THE RELATIONSHIP BETWEEN
DEFENSE SPENDING AND
ECONOMIC PERFORMANCE IN JAPAN

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Section 1: Introduction

Many political analysts and observers suggest that Japan does not spend "enough" on National Defense (Schroeder, 1988; Sato, 1986). The U.S.-Japan military alliance enabled Japan to enjoy the fruits of world economic and political stability while spending very little to maintain the current world order. This potential "free-ride" provided Japan with the resources to grow at over 8 percent per annum between 1951 and 1971 and at an average annual rate of 4 percent thereafter. Since the Japanese government did not have to spend a portion of its budget on paying the salaries of military enlisted men and purchasing tanks and destroyers, the government could channel the large Japanese household savings into investment in promising industries such as automobiles and electronics. Also, since the world was relatively stable during Japan's rapid growth period, Japan could import primary commodities cheaply, and export finished manufactured products to a receptive international market. In short, these analysts imply that Japan after World War II was one of the principal beneficiaries of international political stability, a stability that came mostly at the expense of United States government spending.

Japan's ratio of the defense budget to GNP has averaged just under one percent between 1977 and 1987, while that for
the United States has fluctuated between six and seven percent during the same period. The definition of the defense budget, however, differs in the two countries.

This essay has three aims in evaluating Japan's military security burden. First, the composition of the defense budget of Japan will be reviewed, and an attempt will be made to make the definition of the Japanese defense budget consistent with the NATO definition of the defense budget. The NATO definition includes (1) All spending on regular military forces, (2) Military aid (including equipment and training) to other nations, (3) Military pensions, (4) Host government expenses for U.S. forces, and (5) Host country infrastructure and staff costs. The Japanese defense budget omits item (3), and items (4) and (5) are probably underestimated. The U.S. defense budget definition is roughly consistent with the NATO definition. In Section 2 of this essay, I show that even when the composition of the Japanese defense budget is made comparable to the NATO definition of the budget, the Japanese defense budget as a proportion of its GNP in 1985 will rise to just under two percent.

Second, the essay seeks to provide a rough measure for the level of defense expenditures "appropriate" to the level of benefits that Japan receives from international security and maintenance of the current world order.

The analysis of Japan's security needs has traditionally focused on defining the direct external threats that Japan faces and calculating the likely level of U.S. military aid, given the
prevailing relationship between the two countries. The difference between the defense needed to neutralize the direct external threat and the military aid the U.S. is likely to provide is the level of defense required for Japan. The required level would typically be phrased in the form of the number of minesweepers, submarines, anti-submarines, interceptors, ground-to-air missiles, troops, etc. The optimal mix of military hardware and software will depend on the type and extent of the external threat (whether the threat is from air, land, or sea) and on the type of military aid the U.S. is likely to provide. Corresponding to whatever the appropriate optimal mix of military hardware and software would be a yen or dollar amount needed to finance the defense expenditures. As an example of this traditional analysis of security requirements, Japan in 1976 adopted the National Defense Program Outline (NDPO) stipulating that the country should possess a peacetime force large enough to repel a "limited and small-scale aggression." The assumption underlying the NDPO is that Japan should be able to deter a

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Recently, the notion of "Comprehensive Security" (Sogo Anzenhosho) has been proposed in a number of Japanese government task forces (Akaha, 1987). According to these task forces, threats to a nation are not only of a military nature, but also may relate to a country's food or energy supply. Hence, Japanese security policy should not be merely regional in East Asia, but should also include pursuing political stability in the food and natural resource producing nations in Southeast Asia and oil producing countries in the Middle East.

The "Comprehensive Security" concept, however, still does not recognize the necessity of maintaining the entire current global order so that Japan's export market and foreign investments are protected.
limited attack by the Soviet Union until the United States would come to Japan's rescue (Mochizuki, 1984). To achieve the NDPO objective, the "prevailing" Japanese Self-Defense Forces had to be augmented with a brigade in Shikoku, an armored division in Hokkaido, two helicopters, ten helicopters to equip a helicopter destroyer, and an airborne early warning unit. The sum of the total cost of these improvements and the defense commitments already prevailing was calculated to be about one percent of Japan's 1976 Gross National Product.

An assumption of this essay is that such traditional calculations based on Japan's regional needs are too limited in scope. Japan not only trades with Pacific Basin nations, but also conducts significant commerce with the Middle East and Europe. In 1986, Japanese exports to the European Common Market were 15 percent of its total exports. Japan's imports from the OPEC nations were 18 percent of its total imports. U.S. efforts to provide stability in the Persian Gulf benefit Japanese oil importers and the Japanese petro-chemical industry. Peace and economic prosperity in Europe benefit Japanese exporters of manufactured goods. And of course U.S. economic growth enhances the profitability of a wide range of Japanese industries, both manufacturing and non-manufacturing. Given that Japanese interests are global, and not merely regional in East Asia, Japan should be more concerned with the maintenance of the current world order rather than with securing peace and stability only in its immediate environment. An increase in world instability
hurts Japan, especially since Japan has traditionally refrained from exporting weapons. Japanese exporters of manufactured goods will face diminished foreign markets. The price of primary commodities, especially crude oil, will rise. Japanese owners of overseas financial assets will incur heavy capital losses due to the increased political risk of asset seizure by foreign governments.

