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I am currently a senior majoring in Geography with a minor in History and I'm planning on pursuing higher degrees in Geography

following my graduation. This paper was written for a History and Economics course taught by Professor Peter Hoffenberg. While writing this paper, I struggled to connect economic trends with oftentimes overburdening political ideology, to find a fair and balanced conclusion. In the end, I learned more about the complexity of interconnected systems of military, spending, and governance, and the world at large.

Fjords and Firearms

Military Spending, Economic Growth, and Technological Innovation in Postwar Norway

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Economics 341 / History 340 (Comparative Economic History)

Mentor: Dr. Peter Hoffenberg

Both economists and policy makers disagree on the effects of significant military spending on the economy during peacetime. By looking at Norway, a small but advanced nation with a complex economy and a mixed history of military spending, a case study can be made on the positive and negative influences of military spending. In order to understand this connection, two key national indicators should be analyzed in Norway during the Cold War: military spending and economic growth, as represented by the change in both real gross domestic product (GDP) and GDP per capita over time, while paying particular attention to research and development (R&D). The Norwegian military establishment took a significant turn after the Second World War as military spending increased dramatically and Norway began receiving significant investments by Western nations, specifically the United States. As Norway reached the end of the twentieth century, however, relative military spending began to decrease and the military's role in technology and innovation shifted to the civilian sector. Arguably, one of the most significant contributions of the Norwegian military sector in the twentieth century has been the slow conversion of military R&D to civilian R&D within the public sector; this conversion has provided firms with a constant flow of human resources and enabled the success of Norway's technology-driven industries.

It has been the argument of many economists and and policy makers that military spending allocates resources to an unproductive endeavor. The case against military spending has been put succinctly in a series reports by the United Nations (UN). For example, this statement from 1982: "The arms race represents a waste of resources, a diversion of the economy, a hindrance to national development efforts, and a threat to the democratic processes . . . military outlays have no long-term positive effects on economic growth." (United Nations, 1982, p. 6, p. 47). However, it is hardly surprising that the UN's global perspective is particularly critical of the arms race, when one considers that a single country's security can be perceived as a threat by another country. From the UN's vantage point, the effects of military spending are understandably unfavorable.

At the national level, however, the negative consequences of military spending must be balanced with the positive effects of fulfilling national security needs. A full analysis of this consideration in national policy-making lies outside the scope of this paper. Nor will this paper be able to cover all the macroeconomic aggregates that are significantly affected by military spending, such

as the level of employment, the savings rate, inflation,¹ the volume of imports and exports, income distribution², and so forth. Instead, we shall concentrate on the effects of two key national indicators in Norway during the Cold War: military spending and economic growth, paying particular attention to military research and development.

Generally speaking, the past two centuries can be characterized as a peaceful period in Nordic history. By comparison, in the four preceding centuries, there had been over a dozen civil wars and about forty international wars among Nordic countries and with outside powers. However, only one civil war (in Finland) and four international wars have been recorded since 1815. Sweden has a record of unbroken peace since the Napoleonic wars; Norway holds a similarly long record of peace, only interrupted by World War II.³

Like the other Nordic states, Norway sought to pursue a policy of neutrality after gaining its independence in 1905. This strategy was ultimately a success, as all of the independent Nordic countries managed to stay out of the First World War, but it was less successful in World War II. On the 9th of April, 1940, both Denmark and Norway were simultaneously invaded by German forces. During the war, the Norwegian government took up residence in London and the newly exiled administration began to form strong ties with the British government, shaping close military cooperation at all levels. After liberation in 1945, Norway resumed a mostly-neutral policy of “bridge building” with strong support for the newly formed UN and low emphasis on rearmament. (Gleditsch et al., 1994, p. 37)

As the Cold War intensified, the bridge building policy came under increasing strain. In February and March of 1948, the Prague coup and Soviet pressure on Finland were followed by rumors that Norway might be the next country on the list for Soviet expansion. In response, military collaboration increased between Norway and major Western powers, particularly with the United Kingdom. The following year, Norway joined the North Atlantic Treaty Organization (NATO) as a founding member. (Gleditsch et al., 1994, p. 37)

