

Democracy, war effort, and the systemic democratic peace

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Abstract

This article uses an agent-based model and Selectorate Theory to explore the micro-foundations of the systemic democratic peace. Leaders engage in an international bargaining game that can escalate to conflict. Upon resolving the dispute, leaders distribute winnings to domestic constituencies and stand for reselection. The model's assumptions about selectorate size in a democracy versus an autocracy make democratic leaders more accountable than autocrats and endogenously generates the dyadic democratic peace. The model shows no evidence of an autocratic peace, as mixed dyads are less likely to go to war than autocratic dyads. I further show that democratic leaders invest more resources in wars than predicted by the Nash equilibrium and also more than autocrats. This overinvestment by democratic leaders results in democracies winning more wars than autocrats. This model thus reinforces previous findings that democratic leaders respond to domestic reselection incentives by using more resources in conflict to gain a war-fighting advantage and help ensure victory. Finally, consistent with empirical results, I show that increasing the percentage of democracies in the system does not have a linear effect on the amount of conflict in the system. Below a certain threshold, increasing democracy has no effect on conflict, while after this threshold conflict decreases.

Keywords

agent-based model, democratic peace, selectorate theory

While the dyadic democratic peace has gained wide acceptance by international relations scholars, the effect of democracy on the international system has proved more difficult to evaluate. The frequency of war and peace and its relationship to how democratic the system is as a whole has received little attention relative to the study of the dyadic democratic peace. Moreover, even fewer studies have attempted to model the effect of domestic political institutions when studying the systemic level democratic peace.

Previous attempts to model the systemic democratic peace have included little in the way of domestic politics and have built-in the dyadic democratic peace, either by explicitly preventing democracies from going to war or making wars between democracies less likely (Cederman, 2001b, 2002; Cederman & Gleditsch, 2004; Kadera, Crescenzi & Shannon, 2003; Gartzke & Weisiger, 2013b). In contrast, the agent-based model presented in this article explores the relationship between democracy and war at the systemic level by building from

assumptions about domestic politics. I focus on differences in the mechanisms by which a leader retains office in an autocracy and a democracy and the different incentives these mechanisms provide for autocratic and democratic leaders when engaging in foreign policy. These differences, resulting from the assumptions of Selectorate Theory, make democratic leaders more accountable and force them to engage in less risky foreign policy because their domestic constituency will punish them with removal from office for failed policies (Bueno de Mesquita et al., 1999a, 2004). Using this bottom-up approach, several results consistent with empirical findings emerge from the model, including the dyadic democratic peace and the finding that democracies mobilize more resources for war than autocracies. After establishing these results, I examine the effect of varying the

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proportion of democracies in the system on the amount of conflict in the system.

With the assumptions that leaders seek to retain office and that democratic institutions make democratic leaders more accountable to their domestic constituency than autocratic leaders, several key results emerge from the model. First, democratic leaders are reluctant to engage in difficult wars. Second, as put forth by Bueno de Mesquita et al. (1999a) and confirmed empirically by Bueno de Mesquita et al. (2004), should democratic leaders enter a difficult war, they will mobilize more resources than predicted by the Nash equilibrium and also more resources than autocratic leaders. This intense mobilization gives democracies a war-fighting advantage and results in their winning a higher percentage of wars than autocracies. Third, increasing the proportion of democracies in the system has little effect on the amount of conflict in the system beneath a certain threshold. After that threshold, increasing democracy decreases conflict in the system. Thus, the model establishes that domestic political institutions can have systemic-level consequences without relying on normative assumptions (Mitchell, 2002).

This article proceeds as follows. The next section addresses literature relevant to the democratic peace on both the dyadic and systemic levels. The following section describes an agent-based model that attempts to capture key empirical elements related to the democratic peace with no assumptions specifying how states should interact based on regime type. I then explain the computational experiments used to evaluate the model, including how the parameters of interest such as the percentage of democracies in the system are varied. Finally, the results of the model are presented before concluding.

Democracy, war, and the democratic peace

While the finding that democratic regimes tend not to fight each other is well established, the causal mechanism behind this finding is still contested (Gartzke, 2007; Dafoe, 2011; Choi, 2011). Bueno de Mesquita and his co-authors rely on Selectorate Theory to argue that democratic institutions constrain leaders more than institutions in other regime types and that democratic leaders only initiate war when they have a high probability of winning (Bueno de Mesquita & Siverson, 1995; Bueno de Mesquita et al., 1999a, 2004, 2005). This article demonstrates through the use of an agent-based model that the assumptions of Selectorate Theory alone, particularly that of increased democratic

accountability, are sufficient to generate results that resemble empirical findings related to the democratic peace on both the dyadic and systemic levels. No normative assumptions are necessary to generate the dyadic or systemic level results.

Selectorate Theory starts with the assumption that leaders are primarily motivated by the desire to retain office, although their strategy for doing so may differ by regime type. The regime type of a state is determined by the ratio of two key components: the selectorate and the winning coalition. The selectorate, S , is the set of people with the power to participate in choosing the leader while the winning coalition, W , is the minimum subset of the selectorate that is of sufficient size to support a leader in power. An incumbent loses office if she no longer has the support of a coalition large enough to stay in power, where the necessary size of the winning coalition is determined by the type of government. Roughly speaking, democracies have a large selectorate and a large ratio of W to S while autocracies have a small ratio of W to S . Furthermore, when W/S is large, as in democracies, the leader enhances her chance of surviving in office by investing resources in public goods while leaders of autocracies prefer to buy off individual coalition members through private goods (Morrow et al., 2008; Bausch, 2014b).