Under the assumption that world peace improves a given country's GNP, Section 3 shows that the ratio of a country's defense spending to the country's GNP that is consistent with the benefits a country receives from peace is an increasing function of the country's potential output. A country's potential output is the GNP a nation is capable of producing, given the full employment of its physical capital and labor. Assuming that both the United States and West Germany are currently spending defense-GNP ratios "consistent" with what they derive from world political stability, and assuming Japan's potential output is between those of the United States and West Germany, Japan is deriving benefits from world security that is consistent with its spending between 4.0 and 6.5 percent of its GNP on defense—4.0 and 6.5 percent are the defense spending-GNP ratios for West Germany and the United States.

It should be stressed that in no way does this essay recommend that Japan spend between 4.0 and 6.5 percent of its GNP on defense. The optimal amount of defense spending for Japan depends chiefly on its relationship with the United States, and
on the relationship of the U.S. with NATO, the Soviet Union, and the non-aligned countries. If the U.S. can always be trusted to come to the complete and perfect rescue of Japan against any aggressor, the optimal amount of defense expenditures for Japan is zero. By the level of defense spending "consistent" with benefits, I mean the hypothetical level of taxation that a supranational power will charge each nation according to the benefits from world security that each nation receives. There is no implication that this level of taxation is some "just" or "fair" level. To make an assessment of fairness, we must make an assumption of what distribution of national income among allied nations is desirable, but such an assumption will always be arbitrary.

It should also be pointed out that the simple model of Section 3 assumes that international security increases with the level of defense expenditures by the Western Allies. The assumption may be questionable to many military strategists, but I maintain it for model tractability.

Third and finally, the essay shows the results from the following counterfactual experiment performed in Section 4. The

\footnote{A 1985 Yomiuri-Gallup poll showed that 59 percent of Americans believe that the U.S. must help Japan if Japan is attacked militarily; 46.9 percent of the surveyed Japanese thought the U.S. will come to their rescue (Yomiuri, 1985).}

\footnote{Specifically, the rise in insecurity as a consequence of arms escalation is ruled out. For example, the Soviet Union may increase its arms buildup after a U.S. buildup, but I assume that after the arms competition is played out, world security increases overall. For an analysis of arms escalation, see Snyder (1970).}
experiment will evaluate the effect on Japan's real economic growth of raising the country's defense budget-GNP ratio to the U.S. level of approximately 6.5 percent. The test shows that Japan's real output growth would have only been negligibly affected. Instead of growing at an average annual real rate of 9.29 percent between 1961 and 1971, National Income would have grown at 8.76 per annum. The reason for the small change is the very high level of private saving and domestic private investment between 1961 and 1971, and that many other factors besides the growth of capital were responsible for the rapid growth of Japanese National Income.
Section 2: Adjustments to the Japanese Defense Budget

Table I depicts the Japanese defense budget for 1985. The conversion of yen into dollars used the rate of 220 yen to the dollar. An important component of Japanese defense expenditures is the amount spent on supporting U.S. troops stationed in Japan. Such support includes the construction, maintenance, and improvement of base facilities, the salaries of Japanese workers on bases, and the rental fees associated with the U.S. military's use of Japanese private land. The Japanese government also incurred some costs in the support of U.S. troops that are not included in the defense budget. First, there is the economic opportunity cost of the use of Japanese government land by U.S. military forces. This opportunity cost is listed as .2268 billion dollars in the U.S. Defense Department's 1986 Allied Contributions to the Common Defense, but there is reason to believe that the value of land as assessed by the Japanese government is only a fourth of the true market value of the land (Iwata, 1988). After correcting for this underassessment, the market value of the opportunity cost of the U.S. military's use of Japanese government land would approximately equal .90 billion dollars.\(^4\)

\(^4\)Land prices are also probably underestimated in the NATO countries, but the underestimation cannot be as severe as in Japan where land prices near urban areas rose by an average of more than 50 percent in the early 1980s. Most U.S. bases in Japan are located near major and medium-sized cities.
### 1985 Japanese Defense Budget

*Exchange rate [220 yen/\$]*
*(Billions of yen and dollars)*

<table>
<thead>
<tr>
<th>Category</th>
<th>Dollars</th>
<th>Yen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel; Provisions</td>
<td>6.43</td>
<td>1414</td>
</tr>
<tr>
<td>Equipment Acquisition</td>
<td>3.74</td>
<td>822.1</td>
</tr>
<tr>
<td>Research and Development</td>
<td>0.23</td>
<td>50.4</td>
</tr>
<tr>
<td>Facilities Improvement</td>
<td>0.20</td>
<td>44.2</td>
</tr>
<tr>
<td>Maintenance</td>
<td>2.15</td>
<td>472.2</td>
</tr>
<tr>
<td>Base Countermeasures</td>
<td>1.35</td>
<td>296.5</td>
</tr>
<tr>
<td>Others</td>
<td>0.17</td>
<td>37.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14.3</strong></td>
<td><strong>3137.1</strong></td>
</tr>
</tbody>
</table>

*Numbers may not add-up due to rounding.*

Second, there are .1203 billion dollars of unlevied taxes and fees. The U.S. military forces in Japan are exempted from paying certain national and local government taxes and fees. Such exemptions include custom duties and taxes on petroleum products. Adding .90 billion and .1203 billion to the 14.3 billion dollar total depicted in Table I, we get 15.32 billion dollars.

A major discrepancy between the NATO definition of the defense budget and that of Japan is the omission of military pensions from Japanese defense expenditures. Military pensions in Japan in 1985 equaled 8.15 billion dollars. The recipients of these military pensions include over two million members of the old Imperial Army and Navy and their families. Although it is not appropriate for consistency with the NATO budget to include the pensions of World War II troops, in concert with our underlying objective of providing an upper-bound to Japan's defense spending, we add 8.15 billion dollars to the previous 15.32 billion and get 23.47 billion dollars.

