Capability Change, Economic Dependence and Alliance Termination

Jaewook Chung

What causes an asymmetric alliance to end? This study explores how changes in the capabilities of the weaker ally in an asymmetric alliance can cause the alliance to end. Here I argue that, since the weaker ally in the asymmetric alliance is vulnerable to the influence of the stronger ally, an increase in the capabilities of the weaker ally can increase the likelihood of alliance termination. That is, the underlying motivation of the weaker ally to gain (or restore) more autonomy can increase the likelihood of termination. More precisely, I argue that the effect of the change in capabilities of the weaker ally on alliance termination is conditional upon its economic dependence on the stronger ally. A weaker ally that is highly dependent economically on its strong partner may be restrained from seeking autonomy because it could hamper ongoing economic relations with the stronger ally. Thus, I hypothesize that when there is an increase in the capabilities of the weaker ally, an alliance in which the weaker ally's economic dependence is high is less likely to result in termination than an alliance in which the weaker ally's economic dependence is low. Empirical analysis lends strong support to this hypothesis.

Key Words: change in capabilities, asymmetric alliance, alliance termination, economic dependence, autonomy, weaker ally, stronger state

What causes an asymmetric alliance to end? To answer this question, this study explores the effect of changes in the capabilities of the weaker ally on alliance termination. Prior studies suggest that changes in the capabilities of allied states are associated with alliance termination (Morrow 1991; Bennett

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1997; Leeds and Savun 2007; Leeds, Mattes and Vogel 2009). However, it is not clear whether or how changes in the capabilities of the weaker state affect alliance termination and under what conditions it is more likely. In addition, Morrow (1991) argues that changes in the capabilities of the weaker ally in an asymmetric alliance have little effect on alliance termination because the weaker ally's contribution to the joint capabilities of the alliance would be marginal.

However, based on the assumption that in asymmetric alliances weaker states suffer more from autonomy concerns than allied states in symmetric alliances (Altfeld 1984; Rothstein 1968; Morrow 1991), I argue otherwise; the increased capabilities of a weaker state in an asymmetric alliance can motivate the state to end ties in order to gain more autonomy. Thus, I argue that in an asymmetric alliance a weaker state's increased capabilities can lead to alliance termination. More precisely, I argue that the weaker state's decision to end the alliance is conditional upon its economic dependence on the stronger ally. If its increased capabilities are largely due to economic dependence on its stronger ally, the weaker state may have little incentive to end ties because it may harm the ongoing economic relations that provide the weaker ally with a material basis for its economic growth. Thus, here I hypothesize that when there is an increase in the capabilities of the weaker ally, an alliance in which its economic dependence is high is less likely to terminate than an alliance in which its economic dependence is low. From empirical analysis, I find strong support for this hypothesis.

The remainder of this paper is organized as follows. In the next section, I elaborate my theoretical arguments on how the change in capabilities of the weaker ally in an asymmetric alliance can affect alliance duration. In the third section, I present a research design to test the hypothesis drawn from the arguments. In the fourth section, I provide results from statistical analysis. In the final section, I conclude with a summary of the findings from the study and a few suggestions for future research.

HOW CHANGES IN CAPABILITIES AFFECT THE DURATION OF ASYMMETRIC ALLIANCES

Before elaborating on arguments regarding why changes in the capabilities of weaker states can affect the duration of asymmetric alliances, it is first necessary to discuss what I mean by asymmetric alliances and why this study focuses on asymmetric alliances associated with alliance termination.

Although asymmetric alliances can be defined in various ways, here I define them in terms of the power distribution between allies following Morrow (1991).

In his security-autonomy trade-off model, Morrow (1991) classifies alliances into two types on the basis of the capabilities distribution between allies: symmetric alliances and asymmetric alliances. While symmetric alliances are composed of equal powers, asymmetric alliances are composed of unequal powers, such as major and minor powers. If alliances are simply aimed at aggregating capabilities between allies, as realists posit, the formation of this asymmetric type of alliance cannot be well explained by the realist perspective. Morrow argues that this type of alliance is formed because it allows states to trade security for autonomy, or vice versa, between allies. That is, in asymmetric alliances, the stronger side gains autonomy in return for providing security to its weaker partner, and the weaker partner gains security in exchange for providing its stronger partner with greater autonomy.¹

What does his asymmetric alliance argument suggest about alliance termination? Morrow argues that a change in capabilities plays an important role in alliance dissolution. In particular, in asymmetric alliances, a decline in the stronger state's capabilities can increase the likelihood of alliance termination. Since enhancing its capabilities is the main reason for forming an alliance from the weaker state's point of view, the declining capabilities on the stronger side undermine the incentive for the weaker ally to continue the alliance (Morrow 1991, 917). By contrast, Morrow argues that a change in capabilities on the weaker side is less likely to cause an end to the alliance because the weaker side makes little contribution to the overall capabilities of the alliance in the first place, and thus its change in capabilities is less likely to affect the value of the alliance. That is, the change in capabilities of weaker states in asymmetric alliances has little effect on alliance termination. For this reason, Morrow argues that asymmetric alliances last longer than symmetric alliances (Morrow 1991, 918).

However, I argue that in asymmetric alliances, changes in the capabilities on the weaker side can also increase the likelihood of alliance termination because in asymmetric alliances, weaker states suffer from severe autonomy concerns. Rothstein writes:

“[Through alliance with a superior power] the Small Power may move not from insecurity to security, but from insecurity to the status of a satellite.” (Rothstein 1968, 61)

¹ In this sense, this type of alliance is asymmetric in Morrow's definitions of symmetric and asymmetric alliances. That is, in symmetric alliances both allies enjoy the same kinds of benefits, either security or autonomy, but in asymmetric alliances, one side gains autonomy or security while the other side either sacrifices autonomy or security (Morrow 1991, 908-909).

The quote cited above illustrates well what I mean by the autonomy concerns of weaker states.² The quote suggests that minor powers want to enhance their security by forming alliances with major powers, but they don't want to be subordinate to the influence of stronger allies. However, due to the power gap between them, minor powers are vulnerable to the influence of their stronger allies on their domestic and foreign policy (Barnett and Levy 1991; Rothstein 1968). Granted that minor powers in asymmetric alliances suffer from severe autonomy concerns, it is likely that as their capabilities increase, minor powers could be inclined to terminate the alliance to gain more autonomy. This is the reason why this study focuses on asymmetric alliances associated with alliance termination. In asymmetric alliances, the autonomy concerns of weaker states matter with regard to alliance duration.

Several empirical studies suggest that changes in capabilities are associated with alliance termination (Morrow 1991; Bennett 1997; Leeds and Savun 2007; Leeds, Mattes and Vogel 2009). However, most do not specify which side's change in capabilities is associated with alliance termination. In previous empirical analysis, Morrow (1991) and Bennett (1997) aggregate the capabilities of allied members and test how changes in aggregated capabilities affect alliance termination. Leeds and Savun (2007) and Leeds et al. (2009) take a different approach. They identify factors that can affect the valuation of the alliance and then explain how changes in those factors are associated with alliance termination in violation of the terms. One of those factors is capabilities, and they find that either side's change in capabilities can lead to alliance termination. One exception is the study by Von Hagen-Jamar et al. (2012). They investigate which side's change in capabilities affects alliance termination. By drawing on Morrow's asymmetric arguments (1991) on alliance termination, they hypothesize that the weaker state's increase in capabilities leads to alliance termination because it could increase the probability of winning a war against a rival, as well as the weaker state being better able to provide for its own security by virtue of its increased capabilities. They also find support for this hypothesis by showing empirical evidence that the weaker ally's increased capabilities can lead to alliance termination.

