PREPARATORY COMMITTEE FOR THE
INTERNATIONAL CONFERENCE ON
THE RELATIONSHIP BETWEEN
DISARMAMENT AND DEVELOPMENT
New York, 2-13 June 1986

CROSS-SECTORAL ANALYSES OF MILITARY EXPENDITURES AND CAPITAL
FORMATION, PRODUCTIVITY, ECONOMIC GROWTH AND COMPETITIVENESS

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INTRODUCTION

1. In its resolution 40/155 of 16 December 1975, the General Assembly approved the report of the Preparatory Committee for the International Conference on the Relationship between Disarmament and Development. 1/ Paragraphs 19 and 20 of that report requested the Secretary-General of the Conference, inter alia, to update existing materials, to prepare background papers and bibliographies and to compile information and an analysis relevant to the work of the Conference, including succinct papers on the three substantive items on the agenda. Those have already been published as information papers A/CONF.130/PC/INF/3 to 8.

2. In addition, paragraph 20 of the report stated that "the preparation of a number of other new documents and papers, on a strictly selective basis, might be necessary. In this connection, the Secretary-General of the Conference should make full use of the United Nations system and also be free to consult acknowledged expertise in the field". It should also be noted that a statement by the Secretary-General of the United Nations, contained in document A/C.5/40/52, "anticipated that approximately five research papers would be required".

3. In keeping with the above, the Secretary-General of the Conference, in consultation with the members of the Bureau, invited Mrs. Saadet Deger of Birkbeck College, University of London, England, to prepare in her personal capacity, a contribution on cross-sectoral analyses of military expenditures and capital formation, productivity, economic growth and competitiveness. The paper is reproduced in the annex to the present document. The views expressed in the paper are solely those of the Author.

Notes

Annex

CROSS-SECTORAL ANALYSES OF MILITARY EXPENDITURES AND CAPITAL FORMATION, PRODUCTIVITY, ECONOMIC GROWTH AND COMPETITIVENESS

By Mrs. Saadet Deger of Birkbeck College, University of London, England

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I. BASIC CONCEPTS

1. The massive increase of militarization, defence expenditure and arms trade over the last decades has prompted detailed research into the causes and effects of military spending. This is particularly important for developing countries where reallocation of productive investment funds and scarce foreign exchange into security expenditures may have unfavourable effects on growth and development. The impact of defence on development, however, is not clear-cut. If there were uniformly negative effects across countries and over time, the task of the analyst would be simpler, though that of the policy maker in pursuit of disarmament would still be relatively complicated. Persuasive and formal evidence exists that defence spending may indeed have positive growth effects in developing countries, particularly in the short and medium term. Thus arises the need for detailed analytical research into both the negative and positive impact of military spending and an evaluation of the resultant total and aggregate effect.

2. It is self-evident that economic growth and broader concepts of socio-economic development are not necessarily synonymous. Growth is a means towards the end, that of development in the widest sense of the term. Development encompasses an enhancement of the quality of life, an increase in the entitlement of individuals and an expansion of the capabilities to better oneself. It is not certain that economic growth per se is sufficient to ensure that type of development. However, a great deal of attention has been paid, in general, to economic growth in less developed countries (LDCs) both by planners and policy makers as well as theorists.

3. The methodology for specifying the economic impact of military expenditure (MILEX) with special reference to growth in LDCs, is complicated. There are two basic approaches. Descriptive studies give a detailed view of the developmental process and discuss the effect of defence on growth. The final picture given thereby is comprehensive but may be imprecise since there cannot be any quantification by the very nature of the analysis. Statistical and econometric analyses, on the other hand, are more precise and specific. Depending on the data base, one can get quantitative estimates of the effect of MILEX on growth. It is also possible to do a formal, counter-factual analysis such as investigating the effects on the rate of growth of alternative disarmament scenarios - for example, a unit percentage reduction in the military or defence burden (defence expenditure as a proportion of gross domestic product (GDP)). This approach is model specific; thus the underlying structure must be carefully specified and handled. It is not true that statistical models reveal what the "data speaks" and is thus more scientific; nor is it a narrow representation of reality unable to handle the broad spectrum of factors involved in the defence growth relation. The truth lies in between; data-based formal econometric methods help to discriminate between alternate hypotheses based on the prior model, which needs to be stated explicitly initially. This statement is itself dependent on a descriptive study of the growth process. This paper uses a combination of the two methods.

