10]	0.0112	0.0197	0.0060	0.0351
Δ_S^M	InvGamma	0.020	0.150	[0; 1.00]	0.0103	0.0124	0.0057	0.0193
Δ_N^M	InvGamma	0.010	0.150	[0; 1.00]	0.0123	0.0134	0.0075	0.0193
Δ_D^M	InvGamma	0.005	0.150	[0; 1.00]	0.0028	0.0031	0.0016	0.0045
ρ_I^ω	Beta	0.500	0.150	[0; 0.99]	0.7056	0.6856	0.5560	0.8143
ρ_{II}^ω	Beta	0.500	0.150	[0; 0.99]	0.7057	0.6807	0.5452	0.8101
ρ_S^A	Beta	0.500	0.150	[0; 0.99]	0.7715	0.7712	0.6688	0.8870
ρ_S^M	Beta	0.500	0.150	[0; 0.99]	0.5814	0.5177	0.2812	0.7565
ρ_D^M	Beta	0.500	0.150	[0; 0.99]	0.3260	0.3344	0.1565	0.5053
ρ_N^M	Beta	0.500	0.150	[0; 0.99]	0.7145	0.6331	0.4035	0.8649

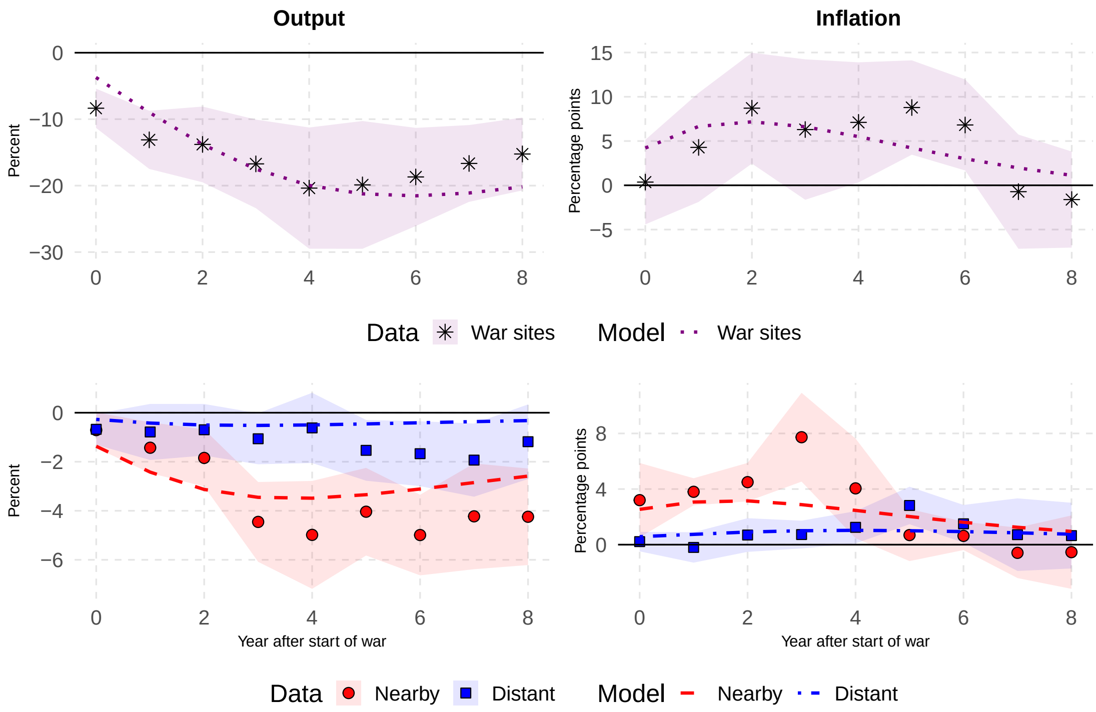
Note: IRF matching based on Slice sampler with 12,000 draws (50% of draws as burn-in).

of the war shock, we estimate the roots ρ_I^ω and ρ_{II}^ω of the process (Born, Peter and Pfeifer, 2013; Bayer, Born and Luetticke, 2023). These are related according to $\rho_1^\omega = \rho_I^\omega + \rho_{II}^\omega$ and $\rho_2^\omega = -\rho_I^\omega \cdot \rho_{II}^\omega$. By imposing the Beta prior distribution with a mean of 0.5, we ensure the stability of this process. All prior standard deviations are set equally to 0.15 and the prior is numerically truncated to ensure that parameters remain within economically plausible bounds.

Initially, a slice sampler is used to generate 2,400 draws across 12 parallel chains. The covariance matrix from these draws is then utilized to scale the stepping out procedure of a subsequent, so-called *rotated* Slice sampler, generating 12,000 draws also spread across 12 parallel chains, allocating half of these samples for burn-in.[24] We report posterior estimates in the right panel of Table 3. We observe updates to the prior distributions for most parameters and all highest posterior density (HPD) intervals contain values that are economically plausible. The estimated persistence of the war shock is adjusted upwards, with both roots being around 0.71. The initial exogenous destruction of the capital stock is somewhat larger than 1% on impact; yet, because of the persistence of

[24] For a comprehensive assessment: convergence diagnostics, trace plots, and relative inefficiency factors are provided in the supplementary Dynare replication codes. These also include additional estimation results using the standard Random-Walk Metropolis-Hastings algorithm (RW-MH) with 12 million draws, where the posterior mode from the rotated Slice serves as the initial guess for an optimization-based search to accurately find the posterior mode. It's noteworthy that the posterior distributions from RW-MH closely match those from the rotated Slice sampler, where the latter typically yields Markov chains with much lower autocorrelation and doesn't require a cumbersome and time-consuming mode-finding step. Note that we contributed our (user-friendly) IRF matching toolbox as a feature of Dynare from version 6.0 onwards.

Figure 10: The macroeconomic impact of war—model v data (targeted)



Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figure 5 above. Vertical axis measures deviation from pre-war (steady-state) level.

the war shock, combined with an endogenous reduction in investment, this leads to a much larger reduction in the capital stock over time of up to 20% after 8 years (as shown in Figure 11 below). The estimated drop in productivity in the *War site* is substantial, at more than 4.6% on impact. Military spending in the *War site* is estimated to increase by about 2 percentage points of GDP initially and subsequently following the trajectory of the war shock. The posterior estimates of the monetary supply parameters suggest some non-trivial monetary accommodation in the *War site* and in *Nearby*, though with different levels of persistence.

Figure 10 shows the predictions of the model at the posterior mode, contrasting it with the empirical responses functions, reproduced from Figure 5 above. The lines represent the model responses and generally align well with empirical responses indicated by the point shapes.

External validation. To assess the performance of the model, we turn to evidence that has not been used in the matching procedure. Here we focus on the key features of the war shock itself, which is shown in the upper-left panel of

Figure 11: The macroeconomic impact of war—model validation

Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figure 8. Vertical axis measures deviation from pre-war (steady-state) level.

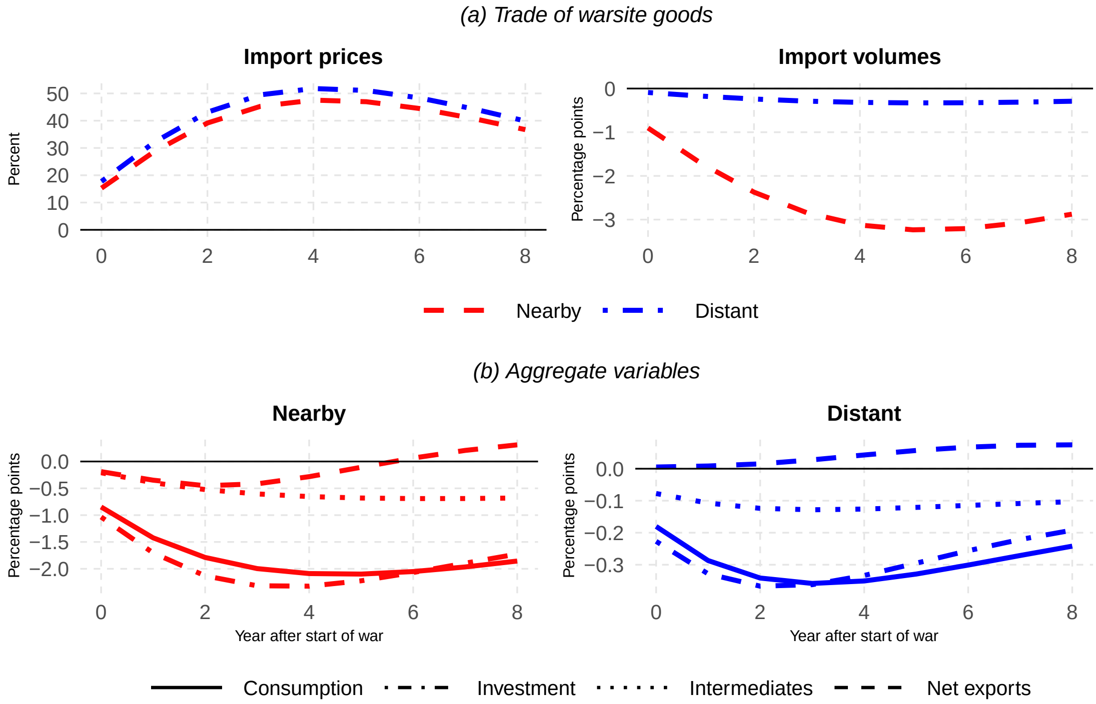
Figure 11. It exhibits a hump-shaped pattern and has no observable counterpart. Yet, in the remaining panels of the same figure we show the responses of TFP, the capital stock, and military expenditures, contrasting the model's predictions (lines) with their empirical counterparts (point shapes and shaded areas) reproduced from Figure 8 above.[25] We find that the model performs reasonably well in tracking the empirical responses. Given that these responses have not been targeted, we conclude that the model provides an empirically successful account of the macroeconomic impact of war on the global economy. Therefore, we use it to gain further insights into the transmission of the war shock to third countries.

4.3 How war impacts third countries

As a first step toward this end, we show the response of selected variables in Figure 12, contrasting the adjustment in *Nearby* and *Distant*. The upper-left panel shows the prices of imports from the *War site*—they increase massively, reflecting the adverse supply shock which war represents for the *War site*. As a result,

[25]Lack of data prevents us from confronting the model response of money supply with direct evidence.

Figure 12: The economic spillovers of the war shock

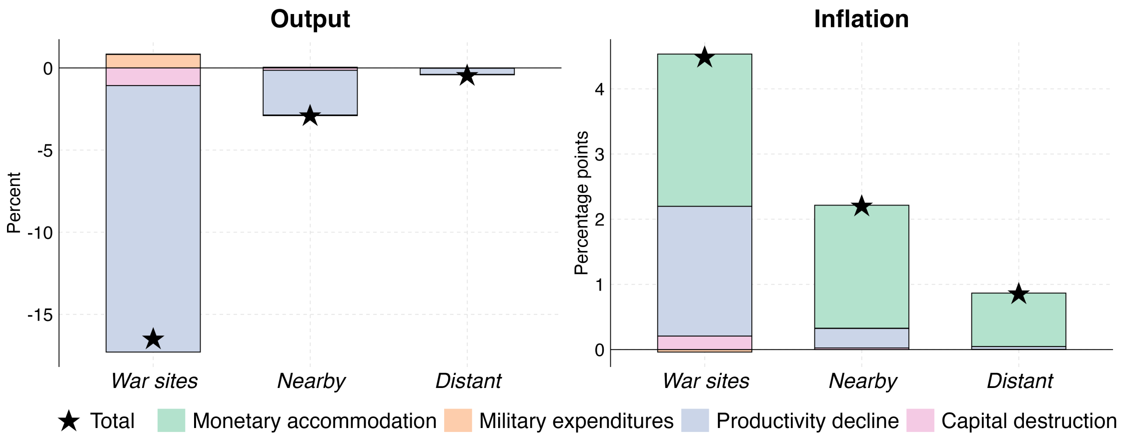


Note: Adjustment of selected variables to the war shock in *Nearby* and *Distant* according to the model. Vertical axis measures deviation from pre-war (steady-state) level in percent/percentage points of GDP.

imports from the *War site* (upper-right panel) drop by more than 3 percentage points of GDP in *Nearby* as it trades a lot with the *War site*. Instead, the effect is quantitatively small in *Distant* because it does not trade much with the *War site* in the first place. Hence, the model endogenously predicts a decline in trade flows during wars. This pattern is consistent with, but does not require us to assume, reduced market access which features prominently in the analysis of Martin, Mayer and Thoenig (2008). Moreover, the decline of trade flows closely mirrors the evidence for imports shown in Figure 9 above, further validating the model's calibration.

