The External Costs of War

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September 2023

Abstract

In an integrated global economy, wars impose costs not only on the economy in which the destruction occurs but also on third countries. Understanding the external costs of war, both empirically and theoretically, is the main goal of this paper. We study the economic effects of interstate wars using a new data set spanning 150 years of data for more than 60 countries. We find large negative effects for countries that are geographically close to the war site. Output in neighboring countries falls by more than 10 percent relative to trend over a 5-year period, and inflation rises sharply. These effects—basically an adverse supply shock—decline in distance to the war site, and can even turn positive for faraway economies. As such, wars create winners and losers in the international economy. We show that our empirical results are consistent with an international business cycle model in which spillovers operate through trade channels, price changes, and market access.

Keywords: Interstate Wars, Inflation, Distance, Recession, Spillovers,
International Transmission, Monetary Policy

JEL Classification: F40, F50, E50

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1 Introduction

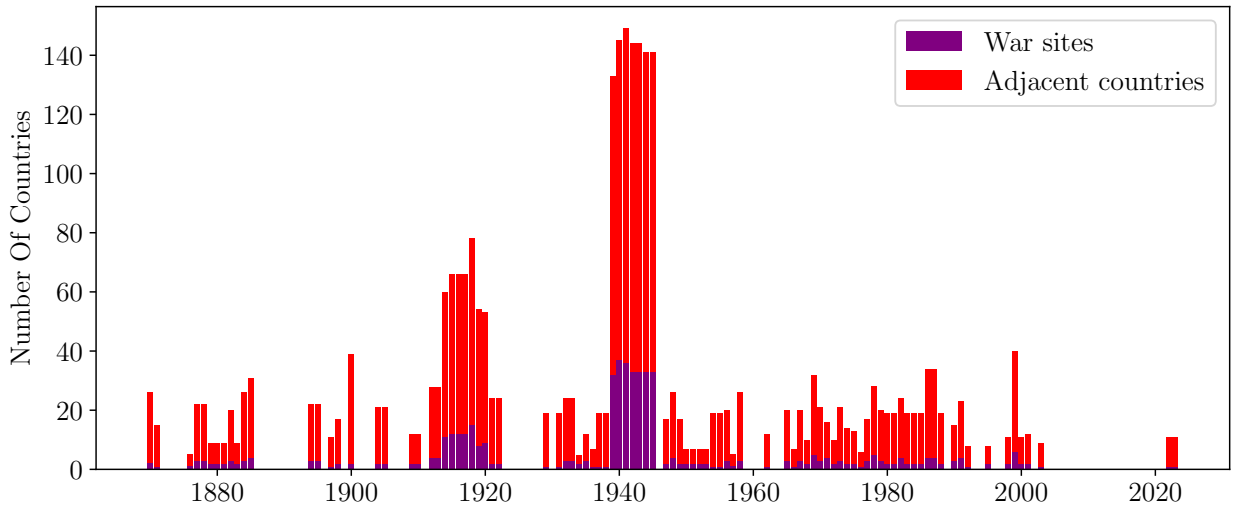
Wars destroy human life and physical capital. The destruction that wars bring has led to some of the most costly economic disasters over the past century (Barro, 2006). Economic historians have studied the (persistent) economic damages of individual wars, as well as the human and economic costs of sustaining the war effort in the belligerent countries (e.g., Harrison, 1998; Davis and Weinstein, 2002; Tooze, 2006).[1] Yet, in an integrated world economy, the economic impact of war is not limited to the war site. Through economic linkages between economies, the effects also spill over to other countries. Wars impose externalities on third countries. From an international perspective, their social costs exceed the "private costs" in the economies at war. This paper quantifies the external costs of war, both empirically and theoretically.

Understanding the external cost of war is an important question for macroeconomics: although experiencing war on a country's own soil is rare, countries are more frequently exposed to wars in their neighborhood, as recent events in Europe have reminded us. Figure 1 illustrates this basic fact. It shows that in a long-run sample starting in 1870, the annual frequency with which a country is a war site in a given year is very low at 1.72%. In contrast, the frequency with which a country is exposed to a war in its immediate neighborhood (without being a party to the war) is much higher at 8.02% – and hence about twice as high as the (unconditional) frequency of financial crises (Schularick and Taylor, 2012). From this perspective, we should not think of exposure to the economic consequences of war as a rare event but more of something occurring almost at business cycle frequency. The spillovers from war are arguably an understudied source of shocks in the international economy.

We start our investigation by compiling a new long-run data set building on the *Correlates of War* (COW) project and on time series data as assembled in the *Jorda-Schularick-Taylor Macrohistory Database* (Jordà, Schularick and Taylor, 2017), augmented in Funke, Schularick and Trebesch (2022). We identify 164 war-site economies since 1870, that is, countries where military action took place during wars. Depending on our classification into all or only major war sites, this gives us in total 2,947 country-year observations for all wars and 998 country-year observations for *major wars* to study the economic spillovers on other countries. The major war sample, for which the recorded toll of the dead, missing, or wounded (DMW)

[1] While establishing adverse effects of interstate war on economic growth has proved empirically challenging (Barro and Lee, 1994; Acemoglu, Johnson and Robinson, 2005), there is consensus about the negative growth effects of conflict more generally (see, for instance, Novta and Pugacheva, 2021; de Groot et al., 2022; Chupilkin and Kóczán, 2022), or for global and very large wars (Rasler and Thompson, 1985; Thies and Baum, 2020).

Figure 1: War sites and adjacent countries



Notes: Total number of countries is 192, Data source: Correlates of War Project. Direct Contiguity Data, 1816–2016. Version 3.2 (Stinnett et al., 2002). Neighbors are countries which are geographically adjacent to the war zone (based on 2016 borders). War sites determined by authors.

exceeds 100K per war, constitutes our baseline. These severe episodes are best suited to identify the effects of war, as argued by Barro (1987) in a related context. As is standard practice, we verify that all of our results also hold qualitatively if we re-estimate our empirical specification on a sample that includes all war sites; we also check that our main result stands if we drop the two World Wars from our sample.

We perform a comprehensive long-run analysis of the macroeconomic consequences of war, with a focus on the spillovers of wars on output and inflation in third countries. In a first step, we move beyond earlier work as we establish systematically the impact of wars on the war-site economy. Focusing on major war sites, we find that output declines by more than 40 percent relative to trend, and inflation increases by 40 percentage points some 5 years after the start of the war. In a second step, we move on to study the external costs of war, i.e., the effects on third countries that do not experience combat on their own soil but are indirectly exposed. Among these third countries, we further distinguish between countries that are geographically close to the war site ("nearby") and more "distant" countries. This distinction will turn out to be essential to understanding the external costs of war. We estimate the effects on third countries in a smooth-transmission framework that allows spillovers to differ depending on countries' geographic distance from the war site.

Our key finding is that wars create relative winners and losers in the global economy. Nearby countries are significantly and substantially affected by the war: On average, output falls

by nearly 15 percent relative to trend over a 5-year period, and inflation rises over several years, peaking at about 15 percentage points above trend. From the perspective of nearby countries, wars are thus akin to a severe contractionary supply shock: they lower productive capacity and generate price pressures, giving rise to difficult trade-offs for stabilization policy. Conceptually, this is noteworthy in light of the classic discussion about the possibility of supply-side driven recessions (King and Rebelo, 1999). For distant countries, the economic impact goes in the opposite direction: output expands somewhat, and prices remain stable relative to the baseline trend. From the perspective of distant countries, wars can therefore be best described as a (moderate) positive demand shock: trade picks up and the integration in the international division of labor increases.

We argue that these empirical findings merit a causal interpretation. This is because we narratively identify, in each individual case, the *casus belli*, or the primary causes and motives behind the war. The overwhelming majority of wars are linked to nationalist, ideological, or historical drivers that are exogenous to the state of the business cycle in non-belligerent, neighboring countries. Even from the perspective of the warring countries, however, short-term business cycle considerations typically play a very minor role in motivating war, as opposed to, say, nationalism, religious or ideological differences, or diversion from domestic politics. Accordingly, we treat the wars in our sample as exogenous to the business cycle, similar to the assumption that is implicit when military expenditures and news of military spending are used to estimate the effects of fiscal policy (Barro and Redlick, 2011; Ramey, 2011; Miyamoto, Nguyen and Sheremirov, 2019).

This is not to say that economic factors play no role in the decision to go to war. They are clearly important. Wars may be waged for economic reasons, such as disputes over natural resources. Wars in the context of colonial expansion may also fall in this category, 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 see a parallel here with the tax changes for which Romer and Romer (2010) identify "more exogenous reasons." With the exception of two smaller wars—the Boxer uprising in 1900 and the Italo-Turkish War in 1911, which we discuss in more detail below, we find no evidence for wars that were triggered by a desire to boost the domestic economy or the economy of neighboring countries in the short run. We drop both wars from our sample.

In our empirical specification, which uses local projections, we interpret the *start* of the war as an exogenous event while acknowledging that *its duration* will likely depend on its

economic impact. Specifically, we relate changes in output and inflation to the start of the war. We also verify that "war shocks" are largely unanticipated by macroeconomic indicators and trace out their effects over time relative to a non-war baseline trend. We compare the effect on war-site economies and third countries that are potentially exposed to the spillovers of the war.

To be able to give a structural interpretation to our empirical results, we study the macroeconomic impact of war in a three-country business cycle model that builds on Gopinath et al. (2020). One of the three countries represents the war site, which is highly integrated with one of the other two economies, the nearby country, and much less so with the distant country. In specifying the war shock, we draw on earlier work on rare disasters (Gourio, 2012). Specifically, we assume that the war shock destroys a large fraction of the capital stock and simultaneously induces a persistent decline of common productivity in the war-site economy and a temporary drop in investment-specific technology. At the same time, the war shock reduces market access to the war-site economy: iceberg trade costs go up. To pin down parameter values, we match the empirical impulse response functions for the war-site economy using a Bayesian approach.[2]

The model is able to generate spillovers that align well with our estimates for both nearby and distant economies—even though these have not been used as input in the estimation of the model. Moreover, the model generates empirical evidence for plausible parameter values. In the estimated model, spillovers operate through trade and, in particular, intermediate inputs. The war-site economy suffers from a large supply contraction (the capital stock is destroyed and productivity declines). This supply contraction spills over to the nearby economy because trade in intermediate inputs collapses while their price shoots up. The capital stock in the nearby economy declines endogenously. Instead, trade with the less integrated economies picks up as market access to the war site is reduced. This is insufficient to contain the contraction in the nearby economy but accounts for the positive output spillover to the distant economy. The supply contraction, both in the war-site and the nearby economy, accounts for the surge in inflation. The inflation spillovers to the distant economy, by contrast, are negligible. Overall, we find that the model offers a plausible account of the war's impact on the war site and its spillovers to other countries. It not only offers additional insights into the transmission mechanism but also serves as an important plausibility check for our empirical results, even from a quantitative point of view.

[2]As a technical contribution of this paper, we extend the method-of-moments toolbox in Dynare to now include formal (Frequentist or Bayesian) 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., 2022).

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 presents our data set, the specification of war sites, the classification of the casus belli, and a number of descriptive statistics. Section 3 discusses our empirical strategy and presents the main results. In Section 4, we outline and calibrate our business cycle model and discuss simulation results, including the policy counterfactuals. A final section offers a brief conclusion.

Related literature. Our analysis adds to the small literature on the macroeconomic impact of wars on war-site economies, some of which are referenced above. We share the business-cycle perspective of Auray and Eyquem (2019), who estimate a model on time series data for the two World Wars. Our main focus, however, is on the macroeconomic spillovers of war, which have not been researched in any significant detail yet. Within our broad area of interest, there is, first, a distinct body of work investigating 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. Second, the role of geographic distance as a determinant of conflict has been highlighted in earlier work, though often with a focus on civil war and ethnic conflict (Murdoch and Sandler, 2002, 2004; Mueller, Rohner and Schönholzer, 2022). By contrast, our analysis is focused on interstate wars. Third, there is work on how trade and distance might influence the probability of war (Martin, Mayer and Thoenig, 2008, 2012). In our analysis, the endogeneity of war with respect to trade and, more generally, economic performance is less of an issue because we are not so much concerned with the economic impact of war on the belligerents as with its spillovers to other countries. Fourth, the market response to conflict, both expected and actual, has been analyzed in some detail (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). What sets our analysis apart from these latter studies is our interest in 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 war on third countries that are not war sites but potentially exposed via close geographic proximity.

2 Data, identification, and basic facts

In this section, we introduce our data set and definitions and narratively classify the wars in our sample. We also present descriptive statistics that show how wars affect economic performance.

