THE ECONOMIC COSTS AND BENEFITS OF UK DEFENCE EXPORTS

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EXECUTIVE SUMMARY

1. This study is the result of collaboration between two MoD economists and two independent academic economists, whose contribution has not been funded by the MoD. The judgements and views are those of the authors alone.

2. The study examines the economic costs and benefits arising from a 50% reduction (over two years) in defence exports to UK resident workers, shareholders and the UK Government. It concludes that the economic costs of reducing defence exports are relatively small and largely one off. It therefore suggests that the balance of argument about defence exports should depend mainly on non-economic considerations.

3. The study's results must be considered in the light of the considerable problems involved in defining and measuring defence exports, as well as the considerable year-to-year volatility in reported defence exports. Defence exports fell by around 30% between 1998 and 1999, with defence employment falling by around 35% between the same years. Recently released data show that total defence export sales in 2000 were largely unchanged on 1999.

4. The study takes the average level of defence exports in 1998 and 1999 as its baseline. Over this period total defence export sales averaged around £6bn a year; and supported (directly and indirectly) about 97,500 jobs.

5. An important health warning about the results of this analysis must be noted. The results are dependent not only on the quality of the available data (and here a comprehensive review of export statistics, including an independent element in such a review, is recommended) but also on the standard “ceteris paribus” assumption that everything else in the economy is taken as given. In reality, there will be a number of other industries also suffering declining domestic and/or export sales while others are growing substantially. A further health warning needs to be placed on extrapolating from the results here to try to estimate the effects of a total cessation of defence exports. While there is no evidence of major non-linearities in relation to reductions in defence exports on the scale examined here, it does not follow that the effect of a total cessation of defence exports would simply double the size of the figures presented here.

The main findings include:

6. Employment and Wages

A halving of defence exports from the average 1998 to 1999 level would result in the loss of nearly 49,000 jobs in the defence sector, many of which would be at relatively high wages. This would be offset by the creation over a five year period of around 67,000 new jobs (at lower wages, on average) in non-defence employment.

7. Adjustment Costs

A sudden 50% reduction in defence exports would result in significant initial adjustment costs, which would then gradually diminish as capital and other resources
released from the defence sector, together with the consequential price and wage
changes, helped to create new investment opportunities and in turn create new jobs,
both for redundant defence workers and others who would otherwise have remained
inactive or unemployed. Adjustment costs would include the following:

a. Some existing capital in the defence sector would be written off early, causing
losses to UK-resident shareholders. These costs would total almost £180m, with an
additional multiplier effect of £90m.

b. The net present cost involved in losing defence jobs now, but only creating other
jobs after some time lag, is estimated to amount to between about £200m and £360m.
A further loss of spending, output and hence employment through the “multiplier”
amounts to between about £100m and £200m. This additional cost is concentrated in
the first two years after the reduction in defence exports.

c. The Exchequer would incur losses due to the costs of unemployment benefit and
revenue losses associated with the defence industry redundancies (net of the costs that
might have been incurred anyway as a result of those workers losing their jobs at a
later stage). These losses would eventually be offset by savings in benefits and
increased revenues from those (previously economically inactive) who gained
additional jobs elsewhere. The net cost would be between £140m and £170m in the
first year.

d. The cumulative overall net adjustment cost is estimated at between £0.9 billion and
£1.4 billion. The range largely reflects different assumptions about the earnings of
defence workers who might otherwise have stayed in the industry, and the scale and
timing of replacement job creation, and the likelihood of job losses and gains
occurring anyway due to other factors. Because these different assumptions impact
upon both the costs and benefits, the lower and upper end of the range of net costs is
calculated by adding the lower end of the cost range to the lower end of the benefit
range and the same for the upper end. These costs are spread over a period of around
five years, with the greatest cost in the first three years. At the end of the five year
period, overall national income would be substantially the same as it would otherwise
have been without the loss of defence exports.

e. A further more speculative adjustment cost is associated with the terms of trade.
Other things being equal, the exchange rate might be expected to temporarily
depreciate in response to a reduction in defence exports. This would increase the
sterling cost of imported materials, goods and services and reduce the foreign
exchange value of existing export earnings. The estimation of this “terms of trade”
cost is uncertain in both its scale and duration, and is predicated on the initial
exchange rate being optimal. It is provisionally estimated at around £440 million in
the first year, but would fall to zero within two years. If this terms of trade effect is
included, the overall net adjustment increases to between £2.1 billion and £2.5 billion.

8. Defence R&D

Over time, the loss of defence exports would result in a reduction in the level of
defence R&D funded by industry and overseas customers. This would lead in turn to a
reduction in the demand made on scarce qualified scientists and engineers (QSE) by
the defence sector. In the short to medium term, this reduction would lead to greater availability of QSE for the civil sector, with potentially positive results for innovation and investment in that sector. Depending on the response of the civil sector, however, in the longer term it could also lead to a reduction in the overall demand for QSE, and consequently on the supply of QSE through the education system. As a result, we are unable to estimate whether the projected reduction of defence R&D would have a positive or negative effect on the long term supply side of the economy.

9. Impact on the Government Budget

In addition to the loss of the tax receipts from workers and companies, there are costs and benefits associated with the costs of support to the defence industry to achieve defence exports as compared with the costs of supporting alternative production and exports, the costs of regulating defence exports, and the costs and benefits associated with the Government’s position as a customer of the defence industry. A summary of the estimated costs and benefits to the government budget is contained in Table 9 of the main paper. The specific components of this estimate are as follows:

a. Firstly, there is the specific assistance provided by the MoD, in particular its Defence Exports Services Organisation (DESO). The annual cost of MoD support over the period 1995/6 to 1999/00 has averaged around £20m a year. The paper assumes that a 50% reduction in defence exports would result in a halving of MoD support, saving around £10m a year. In addition there are the costs of regulating defence exports, estimated at around £9m a year. It is assumed that a halving of exports may save between zero and £4.5m a year on this item.

b. Secondly, there is the assistance provided by the Export Credits Guarantee Department (ECGD). Despite the introduction of stricter financial criteria by ECGD, it is not required to provide a return on the notional capital that would be required to cover claims. The interest on this notional capital is estimated to be between £8m and £48m a year more for the defence exports “lost” than for the ECGD support associated with the additional exports that would be likely to take their place.

c. Third, the contribution that export sales make to producers’ fixed overheads reduces the cost that would otherwise have to be met by the UK MoD for such companies to earn the same rate of profit. Assessing the full impact of defence exports upon the cost of MoD procurement is extremely difficult and would require detailed auditing of all the accounts of the exporting defence companies. On the basis of reports from those companies, the contribution defence export sales make to their fixed overheads is estimated to amount to around £320m. However, in the event of a 50% reduction in defence exports, it is not the case that £160m would be passed on to MoD. Only 20% of this would fall initially to MoD due to the prevalence of fixed and firm price arrangements in existing contracts. Although eventually MoD would bear the full cost, this would be partly offset by some 'fixed' overheads becoming 'variable' with time as companies reorganised their production methods in response to a permanent reduction in total orders. Taking these factors into account, we estimate that the overall cost of the 'overhead effect' to MoD would average around £80m a year: equivalent to 0.8% of the total MoD equipment procurement budget.
d. Fourth, it is assumed that a halving of defence exports would lead to a halving of receipts from the Commercial Exploitation Levy, costing the MoD a total of £18m.

e. Fifth, it is assumed that a halving in total defence exports would include a halving in sales of surplus MoD equipment, at a further cost to MoD of around £8.5m-£17.5m a year.

In total, the net impact upon Government of a halving of defence exports would thus be a loss of between around £40m and £100m a year: around 0.2%-0.4% of the total 2000 defence budget. In contrast to the one-off adjustment costs, these increased costs would be continuing.
INTRODUCTION

1. The purpose of this paper is to examine the economic costs and benefits to the UK of defence exports.

2. Representatives of the UK defence industry often argue that defence exports bring significant benefits to the economy, including defence-related employment. In addition, the UK MoD has estimated that its own procurement budget benefits by around £400 million a year, principally from the sharing of overhead costs with defence equipment exports. By contrast, a number of recent independent studies have suggested that there is a net cost to government in supporting defence exports. A 1999 study by Steve Martin estimated that there was a net cost to government of around £230m a year (at 1995 prices).\(^1\) A 2001 report by the Oxford Research Group and Saferworld into UK Government support for arms exports and the defence industry estimated that there was a net subsidy to defence exports of £420m a year.\(^2\) The economic journalist Sam Brittan has argued that the net effects on the British economy of reducing arms sales 'are negligible or even favourable'.\(^3\)

3. This study will not end this ongoing debate. Its conclusions must be treated as provisional, and the authors would welcome further comment, both on the framework and the assumptions that have been made. Moreover, the results are dependent not only on the quality of the available data (and in this respect a full review of all defence export and import statistics is recommended, with an independent element in the review), but also on the standard "ceteris paribus" assumption that everything else in the economy is taken as given. In reality, there will be a number of other industries also suffering declining domestic and/or export sales while others are growing substantially. What is happening elsewhere may not only either reduce or worsen the impact of a reduction in defence exports, but may also make it difficult to isolate and hence observe that impact.

Yet it is the authors' hope that the study will take forward the debate on this important issue in significant ways:

First, the study is the product of extended collaboration over the last two years between two of the MoD's economists and two independent academic economists (whose contribution has not been funded by the MoD). From the point of view of the

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authors, we believe that the result is a significant improvement on previous studies. The judgements and views contained are those of the authors.

**Second**, it makes use of the most up-to-date figures available. Many of the studies on this topic have used estimates derived from policy and experience in the early 1990s (for example in relation to the element of subsidy involved in export credit guarantees, as well as the use of UK development aid in promoting arms exports to Malaysia). This study, by contrast, takes account of changes in policy that have taken place in recent years.

**Third**, it takes all defence-related exports (including both products and services) into account. Exports of defence equipment (or 'arms') currently account for around half of total defence exports. Yet, in part because of the difficulties involved in interpreting published data, previous studies have often failed to maintain a clear distinction between these two categories. This study takes explicit account of this difference.

**Fourth**, this study is a dynamic rather than static analysis. Rather than comparing the present situation with some hypothetical alternative state, it examines the economic impact of a reduction in defence exports on the present situation.

4. The paper focuses specifically on the economic costs and benefits of defence exports to UK residents – UK resident workers, shareholders in UK resident companies and the UK Government. It does not presume to provide a comprehensive cost benefit analysis of UK defence exports. Such an analysis would also have to take account of the wider security costs and benefits associated with defence exports. These wider costs of defence exports could include their potential effects on regional peace and stability, their use in human rights violations and the possible diversion of arms to others, including the possibility that they may be used against UK armed forces in the future. The wider security benefits could include the maintenance of a strong defence industry for strategic reasons and contributions to international stability by strengthening bilateral and collective defence relationships in accordance with the right of self defence recognised by the UN Charter.

5. Nor does the paper seek to assess the economic costs and benefits to foreign governments from UK defence exports. On the one hand, it could be argued that foreign governments buy British arms because they offer better value for money in meeting their requirements and hence get economic benefit compared to buying from the next best supplier. On the other hand, it may be argued that they could suffer economic loss if the availability of UK arms encourages them to spend more on defence than they otherwise would have spent. The economic losses suffered by other foreign governments, who might feel obliged to increase defence procurement in response to purchases by UK-supplied rivals, might also have to be taken into account. Again this paper makes no judgement on the balance between these different economic factors, nor on the broader impact of UK defence exports on peace and security in recipient countries and regions.

6. Nor does the paper assess the economic costs and benefits that result from UK government domestic procurement of defence equipment and services. Such an assessment would have to include an analysis of whether a preference for 'buying British' has led to the purchase of more expensive and/or less effective defence
systems than would otherwise be available 'off the shelf'. We do examine the narrower
question of whether support for exports has been a significant factor in influencing
MoD procurement decisions. With the single exception of the 1995 Chinook decision,
we have found no evidence for this proposition. The wider question of the economic
costs and benefits involved in domestic procurement is, however, outside the scope of
this paper.\(^4\)

7. As a result this paper is unavoidably partial. It addresses only one element in
the broader cost benefit analysis that would be necessary to assess the extent to which
UK defence exports contribute to, or diminish, overall social welfare. But it is an
important element and needs to be taken into account in any such wider assessment.

**METHODOLOGY**

8. Applying a standard welfare economics framework, the economic costs of
defence exports are the costs of the resources (ie materials, labour, capital and land)
used to produce them. The economic benefits are the contribution provided to the
overall welfare of individuals as compared with the next best alternative use of those
resources. To estimate the net benefits of UK defence exports, it is necessary to
compare the present situation with some baseline. One possible baseline would be a
hypothetical comparative alternative state in which there are no defence exports and
never have been. The output of some sectors of the UK defence industry, for example
nuclear submarine production, is in this position. Their output is devoted entirely to
the domestic market (ie the UK MoD), without any export sales. This approach would
necessitate the use of a “comparative static analysis”, comparing one static situation
with another. It is, however, necessary to make assumptions about the hypothetical
alternative state. A “neo-classical” view would assume that there would be a similar
level of overall employment, and that the next best alternative jobs would provide
almost the same levels of remuneration to the defence export jobs. It would also
assume that shareholders would receive nearly the same rate of return on capital,
allowing for the level of risk involved, as they experience in the defence export sector.
Only if there were economic rents to defence workers or shareholders would there be
any significant difference in incomes. There would, on such assumptions, be virtually
no net economic benefit (or cost) from defence exports to either workers or
shareholders. Departing from the basic neo-classical assumptions would allow for the
possibility of wider economic costs and benefits. The outcome of any such analysis
would be subject to considerable uncertainty, and depend on the assumptions made.

9. An alternative approach would be based on an assessment of the likely
consequences of a significant reduction in the level of defence exports, compared with
what would happen if exports had remained at baseline levels. This is the approach
adopted in this study. It seeks to estimate the net costs and benefits of a reduction in
defence exports from average 1998 and 1999 levels, compared with a situation in
which defence exports were maintained at this level. The underlying economic
framework applied is a “general equilibrium model”, but one that recognises that the
adjustment processes operate with variable time lags. Wherever possible the length of
the lags reflects empirical evidence. However, in many cases the evidence is limited

\(^4\) One of us (Keith Hartley) has written extensively on this issue in other places.
or non-existent and assumptions have had to be made. Inevitably the results are subject to uncertainty and a range of estimates is presented.