Figure 12 also shows the response of key macro aggregates in the bottom panels—again, contrasting the adjustment in *Nearby* (left) and in *Distant* (right). In *Nearby*, consumption and investment drop, as does the use of intermediate goods in production, because these are final goods which feature a substantial part of war-site goods as import content. Since imports from the *War site* become so scarce the level of final-good production can no longer be maintained which, in turn, is reflected in a decline of all aggregates. The decline of intermediates lowers the production in *Nearby* such that net exports drop despite the decline of

Figure 13: Decomposition of average effects



Note: Contribution of different features of war shock to overall effect, as reflected in average impulse responses over projection horizon.

domestic absorption. In sum, the adverse supply shock in the *War site* causes a supply-side contraction in *Nearby* too, even though there is neither a destruction of physical capital nor a shock to productivity. This, together with the expansion of money supply, accounts for the inflationary impact of the war in *Nearby*. The adjustment patterns in *Distant* are generally comparable but the effect is much smaller because *Distant* is less exposed to the war-site economy. Also, the increase of net exports in *Distant* reflects a redirection of trade flows away from the *War site* but this effect is quantitatively small.

Finally, to synthesize the results of our model simulations, Figure 13 decomposes the overall effect of the war shock on output and inflation into the contributions of its different features. Specifically, we compute the average annual change in output and inflation over the projection horizon in the *War site*, in *Nearby*, and *Distant*. In each panel, the grey area represents the contribution of capital destruction, an event that occurs exclusively in the *War site* but endogenously affects output and inflation also abroad. The contribution of the TFP decline, also unique to the *War site*, is represented by the red area. Finally, the contribution of increased military expenditures and money supply are indicated by the green and blue areas, respectively. The cumulative effect of these four factors is indicated by a star. Several aspects are worth noting. First, the TFP contraction in the *War site* is key in driving the effects on output, not only in the *War site* but also in *Nearby*, reinforcing the view that war is first and foremost an adverse supply shock that spills over from the *War site* to its trading partners. Second, in terms of inflation, the increase in money supply accounts for roughly half of the effects in the *War site* and for the largest part of the inflationary impact in the third countries, though the decline of TFP also contributes to the inflationary impact of war in *Nearby*. Third, while capital destruction impacts the *War site*, its quantitative effect on *Nearby* is negligible. Fourth, military expenditures have an expansionary effect on output in the *War site*, but have virtually no impact on inflation, because they are somewhat back-loaded.

5 Conclusion

Which countries pay the price of war? Our analysis addresses this question by focusing on the economic costs of war in terms of business cycle effects. We find that these economic costs are not only massive in the war-site economy itself but also spill over to a significant extent to countries that are geographically close to the war site. Spillovers are similar for belligerents and third countries, as long as they are close to the war site. In this sense, the price of war is largely paid by the war sites and those countries that happen to be located in its proximity. They suffer lower output and higher inflation than would have been the case without the war. For belligerent countries that are distant from the war and hence less exposed to adverse trade effects, we find positive output effects that, in turn, appear to be driven by increased military expenditures.

We rationalize this result in a state-of-the-art model of the global economy. We model the war shock in the war site and let countries differ in their degree of trade integration with the war site. In this way, we are able to account for the time series evidence. In a nutshell, as the war destroys the productive capacity in the war-site economy, exports to nearby economies falter. This, in turn, induces a scarcity of intermediate inputs and induces a decline of the capital stock in the nearby country—even in the absence of any physical destruction of capital. These dynamics largely account for the output and price effects that we observe in the data.

The main takeaway of our study is that the adverse impact of war is not limited to the war site. There are clear and significant spillovers from the war, notably for economies closer to the war site. These spillovers lower output while putting upward pressure on prices. As such, they represent an adverse supply shock and give rise to a difficult trade-off for stabilization policy. What's worse, in contrast to supply shocks of the garden-variety type, the supply contraction induced by war tends to be more persistent. This implies, among other things, that monetary policymakers will generally not be in a position to "look through" the supply shock.

References

Abadie, Alberto, and Javier Gardeazabal. 2003. "The Economic Costs of Conflict: A Case Study of the Basque Country." *American Economic Review*, 93(1): 113–132.

Acemoglu, Daron, Simon Johnson, and James Robinson. 2005. "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth." *American Economic Review*, 95(3): 546–579.

Adjemian, Stéphane, Michel Juillard, Fréderic Karamé, Willi Mutschler, Johannes Pfeifer, Marco Ratto, Normann Rion, and Sébastien Villemot. 2024. "Dynare: Reference Manual Version 6." CEPREMAP 80.

Auray, Stéphane, and Aurélien Eyquem. 2019. "Episodes of War and Peace in an Estimated Open Economy Model." *Journal of Economic Dynamics and Control*, 105: 203–249.

Barbieri, Katherine, and Omar Keshk. 2016. "Correlates of war project trade data set codebook." *Codebook Version*, 4.

Barbieri, Katherine, Omar Keshk, and Brian M. Pollins. 2009. "Trading data: Evaluating our assumptions and coding rules." *Conflict Management and Peace Science*, 26(5): 471–491.

Barro, Robert J. 1987. "Government Spending, Interest Rates, Prices, and Budget Deficits in the United Kingdom, 1701–1918." *Journal of Monetary Economics*, 20(2): 221–247.

Barro, Robert J. 2006. "Rare Disasters and Asset Markets in the Twentieth Century." *Quarterly Journal of Economics*, 121(3): 823–866.

Barro, Robert J., and Charles J. Redlick. 2011. "Macroeconomic Effects From Government Purchases and Taxes." *The Quarterly Journal of Economics*, 126(1): 51–102.

Barro, Robert J., and Jong-Wha Lee. 1994. "Sources of Economic Growth." *Carnegie-Rochester Conference Series on Public Policy*, 40: 1–46.

Bayer, Christian, Benjamin Born, and Ralph Luetticke. 2023. "The Liquidity Channel of Fiscal Policy." *Journal of Monetary Economics*, 134: 86–117.

Ben Zeev, Nadav, Valerie A. Ramey, and Sarah Zubairy. 2023. "Do Government Spending Multipliers Depend on the Sign of the Shock?" *AEA Papers and Proceedings*, 113: 382–387.

Bergeaud, Antonin, Gilbert Cette, and Rémy Lecat. 2016. "Productivity trends in advanced countries between 1890 and 2012." *Review of Income and Wealth*, 62(3): 420–444.

Blomberg, S. Brock, and Gregory D. Hess. 2012. "18 The Economic Welfare Cost of Conflict: An Empirical Assessment." In *The Oxford Handbook of the Economics of Peace and Conflict*. Oxford University Press.

Boer, Lukas, and Helmut Lütkepohl. 2021. "Qualitative versus quantitative external information for proxy vector autoregressive analysis." *Journal of Economic Dynamics and Control*, 127: 104118.

Bolt, Jutta, and Jan Luiten van Zanden. 2014. "The Maddison Project: collaborative research on historical national accounts." *The Economic History Review*, 67(3): 627–651.

Bolt, Jutta, Robert Inklaar, Herman De Jong, and Jan Luiten Van Zanden. 2018. "Rebasing 'Maddison': New Income Comparisons and the Shape of Long-Run Economic Development." University of Groningen 174.

Born, Benjamin, Alexandra Peter, and Johannes Pfeifer. 2013. "Fiscal News and Macroeconomic Volatility." *Journal of Economic Dynamics and Control*, 37(12): 2582–2601.

Born, Benjamin, Gernot J. Müller, and Johannes Pfeifer. 2020. "Does Austerity Pay Off?" *The Review of Economics and Statistics*, 102(2): 323–338.

Bouakez, Hafedh, Omar Rachedi, and Emiliano Santoro. 2023. "The Government Spending Multiplier in a Multisector Economy." *American Economic Journal: Macroeconomics*, 15(1): 209–239.

Braun, R. Anton, and Ellen R. McGrattan. 1993. "The Macroeconomics of War and Peace." *NBER*

Macroeconomics Annual, 8: 197–247.
Caldara, Dario, and Matteo Iacoviello. 2022. "Measuring Geopolitical Risk." *American Economic Review*, 112(4): 1194–1225.
Caplan, Bryan. 2002. "How does war shock the economy?" *Journal of International Money and Finance*, 21(2): 145–162.
Chernyshoff, Natalia, David S. Jacks, and Alan M. Taylor. 2009. "Stuck on gold: Real exchange rate volatility and the rise and fall of the gold standard, 1875–1939." *Journal of International Economics*, 77(2): 195–205.
Christiano, Lawrence J., Mathias Trabandt, and Karl Walentin. 2010. "DSGE Models for Monetary Policy Analysis." In *Handbook of Monetary Economics*. Vol. 3, , ed. Benjamin M. Friedman and Michael Woodford, 285–367. Elsevier.
Chupilkin, Maxim, and Zsóka Kóczán. 2022. "The Economic Consequences of War: Estimates Using Synthetic Controls." European Bank for Reconstruction and Development Working Paper 271.
Clodfelter, Micheal. 2017. *Warfare and Armed Conflicts: A Statistical Encyclopedia of Casualty and Other Figures, 1492-2015.* . Fourth edition ed., Jefferson, North Carolina:McFarland & Company, Inc., Publishers.
Conte, Maddalena, Pierre Cotterlaz, Thierry Mayer, et al. 2022. *The CEPII gravity database.* CEPII.
Corsetti, Giancarlo, Luca Dedola, and Sylvain Leduc. 2008. "High Exchange-Rate Volatility and Low Pass-Through." *Journal of Monetary Economics*, 55(6): 1113–1128.
Couttenier, Mathieu, Nathalie Monnet, and Lavinia Piemontese. 2022. "The Economic Costs of Conflict: A Production Network Approach." Centre for Economic Policy Research CEPR Discussion Papers 16984.
Davies, Shawn, Therése Pettersson, and Magnus Öberg. 2022. "Organized Violence 1989–2021 and Drone Warfare." *Journal of Peace Research*, 59(4): 593–610.
Davis, Donald R, and David E Weinstein. 2002. "Bones, Bombs, and Break Points: The Geography of Economic Activity." *American Economic Review*, 92(5): 1269–1289.
de Groot, Olaf J, Carlos Bozzoli, Anousheh Alamir, and Tilman Brück. 2022. "The Global Economic Burden of Violent Conflict." *Journal of Peace Research*, 59(2): 259–276.
Driscoll, John C., and Aart C. Kraay. 1998. "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data." *Review of Economics and Statistics*, 80(4): 549–560.
Eichenbaum, M. S., B. K. Johannsen, and S. T. Rebelo. 2021. "Monetary Policy and the Predictability of Nominal Exchange Rates." *The Review of Economic Studies*, 88(1): 192–228.
Erceg, Christopher J., Dale W. Henderson, and Andrew T. Levin. 2000. "Optimal Monetary Policy with Staggered Wage and Price Contracts." *Journal of Monetary Economics*, 46(2): 281–313.
Farhi, Emmanuel, and Xavier Gabaix. 2016. "Rare Disasters and Exchange Rates." *The Quarterly Journal of Economics*, 131(1): 1–52.
Federle, Jonathan, André Meier, Gernot Müller, and Victor Sehn. 2022. "Proximity to War: The Stock Market Response to the Russian Invasion of Ukraine." Centre for Economic Policy Research CEPR Discussion Papers 17185.
Ferguson, Niall. 2008. "Earning from History? Financial Markets and the Approach of World Wars." *Brookings Papers on Economic Activity*, 2008: 431–477.
Funke, Manuel, Moritz Schularick, and Christoph Trebesch. 2023. "Populist Leaders and the Economy." *American Economic Review*, 113(12): 3249–88.
García-Cicco, Javier, Roberto Pancrazi, and Martín Uribe. 2010. "Real Business Cycles in Emerging Countries?" *American Economic Review*, 100(5): 2510–2531.
Georgiadis, Georgios, and Ben Schumann. 2021. "Dominant-Currency Pricing and the Global

Output Spillovers from US Dollar Appreciation." *Journal of International Economics*, 133: 1–16.

Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand. 2002. "Armed Conflict 1946-2001: A New Dataset." *Journal of Peace Research*, 39(5): 615–637.

Glick, Reuven, and Alan M Taylor. 2010. "Collateral Damage: Trade Disruption and the Economic Impact of War." *Review of Economics and Statistics*, 92(1): 102–127.

Gopinath, Gita, Emine Boz, Camila Casas, Federico J. Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller. 2020. "Dominant Currency Paradigm." *American Economic Review*, 110(3): 677–719.

Gourio, François. 2012. "Disaster Risk and Business Cycles." *American Economic Review*, 102(6): 2734–66.

Guidolin, Massimo, and Eliana La Ferrara. 2007. "Diamonds Are Forever, Wars Are Not: Is Conflict Bad for Private Firms?" *American Economic Review*, 97(5): 1978–1993.

Harrison, Mark. 1998. "The Economics of World War II: An Overview." In *The Economics of World War II*. . 1 ed., , ed. Mark Harrison, 1–42. Cambridge University Press.