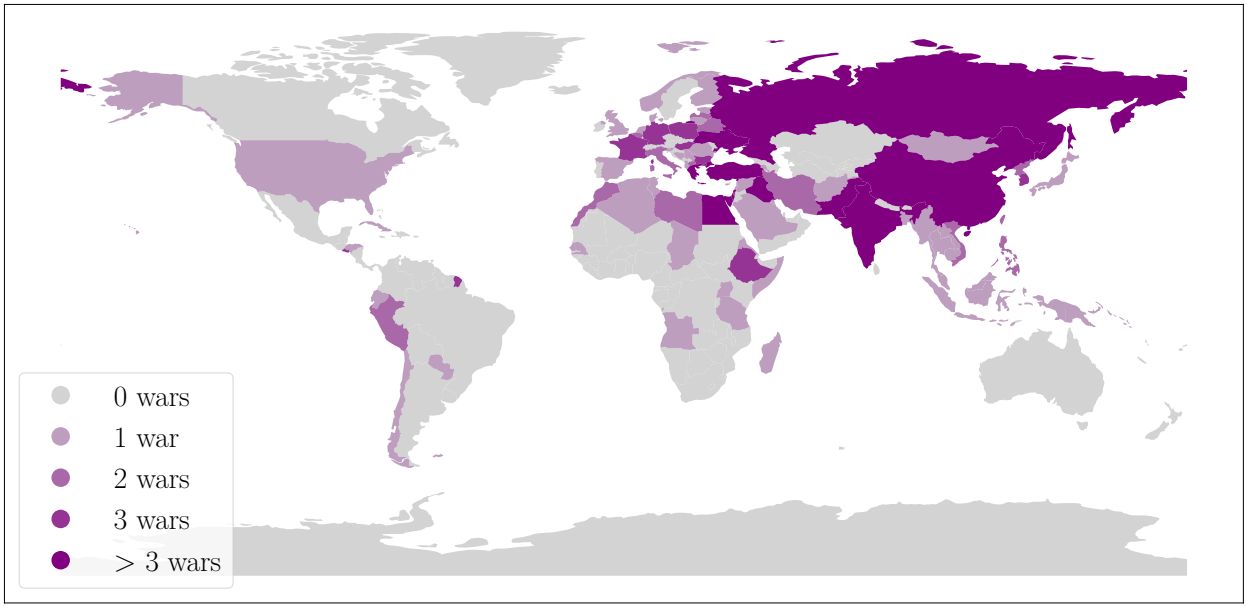
2.1 Data

For our analysis, we bring together data from different sources. First, to identify wars and their most important characteristics, such as length, participants, and casualties, we rely 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 1,000 battle-related fatalities among all of the system members involved." There have been no interstate wars that meet this criterion in the period 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]

The COW project does not provide information on where the war actually took place. This locational information is essential for our analysis below, which distinguishes between a) the economic impact of the war on the war-site economy and b) its spillovers to other economies, which may include both belligerent and non-belligerent countries. We rely on various data sources to determine which countries experienced military conflict on their own soil. This allows us to determine the war sites for each war. Drawing on Clodfelter (2017), Organski and Kugler (1980) and Lebow (2010), we disaggregate the wars in our sample to the battle level. We identify 513 different battles for which we code the precise geolocation. In this way, we are able to identify 164 countries that have been war sites in the 75 wars in our sample. The largest battle in our sample is the Battle of Wuhan in China during the Sino-Japanese War, which is associated with more than 2 million dead, missing, or wounded (DMW) people. Other well-known battles, such as the Battle of Stalingrad and the Siege of Leningrad, with a total of 500k and 485k DMW, respectively, also rank among the bloodiest in our sample.

[3]The definition of wars 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 have caused more than 1,000 battle-related deaths per year.

Figure 2: War Sites



Notes: Figure shows all countries along with the number of wars which took place on their soil.

The map in Figure 2 provides an overview: the darker a country is shaded, the more often it has been a war site. We observe war sites to be distributed across the world, with some clustering in Europe, the Middle East, and Asia. The U.S. is also classified as a war site, but only once: During World War II there were several battles on the Aleutian Islands, a group of islands belonging to Alaska, as well as the Japanese attack on Pearl Harbor. The Aleutian Islands example illustrates that military action will not, in all cases, cause meaningful economic effects. In our baseline, we thus focus on those war-site countries where the fighting was most severe. We set the threshold to 100k DMW and refer to "major war sites" in what follows. The U.S. case does not meet this criterion.

In our formal analysis below, we relate spillovers to geographic distance, which is defined as the distance between the most populated cities across two countries. We also verify that results are robust once we switch to a population-weighted distance measure. Both measures are taken from Mayer and Zignago (2011).

The greatest distance between a war site and a third country in our sample, at 19,812 kilometers, is observed between Peru and Cambodia in the 1977 Vietnamese-Cambodian war. During war times, the mean distance of other countries to the closest war site is 7,026 kilometers.

Finally, to study the economic impact of war, we rely on time-series data from the *macrohistory* database, which covers 18 advanced countries starting in 1870 (Jordà, Schularick and Taylor, 2017). We extend these data with data for additional countries from various sources (Ursùa and Barro, 2010; Bolt et al., 2018; Funke, Schularick and Trebesch, 2022; World Bank, 2022). Our combined data set features annual observations for an unbalanced panel of 60 countries for the period 1870–2022. The main variables of interest are aggregate real GDP ("output") and consumer price inflation.[4]

2.2 The casus belli: a narrative classification

In our analysis below, we seek to identify the macroeconomic effect of wars in the short run. For this purpose, we assume that wars are largely exogenous to the business cycle. A similar assumption is typically invoked for military spending in economic analysis of fiscal policy (see, for instance, Barro and Redlick, 2011; Ramey, 2011; Miyamoto, Nguyen and Sheremirov, 2019). However, given the focus of our study, we go one step further and use narrative records to classify the apparent *casus belli* for all wars in our sample.

For the classification of wars, we rely on the warfare encyclopedia by Clodfelter (2017) and numerous other sources for cross-checks. A detailed overview of the different sources used for the casus belli identification is provided in Table C1 in the Appendix. Countries go to war for a variety of reasons, and we do not restrict these to one. Even as we try to determine the main reasons for a war, our reading of the historical records results in an average of two main reasons per war. These may include, inter alia, nationalism, ideological differences, or power transitions. Table 1 lists the result 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). Indeed, 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

[4]We winsorize inflation at the 99.5% and 0.5% levels.

Table 1: Reasons for Going to War

Reason	Explanation	# Wars
Nationalism	Creation of own sovereign state, wars for independence, imperialism	46
Power Transition or Security Dillemma	A rising power challenges a dominant one. Moreover, the arms races leading up to these wars are classic examples of the security dilemma in action, 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 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

Notes: Table shows different reasons for going to war across wars in sample. 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 C1 in the appendix

or, more specifically, colonialism was key. However, dire economic conditions in Italy, as reflected in mass emigration in the decade prior to war, were arguably conducive to the war, as well. Hence, we drop both of these wars from our sample.

2.3 Descriptive statistics

To set the stage for our analysis, we first establish basic facts about wars and how economic performance differs between wars and normal times.

Table 2: Categories of War Sites

Severity	Min. DMW	Mean DMW	Mean Length	Median Length	Sites	Third Countries
All Sites	46	188,996	2.1	1.0	164	2,947
>10K DMW	10,000	345,312	2.8	3.0	89	1,820
>25K DMW	25,013	460,185	3.0	3.2	66	1,573
Major Sites	105,525	689,049	3.3	3.5	42	998

Notes: Table shows different war-site samples according to DMW thresholds. DMW denotes total number of dead, missing or wounded people on a war-site's soil. Min. DMW denotes war site with lowest number of DMW in sample. Average length denotes mean duration in years for wars in our sample. Sites denote number of war sites in our sample. Third countries refer to other potentially exposed countries covered in our macro time-series. (Sarkees and Wayman, 2010).

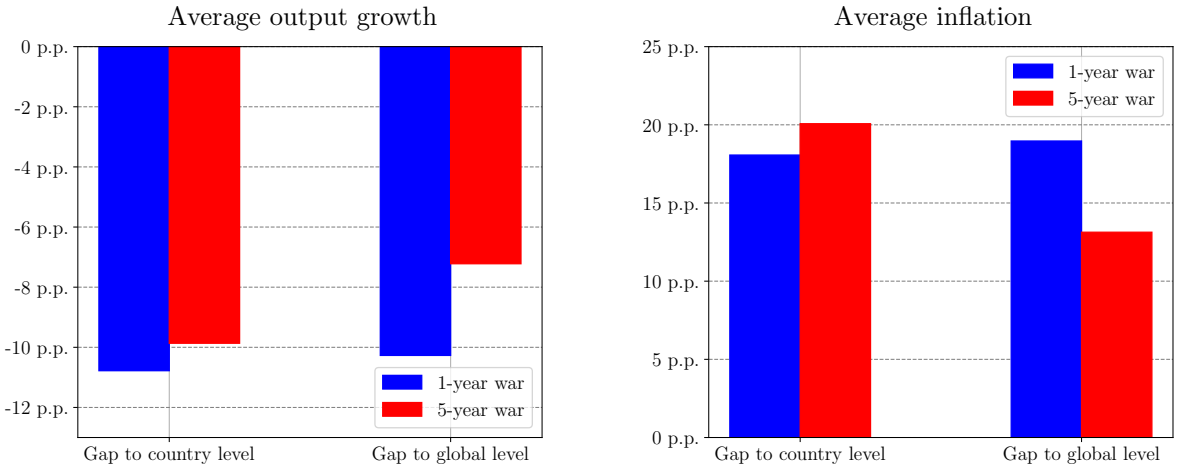
First, we provide a brief overview of the basic war-site characteristics in Table 2. Considering the full sample (first line), we find that there are 164 war sites, with an average duration of war at 2.1 years. The average number of DMW is 188,996. Moreover, the whole sample includes time series data for 2,947 country-year observations of third countries, which are potentially exposed to spillovers from the war site.

In our analysis below, we consider different subsets in order to assess how a war's intensity shapes its economic effects. To set the stage, Table 2 provides summary statistics for progressively more severe wars. The last row of the table reports the numbers for the major war sites that we use as our baseline sample (because we suspect the economic effects of war will stand out most clearly from the worst wars in history). This sample is defined as only those war sites for which the number of DMW exceeds 100k.[5] The average number of DMW is as high as 689k in this sample, and the average length of the war extends to over three years. Importantly, even if the "major sites" sample includes only 42 war sites, the number of third countries, which is our primary focus of analysis, remains substantial at 998.

The three largest war sites in our baseline sample comprise Russia in World War II, China in the Third Sino-Japanese War, and France in World War I. A complete list of all major sites is provided in Table A1 in the appendix.

[5]Our DMW measure for war sites is compiled based on specific battles and, therefore, likely understates the actual number of DMW.

Figure 3: Economic Performance of Major War Sites



Notes: Output growth and inflation are annualized and measured relative to historical country norm (left bars) and contemporaneous cross-sectional norm (right bars). Sample: Major war sites.

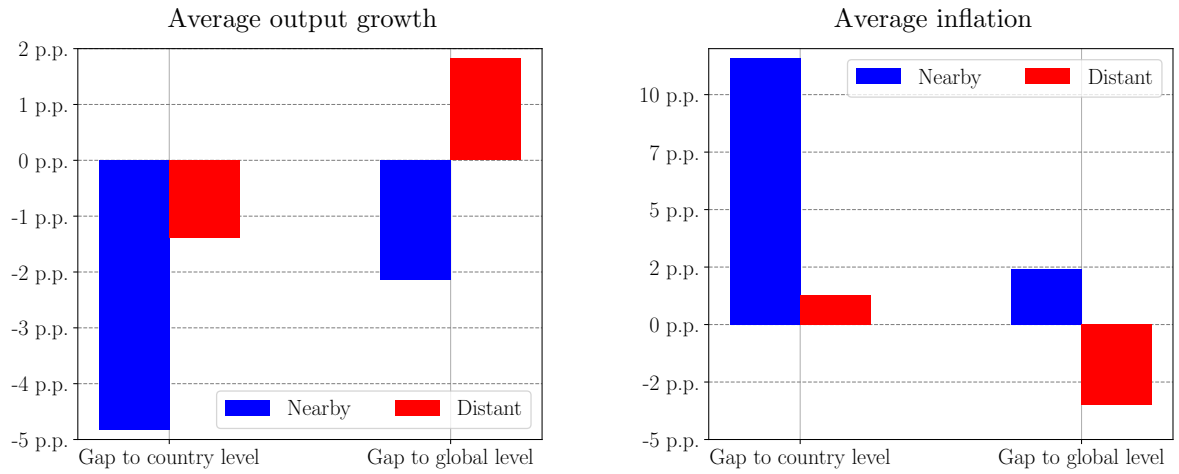
2.4 Economic performance of countries during war

Turning to countries' economic performance during major wars, we benchmark growth and inflation during wars against normal times based on two distinct concepts: the *gap to country norm* and the *gap to global norm*, measured by the difference to a country's own average performance over time and to the cross-sectional average during which a country has been a war site, respectively. We do this for wars that last 1 year and separately for wars that last five years and compute the average annual gap. Figure 3 shows the result for the growth rate of output (left panel) and the average inflation rate (right panel).

The figure illustrates that economic performance during wars differs from normal times. Independently of the specific measure, there is a sizeable shortfall in economic growth. For 1-year wars, average growth in the war site is about 10 percentage points below the total sample average of the country's growth rate and, to a similar extent, below the global average. For 5-year wars, the average annual growth shortfall is of a similar magnitude. This suggests that the adverse impact of war on growth is not obviously non-linear in the duration of the war.

