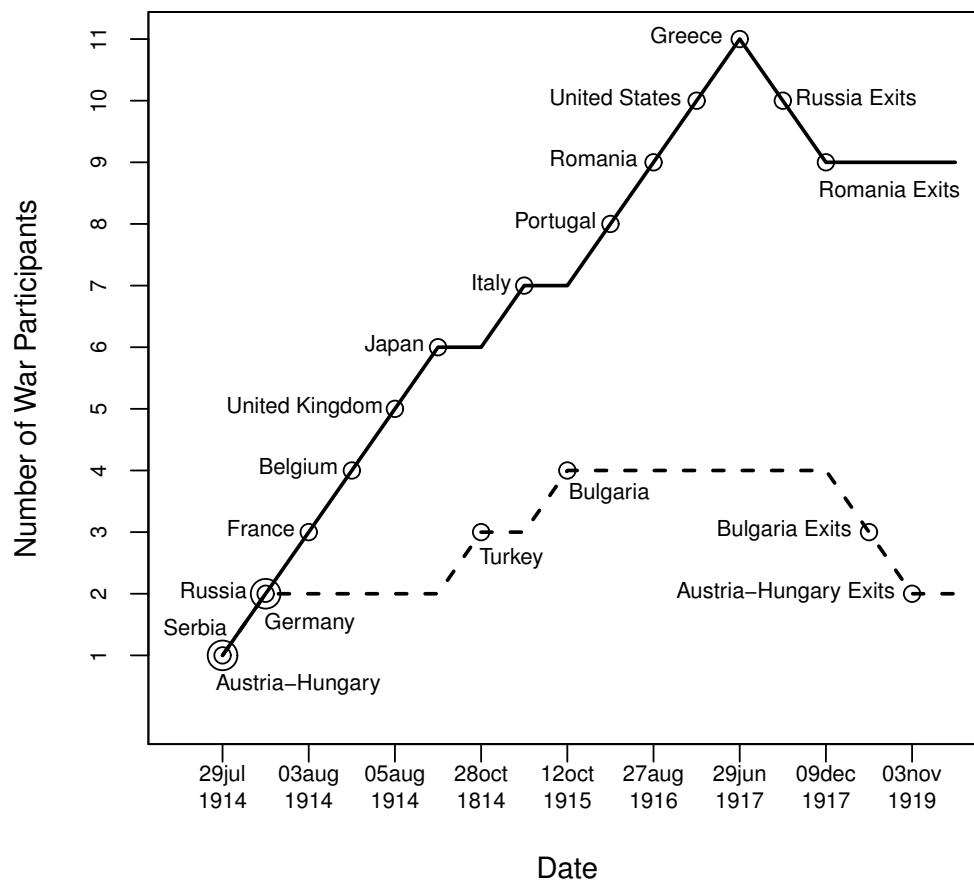# Web Appendix for "The Cascading Dynamics of War Expansion"

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Expansion of World War I

Figure 1: Expansion of World War I.

Note: the solid line tracks the states that joined Serbia and the dashed line tracks the states the joined Austria-Hungary. Source: Correlates of War Project Inter-State War Data, 1816-2007 (Sarkees & Wayman 2010).

Table 1: Expansion of World War I

State	Entry Date	Exit Date	Battle-Connected Fatalities	Joined Austria-Hungary	Joined Serbia
Austria-Hungary	07/29/1914	11/03/1918	1,200,000	.	.
Serbia	07/29/1914	11/11/1918	70,000	.	.
Germany	08/01/1914	11/11/1918	1,773,700	1	.
Russia	08/01/1914	12/05/1917	1,700,000	.	1
France	08/03/1914	11/11/1918	1,385,000	.	1
Belgium	08/04/1914	11/11/1918	13,716	.	1
United Kingdom	08/05/1914	11/11/1918	908,371	.	1
Japan	08/23/1914	11/11/1918	300	.	1
Turkey	10/28/1914	10/30/1918	325,000	1	.
Italy	05/23/1915	11/11/1918	650,000	.	1
Bulgaria	10/12/1915	09/29/1918	87,500	1	.
Portugal	03/01/1916	11/11/1918	7,222	.	1
Romania	08/27/1916	12/09/1917	335,706	.	1
United States	04/17/1917	11/11/1918	116,516	.	1
Greece	06/29/1917	11/11/1918	5,000	.	1
Total			8,578,031	3	10

Source: Correlates of War Project Inter-State War Data, 1816-2007 (Sarkees & Wayman 2010).

The Agents' Characteristics

In this section, I describe the procedures used to create the distributions used to assign agents values to represent their material capability and utility for each initial belligerent winning the war.

