Economic Freedom, Development and Casualties in Interstate Conflict

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Abstract

Theory and anecdote associate industrial development with the increased lethality of conflict. Other arguments suggest ways that prosperous countries might be able to reduce battlefield casualties, if only for themselves. Yet, economic freedom seems to suggest a motive for prosperous nations to reduce the casualties they impose on *other* nations. Existing explanations focus on capabilities, rather than on the willingness of prosperous nations to engage in more intensive types of military violence. I argue that the forms of development generally associated with free markets and economic competition alter the motivations of developed countries, leading to a shift away from high-casualty territorial conflicts and toward less deadly forms of contestation over regime or policy differences. To test this argument, I examine the relationship between economic development and interstate battle deaths using three different conflict datasets and taking into account a variety of other factors. My findings support this demand-side argument; as development increases, casualties decline for both developed states and for their opponents.

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1 Introduction

The invasion of Ukraine in early 2022 triggered considerable surprise and pessimism among western observers. To many, the invasion seemed to demonstrate that territorial aggression — long believed to be an anachronism in the modern world — was alive and well. But while surprise was warranted, there are reasons to remain quite sanguine about broader trends linking modernity with peace.

Observers were indeed shocked by Russia's aggression. Many experts prior to the invasion seemed to believe that President Vladimir Putin of Russia was bluffing, threatening war to generate leverage in diplomatic wrangling with Kyiv and NATO. Invading Ukraine did not make sense, at least not in terms of the economic and political conditions that prevail among prosperous nations in developed portions of the globe. Indeed, Putin's conception of how to "make Russia great again" appears distinctly backward-looking and out of step with modernity, offering striking parallels to an earlier nationalist leader who called for *liebensraum* at the very point that his own citizens were abandoning their rural holdings in the East in favor of jobs and flats in Hamburg or the Ruhr.

The idea that territorial aggrandizement affords nations significant power in the 21st century is nostalgic, at best. For two centuries and more, the impetus has been in the opposite direction. In pre-modern times, wealth was tied to the soil, as arable land basically predicted population size and the size of extractable rents available to the sovereign. Increasingly, however, the contribution of the physical size of countries to national power has given way to the impact of other factor endowments, such as capital and labor, especially when improved with education and technology.

Industrial transformation in Europe, the United States, and parts of Asia also created unprecedented changes in military affairs. Modern sophisticated militaries wield weapons that are more deadly than the most gruesome fantasies concocted by the fiction writers of earlier times. Exponential increases in lethality culminated in the deployment of nuclear weapons by a (slowly) growing number of countries. Mobility also dramatically increased lethality, with air forces able to rain destruction on entire cities, or to transport and supply entire armies. The twentieth century is often said to the bloodiest in history (Grenville 2000, Ferguson 2006). Far more people died as a result of war in modern times than in earlier centuries (Wright 1942). This revolution in lethality followed the process of economic development that created and multiplied the machines of war.

Paradoxically, the same engine powering vast increases in destructive capability might also contribute to a decline in the lethality of war as it is actually practiced in modern international affairs. As the results reported here reveal, prosperous countries — those typically associated with free and open markets — experience fewer battlefield fatalities in interstate wars. This finding is consistent across datasets coding wars, disputes, and armed conflicts over different time periods.

How can the paradox of greater lethality and (relatively) lower battle deaths be explained? While various arguments link economic development to changes in casualty levels, one possibility largely overlooked in other research is that development changes what states fight over, rather than, or in addition to, changing how states fight. Other research shows that development alters the conflict behavior of states with advanced economies (Gartzke 2006, Gartzke & Rohner 2009). Developed countries engage in less resource competition, while experiencing more policy and regime conflicts. Economic development shifts production away from goods requiring heavy inputs of land, minerals, and unskilled labor, and toward products that make intensive use of intellectual and financial capital. Domestic labor becomes more expensive with development, while commodity prices have tended to decline. This implies that the fruits of conquest are no longer so fruitful for developed countries. Sitting on a population as occupiers requires expensive, labor-intensive military structures that manage to extract less and less valuable basic goods. Similarly, taking territory is seen as pointless when domestic workers flee the countryside for employment in industrial and post-industrial cities. If development discourages resource conflicts, and resource or territorial disputes are more casualty-intensive (Vasquez 1993, Hensel 2000), then developed countries should less often fight high-casualty contests with any other state and observed battle deaths will subside.

Thus, while developed states are vastly better able to inflict casualties on their opponents (Boulding 1962, Buhaug & Gleditsch 2006), development also decreases the willingness of these states to compete over issues that are most often associated with high battlefield fatalities. The increased ability to project power is experienced in terms of more far-flung contests over how states will conduct themselves in the international system, and how they will behave at home. Relatively few contests involving developed countries are land grabs of the old-fashioned kind, despite the fact that disparities in power between developed and developing countries have grown, rather than subsided, over time. The shift toward policy manipulation in conflicts involving developed countries also comes

with a decline in salience for most conflicts; developed countries could cause (and incur) heavy casualties, but few find occasions when territorial conflict is justified. Indeed, where conquest of the weak by the strong was the norm in previous epochs, contemporary international affairs seems broadly to be characterized by the indifference of developed countries to the developing world.[1] In the few instances when policy conflicts are of fundamental importance, such as in the two world wars and during the Cold War, clashes between developed countries are likely to be particularly bloody. Indeed, if the willingness to fight varies more substantially than the effects of development on opportunity, then we can expect to see a decline in average battle deaths for developed countries.

After reviewing relevant literatures, I discuss the claim that development changes state objectives, which in turn leads to a decline in battlefield casualties in conflicts involving developed countries. I also discuss other arguments, including deterrence, efficiency or efficacy gains (technology), and substitution. I then offer statistical tests of these arguments, using three conflict datasets (MIDs, COW Wars, Uppsala/PRIO Armed Conflicts), relying on the best available data on battle deaths from Lacina & Gleditsch (2005). I find support for the claim that a shift in motivation, more than the rise in capabilities, best explains the decline in casualties due to development.

2 Studies of Economic Development and Interstate Conflict

The literature linking development to war and peace is as old as the study of international relations. Thucydides attributed the origins of the Peloponnesian War to rising Athenian commercial power.[2] After reviewing the general literature, I examine claims about development and the size of wars.

[1] Antipathy among developing countries to certain kinds of territorial conflict might be interpreted as a norm (Fazal 2004). A norm implies some proscriptive power. While the "ought" is there, it is not clear why not fighting over territory is morally compelling today, when states clearly coveted a neighbor's resources in the past, and when developed countries continue to, and have even increased, the use of force to pursue other political objectives.

[2] "The real cause I consider to be the one which was formally most kept out of sight. The growth of the power of Athens, and the alarm which this inspired in Sparta, make war inevitable" (Thucydides 1985[ca. 411BC], chap 1.34)

2.1 Development and Conflict Occurrence

It has long been argued that prosperity discourages conflict by making aggression unprofitable.[3] One line of reasoning suggests that cultural/political factors such as nationalism make it difficult for states to effectively occupy all or part of another country (Gilpin 1981).[4] Identification with a large territory can serve as a commitment mechanism, stiffening resistance so that aggressors face an "all or nothing" decision that tends to make war prohibitively costly (Goemans 2006). Note as well that this logic implies that warfare among nationalistic states should be more bloody, if less frequent.[5] Another set of arguments claim that changes in the nature of modern economies create states that are disinclined to aggression (Rosecrance 1985). "In economies where capital, labor, and information are mobile and have risen to predominance, no land fetish remains. Developed countries would rather plumb the world market than acquire territory" (Rosecrance 1996, page 46). This set of claims implies that development reduces both the incidence and intensity of conflicts.