10. To measure the overall net costs and benefits that will result from reducing defence exports, the paper considers the position of four groups: defence workers, other workers who would be employed in alternative economic activity in the absence of defence exports, UK-resident shareholders (both in the industries that produce defence exports and in civilian alternatives), and, lastly, the Government. For each of these parties the net cost or benefit from reducing defence exports is as follows:

a. For defence workers the net cost is the difference between the after tax wages (plus non wage benefits and deferred earnings – ie pensions) currently received from producing defence exports and the after tax wages (plus non wage benefits and deferred earnings) that those displaced would otherwise be estimated to earn in their next best alternative employment.

b. For other workers (including would-be workers currently unemployed or economically inactive) the net benefit is the difference between what it is estimated they will earn from the creation of alternative economic activity to defence export production, and what they earn now (or receive in benefits).

c. For shareholders the net cost or benefit is the difference between the return on capital employed in the production of defence exports and the return that it is estimated that they will earn if that capital is invested elsewhere, after tax. Because the focus of interest is on the economic welfare of UK residents the net benefit to non-resident shareholders has been ignored. It is not possible to estimate these precisely. However, foreign shareholdings in the major UK-listed defence companies are now substantial. As a working assumption in this paper, a figure of 25% foreign shareholding has been assumed.

d. For Government the net cost or benefit of reducing defence exports arises from the sum of the following four components:

i) the reduction in the direct costs of providing assistance to defence exports (for example, through export credit guarantees and government-financed export support services), less the costs that will be involved in supporting alternative economic activities that replace defence exports.

ii) the difference between the tax receipts generated by defence exports and the tax receipts that would be generated by any alternative economic activity (this will depend upon the size of the net benefits to workers and shareholders).

iii) the reduced contribution made by defence exports to the overhead and through life support costs of defence equipment procured by the MoD, which will thereby increase the amount
that the Government has to pay to ensure its continuing ability to procure defence equipment that meets UK requirements in the future.

11. Rather than examining the economic costs and benefits involved in the (highly unlikely) event of a total cessation of defence exports, the study seeks to quantify the effects of a 50% reduction. It makes no assumption about the causes of such a reduction, which could come about in any of the following four ways, or (more probably) as a consequence of their combination:

- Firstly, there could be a decline in UK competitiveness in defence export production, which would tend to result in a reduction in the UK’s share of the world defence market.

- Secondly, there could be a reduction in demand for arms worldwide, or a reduction in demand in the UK’s key markets which is not offset by higher demand elsewhere. This could come about because of an improved security environment or through cuts in defence procurement budgets in a number of potential markets due to a shift in national spending priorities away from defence.

- Thirdly, there could be a deterioration in the behaviour, external or internal, of countries currently in receipt of UK defence exports to the extent that they fall foul of existing export licensing criteria.

- Finally, it is possible that concern over issues such as human rights could lead to more severe UK restrictions without any change in the behaviour of current recipients.

There are other scenarios where export sales could decline. One of these would be where, due to increased domestic demand (ie increased UK MoD requirements), there is a diversion of exports to domestic procurement. Such a scenario would not have the effects outlined below.

12. An important factor to be taken into account in establishing a baseline is the volatility of exports from year to year (see Figure 1). It would be misleading to look at the effects of a reduction in exports from any given year. This paper examines the impact of a 50% cut, for whatever reasons, in arms exports from their average 1998 and 1999 levels. This cut is assumed to be made up of two successive annual 25% reductions. Reductions of 25% or even a little more from one year to the next are not unprecedented. Indeed, a 30% reduction was experienced in 1999 on the average level of sales recorded over the previous two years. However, there is no reason to believe this represents the start of a downward trend. The latest figure for 2000 is virtually unchanged on 1999. The following section discusses the MoD data on defence exports and employment.

THE MoD DATA ON DEFENCE EXPORTS AND EMPLOYMENT

13. A fundamental problem with defence exports data, as with other defence industry data, is that there is no standard industrial category for defence products and services. This is in part because there is no universally accepted definition of defence
outputs. Although there is no dispute about products of a wholly military nature bought by Ministries of Defence and associated Armed and Security Services, there is a question mark about products and services capable of a dual military and non-military use, such as trucks or lectures on military history and about products and services which are essentially non-military in nature such as food or accountancy services but are purchased by a Ministry of Defence. Even with warlike products such as guns and swords there is debate about items bought by private individuals (e.g. collectors) and by Governments for internal policing purposes. Figure 1 reproduces the two series published by the MoD on defence exports over the 1985-99 period, re-based to 1999 prices. The series for orders is compiled by Defence Export Services Organisation (DESO) and is based on information collected on a voluntary and confidential basis from UK companies. The orders are based on a quarterly survey of the value of new orders (covering both legally binding contracts and routine or small orders regarded as firm) taken onto a company’s order book. They relate to sales to overseas Ministries of Defence and associated Armed and Security Services, making them customer based, rather than product based.

14. In addition to military equipment the orders data include products and services bought by other governments’ defence ministries some of which may be non-military in nature (e.g. IT equipment or infrastructure projects for civilian staff accommodation.) They will also include any training or logistic support included in the contract. Furthermore, because sales to associated Armed and Security Services are also covered some equipment for policing purposes will be included. Orders covering international collaborative ventures, where the sale is not to one of the partners and where the UK company is the prime contractor, are included. The value recorded should cover the UK work content only. The whole value of the order will be counted in the year the contract is signed even if part or all of the delivery and payment are made only in subsequent years. Furthermore, orders do not necessarily result in the full value being reflected in subsequent deliveries: orders can be amended or even cancelled. Unfortunately, there are no data on amendments and cancellations.

15. The series for deliveries is compiled by the Defence Analytical Services Agency (DASA) from HM Customs and Excise data on deliveries of defence equipment that have passed through UK customs. Unlike the DESO data these figures are product rather than customer based. Furthermore, because as far as possible only tariff codes which cover purely military equipment are used, some dual use items and defence-related services such as training are excluded. The DASA data now list defence equipment under eight commodity groups. The list of tariff headings included has changed over time due to the addition of new tariff headings for parts of guided weapons and missiles (1987), and parts of military aircraft (1988). Moreover, adoption of the INTRASTAT Common Nomenclature in 1993 resulted in military aircraft and parts being identified as ‘other than civil’ rather than ‘military’, and the deletion of the heading for ‘military radio and radar apparatus, optical equipment, and military simulators other than ground flying trainers.’ DASA has tried to preserve, as far as possible, the same overall coverage of exports but as it is not possible to sub-divide individual tariff headings some changes in coverage over time have been unavoidable. Further amendments to the definitions were made in 1999 to address the discrepancies between Defence Statistics figures and those in the “Annual Report on
Strategic Export Controls”, a joint MoD, FCO and DTI publication. The Customs and Excise data in Defence Statistics 2000 and the 1999 Annual Report are now identical.\(^5\)

**Figure 1: Defence Exports: deliveries and orders**

![Defence exports: deliveries and orders](image)

**Sources:** MoD; DESO; *Economic Trends*.

**Note:** Figures have been re-based to 1999 prices using the GDP deflator.

16. However, the tariff-code-based data understates the value of defence exports especially in the electronics and aerospace industry groups where the UK is particularly strong. To fill the gaps in coverage of the Customs and Excise deliveries data, DASA supplements deliveries data with an estimate of additional exports in the Aerospace, Electronics and Other Vehicles industry groups. To do this it makes use of:

- estimates of the annual value of aerospace export orders from the Society of British Aerospace Companies (SBAC). These figures are based more on whether the buyer is the military rather than the type of product sold. They will therefore include not only some dual-use items, but also services. To avoid double-counting DASA deduct the aerospace figure derived already from the Customs data. The combined figures (ie HM Customs and Excise, plus SBAC data) are those for the (misleadingly titled) ‘estimated total deliveries of defence equipment’ published in UK Defence Statistics and shown in Figure 1. However, the exclusion of dual-use items from Customs’ data, and the deletion of the heading covering military radio and radar apparatus etc means that

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the figures (even including SBAC data) are likely to understate the scale of UK defence exports.

- selected categories of orders taken from DESO’s orders database. The categories are electronics and other vehicles. These have been selected because at least the majority of the items covered are likely to have been omitted from the Customs and Excise and SBAC data, and apply to items likely to be delivered within a year or less of the order being signed.

17. For the purpose of this study, it is the total of identified Customs deliveries data plus the difference between the Customs figure and the SBAC or DESO figures (whichever gives the higher figure in that year) for aerospace equipment, electronics and other vehicles which have been used by DASA to generate calendar-year estimates for employment dependent on defence exports. The figures therefore differ from those published in UK Defence Statistics. For 1997 to 1999, the data are summarised in Table 1. Figures for 2000 on this basis are not available.

Table 1: UK Direct Defence Export Sales 1997 – 1999

<table>
<thead>
<tr>
<th></th>
<th>£M Current prices</th>
<th>£M 1999 prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM Customs and Excise identified deliveries</td>
<td>3359</td>
<td>1986</td>
</tr>
<tr>
<td>Additional aerospace (SBAC)</td>
<td>3325</td>
<td>4062</td>
</tr>
<tr>
<td>Electronics and other vehicles (DESO orders)</td>
<td>186</td>
<td>1048</td>
</tr>
<tr>
<td>Total</td>
<td>6870</td>
<td>7087</td>
</tr>
</tbody>
</table>

Sources: DASA; DESO; SBAC.

Notes: (i) VAT exclusive; (ii) The SBAC figure for 'additional aerospace equipment' refers mainly to dual-use items and services, not to equipment; (iii) The DESO figure is derived from orders figures.

18. Clearly, the total figure is based on estimates and judgement, and is hybrid in nature. Nevertheless, it is the result of an attempt to compensate for the deficiencies of the individual data sources. The total may be subject to a degree of uncertainty, but there is no reason to believe that as an estimate of UK defence exports it is biased in either an upward or downward direction.

19. The estimate of direct employment dependent on exports is obtained by allocating the spending in Table 1 to the relevant industrial sector (using the Standard Industrial Classification (SIC)) and applying sales per employee data for each of the
industries receiving spending.\footnote{Most sales per employee data are derived from the ONS’s Annual Business Inquiry (ABI) data. The latest available is the 1997 version. The 1997 estimates must be updated to the appropriate year using quarterly productivity and price indices. The only industry group not covered by the ABI is shipbuilding. Here the sales and employment figures of Vosper Thornycroft (from its annual report) are used.} Indirect employment is estimated using ONS input-output data.\footnote{For more details see DASA, \textit{Defence Statistics Bulletin No 3}, July 1994.} As noted above, the DASA data used in this study are on a calendar year basis. Data prior to 1997 are available at present only on a financial year basis. The data indicate that employment supported by defence exports declined by about 45% between 1990 and 1993 to 80,000, before rising to a peak of 175,000 in 1996. Employment declined in 1997 to 115,000, rose slightly in 1998 to 120,000, before falling to 75,000 in 1999 (35,000 direct and 40,000 indirect). For a number of reasons, the MoD’s export-dependent employment data - like those for exports - will be subject to a degree of uncertainty. First, because of the uncertainty underlying the data on direct export sales noted above; second, because the ONS input-output data are produced only intermittently (DASA uses the 1990 version, the latest available); and finally because sales per head data relate to an entire SIC category, such as aerospace, and not just to its military component. Clearly, it is possible that the data on sales per head for the military component, if they were available, might be different. No figures for employment are available for 2000 in UK Defence Statistics 2001. DASA is instituting a review of the methodology involved. This is welcome, but should also examine the compilation of the defence export and import figures and include an independent, that is non-governmental, element. However, for the purpose of this study, the figures for employment are based on the existing DASA methodology.
20. For the purposes of this study, because of the volatility of the export sales data and the employment data they generate, an average of calendar years 1998 and 1999 has been taken. This gives a baseline for export sales of £6,100m in constant 1999 prices, and a corresponding baseline for employment of 97,500.

21. While the MoD holds no data on the regional or sub-regional breakdown of employment dependent on defence exports, there are estimates of UK regional employment dependent on MoD equipment spending. These estimates make use of Defence Bills Agency (DBA) data on contract expenditure allocated to regions on the basis of location of work codes. Using these data, regional employment can be calculated on the basis of ONS sales per employee data for the relevant industries. These estimates include direct employment only.  

22. To assess the economic impact of a reduction in export sales, and in particular upon the terms of trade, data on imports of components and raw materials incorporated into export production is needed. Unfortunately, MoD data on imports of defence equipment (provided in Table 1.14 of UK Defence Statistics) are not produced on a basis that is compatible with data published for defence exports. Like the export series, they are compiled from HM Customs and Excise data and are product rather than customer based. They cover both imports for MoD use and imports for incorporation into defence export production. It is thus not possible to separate imports destined for UK MoD from those for export production. The series is limited to tariff codes that cover purely military equipment, and hence excludes

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8 For the latest available estimates see UK Defence Statistics 2001, Table 1.11.
components which have potential dual use and raw materials. In contrast to data produced on exports of defence equipment, therefore, they do not include estimates of additional aerospace equipment, despite the fact that this is included in export estimates. The lack of adequate data on defence imports is a serious gap in our understanding of the changing shape of the defence sector, and we would strongly recommend that the MoD seek to rectify this in the near future.

23. To illustrate the potential scale of the omissions, the SBAC figures for UK military aerospace imports in 1998 and 1999 were £3.8bn and £3.5bn. Even allowing for approximately two-thirds of this to be for UK MoD and only about a third for export, whether directly or indirectly, in line with the distribution of total equipment production and employment, this would suggest that total imports for export production are at minimum not much less than £2bn. The import content of defence exports will vary considerably between different categories of export. At one extreme the import content of exports of equipment developed through collaboration with international partners (eg Tornado) will be in the region of two-thirds or more. For other aerospace equipment the import content will be much lower. DESO figures for the Hawk suggest an import content of some 22%. For military aerospace exports overall, which account for about 80% of total defence exports, the import content is likely to be similar to that for the overall aerospace sector, which is about 45%. At the other extreme, for land systems the import content is much lower. Studies of the supply chain for the Challenger 2 Main Battle Tank\(^9\) and for the Warrior APC\(^10\) found import contents of 12½% and 15-20% respectively. DESO data on the import content of the export version of the Challenger 2 suggest an import content of about 30%. Assuming 45% for the import content of aerospace exports and 20% for non-aerospace exports gives an average import content of 40%. This is the figure applied for the import content of defence exports in this paper.

