Time Is of the Essence:
The Causal Effect of Duration on Support for War

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Abstract
It is often observed that public support for non-existential wars diminishes over time, but the micro foundations of this observation as well as its implications for states’ war-fighting capabilities are unclear. I present a modified war of attrition model in which an exogenous event can end the war and the rate of that event is unknown to players. Players’ expectation for the remaining duration of war increases and they find fighting less favorable as time passes. But, we cannot separate the effect of cost from duration using observational data. I use a survey experiment to disentangle the effect of duration on support for war from the effect of costs. The result is that duration has a negative effect on public support for war that is stronger than the effect of aggregate casualties. This has important implications for how we should fight small wars.
1 Introduction

Most of the military engagements of the United States and other developed countries since the end of the Cold War have been asymmetric wars. These wars are characterized by a stark imbalance of power between the two sides and by the fact that the issues at stake are not issues of highest national priority to the strong side. In asymmetric wars, military superiority does not automatically translate into victory as strong states have frequently failed to win these wars.\(^1\) Public opinion in support of these wars, at least in democracies, is an important determinant of the outcome of the war, but support usually diminishes over time.

While there is a general agreement among scholars about the declining public support for asymmetric wars, we do not have a good understanding of the underlying causal mechanisms of wartime public opinion dynamics. Most of these explanations either rely on elite cues or observed costs of war (Mueller 1973; Gartner 2008; Berinsky 2009).

Despite the extent of research over the past decades, a major problem has yet to be addressed: the causal mechanisms driving public support for war are vaguely understood. It is often difficult to interpret the correlations identified in the literature as causal relationships. Consider the conventional wisdom that aggregate casualties drive public opinion. Figure 1 shows the aggregate level of American soldiers killed in action in Iraq starting in March 2003. The aggregate casualties rises with an almost constant slope for the first five years of the war, when there was continuous attrition of public support for war. Certainly, any information to be learnt about the slope of this curve could have been learned within the first few months. Why, then, was public support continuing to ebb? Unless we want to argue that aggregate public opinion reacts to sunk costs, in a matter as important as war, which has dire implications for democratic theory, we need another explanation.\(^2\)

I start with a canonical model of war and let the periods of fighting shrink. The model becomes similar to models of war of attrition in continuous time but is different from the classical war of attrition in a few critical ways (Maynard Smith 1974). Most importantly, the war can end in two ways: the usual way, when one side concedes to the other side; or as the result of an exogenous event, which may happen at any time and end the conflict in a stochastically determined outcome. Nature chooses the rate of the war-ending exogenous event but the belligerents do not know this rate.\(^3\)

In this model, the strong side’s costs are assumed to be public knowledge, but the weak’s costs are not. One of the results is that this asymmetry of information acts like a lever: a non-zero chance

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1. This is a common observation that has been attributed to a variety of reasons including inefficient military strategies, norms that limit the behavior of armed forces of democratic states, and domestic politics in democratic states. See Mack (1975), Arreguin-Toft (2001), and Merom (2003).

2. Notice that arguing that public support has continuously diminished not because of aggregate costs, but because of elite cues is equally problematic. If all the information for a case against war was available within a few months after March 2003, why did it take the opposition elite so long to start opposing the war?

3. See Fearon (1994) for a prominent adaptation of the war of attrition model; for works that study war as a process rather than a single stage see Wagner (2000), Smith and Stam (2003), and Powell (2004, 2013).
Figure 1: The total number of American soldiers killed in action in Iraq, as a function of the duration of the war, from March 2003 until December 2009. The curve is remarkably close to a line for the first five years of the war.

that the weak side is a hothead is enough to force the strong side to effectively have a deadline. If the war is not decided on the battleground, the strong side quits when that deadline is reached. The model also predicts an ever-receding level of support for war. In order to disentangle the effect of time from the effect of aggregate costs, I fix the level of aggregate cost and numerically predict the level of public support. Then I rely on a survey experiment where respondents are given different treatments of duration and casualties. I find that larger treatments of duration lead to larger expected remaining duration of war and lower support for war, even when aggregate casualties is held constant.

Public Opinion, Costs of War

Research on public opinion support for war can be divided into two by and large complementary branches: one is mostly concerned with citizens’ limits and how the elite influence the public, while the other is mostly concerned with how events influence public opinion. The former has its roots in the work of Walter Lippmann, “The American Voter,” and other influential mid-century works in American politics, whereas the latter has a pedigree in the work of scholars of international relations,
most notably John Mueller (Lippmann 1922; Campbell et al. 1960; Mueller 1973). Notwithstanding the depth and breadth of work in each branch, the micro foundations of both branches remain opaque. Here, I will briefly review some of the main results and highlight outstanding questions that have motivated my research.

Perhaps the strongest finding in public opinion about war is the extent to which people’s support for war correlates with their partisanship (also interacting with where they are located on the pyramid of ideological sophistication) and the extent to which public opinion appears to be influenced by elite discourse (Zaller 1994; Berinsky 2009). But, since we know office seeking politicians are themselves influenced by the “latent opinion” of their constituency, elite-based observations are not enough to conclude that the causal arrow of opinion shift is from the elite toward citizens. Alternatively, why do the elite sometimes support war and sometimes not? Recent research on the decisions of members of the House of Representatives shows that the number of casualties in representatives’ home districts influence their speeches and their roll-call votes (Kriner and Shen 2014).

In his pioneering work, Mueller put forth the idea that public support for war wanes as the accumulated level of casualties rises.4 Mueller, however, provided this as one of his empirical observations and did not say “why or how this happens or what the consequences are” (Jennings 1974). Whereas his empirical observations have proved robust, there has been some disagreement about how it should be interpreted. Debates have centered on whether or not the public has a knee-jerk reaction to specific levels of casualties, how sensitive people are to casualties, and whether the American public is “cost-phobic” or “casualty-phobic.” (Smith 2005).