4. There has also been a lot of discussion and some controversy as to whether one should use case studies of specific countries or look at cross-sectional (country) evidence to find the impact of MILEX on growth. The question is fundamental. Are economies developmentally unique or are there enough similarities to warrant the
study of the "representative" less developed country? Again there need not be any conflict between the two views; an initial cross-country study, using a wide sample but discriminating between them by using appropriate statistical methods or dividing them into subgroups, can be supplemented with detailed analysis of individual countries if necessary. The former identifies major common variables; the latter emphasizes the specificity of history. This paper analyses cross-sectional factors and gives a general perspective as a foundation on which more detailed individual cases of specific countries can be constructed.

5. The effect of defence spending on the growth of the economy can sometimes be positive or negative, depending on consideration of short-term or long-term impacts. For example, in an economy with excess capacity, owing to deficient demand, military spending can have a multiplier effect by generating effective demand in the short-run; but in the longer term, by crowding out productive investment, growth may suffer considerably. Econometric models which utilize time series data tend to emphasize short-run effects since only the (relatively) recent past can be considered. Models based on cross-sectional data for a large variety of countries at widely differing stages of development will therefore tend to produce parameters which show more long-term impact. If the two data sources can be combined, one tends to get an overall view; this will be the statistical foundation of this paper.

6. The major objective of the present analysis is to investigate the economic effects of MILEX in LDCs with special reference to growth and related factors such as productivity and competitiveness. To eliminate the problem of reverse causation, it is assumed throughout that defence spending is relatively autonomously determined, by strategic variables involving security and threat, independent of economic factors such as growth or the level of income. There are basically three reasons why this should be so. First, the theoretical interactive models of arms expenditures tend to emphasize action-reaction mechanisms whereby MILEX or defence burden in one country is intricately connected with MILEX (burden) in the adversary's country. Such models are relevant for those LDCs which are involved in adversarial relationships. Econometric tests for such cases also demonstrate that defence spending is explained well by external strategic factors. Second, country studies show that high growth rates do not necessarily increase military spending relative to national income or resources; rather, it is perceived or real threats that provide the main proximate factor. Finally, empirical estimates trying to explain military burden by growth of total or per capita income usually do not give statistically significant coefficients. Overall therefore, given that military spending is relatively autonomous of economic factors, it is valid to investigate the causal effect of changes of defence expenditure on economic growth and related variables.

7. As mentioned earlier, to analyse the effects of military burden on growth it is imperative to construct a proper theoretical framework within which the role of militarization can be defined. The existing literature identifies a number of channels through which these effects work; these are defined in terms of capital formation, the role of the foreign sector, modernization and structural change and aggregate demand effects, as well as technological spin-offs and trade-offs. Such an approach is relatively ad hoc; evidence without theory is counter-productive;
comparison of alternative results becomes meaningless; thus there is no substitute for a well-specified analytical foundation to provide a unifying framework within which the conclusions can be nested. Section II of the present paper offers such a model in terms of capital planning in LDCs and then works out the implications for defence spending. A close economy is first dealt with. Section III explicitly introduces the open economy and the influence of the overseas sector. Section IV gives the econometric results which encapsulate the predictions of the theory. Section V analyses some interesting non-linearities in the direct channels by which military burden affects growth, and section VI offers some concluding remarks.

8. The paper stresses that the defence-growth relationship is complex and characterized by extensive interdependence, feedbacks, simultaneity, etc., between the major variables, such as capital formation, productivity, trade balance, external competitiveness, growth and military spending.

II. CAPITAL PLANNING, DEMAND, GROWTH AND DEFENCE

9. Based on a single but major statistical cross-sectional study, it was thought for a long period that MILEX had a net positive effect on economic growth in LDCs. By using more sophisticated models, recent analysis has come full circle in showing that the impact of MILEX is indeed negative, particularly in the long run, though in the short run there may be some important beneficial effects.