THE PROCESS OF ADJUSTMENT

24. If defence exports were cut by 50%, there would be a reduction in the overall output of the defence industry and consequently reduced employment in both prime contractors and sub-contractors. If such direct and indirect employment fell in proportion to the fall in output it would mean the loss of 48,750 jobs. The loss of earnings of former defence workers would in turn reduce their expenditure on both domestically produced goods and services, causing (through the multiplier effect) a further loss of employment, and imported goods and services. The shareholders in the affected companies would, as a result of the reduced output, see a reduction in their profits and hence in their share values. Some existing capital would also be redundant leading to disposal of some plant, machinery, other fixed assets and land.

25. The reduction in defence exports would leave defence companies having to support their fixed overhead costs from a smaller revenue base. If they sought to compensate for this by raising the prices, particularly the prices of equipment sold to

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the UK MoD, it is probable that they would face a further reduction in the volume of
new orders and hence a further decline in output and employment. Some of this
reduction in employment may have happened anyway as a consequence of improved
productivity. It is important in quantifying the costs of adjustment to focus on the
costs of adjustment net of the changes that would have occurred anyway.

26. The decline in defence production would release labour, capital and land for
other uses, and would mean the cost of such factors of production would be lower
than would otherwise be the case. Firms producing other types of goods and services
would thus be able to expand at a lower cost than otherwise and hence charge lower
prices. Hence the decline in defence exports would facilitate faster growth in output
and employment elsewhere in the economy. This in turn would generate increased
expenditure which in turn would lead to further output and employment.

27. The behaviour of the exchange rate is highly complex and unpredictable in
practice. Actual exchange rates often diverge markedly and for long periods from
estimates of equilibrium exchange rates. Even so, it is important to highlight the
possibility that a reduction in defence exports, although it would be partially offset by
reduced imports, would, other things being equal, lead to a temporary real
depreciation in the value of sterling. If such an effect were to occur, it would improve
the price competitiveness of UK exporters in foreign markets and of UK-based
producers relative to importers in the domestic market, thus increasing UK exports of
goods and services and further reducing imports. It would also raise the rate of return
in foreign currency terms on inward investment in the UK and lower the rate of return
in sterling terms on UK investment overseas. This would in turn lead to an increase in
capital inflows and reduction in capital outflows. The combined effect would restore
the overall current and capital account to balance. However, because UK consumers
and firms might, at least initially, have to pay more in sterling for imported materials,
goods and services and UK shareholders with overseas investments would receive a
lower return, this restoration of overall balance in the external account would be
achieved at the price of a temporarily lower standard of living.

28. Another mechanism by which the loss of output and employment in the
defence sector would eventually be offset would be through fiscal and monetary
adjustment. On the fiscal side, there would be a reduction in tax revenues (reduced
income taxes and indirect taxes from redundant defence workers) and an increase in
expenditure (eg on job seeker’s allowance to redundant defence workers), though
partially offset by increased taxes and lower expenditures associated with the
additional employment elsewhere in the economy. The resulting net increase in public
sector borrowing compared to what would otherwise have been the case, would help
offset the overall initial reduction in domestic demand. The release of resources and
resulting wage and price adjustments would also allow the Bank of England to set
interest rates at a lower rate than would otherwise have been necessary to meet the
inflation target.

29. These processes of adjustment would take some time to provide alternative
jobs for those made redundant from the defence sector, and only some of the
additional new jobs created would be suitable for redundant defence workers. Some
older redundant defence workers are likely to cease to be economically active. Most
who do eventually find alternative employment would be likely to have to accept a
lower wage, in some cases displacing other workers who would end up in lower-paid jobs. However, other people who would otherwise have been unemployed or inactive for a longer period would benefit from the additional new employment opportunities.

30. It is important to put the scale of the required adjustment in context. The estimated reduction in direct and indirect employment on defence exports would account for less than one-fifth of one percent of total UK employment in the baseline period. Even allowing for the possible further marginal effect of the reduction in exports on the Government’s ability to procure equipment for UK use, the effect on employment lost would still be relatively small. The net increase in total employment between January – March 1999 and January – March 2000 was 284,000, or six times the estimated total number of jobs that might be lost in defence exports. The estimated total number of engagements across the economy during 1999 was 5.8m, more than one hundred times the baseline loss in defence export jobs.11

31. Major job losses are not unusual in industries undergoing transition. As a consequence of restructuring resulting from the end of the Cold War, total employment supported by MoD equipment expenditure fell from 360,000 in 1985/86 to 210,000 in 1993/94, a loss of 150,000 jobs: three times the loss assumed in this study. Between 1985 and 1993 employment in the coal industry declined from 216,000 to 36,000, a loss of 180,000 jobs in eight years. Over the same period, 70,000 jobs were lost in metal manufacturing (215,000 to 146,000), and 33,000 in the electricity industry (146,000 to 113,000).

32. Though relatively modest in terms of the total UK economy, the effects of the halving of defence exports could pose particular problems for specific regions or sub-regions. One way of assessing the importance of exports to the different regions would be to assume that defence export employment is distributed across the regions in the same proportion as employment dependent on MOD equipment spending. On this basis, given the similarity of direct equipment employment and total export dependent employment (direct and indirect) in 1998/99 (85,000 and 90,000 respectively), overall dependence on export employment at the regional level would be of a similar magnitude. Defence export employment dependence at regional level would be fairly modest. The greatest dependence would be in the South West (0.7%), with above-average dependence also in the South East, North and North West. If the possible adverse knock-on effects on the viability of the remaining defence industry were taken into account the impact on employment in these regions could be greater.

33. However, direct export employment is unlikely to mirror the distribution of employment on MoD equipment spending. Given the predominance of aerospace in defence exports (around 80% of total deliveries in 1999) it seems likely that regions in which the aerospace industry is located would have higher dependence. An attempt was made by Morgan to take this into account by allocating employment according to MoD expenditure in the aerospace sector.12 Morgan further assumed that indirect export employment followed the same regional pattern as direct employment. This

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11 Figure for increase in employment are based on Labour Force Survey data for total employment. Figure for engagements based on estimates that only about a quarter of engagements (1.457m in 1999) are made through Jobcentres. ONS, Labour Market Trends, January 2001, Tables A1 and G1.
work suggested that in 1994/95 the South East accounted for some 38,000 jobs (43%) of export-related employment, and the South West and North West for 21,000 (23%) and 16,000 (18%) respectively. However, as Morgan noted, such an approach rests on the questionable assumption that the export pattern will follow the pattern of MoD expenditure, ignores non-aerospace exports, and may be biased towards the South East by the ‘head office’ effect (bills paid to head offices in the South East for work done outside the region). The lack of sensitivity in such an approach has been noted by Martin et. al who have pointed out that Yorkshire and Humberside was estimated to have only 270 (0.3%) export related jobs despite being the location of the then British Aerospace Brough plant which employed some 2,000 producing Hawk for export in 1994/95.\(^\text{13}\)

**Estimating the Costs of Adjustment**

34. There have been a limited number of studies of the impact of redundancies in defence industries that provide information about the periods of unemployment experienced, and pay differences for those who eventually found alternative work. They include a study of redundant defence workers from the Dynamics Division of British Aerospace Ltd at its Stevenage and Hatfield sites,\(^\text{14}\) and a study of redundant defence workers in the South West of England.\(^\text{15}\) The latter survey has been used in this study to estimate the transition costs likely to be experienced by workers. Estimates have also been made of the losses to shareholders and the Exchequer. Of course, there are problems with extrapolating from the experience of just one particular region. The bulk – just over 50% - of the redundancies in the South West of England survey occurred in 1990 and 1991. The national labour market as measured by unemployment rates was less favourable than in the South West at around that time (see Table 2 below), and thus the study probably understated the average periods of unemployment that would have been experienced nationally. Other studies (eg of redundant shipyard workers in Tyneside) show workers taking much longer to find alternative jobs.\(^\text{16}\) However, the general improvement in labour market conditions since the period covered by the study, and the measures introduced by the present Government to increase employment opportunities, mean that prospects for workers made redundant today would be somewhat better at a national level than they were in 1990-91. With UK unemployment in 1999 below the average rate in the South West at the time of the redundancies, to use the South West of England data unadjusted would be to overstate the period of unemployment that would be experienced by workers made redundant today. The period of unemployment has therefore been reduced by a quarter to take account of the improvement in labour market conditions (although somewhat arbitrary, this reflects the difference between average UK unemployment rates in 1999 and those in the South West over 1990 and 1991).


\(^{15}\) Hooper, Butler, Hartley, Braddon and Dowell, *Defence Industry Redundancies in the South West Region*, Centre for Defence Economics, University of York, 1996.

Table 2 - Comparison of claimant unemployment in SW region and UK percentage per annum

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>4.6</td>
<td>4.3</td>
<td>6.9</td>
<td>9.2</td>
<td>9.5</td>
<td>8.3</td>
<td>6.8</td>
<td>6.1</td>
<td>4.3</td>
<td>3.5</td>
<td>3.1</td>
</tr>
<tr>
<td>UK</td>
<td>6.4</td>
<td>5.8</td>
<td>8.0</td>
<td>9.8</td>
<td>10.4</td>
<td>9.4</td>
<td>8.0</td>
<td>7.2</td>
<td>5.5</td>
<td>4.7</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Source: Economic Trends.

35. A further problem with the results of such redundancy studies is that they provide information only about what happened to the individuals who were made redundant. They tell us nothing about what might otherwise have happened to those individuals. It is possible that had they not been made redundant they would have remained in the same job or a similar job with another firm in the industry until their retirement. However, it is also possible that some other set of circumstances would have occurred soon afterwards leading to their redundancy or voluntary change of job. Assuming the former results in high estimates of adjustment costs, assuming the latter results in much lower estimates. Although those made redundant typically had long unbroken spells of prior employment it does not follow that they would otherwise have continued in employment until they retired. One reason those made redundant had such long periods of prior unbroken employment is that these are the individuals for whom redundancy is financially most attractive. There are advantages to companies in using voluntary rather than compulsory redundancies.

36. One way of estimating the likelihood that those who would be made redundant as a result of a loss of defence exports would have changed jobs or lost their jobs anyway is to look at the prospects for the defence industry. With little prospect of the UK’s arms procurement budget growing in real terms, employment in that part of the industry engaged in production for MoD faces the prospect of gross employment falling in line with growth in annual labour productivity. Although this could be accommodated by not recruiting and relying on natural wastage this would result in a progressively ageing workforce – hardly ideal for an industry that depends on innovation. Thus it is reasonable to assume that even if those who would be made redundant in the event of a fall in exports escape redundancy and all the associated costs, they would still face a continuing risk each year of being made redundant equal to the annual rate of labour productivity growth (for further details see Appendix paragraphs A3 and A4).

37. It is also necessary to take account of the release of capital and scarce categories of workers (eg managers, professional and technical occupations) on the pace of output and job creation elsewhere in the economy. Here one possible starting point is to look at the amount of capital released from the defence sector and use average economy wide capital: output and capital: labour ratios to estimate the additional output and employment generated. (for further details see Appendix paragraph A5).
ADJUSTMENT COSTS TO WORKERS, SHAREHOLDERS AND THE EXCHEQUER

38. To calculate the adjustment costs, it is assumed that the reduction in jobs is spread equally over a two year period. Details of the calculations are given in the Appendix. The estimated costs (net of tax and statutory deductions) to defence workers comprise the following:

i) loss of income as a result of unemployment – a cost in the first year of around £92m, or between £29m and £46m after allowing for the chance of the jobs being lost anyway. The total cost over the entire time it takes those who are made redundant to find alternative jobs would be around £497m (most of which would fall in the first two years). Allowing for the chance that they would have become unemployed anyway reduces that to between £159m and £248m.

ii) loss of income as a result of permanent withdrawal from the labour force. The study of redundant defence workers in the South West found that 26% never returned to employment. The first year cost of the loss of income to those who fall into this category would be around £73m. Allowing for the risk of this happening anyway due to other causes reduces this to between £24m and £36m. The long run cost to all redundant workers who never return to employment would be substantially higher. This is estimated to be around £631m (most of which falls in the first five years). Allowing for the chance of job loss due to other factors reduces this to between about £202m and £316m.

iii) reduced incomes in replacement jobs. The majority of those who do find replacement jobs suffer a loss of wages compared to their previous defence job. The first-year cost of those who lose their job in the first year and then secure alternative employment is estimated to be between £28m and £41m, or £9m-£14m to £14m-£21m allowing for the chance of job loss due to other causes. The long-run costs would be much higher – between about £319m to £462m, depending on their earnings in new jobs. Allowing for the risk of job loss due to other causes would reduce this cost to between about £102m to £148m and £159m to £231m.

39. Shareholder losses from early writing-off of plant and equipment are estimated at around £105m net of tax in the first year, £79m of which is borne by UK resident shareholders. Allowing for the risk of write-offs due to other causes reduces this to around £86m, giving £65m to UK resident shareholders. Reduced profits from carrying higher overheads involve a further net loss of £39m in the first year, £30m to UK resident shareholders. The total cost is estimated at around £396m, or £237m after allowing for the risk of write-offs due to other causes. For UK resident shareholders the total cost (all of which is borne in the first three years) is £297m or £178m after allowing for the risk of write offs due to other causes. The release of capital and other resources would facilitate the creation of other jobs; some of which would be filled by redundant defence workers while some would be filled by those who would otherwise
have been unemployed or inactive. The eventual number of new jobs created is estimated to be around 67,400. This is some 18,650 more than the number of defence jobs lost. This is because defence jobs use more capital per person employed. These new jobs would take time to be created. Hence, the first-year gain in wages to those who would otherwise have been unemployed or inactive would be only around £25m. Allowing for the chance of these jobs being created anyway would reduce this benefit to between about £12m and £17½m. Over the long run, the gain would be more substantial at around £875m, or between £280m and £437.5m after allowing for the chance of these jobs being created anyway. Because these different assumptions impact upon both the costs and benefits, the lower and upper end of the range of net costs is calculated by adding the lower end of the cost range to the lower end of the benefit range and the same for the upper end.

