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Are Cross-Border Movements and Border Security Complements?¹

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Abstract

The paper addresses a debate about a tradeoff between security and cross-border movements. It suggests that trade and security may be viewed as complements not substitutes to each other. Trade provides the incentives for the trading partners to participate in security policies and to efficiently specialize in security projects.

Introduction

Prior to the attacks on September 11, 2001, Canada and the United States were on their way to effectively eliminating the Canada-U.S. border. The International Boundary has become commonly referred to as “The World’s Longest Undefended Border.” The *1995 Canada-United States Accord on Our Shared Border* (updated in 2000) states the goals of *promoting* international trade; *facilitating* the movement of people; *reducing costs* to both governments and the public; and providing enhanced *protection* against drugs, smuggling, and the illegal and irregular movement of people (page 3). In effect, the border was used to document the imports/exports and to reduce the flow of illegal firearms and drugs. Other than that, very little happened. Even in 2000, the 33-page document devotes exactly one-half of a page to the problem of security.²

The volume of Canada-U.S. trade is large relative to Canada’s GNP. Canadian exports to the United States were \$369.3 billion and imports from the United States were \$258.4 billion in 2005. That’s 81.4% and 66.8% of the total Canadian exports and imports, respectively (Statistics Canada 2006). For the United States, the Canadian shares are 23.4% of the total exports and 17.2% of the total imports (U.S. Census Bureau 2006). Both countries are by far each other’s largest trading partners.

After the attacks on September 11, 2001, establishing a jointly managed “perimeter shield” or a “common security perimeter” appealed to many observers on both sides of the border. And why not? The full-scale customs union seemed a close possibility, and remains such (Goldfarb 2003). Such a union would make documenting the cross-border shipments largely unnecessary. The North American Aerospace Defense Command (NORAD) has been in place since 1958³. One may look at it as a natural institution from which to build the “perimeter.” Such developments have been seen by many as “a natural and logical evolutionary step” from the NAFTA (Bissett 2003).

The idea has received a mixed response from both Canadian and United States governments and their populations at large. Indeed, the idea of common perimeter quickly gained momentum among Canadian businesses and the Canadian Council of Chief Executives (representing 150 of Canada’s largest corporations). In addition, the Foreign Affairs and International Trade Committee of the Canadian House of Commons have recommended just such an arrangement (Bissett 2003). The benefits of a common perimeter seem very attractive. The task of defending external shores from the rest of the world can be greatly helped by relocating resources from the Canada-U.S. boundary, and

² And that one-half a page is not an action plan or any description of the issue but simply an announcement of the “Joint Review of Border Security Study.”

³ Established as the North American Air Command.

the trade flows would be freed from the crossing burden *at the same time*. There have been many developments toward this concept of “Fortress America.” The Independent Task Force has been established and co-chaired by John P. Manley,⁴ William F. Weld,⁵ and Pedro Aspe.⁶ It envisions “ the establishment by 2010 of a North American economic and security community, the boundaries of which would be defined by a common external tariff and an outer security perimeter” (Council on Foreign Relations 2005). In the interim, while waiting for this common perimeter, a long list of the initiatives have been implemented to ease the burden of border crossing for certain travelers (eg. FastGate, NEXUS, FAST, C-TPAT, PAPS, PARS and others). Most of the projects have been put under the umbrella of the Canada-U.S. Smart Border Declaration with a 30-point action plan signed on December 12, 2001.

All these initiatives are essentially directed to alleviate the cost of crossing the border *given* the fact that border security is enhanced. As a part of the United States Patriot Act, the number of agents on the United States border with Canada has tripled, augmented by National Guard troops and the increased vigilance of the Coast Guard on the Great Lakes (Andreas 2003). Even with these initiatives the waiting and processing times at the Canada-United States border increased, as well as the variance in the delays. For instance, one study reports a minimum border truck delay of one-half hour and a maximum border truck delay of one hour as a result of the U.S. security measures (DAMF Consultants 2005).⁷

Even given these documented delays, there exists little political support for a more efficient common external border concept. Former Prime Minister Jean Chrétien opposed the idea of the common perimeter. Prime Minister Stephen Harper does not show much enthusiasm either. And President Bush believes it is important to enforce laws protecting borders and that such enforcement is crucial to keeping prosperity alive.⁸ In fact, under current United States legislation, in January 2008 Canadians or United States citizens will not be able to cross the border without a passport .

In short, the potential benefits of eliminating the Canada-U.S. border are obvious and very attractive. Nevertheless, despite strong pressure from business communities, the Canada-U.S. border

⁴ Senior Counsel at McCarthy Tétrault LLP. Former Deputy Prime Minister, negotiated the Smart Border Agreement with U.S. Secretary for Homeland Security Thomas Ridge.

⁵ Principal at Leeds Weld & Co. Former Governor of Massachusetts and an Assistant U.S. Attorney General.

⁶ Chief Executive Officer of Protego. Former Secretary of the Treasury of Mexico.

⁷ The estimates vary widely due to the scope, methodology and time of the reports, eg. Hon. Perrin Beatty (Beatty 2005) reports that “Since the Smart Border Declaration of 2001, estimated processing times for shipments into the US tripled from 45 seconds to over two minutes and 15 seconds per truck by the end of 2004. Others account for more than just processing times.

⁸ The Associated Press, “Bush ties border controls to prosperity,” March 31, 2006 (www.msnbc.msn.com/id/12094377/)

has become “thicker” not more relaxed, and the development of a common security perimeter apparently has slowed down after 9/11.⁹ Both governments seem resistant to opening the border. The most frequent explanations are that Canadians fear a loss of Canadian sovereignty and that Americans perceive Canada as a “safe haven” for America’s enemies. Most problematic is the prospect that a North American perimeter security concept would require the harmonization of U.S. and Canadian immigration and refugee policies, among other things. Although complete harmonization of policies may be problematic following the events of 9/11, both countries have begun “to harmonize other policies at incremental levels” (Seghetti 2004, p.6). These concerns are not new but the border regime changes are new and seemingly are not warranted since there has been no significant change in the “fundamentals” such as the level of terrorist threat, costs of maintaining heightened security levels or trade features.

Given the abandonment of the common perimeter concept, a careful examination of the costs and benefits of increased security measures may provide an explanation for the continued increase in security measures at the Canada-U.S. border and aid us in predicting future changes and formulating useful policy implications. Such an inquiry should take into account the unique features of the terrorist threat and the responses to it. Below, I outline trends in terrorists threats to provide a context to my analysis.

The prime source of the data for the frequency and targets of international terrorist attacks from 1985 to 2003 is *Patterns of Global Terrorism*, a report published each year on or before April 30 by the United States Department of State. The United States Congress required the Secretary of State to produce detailed assessments for each foreign country in which acts of international terrorism occurred; the extent to which foreign countries are cooperating with the U.S. in the apprehension, conviction, and punishment of terrorists; the extent to which foreign countries are cooperating with the U.S. in the prevention of further acts of terrorism; and activities of any terrorist group known to be responsible for the kidnapping or death of an American citizen. The statistical summary attached to the report listed the total number of the terrorist attacks and data about attacks inflicted on U.S. interests, casualties, targets, and the geographical distribution of attacks (by continents).