Turning to the right panel of Figure 3, we observe that war sites experience sustained levels of excess inflation. Both during 1-year and 5-year wars, annualized excess inflation in the war-site economy amounts to nearly 20 percentage points (gap to country level). Again, the

Figure 4: Economic Performance of Third Countries



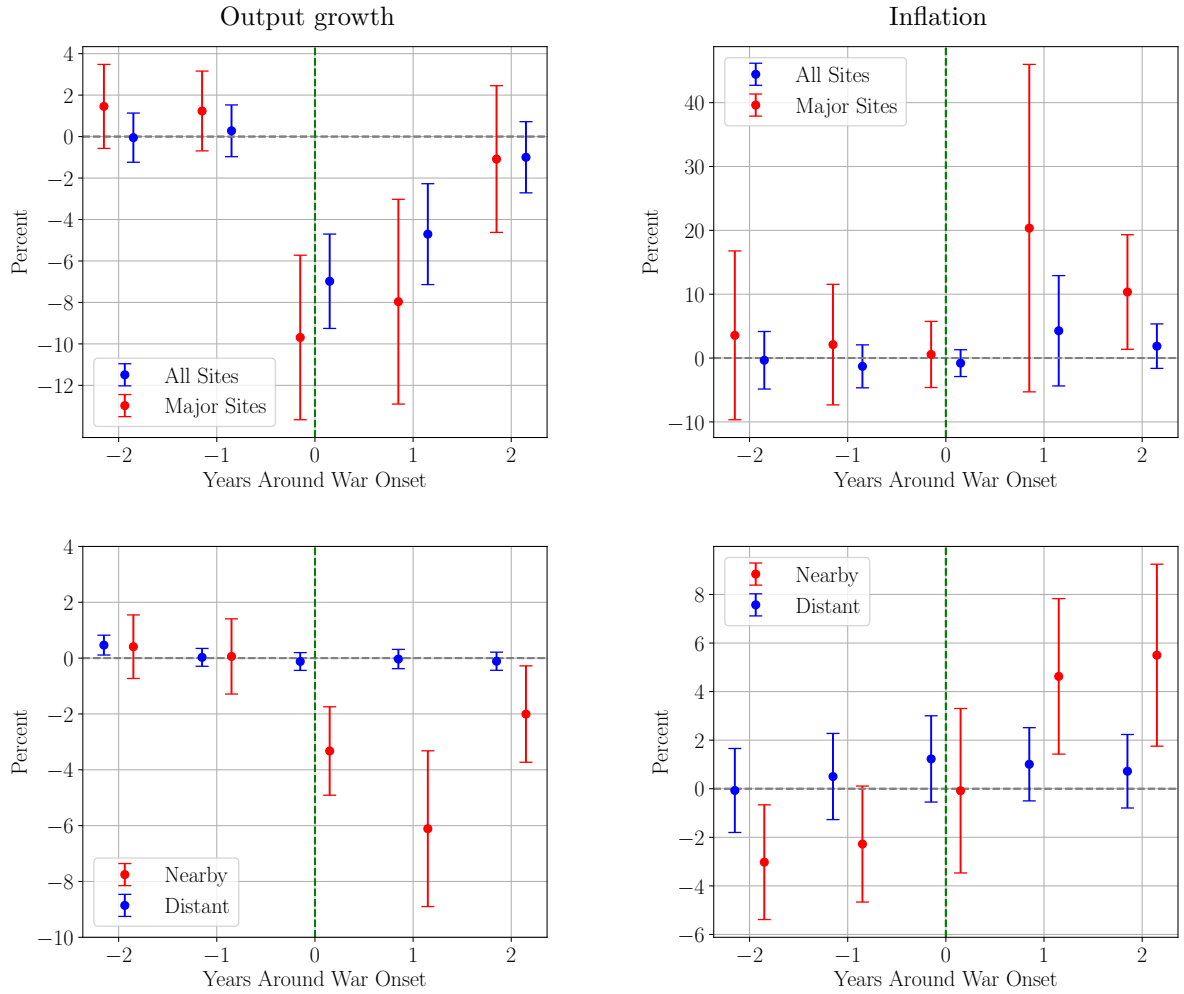
Notes: Output growth and inflation are annualized and measured relative to historical average (left) and cross-sectional average (right). Sample: 5-year wars, major war sites. "Nearby" are all third countries located within 1,000 kilometers of war sites, "distant" comprises all other third countries that are farther away.

effect is somewhat attenuated with an annualized inflation of about 13 percentage points when we benchmark average annual inflation in the war site during a 5-year war against the global level. This difference reflects the fact that the economic impact of the war is not confined to the war site.

To illustrate this point, Figure 4 shows output growth and inflation of third countries that are not war sites but potentially exposed to the war's spillovers. As before, we benchmark growth and inflation against the historical average and the cross-section. For this purpose, we focus on spillovers from major wars which last five years. The figure differentiates between "nearby" and "distant" countries. We define "nearby" countries as all third countries located within 1,000 kilometers of the war site. The set of "distant" countries comprises all third countries located farther away. The effects seen in Figure 3 and Figure 4 turn out to be largely robust and sizeable if we consider the full sample of wars. The corresponding results are depicted in Figure B1 and Figure B2 in the appendix.

Looking at the left panel of Figure 4, we observe that the annualized growth shortfall is much larger in nearby countries. In fact, distant countries achieve positive growth compared to the global average. This is suggestive of the main result that we establish below: the economic spillovers of war depend on a country's distance to the war site.

Figure 5: Economic performance around wars



Notes: Output growth and inflation are annualized and measured relative to historical average. Left panel shows annualized output growth measured relative to country norm. Right panel measures inflation relative to country norm. Top panels show values for war sites. Bottom panel show values in third countries.

The same pattern emerges when we look at excess inflation in the right panel of Figure 4. During 5-year wars, "nearby" countries experience annualized excess inflation of about 12 percentage points as measured against their own non-war norm. This contrasts with negligible excess inflation of about 1 percentage point in "distant" countries. At the global level, we also observe that "nearby" countries experience above-average inflation, whereas in "distant" countries, average inflation declines by some 2 percentage points or more.

In the next section, we formally analyze the macroeconomic impact of war. For this purpose, it is interesting to assess whether economic performance prior to the war suggests the presence

of anticipation effects. To assess this possibility, we compute the annual gap vs the country norm for output growth and inflation in a five-year window centered around the start of the war. The results are depicted in Figure 5 with the top panels showing results for war sites, both for the full sample (blue) and the sample of major war sites (red). Overall, there is not much evidence for anticipation effects. In war sites, output growth drops strongly in the year when the war starts and remains low afterwards. Excess inflation, in turn, is moderate at the beginning of the war but rises substantially in the first year after the start of the war. The bottom panels in the figure show the economic performance in third countries around major wars, again differentiating between nearby (red) and distant (blue) countries. Here, output growth in nearby countries is much reduced relative to the country norm, but remains virtually unchanged in distant countries. Likewise, inflation rises substantially in nearby countries but remains constant in distant countries.

3 The macroeconomic consequences of war

In this section, we establish the effects of wars on the war-site economy and its economic spillovers to other countries. We first introduce our empirical framework and then present the results.

3.1 Identification and empirical setup

Our empirical strategy builds on the notion that the wars in our sample are largely exogenous events—a notion that is supported by the narrative classification in Section 2.2. Importantly, we also focus on how *the start* of a war affects economies over time. In this context, we think of the onset of war as a *shock* to the economy. Recall from Section 2.3 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 wars alter long-term economic prospects. Our identification strategy only requires the start of the war to be exogenous to the business cycle.

Furthermore, our empirical setup is motivated by the hypothesis that wars affect countries differently—depending on whether or not they experience military action on their own soil

and depending on how geographically close they are to the war site. Hence, we define two categories of countries in relation to a war. First, a country is a "war site" in year t if it becomes involved in a war that will feature non-negligible combat on its soil. Second, a country is "third country" in year t if at least one other country becomes a war site in a conflict in which the third country neither is nor will itself become a war site. This way, we ensure that the effects we measure in third countries are not confounded by the effects of them also becoming war sites over the course of the war.

Equipped with these definitions, we estimate a set of local projections (Jordà, 2005). 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 the response of a generic outcome variable to the war and estimate the following linear specification:

$$x_{i,t+h} - x_{i,t-1} = \alpha_{i,h} + \gamma_h s_{i,t} + \psi_h e_{i,t} + \zeta_h Controls_{i,t} + u_{i,t+h}\,. \tag{3.1}$$

Here $\alpha_{i,h}$ captures country fixed effects. $s_{i,t}$ and $e_{i,t}$ are the indicator variables for *war sites* and potentially exposed *third* countries, respectively. They assume a value of 1 in the year in which the war starts and zero otherwise. Note that our specification allows countries to be simultaneously a war site for one war and third country to another war. It restricts, however, the effect on the outcome variable to be additively separable. $u_{i,t+h}$ denotes the error term. The set of controls includes four lags of both the dependent variable and the regressors. 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). We also verify that our results are robust if, instead, we exclude this possibility.

Specification (3.1) allows us to capture the dynamic effect of an average war that starts in period t, with scope for different dynamics across war sites and third countries. In each instance, the parameters ψ_h and γ_h provide an estimate for the effect in year h after the start of the war. Below, to account for the fact that the effects of wars are bound to vary with their size, we estimate versions of specification (3.1) for different samples while focusing on major war sites as our baseline. We also provide estimates that account systematically for the severity of wars and show that our results are not only driven by the largest wars in the sample. Finally, we stress that our specification is agnostic about the duration of the war: It estimates the average effect over time of a war which starts in year t, that is, from year t to year $t + h$.

Our main interest is to identify the economic spillovers from the war site to other countries.

For this purpose, we exploit the geographical variation among the group of third countries in their relation to the war site. Specifically, we consider an extended model where the spillovers on those countries may differ depending on their distance from the war site. This smooth transition model is specified as follows:

$$\begin{aligned} x_{i,t+h} - x_{i,t-1} =& \alpha_{i,h} + \gamma_h s_{i,t} + \psi_{d,h} F(i,t) e_{i,t} + \psi_{n,h} \left[1 - F(i,t)\right] e_{i,t} \\ &+ \zeta_h Controls_{i,t} + u_{i,t+h} \,. \end{aligned} \tag{3.2}$$

Here the response of the dependent variable in a third country differs at each horizon h across regimes "d" (distant) and "n" (nearby), with the ψ-coefficients indexed accordingly. Following a similar approach as Born, Müller and Pfeifer (2020), we compute for each year-country observation weights which determine the relative importance of the regime on the basis of the indicator function:

$$F(i,t) = \begin{cases} \frac{\ln(1+d_{i,t})}{\ln(1+d^{max})} & \text{if } e_{i,t} = 1 \\ 0 & \text{otherwise} \end{cases} . \tag{3.3}$$

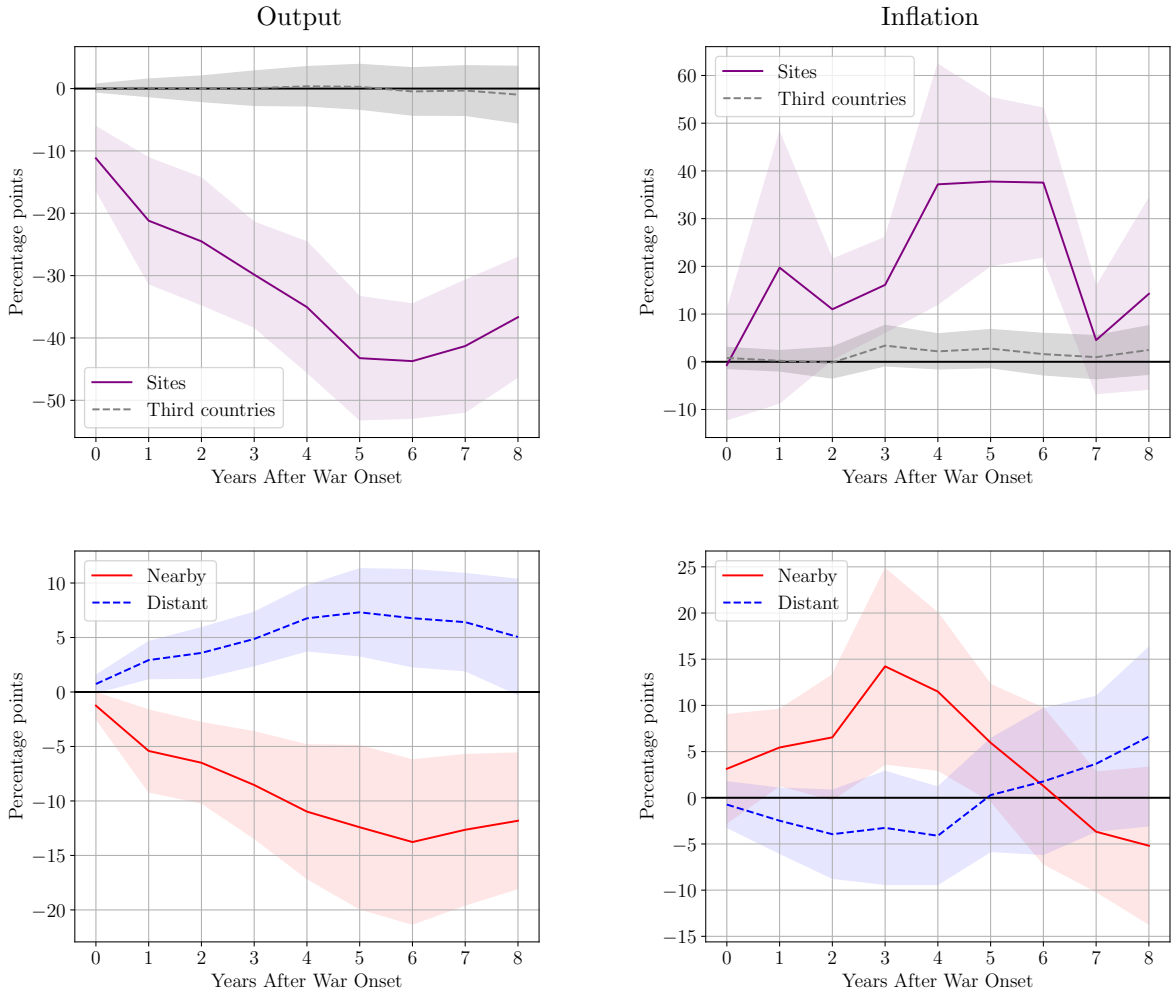
In the expression above, $d_{i,t}$ indicates the distance of a third country i to the geographically closest country that has become a war site in year t in thousands. d^{max} denotes the maximum distance between any third country and a conflict site in our sample. It follows that $0 \leq F(i,t) \leq 1$ and that F increases non-linearly in the distance to the closest war site.