Because autocrats rely on private goods to satisfy their supporters, they are less accountable and less dependent on successful policies to stay in office than democratic leaders (Bueno de Mesquita et al., 1999b). With respect to war, Croco (2011) shows that democratic leaders who are in office when a war begins and then lose are significantly more likely to be removed from office than autocratic leaders under the same circumstances. This higher probability of removal should induce democratic leaders to select wars more carefully and fight easier wars, leading to democracies winning a higher percentage of wars than autocracies due to the selectivity of democratic leaders. In fact, empirical work finds that democratic leaders choose conflicts they are likely to win (Gelpi, 2001; Anderson & Souva, 2010).¹

While democratic leaders select easier wars, they also try harder to win a war once it starts, dedicating more

¹ While acknowledging Goemans's (2000, 2008) finding that the post-tenure fate of autocrats is worse than that of democrats, Bueno de Mesquita et al. (2004) argue that autocrats are ousted so infrequently for war losses that they are better off not spending resources on war and shoring up support among their winning coalition through private goods.

resources to the war and gaining a military advantage (Bueno de Mesquita et al., 1999a; Tanagerås, 2009). More precisely, Selectorate Theory predicts that when fighting extremely weak adversaries, neither democracies nor autocracies have any need to mobilize additional resources. When fighting wars in which the leader will be deposed by the adversary if defeated, both democracies and autocracies should fully mobilize. For wars in between, where most wars fall, democratic leaders should try harder than autocratic leaders (Bueno de Mesquita et al., 2004, 2005). Empirically, several scholars find that democratic leaders devote more resources to war efforts than autocrats (Bueno de Mesquita et al., 2004; Goldsmith, 2007; Valentino, Huth & Croco, 2010; Bausch, 2014a).²

Taken together, we see two pieces of evidence that combine to create the democratic peace. First, democratic leaders prefer to negotiate rather than fight difficult wars. Second, upon entering a difficult war, democratic leaders mobilize more resources for a war than autocracies, giving democracies a military advantage. Bueno de Mesquita et al. (1999a) argue that the democratic peace arises because, when there is a dispute between democracies, both leaders recognize the other leader's need to win the war to stay in office and will anticipate that the other leader will exert a great effort, making the war difficult and costly for both leaders. Thus, neither leader believes the war will be easy, and both will prefer to negotiate rather than fight. Following from this argument is the empirical finding that democracies tend to win the wars they enter more than any other regime type (Lake, 1992; Reiter & Stam, 1998, 2002).³ On one hand, democracies win more often because they avoid difficult wars and tend to fight easier wars (Gelpi, 2001; Anderson & Souva, 2010). On the other, when in difficult wars, democracies mobilize more resources, increasing their chances of winning (Valentino, Huth & Croco, 2010; Goldsmith, 2007).

Assuming this logic holds, two key endogenous results from the model described below should emerge purely as a result of domestic politics. First, democratic leaders should not initiate difficult wars. Second, upon finding themselves in a war, democratic leaders should mobilize

more resources than autocratic leaders and win more wars, even difficult wars they would have preferred to avoid.

Similar to Bueno de Mesquita et al. (1999a), the model in this article starts from a core game of international negotiation followed by settlement or conflict. However, here I place the model in an evolutionary context with repeated interactions where leaders that cannot satisfy their domestic constituencies are removed from office and successful leaders remain in office. The primary advantage of an evolutionary, agent-based model in this context is that it allows the exploration of the systemic democratic peace through a bottom-up process (Axelrod, 1997; Johnson, 1999; Miller & Page, 2007). Bottom-up modeling allows the inclusion of a wide variety of heterogeneous agents, rather than modeling a representative agent or a small number of types as is common in standard game theory (Marney & Tarbert, 2000). By endowing leaders with heuristics on whether to negotiate or fight depending on the regime type of the state it comes into conflict with, and allowing good heuristics to spread through the system while bad ones die off through loss of office, I can determine how micro-level behavior affects system-wide processes such as the democratic peace.

The importance of evaluating the democratic peace on the systemic level separately from the dyad-level democratic peace is underscored by Ray (2001), who argues the democratic peace may function differently across different levels of analysis. For example, if the democratic peace holds at the dyadic level, Gleditsch & Hegre (1997) suggest that conflict in the international system should be at its highest when the proportions of democracies and autocracies are about equal, but then decrease as the system becomes more democratic. Kadera, Crescenzi & Shannon (2003) find similar results, with initial increases in democracy leading to increases in conflict, but, after a critical point, further increases decrease conflict.⁴ Thus, on a systemic level, a non-linear relationship between the percentage of democracies in the system and war should emerge endogenously in the model.

Previous attempts to address the systemic democratic peace with agent-based models tend to assume the dyadic democratic peace holds and examine the macro-level effects. For example, Cederman (2001b, 2002) and

² Reiter & Stam (2002: 120) find the opposite, but Valentino, Huth & Croco (2010) suggest their measure of wartime mobilization is superior to that used by Reiter & Stam.

³ For a dissenting view, see the work of Desch and the responses by Reiter & Stam and Lake (Desch, 2002, 2003; Reiter & Stam, 2003b; Lake, 2003). On the robustness of Reiter & Stam's work, see Downes (2009).