40. Overall, the potential loss to defence workers is estimated to be in the region of £60m to £100m in the first year and between around £460m and £800m over the longer term. This is partially offset by the gains to other workers, leaving the net loss to all workers at between £50m and £85m in the first year and between around £180m and £360m over the longer term.

41. The reduction in incomes of workers and shareholders would lead to a reduction in spending. This would reduce income and hence output and employment elsewhere. These multiplier effects would involve a further loss to the economy estimated at between around £80m and £100m in the first year and between just under £200m and £300m over the longer term.

42. The losses to the Exchequer in the form of reduced tax receipts and increased benefit payments are estimated at between around £140m and £170m in the first year and between around £380m and £540m over the longer term.

43. A further more speculative adjustment cost is associated with the ‘terms of trade’ effect. This is the increased cost of imports and reduced value of export earnings, in foreign currency terms, that might result from the depreciation of the exchange rate in response to the loss of defence exports. In practice, the behaviour of exchange rates is extremely complex and unpredictable. Exchange rates can, and often do, diverge markedly and for long periods from estimates of the “equilibrium exchange rate” (i.e. the exchange rate at which the economy can continue to grow without an unsustainable current account imbalance). Other things being equal, however, the exchange rate might be expected to temporarily depreciate in response to a reduction in defence exports. In these circumstances, the “terms of trade” cost is provisionally estimated at around £440m in the first year and around £1.1bn overall (entirely within the first three years).

**Overall Adjustment Costs**

44. These various adjustment costs are summarised in Table 3. The first year cost provides an indication of the scale of the initial shock of a 25% fall in the value of export sales. Including multiplier effects, the cost to workers, shareholders and the Exchequer of a 25% reduction in exports would be around £400m. Adding the terms of trade effect would bring this to around £850m. This equates to around 50% of the gross value of the bst defence exports (£1,525m). The cumulative net cost of a 50%
reduction in defence exports, excluding terms of trade effects, ranges from £0.9bn to £1.4bn, nearly all of which would occur in the first five years. Including the terms of trade effect would raise this to between £2.1bn and £2.5bn.

**Table 3 – Summary of Adjustment Costs**

<table>
<thead>
<tr>
<th></th>
<th>1st Year costs of 25% fall in exports (including multiplier effects)</th>
<th>Cumulative Costs in NPV terms of 50% fall in exports (including multiplier effects)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Losses and Gains to Workers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defence Workers</td>
<td>62 – 103</td>
<td>463 – 795</td>
</tr>
<tr>
<td>Other Workers [benefits]</td>
<td>[12] – [17½]</td>
<td>[280] – [437.5]</td>
</tr>
<tr>
<td>Multiplier Effects</td>
<td>29 – 50</td>
<td>107 – 209</td>
</tr>
<tr>
<td><strong>Net Losses to UK Shareholders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write Off &amp; Reduced Profits</td>
<td>94</td>
<td>178</td>
</tr>
<tr>
<td>Multiplier Effects</td>
<td>47</td>
<td>89</td>
</tr>
<tr>
<td><strong>Exchequer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Loss of Tax Receipts and Extra Benefit Payments</td>
<td>54 – 86.5</td>
<td>221 – 383</td>
</tr>
<tr>
<td>Net Loss of Receipts from Shareholders</td>
<td>83</td>
<td>158</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>357 - 446</td>
<td>934 – 1,375</td>
</tr>
<tr>
<td><strong>Terms of Trade</strong></td>
<td>440</td>
<td>1,120</td>
</tr>
<tr>
<td><strong>Total including Terms of Trade</strong></td>
<td>797 – 886</td>
<td>2,054 – 2,495</td>
</tr>
</tbody>
</table>
LONGER TERM SUPPLY SIDE EFFECTS ON THE ECONOMY

45. On the supply side, the defence industry is highly research and development intensive. Defence related R&D still accounts for almost 15% of total Business Enterprise R&D, over 50% of total Business Enterprise R&D in the aerospace industry and over 30% in the mechanical engineering and electrical machinery industries.

46. Defence also accounts for a relatively high share of public R&D activity. Although the proportion of total government and public sector R&D devoted to defence has declined over the past 10 years, defence still accounts for 37%. (see Table 4).

Table 4 – Government and Public R&D (net)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Civil</td>
<td>3,639 (59%)</td>
<td>3,415 (61%)</td>
<td>3,687 (63%)</td>
<td>3,599 (63%)</td>
</tr>
<tr>
<td>Defence</td>
<td>2,960 (41%)</td>
<td>2,372 (39%)</td>
<td>2,380 (37%)</td>
<td>2,096 (37%)</td>
</tr>
<tr>
<td>Total</td>
<td>6,599 (100%)</td>
<td>5,787 (100%)</td>
<td>6,067 (100%)</td>
<td>5,695 (100%)</td>
</tr>
</tbody>
</table>


47. There has been a significant shift away from direct government funding of business R&D in both defence and civil areas towards funding from overseas sources (see Table 5).

Table 5- Sources of Funds for Business R&D

<table>
<thead>
<tr>
<th></th>
<th>Government</th>
<th>Overseas</th>
<th>Business</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989 Civil</td>
<td>428 (5%)</td>
<td>1035 (12%)</td>
<td>6831 (82%)</td>
<td>8292 (100%)</td>
</tr>
<tr>
<td>Defence</td>
<td>1410 (58%)</td>
<td>398 (16%)</td>
<td>610 (25%)</td>
<td>2418 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>1838 (17%)</td>
<td>1433 (13%)</td>
<td>7441 (69%)</td>
<td>10,710(100%)</td>
</tr>
<tr>
<td>1998 Civil</td>
<td>403 (5%)</td>
<td>1865 (21%)</td>
<td>6430 (74%)</td>
<td>8,698(100%)</td>
</tr>
<tr>
<td>Defence</td>
<td>787 (51%)</td>
<td>381 (25%)</td>
<td>365 (24%)</td>
<td>1,533(100%)</td>
</tr>
<tr>
<td>Total</td>
<td>1,190 (12%)</td>
<td>2,246(22%)</td>
<td>6,794(66%)</td>
<td>10,231(100%)</td>
</tr>
</tbody>
</table>

48. A substantial reduction in defence exports may be expected, *ceteris paribus*, to be associated with a reduction in overseas and business funding for business R&D in defence. This will result in an increased proportion of defence R&D having to be funded by Government. Since at least some part of defence R&D is a fixed overhead (some R&D is related to specific export requirements), this in turn can be expected to increase the fixed costs to MoD of future UK-produced defence equipment.

49. While these predictions are relatively uncontroversial, their long-term effects on the supply side of the economy are not. Some argue that a reduction in defence R&D would lead to the loss of future civilian technological spin-offs. Drawing mainly on US experience, it is argued that new technologies developed as a result of defence R&D are then used in the civil sector, for example, in electronics, new materials and information systems. Others argue, by contrast, that the concentration of industrial efforts on largely state-financed defence activities has tended to “crowd out” valuable investment in civil markets. Evidence for this has been based in particular on the relatively poor overall industrial performance of both the US and the UK during the Cold War period, when levels of defence spending and production were considerably higher (as a proportion of GDP) than in most other OECD states.\(^{17}\)

50. The crowding out argument is most often made in relation to the stock of qualified scientists and engineers. As a consequence of its high research and development intensity the defence sector employs a high proportion of qualified scientists and engineers and technical occupations. In the short to medium term, a decline in defence exports and in the level of defence R&D would increase the supply of scarce qualified scientists and engineers to the rest of the economy, helping to create new opportunities for civil production and employment. Because the proportion of qualified scientists and engineers is generally lower in other sectors, such a redeployment might be expected to lead to employment of fewer engineers and scientists and greater numbers of relatively unskilled workers than were previously employed.

51. However, over the longer term the benefits obtained from diverting qualified scientists and engineers to civil sectors would be reduced if the reduction in defence demand for such staff were to lead to a reduction in future supply. Here, the available evidence is both limited and uncertain. It is clear from the Institute of Employment Studies Annual Graduate Review that the supply of new scientific and engineering graduates has been growing more slowly than graduates in other disciplines over recent years and that this trend is expected to continue. The reasons behind this, however, and in particular the extent to which this reflects a response to perceived employment prospects, is very uncertain. There is some evidence that at least part of

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the explanation is due to these subjects being seen by prospective students as inherently more demanding and difficult, which is unrelated to employment prospects.

52. The defence industry makes a direct contribution to the supply of highly qualified labour through its own training. Some two-thirds of the redundant defence workers and four-fifths of qualified scientists and engineers surveyed in Hooper’s South West England Study had received training whilst working for their previous defence company employer. The defence industry’s commitment to training was facilitated by its relatively high level of stability of employment – some 70% of these redundant workers had previously been employed by the same defence company for more than 10 years, with 33% employed by the same defence company for more than 25 years. Although such employment stability may foster greater investment in development of firm-specific skills, it does not necessarily make any contribution to developing the skills of the wider labour force.

53. Even though a shift in labour market conditions is likely to lead to a shift in the types and qualification acquired in further and higher education and through on-the-job training (for example away from engineering and science to other skills), it is far less clear that it will have any detrimental impact on the overall supply of highly qualified personnel. The main determinants of this will continue to be (a) the supply of individuals with levels of basic education that make it possible for more advanced skills to be acquired and (b) the investment in, and efficiency of, higher and further education. In consequence it is difficult to assess whether the 'supply side' effect of a reduction in defence exports (operating indirectly through the level of defence R&D, and hence on the future demand for, and supply of, engineers and scientists) would have a negative or positive overall impact upon the long term rate of economic growth. Either way, the scale of any impact seems unlikely to be significant.

OTHER COSTS AND BENEFITS TO GOVERNMENT OF SUPPORT TO DEFENCE EXPORTS

54. In addition to the loss of the tax receipts from workers and companies in their alternative state, there are costs and benefits associated with the costs of support to the defence industry to achieve defence exports as compared with the costs of supporting alternative production and exports, the costs of regulating defence exports, and the costs and benefits associated with the Government’s position as a customer of the defence industry.

55. There are two forms of assistance provided by the Government. Firstly, there is the specific assistance provided by the MoD, particularly its Defence Exports Services Organisation (DESO). Secondly, there is the general assistance provided by other Government programmes, in particular from the Export Credits Guarantee Department (ECGD).

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18 Hooper W, Butler B, Hartley K, Braddon D and Dowell P, Defence Industry Redundancies in the South West Region, Centre for Defence Economics, University of York, 1996. It is difficult to compare directly the results of this survey with surveys of training covering the wider economy such as the Learning and Training at Work (LTW) Survey (see Labour Market Trends, May 2001, Vol 109, No5). The latter was first carried out in 1999, several years after the Hooper study. Moreover the LTW survey only queries respondents about the training received in the previous 12 months, unlike the Hooper study that covered the entire time a worker was with the defence company.
Costs of MoD Support

56. The annual cost of MoD support for defence exports over the period 1998/99 to 1999/00 averaged around £20m a year. This comprised the following elements:

a. **The Net Operating Costs of the Defence Exports Services Organisation (DESO).** The outturn figures for DESO in cash terms for 1998/99 and 1999/00 were £16.2m and £13.6m respectively.

b. **Defence Assistance Fund (DAF).** The Defence Assistance Fund (previously called the Defence Military Assistance Fund) came into existence in 1996/97. Support for exports (£5.6m in 1999/00) is only one activity covered by the fund (for example, UK Defence Diplomacy is also supported by the DAF). That element of the fund used to promote defence exports replaced the Defence Sales Fund (which was not a cash budget but a waiver fund and so is not directly comparable). It has not been possible to identify that component of the fund used to support exports in 1996/97, but the data for subsequent years are shown in Table 6.

c. **Defence attachés.** In 1989 the National Audit Office (NAO) found that defence sales promotion accounted for a third of defence attachés' time, with half of the attachés surveyed spending 40% of their time on defence sales promotion. The development of a targeted marketing strategy by DESO and the creation of more civilian sales promotion posts in key markets reduced the proportion of attachés' time devoted to defence sales promotion. An examination undertaken in 1997/98 for the Strategic Defence Review found that 11% of attachés' time was devoted to defence export promotion (some 40% was devoted to bilateral defence relations, 26% to liaison with other UK government departments and 23% to other duties). Including staff costs, travel and subsistence, entertainment, other operating costs, vehicle costs and apportioned Foreign and Commonwealth Office (FCO) headquarters costs and costs of utilities, the total cost of defence attachés' time was £22.8m, and that devoted to defence exports is estimated at £2.5m. This, however, does not include the cost of accommodation, which is paid by the FCO. Based on Foreign Office estimates, ORG/Saferworld obtained a figure of £14m for the cost of administrative, office and residential accommodation for defence attachés.\(^{19}\) Although there may be some overlap here, adding 11% of this would bring the total costs of defence attachés' export promotion activity to £4m in 1997/98. The annual cost in 1998/99 and 1999/00 is likely to be similar.

d. **Other Promotional Activities.** The ORG/Saferworld study included a figure of £20m a year for ‘a fair apportioning of the budget for official visits to arms promotion’, and a figure of £10m a year for the cost of using MoD personnel and equipment to promote arms exports. In relation to the latter, DESO operates a charging regime which serves to

\(^{19}\) Paul Ingram and Ian Davis, *op cit*, p. 26.
recover the costs of MoD personnel and equipment from industry, or charge them to DESO’s operating budget or the DAF. There may be some costs, however, that we have not taken into account because they cannot be separately identified. This would apply to the proportion of time devoted by armed forces activities (eg visiting Royal Navy warships), ministers and senior military officers to export promotion in the course of other business.

57. It does not follow that a 50% reduction in the level of defence export sales would result in a similar, or even any reduction, in the overall cost of MoD support. Any reduction in MoD support would depend upon a policy decision to make such a reduction. Nevertheless, the paper assumes that expenditure on MoD support would be halved. The resulting overall saving would be around £11m a year.