Hazell, Jonathon, Juan Herreño, Emi Nakamura, and Jón Steinsson. 2022. "The Slope of the Phillips Curve: Evidence from U.S. States." *The Quarterly Journal of Economics*, 137(3): 1299–1344.

Head, Keith, and Thierry Mayer. 2014. "Gravity Equations: Workhorse,Toolkit, and Cookbook." In *Handbook of International Economics*. Vol. 4, 131–195. Elsevier.

Heathcote, Jonathan, and Fabrizio Perri. 2002. "Financial Autarky and International Business Cycles." *Journal of Monetary Economics*, 49(3): 601–627.

Hess, Gregory D., and Athanasios Orphanides. 1995. "War Politics: An Economic, Rational-Voter Framework." *The American Economic Review*, 85(4): 828–846.

Ilzetzki, Ethan. 2024. "Learning by Necessity: Government Demand, Capacity Constraints, and Productivity Growth." *American Economic Review*, 114(8): 2436–71.

Jordà, Òscar. 2005. "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review*, 95(1): 161–182.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor. 2017. "Macrofinancial History and the New Business Cycle Facts." *NBER Macroeconomics Annual*, 31(1): 213–263.

Konrad, Kai, and Florian Morath. 2023. "Alliance Formation in Regional Space: Shifting the Battlefront Between Competing Powers." Max Planck Institute for Tax Law and Public Finance Working Paper 2023 – 15.

Korovkin, Vasily, and Alexey Makarin. 2023. "Conflict and Intergroup Trade: Evidence from the 2014 Russia-Ukraine Crisis." *American Economic Review*, 113(1): 34–70.

Lebow, Richard Ned. 2010. *Why Nations Fight: Past and Future Motives for War*. . 1 ed., Cambridge University Press.

Leigh, Andrew, Justin Wolfers, and Eric Zitzewitz. 2003. "What Do Financial Markets Think of War in Iraq?" National Bureau of Economic Research w9587, Cambridge, MA.

Lenin, Vladimir Ilyich. 1917. *Imperialism, the Highest Stage of Capitalism.* Varga & Mendelsohn.

Maddison, Angus. 1995. "Monitoring the world economy."

Martin, Philippe, Thierry Mayer, and Mathias Thoenig. 2008. "Make Trade Not War?" *Review of Economic Studies*, 75(3): 865–900.

Martin, Philippe, Thierry Mayer, and Mathias Thoenig. 2012. "The Geography of Conflicts and Regional Trade Agreements." *American Economic Journal: Macroeconomics*, 4(4): 1–35.

Mayer, Thierry, and Soledad Zignago. 2011. "Notes on CEPII's Distances Measures: The GeoDist Database." CEPII research center Working Papers 2011-25.

Meier, André, and Gernot J Müller. 2006. "Fleshing out the Monetary Transmission Mechanism:

Output Composition and the Role of Financial Frictions." *Journal of Money, Credit, and Banking*, 38(8): 2099–2133.

Miyamoto, Wataru, Thuy Lan Nguyen, and Viacheslav Sheremirov. 2019. "The Effects of Government Spending on Real Exchange Rates: Evidence from Military Spending Panel Data." *Journal of International Economics*, 116: 144–157.

Mueller, Hannes, Dominic Rohner, and David Schönholzer. 2022. "Ethnic Violence Across Space." *The Economic Journal*, 132(642): 709–740.

Murdoch, James C., and Todd Sandler. 2002. "Economic Growth, Civil Wars, and Spatial Spillovers." *Journal of Conflict Resolution*, 46(1): 91–110.

Murdoch, James C., and Todd Sandler. 2004. "Civil Wars and Economic Growth: Spatial Dispersion." *American Journal of Political Science*, 48(1): 138–151.

Nekarda, Christopher, J., and Valerie A. Ramey. 2020. "The Cyclical Behavior of the Price-Cost Markup." *Journal of Money, Credit and Banking*, 52(S2): 319–353.

Novta, Natalija, and Evgenia Pugacheva. 2021. "The Macroeconomic Costs of Conflict." *Journal of Macroeconomics*, 68: 103286.

Oliver, Henry. 1941. "War and Inflation since 1790 in Engand, France, Germany, and the United States." *The American Economic Review*, 30(5): 344–351.

Organski, A. F. K., and Jacek Kugler. 1980. *The War Ledger.* Chicago:University of Chicago Press.

Ostrom, Charles W., and Brian L. Job. 1986. "The President and the Political Use of Force." *The American Political Science Review*, 80(2): 541–566.

Qureshi, Mahvash Saeed. 2013. "Trade and Thy Neighbor's War." *Journal of Development Economics*, 105: 178–195.

Ramey, Valerie A. 2011. "Identifying Government Spending Shocks: It's All in the Timing." *The Quarterly Journal of Economics*, 126(1): 1–50.

Ramey, Valerie A., and Matthew D. Shapiro. 1998. "Costly Capital Reallocation and the Effects of Government Spending." *Carnegie-Rochester Conference Series on Public Policy*, 48: 145–194.

Rasler, Karen, and William R. Thompson. 1985. "War and the Economic Growth of Major Powers." *American Journal of Political Science*, 29(3): 513.

Romer, Christina D, and David H Romer. 2010. "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks." *American Economic Review*, 100(3): 763–801.

Sarkees, Meredith Reid, and Frank Whelon Wayman. 2010. *Resort to War: 1816-2007. Correlates of War Series*, Washington, D.C:CQ Press.

Schmitt-Grohé, Stephanie, and Martín Uribe. 2003. "Closing Small Open Economy Models." *Journal of International Economics*, 61(1): 163–185.

Schularick, Moritz, and Alan M Taylor. 2012. "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008." *American Economic Review*, 102(2): 1029–1061.

Schvitz, Guy, Luc Girardin, Seraina Rüegger, Nils B Weidmann, Lars-Erik Cederman, and Kristian Skrede Gleditsch. 2022. "Mapping the international system, 1886-2019: the CShapes 2.0 dataset." *Journal of Conflict Resolution*, 66(1): 144–161.

Singer, J David. 1988. "Reconstructing the correlates of war dataset on material capabilities of states, 1816–1985." *International Interactions*, 14(2): 115–132.

Singer, J David, Stuart Bremer, John Stuckey, et al. 1972. "Capability distribution, uncertainty, and major power war, 1820-1965." *Peace, war, and numbers*, 19(48): 9.

Stinnett, Douglas M., Jaroslav Tir, Paul F. Diehl, Philip Schafer, and Charles Gochman. 2002. "The Correlates of War (Cow) Project Direct Contiguity Data, Version 3.0." *Conflict Management* *and Peace Science*, 19(2): 59–67.

Stock, James H., and Mark W. Watson. 2018. "Identification and Estimation of Dynamic Causal Effects in Macroeconomics Using External Instruments." *The Economic Journal*, 128(610): 917–948.

Thies, Clifford F., and Christopher F. Baum. 2020. "The Effect of War on Economic Growth." *The Cato Journal*, 40(1): 199–212.

Tooze, J. Adam. 2006. *The Wages of Destruction: The Making and Breaking of the Nazi Economy.* London:Allen Lane.

Ursùa, Jose F., and Robert J. Barro. 2010. "Barro-Ursùa Macroeconomic Data."

Verdickt, Gertjan. 2020. "The Effect of War Risk on Managerial and Investor Behavior: Evidence from the Brussels Stock Exchange in the Pre-1914 Era." *The Journal of Economic History*, 80(3): 629–669.

World Bank. 2022. "GDP per Capita (Constant 2015 US$)."

Zussman, Asaf, Noam Zussman, and Morten Ørregaard Nielsen. 2008. "Asset Market Perspectives on the Israeli - Palestinian Conflict." *Economica*, 75: 84–115.

Online Appendix to The Price of War

(Not for Publication)

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A Additional descriptive statistics

Table A.1: War site overview

War	Site	Total Casualties	Start Date
Franco-Prussian	France	608,637	1870
First Central American	El Salvador	600	1876
Second Russo-Turkish	Bulgaria	158,475	1877
Second Russo-Turkish	Turkey	35,273	1877
Second Russo-Turkish	Armenia	19,500	1877
War of the Pacific	Peru	21,343	1880
War of the Pacific	Chile	4,422	1879
Conquest of Egypt	Egypt	3,853	1882
Sino-French	Vietnam	4,981	1885
Sino-French	China	2,000	1884
Sino-French	Taiwan	700	1884
Second Central American	El Salvador	1,000	1885
First Sino-Japanese	North Korea	6,698	1894
First Sino-Japanese	China	5,399	1894
Greco-Turkish	Greece	480	1897
Spanish-American	Cuba	2,906	1898
Spanish-American	Philippines	616	1898
Spanish-American	Puerto Rico	520	1898
Sino-Russian	China	4,874	1900
Sino-Russian	Russia	3,500	1900
Russo-Japanese	China	472,255	1904
Third Central American	El Salvador	1,000	1906
Fourth Central American	Honduras	1,000	1907
Second Spanish-Moroccan	Morocco	7,000	1909
Second Spanish-Moroccan	Spain	7,000	1909
First Balkan	Turkey	131,857	1912
First Balkan	Greece	55,404	1912
First Balkan	Macedonia	20,694	1912
First Balkan	Albania	13,400	1913
Second Balkan	Greece	62,370	1913
World War I	France	6,578,999	1914
World War I	Poland	1,969,950	1914
World War I	Belgium	1,310,728	1914
World War I	Italy	1,273,813	1915
World War I	Ukraine	1,089,650	1914

World War I	Slovenia	977,978	1915
World War I	Belarus	771,500	1916
World War I	Romania	527,000	1915
World War I	Serbia	328,667	1914
World War I	Turkey	311,938	1914
World War I	Israel	112,165	1916
World War I	Macedonia	110,792	1915
World War I	Iraq	85,896	1914
World War I	Hungary	84,000	1915
World War I	Slovak Republic	84,000	1915
World War I	Greece	74,554	1916
World War I	Montenegro	70,167	1914
World War I	Tunisia	53,192	1916
World War I	Albania	46,892	1916
World War I	Bosnia and Herzegovina	41,833	1914
World War I	Palestine	30,463	1916
World War I	Latvia	29,200	1917
World War I	Cameroon	14,987	1914
World War I	Azerbaijan	11,156	1918
World War I	Egypt	10,552	1915
World War I	Bulgaria	7,802	1918
World War I	Tanzania	4,344	1914
World War I	Germany	2,589	1918
World War I	China	2,443	1914
World War I	South Africa	2,020	1915
World War I	Estonia	1,411	1917
World War I	Mozambique	1,050	1917
World War I	United Kingdom	190	1915
World War I	Kenya	132	1916
World War I	Togo	78	1914
World War I	Papua New Guinea	6	1914
World War I	Solomon Islands	6	1914
Estonian Liberation	Latvia	10,163	1918
Estonian Liberation	Russia	10,163	1918
Estonian Liberation	Estonia	10,163	1918
Hungarian Adversaries	Hungary	16,666	1918
Latvian Liberation	Latvia	13,586	1918
Franco-Turkish	Turkey	15,000	1919
Second Greco-Turkish	Turkey	195,152	1919
Lithuanian-Polish	Lithuania	470	1920

Lithuanian-Polish	Poland	470	1920
Russo-Polish	Poland	158,433	1920
Russo-Polish	Belarus	50,000	1920
Russo-Polish	Ukraine	1,050	1920
Manchurian	China	9,847	1929
Second Sino-Japanese	China	60,000	1931
Chaco	Paraguay	26,513	1932
Chaco	Bolivia	21,592	1932
Chaco	Brazil	1,224	1933
Saudi-Yemeni	Yemen	1,050	1934
Saudi-Yemeni	Saudi Arabia	1,050	1934
Conquest of Ethiopia	Ethiopia	70,802	1935
Third Sino-Japanese	China	2,235,618	1937
Changkufeng	China	2,492	1938
Changkufeng	Russia	2,492	1938
World War II	Russia	8,636,691	1941
World War II	Ukraine	3,647,439	1941
World War II	Poland	2,795,609	1939
World War II	Germany	2,267,118	1939
World War II	Belarus	732,122	1941
World War II	France	705,425	1940
World War II	Greece	506,414	1940
World War II	Estonia	489,459	1944
World War II	Japan	432,621	1942
World War II	Indonesia	420,026	1942
World War II	Italy	403,000	1943
World War II	Philippines	389,770	1941
World War II	Romania	380,224	1941
World War II	Hungary	352,909	1944
World War II	Libya	279,211	1941
World War II	Lithuania	274,651	1944
World War II	Czech Republic	253,841	1938
World War II	Slovak Republic	213,166	1944
World War II	Moldova	195,000	1944
World War II	Finland	191,010	1941
World War II	Austria	177,745	1945
World War II	Myanmar	160,728	1941
World War II	Egypt	145,405	1940
World War II	Latvia	140,045	1944
World War II	Belgium	97,972	1940