² However, it is important to note that I refer to autonomy as the ability of a state to shape policy without external influence, the definition of which is different from that of Morrow's. Morrow defines autonomy as a state's ability to change the status quo, which makes his definition of autonomy orthogonal to his definition of security defined as a state's ability to maintain the status quo (Morrow 1991, 908-909). This conceptualization of autonomy allows him to analyze a state's decision to seek autonomy independent from its decision on security, which is different from a general notion of autonomy. Thus, here I refer to autonomy as similar to the general notion of autonomy.

In this regard, their empirical findings are somewhat – albeit not fully – consistent with my argument. Here I argue that the desire of the weaker state to terminate the alliance resulting from its increased capabilities is dampened by its economic dependence on its stronger ally. That is, the weaker side's decision to terminate the alliance is conditional upon its economic relations with its stronger ally. If the weaker state is highly dependent economically on its stronger ally for its overall capabilities, the weaker state's incentive to terminate the alliance will be diminished. By contrast, if its overall capabilities are less dependent on its economic relations with its stronger ally, it is more likely to terminate the alliance due to an increase in its overall capabilities.

This conditional argument linking economic dependence and alliance termination is based on many studies indicating that non-security factors, especially economic ties, also play an important role in cementing ties between allies and consequently contribute to the continuation of alliances (Gowa and Mansfield 1993; Long and Leeds 2006; Leeds and Savun 2007; Fordham 2010). For instance, Gowa and Mansfield (1993) and Gowa (1994) emphasize a security externality that trade can generate. Trade allows states to accumulate resources, and states can then transfer those resources gained from trade to the military. This suggests that allied states have an incentive to trade more with allies than with non-allies because trade between allies can enhance the security of the alliance.

Long (2003) found that variations in the type of alliance agreements explained the alliance-trade relationship. He found that defense pacts promote trade between allies, while other types of alliances did not. Long and Leeds (2006) also found that specific provisions in alliance agreements matter. They showed that the pre-World War I and II military alliances of 1885-1938 that pledged economic cooperation in their alliance agreements tended to increase their trade more than non-pledged allies. Their study suggests that there is significant variation across allies in economic cooperation depending on the provisions in their alliance agreements. Leeds and Savun (2007) also showed that allies that agreed on non-military cooperation in signing their alliance treaties were less likely to be exposed to the risk of alliance termination resulting from the opportunistic behavior of either ally.

While these studies indicated some trade-generating effects of alliances, Fordham (2010) argued that, in asymmetric alliances, increasing trade led to alliance formation rather than vice versa. That is, rather than alliances having a trade-generating effect, states that share economic interests, especially trade interests, tend to form alliances to protect their trade interests, and these alliances are less likely to dissolve as well. With this finding, he attempts to pro-

vide an answer to the question of why asymmetric alliances tend to form and last longer than symmetric alliances. He argues that the stronger state's motivation to protect its trade interests plays an important role in forming and continuing the alliance. Although the causal mechanism he offers is different from other scholars', his findings suggest that, in asymmetric alliances, common economic interests are of great importance in sustaining alliance ties.

Figure1. Causal Mechanism

Given both the logic of the autonomy concerns of the weaker state in asymmetric alliances and the importance of economic ties in alliance relationships, I present more detailed arguments on how the changes in the capabilities of weaker states can interact with their economic dependence³ on their major power allies and, consequently, affect the likelihood of alliance termination. Figure1 provides a diagram of a causal mechanism that depicts how an increase in the capabilities of the weaker state can lead to alliance termination.⁴

³ There could be several forms of economic dependence. The most common form of economic dependence concerns trade relations. A weaker state's ally may take up a large portion of the total trade (i.e. the ratio of the trade volume of the weaker state with the stronger ally to the total volume of trade of the weaker state). The greater the portion, the more dependent is the weaker state on its stronger ally. Another form of economic dependence may concern economic or military aid. Depending on the amount of aid, it can help relieve the weak state of its burden of military or societal expenditures; however, in empirical analysis, I focus on trade relations primarily due to the availability of data.

⁴ One reviewer points out that in this causal mechanism, an alliance adjustment process – a bargaining process between allies to reach a new formal or informal agreement – should be included to clarify this casual mechanism. Given that in most cases terminating an existing alliance could involve

To begin with, a weaker state's increase in overall capabilities (or economic growth) can enhance its ability to gain more autonomy. Whether to substitute a military buildup for the alliance will be conditional upon the economic dependence of the weaker state on the stronger ally. If the weaker side is highly dependent on the stronger ally, the weaker state may think that replacing the alliance with self-defense is not a viable option because it may inflict damage on ongoing economic relations that provide a source of its increased capabilities. That is, ending the existing alliance means that the weaker state has to substitute arms for the alliance, if we assume that states will want to maintain their existing security profile.⁵ However, this armament policy definitely requires increasing military expenditures to fill the gap generated by ending alliance ties. If increasing military expenditures can be backed up by domestic mobilization, terminating the alliance causes little problem to security maintenance. However, if increasing arms expenditures is either directly or indirectly dependent on the relationship with a stronger ally, policymakers in the weaker state may find that replacing the alliance with greater military spending is not a viable alternative.

Regarding the arms vs. alliance choice, especially by Third World countries, Barnett and Levy (1991, 372) emphasize the role of alliances as "a source of economic resources and military equipment." Their study suggests that, in asymmetric alliances, the stronger side provides the very material baseline of economic resources that the weaker side needs to increase its arms. Thus, if economically

bargaining between the members of an alliance, consideration of the alliance (re)adjustment would be necessary. Although this study does not adopt a bargaining model, the theoretical arguments drawn from this study could be considered similar to that from a bargaining model. In the theoretical context of this study, the alliance (re)adjustment process would take place if a minor power's capabilities increase. If the increased capabilities stem primarily from its economic dependence, the increased capabilities could be less readily translated into bargaining power, making little change to the existing alliance. By contrast, if the increased capabilities of the minor power have little to do with its economic relations with the major power, the bargaining process itself would become more crucial than in the former case because the less economically dependent state could use its increased capabilities more effectively as bargaining leverage. This means that bargaining is likely to end in favor of the minor power; however, it is important to note that this bargaining would also likely end in no agreement, presumably due to the excessive demand from the weak state. Thus, to determine which outcome is more likely – a new agreement in favor of the minor power or termination – we may need a more sophisticated theoretical framework, such as one reliant on a game theoretical model. Nonetheless, it is still certain that termination of an alliance is likely when the minor power with increased capabilities is less economically dependent on the major power, although we cannot rule out the possibility that this type of alliance also continues.

⁵ The assumption that the weaker state has only two options either to maintain the existing alliance or move towards self-defense could be a strong assumption given that the weaker state has other options, such as joining other alliances or searching for another major power partner. Since I focus on the autonomy concerns of the weak state, forming another alliance with a major power should also incur a similar loss of autonomy. This is why I focus primarily on the two options.

dependent on its stronger partner, despite an increase in its capabilities, the minor power may be forced to stay in the alliance. De Castro's case study (2005) on the U.S.-Philippines alliance illustrates this point. The United States and the Philippines have had a continuous alliance relationship since 1951 when they signed a defense pact. In 1991, with the end of the Cold War and with its increasing capabilities, the Philippine government sought a more autonomous defense posture with a plan to modernize its armed forces. The Philippine Senate refused to ratify a new military bases agreement with the United States in September 1991. This decision prompted the Bush administration to cut U.S. military and economic aid by as much as 60 percent. In particular, the Philippine government was unable to replace the US\$200 million military assistance that had been provided annually until 1991 with internal revenue, and the plan of the Philippine government to modernize its force was scrapped in the end. The Philippine case illustrates that, given that military alliances can create positive security externalities (Gowa and Mansfield 1993; Gowa 1994), the stronger ally may lose an incentive to favor its former ally in economic terms after the end of the alliance ties because economic relations no longer produce a positive security externality. If the weaker state is highly dependent on its stronger ally, the stronger ally's small policy change could have a huge impact on the weaker state's economy and thus it would find it costly to adjust accordingly.

