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NATO BENEFITS, BURDENS AND BORDERS: COMMENT

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This note refutes criticism raised by Solomon about past tests used to ascertain the concordance between NATO benefits and burdens. In so doing, a case is made for keeping the benefit proxy based on exposed borders. Moreover, a truer sensitivity analysis than that offered by Solomon is suggested.

Keywords: Burden sharing; Joint product model; NATO; Public goods; Exposed borders

INTRODUCTION

The pure public good model of defense alliances and its joint product generalization have been important paradigms in the study of defense economics for almost four decades.¹ The pure public good alliance model was first proposed by Olson and Zeckhauser (1966), while the joint product generalization was formulated by Sandler (1977) and Sandler and Forbes (1980).² These paradigms have not only led to reduced-form defense demand equations but also to tests for burden sharing among allies in NATO, ANZUS, and other alliances. The joint product model shows that the manner in which allies respond to burden sharing and allocation concerns depends on strategic doctrines, weapon technology, perceived threats, and alliance composition (Sandler and Hartley, 2001). Insights from this model have been applied to investigate other international organizations and collective action concerns (e.g., peacekeeping burden sharing).

In a recent contribution, Solomon (2004) questioned some empirical findings of the joint product model based on the correlation between derived benefit proxies and defense burdens paid. Solomon indicated that a ‘sensitivity analysis’ of benefit proxies can yield results different than those of Sandler and Forbes (1980), Khanna and Sandler (1996), and Sandler and Murdoch (2000), where an average benefit share measure was compared with actual defense burdens. The average benefit share derives from each ally’s share of NATO’s gross domestic product

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¹On the relevant literature, see the recent survey by Sandler and Hartley (2001).

²Also see the development of the joint product model in Murdoch and Sandler (1982, 1984) and Sandler and Murdoch (1990).

(GDP), its share of NATO's population, and its share of NATO exposed borders (i.e., borders not contiguous with another NATO ally).³ Because an ally's exact preferences for protecting these assets are not known, Sandler *et al.* added these three measures together and divided by three for an 'average benefit share' that equally weights the component measures. In Sandler *et al.*'s past tests, average benefit shares and defense burdens appeared drawn from the same distribution for 1965, 1975, 1980, and each year during 1990–99. Thus, benefits and burdens matched to some degree for these years, thereby lending additional support to the joint product model, which suggests such a match. There was no match found for 1970 and 1985.

Solomon (2004) objected to these authors' use of exposed borders as one of the three benefit proxies on four grounds. First, territorial disputes were not relevant to NATO for the period tested. Second, the asymmetric threat posed by transnational terrorism after 11 September 2001 represents a threat from within a country where borders do not matter. Third, advances in telecommunications and armaments (including strategic weapons) make exposed borders irrelevant. Fourth, only exposed borders with the Warsaw Pact mattered during the cold war. Solomon judged guarding exposed borders as yielding *no defense benefits* whatsoever, and he assigned this measure a zero weight. Thus, Solomon (2004) was able to *reject* that 'weighted' average benefit shares and defense burdens were drawn from the same distribution for 1965, 1970 (already rejected by Khanna and Sandler), 1985 (also rejected by Khanna and Sandler), 1990, 1995 and 1999.

The purpose of this note is to refute Solomon's criticisms and to suggest a truer sensitivity analysis for future research.

JOINT PRODUCT MODEL

The joint product model views an ally's defense spending as yielding multiple outputs whose publicness varies. In particular, defense activities can produce deterrence (a pure public benefit), damage limitation or protection during times of threat (an impure public benefit), and ally-specific outputs (private benefits).⁴ Defense outputs are impurely public among allies when the associated benefits are either partially or wholly excludable by the provider, or else partially rival. Conventional forces deployed to protect coastal resources are subject to spatial rivalry or thinning as a given military force is spread over a longer exposed perimeter. Concentrating military assets in one location along an alliance's external perimeter leads to greater relative vulnerabilities elsewhere and this, in turn, results in consumption rivalry. Ally-specific benefits can stem from providing disaster relief, maintaining order, protecting offshore assets, curbing illegal immigration, and reducing drug smuggling.