It has also long been argued that modernity encourages conflict by making aggression necessary or practicable. The classic Marxist formulation is that states fight wars of expansion to capture markets (Hobson 1938[1905], Lenin 1970[1916]). Overproduction requires mercantilist policies to maintain capitalist economies in developed states. Other scholars see development as a catalyst, which combines with population growth to generate "lateral pressure" (Choucri and North 1975, 1989).[6] Ashley argues that "war is mainly explicable in terms of differential growth..." (1980, page 3). The most pervasive claim is that economic development serves as a permissive condition for interstate conflict. Realist theories share the common expectation that the enrichment of states leads to the accumulation of military might.[7] Development increases state capacity and the ability to project power (Kugler & Arbetman 1997). Simply put, poor countries seldom fight because they cannot, while

[3] Mueller (1989) argues that cultural change leads warfare to become unfashionable. See also Kaysen (1990).
[4] Modern studies offer little support for nationalist "quagmire" arguments (see, Liberman 1996, Brooks 1999).
[5] Bueno de Mesquita, et al. (1999) offer similar logic in an effort to explain the democratic peace. Democracies fight harder, making them less attractive as adversaries, especially to other democracies.
[6] Zuk (1985) rejects the thesis that resource shortages precipitate major power expansion. Tir & Diehl report a weak increase in disputes associated with population growth, but conclude that "there are substantial limits to the validity of extending overcrowding arguments to the context of interstate relations" (1998, page 336).
[7] Liberman (1996) and Brooks (1999) reject the literature on opposite sides of the debate. "Very few existing analyses devote more than a page or two to the economic benefits of conquest" (Brooks 1999, page 648, fn. 1).

rich nations field forces far from home. All of these arguments, while profoundly different in mechanism, suggest that modern industrialization should increase battlefield casualties.

Until recently, available evidence cast considerable doubt on claims of a relationship between economic development and the likelihood of war or peace. Quantitative tests using a standard indicator of national income (Gross Domestic Product per capita) fail to demonstrate a statistically significant relationship between development and whether states fight (Richardson 1960, East & Gregg 1967, Rummel 1967, Maoz & Russett 1992). Curiously, little ambiguity exists for the relationship between development and *intra*state conflict. As Wallensteen et al. note "It has been repeatedly observed that the onset of internal wars is related to the level of economic development" (2001, page 21). The many studies reporting that civil conflict is much more common among developing states than among developed states indicate the robustness of this relationship (Collier & Hoeffler 2002, Elbadawi & Hegre 2008, Elbadawi & Sambanis 2002, Ellingsen 2000, Fearon & Laitin 2003). Fearon & Laitin find that GDP/pop. "is strongly significant in both a statistical and substantive sense" even when controlling for other factors including region, ethnicity, religion, prior conflict, territory, regime type and stability and foreign involvement" (2003, page 83).

A number of studies report that the effect of democracy on interstate conflict is conditional on development (Hegre 2000, Mousseau 2000, Mousseau, Hegre & Oneal 2003). The widely recognized democratic peace result appears to obtain only for wealthy democracies. Boehmer & Sobek (2005) find a non-linear relationship between development and conflict. Economic development has two contrasting effects on dispute behavior. Using the opportunity and willingness framework of Most & Starr (1990), Boehmer and Sobek note that poor states seldom fight other states because poverty limits their ability to project power, while rich states have disincentives to coerce. They report a curvilinear relationship between development and militarized disputes in a statistical model of monadic state years. Finally, Gartzke (2006) shows that development has contrasting effects on dispute behavior, decreasing the willingness of developed states to engage in territorial conflict, while actually increasing the tendency of developed countries to fight far from home over policy.

2.2 Development and Conflict Intensity

Contrasting predictions also appear to confront the related question of whether development or technological change lead to bigger wars, though the empirical relationship is less well established. Scholars again lavish a rich assortment of arguments on the debate. Malthus, for example, peppers his work with anecdotes relating the intensity of organized violence to relative abundance. "Among the Tartars, who from living in a more fertile soil are comparatively richer in cattle, the plunder to be obtained in predatory incursions is greater than among the Arabs. And as the contests are more bloody from the superior strength of the tribes, and the custom of making slaves is general, the loss of numbers in war will be more considerable" (1958[1798], page 82). In contrast, Cobden argues that "[s]hould war break out between two great nations I have no doubt that the immense consumption of material and the rapid destruction of property would have the effect of very soon bringing the combatants to reason or exhausting their resources" (Cobden 1903[1867], page 355).

Popular audiences have paid considerable attention to the effect of technology and development on warfare. The Tofflers ("future shock") and others foresee an age when human casualties are replaced by cyber warfare (Toffler & Toffler 1993). In contrast, in *1984*, Orwell describes a world in which war is perennial, draining "excess population" from societies grown inured of endless losses.

Surprisingly, there has been decidedly little effort to apply the technology of modern social science to the task of evaluating the determinants of war intensity. Levy & Morgan (1984) find an inverse relationship between the frequency and lethality of contests. Cederman (2003) identifies a power law in the relationship between size and the relative frequency of warfare. Rising maximums for battle deaths are associated with technological change, though a question remains about the increasing standard deviation in casualties associated with technology. Cioffi-Revilla (2004) has discovered a pattern of rising intensities and spells between the largest conflicts. According to his calculations, a war involving perhaps 22.5 million battle deaths is currently decades overdue.

3 The Paradox of Development and Declining Battle Deaths

The first half of the twentieth century was the deadliest period of warfare in world history (Wright 1942, Holsti 1991). Killing on an industrial scale was made possible by advances in technology and manufacturing (Herrman 1997, Stephenson 2000). Submarines, machine guns, air-burst artillery,

tanks, aircraft, and the battleship were all invented or perfected (Strachan 2001, Howard 2002). Scholars, statesmen and ordinary citizens naturally attributed the dramatic rise in casualties to industrialization (Angell 1921, 1933; Fuller 1945).[8] Mass production of lethal weapons seemed to ensure that modern war meant mass casualties (Fuller 1961, Hobsbawm 1996, Strachan 1983).

Yet, if the first half of the twentieth century appeared to demonstrate that modern war was much more deadly, the second half suggested that mass casualties in conflicts involving economically advanced nations are far from inevitable. The Cold War was "cold" because battle deaths were limited, though tensions were often quite high. From the 1950's onward, there have been few interstate wars, and none among major powers, though smaller disputes persisted. The frequency and intensity of warfare declined further following the collapse of the Soviet Union (Eriksson & Wallensteen 2004; Gleditsch, et al. 2002). Indeed, casualty levels in conflicts involving developed countries are generally lower than for developing countries. Despite two horrific world wars, development appears more often to result in a diminution of battlefield casualties. This tendency poses something of a paradox for research on war intensity. Why, given that development increases the ability of states to kill, do conflicts involving developed states tend to generate fewer battle deaths?

Most conventional accounts linking development and battlefield casualties emphasize the supply side; development is said to alter military capabilities.[9] An under-explored alternative involves the demand side. Development shifts the nature of interstate conflict away from territory (Gartzke 2006, Gartzke & Rohner 2011). Developed states most often prefer to buy resources rather than steal them through force. Conversely, increasing state power allows developed countries to intervene in the affairs of distant nations and to impose their will on collective policies. Economic development does not make countries more virtuous, but they may become less willing to pursue deadly force.

3.1 A Theory of Economic Development and Interstate Battle Deaths

Suppose that states care about two basic categories of things, resources and policies. Resources (land, labor, minerals) are private goods generally associated with territory (Goertz & Diehl 1992, Vasquez 1993). States benefit from a given resource only by depriving others of the benefit. To the

[8] It was widely believed mid-century that war-profiteering industrialists abetted World War I (c.f. Engelbrecht & Hanighen 1934). The U.S. Senate even held hearings on "undue influence" by arms makers (Coulter 1997).
[9] An exception is Lacina, et al. (2006), who argue that liberal peace contributes to declining casualties.

degree that the issues confronting the community of nations are about resources, the realist conception of a zero-sum security dilemma is a useful simplification. If the acquisition of territory and other productive assets allows for the aggrandizement of one state's power, other states will be threatened. Conversely, the policy actions of states — on subjects such as regime status, ideological alignment, human rights and intervention by hostile third parties — need not be zero sum. Policies that benefit one state can still provide more or less benefit to other states, so that the affinity of interests among states will vary over policy issues in a way not possible when considering resources.