The U.S.-Japan treaty renegotiation case of 1953 is another example. In the time of renegotiation, Japan was really concerned about its alliance ties at the same time it was focused on economic relations with the United States. Japan signed an alliance treaty with the United States in 1953, but with its increased capabilities it wanted to revise the 1953 treaty in the late 1950s. Although Japan's increased capabilities allowed it to move towards self-defense, it recognized the importance of alliance ties with the United States in continuing its economic growth. Buckley emphasizes that the economic dependence of Japan on the United States played a crucial role in extending the alliance. He writes:

New prosperity was also widely seen by the Japanese public as intimately connected with the American alliance. Trade to and from the United States was perceived by both American and Japanese leaders as a vital rationale for continuing friendship between their two nations. Many who had serious reservations about the US-Japan defense arrangement found it impractical to ignore the economic benefits that had accrued to Japan throughout the 1950s and saw the American market as vital to continuing Japanese economic growth... To object to Japan's policies toward the United States was to risk jeopardizing all (Buckley 1992, 77-78).

In sum, the more dependent on its ally for economic prosperity, the less likely the weaker state is to take the risk of terminating the alliance because its increased capabilities come largely from its alliance relationship.⁶

In addition, there could be another reason why an economically dependent ally finds it difficult to seek a more autonomous position. High economic dependence on its stronger ally may constrain the capacity of the political leader of the weaker state to seek a particular policy in the face of resistance from vested domestic interests (Hirschman 1945; Papayouanou 1999). For example, Papayouanou (1999) attempts to explain variations in balancing behavior. That is, why states sometimes balance against a challenger but other times do not. He argues that states will balance against a threat when the economic ties between the defender and the challenger are low. When there are significant economic ties between them, he asserts that the defender is more likely to pursue an appeasement policy rather than stand firm against the challenger because, in such a case, vested domestic interests that benefit from economic relations with the challenger will mobilize opposition to the balancing policy to secure their economic interests. A similar logic can apply to economic dependence and alliance policy. If a weaker ally is highly economically dependent on its major power ally, it is likely that there are domestic interests that benefit from this economic relationship, such as export and import industries. Consequently, if a government sought to shift its alliance policy such that it could influence the status quo in a way that would be detrimental to domestic interests, that government might face internal resistance from the mobilization of those domestic interests. This concern may deter the government from shifting its alliance policy. From the arguments made above I derive one hypothesis:

⁶ It is important to note here that this conditional argument assumes that terminating the alliance with a stronger ally can provoke an economic backlash from the stronger partner. It is important to consider whether the stronger ally has some incentive to impose a penalty on its weaker former ally, however. Wagner (1988) asserts that, unlike the commonly held belief that an economically dependent state is vulnerable to the political influence of the less dependent trading partner (e.g. Hirschman 1945), the more dependent partner does not necessarily suffer from a weak bargaining position. His argument is well represented by the Blackmailer's Fallacy (Wagner 1988, 474). The Blackmailer's Fallacy implies that, since interrupting trade can be costly to the stronger ally as well, such a threat to interrupt trade can be an empty threat. In the context of an asymmetric alliance, his argument suggests that a minor power's economic dependence may not restrain the minor power from terminating the alliance because the economically dependent ally does not need to be concerned about the stronger ally's backlash. However, Keohane and Nye maintain that political influence can still arise from asymmetric economic interdependence because the stronger side can "make concessions at lower cost than more dependent actors" (1987, 734). That is, even if imposing a penalty on the weaker state could be costly to the stronger state, it would be much more costly to the weaker state, and this can effectively act as a constraint on its behavior. Thus, I doubt that the weak state does not need to worry about the stronger ally's backlash.

Hypothesis: *In asymmetric alliances, if the capabilities of the weaker state increase, alliances in which the economic dependence of a weaker ally is high are more likely to endure than alliances in which the economic dependence of the weaker ally is low.*

RESEARCH DESIGN

DATA, SAMPLE, AND DEPENDENT VARIABLE

To test the hypothesis I employ large N analysis.⁷ In this study, the dependent variable is alliance termination and the unit of analysis is a bilateral alliance year. The temporal domain for this study is the period between 1870-2002, which was determined by the availability of data. To identify the sample of asymmetric bilateral alliances,⁸ I use the Alliance Treaty Obligations and Provisions (ATOP) data (Leeds, Ritter, Mitchell and Long 2002). The ATOP data classifies alliance treaties into five categories that are not mutually exclusive: defense pacts, offense pacts, consultation pacts, neutrality pacts and nonaggression pacts. This study does not include all of these five types of agreements; only defense pacts are included because defensive alliances fit the theoretical arguments made earlier. Here I assume a situation where security commitments are provided by major powers to minor powers and then consider how minor powers will change their alliance policy as their capabilities increase. To code asymmetric alliances, I use the COW classification of major power status. In addition, following Morrow (1991), I code the United States as a superpower in the post-World War era and the Soviet Union as a superpower from 1945 to 1990.

In order to determine which cases are included in the sample for analysis, it is necessary to discuss how alliance termination is defined here. Since this study focuses on how alliances end, it considers different modes of alliance termination following the work of Leeds and Savun (2007). They classify alliance termination into four modes: 1) fulfillment, 2) loss of independence, 3) renegotiation, and 4) violation. Based on these four modes of termination, I determine which cases are included in the sample for analysis and which ones are excluded from the sample.⁹ If alliances are terminated for some reason explicitly unrelated to the theoretical arguments made here then including such cases in the sample may result

⁷ To generate a dataset for the statistical analysis conducted here, I used the EUGENE program (Bennett and Stam 2000). The EUGENE program is available at <http://eugenesoftware.org>.

⁸ The sample of alliances includes only bilateral alliances, which refer to alliance agreements signed by two independent states. Multilateral alliances are excluded from analysis.

⁹ More precisely, those cases are right-censored.

in a misleading conclusion about the determinants of alliance termination. Let me start with the fourth mode-violation. All violation cases are included in the sample regardless of which side violated the terms of the agreement. The reasons for including all the violation cases are twofold. First, it is hard to identify which side violated the agreement (Leeds and Savun 2007, 1125). Second, if a major power ally recognizes its partner's grievance against the current defense agreement, it may declare the end of the alliance unilaterally, anticipating excessive demands by its weaker ally for changing the current agreement. For these reasons, I include all the violation cases because the underlying causal mechanism described above can still work even when the major power is responsible for the termination of the agreement.