Material Capability

In order to assign each agent a value to represent their material capability, I first examined the empirical distribution of CINC scores from 1816-2007 (see the left panel of Figure 2).[1] Next, I selected a distribution from which to draw agent capability values that closely resembled the empirical CINC distribution with specific parameter settings. Since the empirical CINC score is continuous and bounded on the unit interval, the chosen distribution should also have these characteristics. The beta distribution was chosen because it is a continuous distribution defined on the unit interval [0,1] with two parameters, $\alpha > 0$ and $\beta > 0$ (Evans, Hastings & Peacock 1993), thus providing additional flexibility and greater accuracy in approximating the empirical CINC distribution. A beta distribution with α=0.05 and β=1.25 closely mirrors the CINC distribution. I restricted the upper interval of the beta distribution so that the maximum value returned would not be greater than the maximum value of the CINC distribution (0.3839). A comparison of the empirical CINC and agent capability distributions is shown in Figure 2. The two distributions are quite similar, with means of 0.0139 (CINC) and 0.0173 (agent) and standard deviations of 0.0380 (CINC) and 0.0551 (agent), respectively. Each agent was randomly assigned a value, drawn from the agent capability distribution (the right panel in Figure 2), to represent their capability. In the artificial international system the modal agent has little capability, a few have a moderate level of capability, and even fewer have high capability.

<div align="center">Insert Figure 2 here.</div>

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[1]The CINC data was generated using *EUGene* version 3.204 (Bennett & Stam 2000).

Utility for Initial War Belligerents Winning the War

In order to assign each agent a value to represent their utility for each of the initial belligerents winning the war, I first examined the empirical distribution of τ_b scores from 1816 to 2000 (see the left panel of Figure 3).[2] Next, I selected a distribution from which to draw τ_b values that closely resembled the empirical distribution of τ_b scores with specific parameter settings. Since the τ_b score is continuous and bounded on the interval [-1,1] the chosen distribution should also have these characteristics. The agent distribution was created in three steps. First, the values for the left side of the distribution were generated using a beta distribution with α=0.25 and β=3. The upper interval of the distribution was bounded at 0.4508, representing the lower bound of the empirical τ_b distribution. Since the beta distribution returns values on the unit interval [0,1], I multiplied the values by -1 in order to create the left side of the distribution. Second, the values for the right side of the distribution were generated using a chi-square distribution with three degrees of freedom (Evans, Hastings & Peacock 1993). Since the chi-square distribution returns values on the interval $[0,+\infty)$, and 1 represents the upper bound of the empirical τ_b distribution, I removed any values greater than 1. Third, I combined the values from the left and right sides to form the complete distribution. In order to resemble the empirical τ_b distribution, 89.78% of the values were assigned from the left side of the distribution, 0.01% were given a value of zero, 6.12% were assigned from the right side of the distribution, and 4.09% were given a value of one. A comparison of the empirical τ_b and agent distributions is shown in Figure 3. The two distributions are quite similar, with means of 0.0211 (τ_b) and 0.0194 (agent) and standard deviations of 0.2525 (τ_b) and 0.2746 (agent), respectively. Each agent was randomly assigned two values from the agent distribution (the right panel in Figure 3); the first one representing its utility from I_a winning the war, the second representing its utility from I_b winning the

[2]Data for τ_b was generated using *EUGene* version 3.204 (Bennett & Stam 2000). A non-directed dyad year specification was chosen and the global τ_b was obtained. The global τ_b is the τ_b score when all states in the international system are included in the calculation even if they do not have an alliance with any other state in the international system. It is important to note that in this data set each state has a τ_b value for its similarity in foreign policy commitments with every other state in the international system. However, in creating the model, each agent is assigned values only for its foreign policy similarity with each of the initial belligerents.

war.

Insert Figure 3 here.