Compared to the pure public good model of alliances, the joint product model yields some different collective action predictions (Sandler and Hartley, 2001). First, sub-optimality is related to the ratio of excludable benefits to total benefits. As this ratio approaches one, independent ally behavior becomes more optimal because there will be a better match between allies' benefits and defense burdens. Second, allies' defense spending may be complementary so that allies may *augment* their defense spending in response to greater allied efforts or defense spill-ins. In an ally's defense demand equation, this results in either a positive coefficient or a smaller negative coefficient on the spill-in term (Murdoch and Sandler, 1984). Third, there is a need to restrict alliance size in the presence of damage-limiting defense benefits. Alliance size restrictions hinge on the thinning of forces; allies with more exposed borders cause more

³ The GDP share represents the industrial base protected; the population share indicates lives protected; and the exposed border share proxies resources and territory protected from threats beyond NATO.

⁴ For details of the pure public deterrence and joint product models, see Sandler and Hartley (1999, 2001).

thinning and must contribute more conventional forces to offset this thinning externality (Sandler 1977).

The applicability of the joint product model was tied, in part, to strategic doctrine. In 1967, NATO adopted directive MC 14/3, which embodied the doctrine of flexible response, whereby NATO would respond in a commensurate manner to Warsaw Pact challenges. Any such threat would be met with an appropriate reaction: conventional or strategic challenges would be countered in kind. The response would escalate if necessary. This doctrine made strategic, tactical, and conventional forces complementary, thereby decreasing substitutability between allied forces and free-rider incentives. Allies that failed to build up their conventional forces could become the weak link that draws an attack. Thus, the interest in exposed borders during the 1970s and 1980s was not due to territorial disputes – a claim made by no one – but was due, in part, to a flexible-response-induced need to keep from becoming the staging ground for a conventional contest. After the doctrine took effect, European allies significantly increased their spending on conventional forces (Murdoch and Sandler, 1984)

Verification and Tests for the Joint Product Model

Sandler *et al.* based their support for the joint product model on three separate tests. First, they tested a reduced-form defense demand equation. Prior to the doctrine of flexible response, most allies' demand equations possessed a negative and significant coefficient on the spill-in term, indicative of free riding, pure publicness, and substitutability among allies' defense spending. After the doctrine took hold, the coefficient of many non-nuclear allies' spill-in terms became positive or less negative, indicative of complementarity among allies' defense efforts. Complementarity is associated with joint products. Second, Sandler *et al.* examined the rank correlation between GDP and defense burdens. The joint product model is consistent with an absence of a positive correlation, which was the finding for virtually all years after 1967. Third, using non-parametric tests, Sandler *et al.* ascertained whether an average benefit share is drawn from the same distribution as defense burdens. Solomon's (2004) argument against the joint product model only depended on his remarks about the third test.

The evidence for or against the joint product model must, however, hinge on all three tests. Solomon's alleged rejection of the third test is inconsistent with evidence from the first two sets of tests. For example, the increases in the spill-in coefficients coming at the time of flexible response, as predicted by the joint product model, were never addressed by Solomon. The contribution of conventional weapons was never considered in Solomon's discussion where exposed borders were dismissed and given a zero weight. Based on Solomon's arguments, there is no derived benefits from protecting borders or areas

THE CASE FOR EXPOSED BORDERS

Sandler *et al.* used exposed, rather than all, borders to adjust for sequestration benefits coming from contiguous allies and to put more weight on borders with the Warsaw Pact countries. In addition, exposed borders include coastlines and, as such, can proxy gains from protecting coastal resources (e.g., fisheries and oil resources) and entry points with naval and coastal forces. Since the Law of the Seas Treaty and the expansion of territorial waters, coastal states had more waters and resources to patrol. Exposed borders can also proxy other benefits from monitoring and protecting borders, such as reducing illegal immigration, interdicting drug traffickers, supplying disaster relief (e.g., from hurricanes and tsunamis), and guarding against transnational terrorism. If, for example, Canada has no interest in its northern territory, then why did it purchase submarines to monitor these northern areas?