1 For studies regarding the effects of arms spending on inflation see Mosley (1985, Chapter 6) and Starr et al. (1984)

2 For studies regarding the effects of arms spending on the income distribution see Abell (1990, 1994)

3 The data on Nordic wars are based on standard histories of the Nordic countries and compilations of international wars such as Levy (1983), Luard (1986), Small & Singer (1982), and Wright (1965)

Following the Second World War, Denmark and Norway were part of the occupying force in Germany. Since then, Nordic countries have only exercised military power to assist in UN’s objectives. By 1993, a total of 38,000 Norwegian personnel had participated in thirteen UN peacekeeping operations in Greece, Kashmir, Somalia, the Congo, the Middle East, Angola, Korea, and the former Yugoslavia. During the Korean War—also defined in Norway as peacekeeping—Norway participated as a non-combatant in the UN-sponsored multilateral force, primarily with a field hospital. In truth, Norwegian authorities offered to send combatant forces, but the offer was declined by the United States. In early 1991, Norway contributed to the multilateral force fighting in the Gulf War in order to support UN-defined objectives. However, the closest thing to a direct military contribution was a Norwegian Coast Guard ship, which acted as a supply ship and never actually saw combat.⁴

Preceding World War II, Norwegian military spending remained at low peacetime levels. Norway started arming more intensively just before the war began, but this process was interrupted by the German occupation in 1940. Military spending dropped sharply immediately following Norwegian liberation in 1945, but the emerging Cold War tension and Norwegian membership in NATO drove it back up and well beyond the prewar level. Aside from a brief time at the end of the bridge-building period, the entire postwar era has seen higher peacetime military consumption as a share of GDP than ever before. World War II represents a distinct turning-point in military consumption. The postwar trend of military consumption rises more than twice as steeply than the prewar trend (Gleditsch et al., 1994).

In the first years of its creation, NATO was primarily a paper alliance—a mutual expression of solidarity. This changed very rapidly with the outbreak of the Korean War in 1950 and the subsequent establishment of an integrated military command in peacetime (Tamnes, 1991). Following the Korean War, military spending in Norway decreased and then leveled out until the mid-1960s, but at an unprecedented level. While military spending has continued to rise slowly in absolute terms, there has been an unwavering downwards trend relative to GDP since the Korean War (Gleditsch et al., 1994).

According to Gleditsch et al. (1994), about 3% of the GDP and 15% of General Government Consumption goes

4 Information on UN and Nordic military partnerships have been compiled by Gleditsch et al. (1994)

to military purposes. With this frame of reference, the military establishment in Norway can be seen as a major project in resource terms. On the other hand, this is far from being a wartime economy; in which, the military sector could constitute 40–50% of a country's national product. Over the past forty years, after the peak rearmament of the early Cold War, military consumption as a share of the national product has stayed at about the same level. However, military consumption as a share of General Government Consumption has decreased steadily since the 1950s, and is now as low as in the interwar years.

It is important to note that the defense budget does not necessarily represent the true cost of maintaining a military establishment. Costs are often hidden in the budgets of civilian ministries or may be extracted from the private sector by unrealistically low prices on goods and services purchased by the military establishment. A significant issue in the true cost consideration is the use of conscripts, who are paid much less than the real value of their labor. In a comment on an official report on the pricing of conscript labor (NOU, 1989), Christensen & Torvanger (1989) argued that the current pricing system conceals the real costs of conscription. They estimated that if the conscripts were paid the same wages as their civilian cohorts, the labor costs of the military establishment would rise by 30–40% and the defense budget by 10–14%. If the military was forced to pay competitive wages, it would likely be required to restructure and cut down on personnel in the peacetime armed forces. Instead, conscription allows the military establishment to pass this extra cost on to the private sector.

While the majority of military spending in Norway comes from Norwegian sources, the country has received very substantial military assistance from its major allies throughout the postwar period. The United States Military Assistance Program (MAP) is of particular economic importance. Despite the difficulty of calculating the exact financial significance of this program, since most of the assistance was in the form of weapons—the value of which is debatable—the Norwegian Ministry of Defense estimates the value of assistance from the United States and Canada amounted to about 20% of domestic military spending from 1951 to 1970, and as much as two thirds in the period from 1951 to 1955 (Holst (1978), p. 95; Holst (1967), vol. II, p. 23).