In what follows, we present estimates for the sample period 1870–2022. Our variables of interest, $x_{i,t}$, are the log of real GDP after removal of a linear country-specific trend prior to the estimation, and inflation, measured in terms of consumer price indices.

3.2 Results

Turning to the results, Figure 6 traces the macroeconomic consequences over time, starting in the year after the start of the war ($h = 0$). In each panel, the horizontal axis measures time after the start of the war along the horizontal axis. In the left panels, we measure the percentage deviation of output from the trend against the vertical axis. In the right panel, we measure the effect of the war on inflation in percentage point deviations from the pre-war level norm. In the top panels, we show results for the linear specification (3.1). The solid (purple) line shows the response for the war sites, and the dashed (black) line the estimated spillovers to the other countries. Here, and in what follows, shaded areas indicate

Figure 6: Macroeconomic consequences of major wars



Notes: Left panels show percentage deviation of output from trend, right panels show deviation of inflation from pre-war rate in percentage points. Horizontal axis measures time in years since start of the war. Top panels show results for linear specification (3.1). Bottom panels show response for smooth-transition specification (3.2). Shaded areas indicate 90% confidence bands. Estimation based on major war sites.

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 that the adverse effect of major wars is particularly strong for war sites and gets stronger over time: the output decline in the first year amounts to about 11% and continues, reaching a maximum effect some six years after impact. At this point, output is depressed by more than 40 percent relative to trend, consistent with the shortfall in growth, which we document for war-site economies in Section 2.3 above. What's more, the subsequent recovery

is rather slow. In year $h = 8$, output is still about 35 percent below trend, and it takes about 15 years for a complete recovery, as Figure B3 in the appendix shows.

Turning to the top-right panel of Figure 6, we also observe a strong inflationary impact on the war site: inflation increases for several years following the start of the war. The maximum effect takes place in year $h = 4$ when inflation exceeds its pre-war rate by almost 40 percentage points. Inflation remains much higher in the war-site economy and converges only slowly back to the pre-war norm. Only in year $h = 7$ it is no longer significantly affected by the war. Again, these patterns are broadly consistent with the extent of excess inflation that we document for war periods in Section 2.3 above.

The top panels of the figure also show that—*on average*—there are virtually no spillovers from the war-site economy to the third countries. The dashed (black) line is no different from zero: neither for output (left) nor for inflation (right). However, this average effect masks sizeable heterogeneity across countries. Consider the bottom panels of Figure 6, which show results for Specification (3.2), allowing spillovers to differ with the distance from the war site. In the panels, the solid (red) line corresponds to regime n, showing the spillovers to a hypothetical "nearby" economy that is literally at a zero distance from the war site. The dashed (blue) line, in turn, corresponds to regime d, representing a hypothetical economy at maximum distance from the war site. The difference across regimes is stark, and it bears noting that actual countries fit somewhere in between these two limiting cases. Output in the *nearby country* declines on impact and persistently so. Five years after the onset of the war, it has declined by some 10 percent compared to the pre-war trend. At the same time inflation increases considerably and in sync with the developments for the war site, shown in the top panel. Roughly speaking, we find that, in the *nearby country*, the output loss and the inflation increase are about one-third of what we find for the war-site economy. In the *distant country* (regime d), an altogether different pattern emerges: Output rises, and significantly so. Inflation does not respond significantly.

3.3 Robustness

In what follows, we explore the robustness of our results along a number of dimensions. First, we investigate whether the economic spillovers from the war site on nearby countries are driven by actual participation in the war: Just because a country is not a war site does not necessarily mean that it is not a belligerent to the war. A case in point may be the 2001 Invasion of Afghanistan in which the United States was involved as a belligerent but not as a

war site. If countries nearer to the war site exhibit a higher likelihood of being involved in the war, our distance measurement may capture the effects of participating rather than that of being geographically exposed. We explicitly address this scenario by further disaggregating the set of third countries into two groups: (1) the belligerents, which take part in the war without being a war site, and (2) the non-belligerents, which neither are a site nor a party to the war. We find that our results are not contingent upon such a disaggregation and instead are highly robust even when we restrict the scope of the proximity analysis to those countries which are neither a war site nor a belligerent, see Figures B4 and B5 in the appendix.

Second, we explore to what extent our results are driven by the two largest wars in our sample: World Wars I and II. We do so by estimating our baseline specification on a sample from which we drop observations for the World Wars. Unsurprisingly, we find that the impact of wars is somewhat weaker compared to the baseline, but the overall pattern is very much the same, see Figure B6 in the appendix. We conclude that the World Wars, as expected—do help to identify the economic impact of war.

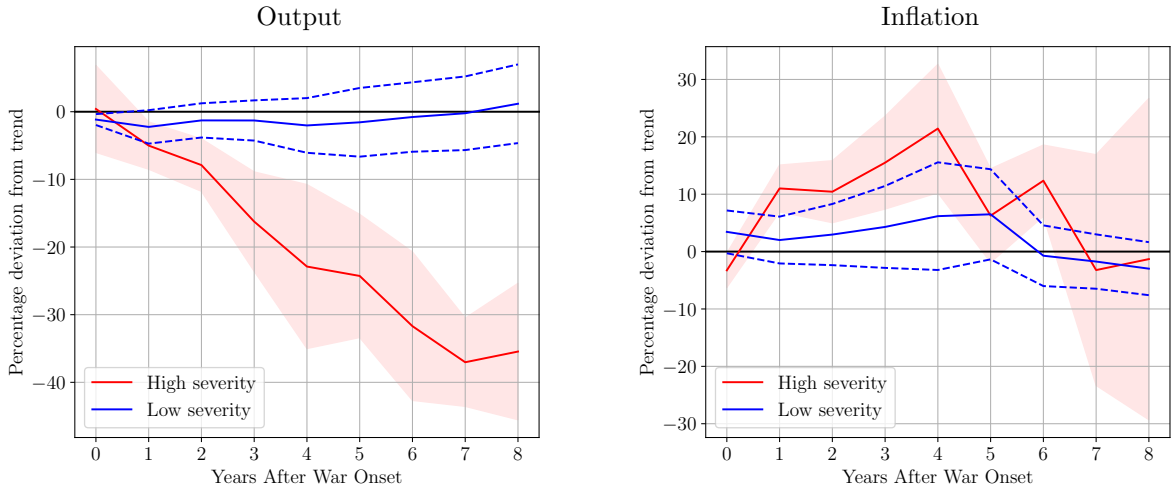
Against this background, we examine more systematically how a war's severity, as reflected in the DMW measure, shapes the economic impact on the non-belligerent countries. Thus, we modify our baseline specification (3.2). First, we expand our sample to all wars without any restrictions regarding their severity. Second, we consider only spillovers on countries located within 1,000 km of the war site and redefine variable, $e_{i,t}$, to take on the value of 1 in this case only. Third, we modify the transition function in the following way:

$$F(i,t) = \begin{cases} \frac{DMW_{i,t}}{\max DMW_{i,t}} & \text{if } e_{i,t} = 1 \\ 0 & \text{otherwise} \end{cases}. \tag{3.1}$$

Here $DMW_{i,t}$ is the average number of battle deaths per war site for which country i is a neighbor in year t and $\max deaths_{i,t}$ is the maximum exposure in terms of war severity in the sample. Thus, the transition function takes on the value of 0 if there is no war going on in the neighborhood of country i and the value of 1 for the country which was exposed to the most battle deaths in its neighborhood throughout the whole sample.

Figure 7 shows results for the modified specification. We find the severity of wars to be a significant determinant of spillovers on "nearby" countries. Notably, the effects for the "low severity" group are negligible for both output and inflation. At the other end of the spectrum, we find the spillovers of the most severe wars to be very large. Countries located in the neighborhood of such a severe war see their output declining by some 40 percent

Figure 7: Spillovers of war to nearby countries by severity



Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from the trend, horizontal axis measures time in years since start of the war. Smooth-transition specification is weighted by wars' severity in neighborhood.

relative to trend, while inflation rises by about 20 percent for an extended period.

3.4 Trade

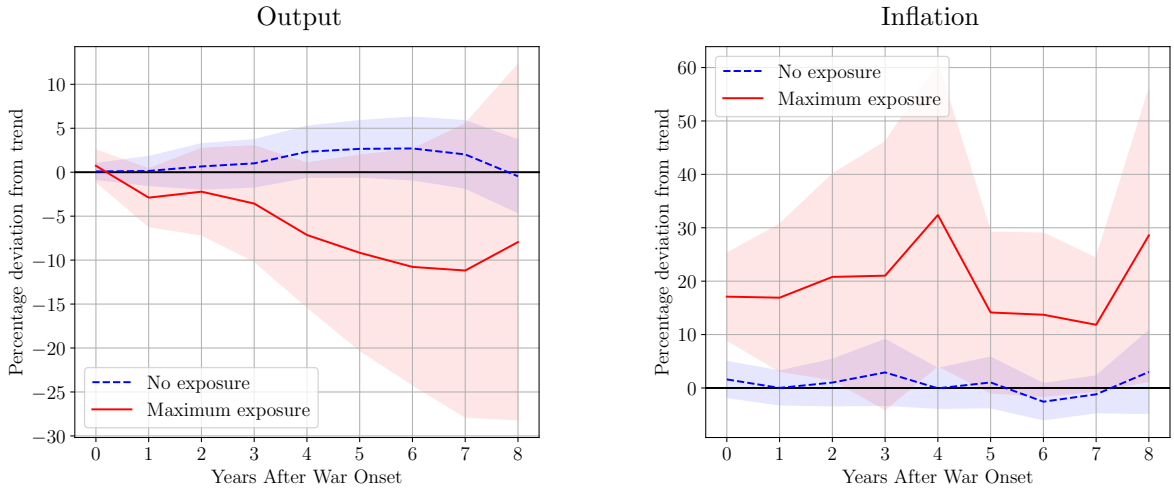
Because distance turns out to be a key differentiator for the economic spillovers of war, it seems natural to consider trade as a potential channel through which these spillovers operate. In what follows we investigate the issue formally, using a variant of specification (3.2): we replace the weighting function (3.3), which is based on geographic distance, with the following alternative:

$$F(i,t) = \begin{cases} \frac{exposure_{i,t}}{exposure_{i,t}^{max}} & \text{if } e_{i,t} = 1 \\ 0 & \text{otherwise} \end{cases}. \tag{3.1}$$

Here $exposure_{i,t}$ is the prior-year trade of country i with the geographically closest war site in year t normalized by country i's prior-year GDP. Variable $exposure_{i,t}^{max}$ denotes the maximum trade exposure in our sample.[6] Defined in this way, F measures a country's openness vis-à-vis the closest war-site economy prior to the war.

[6] As with inflation, we winsorized trade exposure at the 99.5% and 0.5% level. Trade refers to imports of country i from war sites.

Figure 8: Spillovers of war to third countries for different degrees of trade exposure



Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from trend, horizontal axis measures time in years since start of the war. Estimates based on smooth-transition specification (3.2) with weighting function (3.1). Trade share is trade share with war site in country's total trade.

We show results in Figure 8. As with distance, we find that a higher trade exposure leads to more adverse output spillovers of the war. In the maximum trade exposure regime, output falls by more than 10% in the 6 years after the start of the war. Similarly, excess inflation increases to more than 30% in year 4. The effects on countries with virtually no trade exposure closely resemble the findings for countries that stand out by maximum geographic distance: Output rises somewhat, whereas inflation remains unchanged. These findings are consistent with the hypothesis that geographic distance is key for the spillovers of war precisely because distance is a key barrier to trade: countries that are closer to each other, all else equal, tend to trade more and hence are more exposed to each other than countries far apart (Head and Mayer, 2014).

4 Structural interpretation

We offer a structural interpretation of the evidence presented in the previous section based on a state-of-the-art international business cycle model. The model builds on earlier work

by Gopinath et al. (2020) and features three countries.[7] This allows us to distinguish the war-site economy from the nearby economy, on the one hand, and from the distant economy, on the other hand. We augment the original model by explicitly accounting for the dynamics of the capital stock and investment, and by allowing for several channels through which a war shock may affect the economy, akin to those of a rare disaster (Gourio, 2012).

Specifically, for our war-shock scenario, we assume that a fraction of the capital stock of the war-site economy is destroyed while both total factor and investment-specific productivity decline. In addition, war hampers market access, reflected in increased trading frictions. We capture this in the model through 'iceberg' costs that make international trade with the war-site economy more expensive. We show that, under these assumptions, the model is able to provide a quantitatively successful account of the economic impact of the war. Importantly, this holds not only for the war-site economy but also regarding the economic consequences of the war in nearby and more distant countries. As in the empirical analysis, we find that economic spillovers differ fundamentally for nearby and distant economies—where, in the spirit of gravity, distance is proxied by the degree of trade integration.