Table 6 - Costs of MoD Support

<table>
<thead>
<tr>
<th></th>
<th>£M current prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESO Net Operating Costs</td>
<td>14.4</td>
</tr>
<tr>
<td>DAF</td>
<td>1.8</td>
</tr>
<tr>
<td>Other</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21.2</strong></td>
</tr>
</tbody>
</table>

Source: DESO.

The Commercial Exploitation Levy (CEL)

58. The CEL is a fee levied on exports for the use of a design wholly or partly funded by the MoD. Receipts in 1998/99 and 1999/00 were £57.5m and £17.5m respectively, an average over the two years of £37.5m. This compares with an average of £55.5m over the previous three years (1995/96 to 1997/98).

There is no clear relationship between the overall value of defence sales and CEL receipts for a number of reasons. The levy rate ranges from 5% to 10% of the selling price depending on the equipment involved. With total defence equipment export sales of £2,570m in 1998/99 one might therefore expect CEL receipts to be between £120m and £250m (exports include non-equipment items such as construction, training, manpower, maintenance and other support that are not subject to the levy). Export values will include items designed by means of private venture R&D where no CEL entitlement arises, or derivatives where application of the levy and the rate applied will vary according to the proportion of government to privately funded R&D. MoD’s entitlement can be abated where full recovery might harm potential sales. It could be argued that such abatement represents an element of subsidy to defence exports. However, CEL represents a flowback to the Exchequer that one can reasonably assume would be halved if defence exports were halved. It is thus assumed that a 50% reduction in defence exports would involve a loss of £18m in CEL receipts. Were MoD not granting such abatements, CEL receipts would be higher and the consequential loss to the Exchequer arising from a 50% reduction in defence exports would be significantly higher.

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Export sales of surplus equipment

59. In addition, there are export sales of surplus equipment by the Disposal Services Agency (formerly the Disposal Sales Agency). Some of these are government to government sales, and it is reasonable to treat them as close substitutes for new defence equipment. Hence, although the markets involved are different, it would seem reasonable to assume that, if total UK defence exports fell by 50%, then these government to government disposals would also fall by a similar proportion. In addition, MoD estimates that around 70% of sales by the Disposal Sales Agency to commercial agents (ie 'commercial sales') end up overseas. Not all of these will be defence exports, (eg some surplus Land Rovers and surplus airfield support equipment may be for overseas civilian use). But the information available on this point is very limited. A range is therefore used here, treating between zero and 100% of overseas commercial sales as being defence exports. Taking an average of 1998/99 and 1999/2000 as the baseline, this gives a total range of between £17m and £35m.

60. Thus a loss of 50% of UK defence exports would be likely to result in a net cost to MoD in terms of lost sales of surplus equipment of between £8.5 million and £17.5 million.

Table 7 – Value of disposal sales exports

<table>
<thead>
<tr>
<th>£M current prices</th>
<th>Total sales</th>
<th>Government to Government</th>
<th>Commercial Sales</th>
<th>Estimated Commercial Exported</th>
<th>70%</th>
<th>Value of disposal sales of defence exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998/99</td>
<td>51</td>
<td>22</td>
<td>29</td>
<td>20</td>
<td></td>
<td>22–42</td>
</tr>
<tr>
<td>1999/00</td>
<td>33</td>
<td>12</td>
<td>21</td>
<td>15</td>
<td></td>
<td>12–27</td>
</tr>
<tr>
<td>Two-year average</td>
<td>42</td>
<td>17</td>
<td>25</td>
<td>17.5</td>
<td></td>
<td>17–35</td>
</tr>
</tbody>
</table>

Source: DESO.

Export Credits Guarantee Department (ECGD) Costs

61. Defence exports account for a substantial proportion of total ECGD export guarantees. During the five years 1994/95 to 1998/99, defence accounted for 26% of total ECGD cover, compared with 30% for the previous five years (1989/90 to 1993/94). Defence exports also account for about 24% of the ECGD’s outstanding portfolio of business. Reliance on ECGD cover is especially high in riskier markets (eg the Middle East and Far East), where the Defence Manufacturers’ Association estimates that the proportion of defence equipment export sales by their member

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22 ‘Welcome to the ECGD’, ECGD website, October 2000.
companies receiving ECGD cover could be over 60%. On the basis of the 1998 to 1999 average annual figure for defence exports (£6,100m in 1999 prices), some 27% of defence exports received ECGD cover in this two year baseline period. This is broadly comparable with the level of ECGD support provided to equivalent long-term civil projects to similarly risky markets. Overall, however, only 1.4% of total UK exports of goods and services received ECGD cover in the same period.

62. During the 1980s and much of the 1990s ECGD, along with most other export credit agencies, incurred heavy losses on export insurance/guarantees. It was this experience that led previous researchers, including Martin to suggest that there has been an effective public subsidy for defence exports. Martin estimated this at £239m a year (at 1995 prices) by taking average ECGD losses incurred over the period 1985 to 1996 and applying this loss to the proportion of defence exports in total new ECGD business underwritten over the same period. ORG/Saferworld arrived at a similar figure of £227m, drawing upon estimates of what premiums the finance markets would charge. However, this approach relies upon inferences from very different market activities.

63. The calculation also needs to take account of the fact that ECGD introduced stricter financial criteria for determining premiums in 1991. This involves a more cautious approach to determining premiums than a strict interpretation of the World Trading Organisation (WTO) objective of “breaking even in the long run” would require. While the WTO objective could be satisfied by requiring a 50% confidence of break-even, as applied by many other export credit agencies, the ECGD reports that it operates with a higher 70% confidence margin.

64. Although total claims paid out over the past decade on defence business amounted to £789m, over £600m of this was in respect of credit deals taken on in the 1970s and 1980s. Some £120m of these claims have subsequently been recovered and ECGD advise that they anticipate further significant recoveries over the period ahead. Claims paid out on defence business underwritten during the 1990s have amounted to only around £180m, while premiums earned have been £213m. Because of the very long-term nature of the cover provided, and hence the possibility of further claims in relation to this business, even with ten years experience it is still not possible to conclude that the objective of covering the cost of claims through premiums so as to break even over the long run is being achieved.

65. Furthermore an independent report commissioned by ECGD from National Economic Research Associates (NERA) argued that there should be a charge on capital, to reflect the potential resource cost to the Government for use of its balance sheet to underwrite the business. That is the interest on the notional capital that would be required to meet claims. The NERA report recommended that HM Treasury should

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24 ECGD issued guarantees worth £1,700m and £1,583m to support UK defence related exports in 1998/99 and 1999/00 respectively. ECGD, Annual Report and Trading Accounts 1998/99 and 1999/00.
26 Paul Ingram and Ian Davis, op cit, p. 23.
commission a study to investigate the issue and develop policy options.\textsuperscript{27} The NERA view has been echoed by commentators such as Samuel Brittan.\textsuperscript{28} To estimate what this capital charge should be, it would be necessary to quantify the value of capital that would be needed to cover the outstanding contingent liabilities in the portfolio and the liabilities associated with new business and determine the appropriate rate of return on that capital. Work is currently underway to estimate the level of capital necessary to support ECGD’s existing and future cover, and the interest payable on this, as part of the process of establishing ECGD as a trading fund. Until this work is completed no reliable estimates can be made of the overall hypothetical saving associated with a reduction in ECGD cover resulting from a decline in defence exports.

66. It is, however, already possible to arrive at an estimate of the potential saving in ECGD costs. ECGD estimate that the capital requirement to back its existing exposure is in the range of £2.5bn to £3.5bn. There is no single universally applicable expected rate of return which can be used to assess the total level of subsidy provided to ECGD annually to support its current portfolio. However, Ministers have set ECGD a target of delivering a real return on this capital of 6% and ECGD estimates that at present the business generates around 5% towards the achievement of this target. Ministers have agreed therefore that, in order to cover the shortfall between the 5% and 6%, there should be a voted payment, set at £44m for 2001/2, made into the Trading Fund to allow ECGD to meet its return on capital without impacting on the general level of premium rates. ECGD is committed to removing the need for this subsidy through facilitating risk transfer to the private sector on its existing portfolio through Active Portfolio Management (APM). As a result, while the size of the voted payment beyond 2001/2 is uncertain, over time it should fall.

67. If, despite this, we take the voted payment of £44m as the basis of our estimate of the cost of ECGD support for defence exports then, on the basis that defence business constitutes 33% of ECGD’s overall exposure, this suggests a notional capital cost of £15m per annum as the cost of ECGD support for defence business. This relates to the totality of existing ECGD support for defence business. If defence exports were reduced by one half this would lead to higher alternative exports and lower imports equal to the lost defence exports to restore the external account to the same position as before the loss. Some of these alternative exports would attract ECGD cover. The most reasonable assumption here would be that the rate of ECGD cover would be the same as it is now on all exports. Hence the net reduction in ECGD cover would be around £780m, ie from £824m [0.27 x £6,100m x 0.5] to £43m [0.014 x £6,100m x 0.5]. Assuming a ratio of capital to cover of between 10% and 20% and assuming that new business generates a similar return, of 5% real, to that generated by existing business and a profile of ‘repayment’ of cover in line with existing experience (ie no “repayment” for the first three years then “repayment” over the following 8 years) then the net saving in the cost of ECGD would be between £5½m and £11m a year, with a best estimate centred on £8m a year. If instead one assumes that new business generates no real return but merely breaks even then this last figure would be around £48m a year. Although this latter figure is not an insubstantial sum, it is still relatively modest in comparison with some previous estimates.

\textsuperscript{27} NERA, \textit{The Economic Rationale for the Public Provision of Export Credit Insurance by ECGD}, Cm 4791, July 2000.  
The Costs of Other Forms of Government Assistance

68. In the late 1980s and early 1990s there was concern expressed that the aid budget was being used to promote defence exports and, in the case of the Pergau Dam, led to a formal protest by the then Overseas Development Administration (ODA) Permanent Secretary, based on the fact that the use of overseas aid to support UK arms exports was illegal under the provision of the Overseas Development and Co-operation Act, 1980. The Government elected in 1997 has made clear its opposition to such a practice. It is assumed that the UK aid budget is now not being used for this purpose. As far as other forms of general Government assistance, there is no reason to believe that assistance provided to the defence industries associated with exports is any greater than would be provided to whatever alternative economic activity were to replace defence exports.

The Costs of Regulating Defence Exports

69. The broad order costs of export controls in 1999 were about £9m. These include £1.9m incurred by MoD, and costs incurred by FCO and DTI of £2.5m and £4.5m respectively. These costs have remained relatively stable despite quite marked fluctuations in the level of defence exports over the period. Moreover, there are some fixed costs associated with regulating exports that would have to be incurred even in the face of large reductions. The extent to which control costs would diminish as a result of the decline in exports would largely depend on the reasons for the decline. If the reduction reflected a stricter control regime then control costs could actually rise. However, if the reduction reflected a decline in the market then the volume of licence applications should decline in proportion and so, eventually, should the control costs. Cost savings would therefore range from zero to £4.5m. As for the marginal costs to the other regulatory authorities (eg Health and Safety Executive, Environment Agency, etc), it is reasonable to assume that any reductions from a decline in defence exports would be offset by roughly similar increased costs of regulating the increase in activity that would, eventually, take the place of defence export production.

The Benefits to Government as a Customer

70. To estimate the net benefit which current levels of defence exports provide the Government as a customer it is necessary to try to measure the difference between the present cost to the UK MoD of procuring defence equipment, and the cost of procuring equipment, and related services, that would deliver the same defence capability (and involving the same cost to MoD of support and use) if the level of exports were reduced.

71. If a manufacturer produces additional units of production, it can purchase materials in greater bulk at discounted prices, realise greater labour efficiencies and spread fixed overhead costs over more units of production. Thus, the UK MoD can benefit from such economies of scale in the form of lower unit procurement costs where production for export takes place in parallel or prior to production for UK acquisition. Although production of most major UK platform acquisitions tends to precede production of export orders, the UK MoD could still accrue such scale economies in follow-on orders and in mid-life update programmes. Were a company’s
sole activity producing equipment or services of a purely military purpose, and thus their only potential customers were the UK MoD and foreign MoDs, it would be a simple accounting relationship that any contribution export sales made to fixed overhead costs would reduce the cost that would otherwise have to be met by the UK MoD for such companies to earn the same rate of profit.

72. Where companies are producing a mixture of military and non-military products, how any contribution to fixed overheads from military exports affects the prices of the companies’ other products will depend on their accounting practices and pricing strategies. Even where military and civilian production are carried out in separate business units, as is largely the case for example with the aerospace industry, there is scope for effective cross-subsidisation between the military and civilian business units and thus such companies might divert any contribution to overheads from defence exports to the civilian side of the business. To the extent that capacity constraints (in capital equipment or skilled personnel) limit levels of civil production, moreover, a reduction in production for defence export may not lead to an equivalent reduction in overall production.

73. Assessing the full impact of reducing defence exports upon the cost of MoD procurement is thus extremely difficult. Even a detailed auditing of all the accounts of the defence exporting companies would not provide a full answer, since this could not allow for the dynamic effects on production functions that would result from a permanent reduction in order levels. To provide the best approximation of the savings which defence export sales provide to the MoD procurement budget, therefore, we adopt a three-stage process. First, we estimate the short-term costs involved in paying for fixed overhead costs that are no longer covered by foregone defence exports. Second, we divide the cost of meeting these short-term costs between defence companies and the MoD. Third, we estimate the longer term costs to the MoD procurement budget, given reasonable assumptions on production functions, import substitution and equilibrium profit levels.

74. The MoD’s Specialist Procurement Services Agency regularly surveys over 400 defence companies to establish the proportion of the costs of defence export sales considered to comprise overheads and the proportion of overheads considered fixed. The latest survey (1998) reveals that the former is 26.3% and the latter 45.1%. The product of these two represents the share of fixed overhead costs in defence export sales (i.e. 11.9%). Applying this to the £2,570m\(^{29}\) of defence equipment export sales

\[^{29}\text{Total orders in 1999/00 amounted to £5,044m, Defence Statistics 2000, table 1.13. Of this £2,570m comprised orders for defence equipment (based on the list of contracts signed by industry each year and which make up the total of UK export orders). The following guidelines are used to calculate the value of defence equipment exports.}\]

**Inclusions**
- Only contracts valued at over £1m (to make the exercise manageable).
- Equipment with a purely military/defence use.
- Only equipment assembled in UK factories.