There were some minor revisions of the report prior to 2002-2003 due to slight changes in the definition of a terrorist attack. Following publication of the *Patterns of Global Terrorism 2003*, serious doubts were raised about its reliability. Most notable challenges came from Alan Krueger (Princeton University), David Laitin (Stanford University) and Congressman Henry Waxman. It has become apparent that there were serious problems in data entry and the suspect methodologies for the

⁹ “Thickness” here refers to the cost of crossing the border.

identification and classification of terrorism-related events. A corrected version was issued on June 22, 2004. Yet, the questions about the reports reliability continued to arise, and the Department of State has decided to suspend issuing the report. In 2004, a new report, the *Country Reports on Terrorism*, was created, which detailed terrorism by region but offered no statistics or chronology. Any attempts to compare pre-2004 numbers with those reported from 2004 on should be deemed very unreliable, as the methodology for the identification and classification of events has changed significantly.¹⁰ The data about total number of the international terrorist attacks and the attacks on U.S. interests are given in Table 1.1.

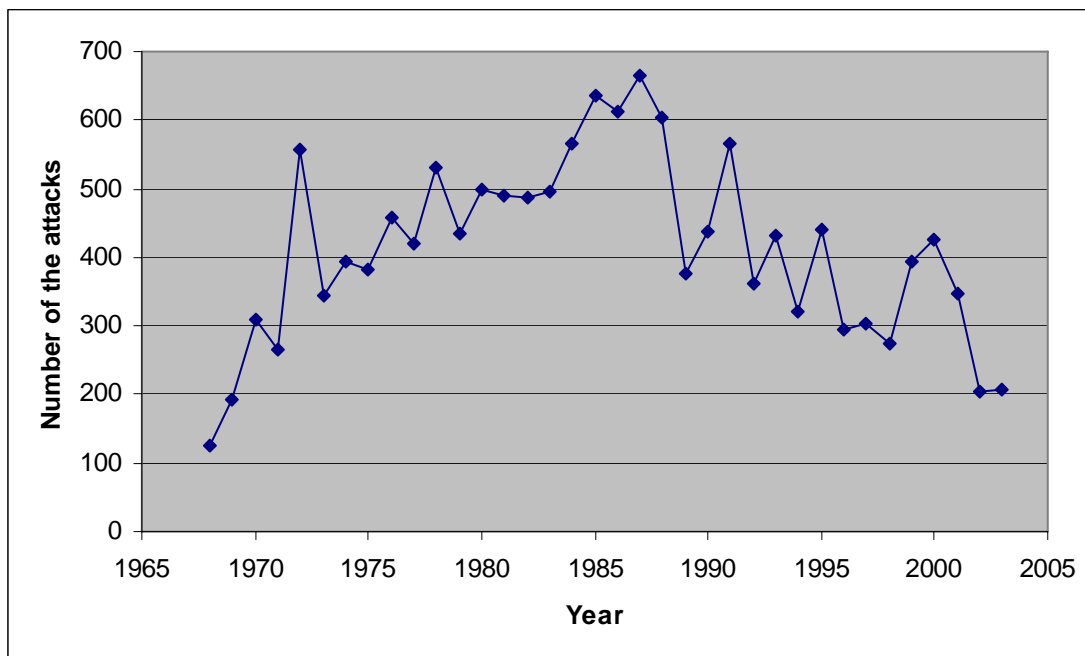
Table 1.1. The international terrorist attacks, 1968-2003

Year	Number of Events	Attacks on US Interests	Year	Number of Events	Attacks on US Interests
1968	125	57	1986	612	204
1969	193	110	1987	665	149
1970	309	202	1988	605	185
1971	264	190	1989	375	193
1972	558	177	1990	437	197
1973	345	152	1991	565	308
1974	394	151	1992	363	142
1975	382	139	1993	431	88
1976	457	164	1994	322	66
1977	419	158	1995	440	90
1978	530	215	1996	296	73
1979	434	157	1997	304	123
1980	499	169	1998	274	111
1981	489	159	1999	395	169
1982	487	208	2000	426	200
1983	497	199	2001	348	219
1984	565	133	2002	205	77
1985	635	170	2003	208	82

Sources: Todd Sandler (2003); U.S. Department of State, "Patterns of Global Terrorism 2003" Appendix G – Statistical Review, Total International Terrorist Attacks, 1982-2003

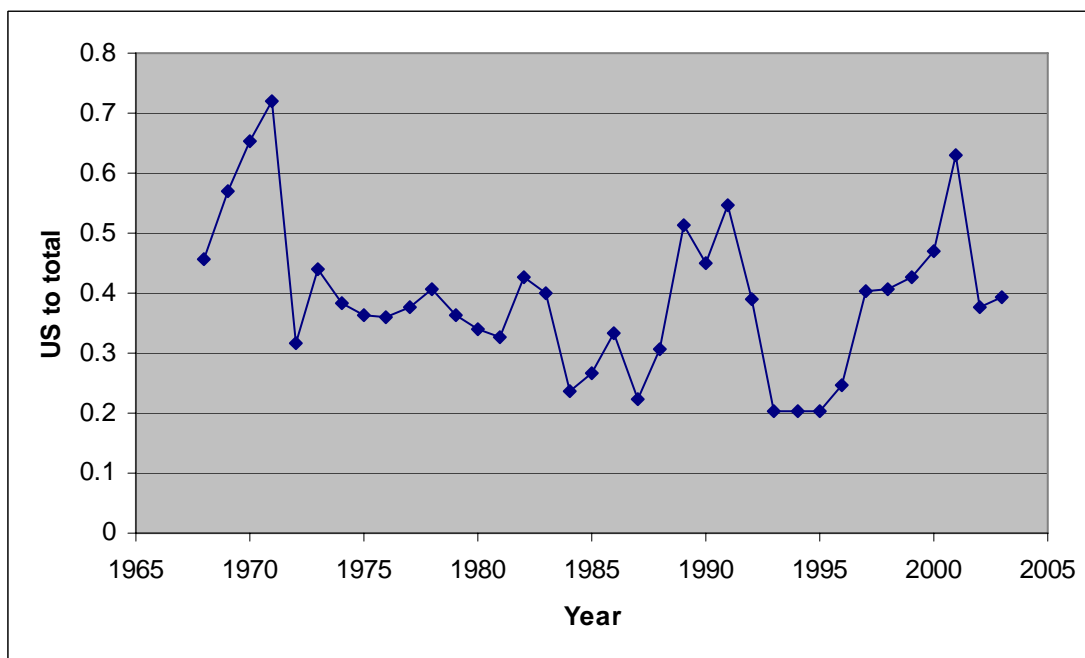
¹⁰ Another reason cited for non-comparability of pre-2003 and post-2003 numbers is that war in Iraq has changed the underlying features of the problem.