⁴ Kadera, Crescenzi & Shannon (2003) cite Mitchell, Gates & Hegre (1999) and Crescenzi & Enterline (1999) as consistent with their predictions. In contrast, Gartzke & Weisiger (2014) find that systemic democracy has no effect on peace, arguing increased economic development has a pacifying effect.

Cederman & Gleditsch (2004) explicitly prevent democratic states from attacking other democratic states.⁵ Furthermore, these models have no domestic politics, with regime type instead serving as an arbitrary label or tag (Axelrod, 1984). Likewise, Gartzke & Weisiger (2013b) include no domestic politics in their model of the democratic peace, instead assuming a 'regime type' policy dimension that makes mixed dyads more likely to fight each other.⁶ Rousseau (2005: Ch. 7) drops the assumption that democracies will not fight and adds domestic opposition to the model. However, domestic opposition in Rousseau's model can only lead to change in the type of regime (from democracy to autocracy or from autocracy to democracy), not simply the removal of the current leader. In fact, leaders play no role there, and, though the state can repress the opposition to avoid regime change, it is never specified how leaders benefit from doing so or if they are punished if regime change occurs.

Furthermore, most of the models discussed here focus on wars of territorial conquest, which places states continuously under an existential threat from other states (Cederman, 1997, 2001b, 2002; Cederman & Gleditsch, 2004; Rousseau, 2005).⁷ This tendency to model such high-stakes wars prevents a prominent feature of international conflict from emerging, namely, that democracies will win wars more often due to greater wartime mobilization than autocracies. Wars involving a threat to the regime or the existence of the state should result in full mobilization by both autocratic and democratic regimes.

The model presented below is innovative with respect to previous agent-based models of international relations in two prominent ways. First, leaders are the primary agents in the model and the foreign policy strategies of

leaders are endogenous outcomes of the evolutionary dynamics. By including both domestic and international aspects in the model and varying the regime type, I present an account of how domestic political institutions affect the system-level democratic peace. Furthermore, the conflicts modeled here are not a direct threat to the leaders. While leaders can lose office due to poor use of resources, including resources expended in a losing war, the leaders and the state incur no direct punishment for engaging in and then losing a war. Focusing on this type of war is important because it is where differences in war effort by regime type are likely to emerge. The model builds on previous analytical results that focused on the incentives of an individual leader or the interactions of two leaders by placing these interactions in the context of a large international system where strategies of failed leaders are discarded and successful leaders are mimicked. The next section presents the details of the model.

Model

The model consists of two types of actors: citizens and leaders. Citizens and leaders are assigned to states, which are not actors in the model. The only important attribute of the state is whether it is democratic or autocratic. In democratic states, the leader needs five of nine votes to retain office for the next period, while in autocratic states, the leader needs only two of nine votes to retain office. This set-up creates a difference in W/S by regime type in accordance with Selectorate Theory. Whether a state is democratic or autocratic is exogenously determined at the beginning of the model and does not change as the model unfolds. The proportion of states that are democratic is also given exogenously according to the parameter d . States in the model have no meaningful geographical relation to each other.⁸

The first actors in the model are citizens, who are purely economic voters. They begin each period with nothing and have an exogenously given minimum number of resources, denoted here as 'points', that are acceptable to them each period. Points here can be most simply conceived of as money, which citizens benefit from if received directly from the leader or if the leader invests them in a public good. If the leader distributes points in such a way that this reservation price is reached for an individual citizen, that citizen votes to retain the

⁵ Using a system of differential equations, Kadera, Crescenzi & Shannon (2003) do not assume the dyadic democratic peace, but do make democratic–democratic pairings more likely to be peaceful. More problematic is their assumption that adding a democracy to the system makes all types of pairings in the system more peaceful through an undertheorized 'democratic community' effect. Meanwhile, Gleditsch & Hegre (1997) require that mixed dyads have the highest level of conflict, effectively building in an autocratic peace.

⁶ Similarly, in their agent-based model of alliances, Gartzke & Weisiger (2013a) assume states derive utility from being in an alliance with a state of the same regime type, but this model includes no domestic politics, and democracies and autocracies serve as arbitrary tags.

⁷ In Gartzke & Weisiger (2013b), wars essentially turn the loser into a puppet state of the winner, though they state their results are robust to other specifications.

⁸ Excluding geography from the model has the benefit of removing the possibility that the democratic peace in the model arises as the result of the clustering of democratic states (Gibler, 2007; Gibler & Miller, 2013).

leader. If the citizen does not end the period with at least her minimum number of points, she votes to replace the leader. Citizens are fickle in that only what the leader does in the current period enters their calculations about whether to retain the leader or not.⁹ Citizens here are best thought of as representatives of voting blocs that can influence the selection of the leader, such as prominent military, religious, or industrial figures.¹⁰

The second and more substantive actors in the models are the leaders. They have two separate sets of strategies, a foreign policy and a domestic policy, and these strategies are the key endogenous parameters of the model. The foreign policy strategy has three elements. First, whether they accept a negotiated deal or go to war when they have a conflict over the distribution of resources with a democratic leader. Second, whether they accept a negotiated deal or go to war when they have a conflict over the distribution of resources with an autocratic leader. A more detailed description of the international conflict game is described below. Third, how much effort they put into wars when they fight. On the domestic side, their strategy instructs the leaders how to distribute points after engaging in war or accepting a negotiated settlement. First, a leader's domestic strategy dictates how many points it gives out to the citizens once the conflict is settled. Second, the leader's strategy specifies whether points are given as private goods or invested in a public good. If she relies on private goods, she gives points directly to either two or five citizens depending on whether she is the leader of an autocracy or democracy. If she relies on public goods, any points invested in the public good are multiplied by g , where g is a parameter of the model, and distributed evenly among the nine voting blocks within the state. Points not given out are retained by the leader.