In what follows, we first outline the model structure and our estimation strategy, which relies on matching impulse response functions. We then use the estimated model to inspect the mechanism through which a war shock transmits internationally. We find that the spillovers from the war-site economy to the rest of the world operate mostly through trade and particularly via intermediate inputs. Since trade integration with the war-site economy differs across countries, so do the economic spillovers.

4.1 Model outline

There are three countries, representing the war *site*, a *nearby* country and a *distant* country, indexed by $i \in \{s, n, d\}$. Except for the degree of trade integration—and the incidence of shocks—the three countries are symmetric. We focus the exposition on country s, with the understanding that the two other economies are isomorphic.

Country s is populated by a large number of households, indexed by $h \in [0, 1]$. The pref-

[7] A key feature of their model is the assumption of dominant currency pricing (DCP). Instead, we assume producer currency pricing (PCP), drawing on earlier work by Georgiadis and Schumann (2021) which allows for variants of PCP, DCP, and local currency pricing within a three-country setup. We also allow for international trade in risk-free bonds that are denominated in all currencies (rather than in a dominant currency) and assume a constant trade-price elasticity.

erences of a generic household h are defined over consumption, $C_{s,t}(h)$, and labor, $N_{s,t}(h)$, and given by

$$U(C_{s,t}(h), N_{s,t}(h)) = \frac{1}{1-\sigma_c}\left[C_{s,t}(h)\right]^{1-\sigma_c} - \frac{\kappa}{1+\varphi}[N_{s,t}(h)]^{1+\varphi}, \tag{4.1}$$

where σ_c^{-1} is the intertemporal elasticity of substitution, φ^{-1} is the Frisch elasticity of labor supply and κ determines hours worked in steady state. Labor-income risk is insured across households via trade in state-contingent securities and, given identical initial conditions, we drop the household index h in what follows, not only for consumption, but also for investment, capital supply and bond holdings, though not for labor supply, which may differ because of sticky wages (introduced below). The household owns an internationally immobile capital stock, $K_{s,t}$, which evolves according to:

$$K_{s,t} = \left[(1-\delta_k)K_{s,t-1} + \zeta_{s,t}\left(1 - \frac{\phi_i}{2}\left(\frac{I_{s,t}}{I_{s,t-1}} - 1\right)^2 I_{s,t}\right)\right] e^{-\omega_t^k}. \tag{4.2}$$

Here $\delta_k > 0$ is the capital deprecation rate, $\zeta_{s,t}$ represents the investment-specific technology, $I_{s,t}$ denotes investment and ϕ_i parameterizes investment-adjustment costs. As in Gourio (2012), ω_t^k captures the destruction of the capital stock, which we assume is due to the war and follows an AR(2) process:

$$\omega_t^k = \rho_{1,k}\omega_{t-1}^k + \rho_{2,k}\omega_{t-2}^k + \Delta_k \eta_t. \tag{4.3}$$

η_t is the war shock: It takes a value of 1 at the onset of the war. Among other things (specified below), it destroys a fraction of the capital stock, Δ_k. The assumptions on the process for ω_t^k allow the destruction to continue as the war unfolds. At the same time, investment-specific technology, $\zeta_{s,t} = e^{-\omega_t^\zeta}$, is also adversely affected by the war shock η_t: We specify a process for ω_t^ζ which is analogous to equation (4.3) and characterized by persistence parameters $\rho_{1,\zeta}$ and $\rho_{2,\zeta}$, with Δ_ζ scaling the initial effect.

The household's flow budget constraint reads as follows:

$$P_{s,t}(C_{s,t} + I_{s,t}) - W_{s,t}(h)N_{s,t}(h) - R_{s,t}^k K_{s,t-1} - Div_{s,t} = \sum_i \mathcal{E}_{is,t}\left(\frac{B_{si,t}}{R_{si,t}} - B_{si,t-1}\right). \tag{4.4}$$

$P_{s,t}$ is the price of final goods in country s, used for consumption and investment; $\mathcal{E}_{is,t}$ denotes nominal exchange rates, measured as the price of country-i currency in terms of country-s currency. We assume that households trade default-free discount bounds internationally and

let $B_{sj,t}$ denote the household's purchases of bonds denominated in the currency of country $j \in \{n, d\}$. $B_{ss,t}$, in turn, are purchases of bonds denominated in domestic currency.

Interest rates may differ across countries, reflecting, albeit in a stylized manner, financial frictions as in García-Cicco, Pancrazi and Uribe (2010). $R_{ss,t}$ denotes the (gross) nominal interest rate on domestic currency-bonds faced by domestic households. Foreign-currency interest rates, in turn, are debt-elastic, which ensures a stationary solution (Schmitt-Grohé and Uribe, 2003). Specifically, we assume: $R_{sj,t} = R_{jj,t}e^{-\mu(B_{sj,t}-B_{sj})}$ for $j \in \{n, d\}$. Finally, $R^k_{s,t}$ is the rental rate of capital, which households lend to firms on a period-by-period basis, and $Div_{s,t}$ denotes nominal dividends paid by monopolistically competitive firms. To ease the notational burden, we do not explicitly note the state-contingent securities in the budget constraint (4.4).

Household h provides differentiated labor services and, under the usual assumptions, faces the labor demand function: $N_{s,t}(h) = (W_{s,t}(h)/W_{s,t})^{-\psi_w} N_{s,t}$. Here $\psi_w > 1$ denotes the elasticity of substitution between distinct labor services at an individual wage rate $W_{s,t}(h)$. $W_{s,t}$ and $N_{s,t}$ are indices of the aggregate wage and aggregate labor supply, respectively. Wages are sticky à la Calvo: In each period, a randomly selected fraction of households $1 - \theta_w$ is permitted to renegotiate its wage.

Final goods are assembled by perfectly competitive firms: They combine domestically produced goods, $Y_{ss,t}$, and imported goods, $Y_{sj,t}$, according to the following aggregation technology:

$$Y_{s,t} = \left(\sum_{j \in \{s,n,d\}} \upsilon_{sj}^{\frac{1}{\psi_f}} \left((1 - \omega^{\rtimes}_{sj,t}) Y_{sj,t} \right)^{\frac{\psi_f - 1}{\psi_f}} \right)^{\frac{\psi_f}{\psi_f - 1}}. \tag{4.5}$$

Final goods are used for consumption and investment, but also for intermediate inputs, $M_{s,t}$, which are used in the production of domestic varieties. In the expression above, ψ_f is the trade-price elasticity; υ_{sj} are parameters that govern the degree of trade integration across countries in steady state. $\omega^{\rtimes}_{sj,t}$ represent iceberg trade costs. We assume that war restricts market access to the war site and specify an AR(2) process for $\omega^{\rtimes}_t = \omega^{\rtimes}_{sn,t} = \omega^{\rtimes}_{sd,t}$ in an analogous manner to equation (4.3) above. Market access to the other economies is unrestricted throughout and we set iceberg costs to zero.

Domestic and imported goods are Dixit-Stigliz aggregates of varieties produced by monopolistically competitive firms at home and abroad. Under the usual assumptions, domestic

demand is given by $Y_{ss,t}(f) = (P_{ss,t}(f)/P_{ss,t})^{-\psi_i} Y_{ss,t}$ and likewise for goods imported from abroad. Here ψ_i is the elasticity of substitution between intermediate goods. The production function is Cobb-Douglas and uses intermediate inputs, $M_{s,t}(f)$, capital, $K_{s,t-1}(f)$, and labor, $N_{s,t}(f)$:

$$Y_{ss,t}(f) = A_{s,t} M_{s,t}(f)^{\alpha} \big(K_{s,t-1}(f)^{\iota} N_{s,t}(f)^{1-\iota}\big)^{1-\alpha}.$$

Here, α and ι are positive constants that capture the weight of intermediate inputs in production as well as the relative weight of capital. $A_{s,t}$ is total factor productivity, the growth rate of which is also subject to the war shock: $\log(A_{s,t}) - \log(A_{s,t-1}) = e^{-\omega_t^A}$. An implication is that a war may permanently alter the level of productivity. As before, we let ω_t^A follow an AR(2) process as in equation (4.3) above. The factors of production can be adjusted in each period without cost such that marginal costs are the same across firms. Prices are sticky à la Calvo: In each period a randomly selected fraction of firms $1 - \theta_p$ is permitted to reset its price. We assume producer currency pricing: Firms set their price optimally in their own currency, given domestic demand and demand from abroad. The law of one price holds and determines the foreign-currency price charged abroad.

Good markets clear at the level of intermediate goods, as do the markets for capital, and labor. Bond market equilibrium requires that $B_{is,t} + B_{in,t} + B_{id,t} = 0$ for each country-i currency bond. Exchange rates adjust freely to clear the foreign exchange market. We use $Z_{s,t}$ to denote GDP and measure it based on aggregate supply:

$$Z_{s,t} = A_{s,t} M_{s,t}^{\alpha} \big(N_{s,t}^{1-\iota} K_{s,t-1}^{\iota}\big)^{1-\alpha}. \tag{4.6}$$

Monetary policy adjusts interest rates according to a simple feedback rule:

$$\frac{R_{s,t}}{R_s} = \left(\frac{R_{s,t-1}}{R_s}\right)^{\rho_{R,s}} \left(\left[\frac{\Pi_{s,t}}{\bar{\Pi}}\right]^{\phi_{\pi,s}} \left[\frac{Z_{s,t}}{Z_s}\right]^{\phi_{z,s}}\right)^{1-\rho_{R,s}}, \tag{4.7}$$

where $\phi_{\pi,s}$ and $\phi_{z,s}$ are the feedback parameters, $\rho_{R,s}$ captures interest-rate smoothing and $\bar{\Pi}$ is the inflation target in terms of the consumer price index for CPI inflation $\Pi_{s,t} = P_{s,t}/P_{s,t-1}$.

4.2 Model estimation and validation

We use a first-order perturbation in order to simulate and estimate the model. Our aim is to offer a structural account of the evidence established in Section 3 above. Hence, we devise a war-shock scenario such that the estimated model is able to match the empirical impulse response functions of the war-site economy (shown in the top panels of Figure 6). Formally, we pin down parameter values based on the Bayesian limited-information approach put forward by Christiano, Trabandt and Walentin (2010). Afterwards, we validate the estimated model by confronting its predictions for economic spillovers—both onto nearby and distant countries—with the evidence (in the bottom panels of Figure 6). Prior to the estimation we fix a number of parameters that are fairly uncontroversial and not the focus of our analysis in order to better identify the parameters of interest.

Calibrated parameters. Importantly, we assume that parameters are identical across countries, with the exception of υ_{ji}. This parameter determines the degree of trade integration, which we leverage—in the spirit of gravity—to represent geographical proximity (Head and Mayer, 2014). To ensure balanced trade in steady state we impose symmetry, $\upsilon_{ji} = \upsilon_{ij}$, and require weights for each country to sum to unity. Next, we assume full integration of the war-site economy and the nearby country, setting: $\upsilon_{ss} = \upsilon_{nn} = \upsilon_{sn} = \upsilon_{ns} = 0.49$. In contrast, for the distant country we assume $\upsilon_{sd} = \upsilon_{ds} = \upsilon_{nd} = \upsilon_{dn} = 0.02$. We determine κ endogenously for each country to normalize labor supply in the steady-state to 1.

A period in the model represents one year and we set the time-discount factor β to 1/1.04. The risk premium elasticity parameter is given by $\mu = 0.001$, capital depreciates at a rate of $\delta = 0.1$, and the investment adjustment cost coefficient ϕ_i is set to 4. Following the original calibration of Gopinath et al. (2020) and Georgiadis and Schumann (2021), we set the elasticity of substitution across labor types (ψ_w) to 2 and the elasticity of substitution between varieties (ψ_i) to 11. The inverse Frisch elasticity φ is set to 1, while the risk aversion parameter σ_c is set to 1.5, as suggested by Auray and Eyquem (2019). We also set θ_p and θ_w equal to 0.15, in line with their estimates. Given the evidence put forward by Bouakez, Rachedi and Santoro (2023), we set α to 0.48 and ι to 0.35. The trade elasticity ψ_f is set to 2.5, a frequently used value in quantitative multi-country models, e.g. Gomes, Jacquinot and Pisani (2012).[8] Lastly, we assume conventional values for the parameters which govern monetary policy in the nearby and distant country: $\rho_{R,n} = \rho_{R,d} = 0.85$, $\phi_{\pi,n} = \phi_{\pi,d} = 1.75$

[8]This parameter shapes the output spillover to the nearby and the distant country. In particular, the spillovers on the distant country increase in ψ_f.

