

RESEARCH PROPOSAL

General Context

This research proposal builds on the ESRC financed programme on the arms trade by Levine, Sen and Smith that produced over 20 papers, established a network of defence economists through which Dunne and Garcia-Alonso made a considerable input and worked with Dunne in establishing a very successful series of annual conferences at Middlesex. In the ESRC's final evaluation, the research project was graded as 'Outstanding' by all three referees. The proposal also draws on the successful Leverhulme grant to Dunne on the military in the South African economy. These projects have contributed to the recognition of the UK as a major centre of excellence in defence economics.

The end of the Cold War has resulted in a number of profound but poorly understood changes in the international security environment. This project aims to undertake a set of tightly linked theoretical and empirical studies of the determinants of military expenditure (which has fallen rapidly since the peak of the mid 1980s) and its effect on economic growth, of procurement and the regulation of the arms trade (both of which have become increasingly competitive), and of arms production (where the industry is being massively restructured). As with the previous programme of research, a combination of economic theory and empirical analysis using recent development in theory and econometrics should provide a deeper understanding of the changes taking place and their policy implications.

Defence economics is important in a post Cold War world that has seen significant changes in economic, political and strategic structures. The old certainties were replaced by a more uncertain and not necessarily safer world. The reduced involvement of two superpowers in areas of conflict did not cause the number of major conflicts to decline as much as expected and there are new threats generated by internal and international factors. It is vital that a proper understanding of the changing economics of military spending is developed. On the demand side it is important to determine the changing nature of the factors that determine military expenditure and arms imports in the new security environment. On the supply side the changing nature of arms productions and trade needs research to determine the underlying forces and dynamics and the implications for national and international policy. There is a need to analyse the economic effects of military spending, to ask if the relationship has changed since the end of the Cold War and attempt to measure the "peace dividend".

Emerging producers and proliferation of weapons of mass destruction are a particular cause for concern. Issues of the arms procurement and the regulation of arms exports need to be considered in relation to each other, to develop our understanding of the changes that have taken place and suggest alternatives. With the decline in demand has come a massive restructuring of the means of production of arms. This has partly reflected the general move to globalisation of industry, but there have also been very specific factors, reflecting the nature of the industry. With the cuts in procurement trade has become increasingly important to the companies and they have pushed to achieve exports. At the same time the subcontracting and creation of networks has led to an increase in trade within companies and within their networks. This has led to

less visibility of the arms trade, an important consideration in the study of arms export regimes.

Profound changes in the nature of procurement have occurred both at a formal and an informal level. For instance in the UK, the Levene reforms of the late 1980s heralded a clear change in the rules, intended to limit cost plus contracts and gold-plating was no more. A more commercial environment was introduced with competitive tendering, contracts awarded with reference to market prices etc. Most importantly the cancellation of Nimrod and the purchase of AWACs from the US made foreign procurement a credible threat and represented a sea change in government industry relations (Dunne, 1995). The present government's Smart Procurement initiative continues these attempts at reform.

Another important development is that it is becoming increasingly difficult to define the concept of military-related technology. Technology spillovers have in the past typically gone from military technology to civil technology. Now there are many instances of civil products with military applications, the so-called dual-use products. Concerns have risen regarding the destabilising effects that exports of state-of-the-art military and dual-use products, in particular, might cause on regions in conflict. Following this concern, export control systems for dual-use goods have been developed by most of the main exporters of dual-use equipment. The implementation of such controls is increasingly difficult due to two major reasons: Firstly, economic concerns, such as competition for the export market with rival countries, clash with security concerns. Secondly, the growing importance of dual-use products adds to the difficulty, already noted, of monitoring and regulating exports. Given all these developments, firms increasingly have private information about their own cost and exports demand characteristics.

The research will be organised into two specific areas. The first has a macroeconomic focus and links together the determinants of military expenditure and its consequences for economic growth. The second has a microeconomic focus and examines the interactions between procurement, the arms trade and the restructuring process in the defence sector. We consider the details of these two components in turn.

1. Military Expenditure, Growth and Investment

There are large but rather separate literatures on the demand for military expenditure and the supply-side effects of military expenditure. Demand for military expenditure is made a function of other countries military expenditure (which have a positive effect for antagonists involved in an arms race and a negative effect for allies), GDP, and a range other economic, political and military variables. The supply-side effects of military expenditure are measured in terms of the impact of military expenditure on GDP, through utilisation, investment, technology, etc. The supply side effects are usually measured either using large macroeconomic models as in Gleditsch et al. (1996) or reduced form type equations for output. The most common form of the latter is the Feder-Ram model which has been extensively used in the defence economics literature to measure the impact of military expenditure on output. This model has major problems, which is why it has not been used in the wider literature on the determinants of growth. There is clearly a role for combining a demand for military expenditure

equation with a more standard set of growth equations to estimate a small simultaneous system. The sort of system we have in mind is similar to that estimated by Knight et al. (1996), who find a negative effect of the share of military expenditure on both investment and growth, holding a variety of other variables constant.