Figure 1.1. Total number of the international terrorist attacks, 1968-2003



Sources: Todd Sandler (2003); U.S. Department of State, "Patterns of Global Terrorism 2003," Appendix G – Statistical Review, Total International Terrorist Attacks, 1982-2003

Figure 1.2. Ratio of the attacks against the US to total attacks, 1968-2003



Sources: Todd Sandler (2003); U.S. Department of State, "Patterns of Global Terrorism 2003," Appendix G – Statistical Review, Total International Terrorist Attacks, 1982-2003

If I analyze Figures 1.1 and 1.2, the year 2001 does not appear to be a spectacular outlier from an historical prospective. The yearly numbers of attacks were greater in any year in 1975-1993 than in 2001. The number of casualties per attack is comparable to 1994 and less than in 1997. The ratio of attacks against the U.S. to total attacks is rather high (but comparable to 1988-1990 and lower than in 1971).

I find it difficult for the two following observations to be in agreement: first, the significantly increased antiterrorism effort of the countries other than the USA, since September 11 2001; and second, rather unclear changes in the level of the terrorist threat these countries are facing over same time frame (as Figures 1.1 and 1.2 suggest). I speculate that the incentive for their increased efforts must come not from the perceived increase in their own threat level but rather in response to the United States' policies of the greatly heightened antiterrorism effort. The model I present describes just that.

Literature

Game Theory is a natural framework to analyze the deterrence efforts by the governments in their struggle against transnational terrorism. Terrorism assumes a *transnational* character when a terrorist incident in one country involves victims, targets, institutions, governments, or citizens of another country¹¹ (Sandler and Enders 2004). It is this influence on more than one country that creates cross-border externalities and potentially makes the governments' responses strategically interdependent. Take, for instance, a bombing of an American business in a European country. The local intelligence and enforcement agencies may expend very little effort to stop such an attack if the damage is mostly to the U.S. interests and there are little negative consequences to the host country. The U.S. counter-terrorism agencies may foresee such a problem and attempt to manipulate the information they provide to the local forces in order to lead them to believe that the resulting damage will be much greater than expected. Increased scrutiny by the U.S. toward the travelers from, say, Spain may induce the Spaniards to increase their domestic security beyond their individually optimal level which, in return, may influence the U.S. to somewhat reduce the restraints against Spanish travelers. Increasing protective measures by one country may encourage the terrorists to attack another "softer target" country instead, meaning that increased deterrence by one nation may demand increased deterrence by others. As there are significant cross-border externalities, the struggle against the transnational terrorism may call for the cooperation among the targeted nations, which necessitates

¹¹ Another oft used definition of transnational terrorism refers to the perpetrators as not being affiliated with any national government.

credible commitments on their parts and raises the problems of shared information and signals. These are all common topics to Game Theory.

One can hope to develop a parsimonious set of simple eclectic game models to analyze diverse situations, including the plays between the targeted country and the terrorists, between the countries under a common threat, or more generally, among the targeted countries, the terrorist organizations, domestic groups that may be related to the foreign terrorists, and the immigrants faced with changed security procedures.

There are several broad overviews of the literature that use game-theoretical models as applied to the study of terrorism (Arce and Sandler 2005a, 2005b; Sandler and Enders 2004). They present general games without much reference to actual data to discuss the most general implications of the strategic interdependence of the governments facing common security threats. Their strongest conclusions concern the comparison of proactive and defensive policies (pre-emption vs. deterrence) and they argue that currently the targeted countries exercise too much deterrence and too little pre-emption. This is a fairly straightforward consequence of the externalities from the two policies. Deterrence produces negative externalities by diverting the terrorists' attention from more protected nations toward the "softer targets." Pre-emption strategies produce positive externalities when one country eliminates a threat that is common to many countries.

The major reason why the games presented are not factual is that the task of measuring cost and benefits of specific policies is quite challenging. Indeed, Sandler and Enders concede as much, "As a future research project, economists should assess the benefits and costs of specific policies to thwart terrorism. Such an exercise has not been adequately done" (Sandler and Enders 2004, 22).

What happens in the relationships between trade partners, post-9/11? Michele Fratianni and Heejoon Kang (2005) offer an answer. The United States, having been badly hurt by terrorism, is willing to bear high costs to suppress it. Counterterrorism policies have features of a public good and normally would require concerted efforts by the parties involved (the target countries) to achieve an efficient level of protection. Nevertheless, initially the United States bears the costs almost unilaterally. Participation by the others is welcomed but not necessary – if they do not participate, the U.S. will carry out the actions all the same. Not surprisingly, one notable feature of the current situation is the free-riding (or, in some cases, pay-riding¹²) of many countries on the U.S. anti-terrorist effort. Over time, other countries will have incentives to stop free-riding and pay-riding for

¹² Under pay-riding, a country participates in the anti-terrorist actions but at same time gives something of value to the terrorists. Saudi Arabia is a classical example (an American ally and the home of radical Wahabism). Spain is another (an American ally who pulled its troops from Iraq).

two reasons: a) faced with greatly increased United States protection, terrorist organizations will redirect their resources toward the “soft targets”; b) the United States will pressure other countries to increase their participation

The evidence that terrorist organizations target more than one country (the U.S.) is clear. The attacks have been perpetrated against other countries, and on many occasions the same organizations were identified as the perpetrators of the attacks on different countries (e.g., Al-Qaeda was allegedly involved in the 2003 Istanbul bombings, the Singapore embassies attack plot, as well as their numerous attacks on other U.S. targets). The theory that terrorist organizations respond in the described predictable manner is strong. The evidence of substitution in technologies under different enforcement regimes to produce terror supports a theory of rational behaviour. For example, metal detectors reduced incidents of skyjacking and increased incidents of hostage-takings. Also, increased fortification of U.S. embassies reduced attacks on them but increased the number of political assassinations (Sandler 2003).

There is an extensive literature that estimates the cost of increased security measures in the post-9/11 world. The major costs are rather obvious, and the numbers are mostly available. There are costs to building and maintaining infrastructure and the costs of border personnel. The estimates of the costs of increased waiting times have to be accounted for, as well as the costs of newly implemented documentation collection, processing and storage. Reduction in trade and significant changes to trade structure give rise to the bulk of the border costs.

The literature on the costs of terrorism lists and estimates many costs not directly related to the increased barriers to trade associated with heightened border security. Accounting for the direct losses of life and property, decrease in tourism, foreign direct investments, domestic investments, stock markets, changes in savings, insurance costs, and development of urban economies has been performed. In addition, studies of the effects of terrorism on life satisfaction have been made by a variety of authors (Frey, Luechinger and Stutzer 2004; Brück and Wickström 2004; Abadie and Gardeazabal 2005). It is worth emphasizing that these “costs” are not really costs in a meaningful way for an economic analysis; they are just negative consequences of the terrorist act or threat. Nevertheless, the structure of such impacts may play a non-trivial role in shaping protective policies, and such policies *are* the subject of this analysis.