**Exclusions**
- Defence training including manuals and teaching equipment.
- Defence clothing, textiles and other materials.
- Defence construction and infrastructure equipment.
- Sales of surplus MoD equipment.
orders in 1999/00 (from DESO’s orders data), hence assuming that non-equipment exports contain no fixed overhead costs, gives a figure of £306m for the contribution that defence exports made to annual defence industry fixed overheads. Taking an average for the five years 1995/96 to 1999/00 gives a figure of about £325m. A reduction of 50% over two years in current levels of defence equipment exports would thus reduce the contribution of defence exports to defence industry fixed overheads by some £162m a year, about £81m in the first year and a further £81m in the second year.

75. Because of the prevalence of firm and fixed price contracts for MoD procurement of major equipment, we assume that the defence industry will have to finance 80% of this cost from its own profits in Year 1. Over time, however, this proportion will steadily fall as MoD contracts come up for renewal. There is evidence that the rates of return of the major defence companies are roughly equivalent to the average for all quoted companies. It can therefore be assumed that defence firms would exit the industry if forced to accept a permanently lower profit rate. We therefore assume that the proportion of additional overheads financed by the defence industry declines to zero over a period of five years. As new equipment contracts for the MoD come up for negotiation, these costs are progressively reflected in increased prices to the MoD.

76. In parallel with the progressive transfer of additional overhead costs to the MoD, however, the level of these costs will be reduced as defence firms reorganise their production processes to take into account permanently reduced levels of production. It will not be possible to recoup all these costs in this way, because of the long-term economies of scale involved in some defence production processes. Nevertheless, it is reasonable to assume, over time, that there will be some transformation of fixed into variable overheads as capital investment comes up for replacement. Here we assume that the level of excess fixed overheads, left over from lost defence exports, progressively falls to 50% of its previous level within five years. (see Table 8)

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30 The use of averages rather than individual years provides a more useful indication of the contribution of exports to defence industry overheads. A number of averages could be taken, we have used a five year average to be consistent with our approach to the estimate of the defence industry capital stock (see paragraph A14).

### Table 8 - Paying for fixed overheads previously financed by exports

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed Overheads £m</th>
<th>Fixed Overheads Financed by Industry £m</th>
<th>Fixed Overheads Financed by Government £m</th>
<th>NPV of cost to Industry £m</th>
<th>NPV of cost to Government £m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80.75</td>
<td>64.6 (80%)</td>
<td>16.15 (20%)</td>
<td>64.6</td>
<td>16.15</td>
</tr>
<tr>
<td>2</td>
<td>153.4</td>
<td>92.04 (60%)</td>
<td>61.36 (40%)</td>
<td>86.8</td>
<td>57.86</td>
</tr>
<tr>
<td>3</td>
<td>137.3</td>
<td>54.9 (40%)</td>
<td>82.365 (60%)</td>
<td>48.9</td>
<td>73.3</td>
</tr>
<tr>
<td>4</td>
<td>121.1</td>
<td>24.2 (20%)</td>
<td>96.9 (80%)</td>
<td>20.3</td>
<td>81.4</td>
</tr>
<tr>
<td>5</td>
<td>105.0</td>
<td>Nil</td>
<td>105 (100%)</td>
<td>Nil</td>
<td>83.1</td>
</tr>
<tr>
<td>6</td>
<td>88.8</td>
<td>Nil</td>
<td>88.8 (100%)</td>
<td>Nil</td>
<td>66.4</td>
</tr>
<tr>
<td>7</td>
<td>80.75</td>
<td>Nil</td>
<td>80.75 (100%)</td>
<td>Nil</td>
<td>56.9</td>
</tr>
<tr>
<td>8-10</td>
<td>80.75</td>
<td>Nil</td>
<td>80.75 (100%)</td>
<td>Nil</td>
<td>152.1</td>
</tr>
</tbody>
</table>

**Equivalent Annual Cost (EAC) £79.8m**

77. We have so far assumed that the reduction in defence exports will have no effect on the level of MoD equipment that is bought from UK defence firms (compared to what it would otherwise have been). If the MoD is obliged to meet some of the costs of fixed overheads previously financed by exports, however, it would be required to pay, by year 7, an additional £81m a year for that equipment: around 0.8% of its total 1999/00 equipment procurement budget of £10.16bn\(^32\). On the basis of orders data, about 80% of defence exports (where it is possible to specify a sector) are identified as air sector equipment.\(^33\) Exports of sea and land sector equipment combined constitute about 20% of overall exports, although they account for some

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\(^{32}\) *UK Defence Statistics 2001*, Table 1.5.

\(^{33}\) *UK Defence Statistics 2001*, Table 1.13.
60% of current MoD annual equipment procurement spending. Thus, in the absence of any import substitution, a 50% reduction in defence exports would eventually raise the unit costs of MoD land and sea systems by around 0.3% but raise the unit cost of air systems by around 1.6%.

78. Since any increase in the defence budget to accommodate the increased cost of equipment would involve reducing the amounts available for other government programmes, or raising additional revenues, it is likely that the MoD would have to accommodate these increased costs either by reducing the number of units of equipment procured or by making savings elsewhere (e.g., in operating or support costs) or by shifting, at the margin, from domestic producers to imports. The increasing internationalisation of defence production makes it easier for defence companies to do this than in the past, especially at the (more competitive) component and subcomponent level. It is hard to estimate in advance the extent of this shift towards imports. Although US defence equipment may offer significant cost advantages due to economies of scale and learning achieved by US defence companies, it is not always most appropriate to UK operational requirements. The loss of national and European industrial capability may reduce future competition and result in a significantly higher price for follow-on systems. In effect, the UK Government is paying for an option to ensure, or try to ensure, its continued ability competitively to procure defence equipment in future. Defence exports help offset the cost of this option. For example, the cost of producing the new Typhoon (Eurofighter) aircraft for the RAF would have been higher had it not been for the earlier Tornado export orders keeping BAE’s design and production facilities at Warton busy. Otherwise, the MoD could have made a direct payment to BAE to continue to maintain this facility or paid the reconstitution costs.

79. To the extent that MoD responds to the increased cost of domestically produced defence equipment by switching to imports or by scaling back the number of units required, there will be a further albeit marginal second round effect upon defence industry sales and profits and employment. These effects have not been included in the analysis covered by this paper.

80. While Martin acknowledged that the MoD benefits from defence exports through lower unit procurement costs, he also suggested that the pursuit of defence exports involved the Government incurring offsetting higher costs on the equipment it procures from UK defence companies. For example, he cites a study by Jackson into the EH101 which suggested that procuring the EH101 involved an additional cost of £300m, of which half (£150m) reflected export considerations. The EH101 procurement is, however, the only recent example that we have found where a procurement decision has clearly been influenced by export considerations. The case was exceptional and required the government to issue a directive to the MOD accounting officer that the decision was justified by the wider benefits involved. The MoD has stated that its decision-making processes are concerned solely with defence operational capability and cost effectiveness. There has been no similar case since and

34 Steve Martin, 1999, ibid.
it would thus not be appropriate to include an allowance for direct savings to MoD procurement costs from a reduction in defence exports.

**Overall Costs and Benefits to Government**

81. A reduction of 50% in defence export sales would enable the Government to make savings in the level of MoD support (about £11m), in the cost of licensing (of between zero and £4.5m), and in ECGD support. Although there is considerable uncertainty about the costs of the last of these, a reasonable estimate would suggest the cost could range from about £8m up to £48m a year. This would make the overall net saving on these items of between about £19m and £64m. But this saving would be substantially offset by reductions in CEL receipts and receipts from disposal of surplus MoD equipment, together worth around £30m a year. In addition, the reduced contribution from export sales to fixed overheads would push up the cost of defence equipment procured by MoD by around an average equivalent annual cost of around £80m a year. Thus the overall net impact upon Government would be a loss of between around £40m and £100m a year.

**Table 9 - Summary of Costs and Benefits to Government**

£M in 1999 prices

<table>
<thead>
<tr>
<th>BENEFITS FOREGONE</th>
<th>EFFECT OF 50% FALL IN EXPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to overhead costs</td>
<td>80</td>
</tr>
<tr>
<td>Commercial Exploitation Levy</td>
<td>18</td>
</tr>
<tr>
<td>Surplus sales</td>
<td>8.5-17.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COSTS AVOIDED</th>
<th>EFFECT OF 50% FALL IN EXPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECGD</td>
<td>8– 48</td>
</tr>
<tr>
<td>DESO and other MoD Support</td>
<td>11</td>
</tr>
<tr>
<td>Regulation</td>
<td>0 – 4.5</td>
</tr>
</tbody>
</table>

---

| LOST NET BENEFIT                    | 43 – 96.5                     |
CONCLUSION

82. This study has estimated that a 50% reduction in defence exports would result in a net financial loss to the Exchequer of between around £40m and £100m a year on a continuing basis. Such a reduction would also involve a one-off cost of adjustment, cumulatively estimated at between £0.9bn and £1.4bn. If possible terms of trade effects were also included, the estimated cumulative cost of economic adjustment would increase to between £2bn and £2.5bn. The bulk of this cost would fall in the first couple of years.

83. This estimated cost of economic adjustment is far from being unprecedented. The decline of coal mining, and indeed of the defence industry itself after the end of the Cold War, both involved much larger adjustment costs. At a local level the process can, however, be painful. The analysis here suggests that the bulk of the costs would fall upon the workers in the defence industry. Despite the difficulty of producing reliable employment estimates at regional level, and the fairly modest level of defence dependency they indicate, it is clear that defence export dependence at sub-regional level – and therefore the seriousness of adjustment problems - could be highly significant at locations with major defence export production.

84. In the short and medium term, a substantial reduction in defence exports would lead to a diversion of qualified scientists and engineers from the defence to other sectors of the economy. Over the longer term, a substantial reduction in defence exports might also lead to a reduction in the overall level of R&D activity within the economy, and perhaps indirectly on the demand for (and thus supply of) qualified scientists and engineers. It has not been possible to assess the significance of any such effects for the long term rate of growth of the economy.

85. An important final health warning about the results of this analysis must be noted. The average annual level for 1998-99 has been used as the baseline for calculating the economic impact of the assumed 50% reduction in defence exports. Yet estimated defence exports fell by more than 30% between 1998 and 1999, and provisional figures for 2000 suggest that exports were largely unchanged on 1999 levels. As a consequence, a large part of the reduction assumed in this study, along with a significant part of the associated adjustment costs, may already have taken place.

86. The significance of our results for the wider debate about defence exports is twofold. Firstly, they suggest that the economic costs of reducing defence exports are relatively small and largely one off. Secondly, as a consequence, they suggest that the balance of argument about defence exports should depend mainly on non-economic considerations.
APPENDIX: THE CALCULATION OF ADJUSTMENT COSTS

Adjustment cost to defence workforce

A1. Unemployment. In examining the additional transition costs, we have assumed that the 48,750 reduction in the number of jobs is distributed equally over a two year period, that is 24,375 in each year. On the basis of the study of redundant defence workers in the South West, 26% of workers can be expected to withdraw from the labour force (for example through early retirement), leaving 74% facing a period of unemployment. In the first year this latter number would be some 18,040 (0.74 x 24,375). The average length of unemployment likely to be experienced by all workers is calculated by drawing upon the length of unemployment experienced by redundant workers in South West England who had found work or were still unemployed at the time of the study.

Table A1: Length of unemployment experienced by redundant defence workers in SW England (1989-94)

<table>
<thead>
<tr>
<th>Duration of Unemployment</th>
<th>Estimated Average No of Months</th>
<th>Number of Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) who had found work (ie completed spells)</td>
<td>b) were still unemployed (ie uncompleted spells)</td>
</tr>
<tr>
<td>1 month</td>
<td>(0.5)</td>
<td>268</td>
</tr>
<tr>
<td>1-3 months</td>
<td>(2)</td>
<td>157</td>
</tr>
<tr>
<td>3-6 months</td>
<td>(4.5)</td>
<td>164</td>
</tr>
<tr>
<td>6-12 months</td>
<td>(9)</td>
<td>139</td>
</tr>
<tr>
<td>1-2 years</td>
<td>(18)</td>
<td>169</td>
</tr>
<tr>
<td>2-3 years</td>
<td>(30)</td>
<td>54</td>
</tr>
<tr>
<td>3-4 years</td>
<td>(42)</td>
<td>35</td>
</tr>
<tr>
<td>4-5 years</td>
<td>(54)</td>
<td>28</td>
</tr>
<tr>
<td>5 + years</td>
<td>(66)</td>
<td>19</td>
</tr>
<tr>
<td>unspecified</td>
<td>164</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: Hooper et al, op cit, 1996.

A2. The average duration of unemployment for those who had found work is straightforward to calculate by multiplying months of unemployment by number of individual completed spells divided by the total number of completed spells and summarising the total. For uncompleted spells, following the same approach as Martin’s paper it was assumed that those who were still unemployed were surveyed, on average, half way through their period of unemployment. Hence those unemployed for say three months were assumed to find work six months after leaving their defence job. Thus the average duration of unemployment for those still unemployed was calculated by multiplying double the months of unemployment by numbers of uncompleted spells divided by the total number of uncompleted spells. An overall weighted average is then obtained by adding the average length of completed spells multiplied by the number of completed spells and the average estimated length of uncompleted spells multiplied by the number of uncompleted spells, and then dividing by the total number of individual spells of unemployment. The overall average was
19.75 months. Taking account of improvements in labour market conditions by reducing this by a quarter gives an estimate of the average period of unemployment likely to be experienced by defence workers losing their jobs in the baseline period (1998-1999) of 14.8 months.