Recent works generally accept that citizens do not automatically respond to some thresholds of accepted levels of cost, but, rather, do cost-benefit analysis, and their opinion depends on the primary policy objective of war.5 Gelpi, Feaver, and Reifler (2006) have argued that citizens’ sensitivity is governed by the interaction of two factors: how justified they think the war effort is, and their perception of the likelihood of victory. It has also been shown that local casualties, shocks in casualty rates, and trends of casualties also affect public opinion (Gartner, Segura, and Wilkening 1997; Gartner and Segura 1998; Gartner 2008).

The causal chain that connects costs to expressions of beliefs still remains unclear and subject of academic debates (Berinsky and Druckman 2007; Gelpi and Reifler 2008). Moreover, even the most widely accepted elements of the conventional wisdom have been challenged: while the recent war in Iraq was happening, Berinsky found that correcting citizens’ beliefs about the number of American casualties did not change their support for the war (Berinsky 2007). Nevertheless, casualties are still considered the most important source of information. For example, in reviewing Gelpi et al.’s work, Gartner (2010) writes that it “remains unclear how the American public updates their

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4. Studying the Korean and the Vietnam wars, Mueller found that public support diminished by 15% for every 10-fold increase in total casualties.

5. Jentleson (1992) and Jentleson and Britton (1998) make the case that public support for war depends on primary policy objectives of the war. For studies on how the American public performs cost-benefit analysis in various wars see Larson and Savych (2005).
views on success independent from casualties. Given well-known limits on the public’s foreign policy knowledge, what stream of wartime information (other than casualties) generates changes in peoples’ perceptions of the probability of success sufficient to explain observed variations in public opinion? In the following section, I will argue that observed duration of a conflict is such a signal, observed at low cost and available to the public without much possibility of manipulation by the elite.

**A War of Attrition with Exogenous Termination**

The war of attrition model is an appealing candidate for modeling the dynamics of asymmetric wars. In terms of the strategy, these wars do not resemble classical warfare and in terms of stakes, these are wars about issues that are existential to the weak side and of marginal importance to the strong side. The critical link between these wars and the war of attrition is that the winner is the one who outlasts the other. But there are a number of mismatches between empirical observations about wars and the theoretical results of wars of attrition. Most relevant to this work is the problem of immediate cessation of hostilities which the typical solution from the classical war of attrition models, which cannot explain why, in asymmetric wars, the weaker side keeps fighting.

Here, I use a canonical model of war in the conflict literature. Two sides are engaged in a multi-period war. In each period, they fight if both sides decide to fight. Each period of war can be decisive or not. If decisive, the war ends with a stochastically determined outcome. If not, it is again up to the adversaries whether they wish to continue the fight or to quit. Figure 2 shows one period of this war. Each period of fighting takes $\Delta t$ units of time. Throughout the paper, I will assume that $\Delta t$ is infinitesimally small, so we are using continuous time—similar to the war of attrition model. Also similar to other models of war of attrition, issue indivisibility is the reason for the possibility of war between rational actors (Fearon 1995). Unlike other model of war of attrition, war is not just a staring contest here; actual fighting is assumed between the two sides.

I will assume that the benefits of war and the likelihood of victory for each side are public knowledge and fixed so that we can focus on how players learn about costs. If the stage-game in Figure 2 is repeated until one side wins—that is, no one drops out—the expected cost is $E[\text{cost}] = \frac{c}{1-\rho}$. To study the effect of duration, I assume that the per period cost is known.

**The setup**

Two states are involved in an international crisis: a strong state (A), and a weak state (B). If they go to war and neither side quits, it is common knowledge that A will eventually win with probability $\pi$ and lose with probability $1-\pi$, but it is not known how long the war might last. The war can either be a short war, which ends with a constant hazard rate $\Lambda$, or a long war, which ends with a constant hazard rate $\lambda$. This implies $\Lambda > \lambda$. The model has two players: A and B. The common
prior about the war being short is $p_0$.

The timing of the events is as follows. At the start, nature decides the hazard rate of the war, but the players will not observe this. Then, starting at $t = 0$, A and B simultaneously decide whether to fight or not. If one side concedes, the prize (with a value of $v$) goes to the other side.

If the war is initiated, it starts at time $t = 0$ and is fought in continuous time until either one side withdraws from the war conceding the prize to the other side, or when the war comes to a natural conclusion, which results in the winner getting the contested prize. At any time during the war, each of A and B have two actions available to them, which I call ‘fight’ and ‘quit.’ For completeness, I assume that if both sides simultaneously withdraw (or neither side play fight at their first chance at $t = 0$), the prize is divided such that both A and B get $v/2$; this assumption does not affect the results.

Players have per unit costs of fighting, which are $c_A$ and $c_B$ for A and B respectively. B is assumed to observe the domestic scene in State A, and know $c_A$. B’s own cost, $c_B \in \mathbb{R}^+$, is private knowledge; A only know the cumulative density function $F_{c_B}$. I assume that $F_{c_B}$ is continuous and differentiable with $f_{c_B}$ being the probability density function of $c_B$. Finally, I assume that players have a common exponential discount factor $r > 1$.

**Some Preliminaries**

A strategy profile in this game should assign an action to each player at every history of the game in which that player plays. Given that there is a continuum of information sets, the equilibrium concepts most often used in extended games of imperfect information require some modification.

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6. Allowing discount factors to be different does not change any of the substantive results, at the cost of more complication in the notations, and therefore seems unnecessary unless we want to obtain comparative statics with respect to discount factors.
Throughout the paper, I use a refinement of the perfect Bayesian equilibrium concept suitable for the current model. In addition to the two conditions of sequential rationality and consistency of beliefs, it is required that players’ strategies during war be such that if a player’s strategy is to ‘quit’ at time $t \geq 0$, that player’s strategy be to quit at any subsequent time.\footnote{I am following Fearon (1994) in calling this a refinement of the Bayesian equilibrium concept. Equivalently, one might consider this constraint a limit on the set of possible strategies of the game, not a refinement of the equilibrium concept. The difference is only semantic. This can also be obtained from the assumption of stationarity, which is typically used to limit the set of equilibria in simple timing games (Fudenberg and Tirole 1991, page 119).}

We can now have a pithy description of every strategy: instead of a complete mapping from every $t \geq 0$ to $\{\text{fight, quit}\}$, we only need to specify the first time each player plays ‘quit’—which may be never, denoted by $+\infty$. This means that strategies can be be simply shown as $t_i = \min\{t|i \text{ plays ‘quit’ at } t\}$.\footnote{Here, $\min\{t\}$ is used with the assumption that the strategy is right-continuous, so that there exists a smallest quitting time in the strategy; we can use the same notation for left-continuous strategies as well, by replacing minimum with infimum and showing a $+$ superscript on the quitting time, like $t_B = 5^+$ which means B’s strategy is to fight if $t \leq 5$ and to quit otherwise.}

For both A and B, any possible strategy is completely described by $t_A$ and $t_B$, which conditioned on their assessment of other parameters, determines when they quit for the first time.