10. Capital planning for growth in labour surplus developing economies emphasizes three problems: optimum saving to generate the total amount of investible resources; allocation of that total to alternative investment programmes; and proper choice of techniques appropriate to an economy where unskilled labour is in excess supply but capital and skills may be scarce. The fundamental objectives are capital formation, growth and absorption of the labour force into productive employment. It is implicitly assumed that supply constraints are binding; given technology, the greater the supply of resources, the higher the growth rate.

11. Recent years have shown an awareness that demand constraints may be a problem in LDCs, albeit with a tropical twist. The leading sectors of the economy, particularly in manufacturing industry, often suffer from excess capacity, high incremental capital output ratio, bankruptcies or massive state subsidies and general under-utilization of installed capital with consequent low employment potential. The structuralists identify low manufacturing demand to the neglect of agriculture and thus to intersectoral disequilibrium. The creation of demand through the growth of agricultural incomes is therefore expected to raise the growth of the national economy.

12. A comprehensive view of the growth process must therefore take into account both domestic supply and demand factors (the foreign sector is implicit here and will be treated in some detail in paras. 22 to 39 below). It is undeniable that the former constraint is generally of major importance in developing economies; but with the growing sophistication of structure and a rise in incomes, analysis of (aggregate) demand is relevant.
13. How does the military fit into this picture? From the supply side there is close correspondence with the three planning problems mentioned above and the various channels through which defence spending affects the economy. These can be grouped into the following three categories: (a) the mobilization effect, whereby MILEX decreases or raises the total supply of savings (resources); (b) the allocation of effect through which defence expenditure reallocates all forms of resources, including those which contribute to absorptive capacity, away from productive investment sectors; and (c) the spin-off effect where MILEX, through the provision of modernization, research and development (R and D), arms industrialization and so forth, create the conditions necessary for growth, or alternatively, through inappropriate social and technological change, reduce the opportunities available for growth. Similar considerations also apply to the open economy discussed later. One can easily see that saving, investment allocation and choice of techniques relate closely to the three defence channels of mobilization, allocation and spin-off.

14. Domestic resources crucially depend on the savings generated by the economy. The two major sources are the public (government) and private sectors. Both can be affected by defence expenditure. If additional MILEX is financed by taxation, the government budget deficit remains unchanged; so also do public savings. However, it is possible that household savings will decline once disposable income has gone down. A more plausible scenario is that defence spending is financed, at least partly, by bond supply or money creation. The former is difficult in an economy with underdeveloped financial institutions. The latter creates inflation which again has implications for savings. In any case, an increase in budget deficits will imply a diminution in state savings.

15. Private savings may rise consequent to an increase in security provided by defence spending. The time preference for the future will increase, thus raising the propensity for saving. On the other hand, if defence contributes to greater internal or external tension, the opposite may occur. A more complicated mechanism would operate via the "social wage". National security being a major public good with no corresponding private sector expenditure, LDC Governments find it obligatory to spend on it in preference to other items of state expenditures such as health, education or infrastructures. Thus, MILEX increases are often at the expense of those items which constitute the social wage. Reduction of governmental provision, e.g., for education or health, will imply a corresponding rise in private sector consumption which will have adverse consequences for the propensity for domestic savings.

16. It is difficult to foretell a priori what the effect of inflation, emanating from increased MILEX, will be. There may be "forced savings"; on the other hand it is possible that inflationary expectations will generate extra current and conspicuous consumption and a corresponding fall in the share of savings in total national income. Empirical evidence shows that the effect of MILEX operating through these channels, particularly via inflation, is overall negative. There are some arguments in favour of MILEX mobilizing more resources (e.g., through inflation, taxation, moral pressures, etc.); but in general it is expected to depress the savings-income ratio.

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17. The direct effect of reallocating investible funds from productive purposes is the standard argument regarding the opportunity cost of defence spending. This is the simplest guns and butter concept. But even here there are more complicated twists. The productivity, quality and even the prospective quantity of investment in LDCs are determined by the absorptive capacity of the economy. This is a major constraint, almost equal in importance to domestic savings and foreign resources. In effect, even if sufficient funds are available, the amount of investment is often limited by the economy's ability to absorb capital. Factors such as the supply of skilled labour, entrepreneurship, the administrative framework, the social environment, etc., are crucial in setting the upper boundary to productive investment, independent of the amount of savings and the available technology. It is possible that two countries with the same rate of capital accumulation (savings) may have widely different levels of growth owing to a difference in their potential for utilizing investment, based on absorptive capacity or, more narrowly, human capital formation.