The crucial analytical observation that national borders do matter also tempers my analysis. Many people were very surprised by John McCallum’s findings that the “border effects” in 1988 amounted to a factor of 20 (McCallum 1995). For example, given approximately equal distances between Ontario and British Columbia and between Ontario and California, and the fact that

California's population and GDP is about 10 times larger than that of British Columbia, one should expect Ontario's trade with California to be 10 times the volume of its trade with British Columbia were they all in the same country and not on different sides of the national border. Ontario's trade with British Columbia was, in fact, only about twice its trade with California. There is a continuing debate about the nature of such "border effects." While potentially a large part of them can be attributed to the existence of optimally local networks with shared norms and trust, there is little doubt that most of the effects are caused by longstanding barriers to trade at the border.

The bilateral Free Trade Agreement between Canada and the United States was signed in 1989, and the trilateral NAFTA agreement came into effect in 1994. These agreements eliminated some barriers and these efforts were sufficient to reduce the "border effect" from 20 in 1988 to 14.7 in 1991 to 10.2 in 1996 (Helliwell 2005). One can view these numbers as evidence that at least one-half of the border effect factor was due to the various taxes on trade, and thus the removal of those taxes manifests itself by a 50% decline in the border effect between 1988 and 1996. Increased border scrutiny is, in fact, a new border tax now in the form of increased waiting times, increased variance of the waiting times, and costs of obtaining new "secure" IDs and other newly invented documentation.

Shakil Quayes and Donn R. Pescatrice attempt to determine if the heightened security regime imposed at both southern and northern U.S. borders have a significant negative impact on U.S. merchandise trade with Mexico and Canada (Quayes and Pescatrice 2004). They found that tighter security did significantly dampen border trade well beyond any trade effect induced by the economic downturn experienced by these three countries. Most components of trade behaved as expected, too. For instance, Canadian trade suffered more than Mexican, truck trade was more severely impacted than rail transport, and commodities that are dangerous in nature (like fuel or chemicals) and more prone to tampering, as well as hidden devices (like electrical equipment) experienced a greater negative impact. One surprising result was that U.S. exports to Mexico have been affected more than U.S. imports from Mexico. Imports from Canada have been affected more than exports to Canada, which is as expected given that the United States is the primary terrorist target thus American customs pays disproportionally more attention to the inspection of their in-bound goods. Quayes and Pescatrice did not attempt to determine whether the changes in trade were temporary or long-lasting in nature.

Research reports prepared for the Government of Canada and the U.S. Department of Transportation give the estimate of the direct costs to the border (not accounting for the reduced output, employment or incomes) as US\$10.30 billion a year, of which US\$4.01 billion represents the

costs of increased transit time or uncertainty, and US\$6.28 billion for such things as brokerage fees, duty, managing custom processes, and federal staff compensation (Taylor and Robideaux 2003; Taylor, Robideaux and Jackson 2003).

Apparently, there is no comprehensive estimate of the total effects on Canada, the United States, or both, from increased border security. This absence of a combined estimate may reflect the difficulties in producing such an estimate, or rather the fact that the policy makers may not be particularly interested in such estimates having accepted increased border security as an inevitable reality. I anticipate, however, that a reasonably good rough estimate can be produced by combining the direct costs estimates with the elasticity estimates from the available gravity model studies.

The papers reviewed above have all emphasized the trade-off between security and trade (or rather, total cross-border flows, including goods, services and people). A more secure border is a border less permeable to trade, and vice versa. Their implicit or explicit conclusion is that because trade is beneficial the United States must strike a balance between its security and its openness to cross-border flows.

This paper will expand the set of simple game-theoretic models, by including a possibility not presented by the above-mentioned authors. While others consider basically symmetric games where the two countries' actions are strategic complements or substitutes, I introduce an asymmetric game played by two trade partners with fundamentally different objectives. Such a model, I believe, also better describes reality where the United States is the primary target of terrorist attacks while many of its trade partners enjoy relative safety. This model also emphasizes that, contrary to the view of trade (more generally, cross-border flows of goods, services and people between trade partners) as a source of security threats, trade might be viewed as a source of incentives for the countries to become more involved in common security actions.

The model

To make the argument clear, the model presented is counter-factual in the part that relates to a common threat and a common interest in trade. This is done to highlight the essential incentives of the two players in the model.

There are two neighboring countries, A and B, who have a common border between them. Country A is a primary target of the terrorist groups and therefore has a great concern about its own protection. Country B experiences a low threat from terrorist groups and the issues of its own

protection are secondary in its policy priorities. In particular, B is much more concerned about its trade with A than it is about the probability of being attacked by terrorists. Trade should be regarded in its broadest sense, as a cross-border flow of goods, services and people. Let us assume that A places no value at all on trade with B but only cares about its own security. Also assume B places no value at all on preventing the terrorist threat but cares only about its trade with A.

The countries decide on their border budgets (resources devoted to regulations of the cross-border flows), B_A and B_B correspondingly. Country A attempts to maximize its security net of cost and B attempts to maximize its trade net of cost. Both security and trade depend on the countries' budgets devoted to the border:

$$S = S(B_A, B_B); \quad (01)$$

$$T = T(B_A, B_B), \quad (02)$$

where S is the value of its own security to country A, and T is the value of trade to country B, both in dollar terms.

Given their interests, the two countries use their border budgets on different programs. Country A uses the budget for screening of the cross-border flows. More thorough screening makes A more secure:

$$\frac{\partial S}{\partial B_A} > 0. \quad (03)$$

More thorough screening makes the border less permeable to trade flow:

$$\frac{\partial T}{\partial B_A} < 0. \quad (04)$$

Country B is not concerned with security *per se* but it may make its exports safer at some cost, since safer imports from B will be more readily allowed in by A. Safer imports from B mean it is less costly to screen them at the border, so A can relocate some resources to other security programs (say, the border with the third country C):

$$\frac{\partial S}{\partial B_B} > 0; \quad (05)$$

$$\frac{\partial T}{\partial B_B} > 0. \quad (06)$$

Additional curvature assumptions involve the marginal effectiveness of the countries' border programs:

$$\frac{\partial^2 S}{\partial B_A \partial B_B} < 0, \quad (07)$$

the marginal benefit from last spent dollar by A is lower if B has already made an effort to assure the safety of the flow (e.g., prescreening). Also,

$$\frac{\partial^2 T}{\partial B_A \partial B_B} > 0, \quad (08)$$

an increase in trade from B's actions is greater for greater level of A's protection. This can be better understood by looking at the low-protection end of A's spending: if there little screening at the border, one should expect rather little effect from B's action to decrease the barriers even more. Alternatively, suppose country A spends great amount B_A . Marginal return on the last \$1 spent must be lower for greater B_A , and country B's increase in spending should induce larger reduction in (rather less effective) country A's spending.