We can now discuss how the beliefs are updated. If a war is started, both players obtain additional information about the expected length of the war as time goes by. Using Bayes’ rule, when the war reaches any time $t$, each player’s belief about the likelihood of the rate of the exogenous event being $\Lambda$ is

$$p(t) = P(\text{short war}|\text{war has reached time } t) = \frac{p_0}{p_0 + (1 - p_0)e^{t(\Lambda - \lambda)}}. \quad (1)$$

Notice that (1) shows that regardless of the initial belief, players use the same rule to update their beliefs. Moreover, $p(t)$ is strictly decreasing in time.

Let $t^*_i$ be the optimal quitting time from player $i$’s perspective if $i$ knew that the other side will never quit. At $t^*_i$, assuming that the other side is never quitting, $i$ would not prefer continuation of the war to a concession. Since the belief in the war being short is strictly decreasing, it suffices to find the time when $i$’s marginal cost and reward match for the first (and only) time. So we should solve $\pi_i v\left(\left(p(t^*_i)\Lambda + (1 - p(t^*_i))\lambda\right)\right) = c_i$, where $p_i$ is obtained from (1) and $c_i$ is $i$’s cost. After some algebra we obtain $t^*_i(c_i) = \log\left(\frac{p_0(\pi_i v\Lambda - c_i)}{(1 - p_0)(\pi_i v\Lambda - c_i)}\right)/(\Lambda - \lambda)$ where $\pi_i$ is used to mean the probability of victory for player $i$ to obtain a generic notation. Note that $\pi_A = 1 - \pi_B = \pi$. To obtain a range of $[0, +\infty)$ for $t^*$, the range of cost should be $(c_i, \bar{c}_i)$, where $c_i = \pi_i v\lambda$, and $\bar{c}_i(p_0) = \pi_i v(p_0\Lambda + (1 - p_0)\lambda)$. The notation is simpler if we extend the definition of $t^*$ and make it such that it always maps to
Equilibrium Outcomes

The optimal time \( t^*_i \) for players were obtained with the assumption that the other side is never quitting. Now, consider when B knows that A is going to quit at a particular time \( \tau \).

**Observation 1.** In any equilibrium where A quits at time \( \tau \), B’s strategy cannot be quitting at any time \( t \geq \tau \).

Given that the war is bound to end at \( \tau \) regardless of B’s action, B cannot find quitting at time \( \tau \) an optimal decision because it is strictly dominated by not quitting. Furthermore, A’s strategy after time \( \tau \) is always to quit, so even if A deviates at \( \tau \), her strategy is to quit at every following history. So in no equilibrium can B’s strategy include quitting at \( \tau \) or any time after that.

Again assume A’s strategy is to quit at time \( \tau \). When is the latest time that B can quit in an equilibrium?

**Definition.** Let \( \tilde{c}_B(\tau) \) denote the lowest cost that makes B indifferent between never quitting and quitting at some optimal time \( \theta \), \( 0 \leq \theta < \tau \). To make the notation more general, I extend the domain to include \( \tau = 0 \) and define \( \tilde{c}_B(0) = +\infty \). It is shown in Appendix A that \( \tilde{c}_B(\tau) \) always exists.

Remember that \( \underline{c}_B = (1 - \pi)\lambda v \), which is the threshold of cost below which fighting is always a dominant strategy for B. I assume that \( F_{c_B}(\underline{c}_B) > 0 \) so that the types of B who regardless of A’s strategy prefer fighting to quitting happen with a non-zero probability. I also assume that \( c_A > \underline{c}_A = \pi v \lambda \), which means if A had perfect information, A would want to fight short wars but not long wars. The following proposition suggests that there is essentially one equilibrium in which A may quit.

**Observation 2.** In any equilibrium in which A quits at some time \( t_A \), B’s strategy is to quit at \( t^*_B(c_B) \) if \( c_B \geq \tilde{c}_B(t_A^*) \) and to never quit otherwise.

The proof follows from the definition and proof of existence of \( \tilde{c}_B \). If A is in equilibrium quitting at every \( t \geq t_A \), then B’s best response cannot be quitting if B has fought until \( t_A \). The types of B who find quitting at some time before \( t_A \) better than waiting until \( t_A \) are those for whom \( c_B > \tilde{c}_B(t_A) \). For simplicity and without any substantive loss, I assume that the border case of

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8. \( \tilde{c}_B(\tau) \) depends on B’s belief about the length of the war. \( \tilde{c}_B(\tau, p_B(0)) \) is a more accurate representation but the second argument is suppressed as there is no risk of confusion.
Figure 3: This graph illustrates the equilibrium discussed in Proposition 1. Types of \( B \) drop out at their ideal quitting time if \( c_B > \tilde{c}_B(t^*_A) \), and will not quit otherwise. Then, there is a period of fighting when no side is expected to quit. Finally, if the war reaches \( t^*_A \), \( A \) quits.

\[ c_B = \tilde{c}_B(t_A) \] also quits. Furthermore, if \( B \)'s cost is such that \( B \) is going to quit, \( B \) must quit at \( t^*_B \) obtained from (2).

**Proposition 1.** In any equilibrium of the game we have

\begin{align*}
- t_A &= t^*_A \\
- t_B &= t^*_B(c_B) \text{ if } c_B \geq \tilde{c}_B(t^*_A) \\
- t_B &= +\infty \text{ if } c_B < \tilde{c}_B(t^*_A).
\end{align*}

Figure 3 depicts the equilibrium. The proof is provided in Appendix B.