The NATO budget includes military aid to other nations, mostly to developing countries. Such aid includes the gift and subsidized sale of weapons, and training expenses for foreign troops. It has been the Japanese government's policy since the 1960s to refrain from exporting weapons, so military aid is absent from its defense budget. It has often been suggested, however, (Sakamoto, 1986) that economic aid may substitute for military aid since economic aid helps preserve international
peace. The logic behind including economic aid is that economically unstable foreign governments are more prone to influence from Communist nations through insurgent groups, guerillas. In 1985, Japanese economic aid to the Third World totalled 3.8 billion dollars. Adding 3.8 billion to 23.47 billion, we get 27.27 billion dollars, which is about 1.9 percent of Japan's 1985 Gross National Product. Even when the Japanese defense budget is made more consistent with the NATO security budget, Japan's defense spending-GNP ratio rises to at most 1.9 percent.
Section 3: A Simple Theory of Defense Burden-sharing

The previous section showed that an upper-bound estimate for the ratio of Japan's defense expenditures to GNP could at most be two percent. The two percent figure puts Japan's security contribution below those of Italy (2.7%) and Canada (2.2%), but above those of the non-NATO European nations, Austria (1.3%) and Finland (1.4%).

It is well known that Article 9 of the 1946 Japanese Constitution prohibits Japan from using force as a means of settling international disputes, and that in 1976 the Japanese Cabinet agreed to limit future defense expenditures to just under one percent of the Japanese Gross National Product. Defense analysts vary in their opinions of whether one percent is "enough" to assure Japan's present and future security. To borrow Mochizuki's (1984) terminology, "unarmed neutralists" argue that there is no realistic threat from the Soviet Union to Japan. Not only do they see further militarization as unnecessary, but they also see further military expenditures as inimical to Japan's security interests by upsetting and provoking the Soviet Union. Unarmed neutralists view arms control and disarmament as leading to world peace. At the other extreme, defense analysts in the Japanese Gaullist camp fear the Soviet military threat and doubt America's commitment to Japan. These critics argue for the revision of the 1946 Constitution and the
elimination of the one percent ceiling; they see a need for a large scale Japanese military buildup. Public opinion, as evidenced by numerous opinion polls, seems to fall somewhere between the two camps. According to one recent U.S.-Japan poll, 54 percent of the Japanese population thought that the United States would not defend Japan when Japan is attacked. However, many Japanese do not view the Self-Defense Force as anything more than a natural disaster relief organization (Johnson, 1986).

There seems to be a spectrum of opinion even within Japan on the appropriate level of defense expenditures. The objective of this section is to derive some measure of the appropriate level of Japan's defense spending by using the theory of Public Goods. The assumption that larger defense expenditures reduce international tension is maintained throughout. The assumption is thus not in agreement with the "unarmed neutralist" position mentioned above.

Public Goods have the characteristic that they are desired by all members of an organization. These goods satisfy the common interests of the organization members. Public or collective goods differ from other kinds of goods in the following two respects. First, if the good exists, then everyone who desires the good automatically benefits. Non-purchasers of the collective good cannot feasibly be prohibited from consuming the good (Non-exclusivity). Second, if the good is available to any one person in a group, the incremental cost of providing it to all other members is zero or negligible (Non-rivalness of
consumption). Examples of collective goods are traffic lights, public schools, and toll-free roads in towns and villages.

The collective goods need not be something tangible; it may be an abstract concept like a general sense of well-being and security. Ever since Adam Smith, defense has been considered an international public good among nations that are allied. Allied countries have a common interest in their collective security. Exclusion of a given country is difficult. If international security exists, then any Western Bloc country will be able to enjoy the fruits of world peace without any additional expenditures. In addition, the incremental cost of providing international security to any one country is often negligible. If West Germany and Austria are allied, the protection of West Germany automatically protects Austria.

Can the U.S.-Japan security alliance be considered a public good? Both Makin and Wong in this volume stress that the alliance fails to satisfy the condition of zero marginal cost. The authors argue that especially in this Nuclear Age, the defense of Japan entails a marginal cost to the U.S. that is prohibitively high. With the long-range atomic capability of the Soviet Union, the United States risks enormous physical destruction of its homeland should it go to war on behalf of Japan.

The opinions of Makin and Wong are no doubt reasonable, but the authors place too much emphasis on how America is self-sacrificing without benefiting from the protection of Japan. It
must be remembered that the security of Japan greatly benefits the United States as well. The fall of the world's second most productive economy to the Soviet Bloc would be highly detrimental to U.S. political and economic interests. As Sato mentions in this edition, the fate of the strategically crucial Northeast Pacific will determine how recklessly the Soviet Union will act in Europe and the Middle East. The three theatres of the Middle East, Western Europe, and the Northeast Pacific are so strategically linked that the attack of one will affect the remaining two. Sato says that "to the Soviet Union, the sinking of its nuclear missile carrying submarines in the Sea of Okhotsk would actually mean U.S. nuclear superiority even though the Soviets have been victorious in a land battle in Europe or in the Middle East." The U.S. defense of Japan indirectly provides the United States with much greater world stability.

The fortunes of U.S. and Japan are tied to the extent that even the U.S. defense of its homeland provides large external benefits to Japan. Given that the United States is Japan's largest export and foreign investment market, a strong America with a high domestic demand gives Japan a reliable large-volume trading partner and a secure place to store excess funds.

The reservations of Makin and Wong notwithstanding, the U.S.-Japan security alliance seems to crudely satisfy the zero marginal cost requirement of a collective good.