Even after the MAP program was discontinued, parts of the military establishment have still been funded by external sources. Through the Military Infrastructure Program, NATO has funded the construction of airfields,

air defense radars, communications facilities, etc. (Gleditsch et al., 1994). Similar to most other NATO members, Norway pays for a share of the infrastructure program, but the volume of projects in Norway have always exceeded Norway's contribution to the program. Therefore, Norway could be considered a 'net recipient' of military infrastructure. Aside from NATO programs, the United States Department of Defense has funded several military installations, such as the Loran-C navigation stations (Wilkes & Gleditsch, 1987) as well as numerous research projects in the Norwegian Defense Research Establishment (Gleditsch et al., 1978). For these particular activities, the amounts involved can be quite significant, but are relatively small in comparison to the overall Norwegian defense budget. The foreign contributions to military construction and operating expenditure in 1990 amounted to about 5% of total expenditure.⁵

Before the Second World War, Norway had virtually no military research and development. During the war however, the exiled Norwegian government in London engaged in close military collaboration with the allied authorities in a number of areas, including military research and development, and after the war the Norwegian Defense Research Establishment (NDRE) was set up under the Ministry of Defense. The organization quickly became a central part of Norwegian defense planning, and eventually an important part of Norwegian industrial policy.

Shortly following its foundation, NDRE received extensive research contracts from the Pentagon. Due to Norway's proximity to the Soviet Union, many of the various projects undertaken included antisubmarine warfare, military communications, and signals intelligence. From the early 1950s to the early 1970s, such contracts made up a substantial portion of the NDRE's funds (Christensen, 1989, p. 38).

Now that we have followed Norway's military spending closely, it is time to cast a wider net and look at a broader overview of the literature on military spending and its overall effects on the economy. Similar to most other forms of government consumption, military spending may serve to stimulate demand in the short-term, with positive consequences for employment and other measures of economic activity (Gleditsch et al., 1994, p. 10). However, in the long-term perspective, military spending influences economic growth and de-

⁵ Calculated by Gleditsch et al. (1994) from Fiscal Accounts figures chs 4799 and 4790.41 in the Defense budget

velopment in a variety of ways. Put simply, the military sector diverts resources away from non-military use. The scarcity of various resources will determine the significance of this effect. For example, financing military spending may have a negative influence on the overall savings rate, which could lead to lower investment and less growth (Gleditsch et al., 1994, p. 11). On the other hand, certain elements of military expenditure, particularly in research, development, and infrastructure, may yield non-military benefits toward economic growth and technological progress.

The argument that military spending has a detrimental effect on economic growth rests on the premise that the defense sector is unproductive and requires a reallocation of investment into the civilian sector in order to improve the overall performance of the economy. The economist Lloyd Dumas (1989, p.3) makes the case that the relentless pursuit of the worldwide arms race has “undermined the product competence and economic wellbeing of even the strongest and most developed economies,” and that both “our physical security and our economic wellbeing require that a significant fraction of the productive resources currently being poured into the militaries of the world be shifted to productive, civilian-oriented activity.”

Such a view is by no means novel. Adam Smith noted in the *Wealth of Nations* (1776) the growing cost of providing weapons for war, and demonstrated his views on how to assemble a military defense in order to distribute the economic burden. David Ricardo was also concerned with finding ways to restrain the government, as well as war profiteers, from financing military expeditions harmful to economic prosperity. He wrote throughout and in the immediate aftermath of the Napoleonic wars that tax financing was much to be preferred over loan financing because “when the pressure of the war is felt at once, without mitigation, we shall be less disposed wantonly to engage in an expensive contest, and if engaged in it, we shall be sooner disposed to get out of it unless it was a contest of some great national interest” (Ricardo, 1820).