In estimating such systems, there is an obvious identification problem if military expenditures depend on GDP, while GDP depends on military expenditure. The issues are set out in Smith and Dunne (2000), which presents the framework and presents some preliminary estimates. The aim of this part of the project would be to estimate small simultaneous systems, using annual data rather than 5 year time averages as do Knight et al. (1996), explaining output, investment and military expenditure for a large panel of countries to see if the effects of the large changes in the share of military expenditure since the end of the Cold War can be estimated consistently. The presence of a large exogenous change in the threat which produced the reduction in the share of military expenditure during a period of relative economic stability should help identify the impact on investment and output. Of course, there is the danger that the regime change with the end of the cold war caused structural change in the relationships and that this will obscure the effects. This would certainly be the case in the former Soviet Union where both economic and security structures have been transformed. Smith, Sola and Spagnolo (2000) suggest a way of handling such regime changes.

Regime change it may not be such a large problem in the OECD countries and newly industrialising countries on which we will focus. For these countries there is fairly good data from 1960 on economic variables from the OECD and World Bank and for military variables from SIPRI. The panel structure will allow us to see how different groups (e.g. NATO versus non-NATO) have differed. The research would draw on the applicants previous work on the demand for military expenditure, Smith (1995), Smith et al. (1999), Dunne et al. (2000); the economic effects of military expenditure, Gleditsch et al. (1996); estimation of growth models, Lee et al. (1997); and heterogeneous panel data estimators, Pesaran et al. (1999).

2. Procurement Policy, Export Controls and the Restructuring of the Defence Industry

The aim of this component of the project is to gain a better understanding the restructuring process and of how the interactions between military firms and governments in this new Post-Cold War context affect procurement policies and exports controls of the major arms exporter countries. The empirical will examine the evolution of industry structure. Since the end of the Cold War the global defence industry has seen massive restructuring. In the US this was relatively early and the period 1993-1998 saw the emergence of a highly concentrated US industry dominated by Lockheed Martin, Boeing, Raytheon and General Dynamics. This was guided by the Department of Defense, from the 'Last Supper' of 1993 to the blocking of the Northrop-Lockheed merger in 1998, which signalled the end of the process. The evolution has been rather slower in Europe, partly because of differences between national governments. However the creation of BAE Systems from BAe and the defence parts of GEC; the formation of the European Aerospace, Defence and Space Company (EADS) from Daimler-Chryslers defence subsidiary, Aerospatiale-Matra and Casa of Spain; and of Thompson-CSF Racal represents a step change. In

addition, defence production capability has proliferated, partly in response to export controls, introducing new competitors. This is analysed in Levine et al. (2000) and Levine and Smith (2000b).

Although the restructuring of the industry has attracted much academic, media and policy attention, there has been no quantitative analysis of this process as far as we are aware. This is despite the availability of annual data from SIPRI on the 100 largest arms producing companies for over a decade, which also provides information on mergers and takeovers, e.g. chapter 10 SIPRI (1999). Dunne has close contacts with SIPRI and would examine the patterns of growth and survival in the defence firms using the same sort of approach that was used in Dunne and Hughes (1994) for UK companies. The SIPRI data would permit an analysis of the survival and growth of the large defence companies as a function of nationality, sector, defence dependence and productivity. This would supplement the largely qualitative analysis that has predominated in this area.

In the theoretical part of this microeconomic component, we will analyse how government procurement and subsidy decisions affect the strategic interaction between competing exporters and the quality and quantity of weapons which are exported. Central to our research into government policy will be consideration of the private information of firms regarding their cost and demand conditions. Our research will draw upon and develop two areas of literature. The first is the procurement and 'new regulation' literature, developed and overviewed in Laffont and Tirole (1993), that designs incentive contracts to force firms to reveal their private information. However, the existence of external or unregulated markets, like export markets, has been relatively neglected throughout this literature. The second strand of literature on the arms trade, to which the applicants have contributed in their earlier ESRC-financed project, does analyse the links between defence procurement, arms exports and export controls (see, in particular, Garcia-Alonso (1999) and Levine and Smith (2000a)). However, in this literature, military firms possess no private information and there is no need for information-revealing incentive contracts. The objectives of this part of the project are then twofold: first to develop the incentive regulation literature to take into account an external market of an oligopolistic nature. Secondly, to further develop the arms trade literature by introducing the different sources of incomplete information involved in the arms procurement-trade problem.