A3. The average length of time spent unemployed during the first year can be estimated in the same way but setting the number of months of unemployment at 12 months for all completed spells exceeding 12 months and all uncompleted spells exceeding 6 months. Thus the overall length of time spent unemployed during the first year equals \[(0.5 \times 268/1318) + (2 \times 157/1318) + (4.5 \times 164/1318) + (9 \times 139/1318) + (12 + 305/1318) + (1 \times 3/1318) + (4 \times 7/1318) + (9 \times 50/1318) + (12 \times 225/1318)\] = 7.04 months. Taking account of improvements in labour market conditions by reducing this by a quarter gives 5.28 months. It is possible that had they not been made redundant they would have remained in the same job or a similar job with another firm in the industry until their retirement. However, it is also possible that some other set of circumstances would have occurred soon afterwards leading to their redundancy or voluntary change of job.

A4. One way of estimating the likelihood that those who would be made redundant as a result of a loss of defence exports would have changed jobs or lost their jobs anyway is to look at the prospects for the defence industry. With little prospect of the UK’s arms procurement budget growing in real terms, employment in that part of the industry engaged in production for MoD faces the prospect of gross employment falling in line with growth in annual labour productivity. Although this could be accommodated by not recruiting and relying on natural wastage this would result in a progressively ageing workforce – hardly ideal for an industry that depends on innovation. Thus it is reasonable to assume that even if those who would be made redundant in the event of a fall in exports escape redundancy and all the associated costs, they would still face a continuing risk each year of being made redundant equal to the annual rate of labour productivity growth. In this case, the one-off risk of redundancy, and associated costs contrasts not with a zero risk of redundancy and zero adjustment costs but with a continuing annual risk and associated cost of between a fifth and a third of the one-off outcome of the scenario examined in this paper. The likelihood of eventually incurring similar adjustment costs is thus given by the cumulative probability of this alternative redundancy risk and the net present value of the associated costs by multiplying the cumulative probability by the discount factor in each year and taking the highest value of the product of these two. In the case of a 3% rate of productivity growth this is 50%, reached in the fifth year. In the case of a 5% rate of productivity growth this is 68%, also reached in the fifth year. Although this is a somewhat artificial representation of the possible alternative future outcomes for employment in the industry, it is far more realistic than assuming that the alternative outcome for employment would be one of continued stability. It suggests that the adjustment costs to workers from a one-off fall in exports would be costs which are largely postponed rather than avoided altogether.

A5. It is also necessary to take account of the release of capital and scarce categories of workers (e.g., managers, professional and technical occupations) on the pace of output and job creation elsewhere in the economy. Here one possible starting point is to look at the amount of capital released from the defence sector and use average economy wide capital: output and capital: labour ratios to estimate the
additional output and employment generated. Not all this capital would be taken up immediately. It is after all limited profitable opportunities for investment far more than any shortage of investment funds that constrains the level of new investment. Although the loss of defence exports that were previously profitable does not in itself create any additional alternative profitable opportunities for investment elsewhere, the release of scarce labour and land and the adjustment to domestic factor costs and to the exchange rate may be expected to do so. Some of the new jobs will be filled by workers made redundant from the defence sector, so to establish the net increase in new employment we need to subtract the number of re-engaged defence workers. Allowance for some of these new jobs being created anyway at some point also needs to be made.

A6. The main cost of unemployment to the worker is the loss of income as a result of unemployment.\textsuperscript{37} The survey of redundant workers in the South West suggests that 58% of those who eventually found alternative work the pay was lower, for 18% it was the same and for 24% it was higher. The average (gross) pay for those in alternative employment full time was around £15,000 per annum. Although the study did not ask about the level of their previous pay an estimate of this was derived by the researchers from the average for those who reported that their current pay was the same as in the previous defence employment.\textsuperscript{38} This figure was around £20,000 per annum. That is about £24,700 at 1999 prices.\textsuperscript{39} This figure is only slightly below average annual earnings in aerospace (£25,180) from the ONS New Earnings Survey (NES). Taking a mid point of £24,950, net income, after tax and national insurance contributions, taking tax and NICs at 25% of gross income would be about £18,700 (0.75 x £24,700). The loss of this income will, however, be offset by unemployment related benefits such as job seeker’s allowance and other benefits such as housing benefit which are income related. Assuming these benefits amount on average to about £7,200\textsuperscript{40}, equivalent to about 40% of net income (ie the ‘replacement rate’ is 40%), the average annual income loss would be £11,500, about £960 per month. On the basis of the average spell of unemployment for all workers, 15 months to the nearest month, the loss of income in the first year would be £11,500 and in the second year £2,875. Discounting the latter by 6% (to take account of social time preference—ie. for “jam today” compared to “jam tomorrow”) produces a discounted average loss due to the average spell of unemployment of about £14,200 (£11,500 + \(\frac{1}{4}\) x £11,500 x 0.943). Thus, the present value (PV) of the loss for all defence export workers losing their jobs in the first year would be about £256m (£14,200 x 18,040) The PV of the loss experienced by workers losing their jobs in the second year would be £242m (£264m x 0.943) giving a total loss of £497m. Reducing this to between 0.32 and 0.5 to allow for the possibility of unemployment happening anyway from other causes

\textsuperscript{37} There are other non-monetary costs, including adverse health effects, resulting from prolonged periods of unemployment.
\textsuperscript{38} Telephone conversation between Neil Davies and Nick Hooper.
\textsuperscript{39} The 1994 data have been uprated to 1999 prices on the basis of the increase in the average earnings index for manufacturing. The index (1995 = 100) was 95.8 in 1994 and 118.3 in 1999, an increase of 23.5%. Economic Trends Annual Supplement 2000 table 3.7.
\textsuperscript{40} The OECD estimate that for the UK the net replacement rate (based on government benefits) for a newly unemployed male aged 40 with a dependent spouse and 2 dependent children at 64% of the average production worker’s earnings in 1997. OECD Economic Surveys UK, June 2000, Table 12 p 99. In April 1999 the average gross pay of assembly and line workers was £ 15,046, net pay would be about £11,300. On this basis replacement payments would be about £7,200, which amounts to some 40% of the higher paid defence worker’s net income.
reduces this cost to between £159m and £248m. The net cost in the first year of the initial 25% decline in export sales (i.e. the “first year cost”) would thus be around £92m (5.3 x £960 x 24,375 x 0.74), allowing for about a 1 in 2 and a 2 in 3 chance of this loss happening anyway reduces this cost to between £29m and £46m.

A7. Withdrawal from the labour force. Some 26% of redundant workers in the survey had left the labour force, for example through early retirement. On this basis it can be assumed that some 6,340 (0.26 x 24,375) workers would leave the labour force in the first year of the reduction in defence exports. If it is further assumed that those withdrawing from the labour force do so on average five years before they would otherwise, and receive pensions and benefits similar to those who are unemployed equivalent to about 40% or £7,200 of their net income in employment (£18,700), the present value of their income loss (£11,500) for 5 years would be the present value of an annuity of £11,500 for 5 years with 6% discount rate, or about £51,350 (£11,500 x 4.4651). The PV of the total loss for all workers in the first year would be about £325m (£51,350 x 6,340). The PV of the loss experienced by workers losing their jobs in the second year would be £306m (£325m x 0.943) giving a total loss of £631m. Reducing this to between 32% and 50% for the risk of this happening anyway results in a cost between £202m and £316m. The first year cost of the initial 25% decline in export sales would be £73m (6,340 x £11,500). Reducing this by between one half and two thirds for the risk of this happening anyway, giving a risk adjusted cost of between £24m and £36m.

A8. Reduced income. The South-West England survey suggests that defence workers who were re-employed secured earnings of around £15,000, or £18,500 at 1999 prices. (24% were found to have secured jobs paying higher wages than they were earning before, no adjustment has been made for this as it may be assumed that these higher wages were offset by other (non-financial) dis-benefits. Otherwise, one would expect such individuals to have already moved jobs). However, £18,500 is considerably below average earnings. To allow for the possibility that the survey overstated the loss of earnings on re-employment, an alternative approach is to look at the effects of switching from average pay in aerospace (£25,180) to whole economy average earnings (£20,919). This results in a gross loss of pay of £4,261. The net loss of pay would be either £4,092 or £2,812 (0.66 x £6,200 or£4,261). If the workers would otherwise have remained in the same job until retirement then the present value of the net of tax loss would be £4,092 or £2,812 x 12.1581 = £49,750 or £34,190 (the present value of an annuity of £4,092 or £2,812 for 20 years using a 6% discount rate). However, the assumption that workers would otherwise have remained in the defence sector until retirement is, looking at likely future employment patterns, implausible. Furthermore, in future years these workers might move to better paid employment eliminating their income loss. It would be more realistic, therefore to apply a cut-off after 5 years. The present value of the net of tax loss would then be £4,092 or £2,812 x 4.4651 = £18,271 or £12,556. In either case the discounted loss corresponding to the actual period of unemployment of £4,092 per annum for 15 months = £5,057 or £3,475 (£4,092 or £2,812 + £4,092 or £2,812 x 1/4 x 0.943) should be deducted, as this period has already been accounted for in estimating the income loss from unemployment. The present value of the average loss from reduced income would therefore be between £9,081 to £13,214. The PV of the loss for workers leaving defence industry jobs in the first year would therefore be between £164m-£238m and £554m-£806m (18,040 x £9,081-£13,214. The PV of the loss for
workers leaving in the second year would be between £155m and £224m (£164m-£238m x 0.943) giving a total loss of between £319m-£462m. Reducing this by between ½ and 2/3 to allow for the possibility of this happening anyway reduces the cost to between £102m and £231m. The net of tax cost of the initial 25% decline in exports in the first year is between £28m and £41m (18,040 x (6.7/12 x £2,812 or £4,092) based on the average number of months of (lower paid) employment achieved in the first year. Reducing this by between two thirds and one half gives a risk adjusted cost of £9-£14m to £14m-£21m.

A9. If one allows for the costs that workers are likely to incur anyway as a result of redundancy due to other factors then the above costs will be reduced. The costs can be summarised as follows, applying the analysis outlined in para 34.

**Table A2 - Adjustment Costs to Defence Workers**

<table>
<thead>
<tr>
<th></th>
<th>Assume otherwise continuous secure employment</th>
<th>Assume 3% pa productivity and 3% pa redundancy risk</th>
<th>Assume 5% pa productivity and 5% pa redundancy risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment</td>
<td>£497m</td>
<td>£248m</td>
<td>£159m</td>
</tr>
<tr>
<td>Early withdrawal</td>
<td>£631m</td>
<td>£316m</td>
<td>£202m</td>
</tr>
<tr>
<td>Reduced income in</td>
<td>£319m-£462m</td>
<td>£159m-£231m</td>
<td>£102m-£148m</td>
</tr>
<tr>
<td>alternative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>£1,447m-£1,590m</td>
<td>£723m-795m</td>
<td>£463m-£509m</td>
</tr>
</tbody>
</table>

The best estimate probably lies in the range between around £463m and £795m.

**Adjustment Benefit to Non-Defence Workers**

A10. The release of capital and other resources from defence and consequential changes in prices and wages will help create new investment opportunities and in turn help facilitate the creation of new jobs. These will provide opportunities for re-employment for redundant defence workers and for others who would otherwise have been inactive or unemployed. The benefit to the redundant defence workers has already been taken into account. It is, however, necessary to try to estimate the benefit to others. This will depend on how many other jobs are created, how long they take to be created and what wages they pay. There is no available information on any of these.

A11. One possible approach to quantifying this benefit would be to examine how much capital is released from the defence sector and how many jobs this could support if each of the new jobs requires similar capital to the average across the economy as a whole. Across the economy as a whole consumption of fixed capital amounted to £103.313bn in 1999, supporting the employment of 27.8m employees and self-employed; an average of £3,716 per worker. In defence exports it is estimated
that around £720m of capital is consumed each year supporting the employment of 97,500: an average of £7,385 per employee. However some 45% of this is in fixed overheads, leaving just £198m of fixed capital available for alternative use as a result of a halving of defence exports. If, as has been assumed in relation to assessing the effects upon MoD procurement, it is assumed that 10% of fixed capital would become variable after a year and 50% after 5 years, then additional capital would be released.

A12. Table A3 shows how many jobs might be created over a five year period from re-use of the capital released from defence, allowing for lags between the release of the capital and creation of the new jobs. In this scenario, by the fifth year 67,400 new jobs have been created, some 38% more than the jobs lost in defence.

A13. If it is assumed that average pay for those other than defence workers gaining these new jobs is 85% of average earnings across the economy as a whole, £17,700, (this is a little below the amount the South West England study found for re-employed ex defence workers who had above average qualifications) then the eventual gains to the workers (before tax) would fully offset the losses to defence workers. This would mean that aggregate national income and its distribution as between labour and capital would be the same as before the loss of defence exports, though with a larger number of workers employed but at lower wages and lower level of capital per worker. In respect of capital, there will be a similar volume of capital and a similar rate of return to that which prevailed before. This outcome is in line with the predictions of economic theory, even if some of the individual assumptions underpinning the result are themselves somewhat arbitrary.

A14. Just as the loss of defence jobs is treated as bringing forward job losses that might have occurred anyway, so it is necessary to apply the same discount of between 50% and 68% to allow for the process of job creation from the release of resources from defence happening anyway. The same requirements of consistency mean that any effects beyond the fifth year are also discounted.