More precisely, military spending is likely to harm economic growth in three different ways, according to the authors of *The Wages of Peace* (Gleditsch et al., 1994). First, it may decrease investment and, in turn, negatively affect the continuation and expansion of civilian industry. Second, if military spending leads to lower employment, as they argue, labor resources will be utilized inefficiently. Third, military spending may create bottlenecks in the demand for highly qualified labor. Their argument is, in

general, military spending takes resources away from civilian research and development, thereby hindering non-military growth and innovation.

In addition, comparisons across national borders indicate that industrialized countries with high military spending tend to have lower economic growth. An analysis of this kind is found, for instance, in the 1982 edition of *World Military and Social Expenditures*, which claimed that “countries with the highest military burdens compete less well in world markets” (Sivard, p. 23).

On the other hand, a familiar argument for the growth-inducing effect of military spending is that military research and development has a significant spillover into the civilian sector by creating new technologies, which have civilian applications as a byproduct. Radar, computers, and electronics are often cited as examples. Specific instances of spillover include commercial aircraft, such as the Boeing 707, which was developed from the B-47 bomber, and the 747—developed from a design submitted for the C-5 cargo plane (Tirman, 1984, p. 18). Even when innovations do not originate through military research and development, the military establishment can provide extensive consumption and use of a new technology, which makes it commercially viable. The transistor is an example where heavy purchases for military purposes led to an improved product and reduced prices for civilian consumers (DeGrasse, 1984, p. 77).

However, an alternative argument can be made against the spillover of military research and development. When large amounts of money flow into the defense sector, engineers and scientists become more attracted to military employment and are often scarce or too expensive for civilian industry. In this argument, military research and development ‘crowds-out’ civilian research and development, which is economically more productive than the former (Gleditsch et al., 1994). In 1987, a candid statement by the United Kingdom government explained the crowding-out effect of military research and development:

“Britain’s resources of qualified scientists and engineers, and the skilled manpower supporting them, are not inexhaustible ... defense and civil work are in competition for the same skills, and it would be regrettable if defense work became such an irresistible magnet for the manpower available that industry’s ability to compete in the international market for civil high technology products became seriously impaired.”⁶

6 UK Ministry of Defence (1987), para 522, quoted from Buck, Hartley & Hooper (1993), p. 162

Spillover, of course, is not a one-way street from military research and development to civilian products. Inventions made in the civilian industrial sector can produce spinoffs for the military sector as well. For example, the development of metallic paint to shield microwave ovens was later repurposed for creating a radar-absorbing surface for stealth aircraft and missiles (SIPRI, 1983, p. 215). Arne Magnus Christensen, the senior adviser in the Ministry of Labour and Social Affairs in Oslo, Norway, argued that there are probably more spillovers from the civilian sector than from the military sector (1989, p. 22).

Given the technological nature of the Cold War arms race, many have accredited great significance to military research and development as a driving force in the growth and global development of science and technology (Thee, 1986, p. 104). However, military research and development—both in Norway and throughout the Organization for Economic Cooperation and Development (OECD) countries—grew much less rapidly than civilian research and development throughout the Cold War (Gleditsch, 1994, p. 31). While significant steps in technological progress were undertaken as a result of military spending, the numbers suggest far greater steps have been taken in the civilian sector. However, the rapid growth of civilian research and development alone cannot conclusively point to its overall significance.

By way of comparing national spending on research and development, DeGrasse (1984, p. 126) presented data for productivity growth in manufacturing industries with military and civilian research and development efforts relative to GDP. For the period 1970–79, six countries were investigated. The study revealed countries with highest military research and development—the United States, the Union of Soviet Socialist Republics, and the United Kingdom—have the slowest productivity growth, while countries with lower military research and development—West Germany, France, and Japan—have higher productivity growth. However, DeGrasse states that the relationship between civilian R&D and productivity is not entirely clear. He argues that the negative relationship between military research and development and productivity growth can be explained, in part, by the low share of military financing spend on basic research. This share was just 3% in the United States from the early 1960s to the early 1980s. In his paper, DeGrasse considers basic research an important factor for both broad innovations and productivity growth.