18. It is interesting to note that the defence sector can have both positive and negative effects on the absorptive capacity of the economy and hence on the productivity of investment. Through the creation of infrastructure, organizational change, imposition of discipline, instillation of a work ethic, modernization of attitudes, instituting a national ethos and various other such channels, militarization in general and MILEX in particular may increase absorptive capacity. But of course, an equally plausible and persuasive case can be built on the harmful, repressive and divisive effects of defence spending on absorptive capacity. Skills are a major input in the modern army and there will be a net loss from the civilian economy. The final effect is thought to be negative.

19. Finally comes the spin-off argument. One part of this reasoning, emphasizing the "modernizing" role of the military, often stressed by Benoit (1978) as a major contribution to growth, has just been mentioned. The other spin-off (which can be positive but also negative occasionally) is technological. This is particularly important for newly industrializing countries (NICs) which have chosen the domestic production of armaments and hope to benefit from the formation of new skills, R and D, technological progress and so forth. It has been correctly asserted that the effective search for new knowledge and for its exploitation in the production of goods for peaceful uses, also served war production in good part because of the technological affinity between the two. Reciprocally, some of the search for new knowledge and for its exploitation specifically for war purposes has been of use for non-military production. But the fundamental question remains regarding the strength of the spin-off. Given the ultra-sophistication of defence technology and the secrecy surrounding its use, the quantifiable effect could be relatively small for LDCs, since arms manufacturers have major links with the foreign sector (import substitution and exports).

20. The demand factors in the growth process need to be considered, first in the context of the closed economy. Armaments production itself can have aggregate demand effects on major industries; these backward linkages will help to reduce excess capacity and help in the fuller utilization of the existing capital stock; in turn, this may increase employment; the rate of profit will certainly go up with greater utilization of installed capital; thus growth will rise. The industries /...
likely to benefit the most from arms are iron and steel, non-ferrous metals, metal products, machinery, shipbuilding and motor vehicles. Significantly, these are also the industries in which LDCs face substantial excess capacity. However, an initial empirical study did not reveal that major output augmented demand; thus, in practice, arms expenditure and production may not be very important, either because of the small size of the defence sector or because of its specialized nature with few linkages in practice.

21. A major source of demand creation in LDCs is the agricultural sector which is potentially vast; a rise in rural incomes, through productivity, growth and investment in the agrarian sector of the economy, is therefore a very effective way of curing the problem of excess capacity and stagflation in developing countries. Unfortunately, the main burden of agricultural investment has to be borne by the government since the population in rural societies is either too poor or is too oriented towards short-run profits and consumption to invest heavily in technical progress to augment output. A pernicious effect of defence spending, potentially of far-reaching consequence, is when it crowds out governmental spending and investment in agriculture. The effects are not easy to test empirically but their heuristic and theoretical significance remain.

III. OPEN ECONOMY AND INTERNATIONAL DIMENSIONS

22. The total value and volume of arms transacted in international markets increased considerably in the 1970s, most of it being directed towards the developing countries. Data from the Stockholm Institute for Peace Research (SIPRI) reveal that major weapons imports by LDCs increased almost fourfold in the present decade. Coupled with this increase was the relative decline in military aid and the corresponding increase in commercial transactions financed by direct sales (from export earnings) and credits. A considerable proportion of the increase was due to the oil revenues earned by the Organization of Petroleum Exporting Countries (OPEC), but a substantial part of the trade was done by non-oil producing countries. The major Powers lost their duopolistic hegemony over the market; smaller developed economies captured larger shares; even some LDCs themselves made their presence felt. The twin features - a jump in the volume of transactions and a significantly larger share of cash and credit sales with less emphasis on aid - contribute in large measure to the burden of imported militarization.