**Implications of the Model**

The main point of the models is that people can make inferences about the type of war that is being fought based on duration. This is conceptually distinct from inference based on costs or based on what the elite say. In the models, players stop supporting a war because the war is likely to be a long war not worth fighting. The cost of fighting in each period is part of the calculus, but the source of information in the models is the time that has elapsed since the start of the war.

An interesting result is that, in equilibrium, the weak side can have little chance of victory and still find fighting profitable due to the leverage it gets from the information asymmetry. A side result is that given the importance of being perceived as a likely low-cost type (i.e., \( B \) not being seen as certainly not a low-cost type), it is natural to expect \( B \) to carry out ostensibly irrational acts. Another result of Proposition 1 is that for wars that do not end fast, there is a period of fighting during which both sides know that no one is quitting. This is similar in appearance to Fearon’s “fighting rather than bargaining”, but the underlying reason is different (Fearon 2007).

We can assume that \( A \) in the game represents the median voter. If we assume that is are other citizens with different levels of per period cost, we can obtain each citizen’s ideal quitting time as \( t^*_A(c) \) using (2). It is clear that as time passes, number of citizens who support the war decreases.
This is not novel, except that we are obtaining this result with the assumption that citizens are rational actors. Still, from an empirical point of view, this may not be distinguished from the effect that is often attributed to aggregate casualties.

Time and any other monotonic function of time, like aggregate costs, are highly correlated. Existing works show that public opinion is correlated with aggregate cost, instantaneous cost, and whether instantaneous costs are increasing or decreasing.10 Without imposing strict assumptions about underlying functional forms, it is not possible to distinguish the effect of duration from the effect of aggregate cost.

Using experimental manipulation, we can assign hypothetical scenarios to survey respondents and isolate the effects of parameters that vary together. Here, we want to isolate the effects of duration and cost. Suppose that there has been an asymmetric war for the past $t$ months, and we have incurred a specific level of cost (for example, casualties). How does the level of support depend on when we observe this level of cost? In other words, assume the cost is fixed and we can experimentally assign different values of $t$ to different citizens (treatment); how would the level of support (outcome) be affected by $t$?

If we subscribe to the idea that only total casualties affect how we evaluate a war, then there should be no difference. If citizens’ opinions only depend on the intensity with which casualties mount up, we should expect support for war to be positively correlated with time. That is, for a fixed level of cost, larger $t$ means smaller rate of increase in casualties (i.e., slope) which should be associated with more support. Moreover, if both aggregate cost and rate of accumulation of cost are operative, their total effect is still positive because aggregate cost is fixed and rate of cost is negatively affected by duration. Finally, the model predicted a different relationship between duration and support because the duration itself has a causal effect. If the model is correct, the result depends on parameters because level of support for war is pulled in two opposite directions: on one hand, longer duration implies lower rate of cost accumulation if the total cost is held constant (which make continuing the war more attractive); on the other hand, longer duration means longer expected remaining duration, which make continuing the war less attractive.

Figure 4 illustrates the prediction of the model for different values of total aggregate cost and $\lambda$, assuming that $\Lambda = 1/9$, the a priori probability of facing a short war is $p_0 = 0.75$, chance of victory is $\pi = .9$, and $v$ (value of the prize) is randomly distributed among citizens with an exponential distribution with mean 20,000. The graphs show the prediction in the hypothetical exercise where total cost is fixed and support is estimated at any duration for different values of expected length for long wars and two different levels of total casualties.

Figure 4 illustrates that when cost is fixed, depending on the parameters, the independent effect of duration on support for war could be positive or negative and is not necessarily monotonous. The expected duration of a short war is assumed to be $6$ months; the result is that for low values of

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10. See (Larson and Savych 2005) for a focus on aggregate costs, and (Gartner 2008) for a focus on trends of costs and recent costs.
Figure 4: Simulation results showing percentage of support for continuation of an asymmetric war for different values of time, predicted by the model. The graphs show how the model predicts the results of experimental manipulation where total casualties is fixed but respondent are treated with different values of time.

Table 1: Duration can have a larger effect on support for war than total casualties. This table is selected from the results in Figure 4, with $\Lambda = 1/9$ and $1/\lambda = \infty$.

<table>
<thead>
<tr>
<th>Time</th>
<th>Total Casualties = 500</th>
<th>Total Casualties = 2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 months</td>
<td>95.39%</td>
<td>78.99%</td>
</tr>
<tr>
<td>60 months</td>
<td>33.43%</td>
<td>0.42%</td>
</tr>
</tbody>
</table>

duration (up to about a year), citizens are still optimistic about the length of the war, and longer time means lower rate of costs which increases support. If the expected duration of the long war scenario is in fact very long (which is what public opinion polls suggest), as time progresses, people are going to expect that the war is to be very long and expected duration is large enough that it eclipses a smaller expected rate of cost. Table 1 presents a selection of numbers from Figure 4 for $\lambda = 1/600$. In this case, the effect of a five-fold increase in duration is slightly larger than the effect of a five-fold increase in casualties.
Table 2: Treatment assignments for the second survey.

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tkia</strong></td>
<td>500</td>
<td>2500</td>
<td>500</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td><strong>Tyear</strong></td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>10</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Hypothesis 1.** When total cost is held constant, except for a brief initial period, the number of people who support war decreases as time passes.

**Hypothesis 2.** When total cost is held constant, the expected remaining duration of war increases as time passes.

**The Effect of Duration on Support**

I use two samples of American adults study the effect of duration as predicted by the model. Appendix C provides information about the recruitment process as well as other practical details of the survey experiment. The two rounds of surveys are referred to as the first survey (convenience sample fielded in August 2015) and the second survey (nationally representative sample fielded in March 2015). The experiment was designed to provide a difference-in-difference test for a manipulation about the observed length of war. Participants were shown a vignette about a war with the Boko Haram, which is a terrorist group in Central Africa and both surveys were fielded after periods when the name Boko Haram had been in the daily news (August 2014 and March 2015). Participants were told about a hypothetical situation (revealed as such) where prominent members of both the Republican and the Democratic parties, including the president, are in favor of initiating a war against the group. The war has not started yet, but the president is expected to order the start of the war in a few days.