Now, turn to the fulfillment category. This category broadly means that an alliance ends as its specific purpose is fulfilled. The fulfillment category can be divided into two subcategories: achievement of alliance goals and lapse (Leeds and Savun 2007, 1124). For example, some alliances have specific goals at the time of formation and the agreements make it clear that the alliance will be terminated once the goals for the alliance are achieved. The U.S.-Israel alliance agreement of 1981 is a case in point. They formed an alliance specifically against the Soviet threat, and they agreed to make the alliance effective as long as a Soviet's threat existed. As a result, they ended the alliance in 1991 when the threat disappeared with the breakup of the Soviet Union.¹⁰ If an alliance has a specific goal, and if it is terminated with its goal accomplished, I do not consider those cases in the sample to be terminated because these cases have little to do with the causal mechanisms associated with alliance termination that this study seeks to assess. Rather, I have those cases right-censored.¹¹

However, if alliances end with the consent of allies not to extend the alliance, which fits in to the second subcategory of fulfillment (lapse), I include some of the cases for analysis by looking at the causes of their terminations because, in those cases, we cannot exclude the possibility that either ally had some grievance against the other, and this may have resulted in failure to extend the alliance agreement. For the sake of accuracy and consistency in making those decisions, I refer to the ATOP data. The ATOP data provides information about the modes of alliance termination (TERMMODE), as well as the causes of alliance termina-

¹⁰ Article 1 of the U.S.-Israeli agreement says, "United States-Israel strategic cooperation, as set forth in this memorandum, is designed against the threat to peace and security of the region caused by the Soviet Union or Soviet-controlled forces from outside the region introduced into the region." Accessed at http://avalon.law.yale.edu/20th_century/pal03.asp (March 1, 2014).

¹¹ This allows us not only to include relevant cases in the sample for analysis, but also to use the information about those right-censored cases until their termination.

tion (TERMCAUS). Regarding fulfillment, the ATOP provides five modes of termination and TERMMODE=1 or 5 falls within the fulfillment category. TERMMODE=1 means, "The alliance was not renewed at its scheduled termination date." TERMMODE=5 means, "The specified casus foederis ceased to exist and thus the alliance was moot" (Leeds 2005, 19). While the TERMMODE variable specifies the conditions under which an alliance member left the alliance, the TERMCAUS variable provides information about why an alliance member left the alliance. If terminated alliances are coded as TERMCAUS=3 of the eight causes identified in the ATOP, which means that the alliance ended because "[t]he problem the alliance was aimed at was resolved" (Leeds 2005, 19), I had those fulfillment cases right-censored. In sum, if TERMCAUS is equal to 3 and if either TERMMODE is equal to 1 or 5, such cases were right-censored. By this coding rule, 6 cases were right-censored.¹²

In addition, I consider the second mode of termination examined in Leeds and Savun (2007), loss of independence. Some alliances are considered terminated due to the fact that one of the alliance members lost independence. In such cases, however, it is probable that allied states sometimes lose independence for reasons unrelated to the alliance relationship, so those lost independence cases are right-censored (Leeds and Savun 2007, 1124). Based on the coding of the ATOP dataset, I had several cases right-censored if its TERMMODE=4 and TERMCAUS=2 (and TERM=0), which means that one of the allied members lost independence without regard to the alliance relationship. By this coding rule, two cases were right-censored.¹³

Finally, when alliance partners renegotiate their alliance agreement and replace it with a new treaty before the old agreement becomes ineffective, I coded such alliance cases as not terminated. That is, I code such renegotiation cases – by which I mean cases where replacing the old alliance agreement with a new agreement takes place in the same year and thus both sides are in an alliance during the transition period – as continued. For instance, as the Japanese case mentioned earlier suggests, although the United States and Japan replaced the old treaty of 1953 with the new treaty of 1960, they did not abrogate their alliance ties. Thus, I coded the U.S.-Japan alliance as started in 1953 and continuing until 2002. This coding rule found 10 renegotiation cases including the Japan case.¹⁴

¹² These six cases include U.S.-Panama (1977), U.S.-Spain (1963), U.S.-Portugal (1944), Britain-Ethiopia (1944), and China-Japan (1918). The years in parentheses in this section indicate the years of alliance formation.

¹³ These two cases are France-Poland (1921) and Britain-Poland (1939).

¹⁴ These renegotiation cases include Britain-Jordan(1948), Britain-Iraq(1955), Soviet Union-

As a result of this coding rule, 1022 bilateral alliance years were identified with 54 bilateral alliances included in the sample.¹⁵ Of the 54 bilateral alliances, 32 alliances were terminated, and the mean duration of the alliances in the sample was 15 years. The shortest-lived alliances lasted for only one year, while the longest-lasting alliance lasted for 52 years.¹⁶

INDEPENDENT VARIABLES

Change in the Capabilities of the Weaker State: To test the hypothesis presented earlier, it is necessary to measure the change in the capabilities of the weaker ally. To this end, how to define capabilities should be determined. In this study, I use energy consumption data in the COW CINC score to operationalize a state's capabilities. In most of the IR quantitative analyses, the COW CINC score is used to capture a state's capabilities. However, in this study I use energy consumption to represent a state's capabilities because it essentially captures the idea of economic capabilities that can be transferred to military capabilities. Another advantage of using consumption data lies in the availability of data dating back to 1816 and its higher correlation with GDP data, whose availability is relatively limited (usually available since 1945). In addition, when it comes to the concept of capabilities in IR, it refers primarily to relative capabilities in the system. To operationalize a state's capabilities with respect to relative capabilities, I sum up the level of energy consumption of all of the countries in the system in a given year and divide a state's energy consumption by this summed value. In sum, a state's capabilities in a given year are operationalized as the energy consumption of the state over the sum of the energy consumption of all the states in the system. Thus, a state's capabilities in a given year indicate the state's share of capabilities in the system.¹⁷

Since this study focuses on changes in capabilities, it is necessary to discuss how to represent those changes in capabilities. Here I follow Leeds and Savun's (2007)

China(1950), Soviet Union-Poland(1965), Soviet Union-Mongolia(1966), Soviet Union-Hungary(1967), Soviet Union-Bulgaria(1967), Soviet Union-Czechoslovakia(1970), and Soviet Union-Romania(1970). Here the years in parentheses indicate the years when the old agreements were replaced by new agreements.

¹⁵ Right-censoring the cases and recoding renegotiation cases as not terminated did not affect the estimation results. When I ran the models by including the excluded cases and by recoding the renegotiated cases as terminated, I found similar results to what I obtained from the main analysis. The sign and significance of the coefficients for the key independent variables remained intact. These results are reported in the Appendix.

¹⁶ The longest alliance is a right-censored case.

¹⁷ A state's relative capabilities calculated here is analogous to a state's CINC score in the COW data. The only difference is here I consider only energy consumption levels.

basic idea of operationalizing changes in capabilities. Rather than calculating an annual change of capabilities, they set the year of alliance formation as a baseline year and calculate the change from that baseline year. Then, they calculate a percentage change of capabilities in a given year. Here I calculate changes in capabilities by using the year of alliance formation as the baseline year, but I do not calculate the percentage change of capabilities because there are many zero values in the energy consumption data at the time of alliance formation, indicating the pre-industrial economy of the countries in question. Thus, calculating percentage values can lead to many missing values because of the zero denominators. For this reason, I simply subtract the baseline year's relative capabilities from a current year's relative capabilities. Consequently, the change in capabilities of a minor power in a given year (t) is calculated as follows:

$$\text{Change in Capabilities}_{it} = \frac{\text{Energy Consumption}_{it}}{\sum_j \text{Energy Consumption}_{jt}} - \frac{\text{Energy Consumption}_{io}}{\sum_j \text{Energy Consumption}_{jo}}$$

Here i denotes a minor power and $j = 1; 2; \dots, N$; N is the number of states in the system in a given year.

Intuitively speaking, this measure captures changes in the share of total capabilities of a minor power in the system. The mean value of this measure is 0.0025, which indicates that minor powers undergo on average a 0.25 percentage point increase in the share of the capabilities measure from the year of alliance formation.