Each of Solomon's cases against exposed borders are easily refuted. First, protection against territorial disputes was never the issue during the period tested. The need for border protection came from the doctrine of flexible response and ally-specific desires to protect coastal resources. Second, the asymmetric threat posed by transnational terrorism after 11 September 2001 is irrelevant for the years tested by Sandler *et al.* Contrary to Solomon's assertion, *transnational* terrorism makes border protection of heightened importance to keep terrorists and their weapons from crossing into a country. This heightened concern is evident from the annual budgets of the US Department of Homeland Security (Enders and Sandler, 2006). Third, telecommunication advances are utilized in border protection, but this utilization does not make guarding exposed borders irrelevant. Once uncovered, a threat must still be addressed. Solomon should produce evidence that such advances eliminated threats transgressing borders during the period tested. Similarly, Solomon should clarify what strategic weapon breakthrough made border protection irrelevant and whether these alleged advances came during the years tested. Fourth, coastlines are just as important as land borders, given the Warsaw Pact's naval forces during the 1970s and 1980s.

Solomon's zero weight on exposed borders eliminates virtually any implied value from conventional forces and is inconsistent with the demand estimates. If borders and/or allies' areas did not need protecting, then why did European members of NATO augment conventional forces in the 1970s and 1980s during the flexible response era? Why did they maintain any conventional forces? At a minimum, Solomon should have offered an alternative proxy that captures the benefits derived from conventional forces and associated thinning. If exposed borders and a country's size are irrelevant in the 1990s, then why were troop requirements for NATO entrants and defense planning geared to protecting these countries' borders?⁵

A TRUER SENSITIVITY ANALYSIS

A fairer and more interesting sensitivity analysis is to vary the weights on exposed borders to ascertain how small a weight is required to reverse the results of Sandler *et al.* If, for example, their results can withstand a 50% reduction in the weight given to exposed borders but not a 55% reduction, then this would be an interesting finding that allows the reader to see how *sensitive* their results are to the equal weights assigned. Removing a proxy completely is not a sensitivity analysis that shows the influence of marginal changes. Moreover, Solomon's assignment of zero weights on population and exposed borders is equivalent to Sandler *et al.*'s finding that GDP and defense burden are not correlated, and does not test for the concordance of benefits and burdens. Sandler *et al.*'s Spearman test already established this lack of correlation; Solomon's second 'sensitivity' test added nothing. Solomon's failure to realize this equivalence is further evidence that Solomon did not keep the entire case for the joint product model in perspective.

Certainly, there may be better proxies for the protection of borders and resource wealth than the one – exposed borders and area – that Sandler *et al.* used. This may require a clever weighting scheme that would better adjust for threat – e.g., more weight given to West Germany's eastern border, Norway's northern border, and Canada's western border. In addition, a better proxy for benefits from conventional forces can be derived.

There is also the issue of outliers – Canada, the United States, and Norway – with respect to exposed borders. Sensitivity analysis can involve leaving out one or more outlier to see how their exclusion influences the results. As a Canadian, Solomon is concerned about Canada's

⁵ See, for example, the Congressional Budget Office (1996) report.

label as a free rider. Even with the Solomon's zero weight, Canada is a free rider. Canada is in a unique position vis-à-vis the United States to free ride and it takes advantage of this opportunity.

CONCLUDING REMARKS

Solomon's exercise would be more convincing if he had provided an even-handed sensitivity analysis. By dropping a key proxy and offering no alternative, his exercise does little more than show that GDP and defense burdens are not correlated after the mid-1960s. This is, however, known from earlier studies. Solomon did not offer a true alternative analysis nor did he expand on our theoretical or empirical understanding of NATO burdens sharing.

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