Participants were asked whether they supported this war or not (PRESUPPORT). Then they were provided an update about the war. In the first survey, the update said that the war has been going on for **Tyear** years and has had limited success, where the treatment they received was an integer between 1 to 5. They also received another treatment (**Tkia** ∈ {NA, 300, 1500}), which was either to see no casualty report, or to see either 300 or 1500 as the number of American casualties. In the second survey, to improve power there were only five treatment groups as shown in Table 2 After this information, respondents were asked about their opinion regarding the continuation of the war (POSTSUPPORT). Then, on the following page, they were asked to estimate how much longer the war would last, if the United States were committed to fight until victory (EXPDURATION). Support was measured using a 4-point Likert scale in the first survey and a 6-point Likert scale in the second survey. Summary statistics of these variables are reported in Table 3.
Table 3: Summary statistics. For the first survey, \( N = 514 \) and for the second, \( N = 956 \).

<table>
<thead>
<tr>
<th>Survey 1:</th>
<th>Min</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T\text{YEAR} )</td>
<td>1.00</td>
<td>2.94</td>
<td>3.00</td>
<td>5.00</td>
<td>1.40</td>
</tr>
<tr>
<td>( T\text{KIA} ) (dropping NA)</td>
<td>300</td>
<td>874.06</td>
<td>300</td>
<td>1500</td>
<td>600.3</td>
</tr>
<tr>
<td>( \text{PRESUPPORT} )</td>
<td>1.00</td>
<td>2.38</td>
<td>2.00</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>( \text{POSTSUPPORT} )</td>
<td>1.00</td>
<td>2.35</td>
<td>2.00</td>
<td>4.00</td>
<td>1.06</td>
</tr>
<tr>
<td>( \Delta\text{SUPPORT} )</td>
<td>-3.00</td>
<td>-0.04</td>
<td>0.00</td>
<td>3.00</td>
<td>0.74</td>
</tr>
<tr>
<td>( \text{EXPDURATION} )</td>
<td>0.00</td>
<td>9.06</td>
<td>5.00</td>
<td>320</td>
<td>22.61</td>
</tr>
<tr>
<td>( \ln(\text{EXPDURATION}+1) )</td>
<td>0.00</td>
<td>1.80</td>
<td>1.79</td>
<td>5.77</td>
<td>0.79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey 2:</th>
<th>Min</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T\text{YEAR} ) (dropping NA)</td>
<td>2</td>
<td>5.91</td>
<td>2</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>( T\text{KIA} )</td>
<td>500</td>
<td>1682.01</td>
<td>2500</td>
<td>2500</td>
<td>983.8</td>
</tr>
<tr>
<td>( \text{PRESUPPORT} )</td>
<td>1.00</td>
<td>3.77</td>
<td>4.00</td>
<td>6.00</td>
<td>1.83</td>
</tr>
<tr>
<td>( \text{POSTSUPPORT} )</td>
<td>1.00</td>
<td>3.64</td>
<td>4.00</td>
<td>6.00</td>
<td>1.94</td>
</tr>
<tr>
<td>( \Delta\text{SUPPORT} )</td>
<td>-5.00</td>
<td>-0.14</td>
<td>0.00</td>
<td>5.00</td>
<td>1.52</td>
</tr>
<tr>
<td>( \text{EXPDURATION}^* )</td>
<td>0.00</td>
<td>~30e3</td>
<td>5.00</td>
<td>30e6</td>
<td>~1e6</td>
</tr>
<tr>
<td>( \ln(\text{EXPDURATION}+1)^* )</td>
<td>0.00</td>
<td>1.96</td>
<td>1.79</td>
<td>17.22</td>
<td>1.02</td>
</tr>
</tbody>
</table>

* There are three observations of \( \text{EXPDURATION} \) larger than 1000 years. The results reported here are obtained without dropping any observations, but the results do not change if we drop the outliers of \( \text{EXPDURATION} \).

The dependent variable for testing Hypothesis 1 is the difference between \( \text{POSTSUPPORT} \) and \( \text{PRESUPPORT} \). This is denoted by \( \Delta\text{SUPPORT} \). Expected duration of war is directly asked and is used to test Hypothesis 2. Given the large variance of expected duration (standard deviations of 22.61 years and 36.33 in the two surveys) a logged dependent variable is used.

**Results**

Figures 5 and 6, for each treatment group in the nationally representative sample, respectively show confidence intervals for change in support (\( \Delta\text{SUPPORT} \)) and predicted duration of war (logarithm of \( \text{EXPDURATION} \)).11 In Figure 5, for those who received the low casualty treatment, the long duration treatment has a large and statistically significant effect. For those who received the high casualty treatment, the long duration treatment has resulted in lower levels of support, but the confidence intervals of the three groups (\( T\text{YEAR}=2 \), \( T\text{YEAR}=10 \), and \( T\text{YEAR} \) not specified) seem to overlap. Interestingly, there is no perceptible difference between the two groups which received \( T\text{YEAR}=10 \). What is seen in Figure 6 is very straightforward. Longer observed duration seems to significantly increase the expected duration of war.

Tables 4 and 5 show the results from the two rounds of surveys. The first two models in each table show the results of the effect of duration on change in support for war (Hypothesis 1). Because

---

11. In Figure 5, respondents who opposed the war before the beginning of the war are dropped.
of the ordinal dependent variable, an ordered choice model is the appropriate model. Models 3 and 7 have Tkia as the only independent variable, and Models 2 and 6 add casualty treatment as another explanatory variable. Because the treatments are randomly assigned, there is no need to control for any other variable. The results corroborate the expectation that an increase in the duration of a conflict has a negative impact on how much citizens support the war. Surprisingly, total casualties has very weak statistical significance (p-value > .10).