Table 3: Estimated war-shock scenario—Priors and Posteriors

War shock	Parameter	Prior			Posterior		
Scenario		Distribution	Mean	Std. Dev.	Mean	5%	95%
Capital	Δ_K	Inv. Gamma	0.120	0.200	0.1278	0.0367	0.2563
	$\rho_{I,K}$	Beta	0.800	0.200	0.6629	0.3166	0.9000
	$\rho_{II,K}$	Beta	0.800	0.200	0.6240	0.2736	0.9000
Market Access	$\Delta_{\bowtie}$	Inv. Gamma	0.150	0.200	0.1557	0.0534	0.2842
	$\rho_{I,\bowtie}$	Beta	0.800	0.200	0.7126	0.4012	0.9000
	$\rho_{II,\bowtie}$	Beta	0.800	0.200	0.7089	0.4141	0.9000
Productivity Growth	Δ_A	Inv. Gamma	0.045	0.200	0.0387	0.0151	0.0629
	$\rho_{I,A}$	Beta	0.800	0.200	0.5028	0.1670	0.7962
	$\rho_{II,A}$	Beta	0.800	0.200	0.4838	0.1580	0.7832
Investment Productivity	Δ_ζ	Inv. Gamma	0.100	0.200	0.0830	0.0248	0.1843
	$\rho_{I,\zeta}$	Beta	0.800	0.200	0.6623	0.2648	0.9000
	$\rho_{II,\zeta}$	Beta	0.800	0.200	0.6687	0.3055	0.9000
Monetary Policy	$\rho_{R,s}$	Beta	0.600	0.200	0.4342	0.1547	0.7165
	$\phi_{\pi,s}$	Normal	1.750	0.200	1.8058	1.4460	2.1439
	$\phi_{z,s}$	Beta	0.350	0.200	0.3584	0.1755	0.5480

Notes: Estimation based on RWMH algorithm with 8 million draws (8 chains, 50 percent of draws used for burn-in, draw acceptance rates about 0.38%). We estimate the driving processes of the war shock based on their roots, given by $\rho_I = \rho_1 + \rho_2$ and $\rho_{II} = -\rho_1 \cdot \rho_2$, while restricting the process to be stable.

and $\phi_{y,n} = \phi_{y,d} = 0.25$.[9]

Estimation. We estimate the key parameters by matching impulse response functions as popularized by Christiano, Eichenbaum and Evans (2005). Here we employ the Bayesian version as developed in Christiano, Trabandt and Walentin (2010). In this way, we treat the empirical impulse responses as *data* and select parameters to ensure the model's impulse responses closely mirror their empirical counterparts. Importantly, we focus exclusively on the effects on the war-site economy during years 0 to 6, shown in the top two panels of Figure 6 above.[10]

Table 3 reports our priors and the estimated parameters. We start from the premise that the war shock affects all margins in a sizeable and persistent way. We adopt an Inverse Gamma prior for $\Delta_j > 0, j \in \{K, \bowtie, A, \zeta\}$, with mean values in line with the calibration of

[9]Intuitively, these parameters matter for the relative strength of inflation and output spillovers in the short run. The overall shape of the spillovers, however, is robust to alternative values for these parameters.

[10]In line with standard practices in impulse response matching, 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.

Gourio (2012) and the estimates of Auray and Eyquem (2019). Instead of directly estimating the coefficients $\rho_{1,j}$ and $\rho_{2,j}$ of the AR(2) processes which govern the dynamics of the war shock, we estimate the roots of the processes (Born, Peter and Pfeifer, 2013; Bayer, Born and Luetticke, 2023). These are given by $\rho_{I,j} = \rho_{1,j} + \rho_{2,j}$ and $\rho_{II,j} = -\rho_{1,j} \cdot \rho_{2,j}$. In this way and by imposing the Beta prior distribution with a mean of 0.8, we ensure that the driving processes are stable. Last, for the parameters which govern interest rate policy in the war site, $\phi_{\pi,s}$ and $\phi_{z,s}$, we impose normal distributions with prior means set at 1.75 and 0.35, respectively. Meanwhile, the interest rate smoothing parameter $\rho_{R,s}$ follows a Beta distribution with a mean of 0.60. All prior standard deviations are consistently fixed at 0.2.

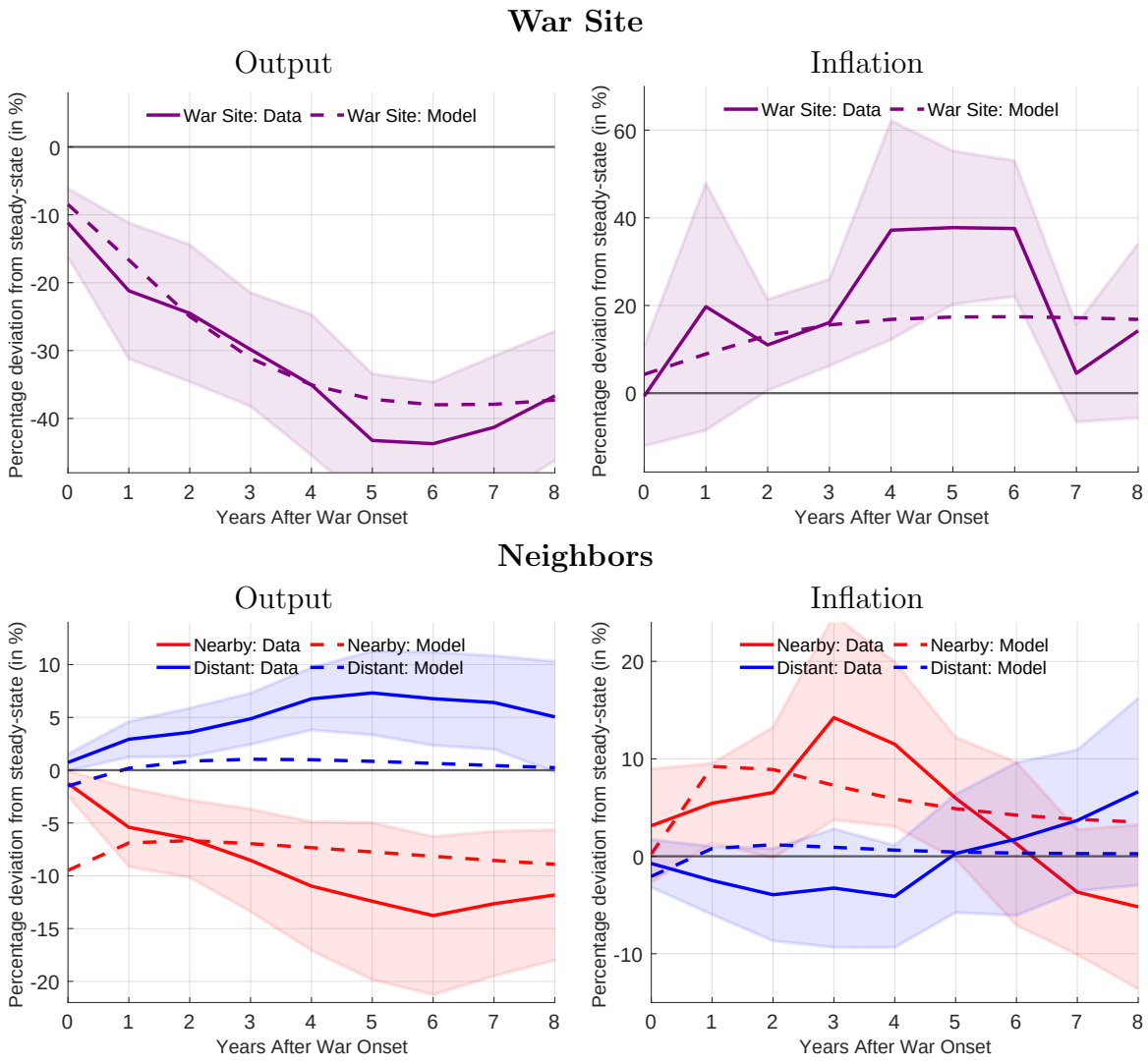
Rather than conducting an extensive optimization-based search for the mode (and a non-singular hessian at the mode), we initially employ a slice sampler, generating 80,000 draws distributed across eight separate chains. We subsequently use these samples to estimate the posterior covariance matrix, which then serves as the covariance matrix of the Gaussian proposal distribution in a standard Random Walk Metropolis-Hastings (RWMH) algorithm. We then generate 8 million draws, also distributed across eight chains, allocating half of these samples for burn-in.[11] We report results in Columns 5 through 7 of Table 3. We note that there is updating of the priors for all parameters and the highest posterior density intervals contain plausible values. There is, in particular, a sizeable destruction of the capital stock by some 12 percent on impact and market access is reduced as iceberg trade costs go up by some 15 percent points. There is also a slowdown of productivity growth which adds up to an overall decline in productivity of about 15% in the long run. The estimates for the monetary policy parameters are also in line with conventional estimates in the literature.

Model validation. We simulate a war-shock scenario based on the posterior mean values of the parameters and compute the impulse response functions. Figure 9 shows the results, contrasting the model predictions given by the dashed lines with their their empirical counterpart, reproduced from Figure 6 above. As before, the top panels show the adjustment dynamics for the war site. We observe that the model predictions align very well with the empirical response functions.

Given that the parameter values are set so as to maximize the predictive success of the model

[11] Although we present results generated by the RWMH algorithm, it's noteworthy that the posterior distributions closely align with those obtained through the slice sampler. The latter typically produces Markov chains with lower autocorrelation compared to the RWMH approach and, more importantly, does not require a time-consuming mode-finding step. For a comprehensive assessment, convergence diagnostics, trace plots, and relative inefficiency factors are provided in the supplementary Dynare replication codes.

Figure 9: The Macroeconomic Impact of War—Model Simulation



Notes: dashed lines show adjustment of model economy to war-scenario in the war site. Solid line and shaded area corresponds to time-series estimate and confidence bounds shown in Figure 6 above. Horizontal axis measures time in years, vertical axis measures percentage deviation from pre-war (steady-state) level.

in terms of the adjustment in the war-site economy, it is of particular interest to compare the model predictions for the international spillovers of the war with the evidence. In this way we offer an external validation of the model because the evidence on spillovers has not been used in the estimation. To see how the model performs in this regard, consider the bottom panels of Figure 9. Again, model predictions are given by the dashed lines, next to the empirical estimates (solid lines), again reproduced from Figure 6 above. The model predicts large negative output spillovers for the nearby country, but positive output spillovers for the distant country. And while the model somewhat underestimates the extent of the output spillovers on the distant country, it captures the inflation spillovers quite well—not

only qualitatively but also quantitatively: They are positive and large for the nearby country and negligible for the distant country. Finally, we want to make two observations. First, there are no shocks in the nearby or distant countries—all the effects come about through spillovers from the war site. Second, the model parameters are set symmetrically prior to the estimation. We therefore conclude that the model is able to account for the empirical evidence on the international spillovers of war.

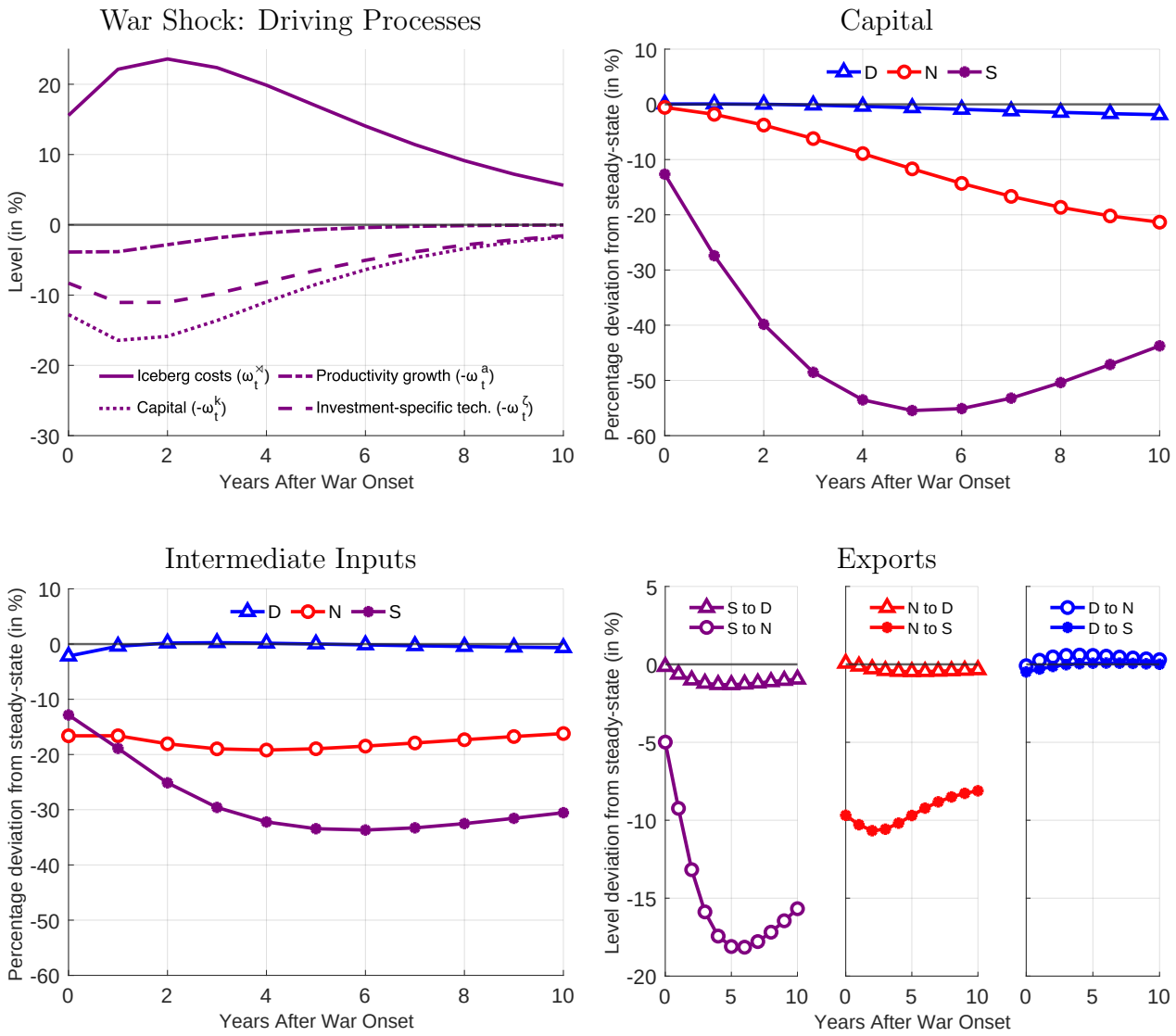
4.3 Inspecting the mechanism

The model also offers a distinct account of how the war shock transmits to the rest of world. To see this, we display the impulse responses of key variables in Figure 10. The upper-left panel shows the response of all four exogenous variables which capture the war-shock scenario: iceberg costs go up (solid line), reflecting limited market access, the growth rate of total factor productivity declines (dashed-dotted line), as does the level of investment-specific technology (dashed line). There are also sizeable direct losses to the capital stock due to the war (dotted line). According to our estimates, these effects become stronger over time and are quite persistent. We observe the maximum effect in year 1-2; afterwards there is a gradual recovery, but it is not completed within a decade after the onset of war, except for total factor productivity growth.