The first Gulf War in 1991 offers an example of this contrast. Iraq fought alone, while the United States in contrast managed to marshall no less than 33 other countries in a coalition. Research has focused on private incentives and subsidies to states to participate (Tago 2005, 2008), but another aspect of the logic of collective force is worth noting. Saddam Hussein fought to capture oil and the cash reserves of Kuwait. Building an Iraqi coalition would have required Saddam to divide up the spoils, diluting his benefits for victory. In contrast, the coalition was broadly interested in asserting territorial integrity and in returning conditions in the Gulf to the status quo ante. These objectives were not diluted by a coalition. Conflict over resources is largely zero-sum, while competition in the policy space introduces different degrees of compromise and allows for multiple winners.[10]

The potential for overlap in state interests over policies but not over resources suggests an important distinction between each set of motives for interstate conflict. Whether it serves as the impetus behind military action or, more often, as the catalyst for diplomatic wrangling, resource competition should consistently result in contrasting interests among states. Policy conflicts can also occur, but need not when policy interests are sufficiently similar. Further, the intensity of conflicts over policy issues will be bounded by the degree to which state interests coincide. The policy goals of states will often be compatible to the point that each state can prefer accepting the ideal choice of the other rather than hazarding violent confrontation. This suggests that conflicts over policies are on average less intense and less intractable than conflicts over resources.

If states can differ in the proximity of their interests over resources and policies — while warfare differs in frequency and intensity between these two motives for conflict — then environmental

[10] The Gulf War highlights problems in describing wars as either resource or policy driven. I rely on Correlates of War codings as a disinterested source for these decisions (coders have no particular interest in my theory).

changes that shift the relative emphasis among states between resource and policy competition should also lead to changes in the intensity and frequency of contests. There is substantial support in the literature for the notion that states fight more often and more intensely over territory than over policy differences (Goertz & Diehl 1992, Vasquez 1993).[11] Fixed resources literally "come with the territory" making warfare more likely, and more intense, for states whose economies make intensive use of arable land and rooted labor.[12] Territory also appears to be less easily divisible than foreign policies, adherence to international norms, and so on (Toft 2003, Walter 2003).[13]

Development should tend to shift the relative emphasis of states from resource to policy competition. If resource conflicts are the most lethal, then this implies a decline in casualties associated with economic development. Note also that the argument applies to developed states *and* to their opponents (developed or otherwise). A shift in the substance over which contests occur is a feature of the contest, and not of individual states. Thus, the level of development for any state should affect casualties for all participants. The anticipated tendency of economic development to reduce battle deaths generally is a feature that differentiates the theory from alternative explanations.

H 1 *Developed states should experience fewer battle deaths in conflicts than developing states.*

H 2 *States fighting developed countries should experience fewer casualties than other states.*

3.2 Alternative Explanations

Other arguments link economic development with changes in battle deaths. Casualties are inflicted as much as they are incurred. One possibility is that development creates military organizations that produce additional *enemy* battle deaths. Increasing the lethality of modern war could make fighting prohibitive. Deterrence theory argues that making war more costly means that war is less likely to occur (Mearsheimer 1983, Huth 1988, George & Smoke 1989, Jervis 1989, Powell 1990). Offense-

[11] Hensel (2000) and Huth (2000) offer detailed reviews of the literature on territory, contiguity, and conflict.
[12] Democracy is assisted by mobile capital, which allows wealthy elites to overcome the commitment problem of redistributive politics (Boix 2003). If wealth no longer derives from holding office, then these societies are less appealing targets of foreign conquest. Downing (1992) and Tilly (1992) offer demand side arguments.
[13] Territory is readily divisible in nominal terms, but there is significant resistance to arbitrary division, at least in modern times. This may be more a product of the location of populations than of land itself (Goemans 2006).

defense theories offer similar claims, suggesting that it is harder to win modern wars in some contexts (Quester 1977, Van Evera 1998, Lieber 2000, Biddle 2001). If development creates more lethal military organizations, or armies that are hard to conquer, then developed countries could experience fewer conflicts. Deterrence theory and offense-defense theory are mostly concerned with the relative frequency of wars and disputes (Snyder 1961, Huth & Russett 1988).[14] To the degree that deterrence works, or that offense-defense theory is correct, we should not expect to see as many wars. However, when war actually occurs involving developed states, these contests should be particularly costly. If it is the fear of casualties that deters contests, then deterrence failures should yield higher rates of slaughter. Battle deaths associated with deterrence failures should take two forms. First, opponents of developed states should experience more casualties. As this is the deterrent, we should expect to see that developed states mete out more fatalities on average than other states. Second, contests between two developed states should be the most bloody, as they involve the feature associated with deterrence and increased killing on both sides of the contest.[15]

H 3 *States fighting developed countries should experience higher casualties than other states.*

H 4 *Dyads in which both states are developed should experience higher casualties than other dyads.*

Another set of possibilities involve changes in how developed countries produce and field armies. Traditional battlefield tactics in land engagements emphasize massed infantry or cavalry. A large number of soldiers stood (or rode) in tight formations. Warfare was a process of slogging toe-to-toe with the enemy (Hackett 1989; Keegan 1993; Anglim, et al. 2002). Usually, the side with the larger formations won.[16] Tactics of the last century increasingly emphasized dispersal and mobility (Dunnigan 2003). Modern armies field divisions in which relatively few soldiers actually appear on the battlefield (van Creveld 1989). There is an increasing disparity in performance between armies

[14] Economic development or technological change could lead to offense or defense dominance (Glaser & Kaufmann 1998). If the defense is dominant, war will become less frequent, but for reasons similar to the deterrence argument, developed states that fight will face higher mutual casualties. If the offense becomes dominant, war is more likely because the attack is more lethal and effective. Opponents of developed states will face higher casualties. Examples of defensive (World War I) and offensive (World War II) advantage illustrate these casualty-increasing effects.

[15] The logical extreme of the deterrence argument is of course Mutual Assured Destruction (Bull 1961).

[16] Voltaire "God is always on the side of the heaviest battalions" (*Bartlett's Familiar Quotations*, No. 9599).

that "do" modern warfare well, and those that do not (Biddle 1998, 2004). Indeed, recent conflicts suggest that the effects of technology and training may be increasing; smaller military forces have proven victorious when better equipped and trained (Hastings & Jenkins 1984, Biddle 1996, Keaney 1997, Press 1997). However, most of the changes in tactics in modern armies took effect by the interval between the two world wars. World War I had demonstrated the devastating effects of the combination of massed formations and modern weaponry. Armies learned that it was necessary to field units designed to minimize casualties from artillery in particular (Ferguson 1999, Keegan 2000). In spite of a number of innovations in tactics, World War II produced significantly more casualties than preceding conflicts (Keegan 1990). Thus, one can argue that changes in tactics and doctrine are a response to evolving conditions imposed by economic development. Non-material aspects of warfare (innovations in strategy, tactics, training and leadership) contribute to lessening the casualty-producing effects of new weaponry, but even with these changes, casualty rates climbed.

A more direct solution might come, not from the "software" of modern war, but from hardware. Traditional conflict is labor intensive. There are many people on the battlefield who could get killed. Most soldiers in traditional armies are deployed as infantry or cavalry. Their weapons are hand-held and usually engage one enemy at a time. Development leads to new weapons of war that multiply the potential killing power of individual soldiers. Tanks and aircraft replace labor with capital. More machines go to war and fewer soldiers. Capital-intensive warfare also requires that a large number of citizens stay home to work in factories rather than heading for the battlefield. The "total" wars of the twentieth century showed that those in machine shops and rail yards are not immune to conflict-caused death, but in the bulk of wars civilian casualties in developed countries have been relatively light. Indeed, the ability to project power that follows economic development means that much more of the fighting occurs far from the heartland of developed countries.

Previous research suggests that developed countries tend to substitute capital for labor in the construction of military organizations (Gartzke 2001). The decline in military personnel, relative to total governmental expenditures, in the armies of developed economies suggests that the armies of developed countries should typically experience fewer casualties in war. Developed opponents should experience a similar reduction in battle deaths, so that developed dyads—where relatively few soldiers appear on the battlefield—should be the least subject to casualties. The effect on opponents

of developed countries that are not themselves developed is less clear. Viewed strictly in terms of the substitution of military capital for labor, developing states should experience little or no change in casualties. Developing states field more traditional force structures subject to traditional battlefield losses. There may be a synergistic effect between substitution and greater lethality, so that the opponents of developed states experience relatively higher casualties. Developing states fighting developed opponents may offer an abundance of targets and thus yield a higher level of slaughter. However, I cannot treat this as a critical implication of the substitution argument.