Assuming that international security is a public good, how should the cost of achieving the optimal level of international
security be allocated among the Western allies? The Appendix to this paper presents a model that is a slight modification of Olsen and Zeckhauser (1966). The model shows that the benefits a country gets from world security is proportional to the country's potential output, defined as the maximum GNP a country can attain given the country's natural resources, population, level of technology, and human capital. This proportionality condition arises when the marginal benefit of defense is made equal to its marginal costs. If a nation has great potential to produce goods and services, then the nation has more to lose by the disruption of its productive capacity. In the extreme case of complete defeat in a war, the entire productive capacity of a nation will be in the hands of the enemy. The importance of international security seems to rise as a country becomes more economically productive.

The theory of public goods predicts, however, that if all nations acted in their self-interest, there will be an undersupply of total allied defense. The reason for the sub-optimal supply of security for the Western Alliance is as follows. If all nations independently decided on their level of defense expenditures, then as in the model in the Appendix, the optimal level of defense in each country will be at the point where the marginal benefit of defense equals its marginal cost. However, the optimal supply of a public good occurs only when the sum of the marginal benefits of the good equals its marginal cost. Since defense is a collective good, a one unit increase in
defense increases the benefits of security for all Western Bloc countries, not just to the country undertaking the expenditures. For there to be an optimal supply of defense, the effect of the defense expenditures of one country on other countries must be taken into account. For example, when the United States spends for defense, other countries with national goals similar to those of the United States automatically benefit. Since the U.S. has the world's largest potential output, the optimal level of defense expenditures for the U.S. will be very large. These large defense expenditures may enable other nations to "free-ride" on international security. This "free-riding" scenario is likely to result in an inadequate provision of total Western Bloc defense.

To help resolve the sub-optimal defense problem, assume that it is feasible to tax each country according to the increment to GNP the country receives from world security. It is straightforward to show that a country with the higher potential output should be assessed the higher tax. When countries in an alliance are taxed in proportion to their marginal benefits from defense, there will be an optimal supply of total allied security. Since the taxes will sum up to the marginal cost of defense, the optimality condition that the sum of the marginal benefits of the public good equals its marginal cost is satisfied.

The above optimal defense burden sharing scheme suggests that Japan should spend somewhere between 4.1 and 6.5 percent of
its GNP on security-related activities. Four point one and 6.5 percent are the GNP shares of defense for West Germany and the United States. Assuming that Japan's potential output is between those of the United States and West Germany, and assuming that the U.S. and West Germany are already contributing optimal amounts to the Western Alliance, Japan should be spending between 4.1 and 6.5 percent of its GNP on defense expenditures to make the total supply of allied defense sufficient. This does not imply that Japan should simply purchase more military hardware. Any expenditure that decreases international tension is appropriate. Such spending may include overseas economic assistance and scholarships for students from developing countries. In addition, it is perhaps in Japan's interest to spend on defense projects that may spin-off products with present or future commercial potential. The development of such "dual-use" technologies should lower the marginal cost to Japanese society of defense spending. Further discussion on the relationship between technology and defense expenditures occurs in the next two sections.

Before I go to the next section, let me point out that it may be unrealistic to assume that both the United States and West Germany are presently contributing optimal amounts to world stability. If they are, then the theory of Public Goods suggests that there is presently a Western Bloc underprovision of measures to achieve international peace. The underprovision comes from the lack of contribution from Japan and possibly other allies.
It may be the case, however, that the perception of fear of the Eastern Bloc is exaggerated in the U.S. and West Germany, exaggerating their estimates of the total costs required to protect the Western Allies from Eastern Bloc aggression. If the "correct" total costs are substantially lower, both the U.S. and West Germany can spend smaller proportions of their GNPs on defense. Japan may not have to increase its present defense-GNP share by much.
Section 4: The Effect of Increased Defense Expenditures on Japanese Economic Growth between 1961 and 1971

The last section established a simple relationship between a country's potential output and the level of defense expenditures, drawing the implication that Japan's benefit from international security is consistent with its spending between 4 and 6.5 percent of its GNP on defense.

Taking the upper-bound estimate for the sake of comparability with the United States, suppose Japan historically did spend 6.5 percent of its GNP on defense. What kind of effect would this larger defense expenditure have on Japan's past economic performance?

The economic effects of defense expenditures can be classified into three broad categories. First, as with any government expenditure program, defense will stimulate a country's aggregate domestic demand. From the late-1950s to the first oil crisis in 1974, Japan was at or near full-employment (Kosai, 1986). After 1974, however, domestic private consumption and investment fell. It is debatable, however, that increased defense spending after 1974 would have increased Japanese GNP, since several economists argue that in 1974 Japan's full-employment level of output growth actually declined from about 8 percent per annum to 4 percent per annum (Lincoln, 1987). Some causes for the fall in Japan's full-employment output are higher
energy and primary commodity prices, lower investment in fixed
assets, and the narrowing of the technology gap with the West.
If Japan were near or at full-employment between 1974 and 1988,
increased defense expenditures would have crowded out domestic
investment, consumption, and exports, rather than raised domestic
output. Of course, increased defense expenditures may be
beneficial to the extent that Japan's external trade surplus will
shrink. Domestic absorption will rise, leaving less of Japan's
domestic production to be exported overseas.