Indeed, it appears the initially intensive military re-

search and development in Norway has gradually transferred into the non-military public and private sector. As in many other countries in the late 1940s, Norway's public R&D efforts initially highlighted defense and nuclear research (Larédo and Mustar, 2001). These activities were concentrated in one important research institute established immediately following WWII: the previously mentioned Norwegian Defense Research Establishment (Njølstad and Wicken, 1997; Njølstad, 1999). Despite the nation's small size, Norway was the seventh largest weapons exporter in the world in 1975 (Wicken, 1983).

Outside the military establishment, a new public-private partnership, the Norwegian Research Council for Technology and Natural Science (NTNF), was founded in 1946 with crucial political support from Norsk Hydro, an aluminum and renewable energy company (Adersen and Yttri, 1997). NTNF was given substantial freedom and not subjected to normal bureaucratic restrictions and directives. The Federation of Norwegian Industries even agreed to contribute half of the funding for the council (Hanisch and Lange 1985, p. 182). Employees in the new research council were a highly selected, "consisting of well-educated young men closely coupled with illegal intelligence work and often forced to leave the country because of their link with the resistance movement," several of whom had worked in British wartime research and development projects, such as radar development (Wicken, 1994, p. 16).

NDRE, for the most part, relied on private companies to develop technologies for military applications and, occasionally, for civilian markets as well (Ørstavik, 1994). Its first success was in sonar technology (Njølstad and Wicken 1997: 69–70), which was used in Norway's domestic fishing fleet and subsequently in other markets (Sogner, 1997). Thus, the interconnectedness of military and private sectors played an important role in the Norwegian postwar innovation system, transferring military research into civilian development (Wicken, 1994).

Motivated in part by the ideology of "technology-based industrial growth," Norway created a vigorous innovation system in the 1960s and 1970s (Fagerberg, 2009). This system included publicly funded research, public planning agencies with responsibility for technological development, tax deductions for research and development, government loans for technology-based industries, public research and development contracts, and structural control of high-tech industries. While these mechanisms were not the result of a single policy, the accumulation of these strategies created a national-level

system with many connections between firms and public research organizations.

An important objective of the research institutes established in the postwar period was the creation of technological solutions for firms with low levels of investment in research and development. The long-term survival of many of Norway's traditional industrial companies, including many with low levels of self-financed research and development, may be taken as evidence of the success of Norwegian policy. Still others have argued the sparse development of new high-tech industries within Norway indicates a failure to break out of a systemic mold, which affects the overall economy (Gulowsen 200, p. 68). Regardless, Norway's surviving firms, even in the "small-scale" industry sector, do not fit the conventional image of "low tech" enterprises; Norwegian oil extraction and transportation, metals production, and even fish farming industries all use highly sophisticated methods and technologies (Fagerberg, 2009, p. 85). These new applications demonstrate efficient adoption and adaptation of technologies, which have been developed in partnership with public sector research or with companies that owe their existence to such research.

Arguably, the most significant contribution of public sector research in Norway, as in other industrial economies, is providing firms with a flow of human resources. Universities and institutes contribute to a "public reservoir of competences" (Larédo and Mustar 2001, p. 504), which includes interpretations of problems, specific solu-

tions, and mobility of students and experienced researchers. Norway's public sector research has also contributed in creating new technologies, commercial activities, and firms throughout the twentieth century. And, it could be argued, Norway's diversion of economic funds away from the military establishment and into non-military public innovation has helped drive these commercial activities.

Whether or not the Norwegian case can be applied to a global scale, or seen as an example for other nations to follow, is difficult to determine. Norway is a unique nation with a unique economy, ideological standing, and culture. Applying the practices undertaken by a small Nordic nation to a state with entirely different economic or cultural underpinnings is, obviously, inadvisable. For example, the 1966 discovery of oil in the North Sea and the consequential economic surge should be taken into account when we consider if military spending had a positive or negative influence on economic growth, or if that was overshadowed by a resource driven boom. Other nations without the same economic opportunities, which both bolster the public and private sectors while providing a steady foundation for civilian industry, will experience either an increase or a decrease in military spending differently. However, some economists, such as Cappelen et al. (1985), argue that Norway makes an excellent case study for OECD countries. Their analysis of the global economy concludes that reducing military spending would have beneficial effects overall.

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