An example of a leader's strategy is (Settle, Fight, 80; Private, 400), where before the semicolon is foreign policy and after is domestic policy. This leader would settle when meeting a democracy, fight when meeting an autocracy, and use 80 points in a war.

⁹ The assumptions regarding the citizens' decisions differ somewhat in this model from those found in Selectorate Theory. In Selectorate Theory, supporters of the current regime take into account the likelihood of being included in the next leader's winning coalition before defecting from the current leader (Buono de Mesquita et al., 1999a). See the online appendix for further discussion.

¹⁰ On the endogenous formation of voting blocs, see Smith, LaGatta & Buono de Mesquita (2013).

This leader would then distribute 400 points as private goods domestically.

Each time period of the model consists of each leader playing the international game once and then distributing resources domestically. The model proceeds as follows:

Each period of the model begins with all leaders endowed with the same number of points, e . Each period, each leader is randomly paired with another leader to divide a prize p , where $p \leq e$.¹¹ The leaders can agree to a settlement in which they split p evenly.¹² If at least one leader does not accept the settlement, the leaders go to war. They set their investment in war effort independently of each other and then leader A wins the war with probability $\frac{\varepsilon_A}{\varepsilon_A + \varepsilon_B}$ and leader B wins the war with probability $1 - \frac{\varepsilon_A}{\varepsilon_A + \varepsilon_B}$. The winner of the war is awarded the entire prize, while the investment of both leaders is lost.

After the settlement or war, the leaders distribute points according to their domestic strategy.¹³ After the distribution, the citizens vote on whether to retain the leader or not based on their reservation price and the number of points they received that period. If the leader of a democracy does not receive five votes or the leader of an autocracy does not receive two votes, that leader is removed from office and her strategy 'dies'. In these cases, we can think of the leader as leaving office and returning to one of the voting blocs as a regular citizen. Furthermore, a specified number of leaders who would have been reelected also leave office and their strategy dies. These random deaths, rd , are meant to capture leaders leaving office due

¹¹ Here, e represents economic output obtained through purely domestic efforts that can be converted to military power. p can represent a variety of issues that states could engage in war over and be of material benefit to the state, although territory and control of access to resources are the most obvious.

¹² An even split is offered here because the endowment is already greater than the prize, so any advantage a leader has from points rolled over from previous periods cannot rationally be put to use. Shifting the offer to splitting p in proportion to the total points held by each leader, including the endowment and any points rolled over from the previous period, does not change the results. An even split has the advantage of allowing a straightforward equilibrium prediction from the stage game.

¹³ If no war occurred, leaders have $e + .5p$ to distribute. If war occurred, leaders have e minus their war effort, plus p if they won the war. If a leader has fewer points remaining than her strategy requires be given out, the leader simply gives out all her points. See the online appendix for discussion of this assumption.

to poor health or death.¹⁴ The surviving leaders' payoffs for the period are calculated.

The available leadership roles left by removal and death are filled in two ways. First, a number of immigrant leaders, i , are introduced into the population. These leaders have randomly determined strategies. Next, the leaders who retained office are ranked by their period payoff, with a specified percentage eligible for reproduction, *rep-per*. Reproduction in the context of the model means that an incoming leader of a state of the same regime type copies that leader's strategy.¹⁵ Essentially, reproduction represents incoming leaders mimicking successful leaders, with more successful strategies more likely to be copied and less successful strategies likely to be abandoned (Axelrod, 1986; Macy & Willer, 2002). The use of a fully specified strategy that determines the agent's actions in all situations and then is copied through reproduction is common in evolutionary models (Hammond & Axelrod, 2006; Bausch, forthcoming). Incoming leaders copy a strategy, but with a small chance of mutation, μ .¹⁶ Mutation and immigration allow the re-entry of strategies that have gone extinct and the introduction of new strategies, helping to assess the robustness of the equilibrium that emerges from the evolutionary process (Hoffmann, 2000; Linster, 1992). If there are more states that need new leaders than there are leaders eligible for reproduction, random immigrant strategies are used to fill out the population.

At this point, the next period begins. All leaders again receive the same endowment, e , which is added to any remaining points the surviving leaders had from the previous period. The points that roll over are discounted by δ . This discounting represents a combination of two factors. First, the discounting may represent capital depreciation. Second, the discounting can represent leader consumption. Citizens, meanwhile, update their reservation prices based on the wealth of the state, demanding a higher payoff if the leader has accumulated wealth for the state from the previous period.

¹⁴ These random deaths also address the concern of Hart (2001) about the implausibility of the assumption used in many game-theoretical models that agents are infinitely-lived.

¹⁵ Waltz (1986) argues that emulation of strategies occurs in any competitive system. Marsh (2003) presents evidence that Chinese leaders sought to learn from the collapse of the Soviet Union in order to safeguard their control of power, while Pantazis & Pemberton (2009) show how the UK has both imported and exported terrorism policy.

¹⁶ The details of mutation are discussed in depth in the online appendix.