H 5 *Dyads in which both states are developed should experience fewer casualties than other dyads.*

H 6 *Developed states in mixed dyads should experience fewer casualties than developing states.*

H 7 *Developing states in mixed dyads should be at least as casualty-prone as two developing states.*

4 Research Design

I use several different datasets and estimators in evaluating the impact of economic development on battle deaths, involving samples of both monads (states) and dyads covering the post-World War II period, all of the twentieth century, and all years from 1816 to 2000. Particular decisions about sample, measurement, or coding can be controversial. I share with the reader the results of several alternative approaches. I estimate initial regressions involving ordinal data on the magnitude of battlefield casualties using ordinal probit. In regressions on actual casualty statistics, I use negative binomial regression. Poisson regression is less appropriate because these data are over dispersed (high variance relative to the mean). The samples of all monads or dyads are also zero inflated. I could use zero-inflated negative binomal regression, but this requires an explicit model of the zero-inflated process, something that involves considerable speculation. As a further test, I include regressions of just the sub-sample of conflicts. Finally, I report results of Heckman Two-Stage regressions used to check for selection bias or other effects attributable to differences in the onset and intensity of conflict (results appear in the appendix). Findings for all models are broadly consistent, though I note differences when I discuss each regression. In all regressions, I adjust for the effects of spatial autocorrelation (clustering) and adopt Huber/White robust standard errors.

4.1 Data

Many of the variables included in the study are generated using the *EUGene* software package (Bennett & Stam 2000). Additional variables come from other sources detailed below. A *Stata* "do" file is available from the author that replicates all aspects of data construction and analysis.

4.1.1 Dependent Variables

I use three different conflict datasets in constructing dependent variables and samples for the study: the Correlates of War (COW) Militarized Interstate Disputes dataset (MIDs), the COW Interstate Warfare data, and the University of Uppsala, Sweden (Uppsala) and International Peace Research Institute of Oslo (PRIO) Armed Conflict Dataset. Rather than advocate a particular dataset, I examine diverse sources with different coding schemes to assess the robustness of these findings.[17]

The EUGene version of the MIDs data cover the period 1816 to 2000 and contain the variable *mzfatald*, which codes six categories of conflict intensity (0=no battle deaths, 1=1 to 25 deaths, 2=26 to 100 deaths, 3=101 to 250 deaths, 4=251 to 500 deaths, 5=501 to 999 deaths, 6=at least 1000 battle deaths). Lack of confidence in available statistics on battlefield casualties led the MID project to adopt this ordinal variable (Gochman & Maoz 1984, Jones, Bremer & Singer 1996). I use *mzfatald* for a "first-cut" analysis of the relationship between development and battle deaths.

A more fine-grained assessment of the effect of development on wartime casualties can be gleaned from new data compiled by Lacina & Gleditsch (2005). The authors are particularly concerned to address discrepancies between the COW coding of battle deaths in interstate and civil conflicts, which is less relevant to this study, but the apparent care in data collection indicates that these are the best available casualty data. The Lacina & Gleditsch battle death data merge with two sources of information about international conflict, the COW Interstate War data (Sarkees 2000, Singer

[17] Researchers often drop observations for the two world wars, as the large number of participants greatly inflates representation in dyadic analysis. I include the world wars. Tests should properly favor the null or alternative hypotheses. The world wars give rise to claims that development greatly increases conflict lethality. If development does not increase casualties, even when the world wars are included, this supports the thesis.

& Small 1972, Small & Singer 1982), and the Uppsala/PRIO Armed Conflict data (Eriksson & Wallensteen 2004; Gleditsch, et al. 2002; Strand, et al. 2004**?**). The Uppsala/PRIO data cover armed conflicts exceeding 25 battle deaths over the post-World War II period (1946–2000). COW defines an interstate war as a conflict between nation members of the international system involving at least 1000 annual aggregate battle deaths and 1000 total battle deaths per participant. Lacina & Gleditsch provide battle death statistics for the COW interstate war data from 1900 to 2000.

4.1.2 Independent Variables

Economic development represents the productivity of a society. Major technological change in the twentieth century, combined with capital accumulation and advances in education yielded unprecedented increases in productivity for some countries. Development also changed the training, equipment, and mobility of military forces. While developed countries experience fewer wars and more low-casualty/low intensity conflicts (Gartzke 2006, Gartzke & Rohner 2009), it is not clear whether development influences casualties in those large conflicts that actually occur, given that wars and armed conflicts are defined by relatively high battle deaths. Developed countries may experience fewer wars without having their wars become any less deadly. Indeed, warfare involving developed countries may be *even more* lethal, due to deterrence, technology, or substitution.

Development is typically measured gross domestic product per capita (GDP/population, average national income). I obtain GDP and population data from Gleditsch (2002). Dyadic analyses necessitate aggregating state-level variables. Dixon (1993) suggests using the "weak link" assumption. Values for the least developed state in the dyad act as a threshold (Dixon & Goertz 2005). *Development (Low)* reports the lower of two monadic population weighted GDP statistics in a dyad.

Statistics on GDP per capita are generally unavailable prior to 1950. A large proportion of values are also missing, even in recent decades. In order to push the analysis back in time as far as possible, capturing the important dynamic early in the twentieth century, I also use the COW Composite Indicators of National Capability (CINC) component *energy*, which provides annual observations in thousands of coal-ton equivalents (Singer 1990). Energy consumption is a commonly used proxy for

GDP (Lipset 1959; Burkhart & Lewis-Beck 1994; Hegre et al. 2001). I use the COW monadic *energy* variable divided by population, applying the weak link assumption in dyadic analysis.

Democracy: I measure democracy using the standard Polity IV data (Jaggers & Gurr. 1995). Polity data provide two eleven-point indexes of regime type based on formal constraints on the executive (*AUTOC*) and institutional support for democracy (*DEMOC*) (Gurr et al. 1989). I prepare monadic values by combining Polity democracy (democ) and autocracy (autoc) scales as follows, $[(\text{democ}_i - \text{autoc}_i) + 10]/2$, (where $i \in [A,B]$]).[18] For the dyadic regressions, I use *Democracy (Low)* and *Democracy (High)*, respectively the lower and higher democracy values in the dyad in a given year (Oneal & Russett 1999b; Oneal et al. 2003; Russett & Oneal 2001).

Trade: Interdependence constitutes the second of three components emphasized in research on liberal peace.[19] I measure economic interdependence in two ways, depending on whether the sample is monadic or dyadic. *Trade Openness* represents the GDP weighted total goods and services trade of a given country in a given year. *Trade (Low)* is measured as the lower of the two sums of bilateral imports and exports between two countries, divided by GDP (Oneal & Russett 1997).

Geographic Contiguity and Distance: States are more likely to fight the closer they are geographically (Bremer 1992). In part, this can be explained by opportunity, as neighbors have easier access. Yet, there is a greater likelihood of fighting among contiguous dyads independent of distance, suggesting that proximity also increases the motives for conflict. *Contiguity* is a dichotomous variable for dyadic partners that share a land border or are separated by less than 150 miles of water. The contiguity dummy is expected to increase the intensity of conflicts. I also include a variable measuring the metric distance between states in a dyad. *Distance* is the natural logarithm of the great circle distance between national capitals. Distance should decrease battle deaths.

Major Power Status: Major powers are more active internationally. Since major powers also tend to be prosperous, hypotheses involving development might be confounded by major power behavior.

[18] This construction differs slightly from Oneal and Russett. I also examined variables with interpolated values.
[19] I do not include a variable for membership in intergovernmental organizations (IGOs) as advocated by Oneal and Russett. Initial tests showed no significant effect of IGO membership on the lethality of interstate contests.

The dichotomous variable, *Major Power (dummy)*, in monadic regressions is coded "1" if a state is a major power and also equals "1" if at least one state in a dyad is a major power.

Allies: Alliances are formed with the intention of influencing interstate conflict by deterring aggression or encouraging intervention. *Defense Pact* is a dummy coded for the presence or absence of a defense pact, as specified by the COW Alliance dataset (Singer & Small 1966, Small & Singer 1990). For monadic analysis, any defense pact (a state may have several) is sufficient. For dyadic regressions, *Defense Pact* codes only military commitments involving both members of the dyad.

Capabilities: Capabilities determine the ability of states to project power and conduct warfare. COW Composite Indicators of National Capabilities (CINC) measures a state's potential for using force. CINC scores are computed as the weighted average of a state's share of total system population, urban population, energy consumption, iron and steel production, and military personnel and expenditures. Monadic analyses include a state's annual CINC score. For dyadic regressions, *Capability Ratio* measures capabilities as the CINC owned by the least powerful state, divided by the sum of dyadic CINCs ($\frac{CINC_{low}}{CINC_A+CINC_B}$). Parity should tend to increase the intensity of disputes.