In the upper-right panel, we show the dynamics of the capital stock in the war-site economy (purple line with stars), but also in the the nearby country (red line with circles) and the distant country (blue line with triangles). Two observations are key. First, the reduction of the capital stock in the war-site economy is not only a consequence of direct, exogenous damage. Rather, it also reflects endogenous investment decisions which, in turn, are driven by the changes in productivity. Remarkably, some 5 years after the start of the war, the capital stock is reduced to less than 50 percent of its pre-war level. Only afterwards, we observe a gradual recovery. Second, in the nearby country, there is a noticeable and lasting drop in the capital stock as well. It amounts to more than 20 percent and reflects an entirely endogenous adjustment. We do not observe a comparable effect in the distant economy.

To understand what causes this effect in the nearby country, turn to the lower-left panel of Figure 10. It shows the use of intermediate inputs in production. Recall that these are composite goods of domestically produced and imported varieties. The use of intermediates falls strongly in the war-site economy but also in the nearby country, the latter being highly integrated with the former. As a result, the economic impact of the war spills over to the

Figure 10: The transmission of the war shock



Notes: Adjustment to war shock according to estimated model. Upper-left panel shows responses of the driving processes $\omega_t^j, j \in \{\rtimes, K, \zeta, A\}$), which represent the war-shock scenario (exogenous). The other panels show the adjustment of endogenous variables: lines with stars represent the war-site economy, lines with circles the nearby country, lines with triangles the distant economy. Export volumes are measured as a ratio to pre-war steady-state output. Horizontal axis measures time in years, vertical axis measures deviation from pre-war level in percent/percentage points.

nearby country via an increased scarcity of intermediate inputs. This, in turn, is partly accommodated by lower investment and results in the decline of the capital stock of the nearby economy. In sum, the war shock represents a massive adverse supply shock.[12] And this shock is not confined to the war-site economy; it spills over to the nearby economy, too.

[12]Labor inputs (not shown) increase somewhat, but this is insufficient to make up for the decline of the capital stock and the use of intermediate inputs.

As a result, the war is strongly inflationary in both economies, as shown in Figure 9 above.

The effect of the war on the distant country is fundamentally different. Neither is the capital stock declining much, nor the use of intermediate inputs. This reflects the lower degree of trade integration with the war site: imported goods from the war site and the nearby country account for a small fraction in the production of final goods as well as of intermediate inputs. In addition, there are positive output spillovers from the war to the distant country. They are due to a redirection of trade flows which is visible in the lower-right panel of Figure 10. Exports from the war site to the nearby and the distant country decline strongly as a result of the strong reduction of its productive capacity. Exports from the nearby country to the war site likewise drop sharply for two reasons. First, the productive capacity of the nearby country shrinks, too. Second, market access to the war site is severely restricted as iceberg costs go up. Some of the lost trade is made up by increased imports from the distant country, in particular to the nearby country. Thus, exports in the distant country go up, explaining the positive output spillover of the war. Quantitatively, the effect is moderate, however, because the initial level of trade between the distant country and both the war site and the nearby country is low.

5 Conclusion

What are the macroeconomic effects of war? In addressing this question, we look beyond actual war sites and focus specifically on third countries that may be exposed to the economic spillovers of war. This is a very relevant aspect to consider: although a war on a country's own soil is a rare event, war in a nearby country is not. Studying the period since 1870, we find that wars have large adverse effects on the war-site economy. Focusing on major war sites, we find that output drops by more than 40 percent relative to trend and inflation increases by almost 40 percentage points for an extended period. These effects are reversed only gradually some 5-6 years after the start of the war. About one-third of the output and inflation effects observed in the war site spill over to nearby countries. Geography is key: for more distant countries we observe no inflation spillovers while output spillovers actually turn *positive*. As such, wars create winners and losers in the international economy.

In the last part of the paper, we interpret this evidence through the lens of a structural business cycle model of the global economy. It features three countries and is estimated by matching the impulse responses of the war-site economy. The model predicts the spillover

effects on nearby and distant countries with remarkable accuracy. The nearby country is highly integrated with the war-site economy. As the war destroys the latter's productivity capacity, exports to the nearby economy 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. This accounts for the price pressures. By contrast, the more distant country experiences a mild output boost, reflecting a redirection of trade flows.

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 external costs to the war, notably for economies closer to the war site. Specifically, the spillovers from the war site lower output while putting upward pressures on prices. As such, they represent an adverse supply shock and give rise to a difficult trade-off for stabilization policy. Price pressures may only be contained by lowering economic activity further, or vice versa. The issue becomes more challenging once we consider the geographic distribution of the war's spillovers—notably within currency unions: Given the unequal distribution of the war's external impact, a common monetary policy is confronted with the additional trade-off of stabilizing one region at the expense of another.

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Online Appendix

A Additional Descriptives

Table A1: War Site Overview

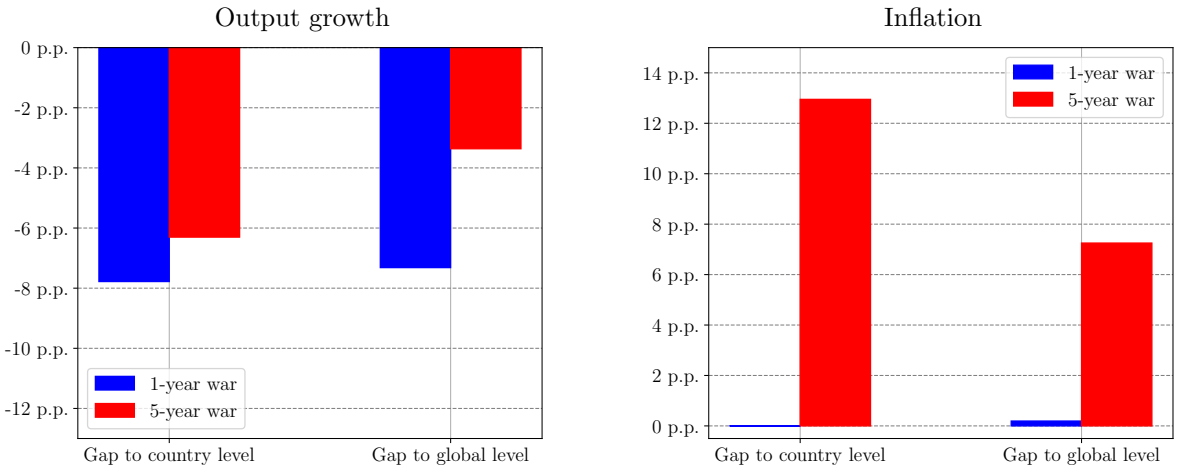
War	Site	Total DMW	Start Date
World War I	France	4,027,517	1914
Third Sino-Japanese	China	3,531,359	1937
World War II	Russia	2,288,675	1939
Vietnam War, Phase 2	Viet Nam	2,006,561	1965
World War I	Ukraine	1,891,000	1914
World War II	Poland	1,864,645	1939
World War I	Belgium	1,162,039	1914
World War II	Belarus	1,030,815	1939
World War II	Germany	982,127	1939
World War I	Italy	951,812	1914
World War II	Japan	868,392	1941
World War I	Poland	640,500	1914
World War I	Slovenia	562,452	1914
World War II	Ukraine	440,807	1939
World War II	France	424,849	1940
Russo-Japanese	China	419,098	1904
World War II	Philippines	402,157	1939
World War II	Romania	369,188	1944
World War II	Hungary	369,082	1941
Conquest of Ethiopia	Ethiopia	349,601	1935
World War II	Indonesia	339,039	1939
World War I	Germany	303,000	1914
Vietnamese-Cambodian	Cambodia	280,300	1977
Franco-Prussian	France	266,224	1870
Korean	Korea, Republic of	262,037	1950
World War II	Italy	251,693	1940
Second Laotian, Phase 2	Lao People's Democratic Republic	250,000	1968
World War II	Greece	240,824	1940
Iran-Iraq	Iraq	224,526	1980
Korean	North Korea	191,536	1950
Invasion of Iraq	Iraq	177,113	2003
World War II	Belgium	173,010	1940
Second Greco-Turkish	Turkey	162,652	1919

World War II	United Kingdom	134,237	1939
World War I	Belarus	132,000	1914
Russo-Polish	Poland	126,113	1919
World War II	Myanmar	125,843	1939
Second Russo-Turkish	Bulgaria	111,700	1877
First Balkan	Turkey	105,525	1912

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

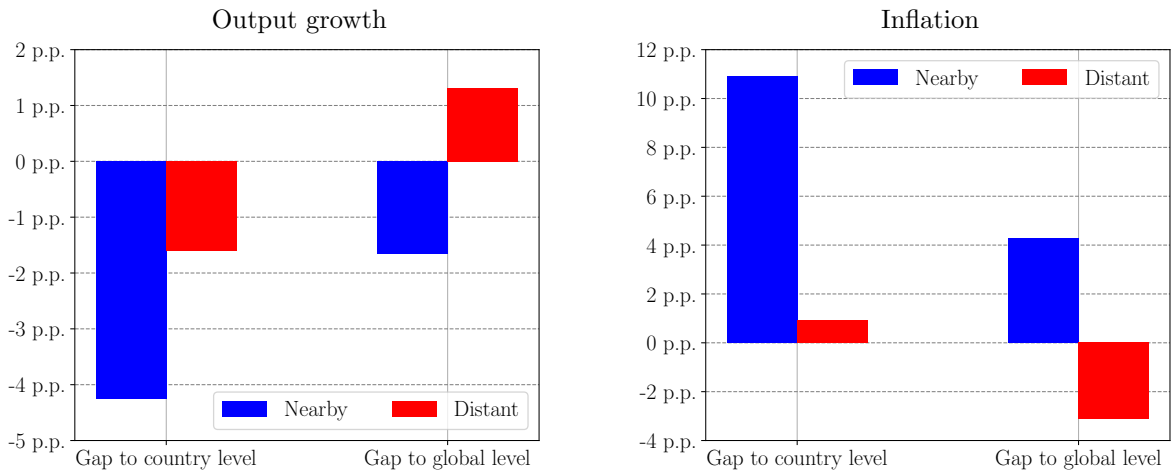
B Robustness

Figure B1: Economic performance during all wars—war sites



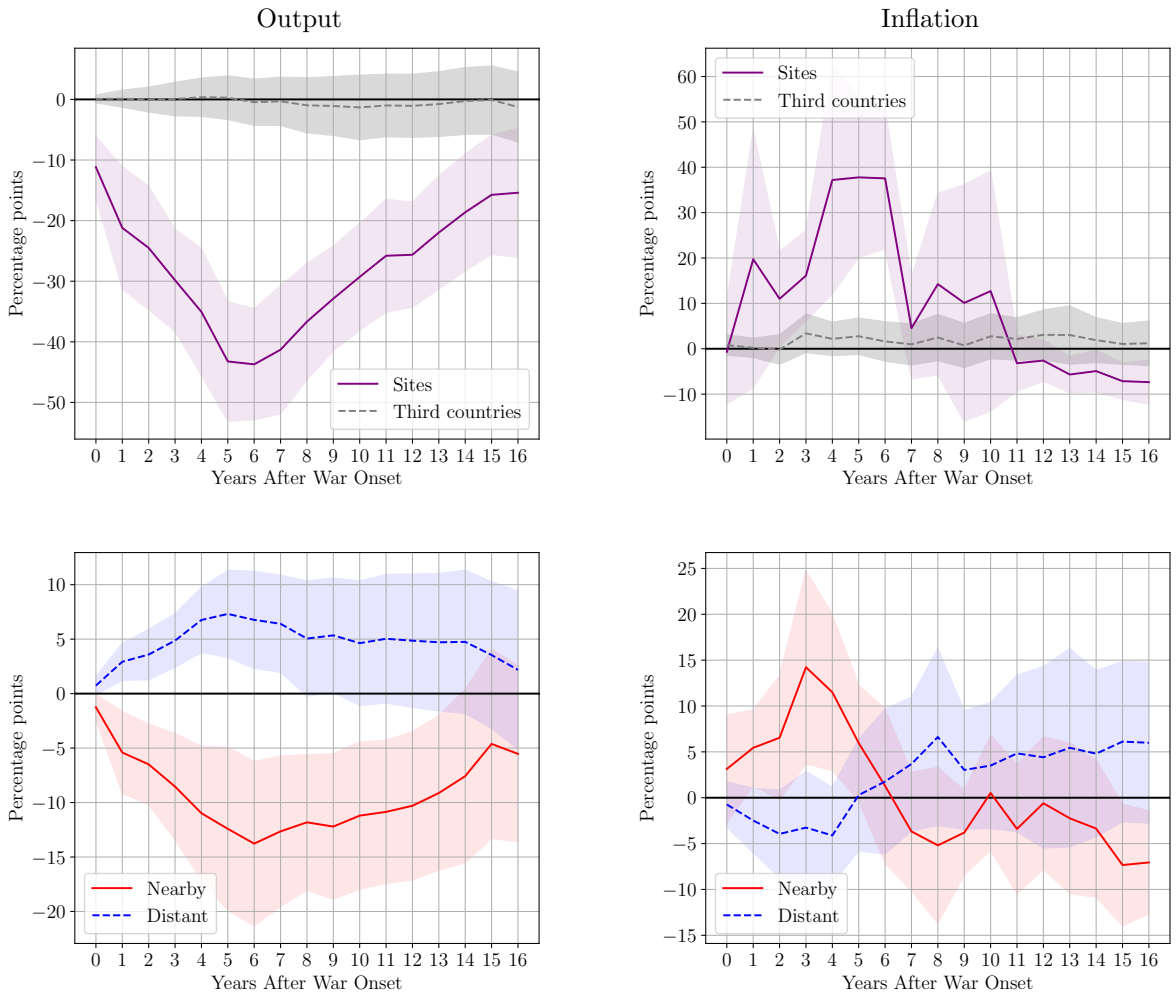
Notes: Output growth and inflation are annualized and measured relative to historical average (left) and the cross-sectional average (right). Sample: All war sites.