A15. Typically, about a third of additional jobs created in the economy are associated with a decline in unemployment and about two thirds with a reduction in inactivity or increase in labour market participation. Hence the benefits to other workers can be estimated by multiplying the number of new jobs filled by other workers by two thirds times the net increase in income from those otherwise inactive, (£17,700 x 0.75) plus one third times the net increase in income for those otherwise unemployed (£17,700 x 0.75 - £7,200). This gives an average gain of £10,875 per annum. The cumulative net present value is obtained by summing the results for each year multiplied by the appropriate discount rate. The result is a gross gain of £875m. Allowing for the chance of these gains happening anyway reduces this to between £280m and £437.5m. The benefit in the first year would be £35m, or between £12m and £17½m after allowing for the chance of these effects happening anyway.
<table>
<thead>
<tr>
<th>YEAR</th>
<th>VARIABLE CAPITAL RELEASED £m</th>
<th>FIXED CAPITAL RELEASED £m</th>
<th>NEW JOBS CREATED (GROSS NUMBER (000S))</th>
<th>NEW JOBS (GROSS ALLOWING FOR LAGS)</th>
<th>JOBS LOST IN DEFENCE (000S)</th>
<th>NET NEW JOBS (000S)</th>
<th>NEW JOBS TAKEN UP BY DEFENCE WORKERS (000S)</th>
<th>NEW JOBS FOR OTHERS (000S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99</td>
<td>Nil</td>
<td>26.6</td>
<td>21.5</td>
<td>24.375</td>
<td>(2.875)</td>
<td>18.04</td>
<td>3.46</td>
</tr>
<tr>
<td>2</td>
<td>198</td>
<td>8</td>
<td>55.5 (+29.9)</td>
<td>49.1</td>
<td>48.75</td>
<td>0.35</td>
<td>36.08</td>
<td>13.02</td>
</tr>
<tr>
<td>3</td>
<td>198</td>
<td>24</td>
<td>59.8 (+4.3)</td>
<td>58.1</td>
<td>48.75</td>
<td>9.35</td>
<td>36.08</td>
<td>22.02</td>
</tr>
<tr>
<td>4</td>
<td>198</td>
<td>40</td>
<td>64.1 (+4.3)</td>
<td>6.30</td>
<td>48.75</td>
<td>14.25</td>
<td>36.08</td>
<td>29.92</td>
</tr>
<tr>
<td>5</td>
<td>198</td>
<td>57</td>
<td>68.8 (+4.4)</td>
<td>67.4</td>
<td>48.75</td>
<td>18.65</td>
<td>36.08</td>
<td>31.32</td>
</tr>
</tbody>
</table>

**Adjustment costs to defence shareholders**

A16. There have been no studies of the impact of the decline in the defence industry upon shareholders, from which to draw in order to quantify the transition costs to shareholders that would follow any reduction in defence exports. These costs would encompass the short run cost of writing off fixed assets ahead of their expected life and a longer run cost if there were greater net profits from defence exports than available from alternative economic activity. On the basis of studies of defence industry profitability, this would not appear to be the case.\footnote{A study by Paul Dunne (‘The Changing Military Industrial Complex in the UK’, *Defence Economics*, 4, 2, 1993, pp. 91-112) found that for a sample of defence contractors, mean profits, in 1980 were higher than for manufacturing industry as a whole. However, the more competitive procurement policies introduced in 1985 were found to have reduced relative returns with a sharp decline in defence shares relative to the FT all share index. A similar study by Martin, White and Hartley (‘Defence and Firm Performance in the UK’, *Defence & Peace Economics*, 7, 1996, pp. 325-337) found no significant difference in rates of return between defence-dependent and non-defence-dependent firms over the period 1983-89. There was a study by Martin and Hartley (1997) which found higher rates of return in the “profit regulated” sectors of defence, pharmaceutical and utilities than in manufacturing as a whole but defence and pharmaceuticals showed less evidence of excess profits and no account was taken of potential differences in risk between the sectors. Finally, a review of the Government Profit Formula by Hartley et al (1999) found that the weighted average cost of capital for major defence related firms was little different from the UK stock market as a whole.} Although some individual export contracts may yield high rates of profit we have no information about the profitability of defence exports and are forced to rely on information related to the defence industry as a whole. An approximate estimate of the cost of writing off fixed assets can be made by assuming that the defence industry would expect to recover their investment in overhead costs over a five year period. Work by MoD’s Specialist Procurement Service indicates that 26.3% of the costs of defence equipment export sales are considered to comprise overheads (see paragraph 74). This suggests that the value of the capital stock associated with defence exports should be around £3.6bn (0.263 x £2.74bn x 5, where £2.74bn is average defence equipment exports over the five years 1995/96 to 1999/00). Around £0.72bn would be amortised each year. A reduction in export sales of 25% would instead mean writing off 25% of the capital stock, ie £900m. The cost of writing part of this off early as a result of the first
year reduction would thus be around £180m, and as a result of the second year £170m (0.943 x £180m), giving a total of £350m or £210m net of tax. The cost to UK resident shareholders is thus £262.5m before tax, or £157.5m net of tax.

A17. As with the cost of adjustment to workers, it is probably unrealistic to assume that in the absence of a fall in export sales, there would otherwise be no risk of having to write off capital early. A more plausible alternative would be to assume that there is otherwise a risk each year of having to write off capital early. If there is a one in five chance each year that any item of plant and equipment will anyway need to be written off due to unexpected changed market conditions, then the net present value of the cumulative risk would be some 50% of the cost estimated above. Thus the net additional cost of write-offs associated with the loss of defence exports would be only around £175m, or £105m net of tax, for UK resident shareholders the cost would be around £131m, or £79m net of tax. The first-year costs of a reduction in export sales of a quarter allowing for a one in five chance of write-offs happening anyway would be £144m gross or £86.5m net. For UK resident shareholders the cost would be £108m gross or £65m net.

A18. In addition, shareholders would bear part of the lost contribution from exports to covering fixed overheads. As mentioned in paragraph 74 it is estimated that export sales contributed an average of about £325m a year to fixed overheads of MoD procurement equipment. Assuming that initially only 20% of the loss of this contribution is passed through to MoD with 80% falling on industry, rising to 100% passed through to MoD in the fifth year, and assuming that after one year 10% of the fixed cost can be made variable, rising to 50% after five years then the NPV of this cost to shareholders is estimated at £221m before tax, or some £133m after tax (see Table 8). The total cost to shareholders the cost would be £297m gross, or £178m net. The first year cost would be £208m gross and £125m net. For UK resident shareholders the cost would be £156m gross and £94m net.

Exchequer Losses

A19. The losses to the Exchequer cover the costs of unemployment and other benefits and loss of revenue from those defence workers made redundant, net of the costs that would have been incurred as a result of those workers losing their jobs at a later stage, less savings in benefits and increased revenues from the additional jobs created elsewhere for non-defence workers. These are estimated to be as follows:

a. Unemployment. Unemployment is associated with a number of expenditure costs (including providing and administering unemployment benefits), and lost revenue items (forgone employee taxes, lost employers’ NICs and forgone indirect taxes). These Exchequer costs are estimated by adding to lost employee tax and NI payments, about £6,238 at 1999 prices, replacement benefits at £7,200 and lost indirect taxes, the latter estimated at £1,150 (10% of the reduction in net disposable income). The total annual loss per unemployed person is estimated at about £14,600. On the basis of this number and the average period of unemployment as estimated above, the PV of the total Exchequer costs in relation to those becoming unemployed in the first year would be between about £104m and £163m (£14,600 + (£14,600 x
1/4 x 0.943) x 18,040 x (0.32 to 0.5)). The PV of the loss in relation to workers becoming unemployed in the second year would be between £98m and £153m (£104m to £163m x 0.943), giving a total loss of £202m to £316m. This is offset by savings associated with the new jobs created for those who might otherwise have remained unemployed. This comprises the saving in benefits (£7,200) plus direct tax and NI payments (£4,425) plus indirect taxes (£608). Totalling, after allowance for the possibility of this occurring anyway, £105m to £164m. The net cost of unemployment is thus between £97m and £152m. The first year cost would be around £116m (5.28 x £1,216 x 18,040), less savings from new jobs (1/3 x £12,233 x 3,460 x 0.943) = £13m, giving a total net cost of around £103m. Allowing for the probability of job changes happening anyway reduces this to between £33m and £51m.

b. Withdrawal from labour force. Withdrawal from the labour force also has financial implications for the Exchequer. The cost of each person leaving the labour force is assumed to be about £9,733, two thirds of the cost of someone who is unemployed (0.67 x £14,019). This loss is composed of lost employee tax and NI payments (£6,238), and lost indirect taxes estimated at £1,150 or 10% of the reduction in net disposable income. The balance is assumed to be accounted for by other benefits such as housing benefit. On the basis of the numbers estimated above, the PV of total Exchequer costs of withdrawal from the labour force in the first year would be some £86m to £138m (£9,733 x 4.4651 x 6,340 x (0.32 to 0.5)), and in the second year £81 to £130m (£86m to £138m x 0.943), giving a total loss of £171m to £268m. This is offset by gains from those drawn into the labour force to fill the new jobs. This comprises the direct tax and NI payments (£4,425) plus indirect tax (£1,328, or 10% of the new net of tax income, assuming no other declared taxable income) multiplied by the sum of two thirds the number of new jobs multiplied by the appropriate discount rate. This would be £308m or £98m to £150m in total, allowing for the probability of the new jobs being created anyway. The net cost is thus between £73m and £114m. The first year cost would be around £62m (£9,733 x 6,340), less gains from new jobs £13m (2/3 x 3,460 x 0.943 x £5,753) giving a net cost of about £49m. Allowing for the probability of job changes happening anyway reduces this to between £16m and £24.5m.

c. Reduced income of workers. The move of redundant defence workers to lower-paying jobs would also have an impact on the Exchequer. If the loss of every £3,000 in gross income is assumed to cost the Exchequer £1,000, then on the basis of the typical income loss estimated above (£4,261-£6,200), the loss to the Exchequer would be £1,420-£2,067. Taking into account the losses accounted for during their period of unemployment, the PV of Exchequer costs in relation to the reduced income of workers losing their jobs in the first year would be between £26m and £60m [(£1,420 to £2,067 x 4.4651) less (£1,420 to £2,067) + (£1,420 to £2,067) x 1/4 x 0.943 x 18,040 x (0.32 to 0.5)]. The loss in relation to workers losing their jobs in the second year would be between £25m to £57m (£26m to £60m x 0.943), giving a total loss of between £51 to £117m. The first year cost would be between £14m and £21m (£1,420 to £2,067/12 x 18,040 x (6.7). Allowing for the probability of job
changes happening anyway reduces this to between £5m to £7m and £7m to £11m.

d. Loss of tax receipts from shareholders. The writing-off of capital would result in a loss of corporation tax and capital gains and other tax receipts of around £140m. Allowing for the probability of write-offs anyway reduces this to £70m. The loss of corporation tax resulting from the reduction in profit caused by loss of contribution from exports to overheads amounts to around £88m, bringing the total loss to £158m. The first year cost after allowing for the likelihood of write-off any way is £57.5m, adding the £25.5m associated with overheads, bringing the total to £83m.

**Estimation of Induced Multiplier Effects**

A20. The reduction in income to workers and shareholders resulting from a reduction in defence exports would mean that both are forced to spend less, both on domestically produced goods and services and on imports, though this is partly offset by increased spending associated with the new jobs created elsewhere. The reduction in domestic spending will in turn mean reduced income for workers and shareholders in the rest of the economy. These induced or multiplier effects may be expressed in terms of either income or employment multipliers. Estimates of UK income multipliers vary from around 1 up to around 2.5 reflecting differing assumptions about the structure and dynamic operation of the UK economy. For the purpose of this analysis a multiplier of 1.585 for workers’ net of tax income based on a marginal propensity to consume of 0.9 and an import propensity of 0.35 is used, giving a second round multiplier of 0.585. For shareholders, to take account of their greater concentration amongst higher income groups who tend to have a greater marginal propensity both to save and to spend on imports rather than domestic goods and services, a lower multiplier of 1.5 is used, 0.5 for the second round effects.

A21. To estimate the multiplier effects these second round multipliers are applied to the net cost to workers and shareholders. The net cost to workers is the overall reduction in net of tax incomes to defence workers less the increase in net of tax income to workers elsewhere as a result of new jobs being created. In the first year as a result of a 25% fall in exports this is between £50m and £85.5m, giving an additional multiplier effect of between £29m and £50m. The overall net present value of the cumulative loss to workers lies between £183m and £357.5m. The long run multiplier effect from workers’ net losses is thus between £107m and £209m. The estimated multiplier effect from losses to shareholders is £47m in the first year. The long run multiplier effect is £89m.

**Terms of Trade Effect**

A22. As mentioned at para 27, one of the mechanisms of adjustment to a loss of exports is through a depreciation of the exchange rate. This would increase the cost of imported materials, goods and services and reduce the value of existing export earnings. This “terms of trade” effect is part of the costs of adjustment. To quantify the possible scale of this effect it is assumed that the actual exchange rate response to the net export loss resulting from the reduction in defence exports would immediately reflect the required movement in the equilibrium exchange rate – i.e. the exchange rate
at which the economy can continue to grow without an unsustainable current account imbalance. There are two major problems with this. Firstly, estimating the equilibrium exchange rate and import and export elasticities is subject to considerable uncertainty. Secondly, actual movements in exchange rates over the short and medium term frequently diverge considerably from the equilibrium. This makes the estimate of this particular cost both uncertain in its scale and somewhat hypothetical in its nature. It is predicated on all other things remaining equal.

A23. The HM Treasury’s estimate of the reduction in the real exchange rate necessary to achieve a 1% rise in UK exports is –1.0%. Other estimates range between –0.5% and –1.3%; (eg the Bank of England model has a coefficient of just under –0.9%). Estimates of the responsiveness of imports to changes in the real exchange rate tend to be significantly smaller, ie a larger reduction in the real exchange rate is necessary to achieve a 1.0% reduction in UK imports. Hence estimates of the reduction in the equilibrium exchange rate necessary to achieve a 1% increase in GDP to compensate for a reduction in net exports amounting to 1% of GDP are around 2.5%. Allowing for defence exports having an average import content of around 40%, a 25% reduction in export sales results in a reduction in net exports of £915m. This is just over 0.1% of the UK’s GDP (£891bn in 1999).42 The real equilibrium exchange rate depreciation necessary to offset this would thus be 0.25%. This would increase the real sterling cost of the pre-existing level of imports of goods and services by £600m and reduce the real foreign exchange value of the pre-existing level of exports of goods and services by £570m – an overall cost of £1.17bn. As the economy adjusts this cost diminishes. With almost half of those workers who lose their jobs back in employment within 6 months it would be reasonable to assume that half of the net export loss is made up in 6 months. It is thus assumed, consistent with past observations of the “J curve effect”, that half of this term of trade effect is offset (by volume and price adjustments) after 6 months, half of the remainder 12 months later and the rest after a further 6 months. The overall net present value of the terms of trade effect of a 25% reduction in defence exports would thus be £1.17bn x [0.375 + 0.125 x 0.943] = £1.11bn x 0.493 = £0.58bn. The net present value of two successive 25% reductions would thus be around £1.1bn (£0.58bn x 1.943). The first year cost of a 25% reduction in defence exports would be £1.17bn x 0.375 = £440m.