Economic Dependence: To measure the economic dependence of a weaker ally on its stronger ally, this study uses a weaker state's trade dependence on its stronger ally. In IR studies, the trade dependence of a country has been operationalized as a ratio of bilateral trade to the country's GDP or a ratio of bilateral trade to the country's total trade.¹⁸ Of the two, I use the latter because the availability of GDP data is temporally limited. To obtain annual trade and bilateral trade data, I use the COW Trade Data (v.2.0) extracted from the EUGENE program. In this study, I focus on the economic dependence of minor powers on their major power allies and, thus, trade dependence in a given year is operationalized as follows:

$$\text{Trade Dependence}_{it} = \frac{\text{Bilateral Trade}_t}{\text{Total Trade of Minor Power}_t}$$

¹⁸ Gartzke and Li (2003b) calls the former measure trade dependence and the latter trade share, and which measure is more appropriate for capturing economic interdependence has been a subject

CONTROL VARIABLES

Here I include a set of control variables that may confound the theoretical relationship or affect alliance duration.

Change in the Capabilities of the Stronger State: In this study, I focus on how the change in capabilities of the weaker state can affect alliance duration. However, it is also likely that the change in the capabilities of the stronger state can affect alliance duration. Since in an asymmetric alliance the major power's capabilities take up a major portion of the alliance, the major power's change in capabilities may alter the valuation of the alliance (Morrow 1991). In particular, if the major power's capabilities decline, the value of an asymmetric alliance also declines. Therefore, I expect that a decrease in a major power's capabilities increases the likelihood of alliance termination. To measure the change in capabilities of the major power ally, I applied the same procedures that I used to measure the change in the capabilities of a minor power ally.

Changes in Threat: An external threat is an important factor that can influence alliance formation and, whether such a threat persists or not, can influence alliance duration (e.g. Walt 1987; 1997). We can anticipate that, as an external threat declines, alliances are more likely to terminate. To control for the threat effect, I used a similar method to the one that I applied to capture the change in capabilities – a relative change in capabilities from the year of alliance formation. To identify sources of threat, I use the strategic rivalry data collected by Thompson (2001). By focusing on policymakers' perceptions of threat rather than on the frequency of military disputes between states in defining rivalries (Klein, Goertz and Diehl 2006), Thompson's strategic rivalry data have more strength than dispute-based rivalry data, given that defensive alliances generate deterrent effects (Leeds 2003; Johnson and Leeds 2011). Therefore, it is highly probable that we can observe no dispute between rivals, and Thompson's data take this possibility into consideration. Based on Thompson's data, I calculate the CINC score of a particular rival state corresponding to an allied state. Then this rival state's CINC score in the year of alliance formation serves as the baseline threat posed to an allied state. The changes in threat are then calculated as the current year's rival CINC score minus the baseline year's rival CINC score.¹⁹ Here I separate the changes in threat faced by a minor power from those faced by a major power. I expect that the decline in threat may increase the likelihood of

of heated debate (e.g. Oneal and Russett (1999), Barbieri and Peters (2003), Gartzke and Li (2003a), Gartzke and Li (2003b)).

¹⁹ However, there is some drawback from using strategic rivalry data because not all states have a strategic rival. Of the 1016 observed years, 611 (60.14%) years had no strategic rivals.

alliance termination.

Domestic Political Changes: Domestic political changes can influence a country's foreign policy. Siverson and Starr (1994) find that drastic domestic political changes, such as a military coup that may alter the rules of the game under which domestic politics is played out, may affect alliance policy. Leeds et al. (2009) also find that leadership changes accompanied by changes in societal supporting coalitions increase the likelihood of alliance termination, although such an effect is more prominent in nondemocratic regimes than in democratic regimes. These findings suggest that domestic political changes involving domestic institutional changes, or the emergence of new domestic political forces, can affect existing foreign policy in general and alliance policy in particular.

To control for the effects of domestic political changes, this study includes two control variables. One focuses on institutional changes and the other on social preference changes.²⁰ To measure institutional changes, I use polity scores from the POLITY IV dataset (Marshall, Gurr and Jaggers 2010). Following Leeds and Savun (2007), I consider domestic institutional change from the time of alliance formation. Leeds and Savun operationalize a two-point polity score change from the time of alliance formation as the occurrence of domestic institutional change. Here I define it slightly differently, counting a three-point polity score change in minor powers as institutional change and a one-point polity score change in major powers as institutional change.²¹ Then, if either the major or the minor power undergoes a domestic political change in a given year as defined above, I code the variable as one; otherwise, zero. Thus, domestic political change is a binary variable. As the prior empirical findings suggest, I expect that domestic institutional change will increase the likelihood of alliance termination.

To measure social preference change, I employ a leadership change variable called SOLS change²² drawn from the Change in Source of Leader Support (CHISOLS) dataset collected by Leeds and Mattes (2013). In the original dataset, the leadership change variable that accounts for a change in the societal supporting coalitions is a count variable because SOLS change can occur more than once

²⁰ This distinction between institutional change and social preference change is intended to isolate one effect from the other, as in Leeds et al. (2009).

²¹ I use this coding rule because major powers are less likely to undergo institutional change than are minor powers. Looking at the polity score change from the year of alliance formation, I find minor powers' 75 percentile polity change falls on a three-point change, while major powers' 75 percentile polity change falls on a one-point change. That is why I chose these threshold values.

²² To avoid any confusion between a simple change in leadership and leadership change accompanied by a supporting change in coalitions, hereafter I call the variable for leadership change accompanied by supporting coalitions SOLS change because, in the original dataset, the variable is named "sols change."

in a year. Here I recode the SOLSchange variable into a binary variable. Thus, if there is any SOLSchange in either major or minor power in a given year, the variable of the year was coded one; otherwise, zero. Currently, the dataset is available from 1945. Thus the SOLSchange variable is included in the statistical model testing the hypothesis in the post-1945 era. Finally, I expect that SOLSchange will increase the likelihood of alliance termination, as prior studies suggest.

Joint Democracy: According to Gaubatz (1996), joint regime type may also influence the duration of alliances. If democratic regimes are more committed to international treaties than nondemocratic regimes, and if alliance duration reflects this distinct joint regime characteristic, we can expect that alliances formed by joint democratic regimes will tend to last longer than those by nondemocratic regimes. To operationalize the joint regime type, I use Polity2 scores from the POLITY IV data (Marshall, Gurr and Jaggers 2010), which range from -10 to 10, with lower scores indicating less democratic regimes. To make a joint democracy variable dichotomous, I code a pair of countries as joint democracies (=1) if both countries have a Polity2 score equal to or higher than six in a given year; otherwise, zero.

New Alliance Formation: If an allied state forms a new alliance with a third country, this may affect the relationship with an existing ally. An allied state also may form a new alliance in order to change its existing alliance policy. Prior studies indicate that new alliance formation will increase the likelihood of the termination of pre-existing alliances (Leeds and Savun 2007; Leeds, Mattes and Vogel 2009). To account for this effect on alliance termination, I include a dummy variable in the model using the ATOP dataset. If either of the allied states formed a new alliance in a given year, regardless of the type of alliance, that year was coded one; otherwise, zero. I expect that newly formed alliances may increase the likelihood of alliance termination.