Interpreting the magnitude of the effects seen in Models 1, 2, 5, and 6, like any other multinomial choice model, is not straightforward. The results of Figure 5 provide a more natural interpretation—albeit, with the assumption that support for war is an interval measure. The difference between the change in support for the groups that had a low casualty treatment of Tkia=500 is −0.55 (s.d. = 0.177). Similarly, the difference between the change in support for the groups that had a low casualty treatment of Tkia=2500 is −0.34 (s.d. = 0.177). Both of these numbers are statistically significant but to make better sense of their practical significance, let us transform them to a scale of 0 to 100. This gives the effect sizes of −11% (difference between those who received Tkia=500, Tyear=2 and those who received Tkia=500, Tyear=10) and −6.8% (difference between those who received Tkia=2500, Tyear=2 and those who received Tkia=2500, Tyear=10).

Models 3, 4, 7, and 8, reported in Tables 4 and 5, test Hypothesis 2. Table 5 shows that in the nationally representative survey, changing Tyear from 2 years to 10 years, on average has increased expected duration of war by 66%.

Both hypotheses are out by the evidence. This has important implications for how we fight wars. Even in democracies, public support is not a required condition for fighting asymmetric wars in short periods. But in the long run, leaders have to expend enormous political capital to continue fighting wars that are not supported by a majority of the electorate. If duration is an important informative signal about whether people support a war or not, and if public support is required, military leaders should use stronger forces hoping to achieve victory faster. Finding the optimal level of use of force depends on how exactly the level of force used relates to costs and to the chance of victory in each period of a war, which clearly is beyond the scope of the model or the empirical evidence presented here. But it is clear in what direction we err if we ignore the effect of duration: we will use a force that is weaker than optimal.

12. The logarithm of expected duration is used due to its large observed variance. The substantive results presented here, however, are not sensitive to whether we use a logarithm transformed values or not.
13. The dependent variable is logged, so we can calculate $\exp(0.063 \times (10 - 2)) = 1.6553$.
14. A prominent example with disastrous consequences is the lead-up to the 2003 war, when the American Secretary of Defense, Donald Rumsfeld overruled Army Chief of Staff, General Shinseki’s assessment about the number of troops required for the invasion of Iraq (Shanker, 2007, January 12).
Figure 5: Confidence intervals showing changes in level of support for war for the five different treatment groups in the nationally representative survey. The vertical axis is change in the six-point Likert scale measure of support for war. Respondents who opposed the war even before the war was started are dropped.

Figure 6: Confidence intervals showing expected duration of the remainder of the war for different treatment groups in the nationally representative survey.
Table 4: Experimental results show significant and substantively large effects of observed duration of war on the change in support for the continuation of war as well as the expected remaining duration of war.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ΔSupport</th>
<th>ln(Expected Duration+1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td><strong>T YEAR</strong></td>
<td>-0.148 (0.067)</td>
<td>-0.146 (0.067)</td>
</tr>
<tr>
<td>TkIA=300</td>
<td>0.004 (0.226)</td>
<td></td>
</tr>
<tr>
<td>TkIA=1500</td>
<td>-0.243 (0.229)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.493 (0.080)</td>
<td>1.509 (0.093)</td>
</tr>
<tr>
<td>Res. deviance</td>
<td>1043.4</td>
<td>1042.24</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.032</td>
<td>0.029</td>
</tr>
<tr>
<td>N</td>
<td>514</td>
<td>514</td>
</tr>
</tbody>
</table>

Models 1 and 2 are ordered logit and models 3 and 4 are ordinary least squares regressions. Intercepts in the ordered logit models are suppressed. Standard errors are reported in parentheses.

Table 5: Experimental results show significant and substantively large effects of observed duration of war on the change in support for the continuation of war as well as the expected remaining duration of war.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ΔSupport</th>
<th>ln(Expected Duration+1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 5</td>
<td>Model 6</td>
</tr>
<tr>
<td><strong>T YEAR</strong></td>
<td>-0.048 (0.017)</td>
<td>-0.048 (0.017)</td>
</tr>
<tr>
<td>TkIA</td>
<td>-11e-5 (6.9e-5)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.566 (0.064)</td>
<td>1.642 (0.085)</td>
</tr>
<tr>
<td>Res. deviance</td>
<td>2545.11</td>
<td>2542.40</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.102</td>
<td>0.101</td>
</tr>
<tr>
<td>N</td>
<td>791</td>
<td>791</td>
</tr>
</tbody>
</table>

Models 5 and 6 are ordered logit and models 7 and 8 are ordinary least squares regressions. Intercepts in the ordered logit models are suppressed. Standard errors are reported in parentheses.

**Conclusion**

Public support for many wars seem to start high and then decline over time. It is often assumed that the public obtains information over time, but the source of this information has been subject to much disagreement. Conventional wisdom holds that aggregate cost of war is the main source of information. But, whereas a citizen concerned about the past may truly care about the total cost of war, a forward-looking citizen uses the available information (including costs) to foresee the likely path of the war in the future.
Then I presented a model war that showed how duration of a war is a critical source of information about war. Since time is highly correlated with any aggregate measure of cost, it is not possible to test the causal effect of time using available observational data. I relied on a survey experiment to provide a test of the theory. The results show that even when aggregate costs are held constant, as a war continues, citizens’ support for the continuation of the war decreases while their estimation about its expected remaining length increases.