Second, the growth in defense expenditures can affect
Japanese aggregate supply by crowding out domestic investment in
the private sector and reducing civilian employment. Larger
defense spending will raise domestic real interest rates, raising
the cost of capital, and lowering private investment. This fall
in investment will make the aggregate capital stock grow at a
slower rate, and through the aggregate production function,
decrease the growth of potential output. Jorgenson and Nishimizu
(1978) estimate that Japan's rapid postwar output growth can be
largely attributed to Japan's very high growth rate of capital
input. If the growth in capital were dampened, the growth in
output will slow. In addition, a rise in the military demand for
manpower may divert scarce human resources from the civilian to
the military sector. To the extent that labor is an input in
production, the fall in civilian employment will slow the growth
in aggregate output.

The third economic effect is related to the second. Not
all defense expenditures are purely for government consumption; some spending is for investment. For example, 1.1 percent of Japan's 1985 defense budget was directed to research and development (R & D). It has often been maintained that defense R & D may have large potential civilian spillovers (Saxonhouse, 1988). For example, in the U.S., the military support of airplane development and the production of the cargo transport plane Boeing 367-80 led to the rapid and relatively inexpensive development of the successful commercial jet aircraft, the Boeing 707. Other notable examples of defense R & D spillovers are the General Electric jet engine, supercomputers, and the Teflon coating on household utensils.

It is very difficult to assess the potential economic impact of military R & D spillovers. The main problems lie in the unavailability of direct measures of R & D productivity and the necessity of using imperfect proxy variables such as total factor productivity growth (Griliches, 1987). As Denison and Chung (1976) and Ohkawa and Rosovsky (1973) argue, Japan's rapid growth in the 1960s and early 1970s owes a large amount to the import of technology from the West. There was probably little need for Japan to develop its indigenous high technology through defense R & D between the early 1960s and the early 1970s. In addition to the direct effect of military R & D on technological progress, the development of military hardware will have an indirect negative effect on the competitiveness of an economy by consuming the time and energies of highly skilled
engineers and scientists. For example, in the United States, it is argued that the "deep pockets" of the defense industries raised the cost of attracting technicians, engineers, and scientists to the non-military sector; this, in turn, raised the production costs of commercial goods, making commercial goods less price competitive relative to the commercial goods of competing countries (Rosenberg, 1987). Japan's competitive position in the world economy may have been hampered had Japan used its scarce engineers to develop military hardware.

In several high technology areas, Japan is thought to have caught up with the West by 1979 (Oshima, 1987). These areas include optical fibers, flexible manufacturing systems, and semiconductors. Japan is still considerably behind the United States in fields such as supercomputers, rockets, and space communications. The development of these fields entails a high degree of problem solving and unpredictability, and requires an ability to integrate complicated systems (Saxonhouse, 1988). A stable and high level of U.S. military procurement for new high technology products is said to have encouraged risk-taking in R & D by U.S. companies (Rosenberg, 1987). With no guarantee of government demand for new products, Japanese companies have followed a fairly conservative approach to R & D, emphasizing projects with a high degree of commercial feasibility. This absence of risk-taking may have slowed Japanese technological development since 1979, especially in frontier areas such as high-speed supercomputers and new materials. The future
prospects for Japanese technological development may not be bright, since the United States is increasingly reluctant to share its advanced technology. For example, it was widely publicized in Japan that a recent superconductor conference in Washington was closed to foreign researchers. The Japanese themselves now seem to realize that the need to develop indigenous technology is great (Yamakage, 1985). The conclusion to this paper briefly discusses how Japan should develop its high technology through government defense spending on basic R & D.

This section will mostly address the effect of defense expenditures on the aggregate supply or full-employment level of output for Japan. The analysis will focus on the period between 1961 and 1971, the era of Japanese high speed growth. The level of Japan's National Product for this period satisfies most standard definitions of full-employment. Kosai (1986) states that the unemployment rate on average was less than two percent, and that any further increase in aggregate demand would have accelerated price increases. A rise in military expenditures would have crowded out private investment and lowered civilian employment. The remainder of this section will estimate the effect on National Output of the transfer of labor and capital from the private to the military sector.

There are three reasons for focusing on the "high-growth" period from 1961 to 1971. First during this time span, Japan

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5 The exception is 1965; there was a slight recession after the 1964 Tokyo Olympics.
witnessed a rapid increase in its capital stock. At the end of 1960, Japan's net fixed capital stock was 14,353 billion in terms of 1965 yen. By the end of 1971, this stock had grown to 46,880 billion — a real growth of 327 percent. This large increase in capital no doubt served as a foundation for Japan's sustained progress growth during the 1970s and 1980s, despite adverse shocks from abroad.

Second, Wong in this volume has already performed a careful study of the relationship between defense spending and GNP growth from 1970 to 1985.

The third reason for focusing on the 1961 to 1971 period is that there already exists an exhaustive growth accounting model of the causes for Japan's high speed growth from the early 1960s to the early 1970s. Denison and Chung's (1976) impressive work greatly simplifies my task, since a new growth accounting model will not be required. To the best of my knowledge, there has yet to be a growth accounting study that treats the period from 1972 to the present.