Economic Cooperation: Here one of the key independent variables is the economic dependence of a minor power on a stronger ally. However, the variation in economic interactions between allies may stem from the commitment to engage in economic cooperation at the alliance formation stage. That is, allies that included a provision for economic cooperation in their alliance agreement may engage in more trade than those that did not (2007). I looked at each alliance case and checked whether each agreement refers specifically to economic cooperation.²³ If an alliance agreement contained a provision for economic cooperation, I coded the alliance one; otherwise, zero. Thus, this economic cooperation variable is a

²³ To do this, I referred to the ATOP code sheets accessed at <http://atop.rice.edu/codesheets> (March 18, 2014).

binary variable.

Economic Aid: For reasons similar to why I included the economic cooperation variable in the model, I also controlled for the effect of a commitment by the stronger ally to provide economic aid to the weaker alliance partner. If states are committed to offering economic aid to alliance partners in various forms, such a commitment can affect the level of economic dependence and the likelihood of alliance termination as well. The ATOP dataset provides information about this kind of aid commitment (Leeds 2005). ATOP classifies three types of economic aid: 1) general economic aid, 2) aid for postwar recovery, and 3) trade concessions such as granting MFN status. However, here I do not make distinctions as to which type of aid is committed. Instead, if an agreement includes any type of economic aid commitment, I then code the economic aid variable as one; otherwise, zero. Thus, this is also a binary variable. I expect that alliances with provisions for economic aid are less likely to terminate than those without.

Former Colony: Past history between allies can affect alliance duration. In particular, if a minor power was a colony of its major power ally, and if this special relationship affected their decision to form an alliance, it may also affect alliance termination. From the minor power's point of view, an alliance with a former colonizer may be viewed as a colonial legacy that it seeks to overcome in the end, or it may be viewed as a source of economic aid for economic development. Thus, although it is difficult to predict in which direction – towards termination or continuation – the history of colonial rule may have a stronger effect, still it is likely to affect the alliance relationships. To identify whether the allied states had a colonial history, I use the ICOW Colonial History Data Set (v. 0.4), which provides information about whether a country was a colony of a certain country (Hensel 2009). Thus, if a weaker state was a former colony of its stronger ally, the alliance is coded one; otherwise, zero.

Table1. Descriptive Statistics

Variables	Mean	SD	Min	Max
Alliance Duration (year)	15.132	14.248	1	52
Capabilities Change of the Weak	.0025	.009	-.016	.057
Economic Dependence	.248	.162	0	.963
Capabilities Change of the Strong	-.032	.084	-.342	.098
Change in Rival Capabilities (W)	.0007	.023	-.139	.339
Change in Rival Capabilities (S)	-.0783	.127	-.563	.314
Domestic Institutional Change	.103	.304	0	1
Joint Democracy	.176	.381	0	1
SOLS change	.132	.338	0	1
New Alliance Formation	.403	.491	0	1
Economic Cooperation	.407	.491	0	1
Economic Aid	.194	.396	0	1
Former Colony	.318	.466	0	1

RESULTS

To evaluate the validity of the hypothesis presented above, I explore the effects of the key independent variables across several model specifications. The results are reported in Table 2. Since I use the COX proportional hazard model, the positive coefficients indicate a shorter duration (or a greater likelihood of termination) and the negative coefficients a longer duration (less likelihood of termination).

Model 1 includes only the key independent variables without the set of control variables. Since including control variables would drop many observations due to missing values in the set of control variables, I included the key independent variables only to test the first hypothesis with as many observations as possible. I find strong support for the hypothesis in the first model. The coefficient for the interaction term is negative and statistically significant at the .01 level, suggesting that when there is an increase in the capabilities of a weak ally and a high level of economic dependence of the weak ally on its stronger ally, the alliance is less likely to terminate. In addition, the first-order term – the coefficient for a change in capabilities – is positive and statistically significant at the .01 level. Since I included the interaction term in the model, the effect of a change in capabilities of the weaker state on alliance termination represented a conditional effect when there was no economic dependence of the weaker state on its stronger ally (Brambor,

Clark and Golder 2006; Braumoeller 2004). That is, when the weaker state is not at all economically dependent on its stronger ally, as the positive coefficient indicates, such an alliance is more likely to end.

Here, I did not make an explicit theoretical prediction about the effect of economic dependence on alliance termination because my argument focuses on an interaction effect of a change in capabilities and economic dependence. That is, the starting point of my theoretical argument presupposes an increase in the capabilities of the weaker ally in an asymmetric alliance. In this regard, I did not provide any theoretical prediction about the effect of economic dependence on alliance duration when there is no change in capabilities. Nor did I provide any theoretical prediction about an independent effect of economic dependence on alliance termination. However, provided there is no capabilities increase in the weaker ally, such an alliance is less likely to terminate. The estimated coefficient for economic dependence in Model 1 indicates that, given no change in capabilities, the higher the level of economic dependence, the less likely the alliance is to end. However, this is statistically significant only at the .1 level, and this effect becomes insignificant in the other models. This result suggests that economic dependence generates a conditional effect rather than an independent effect on alliance termination, especially when the weaker ally's capabilities are on the rise.

Table 2. Event History Analysis of Alliance Termination, 1870-2002

	(1) Basic	(2) Full	(3) Post1945	(4) No Interaction	(5) CINC	(6) Weibull
Capabilities Change(W)	43.40*** (14.96)	74.45*** (27.38)	95.94** (39.62)	10.81 (28.53)	285.54*** (97.04)	30.55** (15.15)
Economic Dependence	-2.15* (1.17)	-1.42 (1.32)	-0.79 (1.55)	-1.66 (1.46)	-1.55 (1.51)	-1.61 (1.40)
Cap Changex Econ Dep	-735.38*** (239.15)	-664.81*** (247.51)	-770.00** (307.37)		-1841.75*** (395.41)	-612.44** (270.62)
Capabilities Change(S)		-0.17 (3.26)	-3.39 (4.19)	1.62 (3.63)	-7.16 (6.05)	0.13 (2.71)
Changesin Rival Cap(W)		14.42** (6.11)	13.23 (13.32)	13.45 (8.83)	18.52*** (4.35)	12.47 (10.22)
Changesin Rival Cap(S)		-2.41** (1.22)	-6.33*** (2.31)	-2.20* (1.22)	-1.90 (1.33)	-2.64*** (0.98)
Institutional Change		0.95* (0.49)	1.08** (0.53)	0.99** (0.48)	0.81* (0.46)	0.75* (0.40)
Joint Democracy		0.27 (0.45)	-0.12 (0.67)	0.16 (0.51)	0.18 (0.53)	0.52 (0.47)
New Alliance Formation		0.49 (0.50)	0.93 (0.60)	0.68 (0.48)	0.77* (0.45)	0.53 (0.38)

	(1) Basic	(2) Full	(3) Post1945	(4) No Interaction	(5) CINC	(6) Weibull
Economic Cooperation		0.23 (0.46)	0.71 (0.57)	0.30 (0.48)	0.54 (0.42)	0.26 (0.40)
Economic Aid		0.19 (0.49)	0.41 (0.50)	0.63 (0.41)	0.39 (0.44)	0.05 (0.52)
Former Colony		0.49 (0.41)	0.56 (0.50)	0.51 (0.42)	0.69* (0.40)	0.53 (0.37)
SOLSCchange			0.88** (0.44)			-5.03*** (1.01)
Constant						-5.03*** (1.01)
<i>Inp</i>						0.18 (0.18)
Observations	1022	994	883	994	994	994
Log Likelihood	-84.20	-69.84	-47.00	-73.13	-66.81	-36.23
Subjects	54.00	52.00	44.00	52.00	52.00	52.00
Failures	32.00	30.00	25.00	30.00	30.00	30.00
Time at Risk	1022.00	994.00	883.00	994.00	994.00	994.00
Chi-Squared	16.67	32.85	37.30	27.05	52.45	95.26

Dependent variable: Alliance termination
W*denotes Weak State; S*denotes Strong State
Robust standard errors in parentheses
*p<.10,**p<.05,***p<.01

Across the other models specified to test the hypothesis, I also find strong support for the hypothesis. Even when all control variables except SOLSCchange are included in the model, as shown in Model 2 (Full), the relationships between the key independent variables and the dependent variable remain intact. Even when the temporal domain is limited to the post-World War era, the relationships remain intact. Both the coefficients for a change in capabilities and for the interaction term are statistically significant at the .05 level.