Country A's problem is to maximize the value of its security net of cost (given B's border budget $B_B = \bar{B}_B$):

$$\max_{B_A} U_A = S(B_A, \bar{B}_B) - B_A. \quad (09)$$

The first-order condition, $\frac{dU_A}{dB_A} = 0$, (10)

implies:

$$\frac{dS}{dB_A}(B_A, \bar{B}_B) = 1, \quad (11)$$

the last \$1 spent on security produces \$1 worth of increase in the value of security.

The second-order condition, $\frac{d^2 U_A}{dB_A^2} < 0$, (12)

insures that the marginal value of security at the optimal level decreases:

$$\frac{d^2 U_A}{dB_A^2} = \frac{d^2 S}{dB_A^2}(B_A, \bar{B}_B) < 0, \quad (13)$$

The first-order condition (10), when satisfied for every possible level of B_B , produces implicit function

$$B_A^* = B_A^*(B_B). \quad (14)$$

This function is country A's best-response to any level of B_B chosen by B. Along the best-response function, the first-order condition is an identity:

$$\frac{dS}{dB_A} [B_A^*(B_B), B_B] \equiv 1 \quad (15)$$

Taking the derivative of the identity (15) with respect to B_B allows obtaining the slope of the A's best-response function:

$$\frac{d}{dB_B} \left\{ \frac{\partial S}{\partial B_A} [B_A^*(B_B), B_B] \right\} \equiv \frac{d}{dB_B} \{1\} \Rightarrow \quad (16)$$

$$\frac{\partial^2 S}{\partial B_A^2} \frac{dB_A^*}{dB_B} + \frac{\partial^2 S}{\partial B_A \partial B_B} = 0 \Rightarrow \quad (17)$$

$$\frac{dB_A^*}{dB_B} = - \frac{\frac{\partial^2 S}{\partial B_A \partial B_B}}{\frac{\partial^2 S}{\partial B_A^2}}. \quad (18)$$

The denominator in the right-hand-side ratio in (18) is negative by the second-order condition (13), and the numerator is negative by the curvature condition (07). Thus the A's best-response function is negatively sloped. Intuitively, country B's spending B_B is a substitute for country A's spending B_A . With B's increased effort, A does not need to spend as much.

Country B's problem is to maximize the value of its trade net of cost (given A's border budget $B_A = \bar{B}_A$):

$$\max_{B_B} U_B = T(\bar{B}_A, B_B) - B_B. \quad (19)$$

The first-order condition, $\frac{dU_B}{dB_B} = 0$, (20)

implies:

$$\frac{dT}{dB_B}(\bar{B}_A, B_B) = 1, \quad (21)$$

the last \$1 spent on attempts to increase trade produces \$1 worth of increase in the value of the trade.

The second-order condition, $\frac{d^2U_B}{dB_B^2} < 0$, (22)

insures that the marginal value of security at the optimal level decreases:

$$\frac{d^2U_B}{dB_B^2} = \frac{d^2T}{dB_B^2}(\bar{B}_A, B_B) < 0, \quad (23)$$

The first-order condition (20), when satisfied for every possible level of B_A , produces implicit function

$$B_B^* = B_B^*(B_A). \quad (24)$$

This function is country B's best-response to any level of B_A chosen by A. Along the best-response function, the first-order condition is an identity:

$$\frac{dT}{dB_B}[B_A, B_B^*(B_A)] \equiv 1 \quad (25)$$

Taking the derivative of the identity (25) with respect to B_A allows obtaining the slope of the B's best-response function:

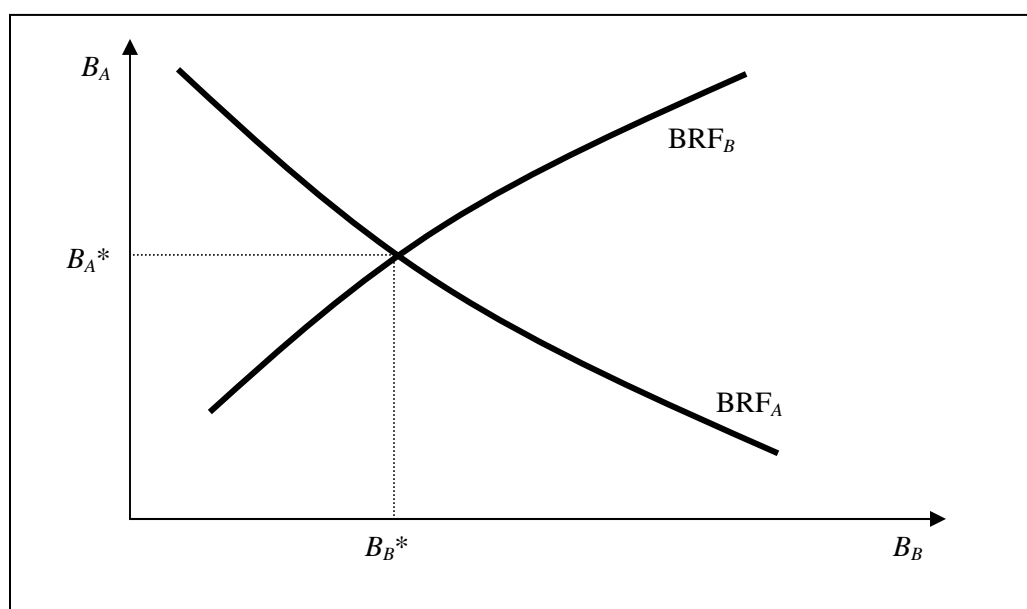
$$\frac{d}{dB_A} \left\{ \frac{\partial T}{\partial B_A} [B_A, B_B^*(B_A)] \right\} \equiv \frac{d}{dB_A} \{1\} \Rightarrow \quad (26)$$

$$\frac{\partial^2 T}{\partial B_A \partial B_B} + \frac{\partial^2 T}{\partial B_B^2} \frac{dB_B^*}{dB_A} = 0 \Rightarrow \quad (27)$$

$$\frac{dB_B^*}{dB_A} = -\frac{\frac{\partial^2 T}{\partial B_A \partial B_B}}{\frac{\partial^2 T}{\partial B_B^2}}. \quad (28)$$

The denominator in the right-hand-side ratio in (28) is negative by the second-order condition (23), and the numerator is positive by the curvature condition (08). Thus the B's best-response function is positively sloped. The game is illustrated in Figure 1.3.

Figure 1.3. The border spending game.