World War II	United Kingdom	88,988	1940
World War II	India	77,310	1944
World War II	Tunisia	76,340	1942
World War II	Papua New Guinea	72,938	1942
World War II	Bosnia and Herzegovina	72,723	1942
World War II	Serbia	69,892	1941
World War II	Singapore	67,087	1942
World War II	Netherlands	63,372	1940
World War II	Malaysia	30,200	1941
World War II	Norway	29,895	1940
World War II	Albania	28,836	1940
World War II	Ethiopia	28,083	1941
World War II	Eritrea	18,324	1941
World War II	Solomon Islands	18,044	1942
World War II	Hong Kong	14,602	1941
World War II	Marshall Islands	14,498	1944
World War II	Luxembourg	11,192	1940
World War II	Kiribati	9,936	1942
World War II	Croatia	3,768	1944
World War II	Slovenia	3,768	1944
World War II	Palau	2,859	1944
World War II	Algeria	2,487	1940
World War II	Morocco	2,480	1942
World War II	Brunei	2,335	1945
World War II	Somalia	2,289	1940
World War II	Madagascar	2,174	1942
World War II	Bulgaria	1,400	1944
World War II	Denmark	1,392	1940
World War II	Iraq	1,042	1941
World War II	Australia	972	1942
World War II	Syria	924	1941
World War II	Senegal	786	1940
World War II	Timor	770	1942
World War II	Gabon	416	1940
World War II	China	277	1945
World War II	Sudan	157	1940
World War II	Lebanon	120	1941
World War II	Ireland	34	1940
World War II	Malta	30	1940
Russo-Finnish	Finland	49,499	1939

Russo-Finnish	Russia	1,000	1940
Nomonhan	Mongolia	40,441	1939
Franco-Thai	Laos	570	1941
Franco-Thai	Cambodia	570	1941
Arab-Israeli	Israel	11,798	1946
Arab-Israeli	Palestine	2,198	1948
First Kashmir	India	2,738	1947
Korean	South Korea	757,649	1950
Korean	North Korea	274,585	1950
Off-shore Islands	China	2,961	1954
Sinai War	Egypt	3,613	1956
Sinai War	Palestine	386	1956
Soviet Invasion of Hungary	Hungary	22,753	1956
IfniWar	Morocco	654	1957
Taiwan Straits	Taiwan	2,482	1958
Assam	India	10,846	1962
Second Kashmir	India	2,791	1965
Second Kashmir	Pakistan	619	1965
Vietnam War, Phase 2	Vietnam	653,058	1965
Vietnam War, Phase 2	Laos	15,876	1969
Vietnam War, Phase 2	Cambodia	8,546	1970
Six Day War	Egypt	14,754	1967
Six Day War	Israel	5,682	1967
Six Day War	Palestine	3,056	1967
Second Laotian, Phase 2	Laos	12,375	1968
Football War	El Salvador	1,350	1969
Football War	Honduras	1,350	1969
War of Attrition	Egypt	18,548	1969
Communist Coalition	Cambodia	19,048	1970
Bangladesh	Bangladesh	14,263	1971
Bangladesh	India	12,144	1971
Yom Kippur War	Israel	14,065	1973
Yom Kippur War	Egypt	6,333	1973
Turco-Cypriot	Cyprus	8,614	1974
War over Angola	Angola	50,628	1975
Second Ogaden War, Phase 2	Ethiopia	13,954	1977
Second Ogaden War, Phase 2	Somalia	2,100	1978
Vietnamese-Cambodian	Vietnam	90,150	1977
Vietnamese-Cambodian	Cambodia	90,150	1977
Ugandian-Tanzanian	Tanzania	1,500	1978

Ugandian-Tanzanian	Uganda	1,045	1979
Sino-Vietnamese Border War	Vietnam	38,000	1979
Sino-Vietnamese Punitive	Vietnam	38,000	1979
Iran-Iraq	Iraq	334,275	1982
Iran-Iraq	Iran	152,566	1980
War over Lebanon	Lebanon	12,586	1982
War over Lebanon	Argentina	315	1992
War over Lebanon	Tunisia	73	1985
War over Lebanon	Israel	70	1996
Falkland Islands	Falkland Islands	1,847	1982
War over the Aouzou Strip	Chad	2,662	1987
War over the Aouzou Strip	Libya	1,783	1987
Azeri-Armenian	Azerbaijan	744	1988
Gulf War	Iraq	74,568	1991
Gulf War	Kuwait	49,844	1990
Gulf War	Saudi Arabia	512	1991
Gulf War	Israel	78	1991
Bosnian Independence	Bosnia and Herzegovina	35,895	1992
Cenepa Valley	Ecuador	30	1995
Cenepa Valley	Peru	30	1995
War for Kosovo	Kosovo	324	1998
War for Kosovo	Albania	2	1998
Badme Border	Eritrea	44,600	1998
Kargil War	Pakistan	2,440	1999
Kargil War	India	2,440	1999
Invasion of Afghanistan	Afghanistan	15,029	2001
Invasion of Afghanistan	Pakistan	5,753	2009
Invasion of Iraq	Iraq	69,661	2003
Russo-Ukrainian	Ukraine	475,000	2022

Note: Table provides an overview over all war sites in our sample. Name corresponds to the war names given in the Correlates of War Project (Sarkees and Wayman, 2010).

Table A.2: War sites identified via GPT-4

War	Site	Total casualties	Start date
World War II	Estonia	489,459	1944
World War I	Latvia	29,200	1917
World War I	Estonia	1,411	1917
Second Russo-Turkish	Romania	N/A	1877
World War I	Lithuania	N/A	1914

Note: Table shows war sites that have been identified after cross-checking with GPT-4 and additional sources. For some sites, we could not come up with credible sources for the casualties incurred (outlined as N/A). We assume that these poorly documented battles are likely small in terms of casualties.

Table A.3: Sample size across variables

	Macro time series for...		
Variable	Sites	Belligerents	Third
Inflation	86	122	2,525
GDP	68	107	2,342
TFP	25	81	1,036
Capital stock	25	81	1,036
Military expenditures	76	122	2,096
Employment in the military	78	113	2,075
Population	70	107	2,470
Imports	85	123	2,191
Exports	85	123	2,191

Note: Table counts non-missing observations in sample for each variable in years of war shocks.

Table A.4: Variable descriptions

Variable	Sources	Notes
Inflation	Jordà, Schularick and Taylor (2017); World Bank (2022); Funke, Schularick and Trebesch (2023)	Projections estimated on differences. Winsorized at 1% and 99% levels to account for hyperinflationary episodes.
GDP	Jordà, Schularick and Taylor (2017); Bolt and van Zanden (2014); Funke, Schularick and Trebesch (2023); World Bank (2022); Ursùa and Barro (2010); Bolt et al. (2018)	Projections estimated on log differences.
TFP	Bergeaud, Cette and Lecat (2016)	Projections estimated on log differences.
Capital stock	Bergeaud, Cette and Lecat (2016); Bolt et al. (2018)	Projections estimated on log differences. Variable backed out from capital intensity, labor productivity, and GDP.
Military expenditures	Singer et al. (1972); Singer (1988)	Projections estimated on differences relative to pre-war GDP. COW country codes transformed to iso codes in same way as for belligerents.
Employment in the military	Singer et al. (1972); Singer (1988)	Projections estimated on differences relative to pre-war population. COW country codes transformed to iso codes in same way as for belligerents.
Population	Bolt et al. (2018)	Projections estimated on log differences. COW country codes transformed to iso codes in same way as for belligerents.
Imports	Barbieri, Keshk and Pollins (2009); Barbieri and Keshk (2016)	Projections estimated on differences relative to pre-war GDP, winsorized at 0.1% and 99.9% levels. COW country codes transformed to iso codes in same way as for belligerents.
Exports	Barbieri, Keshk and Pollins (2009); Barbieri and Keshk (2016)	Projections estimated on differences relative to pre-war GDP, winsorized at 0.1% and 99.9% levels. COW country codes transformed to iso codes in same way as for belligerents.
Military strength	Singer et al. (1972)	Proxied by Composite Indicator of National Capability. COW country codes transformed to iso codes in same way as for belligerents.

Note: Table outlines specific sources and construction of variables throughout our sample.

Table A.5: Military strength and the economy

	Log of military strength	
Log GDP	0.823 (0.0167)	
GDP Growth		−0.0849 (0.115)
Country fixed effects	✓	✓
Year fixed effects	✓	✓
Adj. within R^2	0.42	-0.00
N	5,813	5,764

Note: Table shows results for regressing log of military strength, as proxied by the Composite Indicator of National Capability (Singer et al., 1972), on log GDP and GDP growth. Standard errors (in round brackets) are clustered at the year level.

B Further evidence

B.1 Additional figures

Figure B.1: Cumulative distribution of weighting functions

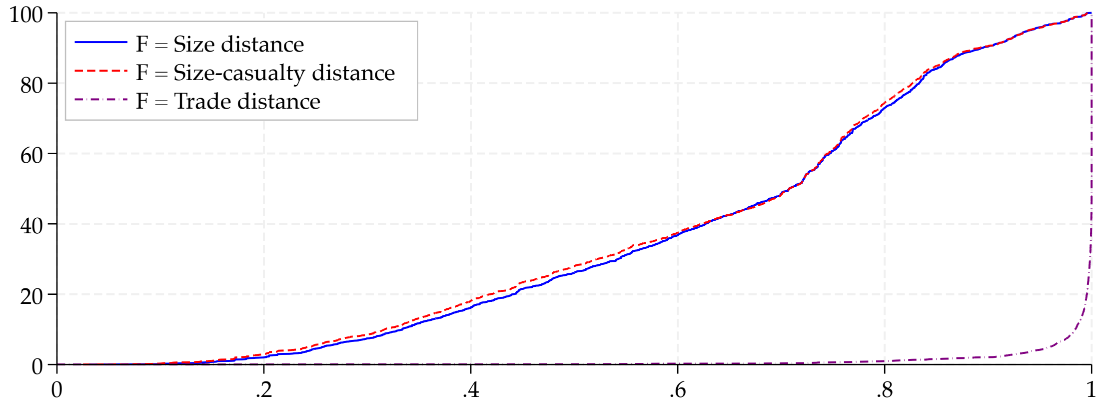
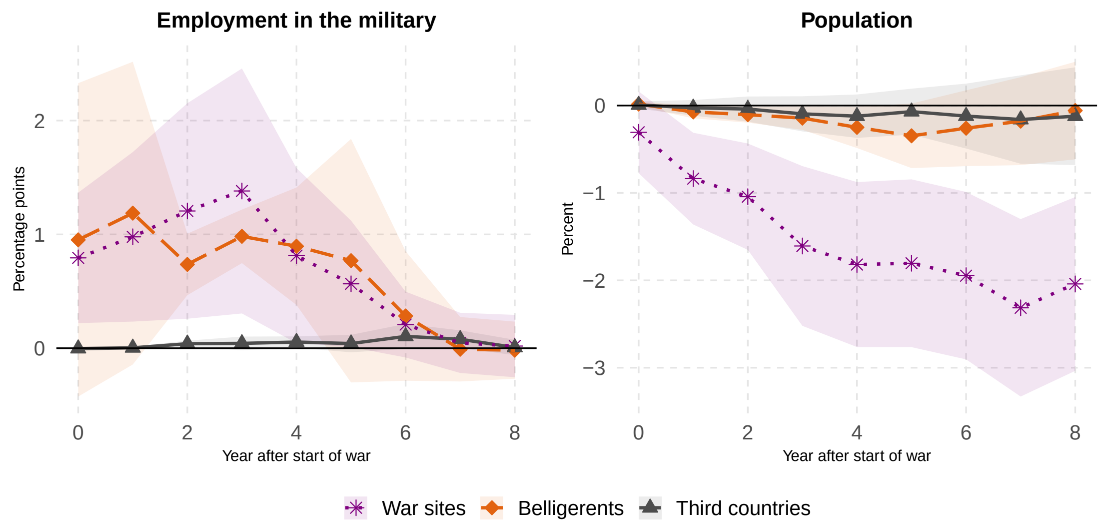


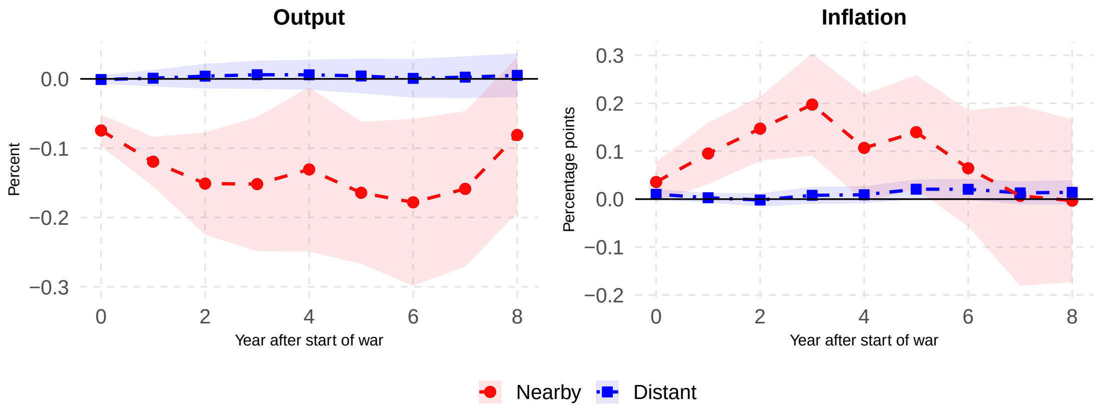
Figure B.2: Employment in the military and population—response to war



Note: Left panel shows change in military personnel relative to pre-war population in percentage points. Right panel shows deviation of population relative to pre-war population in percent. Shaded areas indicate 90% confidence bands.