Figure 2: Comparison of the Empirical CINC and Agent Capability Distributions.
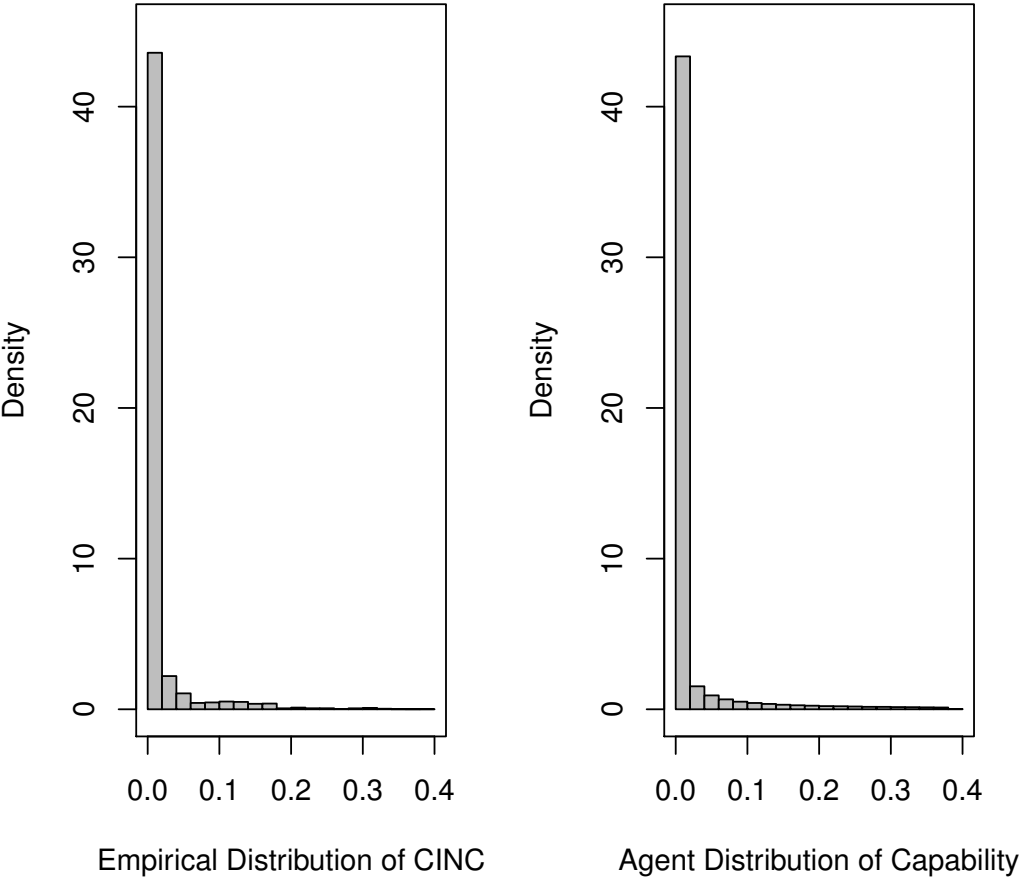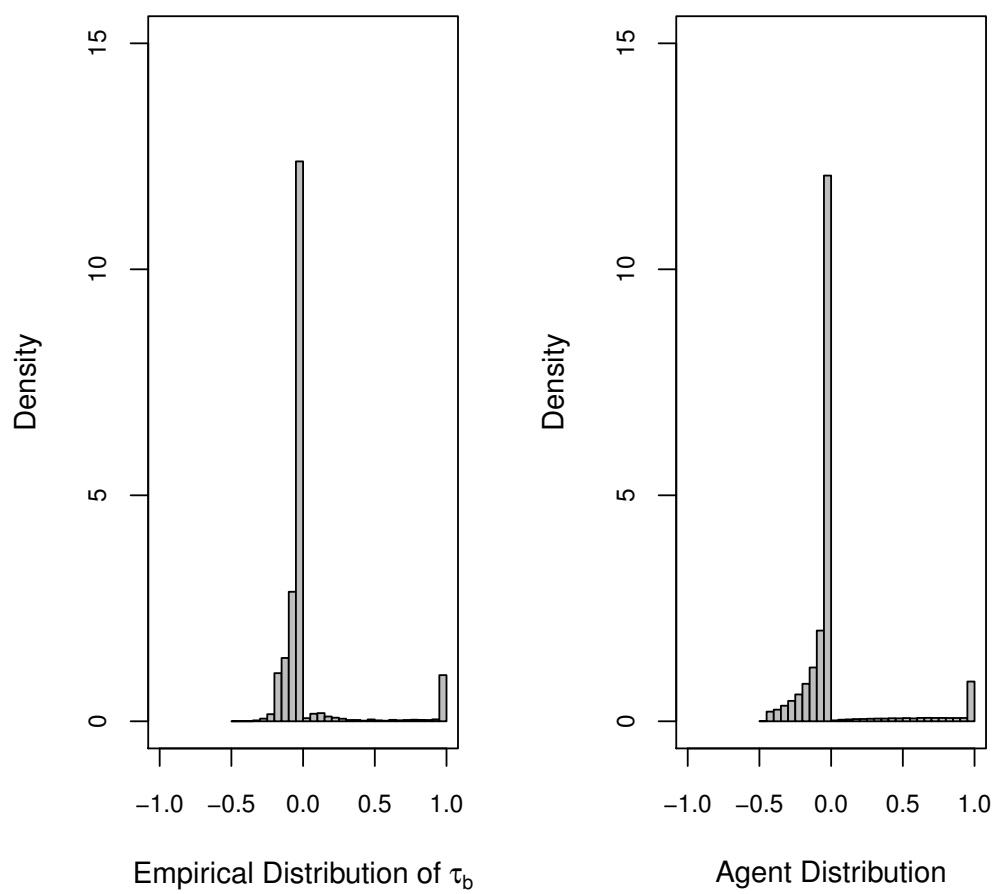
Figure 3: Comparison of the Empirical τ_b and Agent Distributions.

References

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