Here, we assumed the likelihood of victory was fixed in each period. In reality, a military strategist has to take the relationship between per period costs and per period chance of victory (expected duration) into account. A full discussion of the implications of the results presented here for choosing optimal levels of military deployments requires further studies, but it is clear that if we ignore the effect of time, we are going to use a smaller-than-optimal force.
Appendix A  Existence of $\tilde{c}_B(\tau)$

I show that $\tilde{c}_B(\tau)$ always exists. If $c_B \leq \tilde{c}_B(\tau)$, B’s optimal quitting time is the same as what was obtained in (2): when possible, this is the time when B’s marginal payoff of fighting is zero. The payoff that a type of B with cost $c_B$ obtains from not quitting until $\tau > 0$, when looking down the game tree at time $\theta$ is obtained from the following (nqaob stands for ‘not quitting at or before’) 

\[
E_{U_B}(\theta, c_B, B \text{ nqaob } \tau \mid A \text{ quits at } \tau) = 
\int_0^{\tau-\theta} \left[ (1-p(\theta))\lambda e^{-\lambda t} + p(\theta)\Lambda e^{-\Lambda t} \right] \left( (1-\pi)ve^{-rt} - c_B(1-e^{-rt})/r \right) dt + 
\int_{\tau-\theta}^{\infty} \left[ (1-p(\theta))\lambda e^{-\lambda t} + p(\theta)\Lambda e^{-\Lambda t} \right] dt \left( ve^{-rt} - c_B(1-e^{-rt})/r \right),
\]

where the first integral is for the chance that the exogenous event happens during $(\theta, \tau)$, conditioned on its not having happened before $\theta$; the second integral is the probability mass of the tail of the distribution of the exogenous event; and $c_B(1-e^{-rt})/r = \int_0^t c_B e^{-r\theta} d\theta$ is the aggregated and discounted cost of fighting up to time $t$.

Setting $\theta = t^*_B(p_0)$ which is the optimal quitting time, if B is to quit, gives 

\[
\Upsilon(c_B, \tau) = E_{U_B}(t^*_B(c_B), c_B, B \text{ nqaob } \tau \mid A \text{ quits at } \tau).
\]

We can now use the intermediate value theorem to show that for all $\tau > 0$, $\hat{c}$ exists such that $\Upsilon(\hat{c}, \tau) = 0$. It suffices that $\Upsilon(t^*_B(c_B), \tau) > 0$, and $\lim_{c \to +\infty} \Upsilon(c_B, \tau) < 0$, where the inverse of $t^*$ with respect to its first argument is assumed to exist because it is strictly decreasing for $\tau > 0$. Hence, we have 

\[
\tilde{c}_B(t) = \inf\{\hat{c}, \text{ such that } \Upsilon(\hat{c}, \tau) = 0\},
\]

which gives us $\Upsilon(\tilde{c}_B, \tau) = 0$ because of the continuity of $\Upsilon$.

Appendix B  Proof of Proposition 1

The proposition means that A cannot commit to fighting forever, and more specifically, quits at an exact time. Depending on B’s cost, B’s strategy may be quitting or fighting until L quits. Figure 3 illustrates this equilibrium.

I first show that the proposed strategy is an equilibrium for the game. Then I shall demonstrate that this is the only equilibrium in which A may quit at some time, and that there is no equilibrium where A fights forever. Together, these three parts prove the uniqueness of this equilibrium. L’s cost is known, and L and B have similar priors about the length of the war. Hence, L’s quitting time assuming that B never quits, $t^*_L$, is known and is obtained from (2). B cannot profitably deviate from the prescribed strategy, as shown in Observation 2. If B does not quit by $t^*_B(\tilde{c}_B(t^*_L))$,
L becomes certain that B would never quit. This means that L also cannot profitably deviate from this equilibrium.

A and B’s beliefs about the length of the war is updated over time, as shown in (1). A’s belief about B’s type (B’s cost) can also be updated until $t_B^*\left(\tilde{c}_B(t_A^*)\right)$ because, at every moment up to that time, a type of B is expected to drop out with certainty. Therefore, when the war reaches time $t$, $0 < t \leq t_B^*\left(\tilde{c}_B(t_A^*)\right)$, A’s belief about $c_B$ is the original distribution without its tail. That is,

$$
\hat{F}_{c_B}(c|B \text{ has not quit before } t) = \begin{cases} 
0 & c \geq t_B^{*1}(t) \\
\frac{F_{c_B}(c)}{F_{c_B}(t_B^{*1}(t))} & c < t_B^{*1}(t)
\end{cases}
$$

where $t_B^{*1}(t)$ is the inverse of $t^*(c_B)$. This concludes the demonstration of the proposed strategy profile in tandem with the stated beliefs as an equilibrium of the game.

To show that the proposed equilibrium is unique, notice that from the first part of this proof, if A is quitting at $t_A^*$, as described, B’s unique best response is what is described. So, to have any different equilibrium in which L may quit at some time, A must either quit at some $t_1 < t_A^*$ or at some $t_2 > t_A^*$. I show that neither case can be held in equilibrium.

First, assume that A quits at $t_1 < t_A^*$. This cannot be held, as L can always deviate to quitting at $t_A^*$ and obtain a strictly better payoff. The reason is that, according to Observation 2, by the time A reaches $t_1$, she is certain that B is not quitting and therefore ought to quit at $t_A^*$, following the definition of $t_A^*$.

Second, assume that A quits at $t_2 > t_A^*$. B’s best response is to quit at $t_B^*(c_B)$ if $c_B \geq \tilde{c}_B(t_2)$. So types of B keep dropping out until $t_B^*(\tilde{c}_B(t_2))$. There are two possible cases. First assume $t_B^*(\tilde{c}_B(t_2)) \geq t_A^*$. This means that when A reaches $t_B^*(\tilde{c}_B(t_2))$, A becomes certain that B is not quitting and because $t_B^*(\tilde{c}_B(t_2)) \geq t_A^*$, A ought to quit immediately, but we assumed A does not quit until $t_2$ and we know $t_2 > t_B^*(\tilde{c}_B(t_2))$, hence a contradiction. Alternatively, $t_B^*(\tilde{c}_B(t_2)) < t_A^*$, which again means that by the time A reaches $t_A^*$, she is certain B is not quitting and should quit immediately, not waiting until $t_2 > t_A^*$.

Finally, assume that there exists an equilibrium where A’s strategy is to always fight (i.e., $t_A = +\infty$). It follows that if $c_B > \xi_B$, B must quit at $t_B^*(c_B)$, and if $c_B < \xi_B$, B must never quit. I will show there exists a time after which A would prefer quitting to fighting, contradicting the assumption.