In an equilibrium, the two countries chose their border budgets B_A^* and B_B^* at the intercept of their best-response functions. It is uncommon for a non-cooperative game equilibrium to be efficient. Usually one can show that there exists a feasible outcome that is superior to the equilibrium outcome. To illustrate, let us introduce the two countries' indifference maps. Country A's indifference curve is a locus of points with constant value of security net of cost:

$$S(B_A, B_B) - B_A = \bar{S}. \quad (29)$$

$$\text{The implicit function } B_A^0 = B_A^0(B_B) \quad (30)$$

satisfying (29) is such an indifference curve. Along the indifference curve, (29) is an identity:

$$S[B_A^0(B_B), B_B] - B_A^0(B_B) \equiv \bar{S}. \quad (31)$$

Taking the derivative of the both sides of (31) with respect to B_B gives

$$\frac{d}{dB_B} \{S[B_A^0(B_B), B_B] - B_A^0(B_B)\} \equiv \frac{d}{dB_B} \{\bar{S}\} \Rightarrow \quad (32)$$

$$\frac{\partial S}{\partial B_A} \frac{dB_A^0}{dB_B} + \frac{\partial S}{\partial B_B} - \frac{dB_A^0}{dB_B} = 0 \Rightarrow \quad (33)$$

$$\frac{dB_A^0}{dB_B} = \frac{\frac{\partial S}{\partial B_B}}{1 - \frac{\partial S}{\partial B_A}}. \quad (34)$$

The numerator of the right-hand side ratio is positive by (05), and the denominator sign is indeterminate in general. For $\frac{\partial S}{\partial B_A} > 1$, $\frac{dB_A^0}{dB_B} < 0$, the indifference curve is negatively sloped.

$\frac{\partial S}{\partial B_A} > 1$ describes the region where, for a given B_B , less than optimal budget B_A^* is chosen. This

follows from the first and second order conditions (11) and (13), and corresponds to the part of the graph below the A's best-response function in Figure 1.3. For $\frac{\partial S}{\partial B_A} < 1$, $\frac{dB_A^0}{dB_B} > 0$, the indifference

curve is positively sloped. $\frac{\partial S}{\partial B_A} < 1$ describes the region where, for a given B_B , more than optimal

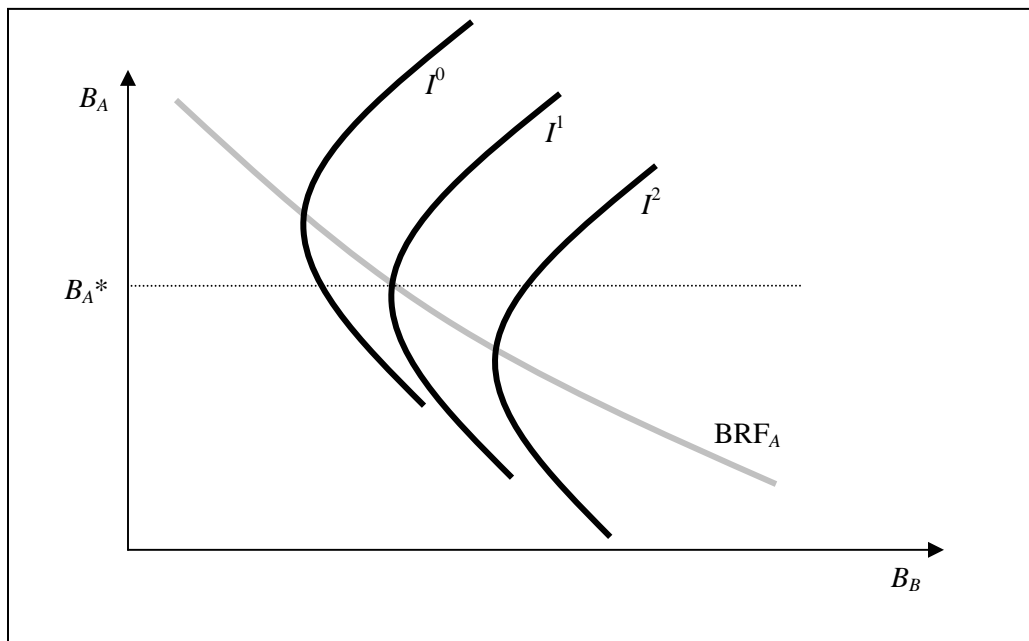
budget B_A^* is chosen. This follows from the first and second order conditions (11) and (13), and

corresponds to the part of the graph above the A's best-response function in Figure 1.3. For $\frac{\partial S}{\partial B_A} = 1$,

$\frac{dB_A^0}{dB_B} = \infty$, the indifference curve is vertical at B_A^* (on the best-response curve). Figure 1.4.

illustrates. A move from I^0 to I^1 to I^2 increases A's value of security net of cost, $I^2 \succ I^1 \succ I^0$.

Figure 1.4. Country A's indifference map.



Similar derivations produce the B's indifference map. Country B's indifference curve is a locus of points with constant value of trade net of cost:

$$T(B_A, B_B) - B_B = \bar{T} . \quad (35)$$

$$\text{The implicit function } B_B^0 = B_B^0(B_A) \quad (36)$$

satisfying (35) is such an indifference curve. Along the indifference curve, (35) is an identity:

$$T[B_A, B_B^0(B_A)] - B_B^0(B_A) \equiv \bar{T} . \quad (37)$$

Taking the derivative of the both sides of (37) with respect to B_A gives

$$\frac{d}{dB_A} \{T[B_A, B_B^0(B_A)] - B_B^0(B_A)\} \equiv \frac{d}{dB_B} \{\bar{T}\} \Rightarrow \quad (38)$$

$$\frac{\partial T}{\partial B_A} + \frac{\partial T}{\partial B_B} \frac{dB_B^0}{dB_A} - \frac{dB_B^0}{dB_A} = 0 \Rightarrow \quad (39)$$

$$\frac{dB_B^0}{dB_A} = \frac{\frac{\partial T}{\partial B_A}}{1 - \frac{\partial T}{\partial B_B}}. \quad (40)$$

The numerator of the right-hand side ratio is positive by (05), and the denominator sign is indeterminate in general. Again, the slope will depend on whether B_B is less than optimal, more than optimal, or just right (B_B^*). Figure 1.5. illustrates. A move from I^0 to I^1 to I^2 increases B's value of trade net of cost, $I^2 \succ I^1 \succ I^0$.

Figure 1.5. Country B's indifference map.