Table II reproduces Denison and Chung's Table 4-6 showing the sources for the growth rate of Japanese National Income. Japan's growth of real National Income between 1961 to 1971 averaged 9.29 percent per annum. According to Denison and Chung, of this 9.29 percent growth, growth in the capital stock
Table II

Sources of Growth for the Growth Rate of National Income (in percent) [1961-1971]

<table>
<thead>
<tr>
<th>Source</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Income Growth</td>
<td>9.29</td>
</tr>
<tr>
<td>Labor</td>
<td>1.78</td>
</tr>
<tr>
<td>Employment</td>
<td>1.09</td>
</tr>
<tr>
<td>Hours of Work</td>
<td>0.11</td>
</tr>
<tr>
<td>Age-Sex Composition</td>
<td>0.19</td>
</tr>
<tr>
<td>Education</td>
<td>0.35</td>
</tr>
<tr>
<td>Unallocated</td>
<td>0.04</td>
</tr>
<tr>
<td>Capital</td>
<td>2.57</td>
</tr>
<tr>
<td>Inventories</td>
<td>0.86</td>
</tr>
<tr>
<td>Nonresidential Structures and Equipments</td>
<td>1.44</td>
</tr>
<tr>
<td>Dwellings</td>
<td>0.27</td>
</tr>
<tr>
<td>Advances in Knowledge</td>
<td>2.43</td>
</tr>
<tr>
<td>Improved Resource Allocation</td>
<td>0.82</td>
</tr>
<tr>
<td>Economics of Scale</td>
<td>1.96</td>
</tr>
</tbody>
</table>

Source: Denison and Chung (1976), Table 4-6.
accounted for 2.57 percent, advances in knowledge 2.43 percent, economies of scale 1.96 percent, increases in the supply of labor 1.78 percent, and the improved allocation of resources .82 percent. The growth in the capital stock is the most significant factor.

Under the definition of Denison and Chung, "capital" includes inventories, nonresidential structures and equipments, and dwellings of the private sector. The government sector is assumed to make no factor payments to capital. Hence, the contribution of the government sector to National Income is solely through factor payments to labor. Between 1961 and 1971, private sector capital grew by 11.8 percent.

The following assumptions are made in the calculation of the negative effect of defense expenditures on National Income.
1) Government defense spending crowds out investment in nonresidential structures and equipment one-for-one.
2) The expansion of the military sector increases the proportion of the Japanese population engaged in the military to .88 percent from the customary .20 percent.
3) Military employment does not result in an increase in real output.
4) The capital and civilian labor shares in National Income are constant.
5) Technological progress is disembodied from new capital inputs.

Assumption (1) is reasonable at or near full-employment.
Assumption (2) implies that Japan will have the same proportion of its population in the military as does the U.S. when Japan has the same defense-GNP share. This assumption is tenuous, however, since the two countries may desire a different mix of military hardware and human resources. If Japan defines its main security objective as the defense of its Sea Lanes and its straits and to cope with Soviet contingency in Hokkaido and Tohoku, Japan's manpower requirements will probably differ from those of the U.S.; the U.S. will define its security objectives in more global terms. In addition, Japan may choose to pursue its international security by sending economic aid to politically and economically unstable countries, and this strategy will surely require less manpower than maintaining a standing army. Despite these complications, for the sake of argument, let us assume that Japan had maintained an active military force that was .88 percent of its population throughout the 1960s.

As in Section 2, assumption (3) implies that military employment has no direct positive effect on real National Income. The reallocation of civilian employment to defense employment lowers real National Income by the amount of factor payments previously made to the reallocated civilians. Wage payments to military employees results in pure inflation, since military employees are assumed not to produce real output. That is, the wage bill of servicemen is satisfied by printing money.

Assumptions (4) and (5) are implicit in the constant-returns-to-scale growth accounting exercise. Assumption (5) is
of course unrealistic. Japanese technological progress proceeded by the rapid introduction of the latest vintage of capital equipment (Uno, 1987, p.65). For example, the Japanese steel industry became highly efficient by the incorporation of oxygen-processing and large scale open-hearth furnaces. In practice, technical change and capital investment seem inseparable, but the growth accounting literature has maintained the disembodiment hypothesis to make the calculations tractable.

I first estimate the effect of defense spending on the crowding-out of plant and equipment investment. Denison and Chung's Table 4-6 shows that structure and equipment investment contributed 1.44 points to the 9.29 percent growth in National Income. Division of .0144 by .11, the average growth rate of fixed net non-residential investment, gives .131 as the constant capital share, or the percentage National Income will grow when capital input grows by a certain percentage.

The hypothetical levels of annual defense expenditures that are 6.5 percent of GNP are derived by multiplying Japan's annual GNP between 1961 and 1971 by 6.5 percent. From these annual defense levels, Japan's actual defense expenditures are subtracted. A post-crowding out net investment time series is derived by subtracting from Denison and Chung's net investment data (Table I-2), Japan's hypothetical defense spending levels calculated above. Instead of growing at 11 percent between 1961 and 1971, net fixed non-residential capital would have increased at an annual rate of only 7 percent.
Subtracting 7 percent from the actual growth rate of capital of 11 percent, we get 4 percent. The fall in plant and equipment investment due to the increased government defense spending does not seem to be high, especially relative to the very high level of real net capital investment undertaken between 1961 and 1971. Net private investment during this period averaged 15.7 percent of National Income.

The multiplication of the 4 percent fall in net investment by the capital share of .131 gives .524 percent. The decline in plant and capital investment would have decreased the growth in National Income by .52 points, from 9.29 percent to 8.77 percent per annum.

The estimation of the effect on National Income of a fall in civilian employment entails further assumptions. First, it is assumed that the decline in the contribution of labor arises entirely from the decline in total private employment. This is probably unrealistic, since the military sector would not have drawn employees evenly from the various age, sex, and education groups. The burden of military service probably would have fallen disproportionately on prime-age (20-34) males. Since prime-age males work longer hours and are more productive than females and older workers, we would expect that two other components of "Labor," "Hours of Work" and "Age-Sex Composition" would both have contributed less to the growth in output. Given
that highly educated workers are more prone to finding ways of avoiding military service, however, the average level of education in the civilian sector should have grown at the same rate as before. It proved intractable to calculate the changes in the components of labor other than total employment.