B.2 Trade-distance specification

Figure B.3: Trade-distance specification



Note: Left panels show deviation of (detrended) output from pre-war level, right panels show deviation of inflation from pre-war rate. Estimates are based on trade-distance specification (B.1). Shaded areas indicate 90% confidence bands.

In our baseline, we allow economic spillovers of war to depend on geographic distance. Ultimately, we think of these spillovers as reflecting the extent of economic integration across countries, very much in the spirit of the gravity equation (Head and Mayer, 2014). To assess this hypothesis we depart from our baseline specification (3.2) in two ways: First, we redefine the variable $Third_{i,t}$ as a dummy variable indicating the onset of at least one war on foreign soil to which country i is a third country. Second, we replace the weighting function (3.1) with a measure of "trade-distance":

$$0 \leq F(i,t) = 1 - \sum_{j \in T_t} \frac{imports_{j \to i,t-1}}{imports_{i,t-1}} \leq 1. \tag{B.1}$$

Here $imports_{j \to i,t-1}$ are imports of country i from war site j in the year prior to the war. We scale these with the total imports of country i and sum over all war sites.[26] At its maximum value of 1, $F(i,t)$ indicates that there is virtually no trade with the war site, just like $F(i,t) = 1$ reflects a maximum distance in the baseline.

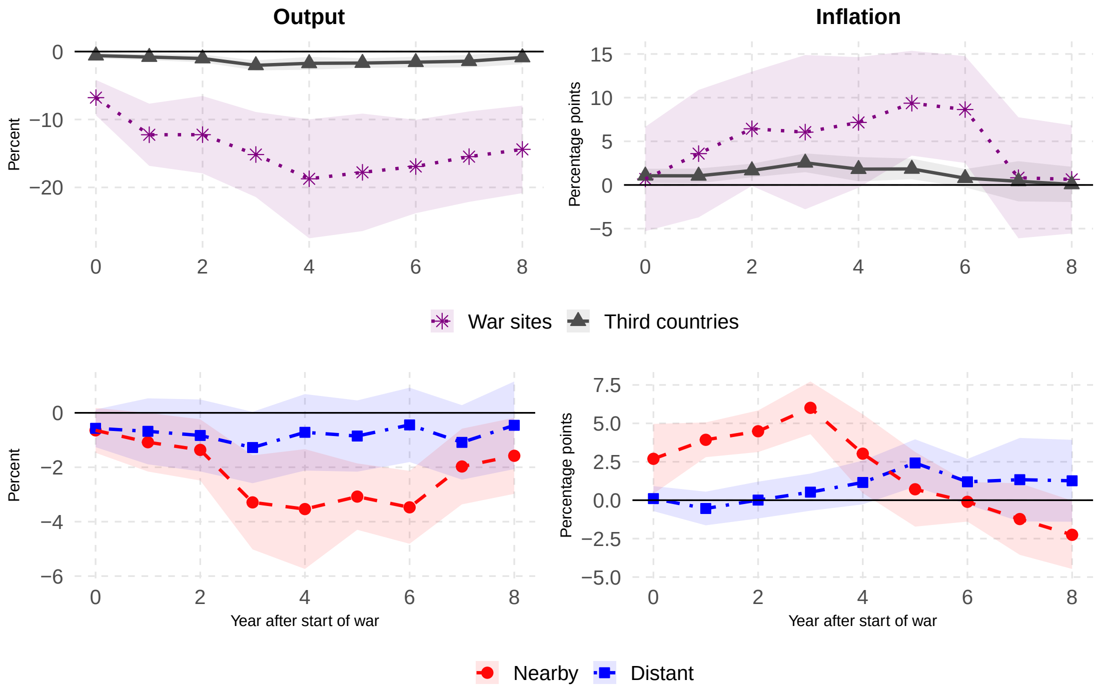
The corresponding responses are shown in Figure B.3. For the distant country, which effectively does not trade with the war site, we do not see any significant response to the war – neither for output nor for inflation. For the nearby country, we outline the scaled responses for the hypothetical case in which the import

[26] Relative importance of trading partners is winsorized at the 99% level to account for varying coverage over time and across country-pairs.

share from the war site is 1%. Here, we see the same pattern of falling output and surging inflation as in our main analysis. Notably, these effects linearly scale in the share of imports a country received from the war site. This pattern is consistent with the notion that the results of our baseline specification regarding the role of distance largely reflect different degrees of trade integration.

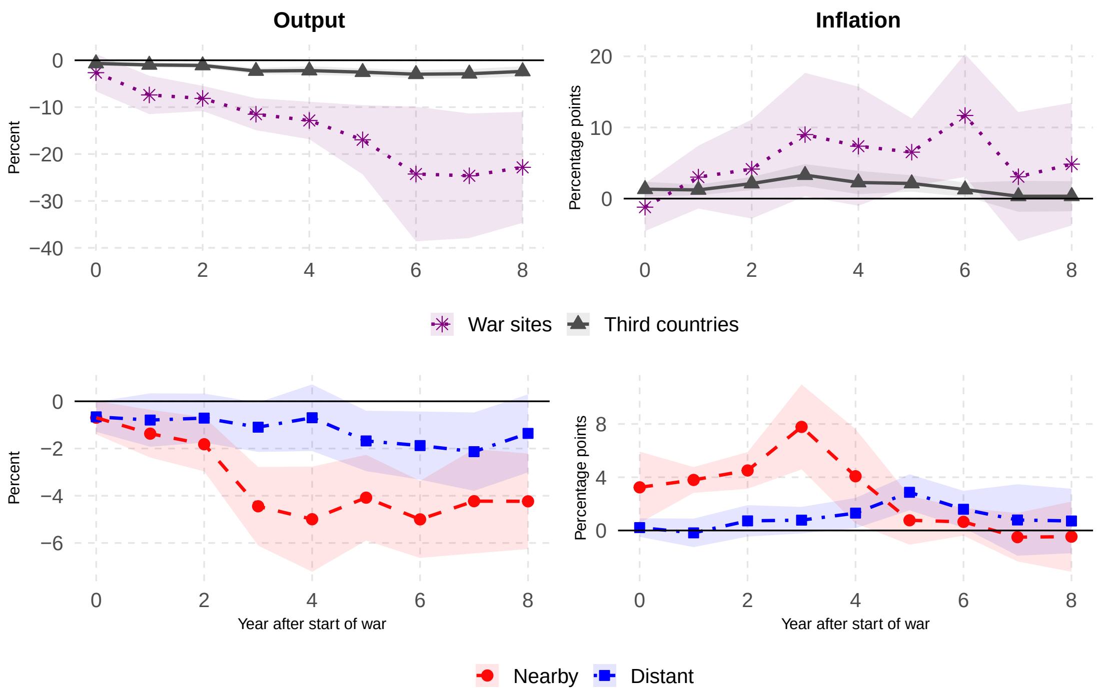
C Robustness

Figure C.1: Controlling for military strength



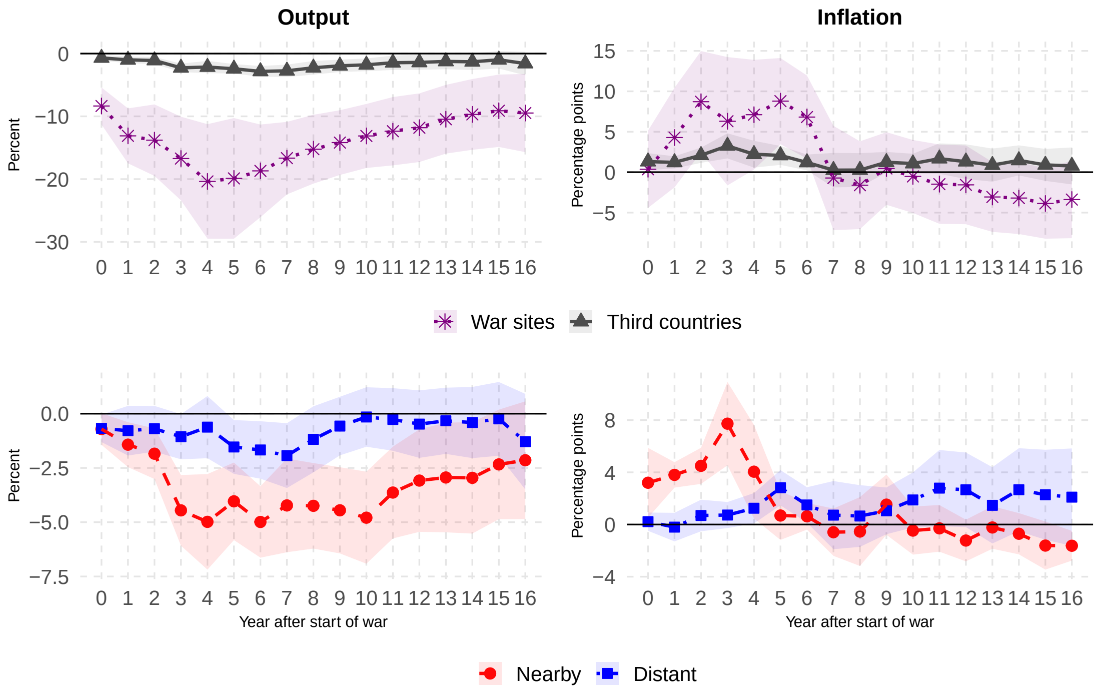
Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Specification controls for military strength by also including the Composite Indicator of National Capability, see Table A.4. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.2: Alternative start years



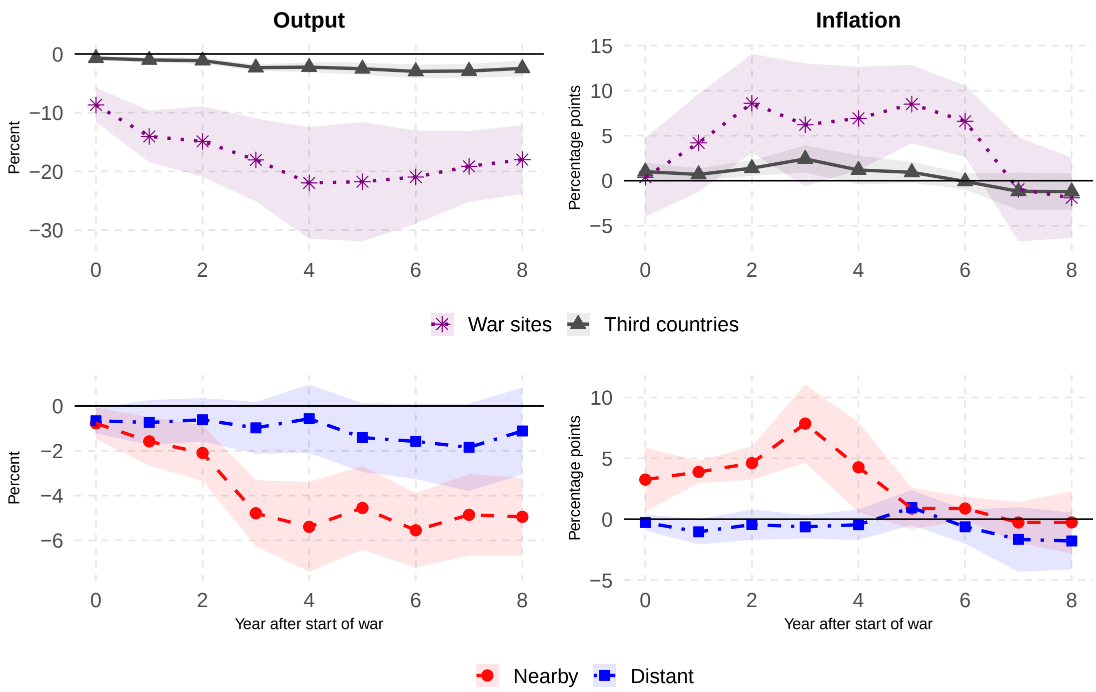
Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, start of the war is no longer the year when military action starts in war site (as in baseline), but when war starts. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.3: Longer horizons