Population: Countries with many people might experience battle deaths differently than small countries with relatively few citizens. I include *Population*, in 1000's from the COW CINC in the monadic analysis and use the weak link assumption, including the lower state population in dyadic regressions. Populations may also be large or small relative to available territory (Choucri & North 1975, 1989). I add the variable *Population Density*, which measures the total national population divided by total square miles of territory, to some regressions to assess the effect of "lateral pressure." *Arable Land/Pop.* measures the number of hectares of productive agricultural or pasture land, weighted by population. These data come from the *CIA World Factbook*. I replace missing values with values from other years, since these data do not change much over time.

Nuclear Weapons: Nuclear weapons are a special, arguably transformative, military technology that might inhibit large-scale warfare involving some nations (Bueno de Mesquita & Riker 1982; Mearsheimer 1984, 1993; Rosato 2003). Alternately, so-called "domino" conflicts in the shadow of nuclear Cold War might lead to higher casualty counts (Sagan & Waltz 2003). I use Jo & Gartzke (2007) to identify nuclear states and dyads in which either state possesses nuclear weapons.

Post-World War II: Numerous changes occur in the mid-twentieth century. Fazal (2004, 2007) identifies a norm of territorial integrity supported by the United States that is said to have suffused Cold War and post-Cold War international politics. This norm might also reduce the number of casualties occurring in wars if territorial conflicts are particularly bloody. Cederman (2001*b*, 2001*a*) argues that certain states are learning to cooperate. Reiter (1994, 1996) suggests generally that states learn to cooperate over time. These and other versions of arguments about social, cultural, or identity change in the international system are plausible, but difficult to measure, test, and differentiate. Rather than attempt to develop or improve upon a social theory of international politics (Wendt 1999), I construct two control variables designed to capture the possible impact of these factors. *Post-World War II* is a dummy coded "1" if the date of the onset of a conflict is after December 31, 1945, and zero otherwise. I also examined the year as a variable in analyses not reported here, as results were consistent with those for the post World War II dummy.[20]

Number of States/Major Powers: For monadic analyses, I include a count of the number of states and major powers in the international system. Changing the number of member nations could increase the intensity of wars, as more countries join, or decrease battle deaths, since empires are no longer able to call on colonial conscripts. The number of major powers in the system also addresses putative stabilizing/destabilizing effects of balancing (Waltz 1959, Deutsch & Singer 1964).

5 Results

Economic development will not produce global amity, but a decline in the value of disputed resources or territory should lead to conflicts of lower intensity. Developed countries appear less willing to incur casualties to obtain a parcel of land, access to minerals, and so on. While the potential for policy-related conflict may increase with development, these contests are typically less bloody than disputes over territory or resources (Vasquez 1993). Distant developed states can compete over preferred policies in a way that impoverished countries cannot. But there has been a degree of overlap in the policy preferences of developed countries, suggesting that these conflicts are less intense. The general

[20] Fazal (2007) uses a similar dummy to represent her key independent variable (a norm of territorial integrity).

tendency for developed states should thus be toward fewer battle deaths. Though the number of disputes may not decline noticeably, death tolls are expected to subside. I test these arguments, along with alternative hypotheses, in a series of regressions reported in four tables and one graph (additional tables appear in the appendix). The first table focuses on MID fatality levels. Tables 2 through 4 examine the Lacina & Gleditsch (2005) casualty statistics, combining regressions of the Uppsala/PRIO Armed Conflict data with the COW War data. Table 2 presents monadic regressions, Table 3 offers dyadic analysis, and Table 4 examines directed dyads.

Table 1 lists four ordinal probit regressions of development, democracy, trade, and other variables on the magnitude of wartime casualties, as represented by the MID *fatald* variable. The intention is to present a basic model of conflict including economic development, and then to add variables designed to address specific concerns about the robustness of these results. Ordinal probit is appropriate given the ordinal nature of the dependent variable, in which there are six categories of increasing casualty intensity. In the first three regressions in Table 1, I use GDP/population to measure economic development. Regression Model 4 substitutes population weighted energy consumption to limit missing values in the smaller sample explained below. Model 1 contains what might be called the "usual suspects" list of variables. Democracy decreases casualty figures, while a difference in regime type between dyad members increases the intensity of hostilities. Trade may also lower fatality levels, though this result is statistically ambiguous. Contiguity modestly increases battlefield casualties. This and subsequent results for contiguity are somewhat surprising given that the variable is usually extremely robust in analyses of conflict. The distinction here, of course, is that the model is not predicting whether states fight, but how much fighting occurs. Distance and alliance ties lower casualties, making fighting harder or easier in turn. Major power status and rough parity increase casualties. Economic development is found to decrease dispute intensity. The fact that *Development (Low)* is consistently negative and statistically significant in Table 1 suggests support for hypotheses 1 and 5 and casts doubt on hypothesis 4 (that development increases casualties in developed dyads). However, the other hypotheses remain to be tested.

Model 2 adds three demographic variables to control for possible confounding effects of population, population density, and the domestic scarcity of arable land. Populous, densely populated, or arid agricultural societies may substitute human labor in warfare for needed land, distorting the

apparent effect of development in discouraging large-scale conflicts. It can be argued that "lateral pressure," over-population, or a very large population accounts for the apparent effect of economic

Table 1: Ordinal Probit Models of Economic Development and MID Fatalities

D.V.: MID Fatality Level	1: GDP/pop.	2: GDP/pop.	3: GDP/pop.	4: Energy
Development (Low)	-0.064***	-0.061***	-0.049**	-0.214**
	(0.015)	(0.015)	(0.017)	(0.075)
Development (High)	0.000	0.000	0.000	-0.023
	(0.005)	(0.004)	(0.004)	(0.014)
Democracy (Low)	-0.079***	-0.083***	0.048	-0.081†
	(0.017)	(0.017)	(0.112)	(0.042)
Democracy (High)	0.054***	0.052***	0.051***	-0.012
	(0.010)	(0.010)	(0.010)	(0.022)
Dev. × Dem.			-0.017	0.076
			(0.014)	(0.061)
Trade (Low)	-5.884	-8.221	-7.512	
	(10.870)	(10.943)	(10.567)	
Contiguity	0.450†	0.284	0.279	-0.128
	(0.255)	(0.230)	(0.230)	(0.349)
Distance (ln)	-0.128***	-0.148***	-0.149***	0.088†
	(0.032)	(0.029)	(0.029)	(0.047)
Major Power	0.771***	0.767***	0.771***	0.557***
	(0.086)	(0.095)	(0.094)	(0.169)
Defense Pact	-0.303**	-0.246*	-0.243*	-0.384*
	(0.109)	(0.108)	(0.108)	(0.166)
Capability Ratio	1.114***	1.095***	1.093***	1.178*
	(0.195)	(0.206)	(0.206)	(0.488)
Population		0.000	0.000	0.000†
		(0.000)	(0.000)	(0.000)
Population Density		0.001***	0.001***	
		(0.000)	(0.000)	
Arable Land/Pop.		-0.038*	-0.039*	
		(0.019)	(0.019)	
N	369298	355537	355537	1205
Log-likelihood	-5229.476	-5033.071	-5031.262	-1398.448
$\chi^2_{(10,13,14,11)}$	453.756	455.039	458.275	97.476

Significance : † : 10% * : 5% ** : 1% *** : 0.1% Values in parentheses are standard errors. Significance tests are two-tailed. Ancillary parameters suppressed to save space (available from the author).

development on casualty levels. While high population densities do increase casualties, and abundant arable land lowers battle deaths, neither effect alters the relationship between development and casualties. Population itself has no discernable effect on how intensely states fight. Of the other independent variables, only contiguity becomes insignificant due to demographic controls.

Model 3 introduces an interaction term between development and democracy. Several studies point to a link between economic development and regime type (Hegre 2000; Mousseau et al. 2003; Mousseau 2000). At least in these data, the interaction term is not statistically significant. It does, however, alter the statistical significance of the lower democracy variable. This result needs to be treated with some caution given the insignificance of the interaction term (Braumoeller 2004). The relevant point here is that the effect of economic development on casualties remains unaffected.