23. For small open economies in the developing world the import content of MILEX is of major importance for it affects the domestic economy in many ways; there are the usual opportunity costs, such as loss of scarce foreign exchange. Further, defence imports crowd out possible imported intermediate investment goods, often essential for growth; the deficit in the trade balance has to be compensated by export promotion or rising indebtedness, the alternative being a declining competitiveness.

24. In terms of the capital planning model for an open economy, the three major issues are: the total amount of foreign resources available (needed); the allocation of investment in terms of import substituting or export promoting industrialization; and finally the use of international and/or appropriate
technology. The last two issues are best discussed in the context of arms production. The aggregate (foreign) resource used will first be analysed.

25. If arms imports are financed by foreign aid, clearly the direct costs are minimized, although opportunity costs are still relevant. Defence aid is not very fungible in the sense that it cannot be used for other purposes easily. It is generally tied up quite strictly, thus spin-offs are low. Since foreign exchange tends to be one of the scarcest resources in LDCs, however, and if Governments have to spend on imported armaments for non-economic reasons, military aid and grants can be of immense benefit. Concessionary or free transfer of defence equipment declined considerably in the 1970s and this phenomenon seems to be long-lasting.

26. When arms have to be paid, either from foreign exchange reserves or through debt financing, the costs are considerable. The foreign exchange gap widens and even if domestic savings are adequate, specific imports of intermediate investment goods, so vital for the national economy, have to be curtailed. These have major indirect effects on growth. Some analysts show that if all military imports had been eliminated for a sample of 50 LDCs during the period 1965 to 1973 the growth rate would have risen by about 0.76 per cent. Essentially, the foregone imported investment inputs in the growth process reflect the most important opportunity cost of defence in an open economy.

27. Defence spending in general and imported weaponry in particular have many implications for the trade and payment balance. MILEX affects overall balances as well as those specifically related to military flows. Defence spending increases aggregate demand. If the domestic supply is relatively inelastic, to accommodate this increased demand, exports might have to be diverted for internal use and/or imports stepped up. If aggregate demand causes a "multiplier" expansion in national income, this again will increase imports. In both cases the balance of trade will become adverse.

28. Specific trade patterns attributed to the military are more important. It is necessary to distinguish between trade in visibles (goods, armaments) and invisibles (services, spending by foreign military personnel, financial aid for defence). With few exceptions, LDCs usually have to import the more sophisticated of their armament needs and have low arms production and exports. Thus, the visible account will always show a deficit. For invisibles the situation is not clear. If military aid is high or the net borrowing (current funds borrowed minus interest payments) on the defence account is positive, the invisibles will show a surplus. This seems to be the general pattern for LDCs: a deficit in the visible account and a surplus in the invisibles.

29. A deficit in the trade balance can be looked upon from a different perspective as an addition to a nation's resources. This will be temporary though, since the borrowing needed to finance the deficit has to be paid back in the future. However, this concept implies that the resources are used to build up productive assets which in future will give a return sufficient to pay back the debt. Defence related deficits are economically "unproductive" in the sense that they do not lead to an accumulation of assets. On the other hand, by adding to "security", they do have an indirect productivity, at least in protecting other more productive assets.
30. Two basic points need to be made. First, diversion of scarce foreign exchange to the military has a direct opportunity cost in terms of investment imports foregone. This is the direct foreign sector counterpart of the allocation cost discussed in paragraphs 9 to 21 above. Second, MILLEX in open economies leads to higher imports and consequential deficits in trade and payment balances. There is thus a need to consider how this deficit will be paid for.

31. Financing the deficit in the absence of full compensation by foreign aid increases foreign debt; and its servicing (interest payments, etc.) requires a consideration of the military related debt burden. To analyse the debt burden, one needs relatively precise data on military sales to LDCs financed by credit and concessional grants. Such data is almost impossible to find, however, and one has to rely on estimates some of which may have been built on rather fragile assumptions. A recent paper by Brzoska (1983) tries to tackle squarely the foreign debt problem emanating from military imports during the 1970s. The opportunity cost of debt is estimated to be about 20 to 30 per cent. This implies that in the absence of all arms imports, the debt inflow would be approximately 20 to 30 per cent less than the actual amount incurred during that period. In a similar vein, military related interest paid to overseas seller (lender) countries amounted to about 26 per cent of all interest paid; total indebtedness due to defence imports was about 20 per cent of total accumulated debt for all imports; and if one looks further, about 20 per cent of the new financial capital was used to finance armaments imports. It is also possible that debt service for arms imports may be larger than the cost of new arms to the importing country.