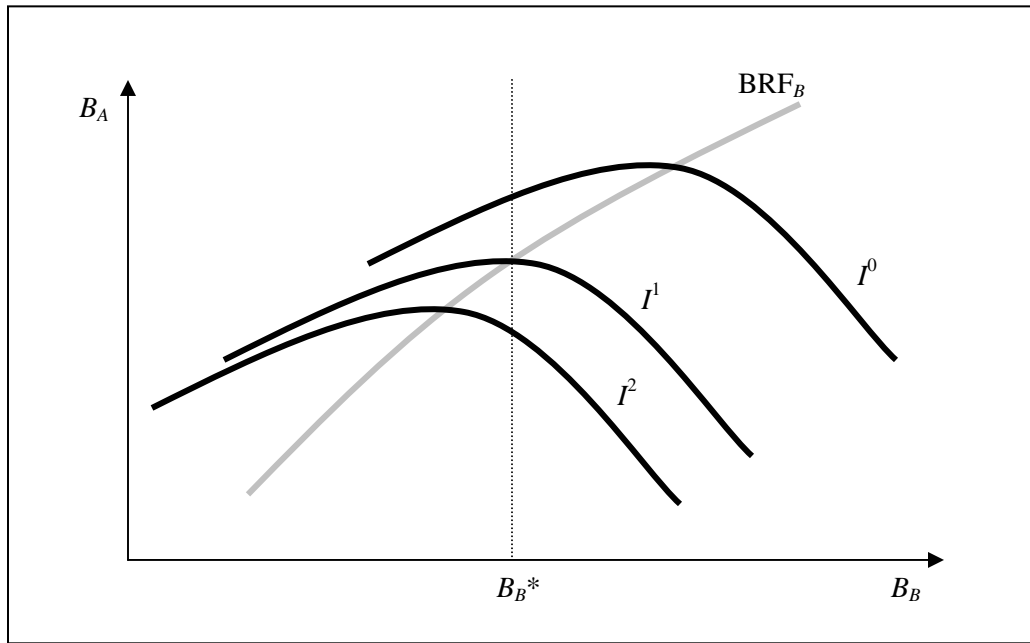
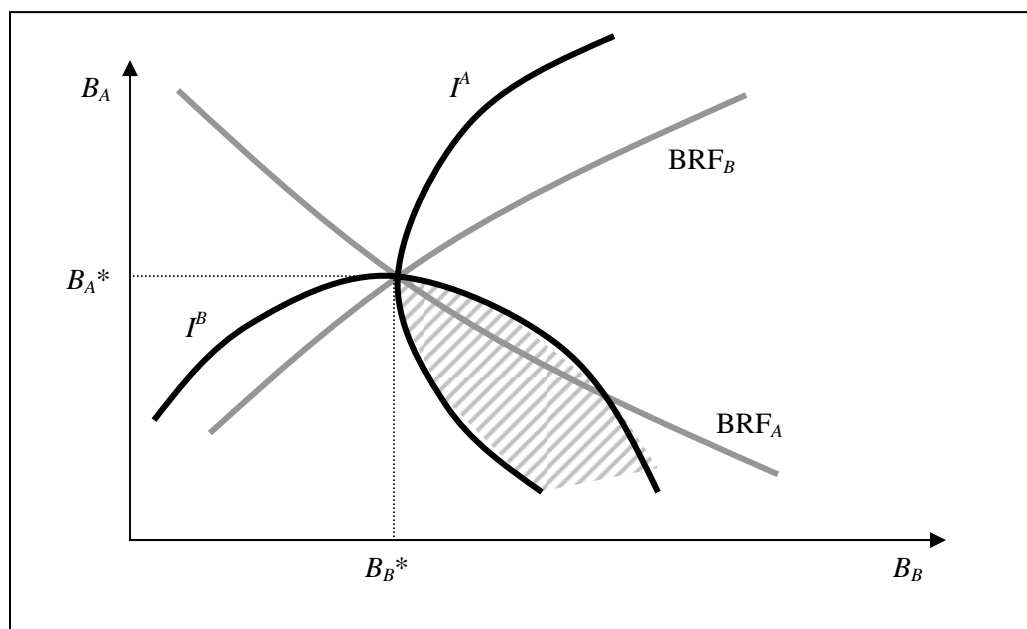


Figure 1.6. illustrates a Pareto improvement region (shaded area) compared to the non-cooperative equilibrium.

Figure 1.6. The Pareto improvement.



Discussion

The presumption that the substitution between the attacks on different countries works basically in the same way as the substitution between skyjackings and hostage-takings may be dubious. The adherents of the notion (e.g., Fratianni and Kang 2005) point out that following 9/11 and the hardening of the U.S. border, terrorists have hit Indonesia, the Philippines, Saudi Arabia, Spain, and Turkey, and interpret this as evidence of such a shift in favour of softer targets. An alternative view may be equally reasonable. The ratio of attacks against the U.S. to total attacks hovered in the 40-48% percent range in 1997-2000, shot up to over 60% in 2001 and dropped back to 40-45% in 2002-2003. Historically, the ratio jumped up and reverted to pre-jump level several times. There is little one can do to persuade a non-believer that any significant change in the historic pattern has occurred.

The literature that discusses the terrorists' substitution between targets may be more convincing but it is open to various interpretations. One compelling explanation of the increase in the average number of people killed in an attack (10.3 on 2001, 13.4 in 2002, 9.1 in 2003; compare to no more than 4 in previous years, 1968-2000) is such substitution toward soft targets. Following increased protection of government buildings, embassies, and military bases, terrorists began to strike unprotected places of gathering like shopping malls, offices, and places of prayer (Sandler 2003). An

intended target is a subject of interpretation. One can argue, in accordance to the nature of terrorism, that the actual target of such attacks is a government nevertheless. In this view, what changes is not the intended target (one whom terrorists try to influence) has not changed but the venue of influence has changed.

In the absence of convincing evidence that countries other than the United States has suffered historically significantly increases in their individual levels of threat, an alternative explanation of why they would join costly efforts of the United States counterterrorism policies is needed. I offer this explanation. I also believe that this explanation (model) offers a more accurate account of reality. Consider the case of Canada. There is no good evidence that Canadian safety greatly diminished after the United States fortified its borders and foreign bases. Yet Canadian involvement in the counterterrorism efforts increased. Also, in accordance with the model, the bulk of Canadian efforts were devoted toward making its exports and its human flows to the United States more secure, not toward making its own borders less permeable. To pursue the *Canada-U.S. Smart Border Declaration* projects \$1.2 billion was invested in 2001 “to make the border more secure, open, and efficient,” and expenditures of \$7.7 billion are planned for 2002-2007 (Canada Border Services Agency).

Elimination of the U.S.-Canada border and creation of a common security perimeter (Fortress North America) appears a rather distant possibility in light of post-9/11 developments. The prevailing view is that security cooperation will increase but, short of Canada surrendering its immigration policies to U.S interests, creation of the common security perimeter is not likely to happen.

The discussion of the relationship between Canada-USA trade and United States security is commonly framed along the following lines:

- Trade is beneficial to the USA as well as Canada;
- Trade requires permeable borders, and the borders that are permeable to trade are also inevitably permeable to terrorists. In other words, trade requires accepting some security risks that could be absent without trade;
- But some trade is preferable to no trade as the benefits from trade outweigh some security risks.

This line of reasoning sees the trade-security relationship as a trade-off between beneficial trade and undesirable security risks. As with most trade-offs, one expects some sort of cost-benefit analysis that determines optimal levels of trade and optimal levels of border barriers.