In essence the theoretical problem to be studied can be summarised as follows: governments in the major arms exporting countries demands its defence procurement from the domestic firm that also competes in an oligopolistic exports market with other national champions. In increasingly liberalized markets, there exists at very least the threat that the government may purchase from an overseas producer. Large R&D and other fixed costs, together with lower domestic demand in the post Cold War environment, make the successful participation in the international market crucial for the military sector's commercial viability. However a further distinctive feature of this sector is the existence of a negative externality in that arms exports from any individual country can exacerbate regional conflicts and have negative security effects for all arms exporters.

There are a number of forms of asymmetric information relevant to this arms procurement-trade context. First, the firm is likely to have more information than the

government about its profit function, either through its cost structure, its export demand or the quality of its domestic and exported output. Second, there can be some uncertainty about the security concerns of other governments, and this can affect both governments and firms. Although the government may observe some features of the firm such as total costs, it may not observe their underlying technology, or the effort they exert in order to reduce costs. This generates a moral hazard and adverse selection problem, which the government can solve by setting a procurement contract that forces the firm to 'reveal' its private information. In designing these contracts, the government ensure that they are such that any firm type would want to participate in production and also, it must account for the fact that once contracts are set, the firm will exert only that amount of cost reducing effort that maximises its profit.

The impact of incomplete information on optimal regulatory or procurement policies with an external market has been analysed in only a few papers. Anton and Gertler (1988) considers the problem of a government which uses an indirect mechanism, a lump sum tax, to regulate a domestic producer that sells its product domestically and abroad in a competitive market. Our study will draw on this work to study an oligopolistic export market involving a security externality.

A very recent literature relevant to the problem to be investigated studies the impact of asymmetric information on optimal strategic trade policies. Maggi (1999) analyses the impact of asymmetric information on optimal strategic trade policies in a third market. It is well-known in the strategic trade literature that strategic trade policies can exacerbate the prisoner's dilemma problem that oligopolistic firms face when they compete, i.e., the Nash equilibrium quantity sold by each firm is higher than the quantity they would each sell if they could form a cartel. Multilateral government subsidies make this problem even worse. Maggi (1999) shows that, when firm's profits depend on a parameter that can be observed by firms but not by the government, strategic trade policies further worsen the prisoner's dilemma problem in relation to the perfect information case. It is interesting to note how the change in the informational structure and the absence of domestic procurement changes the effect of uncertainty on the amount of exports. As this effect is crucial for exports control purposes there is a clear need to develop a model which captures both the defence procurement problem and the exports market informational structure.

Another important issue to be addressed is the regulation of the quality of exported dual-use technology. The information on the exports market now becomes even more crucial for a government in its implementation of export controls. Different information structures can arise as a result of the special characteristics of the arms trade market in dual-use technology. First, we will consider the case where firms are better informed than the government about the quality of the dual use products which are being exported. Also, demand parameters only known to the firm, might make it difficult to the government to infer the quality exported using exporters' profits. Second, we will consider a scenario in which firms are not fully aware of the governments' concern for security, in other words, whether or not they will restrict quality restrictions. This aspect of the research will develop the work of García-Alonso (2000) that examines, in a complete information context, the relationship between the optimal subsidisation policies of R&D investments of producers of security sensitive technologies and export controls.

The Research Network

A major success of the previous ESRC-financed project on the arms trade was the building up of a network of researchers interested in this area. In the end of award report we stated as a priority the intention of retaining this network and continuing research in the wider context of defence and peace economics. This proposal, if successful, will enable us to achieve this objective. The project will draw on valuable inputs from the following colleagues in this network at the cost to the ESRC of only travel and subsistence. Ron Smith will continue his involvement and very successful research collaboration with Paul Levine and Paul Dunne, as part of his normal research. Colleagues of Paul Dunne at Middlesex University, Alvin Birdi and Eftychia Nikolaidou will continue their fruitful collaboration with him and Ron Smith. These are the six UK network members for which travel and subsistence is being requested. However, as before, we envisage other researchers to be drawn into the network. The 4 international researchers, all of whom have an international reputation in defence and peace economics, are Todd Sandler and Jurgen Brauer from the US, and Jacques Fontanel and Sylvie Mattely from France.

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