Finally, it makes sense to isolate the relationship between the independent variables and battlefield casualties. The first three regressions combine a large number of cases where no dispute occurs with a small number of cases where a dispute occurs and the magnitude of casualties in that dispute is recorded. Whether states fight, and how much they fight, are potentially distinct processes (the issue is explored further in the appendix). It might be that variables that appear to influence battlefield casualties only determine conflict onset or occurrence. To test for this possibility, and to control for the effect of a large number of non-events on the analysis, I run a fourth regression on the ordinal MID fatality variable on a sample of only disputes. Given the limited sample size, I use the energy proxy for development to limit missing values. I also drop the trade variable to avoid eliminating values prior to 1950. Model 4 shows lower statistical significance levels for most variables, and in a few cases coefficients change signs. However, the economic development variable continues to significantly reduce casualty levels. Surprisingly, contiguity and distance flip signs. The relationship between contiguity, distance, and battlefield casualties appears to be inconsistent. Table 2 examines the effect of development on actual count data on battlefield casualties. All four regressions in Table 2 use the Lacina and Gleditsch battle death data as the dependent variable. The first two regressions use the Uppsala/PRIO Armed Conflict data as the sample, while the second pair of regressions examine COW Wars. The first and third regressions estimate coefficients on all cases in each respective sample. The second and fourth regressions select on conflicts or wars to isolate the effects of the independent variables on casualty levels. The state level-of-analysis (monads) in Table

2 is not capable of revealing strategic interaction. However, the analysis does make clear that there is a monadic effect of development on battle deaths. Thus, we have further support for hypothesis 1, but obtain nothing definitive about the other hypotheses.

In general the key results are consistent with those from Table 1. Development significantly decreases battle deaths, as does democracy. Estimated coefficients for some of the other variables depend on the sample. For example, major power status and the defense pact dummy swap signs depending on whether one is using the Uppsala or COW data. Similarly, a new variable added to the analysis to indicate the effect of nuclear weapons possession, *Nuclear Status*, is associated with an increase in casualties in the Uppsala sample, but a decrease in battle deaths in the COW War dataset. However, the main variables of interest appear robust to changes in model specification.

Table 3 returns to the dyad as the unit-of-analysis. Other than several changes in model specification to explore robustness, Table 3 is organized in a familiar manner. Uppsala Armed Conflict data serves as the sample for Models 1 and 2, while the COW War data are used in Models 3 and 4. All observations are examined in Models 1 and 3, with conflicts or wars isolated for regressions 2 and 4. Monadic variables (*Number of States*, *No. Major Powers*) are replaced with dyadic variables (*Contiguity*, *Distance*). I also re-introduce lower and higher democracy variables.

As in previous regressions, economic development significantly reduces battlefield casualties. These results conform with hypotheses 1 and 5, and reject hypothesis 4. Re-introducing Development (High) reveals that the effects of development are non-directional; development decreases conflict for both states in a dyad. This finding casts doubt on arguments that opponents of developed states experience higher casualties and suggests the need to examine directed dyads. *Democracy (Low)* and the trade variable are also associated with a reduction in battle deaths. Nuclear weapons possession significantly reduces casualties in three of four regressions, while the post-World War II period appears significantly less bloody than prior decades. This may be an artifact of periodization, since by definition the post-war period does not include the two world wars. Major power status consistently increases casualties, as does power parity. Defense pacts have significant but contradictory effects depending on the sample, increasing the hazard of conflicts or wars, while reducing or having limited

Table 2: Negative Binomial Regressions of Economic Development and Battle Deaths (States)

D.V.: Battle Deaths	1: Uppsala/PRIO Lacina (all)	2: Uppsala/PRIO Lacina (conflicts)	3: COW Wars Lacina (all)	4: COW Wars Lacina (wars)
Development	-0.201***	-0.172*	-0.259***	-0.291***
	(0.061)	(0.070)	(0.037)	(0.030)
Democracy	-0.448***	-0.369***	-0.379***	-0.292***
	(0.121)	(0.082)	(0.108)	(0.066)
Dev. × Dem.	-0.343***	-0.172*	0.039	0.002
	(0.083)	(0.079)	(0.074)	(0.045)
Trade Openness	0.000	0.000*		
	(0.000)	(0.000)		
Major Power	-0.137	-0.568	3.007**	2.017*
	(1.779)	(0.837)	(0.981)	(0.900)
Defense Pact	1.972*	0.025	-0.928	-0.961*
	(0.773)	(0.678)	(0.566)	(0.480)
Capabilities	39.320	16.266***	16.372	16.508†
	(55.342)	(3.658)	(11.757)	(9.792)
Population	0.000	0.000**	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of States	-0.051***	-0.033***	-0.019†	0.006
	(0.010)	(0.009)	(0.011)	(0.008)
No. Major Powers	0.657	1.321**	-0.095	-0.028
	(0.448)	(0.450)	(0.252)	(0.175)
Nuclear Status	6.798***	1.828†	-0.408	-0.626
	(1.363)	(0.982)	(0.971)	(0.881)
Post-World War II			0.266	-1.407*
			(0.975)	(0.714)
Intercept	8.997***	7.825***	10.216***	11.670***
	(2.058)	(2.079)	(1.929)	(1.230)
$/\ln(\alpha)$	6.042***	1.593***	5.700***	0.990***
	(0.158)	(0.100)	(0.132)	(0.090)
N	6334	159	11199	424
Log-likelihood	-1719.875	-1137.866	-6242.23	-4353.936
$\chi^2_{(11,11,11,11)}$	172.832	367.532	404.22	681.514

Significance : † : 10% * : 5% ** : 1% *** : 0.1% Values in parentheses are standard errors.

Table 3: Negative Binomial Regressions of Economic Development and Battle Deaths (Dyads)

D.V.: Battle Deaths	1: Uppsala/PRIO Lacina (all)	2: Uppsala/PRIO Lacina (conflicts)	3: COW Wars Lacina (all)	4: COW Wars Lacina (wars)
Development (Low)	-0.332***	-0.287***	-0.324***	-0.317***
	(0.040)	(0.059)	(0.056)	(0.048)
Development (High)	-0.029**	-0.111***	0.010	-0.048**
	(0.009)	(0.023)	(0.031)	(0.019)
Democracy (Low)	-0.374***	-0.197*	-0.288**	-0.315***
	(0.092)	(0.081)	(0.101)	(0.038)
Democracy (High)	0.086*	-0.116†	0.186*	-0.015
	(0.038)	(0.066)	(0.075)	(0.026)
Dev. × Dem.	-0.103†	-0.230***	0.020	0.090***
	(0.061)	(0.066)	(0.097)	(0.027)
Trade (Low)	-55.213***	-36.682		
	(14.861)	(32.432)		
Distance (ln)	0.008	0.222	-0.398**	-0.028
	(0.119)	(0.354)	(0.145)	(0.042)
Contiguity	0.912	1.620	-0.543	0.022
	(0.901)	(2.921)	(1.089)	(0.307)
Major Power	3.051***	2.951***	5.513***	2.100***
	(0.345)	(0.481)	(0.510)	(0.228)
Defense Pact	1.604***	2.570**	1.749*	-0.570***
	(0.448)	(0.850)	(0.685)	(0.164)
Capability Ratio	6.350***	1.609	11.140***	1.965**
	(0.923)	(1.480)	(1.852)	(0.669)
Population (Low)	0.000	0.000*	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Nuclear Status	2.559***	-0.380	-2.144***	-0.651*
	(0.339)	(0.514)	(0.545)	(0.271)
Post-World War II			-3.939***	-1.512***
			(0.440)	(0.191)
Intercept	2.045*	9.622***	4.322**	12.151***
	(0.984)	(2.846)	(1.482)	(0.417)
$/\ln(\alpha)$	7.655***	2.296***	8.243***	0.840***
	(0.033)	(0.048)	(0.065)	(0.047)
N	370148	653	490727	1369
Log-likelihood	-28035.04	-4226.308	-25794.012	-16049.233
$\chi^2_{(13,13,13,13)}$	523.577	392.482	629.401	867.151

Significance : † : 10% * : 5% ** : 1% *** : 0.1% Values in parentheses are standard errors.

effects on casualties. Distance and contiguity appear to have no effect on casualties. Uppsala Armed Conflicts and COW Wars have higher casualty thresholds than MIDs. Proximity appears to matter more for whether conflicts arise than for how big they become.