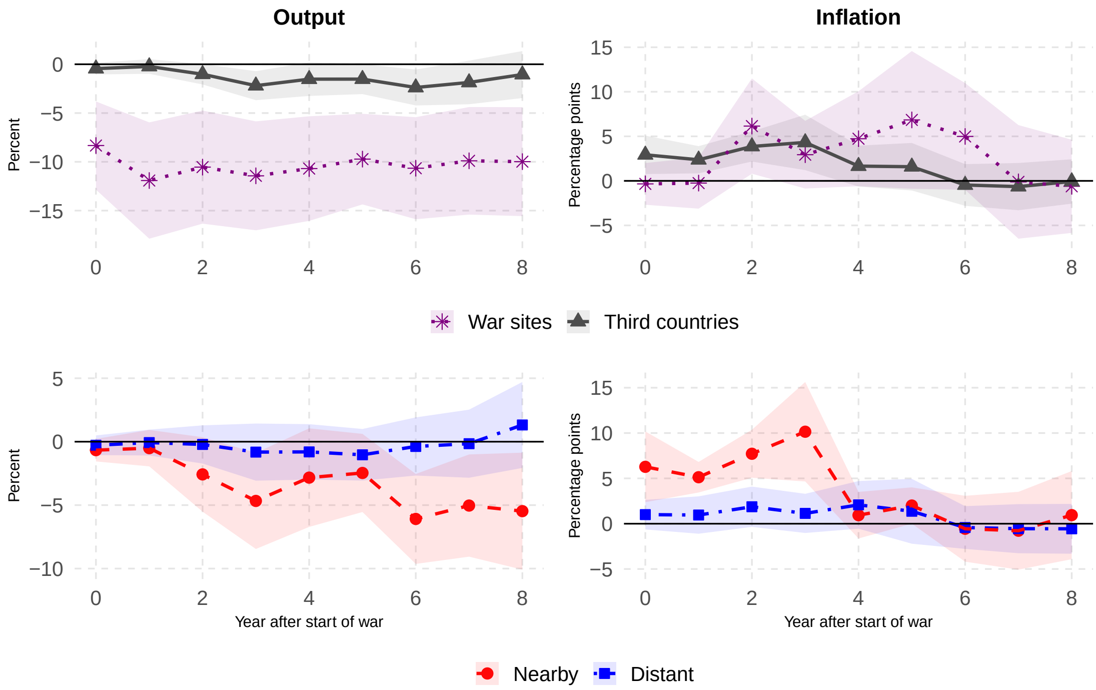
Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, responses are shown for horizons of up to 16 years after the start of the war. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.4: Dependent variables in levels



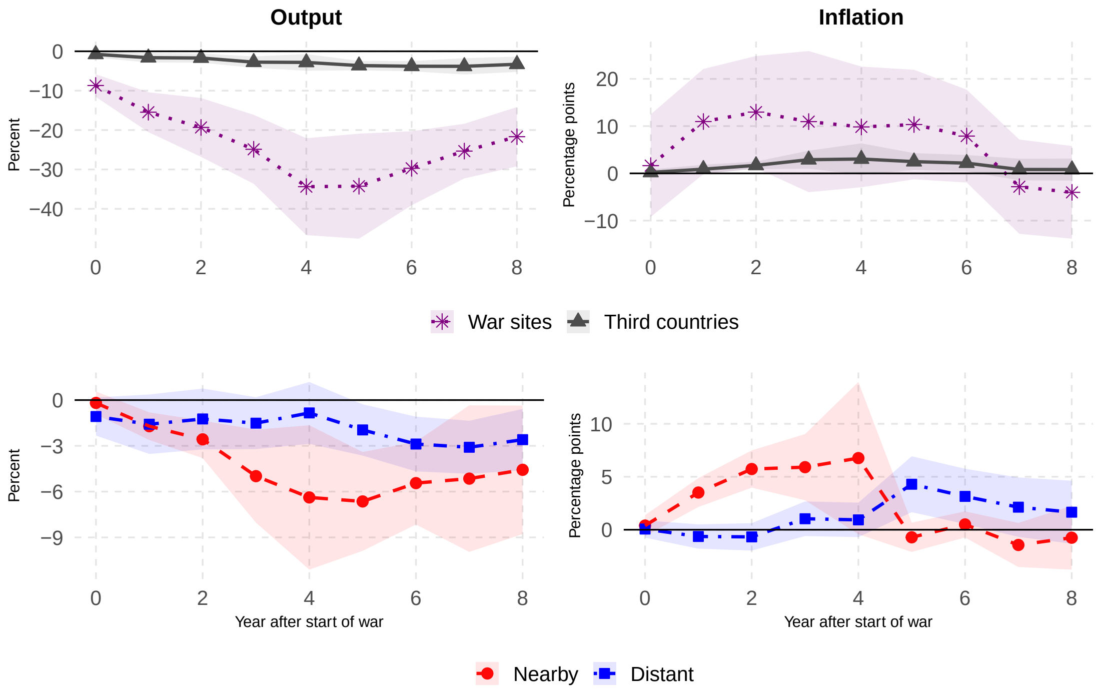
Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, dependent variables are defined in levels rather than in differences from the pre-war level. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.5: Duration $\leq$ 2 years



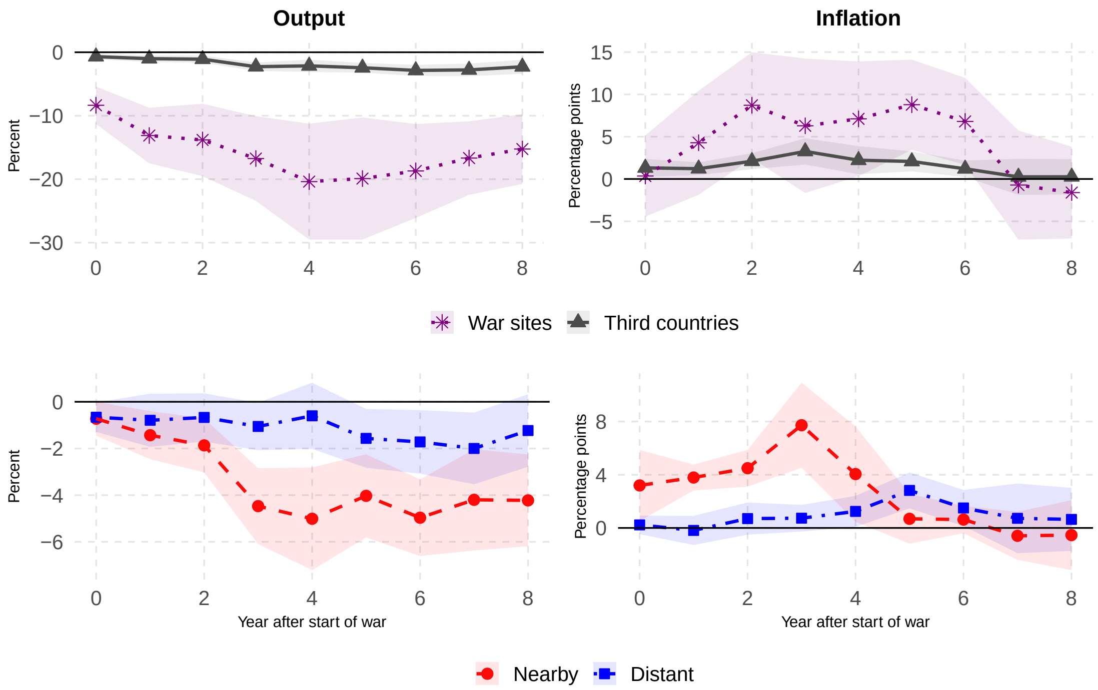
Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, we only consider those wars with a duration of at most 2 years. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.6: Duration > 2 years



Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, we only consider those wars with a duration of at least 3 years. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

Figure C.7: Excluding the U.S.



Note: Left panels show deviation of (detrended) output from pre-war level in response to start of war, right panels show deviation of inflation from pre-war rate. Here, we excluded the U.S. from our sample. Top panels show estimates based on linear specification (3.1), bottom panels based on baseline specification (3.2). Shock size: $Site_{i,t} = 1$ for war site and $Third_{i,t} = 0.05$ for third countries.

D Casus-belli coding

Table D.1 provides an overview of reasons for which wars were fought. Except for the 2022 invasion of Ukraine, primary sources are always Sarkees and Wayman (2010) and Clodfelter (2017). Secondary sources are outlined in the table and were used to cross-check and complement our casus-belli coding, where applicable.

Table D.1: Wars and their casus belli

War	Onset	Nationalism	Religion or Ideology	Power Transition	Border Clashes	Economic Long-Run	Domestic Politics	Revenge Retribution	Economic Short-Run	Secondary Sources
Franco-Prussian	1870		✓							Britannica. 2023. Franco-German War. Accessed August 19, 2023. `https://www.britannica.com/event/Franco-German-War`
First Central American	1876	✓								Bancroft, Hubert H. 1887. “History of Central America.” p. 402.
Second Russo-Turkish	1877	✓	✓							Britannica. 2014. Russo-Turkish Wars. Accessed August 20, 2023. `https://www.britannica.com/topic/Russo-Turkish-wars`
War of the Pacific	1879					✓				Britannica. 2023. War of the Pacific. Accessed August 20, 2023. `https://www.britannica.com/event/War-of-the-Pacific`
Conquest of Egypt	1882					✓	✓			Hopkins, Antony. G. 1882. “The Victorians and Africa: A Reconsideration of the Occupation of Egypt, 1882.” The Journal of African History.
Sino-French	1884	✓								Britannica. 2023. Sino-French War. Accessed August 20, 2023. `https://www.britannica.com/event/Sino-French-War`
Second Central American	1885	✓	✓	✓						Palmer, Steven. 1993. “Central American Union or Guatemalan Republic? The National Question in Liberal Guatemala, 1871-1885.” The Americas.
First Sino-Japanese	1894		✓			✓				Britannica. 2023. First Sino-Japanese War. Accessed August 19, 2023. `https://www.britannica.com/event/First-Sino-Japanese-War-1894-1895`
Greco-Turkish	1897	✓		✓						Britannica. 2016. Greco-Turkish wars. Accessed August 19, 2023. `https://www.britannica.com/event/Greco-Turkish-wars`
Spanish-American	1898	✓								Britannica. 2023. Spanish-American War. Accessed August 20, 2023. `https://www.britannica.com/event/Spanish-American-War`
Boxer Rebellion	1900			✓					✓	Britannica. 2023. Boxer Rebellion. Accessed August 19, 2023. `https://www.britannica.com/event/Boxer-Rebellion`

War	Onset	**N**	**RI**	**PT**	**BC**	**EL**	**DP**	**RR**	**ES**	Secondary Sources
Sino-Russian	1900	✓		✓						Glebov, Sergey. "11 Blagoveshchensk Massacre and Beyond: The Landscape of Violence in the Amur Province in the Spring and Summer of 1900." Russia's North Pacific: 211. Heidelberg University Publishing. ; Britannica. 2023. Boxer Rebellion. Accessed August 19, 2023. `https://www.britannica.com/event/Boxer-Rebellion`
Russo-Japanese	1904	✓								Britannica. 2023. Russo-Japanese War. Accessed August 20, 2023. `https://www.britannica.com/event/Russo-Japanese-War`
Third Central American	1906	✓								Slade, William F. 1917. "The Journal of Race Development." The Federation of Central America
Fourth Central American	1907		✓							Slade, William F. 1917. "The Journal of Race Development." The Federation of Central America; Martin, Percy F. 1911. "Salvador of the Twentieth Century". P. 72-74
Second Spanish-Moroccan	1909	✓	✓							Chandler, James A. 1975. "Spain and Her Moroccan Protectorate 1898 - 1927." Journal of Contemporary History.
Italian-Turkish	1911	✓					✓		✓	Clark, Christopher M. 2012. "The Sleepwalkers: How Europe Went to War in 1914." Allen Lane. p. 177.; See "Libyen, verheißenes Land," Die Zeit, May 15, 2003.
First Balkan	1912	✓								Britannica. 2023. Balkan Wars. Accessed August 19, 2023. `https://www.britannica.com/topic/Balkan-Wars`
Second Balkan	1913	✓								Britannica. 2023. Balkan Wars. Accessed August 19, 2023. `https://www.britannica.com/topic/Balkan-Wars`
World War I	1914	✓	✓							Norwich University Only. 2017. "Six Causes of World War I." Accessed August 20, 2023. `https://online.norwich.edu/academic-programs/resources/six-causes-of-world-war-i`
Estonian Liberation	1918	✓		✓				✓		Minnik, Taavi. 2015. "The Cycle of Terror in Estonia, 1917–1919".; Republic of Estonia, Ministry of Foreign Affairs. "Estonian War of Independence 1918-1920 Estonia's Allies"
Latvian Liberation	1918	✓		✓						Britannica. 2023. Baltic War of Liberation. Accessed August 20, 2023. `https://www.britannica.com/event/Baltic-War-of-Liberation`