Solving the stage game

This subsection describes the Nash equilibrium of the stage game, which serves as an important baseline prediction of how leaders should behave in the model.¹⁷ I then turn to why this prediction may not hold in an evolutionary context.

The Nash equilibrium of the international game is that, conditional on war occurring, both leaders should put forth an effort equal to one-quarter of the prize and both have an equal chance of winning. However, the leaders are given an initial offer to split the prize evenly before the war, so no war should occur in equilibrium. Therefore, war is inefficient in the model and should never occur (Fearon, 1995).

However, the evolutionary dynamics modeled here may result in deviations from the equilibrium prediction of no war. In fact, Leininger (2003) has shown that evolutionarily stable behavior in contests always differs from Nash equilibrium behavior. More specifically, Hehenkamp, Leininger & Possajennikov (2004) argue that in an evolutionary environment, agents maximize relative payoffs, leading to more aggressive behavior. Agents will invest more effort in the Tullock contest than predicted by the Nash equilibrium (Hehenkamp, Leininger & Possajennikov, 2004; Leininger, 2009). These results suggest that, conditional on going to war, leaders will likely invest more than the Nash equilibrium. On one hand, this increased aggressiveness should further lower the value of war for the leader, lowering the probability of the continued presence of leaders willing to go to war in the population. On the other hand, because wars increase the relative payoff of the winners, aggressiveness may persist in the population. In particular, starting a war may be a good strategy for leaders such as autocrats that have a high chance of reselection, since losing the war will be unlikely to result in removal from office.

The domestic strategy of the leaders is straightforward. Autocrats will provide private goods to two citizens while democrats will invest in public goods. More importantly, democratic leaders will give out more points in total than autocratic leaders to ensure reselection. The increased demand for points on the domestic side makes the foreign policy of democratic leaders more important for their reselection than the foreign policy of autocratic leaders, and bad democratic foreign policies will die out more quickly than bad autocratic foreign policies. The key difference between autocrats and democrats in the model is that democrats are more accountable to their domestic supporters.

¹⁷ The stage game is fully solved in the online appendix.

Table I. Summary statistics on the outcome of interactions from 1,000 runs of the benchmark parameterization

	<i>Mean</i>	<i>Std. dev.</i>
Democracy–democracy war (%)	2.40	0.66
Democracy–autocracy war (%)	27.91	9.90
Autocracy–autocracy war (%)	69.91	19.07
Overall war (%)	35.74	4.69
Democracy defeats autocracy (%)	62.98	5.89

Table II. Summary statistics of leader strategies from 1,000 runs of the benchmark parameterization

	<i>Democracy</i>	<i>Std. dev.</i>	<i>Autocracy</i>	<i>Std. dev.</i>
Accept democracy	99.24	8.66	73.88	43.93
Accept autocracy	98.35	12.74	51.50	49.98
Conflict use	124.3	15.49	79.8	27.4
Give out	605.7	15.75	430.7	45.2
Public good	1	0	0.21	4.58

'Accept democracy' and 'Accept autocracy' are the percentage of leaders who accept the negotiated settlement when meeting democratic or autocratic leader, respectively. 'Conflict use' is the number of points invested in a war by the leader, conditional on a war occurring. 'Give out' is the total number of points a leader gives to her constituents in each period, while 'Public good' is a binary variable set to 1 when these points are given out as a public good and 0 when they are given out as private goods.

Experimental design

Because the evolutionary dynamics make it intractable analytically, I use computational methods to study the unfolding of the model.¹⁸ I first present results from what I will refer to as the benchmark parameterization of the model, where all parameters are held constant and the model is repeated several times.¹⁹ The results of this benchmark give a general sense of the dynamics of the model. After presenting the results from 1,000 runs of the benchmark parameterization, I vary a single key parameter at a time while holding everything else constant, producing the equivalent of comparative statics in a game-theoretic model (Holland et al., 1989).

The key parameters of interest in the model are: the value of the prize, p , and the percentage of democracies in the system, d . Varying these two parameters allows me to address how war effort changes as the value of the prize increases and how frequently war occurs as the proportion of democracies in the system increases. I evaluate

these parameters by holding all the other variables constant at their value in the benchmark model while varying p or d . I follow Laver & Sergenti (2011) in using a Monte Carlo parameterization for the parameters of interest. First, for each run of the model, p is drawn at random from a uniform distribution between 0 and ϵ , capturing an interval ranging from conflicts with insignificant value to very valuable, but non-existentially threatening, conflicts. Then, to test for systemic effects of democracy, I vary d , the percentage of democratic states in the system, over the interval from 0 to 1 while holding all the other variables constant at their value from the benchmark parameterization. For both p and d , there are 1,000 runs of the model and the key outcome variables are recorded as described in the online appendix, but presented using fractional polynomial plots to uncover any non-linearities in the results.

Results

Benchmark parameterization

Tables I and II present the results from runs of the benchmark parameterization. Table I presents the outcomes of all interactions. Overall, nearly 36% of interactions resulted in war, though this rate was not constant across dyad type.²⁰ Nearly 70% of interactions between autocratic leaders resulted in war, while less than 2.5% of interactions between democratic leaders ended in war. Mixed dyads fell in the middle, with approximately 28% leading to war. The most interesting finding from Table I is that in mixed dyadic interactions that ended in war, the democracy won nearly 63% of the time. This large winning percentage for democratic leaders emerges despite regime types receiving the same initial endowment and democracies having no *a priori* advantage. Instead, in accordance with the logic of Selectorate Theory, the endogenously evolved strategies of democratic leaders lead to democracies trying harder in war than autocrats, which, in turn, leads to more wins in mixed-dyadic wars for democracies.