Figure B2: Economic performance of exposed countries during all wars



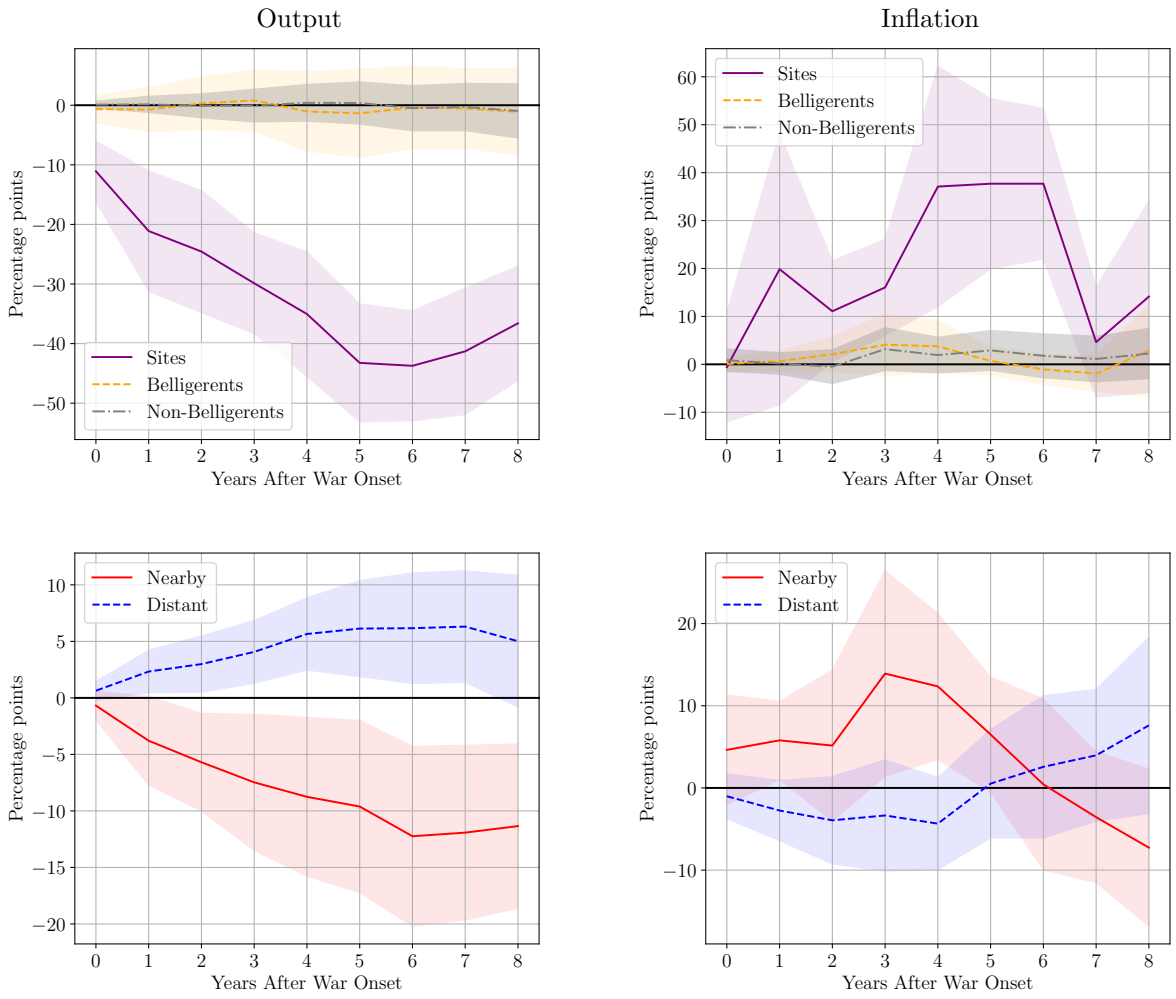
Notes: Output growth and inflation are annualized and measured relative to historical average (left) and the cross-sectional average (right). Sample: All war sites. "Nearby" countries are all other countries located within 1,000 kilometers of war sites, "distant" countries comprises all other countries that are farther away.

Figure B3: Longer horizons



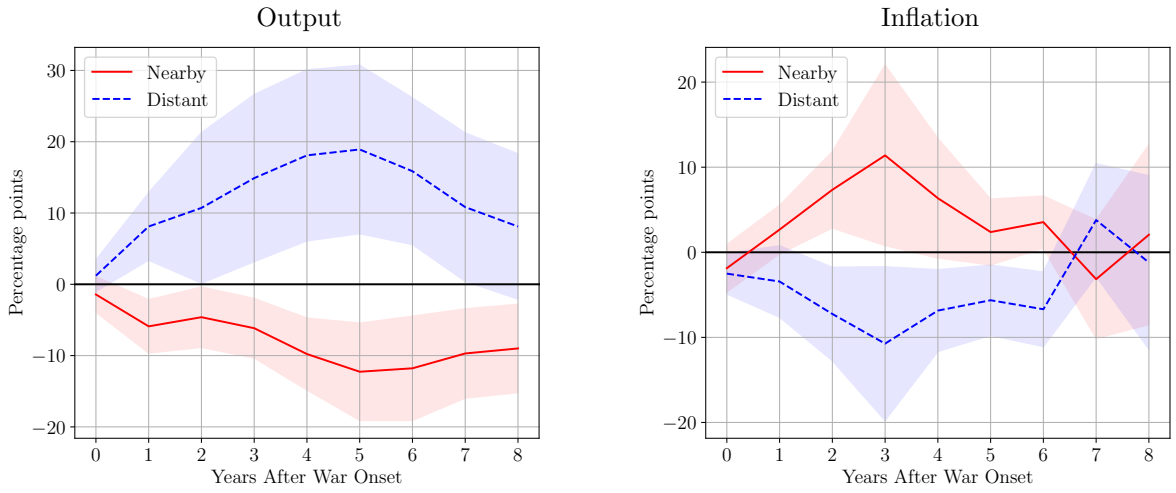
Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from the trend, horizontal axis measures time in years since start of the war. Top panels show results for linear specification (3.1). Bottom panel show response for smooth-transition specification (3.2). Shaded areas indicate 90% confidence bands. Sample is limited major war sites.

Figure B4: Disentangled Groups



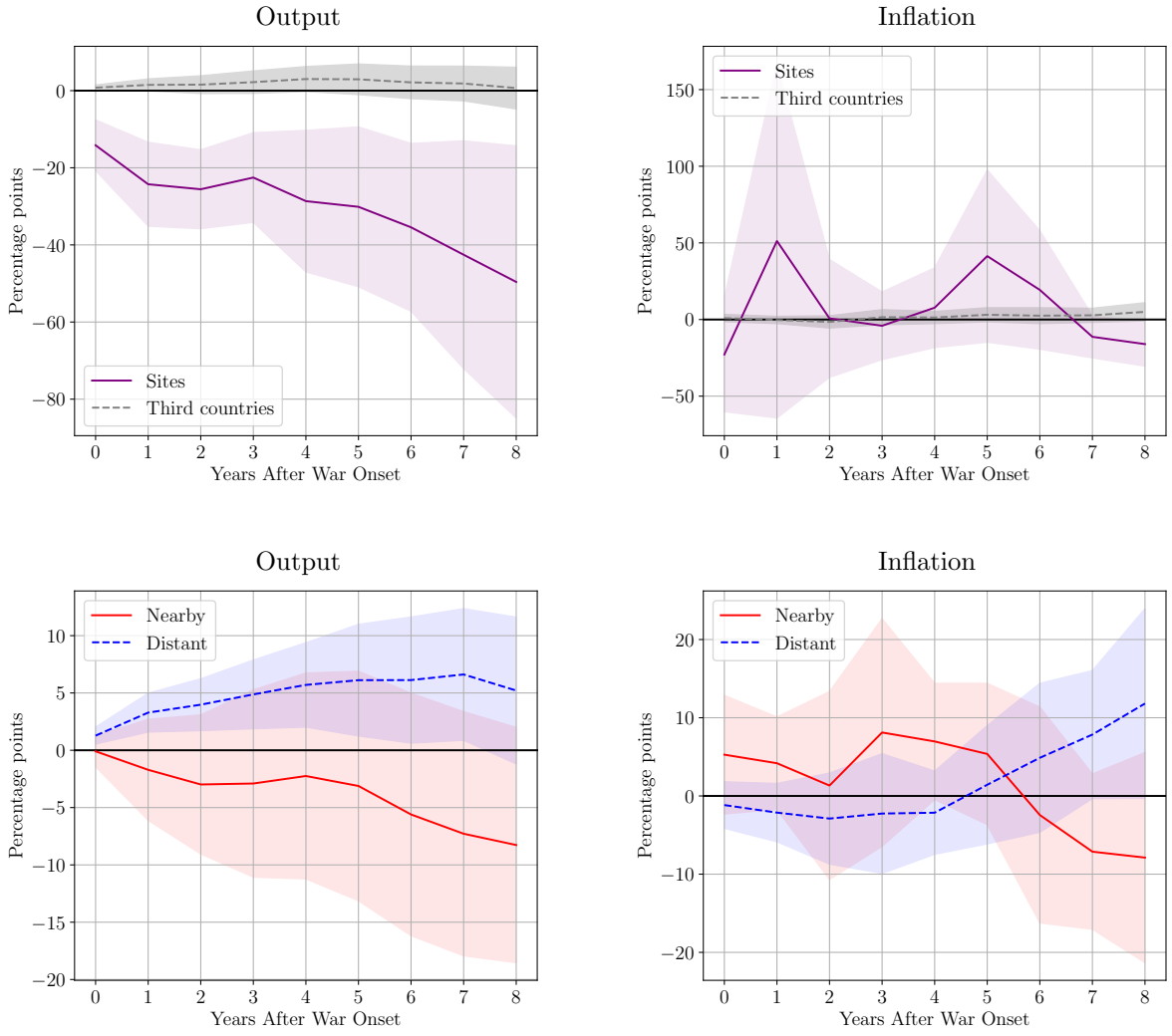
Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from the trend, horizontal axis measures time in years since start of the war. Top panels show results for linear specification (3.1). Bottom panel show response for smooth-transition specification for the set of countries which are neither war site nor party to the war (3.2). Shaded areas indicate 90% confidence bands. Sample is limited major war sites.

Figure B5: Effect of major wars on belligerents by distance



Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from the trend, horizontal axis measures time in years since start of the war. Top panels show results for linear specification (3.1). Bottom panel show response for smooth-transition specification (3.2). Shaded areas indicate 90% confidence bands. Sample is limited to major war sites.

Figure B6: Major wars w/o world wars



Notes: Left panel shows deviation of output from trend, right panel shows response of inflation. Vertical axis measures percentage deviation from the trend, horizontal axis measures time in years since start of the war. Top panels show results for linear specification (3.1). Bottom panel show response for smooth-transition specification (3.2). Shaded areas indicate 90% confidence bands. Sample is limited to major war sites excluding those of World War I and World War II.

C Casus Belli Coding

Table C1: 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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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
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.

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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
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/

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
Conquest of Ethiopia	1935	✓								Britannica. 2023. Italo-Ethiopian War. Accessed August 19, 2023. https://www.britannica.com/event/Italo-Ethiopian-War-1935-1936
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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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
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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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.
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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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 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.

War	Onset	Nation-alism	Religion or Ideology	Power Transition	Border Clashes	Economic, Long-Run	Domestic Politics	Revenge/ Retribution	Economic, Short-Run	Secondary Sources
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
Invasion of Iraq	2003		✓	✓						Britannica. 2023. Iraq War. Accessed August 19, 2023. https://www.britannica.com/event/Iraq-War
Invasion of Ukraine	2022	✓	✓							The Economist. 2022. "John Mearsheimer on why the West is principally responsible for the Ukrainian crisis.".

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