War	Onset	N	RI	PT	BC	EL	DP	RR	ES	Secondary Sources
Russo-Polish	1919	✓								Britannica. 2023. Russo-Polish War. Accessed August 20, 2023. https://www.britannica.com/event/Russo-Polish-War-1919-1920
Hungarian Adversaries	1919		✓							University of Central Arkansas. https://uca.edu/politicalscience/home/research-projects/dadm-project/europerussiacentral-asia-region/hungary-1918-present/
Second Greco-Turkish	1919				✓					Britannica. 2016. Greco-Turkish wars. Accessed August 19, 2023. https://www.britannica.com/event/Greco-Turkish-wars
Franco-Turkish	1919	✓	✓							Britannica. 2023. The nationalist movement and the war for independence. Accessed August 19, 2023. https://www.britannica.com/biography/Kemal-Ataturk/The-nationalist-movement-and-the-war-for-independence
Lithuanian-Polish	1920	✓	✓	✓	✓					Balkelis, Thomas. 2018. “War, Revolution, and Nation-Making in Lithuania, 1914–1923” via Tauber, Joachim. 2019. “Tomas Balkelis, War, Revolution, and Nation-Making in Lithuania, 1914–1923.” European History Quarterly.; Britannica. 2023. Vilnius Dispute. Accessed August 20, 2023. https://www.britannica.com/event/Vilnius-dispute
Manchurian	1929	✓					✓			Siegelbaum, Lewis. “Chinese Railway Incident”. Michigan State University. Accessed August 20, 2023. https://soviethistory.msu.edu/1929-2/chinese-railway-incident/
Second Sino-Japanese	1931	✓			✓					Britannica. 2022. Mukden Incident. Accessed August 20, 2023. https://www.britannica.com/event/Mukden-Incident
Chaco	1932		✓			✓				Britannica. 2023. Chaco War. Accessed August 19, 2023. https://www.britannica.com/event/Chaco-War
Saudi-Yemeni	1934		✓		✓					Britannica. 2023. The Kingdom of Saudi Arabia. Accessed August 20, 2023. https://www.britannica.com/place/Saudi-Arabia/The-Kingdom-of-Saudi-Arabia
Conquest of Ethiopia	1935	✓								Britannica. 2023. Italo-Ethiopian War. Accessed August 19, 2023. https://www.britannica.com/event/Italo-Ethiopian-War-1935-1936

War	Onset	N	RI	PT	BC	EL	DP	RR	ES	Secondary Sources
Third Sino-Japanese	1937	✓								Britannica. 2023. Second Sino-Japanese War. Accessed August 20, 2023. `https://www.britannica.com/event/Second-Sino-Japanese-War`
Changkufeng	1938		✓							Blumenson, Martin. 1960. "The Soviet Power Play at Changkufeng". World Politics.
World War II	1939	✓	✓			✓	✓			Vasquez, John A. 1996. "The Causes of the Second World War in Europe: A New Scientific Explanation."
Nomonhan	1939	✓	✓							Otterstedt Charles. 2000. "The Kwantun Army and the Nomonhan Incident: Its Impact on National Security". USAWC Strategy Research Project.; Britannica. 2023. Mongolia - Counterrevolution and Japan. Accessed August 20, 2023. `https://www.britannica.com/place/Mongolia/Reform-and-the-birth-of-democracy`
Russo-Finnish	1939		✓							Britannica. 2023. Russo-Finnish War. Accessed August 20, 2023. `https://www.britannica.com/event/Russo-Finnish-War`
Franco-Thai	1940				✓					Flood Thadeus. 1969."The 1940 Franco-Thai Border Dispute and Phibuun Sonkhraam's Commitment to Japan." Journal of Southeast Asian History
First Kashmir	1947	✓								Britannica. 2023. Kashmir. Accessed August 19, 2023. `https://www.britannica.com/place/Kashmir-region-Indian-subcontinent`
Arab-Israeli	1948	✓					✓			Cashman, G., and Leonard C. Robinson. 2007. "An Introduction to the Causes of War: Patterns of Interstate Conflict from World War I to Iraq." Rowman & Littlefield Publishers, Inc.
Korean	1950	✓	✓	✓						Britannica. 2023. Korean War. Accessed August 20, 2023. `https://www.britannica.com/event/Korean-War`
Off-shore Islands	1954	✓	✓							Office of the Historian, Foreign Service Institute United States Department of State. "The Taiwan Straits Crises: 1954–55 and 1958."
Sinai War	1956			✓		✓				Wright, William M., Michael C. Shupe, Niall M. Fraser, and Keith W. Hipel. 1980. "A Conflict Analysis of the Suez Canal Invasion of 1956." Conflict Management and Peace Science

War	Onset	N	RI	PT	BC	EL	DP	RR	ES	Secondary Sources
Soviet Invasion of Hungary	1956	✓								Britannica. 2023. Hungarian Revolution. Accessed August 20, 2023. https://www.britannica.com/event/Hungarian-Revolution-1956
IfniWar	1957	✓	✓							Studies Institute, US Army War College. 2013. "War and Insurgency in the Western Sahara"; Britannica. 2023. Ifni. Accessed August 19, 2023. https://www.britannica.com/place/Ifni
Taiwan Straits	1958	✓	✓							Office of the Historian, Foreign Service Institute United States Department of State. "The Taiwan Straits Crises: 1954–55 and 1958."
Assam	1962				✓					Britannica. 2023. Sino-Indian War. Accessed August 19, 2023. https://www.britannica.com/topic/Sino-Indian-War
Vietnam War, Phase 2	1965	✓		✓						Britannica. 2023. Vietnam War. Accessed August 20, 2023. https://www.britannica.com/event/Vietnam-War
Second Kashmir	1965			✓						Britannica. 2023. Kashmir. Accessed August 20, 2023. https://www.britannica.com/place/Kashmir-region-Indian-subcontinent
Six Day War	1967		✓	✓	✓					Britannica. 2023. Six-Day War Accessed August 20, 2023. https://www.britannica.com/event/Six-Day-War
Second Laotian, Phase 2	1968			✓						Britannica. 2023. History of Laos. Accessed August 20, 2023. https://www.britannica.com/topic/history-of-Laos
War of Attrition	1969		✓	✓	✓					Britannica. 2020. War of Attrition. Accessed August 20, 2023. https://www.britannica.com/event/War-of-Attrition-1969-1970; Britannica. 2023. Six-Day War Accessed August 20, 2023. https://www.britannica.com/event/Six-Day-War
Football War	1969	✓								Britannica. 2023. El Salvador - Military Dictatorships. Accessed August 19, 2023. https://www.britannica.com/place/El-Salvador/Military-dictatorships#ref468021
Communist Coalition	1970	✓	✓	✓						Pradhan, P. C. "Cambodian Crisis of 1970." Proceedings of the Indian History Congress.

War	Onset	**N**	**RI**	**PT**	**BC**	**EL**	**DP**	**RR**	**ES**	Secondary Sources
Bangladesh	1971	✓								The National Archive. "The Independence of Bangladesh in 1971 ." Accessed 2023-08-19. `https://www.nationalarchives.gov.uk/education/resources/the-independence-of-bangladesh-in-1971`
Yom Kippur War	1973		✓	✓	✓					Britannica. 2023. Yom Kippur War. Accessed August 20, 2023. `https://www.britannica.com/event/Yom-Kippur-War`; Britannica. 2023. Six-Day War Accessed August 20, 2023. `https://www.britannica.com/event/Six-Day-War`
Turco-Cypriot	1974			✓						Bishku, Michael B. 1991."Turkey, Greece and the Cyprus Conflict." Journal of Third World Studies
War over Angola	1975	✓	✓							Britannica. 2023. Angola - Independence and Civil War. Accessed August 20, 2023. `https://www.britannica.com/place/Angola/Independence-and-civil-war`
Second Ogaden War, Phase 2	1977	✓								Lewis, Ioan M. 1989. "The Ogaden and the Fragility of Somali Segmentary Nationalism." African Affairs.
Vietnamese-Cambodian	1977	✓	✓				✓			Abuza, Zachary. 1995."The Khmer Rouge and the Crisis of Vietnamese Settlers in Cambodia." Contemporary Southeast Asia
Ugandian-Tanzanian	1978	✓			✓					Thomas, C. 2022. Uganda–Tanzania War. Oxford Research Encyclopedia of African History. Accessed August 20, 2023. `https://oxfordre.com/africanhistory/display/10.1093/acrefore/9780190277734.001.0001/acrefore-9780190277734-e-1040`
Sino-Vietnamese Punitive	1979		✓					✓		Britannica. 2023. 20th Century International Relations - American Uncertainty. Accessed August 20, 2023. `https://www.britannica.com/topic/20th-century-international-relations-2085155/American-uncertainty#ref305042`
Iran-Iraq	1980			✓	✓	✓				Britannica. 2023. Iran-Iraq War. Accessed August 19, 2023. `https://www.britannica.com/event/Iran-Iraq-War`
War over Lebanon	1982	✓		✓	✓					Britannica. 2023. Lebanese Civil War. Accessed August 20, 2023. `https://www.britannica.com/event/Lebanese-Civil-War`
Falkland Islands	1982	✓					✓			Britannica. 2023. Falkland Islands War. Accessed August 19, 2023. `https://www.britannica.com/event/Falkland-Islands-War`

War	Onset	**N**	**RI**	**PT**	**BC**	**EL**	**DP**	**RR**	**ES**	Secondary Sources
War over the Aouzou Strip	1986	✓				✓				Naldi, Gino J. 2009. "The Aouzou Strip Dispute — A Legal Analysis." Journal of African Law; Britannica. 2011. Aozou Strip. Accessed August 20, 2023. `https://www.britannica.com/place/Aozou-Strip`
Sino-Vietnamese Border War	1987		✓				✓			Yu, Miles M. 2022. "The 1979 Sino-Vietnamese War and Its Consequences ." Hoover Institution.; Britannica. 2023. 20th Century International Relations - American Uncertainty. Accessed August 20, 2023. `https://www.britannica.com/topic/20th-century-international-relations-2085155/American-uncertainty#ref305042`
Gulf War	1990		✓			✓				Britannica. 2023. Persian Gulf War. Accessed August 19, 2023. `https://www.britannica.com/event/Persian-Gulf-War`
Bosnian Independence	1992	✓								Britannica. 2023. Bosnian War. Accessed August 19, 2023. `https://www.britannica.com/event/Bosnian-War`
Azeri-Armenian	1993			✓						Melander, Erik. 2001. "The Nagorno-Karabakh Conflict Revisited." Journal of Cold War Studies.
Cenepa Valley	1995				✓	✓				The Economist. 1998. Peace in the Andes.
Badme Border	1998				✓			✓		Pratt, Martin. 2006. "A Terminal Crisis? Examining the Breakdown of the Eritrea-Ethiopia Boundary Dispute Resolution Process." Conflict Management and Peace Science; Britannica. 2023. Independent Eritrea. Accessed August 19, 2023. `https://www.britannica.com/place/Eritrea/Independent-Eritrea`
War for Kosovo	1999	✓		✓						Larson, Eric V. and Bogdan Savych. 1999. "Operation Allied Force (Kosovo, 1999)." in Misfortunes of War. RAND Corporation.
Kargil War	1999		✓		✓					Tellis, Ashley J., C. Christine Fair, and Jamison Jo Medby. 2001. "Limited Conflicts Under the Nuclear Umbrella: Indian and Pakistani Lessons from the Kargil Crisis." 1st ed. RAND Corporation.; Britannica. 2023. Kargil War. Accessed August 20, 2023. `https://www.britannica.com/event/Kargil-War`
Invasion of Afghanistan	2001		✓	✓						Britannica. 2023. Afghanistan War. Accessed August 19, 2023. `https://www.britannica.com/event/Afghanistan-War`

War	Onset	**N**	**RI**	**PT**	**BC**	**EL**	**DP**	**RR**	**ES**	Secondary Sources
Invasion of Iraq	2003		✓	✓						Britannica. 2023. Iraq War. Accessed August 19, 2023. `https://www.britannica.com/event/Iraq-War`
Invasion of Ukraine	2022	✓	✓							Atlantic Council. 2023. "Putin's dreams of a new Russian Empire are unraveling in Ukraine". The Economist. 2022. "John Mearsheimer on why the West is principally responsible for the Ukrainian crisis.".