I also include a model without an interaction term between a change in capabilities and economic dependence to see if there is an independent effect of the change in capabilities of weaker states on alliance termination. For example, Morrow (1991) argues that changes in the capabilities of the weaker ally have little effect on alliance duration due to the marginal contribution to the total capabilities of the alliance. The results from Model 4 (No Interaction Model) show that the increased capabilities of minor powers have no discernible effect on the likelihood of alliance termination. This may support Morrow's argument, but the presence of the conditional effect suggests that the effect of a change in capabili-

ties on alliance termination is highly conditional upon economic dependence, lending support to the hypothesis.

In Model 5, I replace the energy consumption variable with the CINC score. The results from this model are consistent with those from the prior models tested using the energy consumption measure, and lend support to the hypothesis. Both the coefficient for the CINC change in capabilities and the coefficient for the interaction term are consistent with the hypothesis and are highly statistically significant. Thus, the empirical finding is robust to the measurement change.

In the final model specification, I replace the semi-parametric COX proportional hazards model with a parametric Weibull model to see if using the parametric model can affect the estimation result. As shown in Model 6, there is little change in the result. Since the Weibull model includes a shape parameter to estimate, the estimate for this parameter is reported here. The shape parameter (p) indicates the shape of the baseline hazard (or duration dependence). If $\ln p$ is positive or p is greater than one, it means that the event of interest is likely to occur over time. By contrast, if $\ln p$ is negative or p is less than one, it means that the event of interest is less likely to occur as time passes.²⁴ Here the estimated coefficient for $\ln p$ is .18, which indicates that asymmetric alliances are more likely to terminate over time. However, this is not statistically significant. Therefore, we find no evidence of duration dependence in this sample.

Finally, let me briefly discuss the results of the set of control variables included in the model. First, we expect that with an increase in the capability of the stronger ally, the alliance is less likely to end because the stronger ally makes an essential contribution to the overall capabilities of the alliance and, thus, maintaining the alliance is a more attractive option. As expected, the coefficients for the stronger ally's change in capabilities are all negative across the models, but they all fall short of being statistically significant. Thus, I find no strong evidence that a decline of a stronger ally's capabilities increases the likelihood of alliance termination. Here I include the rival's change in capabilities as a proxy for threat. However, the empirical results from this variable are somewhat puzzling. In particular, the coefficients suggest that, when the capabilities of a strategic rival faced with a weaker ally increases relative to the time of alliance formation then the alliance is more likely to terminate. Furthermore, some of the coefficients are highly significant, as in Model 2 and Model 5. This puzzling result may stem from the possibility that strategic rivalry is not a valid measure for an external threat.²⁵

²⁴ If it is zero, it means that there is no duration dependence.

²⁵ In fact, there are many cases where weaker allies do not have any strategic rival in the data. Of the 1016 observed years, 611 (60.14%) years had no strategic rivals. This fact poses a challenge to the

Otherwise, as the result indicates, asymmetric alliances may be less influenced by a change in the capabilities of an external threat, although this interpretation may not be so convincing.

Domestic institutional changes seem to increase the likelihood of alliance termination. Despite some variations in the significance level, the coefficients for institutional change are all positive and statistically significant. I find a similar result for leadership changes accompanied by changes in societal supporting coalitions, although it is statistically significant only at the .1 level. These empirical findings are consistent with prior findings that domestic institutional changes, either in a major or in a minor power, lead to change in alliance policy (Leeds and Savun 2007; Leeds, Mattes and Vogel 2009).

Joint democracy has no discernible impact on the likelihood of alliance termination, nor does new alliance formation have a significant effect on the likelihood of alliance termination, although the signs of the coefficients are positive as predicted. A history of being a former colony tends to increase the likelihood of alliance termination. This may suggest that a weaker ally that experienced colonial rule by its major power ally may have a stronger desire to seek more autonomy; however, the coefficient for former colonial rule is significant only in Model 5. Finally, the results from economic cooperation and economic aid are puzzling. Contrary to the prediction, the coefficients for economic cooperation and economic aid are all positive, although most of them are not statistically significant.

argument that alliances are formed in response to external threats in the first place.

Figure2. This figure illustrates how the predicted hazard rate changes in response to changes in the level of economic dependence over changes in capabilities

SUBSTANTIVE EFFECTS

So far I have discussed whether the estimated coefficients are statistically significant; that is, whether the effects of the key independent and control variables are statistically discernible from zero. However, it is also necessary to examine the substantive effects: the size of the effects of the key variables of interest on the likelihood of alliance termination. Figure 2 illustrates the extent to which the predicted hazard rates change in response to changes in the level of economic dependence over changes in the share of capabilities of the minor power. In the event history model, the coefficients obtained from estimation defy intuitive interpretations. In this regard, hazard ratios obtained by the exponentiation of the coefficients are more intuitively appealing. However, the obtained hazard ratio values should also go through a computational process, although not complex, to obtain values that allow for easier interpretation. For example, if a hazard ratio (HR) is .4, it means that the predicted hazard rate (or the risk of termination) decreases by 60 percent. This predicted hazard rate change is obtained by this simple formula (Box-Steffensmeier and Jones 2004, 60):

$$\Delta hazard\ rate(\%) = (HR - 1) \times 100 = \left(\frac{e^{x_2\beta}}{e^{x_1\beta}} \right) - 1 \times 100$$

There are a couple of advantages of using this formula. Since the calculation of hazard rate changes is based on hazard ratios, it allows us to assess the changes of the predicted hazard rate when an independent variable of interest changes from x_1 to x_2 . In addition, since the hazard ratio is constant over time in the proportional hazard model – and in this analysis the proportional hazard assumption does hold – it can be assumed that the resulting predicted hazard rate changes remain constant over time. For these reasons, I report predicted hazard rates change (%) on the y-axis. The x-axis represents the change in capabilities. For easier interpretation of the x-axis variable, I multiply the change in capabilities values by 100 so that they can represent a percentage point change in the share of capabilities. Originally, the change in capabilities represents the current year's share of capabilities in the system $\left(\frac{Energy\ Consumption_{it}}{\sum Energy\ Consumption_{jt}} \right)$ minus the baseline year's share of capabilities in the system $\left(\frac{Energy\ Consumption_{io}}{\sum Energy\ Consumption_{jo}} \right)$. However, each share of capabilities was not calculated as a percentage, so I multiply them by 100 to make each share represent percentage point values. As a result, if an original value of the change in capabilities is equal to 0.003 in a given year, for example, then it is equivalent to a 0.3 percentage point change in the share of capabilities. Intuitively speaking, if this occurred to a state, it means that the state's relative capabilities increased by 0.3 percentage points as compared to those of the year of alliance formation.²⁶

Here I also added two reference lines in the graph. The vertical reference line indicates the mean value of the change in capabilities (0.25 percentage points), and the horizontal reference line indicates a zero of the predicted hazard rate change. A diamond-shaped point represents the mean value of a predicted hazard rate change at the corresponding x-axis value and the vertical bar from the mean value represents a 95 percent confidence interval. Thus, if a 95 percent confidence interval line touches the zero horizontal bar, then the predicted hazard rate change is indiscernible from zero at the .05 significance level.