The model presented emphasizes that trade may be presented from quite an opposite angle. To make this clear, I ignore the benefits of trade to the primary terrorist-target country. And yet the result suggests that the country would benefit from allowing trade, purely for security-enhancing reasons. In essence, trade is an engine to enhance security. It improves security by giving the incentives to the trading partner to participate in the primary terrorist-target country's security measures. It may work through two relating channels.

First, there is little doubt that there are some security measures (beneficial to country A's security) that are best done by a trading partner. Containers shipped from country B may be inspected at lower costs when they are loaded at the point of their origin. The background of the travelers from county B to country A may be checked at lower cost and with greater thoroughness in their place of permanent residence where historical records of their activities exist. It is efficient and effective to delegate this kind of task to country B, which performs them better.

Second, letting a partner to perform some security measures allows country A to direct some freed resources toward other projects. They can be now used on other borders. Alternatively, the resources may be used for non-border-related security measures like intelligence operations, detecting the threat within the country borders, etc.

One feature of the model presented is that it is a non-cooperative game. It can be viewed as a market where the security of country A is traded for the access of country B to A's market. One attractive feature of such a market is that information requirements are relaxed compared to the explicit negotiations by the two countries to jointly determine the levels of border controls and volumes of trade. In such negotiations credibility of the information presented by the two partners to each other is likely to be always questionable in view of their diverging objectives. One expects that a more efficient outcome may be approximated without the two partners transferring credible information about their own costs and benefits.

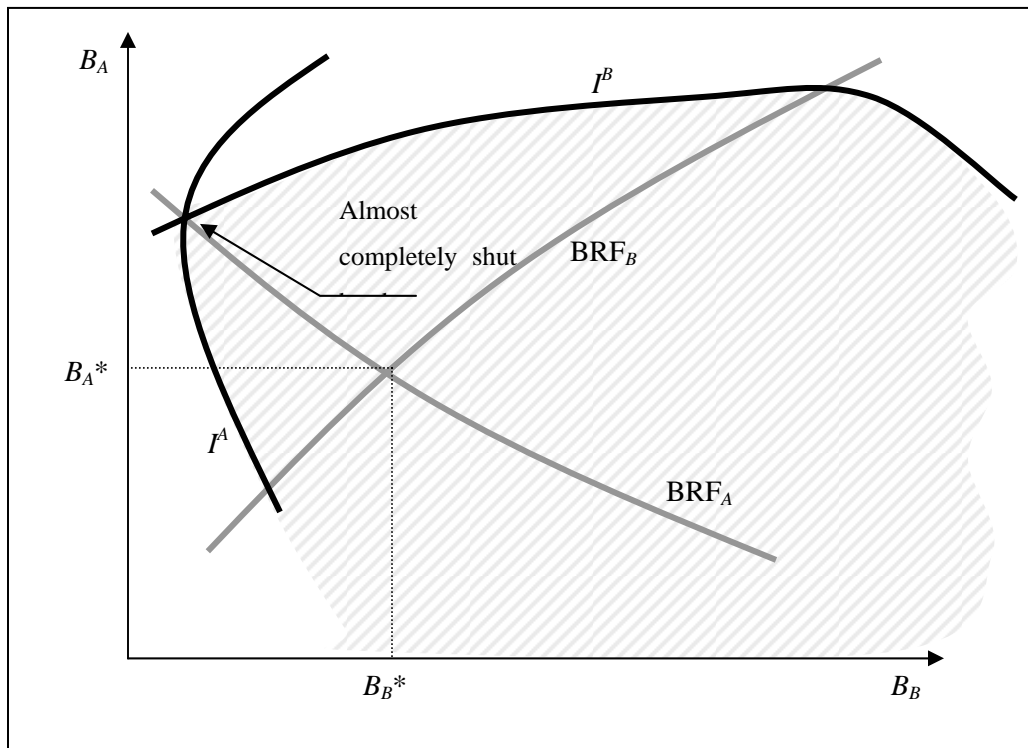
Let me now address the indifference map in the model.

The shapes and ordering of the indifference curves have a plausible intuitive explanation. Take an A's indifference curve. A negatively sloped portion refers to the unchanged net benefits to A when A's increased spending on the border is accompanied by B's decreased spending. To keep the net benefits of protection constant, A has to compensate for decreased safety of imports from B. Along the positively sloped portion, A's efforts of protecting its borders are essentially subsidized by increased B's spending, so the optimal choice by A is pushed to increase. Similar reasoning is applicable to B. A positively sloped portion refers to the unchanged net benefits to B when B's

increased spending on the border is accompanied by A's increased spending. When A makes its borders less permeable, B can restore its net benefits from trade by applying security measures to its exports where doing so offers benefits from trade greater than the costs of achieving this greater volume of trade. Along the negatively sloped portion, B's efforts of insuring the safety of its exports are encouraged by A's relaxing its border scrutiny. To determine the ordering of the indifference curves, one can fix the border expenditures by one country and consider the change in its net benefits with the change in the other country's effort. With B's effort fixed at B_B^* , lower B_A allows greater trade which is B's objective. Thus B's net benefits go up with a jump to a curve located lower on the graph ($I^2 \succ I^1 \succ I^0$ in Figure 1.5). With A's effort fixed at B_A^* , greater B_B allows greater security which is A's objective. Thus A's net benefits go up with a jump to a curve located to the right on the graph ($I^2 \succ I^1 \succ I^0$ in Figure 1.4). With closed borders, A would be locked in the upper-left corner of the graph (Figure 1.7) which corresponds to a low payoff. And since the A's payoff in the model is solely in terms of security net of cost achieving it, one must conclude that closing the borders to goods, services and travelers is not in the interest of A's national security.

From B's point of view, A's closed borders would put it on the curve far north-west from the origin (the origin is B's most preferred location) as illustrated in Figure 1.7.

Figure 1.7. The shut border.



Faced with the closed border, both countries have great incentives to restore trade. The shaded area in Figure 1.7 shows an impressive Pareto improvement region. The losses to the economy when the border was closed for several days immediately following 9/11 attacks give some idea how costly closed borders are. Canadian GDP declined by 0.6% in September 2001 compared with the previous month, and unemployment rate rose during the fourth quarter of 2001 to 8.0% in December from 7.2% in September (Canada Border Services Agency).

Unfortunately (as it is usually expected in a non-cooperative game), an equilibrium in the model is not efficient. Compared to the shut-border scenario, it exhausts a great part of the possible Pareto improvement possibilities (compare shaded regions in Figures 1.6 and 1.7) but does not exhaust all such possibilities. The remaining improvements should be analyzed by more explicitly addressing the mutually beneficial direct negotiations and is likely to bring a researcher to consider information-related problems at the border: credibility of the information conveyed in the direct negotiations about joint border-security policies, allocation of the economic property rights over terrorism-inflicted losses, and so on.

In conclusion, this essay addresses a debate about a trade-off between security and cross-border movements. It suggests that trade and security may be viewed as complements not substitutes to each other. Trade provides the incentives for the trading partners to participate in security policies and to efficiently specialize in security projects.

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