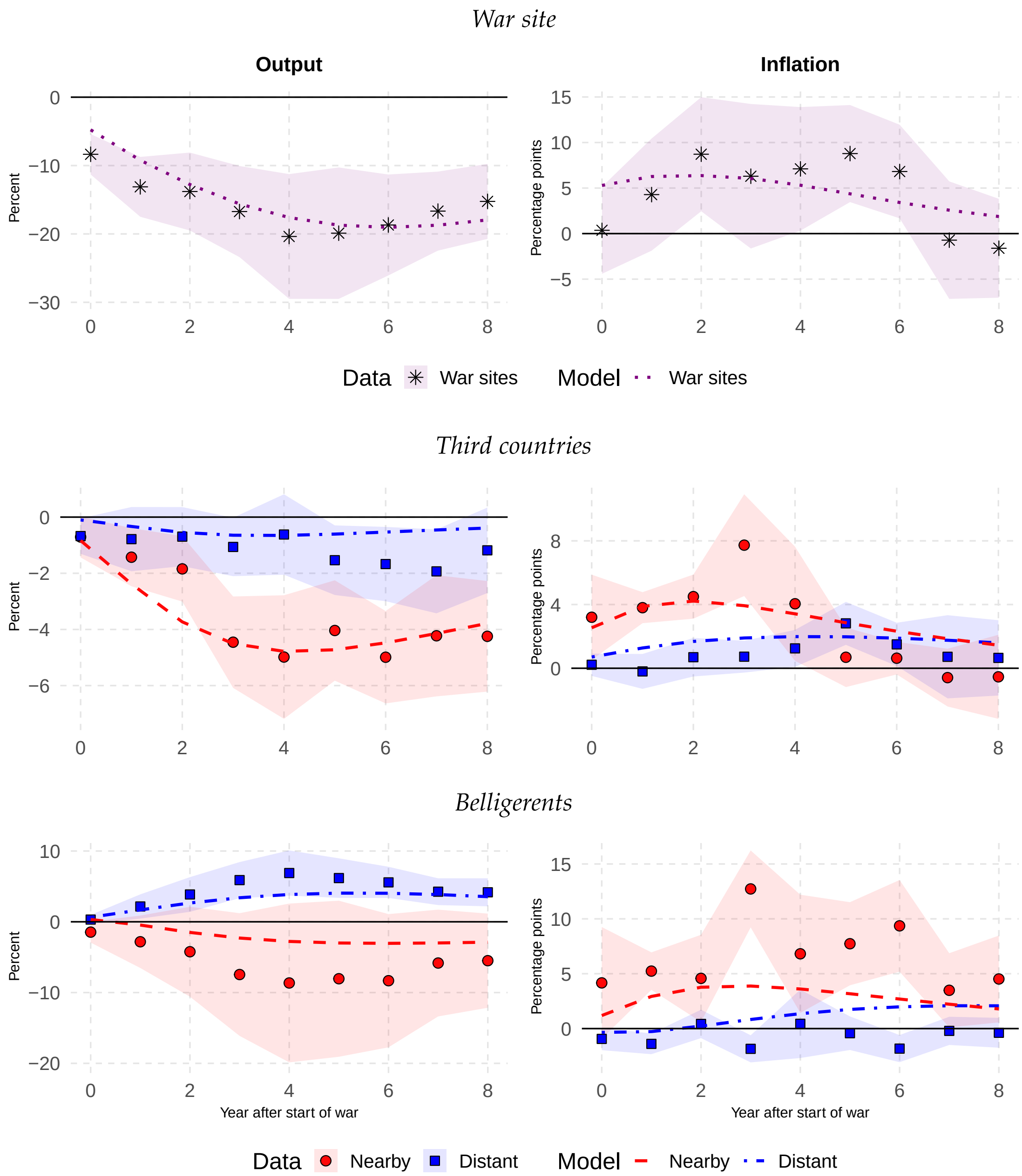
E Structural model

The replication files include a detailed derivation of the equilibrium conditions and alternative calibrations:

`https://github.com/wmutschl/price-of-war`

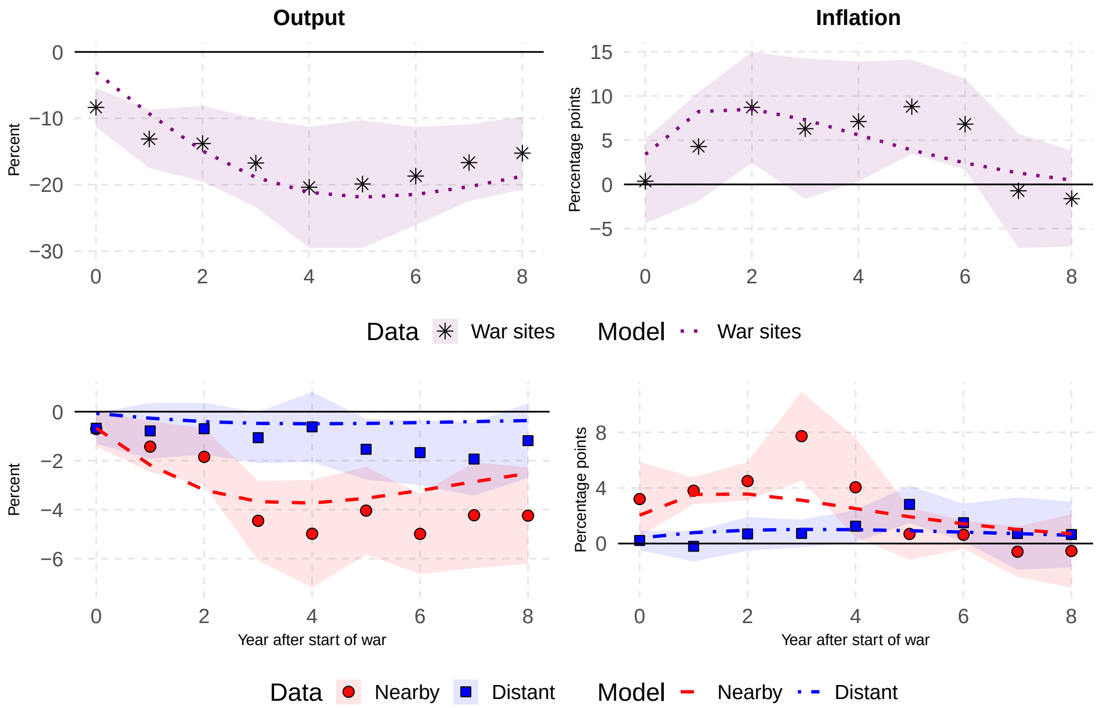
In figures E.1, E.2, E.3, and E.4 we show the outcome of the matching exercise to selected model variants as mentioned in the main paper.

Figure E.1: Six countries—model v data (targeted)



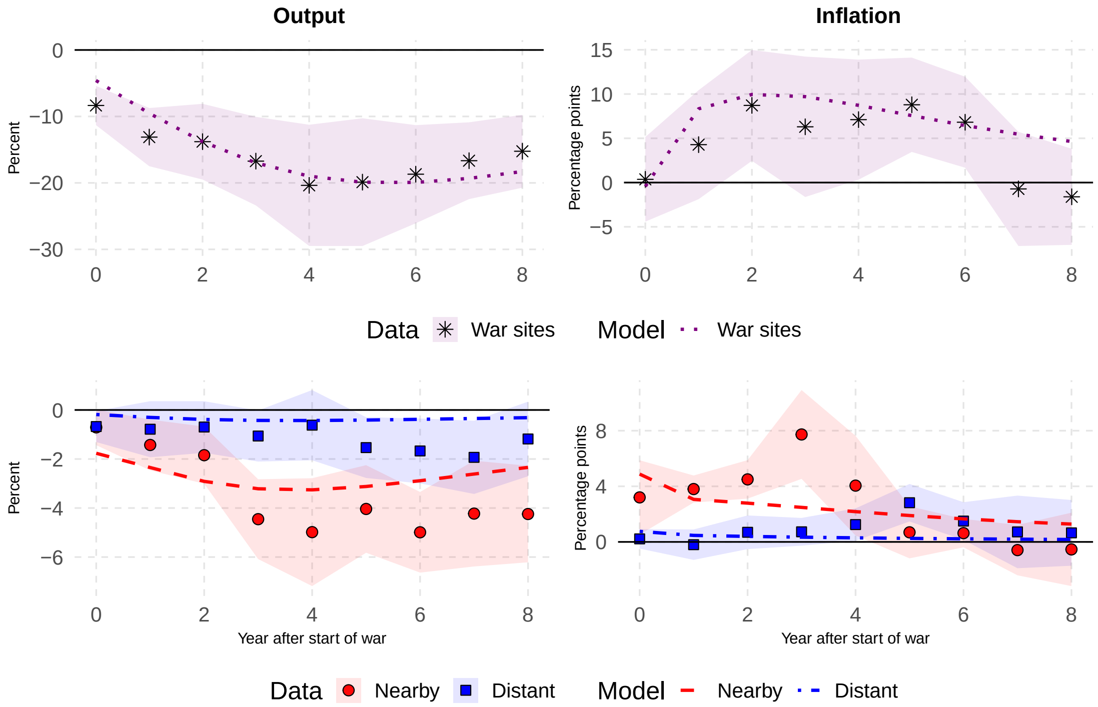
Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figures 5 and 7 above. Vertical axis measures deviation from pre-war (steady-state) level. Compared to the baseline model, this version adds two belligerent countries (nearby and distant) where military expenditures increase in response to the war shock. The extended model is re-matched to the evidence. Posterior estimates are provided in the replication files.

Figure E.2: Flexible price and flexible wage—model v data (targeted)



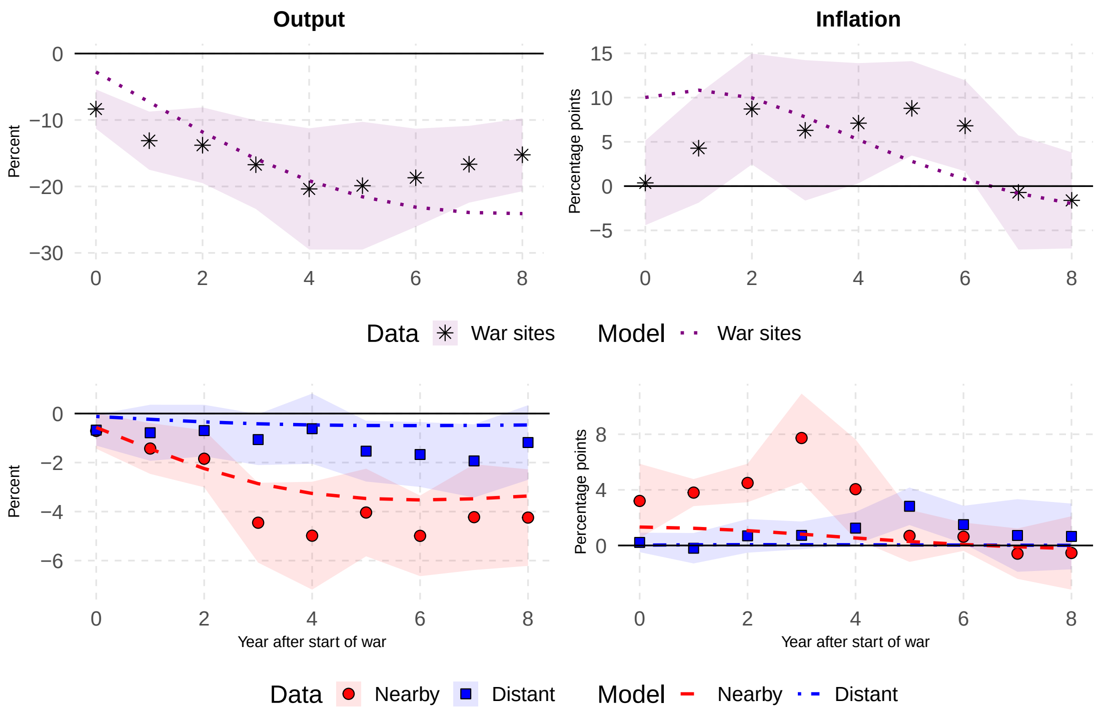
Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figure 5 above. Vertical axis measures deviation from pre-war (steady-state) level. Compared to the baseline model, this version abstracts from nominal price and wage rigidities and is re-matched to the evidence. Posterior estimates are provided in the replication files.

Figure E.3: Interest rate rule—model v data (targeted)



Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figure 5 above. Vertical axis measures deviation from pre-war (steady-state) level. Compared to the baseline model, this version uses an interest rate instead of a money growth rate rule for monetary policy and is re-matched to the evidence. Posterior estimates are provided in the replication files.

Figure E.4: Fixed exchanges rates (peg with *RoW*)—model v data (targeted)



Note: Lines show adjustment to war shock according to calibrated model at posterior mode. Point shapes and shaded areas are reproduced from Figure 5 above. Vertical axis measures deviation from pre-war (steady-state) level. Compared to the baseline model, this version uses fixed exchange rates for *War site*, *Nearby*, and *Distant* with the *Rest of World (RoW)* instead of a monetary policy rule and is re-matched to the evidence. Posterior estimates are provided in the replication files.