According to Denison and Chung's Table D-1, total employment increased by 6.78 million between 1961 and 1971. The rise in total employment, however, was less than the increase in the total adult population. The labor force equaled 69.1 percent of the population in 1961, but only 65.0 percent in 1971. If the rate of participation in the military had remained at a constant .88 percent level of the population between 1961 and 1971, there would have been a smaller increase in total civilian employment. Arithmetic identical to that for the crowding-out of plant and equipment investment showed that military employment would have lowered the growth of civilian employment by an annual .0075 percentage points. This fall in the growth rate of the private labor force would have decreased the growth of National Income by only .0063 points.

Because of the fall in the growth rates of both capital and labor, the growth of National Income between 1961 and 1971 would have declined from an average annual rate of 9.29 percent to 8.76 percent. It should be remembered, however, that this calculation is based on stringent and somewhat unrealistic assumptions; the results are only suggestive.

In a footnote, Patrick and Rosovsky (1976) state that under
the assumption that all defense expenditures would be at the expense of investment, the annual growth of output would have fallen by two percentage points between 1954 and 1974. Since their assumption of one-for-one crowding out of investment is similar to mine, it is surprising that they find such a large effect. Although they do not explain their calculation procedure, it is probably the case that their growth accounting model ascribes more importance to the growth of the private capital stock than the model of Denison and Chung.

This section has so far showed that the increase in military expenditures during the 1960s would have decreased the growth in physical capital and civilian employment by only an insignificant amount. Two other factors that Denison and Chung find important for aggregate economic growth are the advances in knowledge (1.97 of 8.77), and economies of scale (1.94 of 8.77). The former refers to the improvements in the techniques of production, distribution, and management adopted during a given period; the latter refers to the growth of the national market that business serves, which allows for greater specialization in production and marketing. It is hard to imagine that increased defense expenditures would have affected these two factors significantly during the 1960s. As Denison and Chung argue, most of Japan's advances in knowledge during this period were due to the "catching-up" with the "best practice" performed in the United States. It is possible, however, that there could have been some improvements in the techniques of production in industries such
as aerospace and high grade steel. These are sectors that Japan has traditionally been weak. Also, it seems probable that defense production would have increased scale economies in industrial production. The production of defense hardware such as tanks, destroyers, and aircraft carriers requires a very large plant capacity.

Before the end of this section, let me briefly discuss the plausible effect of the increased employment of engineers in the military sector on economic growth in the civilian sector. Relative to its population, Japan has a large number of engineers. According to Dore (1986), Japan in 1979 had 311 students in university level engineering programs for every 100,000 of the population. Great Britain had 47 per 100,000 in that year. As for the number of practicing full-time researchers in 1985, Japan had 410 per 100,000, the U.S. had 360 per 100,000 (Science and Technology Agency, 1988). Given that expenditures for Research and Development Programs in the Japanese defense budget has traditionally been only about one percent compared to 9.8 percent for the United States, past Japanese demand for engineers for military research could not have been high. The relatively low military demand combined with the large potential supply of engineers in Japan suggests that in the past, the salaries of engineers have not been bid up by military R & D.

The rise in the demand for engineers in the military sector between 1961 and 1971 would have increased wages in the civilian sector, but the increase would not have been so large as to have
made Japanese firms non-competitive in civilian manufacturing industries such as cars, textiles, and shipbuilding. Compared to other countries, Japan should have had a large supply of engineers relative to the supply of other workers.
Section 5: Conclusions and Suggestions

American demands for greater Japanese defense contributions remain powerful. Especially in Congress, there is a strong sense that the U.S. can no longer pursue domestic economic growth and also be the world's policeman. Both the House and the Senate recently passed a resolution calling on Japan to spend 3 percent of its Gross National Product on defense. There is also a proposal pending that requires allies to pay a duty on all products that they export to the U.S. equivalent to the proportion of GNP the U.S. spends on defense minus the share the allies spend on security (Japan Economic Institute, 1988). If this proposal is adopted, Japan will have to pay an additional tariff of 5.5 percent (6.5 - 1.0) on all exports to the United States.

This paper has argued that for Japan to spend between 4 and 6.5 percent of its GNP on defense is not inconsistent with the benefits Japan receives from world security. It should be emphasized that these GNP proportions are not necessarily "moral" or "fair." To arrive at some "fair" level of defense contributions, we must specify how incomes are to be distributed among nations. Such specifications can only be arbitrary.6

6Also arbitrary is the notion that an ally's contribution to world security can be expressed only in monetary terms (Singer, 1970). That Japan's political institutions are in general supportive of capitalism aids the U.S. in its pursuit of foreign
U.S. pressure for increased Japanese defense commitments will continue. Given that the United States absorbs about 35 percent of Japan's exports, U.S. threats of quotas and tariffs against Japanese products must be taken seriously. Assuming that Japan has to increase its security contributions, how should these new expenditures be allocated among different projects?

It is well-known that a massive Japanese acquisition of conventional or nuclear weapons would have enormous drawbacks. If Japan were to re-arm, Japan's Asian neighbors would be at considerable unease (Johnson, 1986). The Japanese Constitution prohibits a full-scale conventional re-militarization, and what is more important, the Japanese population seems to be vehemently opposed to a large-scale military buildup. According to a recent poll by the Prime Minister's Office, only 7.8 percent of the population were supportive of a strengthening of the military (Asahi, 1988).