Table II presents the strategies of leaders broken down by regime type. The left-hand column clearly shows that democracies prefer to split the prize rather than engage in conflict regardless of the regime type of the opponent.

¹⁸ A description of the Markov properties of the model can be found in the online appendix.

¹⁹ The benchmark parameterization is described fully in the online appendix.

²⁰ It is important to note that the model overrepresents the occurrence of war. The relatively high frequency of war in the model is necessary because war is the outcome of interest. The model does not attempt to replicate the actual international system's frequency of war but rather the distribution of war across regime types. War must therefore occur often enough to allow these differences to emerge.

Over 99% of democratic leaders attempt to settle conflicts with other democracies peacefully, while over 98% prefer to settle conflicts with autocracies peacefully.²¹ However, we should be careful not to interpret the peacefulness of democracies in this model as evidence in favor of a universal monadic democratic peace. The finding is that for the types of wars specified here, wars that are likely to be difficult because both sides can bring an equal amount of effort to the battlefield and when there is an option both sides gain from by settling peacefully, democratic leaders are likely to be averse to entering a war.

Meanwhile, autocrats are much more willing to engage in war. About 74% of autocrats prefer peace when meeting a democracy and 51.5% prefer peace when meeting an autocracy.²² Thus, the model predicts that autocrats target democracies more than democracies target autocrats, a result consistent with previous analytical and empirical results (Bueno de Mesquita et al., 1999a; Reiter & Stam, 2003a; Bennett, 2006). However, in the model, war occurs more frequently between two autocracies than between mixed dyads, a result backed empirically by Bremer (1992), but which contradicts a tenuous consensus that domestic political similarity, even between autocrats, is associated with peace (Gartzke & Weisiger, 2013b; Werner, 2000; Souva, 2004; Bennett, 2006).²³ Again, the low level of mixed dyad wars may be due the impossibility in the model

of democracies selecting into wars with much weaker autocracies. Moreover, the lack of alliances and balancing in the model may hinder the autocratic peace if that finding is driven by the Cold War alliance system.²⁴ In fact, Gowa (2011) finds that in the post-Cold War era, autocratic dyads have a higher likelihood of war than mixed dyads.

The key result that emerges, though, is that autocratic leaders have much less pressure to implement an optimal foreign policy and can engage in war much more freely, without affecting their hold on office, than democratic leaders.

When engaged in war, democratic leaders invest more resources in war than autocratic leaders and use nearly twice the resources predicted by the Nash equilibrium of the Tullock contest. In contrast, while autocrats also overinvest in war relative to the Nash equilibrium on average, the Nash equilibrium falls within the first standard deviation of autocrats' conflict use. So, in the model, democratic leaders prefer peace, both absolutely and relative to autocrats, but when engaged in war they put forth a large effort, both relative to the Nash equilibrium and relative to autocrats. Furthermore, this difference in war effort leads to a democracies winning a majority of mixed-dyad wars.

The difference in foreign policy between autocrats and democrats is forced by different levels of accountability on the domestic level. Unsurprisingly, since democrats need to satisfy more citizens to stay in office, they exclusively rely on distributing public goods, while autocrats almost exclusively rely on private goods. Moreover, given democrats need to satisfy more voters than autocrats, it follows that autocrats give out fewer resources than democrats. Democrats, on average, distribute the entire endowment e plus close to half the prize p . Thus, settling a conflict through negotiation ensures enough resources to satisfy the citizens, but engaging in a war and losing nearly guarantees their removal from office. This dynamic results in democratic leaders avoiding war, but, when finding themselves in a war, mobilizing resources extensively to try to ensure a victory. In contrast, autocrats give out less than the endowment on average. This low domestic burden permits them to start a war, save resources by giving a low effort in the war, retain enough resources to satisfy their winning coalition if they lose, and keep the prize for themselves if they win. Losing a war is not sufficient to remove autocrats from office in

²¹ The difference between the percentage of democracies accepting the offer to settle peacefully with autocracies and democracies is nearly statistically significant ($p < 0.07$). However, substantively, these numbers are nearly equal, and the large number of observations makes overfitting a concern, so I choose not to emphasize the difference.

²² The difference between the percentage of autocrats accepting the offer to settle peacefully with autocracies and democracies is highly statistically significant ($p < 0.01$) as well as substantively large.

²³ Dafoe, Oneal & Russett (2013) argue autocratic pairs engage in conflict frequently but less so than mixed dyads, which are particularly war-like. However, several papers disagree or complicate the story. For example, Peceny, Beer & Sanchez-Terry (2002) find no evidence of an overall autocratic peace, but do find certain types of autocracies are less likely to go to war with each other. Likewise, Ray (2013) argues autocratic regimes are too diverse for a pacifying effect due to regime similarity to emerge, which is similar to Bennett's (2006) finding that the autocratic peace only holds for extreme autocracies. For further discussion of war and different types of autocratic regimes, see Weeks (2012). Meanwhile, Conrad & Souva (2011) show that protracted rivalries are no less likely to develop between autocracies than mixed dyads. Furthermore, Tan (2013) shows transitions from a mixed dyad to a democratic dyad tend to terminate rivalries while transitions from a mixed dyad to an autocratic dyad do not.