Finally, Table 4 reports regressions for directed dyads. Results are organized as before, with Models 1 and 2 consisting of Armed Conflicts and Models 3 and 4 examining COW War battle deaths. Again, Models 1 and 3 include all cases, while models 2 and 4 select on armed conflicts or wars. The dependent variable could consist of battle deaths for either state in the dyad, or for both. I examine all three possibilities, but only report results using one of the two monadic statistics in the dyad, since Table 3 offers examples using the sum of dyadic battle deaths. Model 1 and Model 4 use battle deaths for the state with the smaller COW country code in the dyad. Model 2 and 3 use the battle death statistic for the state with the larger COW country code. Results are symmetric (estimated coefficients for state A's variables switch to state B when swapping battle death data).

Development decreases battle deaths for both the actor and its target. Contests between a developed state and a developing state result in casualties that fall between the levels for homogeneous contests (hypothesis 6), while contests involving developing states and economically developed adversaries experience fewer casualties than contests among developing states (hypothesis 5). The size of the impact of development on casualties is also context dependent. Economic development decreases casualties for both actors and targets, but the decrease is far more substantial for the actor than for the target. Hypotheses 3, 4 and 7 are not supported by these findings.

Interestingly, the *Post-World War II* variable in regressions 3 and 4 in Table 4 is negative and significant. Conflicts between countries are less intense after 1945. There are several reasons that this could be the case, including the norms-based arguments proposed by Fazal (2004) and others. While these results do not identify what it is about the post-World War II period that yields this change, the effect of development is independent of other changes that occur after 1945. As for the other variables, capabilities always increase battle deaths, as does population. The effects of defense pacts, major power status, distance, and contiguity seem contingent on the chosen dataset or sample. For the major power variable in particular, the results suggest that the sample determines findings. Democracy usually decreases battle deaths, though the signs flip in Model 3.

Table 4: Negative Binomial Regressions of Development and Battle Deaths (Directed Dyads)

D.V.: Battle Deaths D.V. from [A,B,B,A]	1: Uppsala/PRIO Lacina (all)	2: Uppsala/PRIO Lacina (conflicts)	3: COW Wars Lacina (all)	4: COW Wars Lacina (wars)
Development A	-2.812***	-0.644***	-0.085***	-0.304***
	(0.112)	(0.101)	(0.015)	(0.012)
Development B	-0.837***	-2.844***	-0.320***	-0.067***
	(0.175)	(0.109)	(0.015)	(0.014)
Democracy A	-0.412***	-0.024	0.184***	-0.298***
	(0.063)	(0.044)	(0.048)	(0.024)
Democracy B	0.304***	-0.539***	-0.237***	0.031
	(0.069)	(0.046)	(0.048)	(0.024)
Dem. A × B	-0.020*	0.007	-0.006	-0.002
	(0.008)	(0.006)	(0.007)	(0.004)
Trade A	-2.693***	-3.865***		
	(0.799)	(1.153)		
Trade B	5.153	-1.524***		
	(12.490)	(0.189)		
Distance (ln)	0.279	0.230*	-0.332***	-0.049
	(0.264)	(0.089)	(0.095)	(0.036)
Contiguity	6.468**	1.903**	0.611	0.000
	(2.276)	(0.702)	(0.575)	(0.258)
Major Power A	-1.152	0.118	1.971***	2.258***
	(0.765)	(0.318)	(0.305)	(0.216)
Major Power B	0.299	0.873***	0.333	0.561***
	(0.523)	(0.264)	(0.589)	(0.153)
Defense Pact	2.675***	0.183	0.061	-0.892***
	(0.834)	(0.323)	(0.324)	(0.166)
Capability A	265.541***	8.272***	14.191***	14.255***
	(42.755)	(2.188)	(3.297)	(1.837)
Capability B	33.552***	38.076***	82.670***	2.193*
	(7.634)	(3.338)	(12.739)	(0.966)
Population A	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Population B	0.000***	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.244	10.771***	5.699***	11.567***
	(2.199)	(0.816)	(0.698)	(0.284)
$/\ln(\alpha)$	9.282***	2.358***	8.261***	1.066***
	(0.047)	(0.046)	(0.044)	(0.031)
N	740296	1306	981473	2757
Log-likelihood	-10317.96	-5845.156	-46993.33	-28124.105
$\chi^2_{(16,16,14,14)}$	1260.672	1958.798	1582.331	2030.055

Significance : † : 10% ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1% Values in parentheses are standard errors.

6 Conclusion

The apocalyptic visions of many writers and experts that development would lead to monstrous wartime losses are not generally supported by available evidence. This finding is robust to different model specifications, different measures of conflict, and different estimation techniques. Evidence of this "second best outcome" suggests that developed countries fight less intensely, when they fight. The reduction in casualties associated with development also extends beyond developed countries; opponents of developed countries, whether developed or not, experience fewer battlefield fatalities.

Arguments have been advanced that development makes armies more lethal. Whether true or not, increasing lethality is not reflected in terms of increased casualties in war. To the degree that development alters the "ingredients" of modern militaries, it does so without interfering with the overall diminution of battle deaths. The fact that the opponents of developed countries also experience a reduction in casualties implies that something else is at work. Norms, learning, or culture can potentially account for the downturn in casualties in general after World War II. However, the effect of development on conflict intensity exists independent of broader changes in the second half of the twentieth century. The evidence seems to be consistent with demand-side variables, since the change in capacity for casualties is not met by increased bloodshed; development shifts the "what" of modern warfare as much or more than the "how." Though conventional discussions of modernity and the state emphasize capabilities, the idea here is that development makes states less interested in fighting, particularly over territory. Developed countries still fight, but increasingly they focus on contests that necessitate fewer casualties on either side of the dispute.

If development reduces battle deaths, then why did the twentieth century experience two terrible wars? Part of the lethality argument is correct; development has afforded nations the ability to conduct unprecedented slaughter. Yet, there have been few occasions where developed countries felt inclined to unleash such capabilities. Wars involving developed countries are bound to be horrendous when the issues at stake are fundamental. If the powerful countries of the twentieth and twenty-first century really want to fight, they can ensure casualty figures unprecedented in the history of warfare. But increasingly, the issues facing developed countries are simply not as divisive as those that haunted most of the rest of history. Nations can lose interest in warfare for two reasons.

First, the impetus to fight over territory can subside as the value of land as an input to production declines in value. Coercion and/or occupation is expensive; developed countries find it cheaper to buy what they need than fight for it. Second, though differences can persist over the policies of other nations, developed countries have largely found that their objectives are compatible. Where they are not, the differences have typically—though not always—been of secondary importance. On three occasions in the twentieth century, differences between developed countries mattered enough to foster great contests. The two world wars determined the fate of world affairs to the present day. Precisely because they settled fundamental issues of international organization, they also ensured that subsequent conflicts were not necessary. In each case, the developed major powers were not fighting over property, but over the right to determine how the system as a whole would function. Policy differences of this order are rare. Paradoxically, the Cold War saw an ideological divide that was so great, and the technological advances so horrifying, that war was inconceivable. Here, the deterrence argument makes sense, though the superpowers still experienced disputes every year.

What does the future hold? We cannot know whether policy differences will eventually overwhelm the tendency of developed countries to have less deadly contests. To reduce the prospect of world war in the twenty-first century, the interests of rising powers such as China and India must be incorporated into the existing international system. The risk of high casualty warfare may be greatest in the coming decades in places that have exhibited only limited interstate conflict in the past. A dramatic increase in casualty levels may occur among poorer countries as these states escape poverty and become more capable, without (yet) adjusting their values in line with their interests as developed nations. Most of the poorest states have difficulty effectively governing, let alone projecting power abroad. As these countries become richer, and their governments more capable, they may seek to rectify what they see as artificial boundaries. Indeed, Russia's current problematic push into Ukraine seems very much akin to the land grabs of a bygone era.

One solution may be to seek to transition nations from poor to developed as rapidly as possible. Increasing the capacity for using force, without also altering the incentives of these nations is a recipe for casualty-producing territorial aggression. Russia's imperialist nostalgia, combined with the absence of thorough economic development, encouraged renewed myths of territorial empire.