To the extent that foreign aid improves a developing country's political stability, Japan may be able to pursue international peace through its overseas economic assistance program. For example, foreign aid may serve to mitigate low intensity conflicts occurring in El Salvador, the Philippines, Cambodia, and Lebanon. In 1986, Japan gave over 6 billion dollars in foreign aid, second only to the United States. The Japanese government announced in 1985 that it intended to spend policy. The productive Japanese economy in itself is a last resort provider of military hardware to the United States.
over 40 billion dollars in aid between 1986 and 1992. In 1987, the time-frame for spending the 6 billion was shortened to 1990. There is some concern that much of Japan's present foreign aid is de facto tied; that is, the nation often mixes foreign aid with export credits to win commercial contracts in developing countries (Japan Economic Institute, 1987). If Japan were to spend 3 percent of its GNP on development assistance, the country would be disbursing approximately 55 billion dollars in fiscal 1988. If a large portion of this aid were "tied," the increased government budget deficits should be more palatable to the Japanese voting public; Japanese exports to developing countries will rise and there will be some offsetting positive aggregate demand effect on GNP. That aid is tied does not imply that economic benefits for the receiving country are reduced. The developing country may gain substantially if the aid is used to hire Japanese construction companies to build industrial plants and infrastructure such as roads and irrigation systems. Of course, the possibility that development aid will be used to purchase Japanese consumer products exists. Such an outcome will be detrimental to long-term development goals.

Another area of "defense spending" that may appeal to the Japanese public is government support for basic research. Basic research has the property that the fruits from the research has wide applicability. A subset of the products that are ultimately derived from the research effort may be applicable for advanced weapons design. For example, improvement in high speed numerical
computing may have important uses in tactical missile guidance systems.

Relative to its strength in applied research, Japan is weak in basic research. A counting of citations in international scientific journals has revealed that Japan is fifth in the world in physics, fifth in chemistry, and third in the biological sciences. This weakness seems to be a result of the low level of government support. While the U.S. government finances about half of the total U.S. R & D expenditures, the Japanese government supports only about 20 percent.

Basic research will have a large economic rate of return in both countries. Griliches (1987) cites econometric results showing that all R & D spending increases the annual growth rate of U.S. corporate output by 33 to 62 percent, depending on the year. Basic R & D spending, in addition, has a premium over general R & D spending by several hundred percent. The impact of R & D spending on corporate output in Japan is similarly large. Suzuki and Miyagawa (1986) show for manufacturing firms that all R & D spending raises the growth rate of output by 40 to 55 percent. They do not have figures for the returns to basic research, but it can probably be assumed that over the long run the premium of basic research over general research is as high in Japan as in the United States.
Griliches, however, does show that basic research undertaken by the private sector has a larger return than basic research supported by the government. This is because defense related research has typically been characterized by inefficient featherbedding and cost-plus-profit procurement (Tow, 1983). Defense related basic research also has little regard for minimizing costs. High performance testing and laboratory equipment are bought with almost no cost-benefit considerations (Rosenberg, 1987). Still it is probably more efficient for the government to sponsor research rather than to spend on the salaries of enlisted men. Sponsored research at least leads to some increment in future GNP, but wages are a pure government consumption item. Recall that in the 1985 Japanese defense budget, salaries and wages comprised 45 percent of the total.

Given that a large-scale increase in Japanese government sponsored basic research is probably acceptable to the Japanese public, the country should try to convince the United States that it is appropriate to classify expenditures on basic research as defense spending. To facilitate this aim, Japan should administer its government sponsored R & D projects through the Defense Agency, as DARPA (Defense Advanced Research Projects Agency) does in the U.S. From at least an accounting standpoint, Japanese defense spending will then rise. Because of the nature of basic research, the results from the research will have applications in the commercial as well as in the defense sectors.
Tokyo should be liberal with the transfer of basic technology to the United States. The 1983 U.S.-Japan technology cooperation agreement has been plagued with concerns on both sides that the technology "give-away" will be spun-off to commercial applications (Tow, 1983). The Japanese worries of transferring technology to U.S. companies are real, but the risk of transferring commercially viable technology should be viewed as the cost of gaining relatively free access to the U.S. domestic market.
Appendix:

This Appendix will show that the benefits a nation gets from world security is proportional to the country's potential output. Assume that international security is a strictly increasing function of allied common defense expenditures represented by vector \( D = (D(1), D(2), \ldots, D(i), \ldots, D(N)) \), \( i \), an index of countries. Define country \( i \)'s actual Gross National Product as international security times potential output, \( Y \), minus defense expenditures, \( \text{GNP}(i) = F(D)Y(i) - cD(i) \), where \( c \) is the constant unit cost of defense. \( c \) should be interpreted as the financial wealth and human capital diverted from the productive sector of the economy to the military sector to create a unit of defense. The diversion of resources from the productive sector results in a fall in actual GNP. \( cD(i) \) will be positively related to the amount a nation spends on defense as reported in the official government budget statistics. The model above assumes full-employment; if the economy is not fully-employed, then defense spending will have the usual stimulative effects. Potential output is the maximum GNP a country can attain given the country's natural resources, population, level of technology, and human capital. The assumption is that as international tension rises, a country will have greater difficulty in achieving its economic potential. An increase in country \( i \) defense spending, an increase in world security, makes a country better able to reach its full-employment output. Assuming that other allies do
not react to a change in country i's defense spending (the Nash assumption), the GNP of country i will be maximized when the marginal benefit of defense, \( F'(D)Y \) equals its marginal cost, \( c \). Let this level of optimum defense expenditures be \( cD^*(i) \).

A straightforward application of the envelope theorem demonstrates that 
\[
d \left[ \frac{(cD^*(i))/GNP}{dY(i)} \right] = F(D(1),...,D^*(i),...D(N))
\] is positive. As a country's potential output rises, it would desire a higher level of defense.
References