²⁴ I thank Håvard Hegre for this point.

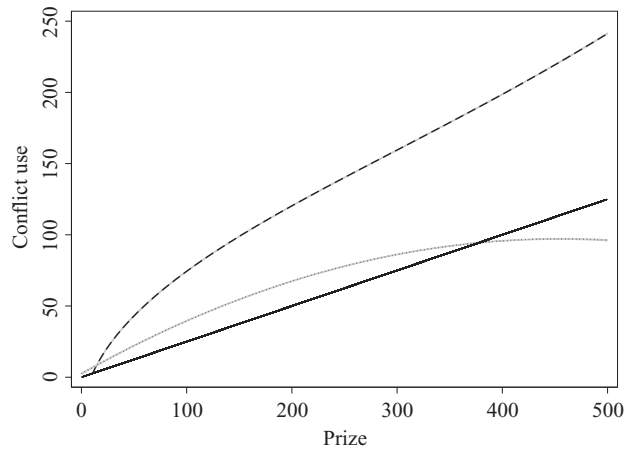


Figure 1. The amount spent on war by regime type as the prize increases

The solid line represents the Nash equilibrium of the Tullock contest for a given level of prize. The dashed line represents the average level of investment for a democrat, while the dotted line represents the average level of spending for an autocrat. Gray areas represent 95% confidence intervals.

the model, as it is for democrats, so the system does not pressure autocrats to evolve optimal foreign policies.

Varying the size of the prize

Figure 1 depicts how the average war effort changes by regime type as the prize increases. The solid line represents the Nash equilibrium of the Tullock contest for a given prize value. As can be seen from the dashed line, democratic leaders consistently invest significantly more resources in war than the Nash equilibrium with the exception of very low prize values. In fact, over most of the graph, democratic leaders approximately double the Nash equilibrium. Meanwhile, autocratic leaders, depicted as a dotted line, invest slightly more than the Nash equilibrium for low- and mid-range values of the prize and slightly less at the highest values. As in the benchmark parameterization, democracies win over 60% of conflicts with autocracies, regardless of the size of the prize, and this percentage increases slightly as the gap between democratic and autocratic war investment increases.

These results from Figure 1 largely confirm the results from the benchmark parameterization and are consistent with the results of analytical models (Bueno de Mesquita et al., 1999a; Tangerås, 2009). Democratic leaders, while reluctant to engage in the type of war modeled here, attempt to ensure victory when they find themselves fighting regardless of the value of the war. They spend much more than the Nash equilibrium because losing

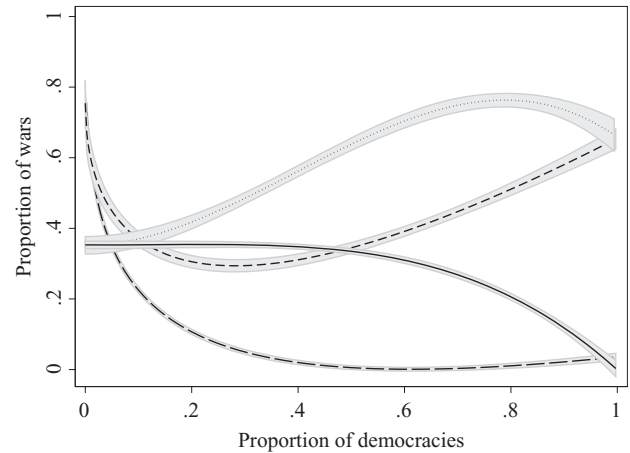


Figure 2. Proportion of interactions that end in war for various regime type pairings as the proportion of democracies in the system increases

The solid line represents the total proportion of interactions ending in war. The line with long dashes represents the proportion of interactions between democracies that end in war, while the line with medium dashes represents interactions between democracies and autocracies. The dotted line represents autocracy-autocracy interactions. Gray areas represent 95% confidence intervals.

a war will leave them unable to satisfy their selectorate and they will be removed from office. Autocratic leaders, meanwhile, put forth a substantial war effort that is often more than the Nash equilibrium. However, their efforts are significantly less than those of democratic leaders because an autocrat's hold on office is much less dependent on successful foreign policy than a democrat's.

Varying the proportion of democracies

Figure 2 presents the proportion of war by interaction type as the proportion of democracies in the system increases. Unsurprisingly, given the discussion above, the proportion of democracy–democracy wars falls quickly as the proportion of democracies in the system increases, eventually reaching nearly zero as democratic leaders learn that other democracies are difficult to defeat in wars.²⁵ This finding resembles empirical research suggesting that democratic pairs have become more peaceful as the proportion of democracies in the international system has grown (Dafoe, Oneal & Russett, 2013). Furthermore, the rate at which conflict between democratic

²⁵ The high level of democracy–democracy wars on the far left of the graph is due to random chance and sensitive to the initialization process. With few democracies in the system, democracies seldom meet, making the sample size small, and little learning can occur.

pairs falls off is consistent with Cederman's (2001a) finding that democracies quickly learn the benefits of mutual cooperation, although he places more emphasis on this learning occurring throughout the democratic citizenry as a whole. In the present model, leaders learn in response to their incentives.