A Two-Stage Estimation of Economic Development on Conflict

The theory presented in the text argues that the level of economic development affects both decisions to engage in warfare and the number of battle deaths if and when warfare occurs. Isolating the independent effect of development on combat fatalities is challenging because the variable potentially affects both selection into conflict and the intensity of the dispute (Achen 1986). Is economic development causing fewer battle deaths, or does development merely lower the probability that states fight? In the text, I present separate models that estimate the effect of development on fatality levels in the universe of cases and in the subset of cases involving conflict or war.

An alternate strategy is to employ a two-stage estimator that explicitly models each step of the process through a selection and an outcome equation. The selection equation consists of those variables that lead states to engage in warfare and the outcome equation involves those variables that affect the number of battle deaths. I use Heckman two-stage regression to provide additional estimates of the effect of development on battle deaths (Heckman 1978). The Heckman model is not flawless (Greene 1981; Winship and Mare 1992). In this context, the most serious shortcoming of the Heckman estimator is its inability to cope with non-normally distributed data. As discussed in the body of the paper, the dependent variable displays a high variance relative to its mean. Despite these concerns, the results are suggestive. The negative relationship between economic development and battle deaths appears to be robust to a model specification that explicitly differentiates between the processes that lead states to resort to arms and those that determine the intensity of bloodshed.

I cannot simply re-run the reported models with all of the variables included in both the selection and outcome equation. Instead, it is necessary to hypothesize further about different factors that lead to war, and those that determine casualties. Table A1 presents four Heckman two-step models with the MID *mzfatald* variable as the basis for the dependent variable. Model A1.1 includes all of the independent variables found in Model 1.1 in the outcome equation, but only the economic development, geographic, and capability ratio variables are placed in the selection equation. Unlike the level of democracy or the presence of a defense pact, for example, these five variables directly determine the bloodiness of battle once conflict has begun.[21] In Model A1.1, economic development

[21] Democracies may fight harder against autocracies (Reiter & Stam 2002). Alternately, democracy-on-democracy

does not have a statistically significant effect on MID fatalities. Once population effects are introduced into the outcome and selection equations in Model A1.2, however, the hypothesized relationship holds at the 0.1% percent significance level. As one would suspect, population plays a critical role in fatality levels. Low population density and total population are positively related to battle deaths, while population to arable land (low) decreases battle deaths.

Table A1: Heckman Models of Economic Development and MID Fatalities

D.V.: MID Fatality Level	1: GDP/pop.	2: GDP/pop.	3: GDP/pop.	4: Energy
Development (Low)	-0.001*	-0.001**	-0.001**	-0.002**
	(0.001)	(0.000)	(0.000)	(0.000)
Development (High)	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Contiguity (dummy)	0.020	0.025**	0.025**	0.026**
	(0.014)	(0.007)	(0.007)	(0.004)
Distance (ln)	-0.005**	-0.005**	-0.006**	-0.006**
	(0.002)	(0.001)	(0.001)	(0.001)
Capability Ratio		0.005	0.005	0.004
		(0.005)	(0.005)	(0.003)
Population Density (Low)		0.000**	0.000*	0.000**
		(0.000)	(0.000)	(0.000)
Arable Land/Pop. (Low)			-0.001**	-0.001**
			(0.000)	(0.000)
Population		0.000**	0.000**	0.000**
		(0.000)	(0.000)	(0.000)
Intercept	0.047**	0.050**	0.051**	0.054**
	(0.014)	(0.008)	(0.008)	(0.004)
N	356096	356096	356096	356096
χ^2	654.65	952.88	962.92	1418.50

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% Values in parentheses are standard errors.

Note: Selection equations are omitted to preserve space. The selection equations include: development, contiguity, distance, capability ratio, population density, arable population, total population, democracy, trade, major power, defense pact, and an interaction term between development and democracy.

warfare may be the most casualty intensive, accounting for the democratic peace (Bueno de Mesquita, et al. 2001). With so little jointly democratic conflict, regime type probably matters most in determining whether states fight.

Model A1.3 is identical to Model A1.2, but includes the interaction between development and democracy. Once again, the lower economic development variable continues to be significant and exert a downward effect on battle deaths. Model A1.4 employs an alternate measure of economic development, the Correlates of War energy consumption proxy. Development (Low) continues to display a negative relationship with the MIDs coding for fatalities and is statistically significant.

Table A2 presents Heckman models that examine alternate operationalizations of battle deaths. Models A2.1 and A2.3 use the Uppsala/PRIO data and Lacina battle death data while Models A2.2 and A2.4 use the COW War data. Models A2.1 and A2.4 employ the COW energy proxy for economic development and Models A2.2 and A2.3 use the per capita income measure to capture the level of development. The selection equations in all four models are identical to Table A1, but adding the nuclear status variable. Models A2.1 and A2.2 omit the population variables from the outcome equation while Models A2.3 and A2.4 include all variables in the equation. Economic development displays a negative and statistically significant effect on battle deaths in all models.

Lastly, Table A3 provides estimates of the Heckman model for the directed dyads data set. In Models A3.1 and A3.3 the dependent variable is Country A's battle deaths and in Models A3.2 and A3.4 the dependent variable is Country B's battle deaths. Once again the results reveal a negative and statistically significant relationship between economic development and the incidence of battle deaths. More specifically, increased economic development displays a statistically significant relationship with a nation's *own* battle deaths. In contrast, the effect of development on an opponent's battle deaths appears statistically insignificant. Each model is estimated with identical selection equations as enumerated in Table A2. Other results are largely consistent with previous findings.

Table A2: Heckman Model of Economic Development and Battle Deaths

D.V.: Battle Deaths	1: Uppsala/PRIO Energy	2: COW Wars GDP/Pop	3: Uppsala/PRIO GDP/Pop	4: COW Wars Energy
Development (Low)	-17.752**	-12.130**	-11.882**	-21.542**
	(3.353)	(6.492)	(2.048)	(6.490)
Development (High)	-0.594	-2.312†	-1.763*	-0.989
	(0.465)	(1.386)	(0.852)	(0.972)
Contiguity (dummy)	232.896**	319.568**	214.029**	281.323**
	(44.879)	(90.342)	(56.026)	(90.468)
Distance (ln)	2.397	9.731	2.812	8.310
	(5.356)	(10.889)	(6.632)	(10.948)
Capability Ratio	128.035 **	57.254	96.086**	32.824
	(29.517)	(60.365)	(37.072)	(61.034)
Pop. Density (Low)			1.024**	0.791**
			(0.098)	(0.163)
Arable Land/Pop.			-5.821†	-3.773
			(3.299)	(5.495)
Population			0.002**	0.003**
			(0.000)	(0.001)
Intercept	26.264	27.740	10.872	-40.968
	(45.760)	(93.294)	(58.457)	(95.549)
N	356096	356096	356096	356096
χ^2	114.78	70.58	299.57	115.84

Significance levels : † : 10% * : 5% ** : 1%

Note: Selection equations are omitted to preserve space. The selection equations include: development, contiguity, ln distance, capability ratio, population density, arable population, total population, democracy, trade, major power, defense pact, nuclear status, and an interaction between the development measure and democracy.

Table A3: Heckman Model of Development and Battle Deaths (Directed Dyads)

D.V.: SIPRI Battle Deaths D.V. from [A,B,A,B]	1: Energy	2: Energy	3: Energy	4: Energy
Development (A)	-23.312*	4.496	-24.156**	0.133
	(10.763)	(10.742)	(5.050)	(5.058)
Development (B)	4.497	-23.312*	0.133	-24.157**
	(10.751)	(10.755)	(5.051)	(5.057)
Contiguity (dummy)	86.179	86.173	72.534*	72.526*
	(79.583)	(79.520)	(36.274)	(36.322)
Distance (ln)	4.319	4.318	3.395	3.393
	(9.590)	(9.582)	(4.376)	(4.382)
Population (A)			0.000**	0.000
			(0.000)	(0.000)
Population (B)			0.000	0.000**
			(0.000)	(0.000)
Capability (A)			366.848*	687.551**
			(147.631)	(148.287)
Capability (B)			687.630**	366.928*
			(148.093)	(147.830)
Intercept	-0.664	-0.651	-7.812	-7.797
	(80.922)	(80.858)	(36.902)	(36.951)
N	981492	981492	981492	981492
χ^2	55.59	55.60	229.15	228.73

Significance levels : † : 10% * : 5% ** : 1%

Note: Selection equations are omitted to preserve space. The selection equations include: development, contiguity, distance, total population, capability, major power, democracy, defense pact, and an interaction term between democracy and development.

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