A’s expected marginal utility for fighting at time $t$ can be found as

$$
d\text{EU}_A(t, \text{fight}) = v \left( \frac{f_{c_B}(t_B^{*1}(t))}{F_{c_B}(t_B^{*1}(t))} \right) \left[ \frac{\partial t_B^{*1}(t)}{\partial t} \right] + \pi p(t) \Lambda + \pi (1 - p(t)) \lambda - c_A,
$$

which comprises three elements. The first term shows expected benefits from the chance that B may quit in the near future, given that B has not quit before time $t$. The rest of the equation, similar to the derivation of (2), shows the payoff that may be obtained if the war ends. We have
\[ F_{c_B}(t_B^{* -1}(t)) > F_{c_B}(c_B) > 0, \text{ and } f_{c_B}(t_B^{* -1}(t)) \text{ is bounded. Also, } \left| \frac{\partial t_B^{* -1}(t)}{\partial t} \right| \text{ goes to zero as time goes to infinity. Since the rest of the payoff is negative for } t > t_A^*, \text{ at some point in time } A \text{ will have negative marginal utility for continuing the fighting, which implies } A \text{'s strategy of never quitting is strictly dominated. This contradicts the assumption of } t_A = +\infty. \]

**Appendix C  Survey Design and Recruitment**

**Survey Flow**

The survey flow was as follows: a number of demographic question (gender, age, education, income, and political ideology; only asked in the first survey), a question about participants’ ideology (branching Likert scale ranging from 1 to 7), the war vignette (reflected below), a question about their level of support for war (branching Likert scale ranging from 1 to 4 in the first survey and ranging from 1 to 6 in the second survey), information about the war (which provided two types of treatment: length of time since the beginning of the war and casualty information, a question about their level of support for the continuation of the war (branching Likert scale from 1 to 4 in the first survey and ranging from 1 to 6 in the second survey), reminding the information about war, and a question about their expectation for the remainder of the war if the United States decided to fight until the terrorists are completely disarmed. Two trick questions were asked: one in the middle of the demographic question and the other at the end of the survey. Both asked simple arithmetic questions, but instructed participants to choose a specific wrong answer instead of solving the question, to test their attentiveness.

**War Introduction Vignette**

The following is a hypothetical scenario about a war with a terrorist group that has recently been in the news. Please read the description carefully.

Boko Haram is a terrorist group in Central Africa. They have been recently involved in a number of high profile terrorist activities, including kidnapping schoolgirls. They now control parts of Nigeria and Cameroon and they have also threatened to harm the United States. Some intelligence experts have argued that Boko Haram is trying to acquire the capability to carry out terrorist operations within the United States. The US is going to start a war with this group. The goal of the war is to destroy Boko Haram’s military capabilities. The president as well as the leading figures of both Democratic and Republican parties support this war. In a televised speech, the president has informed the nation that he “will do whatever it takes to defeat Boko Haram.” It is expected that the president will order the start of the war within a few days.
War Information

Treatment category is randomly selected and T\text{YEAR} and T\text{KI}A are chosen depending the treatment category.

The US has been fighting this war for some time now. We want to know how you would think about this war. Here are some critical information about the war. Please read them carefully and spend a moment thinking about the situation. You will be tested on this information.

- [Not shown if T\text{YEAR} = \text{NA}] The war has been going on for [T\text{YEAR}] years.
- [Not shown if T\text{KI}A = \text{NA}] In this period, [T\text{KI}A] American soldiers have lost their lives.
- Boko Haram has been weakened, but they continue to operate a global network of terrorism.
- The war still has bipartisan support in the US Congress.

Recruitment of Participants

The first survey relied on MTurk to recruit respondents. Mturk participants have been shown to be different from a representative sample of the American public. While this may be worrisome for surveys, it is not necessarily a source of concern for experimental designs. There is a growing body of published research that is relying on MTurk and investigations are showing MTurk to be better than an undergraduate convenience sample in that MTurk results are closer to results obtained from representative samples of the public (Berinsky, Huber, and Lenz 2012).

A task was defined requesting 600 participants (1 per person) and offering $0.30 to each successful participant. Participants were recruited with three conditions: Be inside the United States, have a total approval rating equal or greater than 90%, and have at least completed 50 job requests before. Participants were instructed that they need to be American citizens, connecting from a regular Internet connection, and not connecting from a mobile device. The description said that the survey was for academic research and that geographic information would be collected to make sure participants were within the United States. Participants needed to follow a link to Qualtrics website to take the survey. The first page of the survey informed participants that they should read the questions carefully and that failing to follow instructions may result in early termination of the survey. Participants who reached the last page were given a personal token to enter in MTurk. They were rewarded based on their token.

In total, 722 workers started the survey but 111 either voluntarily dropped out of the survey or were led to the end of the survey because they failed one of the trick questions. Extensive efforts were made to remove participants who did not connect from the United States, connected from a known problematic IP address, connected using a mobile device, or failed to correctly answer
After this cleaning process, 514 rows of data remained. The removal was not based on the values of the variables.

Because drawing the policy-relevant lessons from this research requires the ability to generalize to the American adult population, the second survey relied on Survey Sampling International (SSI) to field the survey to an existing panel and match the sample to the American adult population on age, gender, race, income, education, and geographic location. The target was set at $N = 1000$ which was reached after 2575 respondents had started the survey. Respondents who failed to correctly answer two trick questions were not able to continue. After removing respondents who had failed to correctly answer manipulation checks, 956 rows of data remained. The removal was not based on the values of outcome variables.

**Survey Experiment**

The results reported in Tables 4 and 5 reflect the design prior to the fielding of the survey. The model specifications are minimal and no observation has been removed from the data, except for those which were dropped because of geographic location outside the US or those who failed treatment checks.

It may be the case that we are only observing a positive correlation between duration treatment and expected remaining duration because participants are mindlessly repeating the duration treatment they have received as the expected duration. Removing the observations where $\text{TYEAR} = \text{EXPDURATION}$ is a simple way to check if this is the case. Doing so reduces the correlation, but the result is still substantively large and statistically significant: in the first survey (Model 3) we obtain $\hat{\beta} = 0.084$ (s.e.=0.030) and in the second survey (Model 7) we obtain $\hat{\beta} = 0.035$ (s.e.=0.012). But we do not know how much external validity is sacrificed to obtain ease of experimental manipulation. Further research is needed in this area.
References