In contrast to the democratic peacefulness, wars in democracy–autocracy and autocracy–autocracy interactions both increase consistently once the proportion of democracies reaches 0.2. As in the benchmark parameterization, wars between autocratic dyads remain more common than wars between mixed dyads. Nevertheless, the increase in proportion of wars between democracies and autocracies as the proportion of democracies increases is noteworthy because the model presented here does not explicitly build in any effect of regime type on interactions nor do agents explicitly base their actions on the proportion of democracies in the system (Gartzke & Weisiger, 2013b; Kadera, Crescenzi & Shannon, 2003).

While democracies always use more resources in conflict than autocracies regardless of how democratic the system is, as the proportion of autocracies decreases, the average autocrat uses fewer resources. When the system is mostly autocratic, autocratic leaders learn using resources in war is a good investment because winning is relatively cheap. This learning process increases the cost of war, making war between autocracies less likely. Thus, when autocracy is common in the system, some deterrence among autocracies occurs similar to, but weaker than, that among democracies. However, this effect dissipates as the proportion of autocracies decreases. When democracies dominate the system, autocrats learn that investing heavily in wars is not worthwhile because democracies are willing to use significantly more resources than autocrats. Thus, they decrease war spending, but engage in war more frequently because it costs them little and they can occasionally win. The empirical implication is that as the world becomes more democratic, autocrats become more war-like, but use fewer resources in war.

Perhaps most interesting in Figure 2 is the solid line representing the total proportion of wars in all interactions. The graph is clearly divided into two sections. When less than half the system is democratic, increases in the proportion of democracies has no effect on how often war occurs. The second half of the graph is consistent with empirical studies showing that after a critical point, increases in the proportion of democracies in the system enhances the overall peacefulness of the system (Gleditsch & Hegre, 1997; Crescenzi & Enterline, 1999; Mitchell, Gates & Hegre, 1999). The constant

rate of war as the proportion of democracies increases towards 50% differs from the empirical work of Gleditsch & Hegre (1997), who find that war increases until the critical point. However, a closer look at the shape of their parabola shows only a mild increase in the probability that a country engages in a dispute as the system increases from no democracies to 40% democracy.²⁶ Overall, then, the shape of the curve representing the total proportion of wars is largely consistent with empirical findings, differing only slightly at lower levels of democracy. The key finding here with respect to the systemic democratic peace is that increasing the proportion of democracies in the system does not have a linear effect on conflict. At lower levels of democracy, adding democracies has little effect on the amount of conflict in the system. After a threshold of around 0.5, increasing democracy decreases conflict in the system. Furthermore, this non-linear effect emerges despite making no assumptions about how states of the same regime type should interact and no normative assumptions about spillover effects from an increased presence of democracies in the system.

The results related to the proportion of wars won, which are not pictured here, are similar to the results of the benchmark parameterization and do not vary substantially with the proportion of democracies in the system.

Conclusion

This article has presented an agent-based model of the international political system. One major innovation of this agent-based model relative to other agent-based models of international conflict is making leaders the primary agents and endogenizing their strategies, allowing the inclusion of domestic politics in the model and avoiding the assumption of the dyadic-level democratic peace. The model relies on Selectorate Theory's distinction between states where the leader needs only a few supporters to remain in office versus those where the leader requires a majority. Leaders of states with small winning coalitions, autocracies, can satisfy their supporters using fewer total resources than leaders of states with bigger winning coalitions. In turn, this difference makes democratic leaders more accountable to their domestic supporters than autocratic leaders and more likely to lose office after spending resources on a failed war.

²⁶ See Gleditsch & Hegre (1997: 303, Figure 2).

This model also differs from previous agent-based models of international conflict in removing existential threats to states through territorial conquest. Instead, I focus on difficult wars between relatively equally powerful states that can be settled through negotiation. In these types of wars, the increased accountability of democratic leaders to their domestic supports has two consequences. First, it causes democratic leaders to avoid wars much more frequently than autocratic leaders, resulting in the democratic peace emerging from the micro-level assumptions of the model. Second, when democratic leaders do fight, they mobilize more resources than autocratic leaders. Democratic leaders' increased war effort leads to democracies defeating autocracies in a majority of mixed-dyad wars. Thus, findings that democratic leaders select out of difficult wars and mobilize more resources when forced to fight one suggest that democratic leaders' fear of losing office due to losing a war alone is enough to produce the dyadic democratic peace and the result that democracies win a higher percentage of wars than autocracies. The mechanism that produces these is accountability, induced by Selectorate Theory's assumptions that all leaders primarily aim to retain office and that democratic leaders need to satisfy more supporters than autocrats to do so.

Moreover, the major contribution of this article is on the systemic level. The key innovation is that the model incorporates a theory of domestic politics, which affects the dyadic level up through to the systemic level. On the systemic level, the model presented here provides micro-foundations for empirical work suggesting that an increase in democracies in the system does not result in a linear decrease in the amount of war in the system. In fact, the model predicts that below a threshold percentage of democracies, increases in democracy produce almost no change in the number of wars. A further empirical implication of the model is that, despite the infrequency of wars between democracies, mixed-dyad wars and wars between autocracies increase as the percentage of democracies in the system increases. This finding is especially interesting because there are no assumptions in the model making states or leaders inherently combative in mixed dyads, nor do leaders take into account the state of the international system when making their decision on whether or not to go to war. Despite lacking these types of assumptions, the model still reveals that until a critical number of democracies exist, adding additional democracies does not necessarily lead to a more peaceful system.

Replication data

The NetLogo code used to run the model, the output used in the analysis, and the Stata .do files used to perform the analysis, as well as the online appendix, can be found at <http://www.prio.no/jpr/datasets>.

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