Here I illustrate how the risk of termination (or predicted hazard rate) changes

²⁶ Since minor powers take up a tiny proportion of global capabilities, this figure may be too small to have an intuitive understanding. Let us assume that the world is composed of two states, state A and state B. Then, state A and state B form an alliance, state A accounts for 50 percent of the global capabilities in the year of alliance formation, and its share increases up to 80 percent in year t, for example. Then, state A's capability change in year t is equal to 0.3(0.8-0.5), meaning a 30 percentage-point change in the share of capabilities.

as the level of economic dependence grows. The graph on the left shows how the risk of termination changes as the level of economic dependence changes from 8 percent to 25 percent. Here 8 percent represents one standard deviation below the mean of economic dependence and 25 percent represents the mean value of economic dependence. I argued earlier that when there is an increase in the capabilities of minor powers, asymmetric alliances with economically dependent minor powers are less likely to terminate. As predicted, the risk of termination decreases, as the graph illustrates. For example, when a change in the share of capabilities is .4 percentage points,²⁷ the risk of termination decreases by 48 percent as the economic dependence level changes from 8 percent to 25 percent. This suggests that when there are two minor power allies under comparison, whose economic dependence level is 8 and 25 percent, respectively, the latter's risk of termination is 48 percent lower than the former when they both experience a substantial rise in their capabilities. Meanwhile, the graph on the right illustrates how the risk of termination changes when the economic dependence level changes from 8 percent to 41 percent.²⁸ Again, when the change in capabilities share is fixed at .4 percentage points, the risk of termination decreases by 69 percent. These results show that in the meaningful ranges of the independent variables, the substantive effects of the independent variables are substantial and significant.

²⁷ Here I chose the change in the share of capabilities (.4 percentage points) to represent a significant increase in the capabilities of a weaker ally, and this value falls on the 75 to 90 percentiles of the change in capabilities.

²⁸ Here 41 percent represents one standard deviation above the mean of economic dependence.

Figure3. Estimated Survival Functions

Finally, Figure 3 illustrates estimated survival functions corresponding to Figure 2. I fixed the value of the change in capabilities at .4 percentage points as before, with all other values of the variables held at their mean values. The visualized estimated survival functions show that when there is substantial change in capabilities on the side of the weaker ally, the durations of alliances differ depending on the levels of economic dependence. As predicted, when there is a significant increase in the capabilities of a weaker ally, alliances with a weaker ally whose level of economic dependence on its stronger ally is low have lower probabilities of survival in a given year than alliances with a weaker ally whose level of economic dependence is high. Also, the differences in predicted survival probabilities become larger as the differences in the level of economic dependence increase, as the graph on the right side illustrates.

CONCLUSION

In this study, I have explored whether and how a change in the capabilities of minor powers in asymmetric alliances can affect alliance duration. In existing studies, whether a minor power's change in capabilities in an asymmetric alliance

has any effect on alliance duration has not been clarified. Starting from the structural condition that minor powers suffer from severe autonomy concerns in asymmetric alliances due to the power gap with their stronger allies, this study developed arguments on how a change in the capabilities of minor powers can affect the likelihood of alliance termination. I argued that as the capabilities of minor powers increase in asymmetric alliances, they have an ability to gain more autonomy, and this will destabilize the existing alliance. More precisely, I argued that whether increased capabilities of minor powers can lead to alliance termination is conditional upon their economic dependence on major powers because, under economic dependence, ending the alliance can jeopardize economic benefits from the alliance relationship which may provide the very sources for the increased capabilities of those minor powers. I tested this argument against empirical data and found strong support for this conditional argument. This implies that asymmetric alliances that link security interests with economic interests are more likely to endure than otherwise, and that economic dependence serves to restrain weaker allies from seeking more autonomy by ending alliances. In this regard, economic benefits that the weaker ally gains from trade with the major power ally may be considered by the weaker ally as some compensation for its autonomy concern. This finding suggests that for major powers that want to continue alliances, promoting economic ties with weaker allies when the capabilities of those weaker states increase would be an effective policy in managing the alliance relationship.²⁹

Finally, what can we learn from this and how can this study advance our understanding of international politics? This study attempted to ascertain a causal mechanism driven by changes in the capabilities of minor powers in asymmetric alliances. By highlighting the autonomy concerns of the weak state, which was done by defining the notion of autonomy in a traditional sense, this study urged paying due attention to the autonomy concerns of the minor power, which has been relatively ignored even in Morrow's security-autonomy tradeoff model. Given that asymmetric alliances take up almost 50 percent of military alliances (Fordham 2010), and that military alliances have been recognized as an impor-

²⁹ This study has some policy implications for the ROK-U.S. alliance. While South Korea's capabilities have gradually increased due to its economic growth since 1960, its trade dependence on the United States has relatively declined in recent years, with China replacing the United States as the top export market since 2003. (Manyin et al. 2014, 27) This may suggest that, in structural terms, the ROK-U.S. alliance is inching towards dissolution rather than consolidation, *ceteris paribus*. In this sense, the former South Korean government's efforts to regain wartime operational control might be interpreted as part of an attempt to regain autonomy. As such, this study raises issues related to the ROK-U.S. alliance, and delineating appropriate policy implications requires further research.

tant policy tool for maintaining security and peace in the world, advancing our understanding of how to maintain alliances is important. In this regard, the empirical findings of this study suggest that paying more attention to the autonomy concerns of minor powers, and investigating further how they can impact alliance relationships, could be a promising direction for future research.

Table3. [Appendix] Event History Analysis of Alliance Termination, 1870-2002

	(1) Model1	(2) Model2	(3) Model3
Capabilities Change(W)	76.62*** (25.68)	112.68*** (27.80)	73.90*** (26.27)
Economic Dependence	-0.94 (1.09)	-1.53 (1.36)	-0.84 (1.08)
Cap Changex Econ Dep	-686.95*** (232.36)	-751.94*** (272.81)	-499.71*** (190.15)
Capabilities Change(S)	0.07 (2.91)	-0.89 (3.07)	0.41 (2.71)
Changesin Rival Cap(W)	13.39** (5.28)	15.17** (6.62)	11.87** (5.85)
Changesin Rival Cap(S)	-2.72** (1.18)	-3.63** (1.75)	-2.85* (1.59)
Institutional Change	0.88* (0.47)	1.08*** (0.40)	0.53 (0.37)
Joint Democracy	0.42 (0.38)	0.41 (0.49)	0.55 (0.37)
New Alliance Formation	0.51 (0.46)	0.52 (0.47)	0.22 (0.39)
Economic Cooperation	0.25 (0.40)	0.16 (0.44)	0.29 (0.37)
Economic Aid	-0.01 (0.49)	0.14 (0.54)	0.11 (0.48)
Former Colony	0.18 (0.38)	0.68* (0.39)	0.40 (0.35)
Observations	994	994	994
Log Likelihood	-83.21	-77.26	-109.29
Subjects	52.00	61.00	61.00
Failures	34.00	30.00	38.00
Time at Risk	994.00	994.00	994.00
Chi-Squared	32.87	66.84	42.38

Model1: Renegotiated as not terminated with the right-censored cases as terminated

Model2: Renegotiated as terminated with the right-censored cases intact

Model3: Renegotiated as terminated with the right-censored cases as terminated

Robust standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

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