32. High military related imports leading to large trade deficits put pressure on the domestic currency. Under flexible exchange rates, the currency will depreciate which may reduce the deficit by making exports cheaper in world markets, thus increasing their demand. LDCs usually have fixed exchange rates; a sizeable trade deficit therefore implies an overvalued exchange rate and a corresponding loss in competitiveness. It is difficult for developing countries to pursue export promoting growth when they have large-scale defence imports and concomitant trade deficits, contributing to reduced competitiveness. It is not surprising that when an economy has faced a war and been forced to raise defence imports sizeably within a short period, its overall export performance suffers because its exchange rate is above market level.

33. The rising real costs of weapons imports have prompted some developing economies, particularly the newly industrializing countries, to initiate domestic arms industrialization. There are of course important political and strategic reasons why LDCs decide to manufacture arms at home rather than import them from abroad. Perceived, potential and actual threats, together with the desire for self-sufficiency and independence from overseas suppliers, (who may impose embargoes at the time of maximum need, e.g., during wars), have been cited as major reasons for domestic (arms) industrialization. However, economic factors are increasingly more important and these need to be stressed.

34. The first reason has already been mentioned; expansion of the international trade in arms and its rapid commercialization imply a heavy burden in terms of scarce foreign exchange; import substituting industrialization saves foreign
resources; export promotion, for some countries, also adds to reserves. The second set of reasons pertain to technological spin-offs, including induced R and D; increased productivity of the labour force in advanced strategic industries; and skill formation through learning by doing and familiarization with advanced technology (which these industries seem to have). Third, arms industries may create effective demand particularly in sectors, such as engineering goods and steel, where excess capacity often exists. Inasmuch as the last two factors have already been analysed in some detail in paragraphs 9 to 21 above, the first, specifically related to the open economy, will now be taken up.

35. There can be little doubt that domestic arms production reduces the cost of imports, particularly for the final product. However, the anticipated benefits that domestic military production is supposed to bring in terms of foreign exchange savings has not materialized in many cases. Variable data on arms exports, imports and the value of domestic weapons production for six large producers do not show a corresponding reduction in the military trade deficit. Rather, the deficit (imports minus exports) increased substantially from the first to the second half of the decade considered (1974 to 1984), 1985 being the last year for which data are available. It is possible that the import burden is passed on to the arms industries from direct imports; in effect, technology transfer and purchase from abroad compensates for the reduction in weapons imports per se. Import substitution by itself does not necessarily reduce the value of imports, a simple shifting of the burden occurs from the final product to intermediate imported goods and technology. On the other hand, there are examples of arms-producing countries showing a favourable impact of weapons exports on the trade deficit. In these cases, arms production increases were matched by rising rapidly exports, with resultant effects on the military trade balance.

36. This has implications for international arms control and disarmament strategy. If the objectives of weapons manufactures are political and strategic, it really does not matter what price needs to be paid. However, with economic cost-benefits entering the picture, countries which rely on industrialization based on the promotion of exports tend to gain (in terms of foreign exchange costs) relative to countries which opt for industrialization based on import substitutes. It should be noted that arms manufacturing does not occur in a vacuum; industrial strategy on a general scale is usually the foundation on which arms production strategy is built. Thus, countries following import substitution in general will do the same for armaments; similarly for export promotion. Given this, it possibly pays, from a purely economic point of view, for newly industrializing countries to go for export promotion. It must be noted, of course, that successful export promotion depends crucially on the size of the market; if every such country capable of selling arms world-wide were to do so, competitive pressures could make such an exercise unprofitable.

37. It has been claimed for developed economies that concentrating on arms production may have a negative effect on overall industrialization, particularly for the prospects for export-led growth. The military competes with resources from the most dynamic sectors of the economy and the resultant trade-off falls exclusively on aggregate investment with the defence industry skimming off the potential for growth. Again, this is not borne out by the facts in the newly
industrializing countries stressing export promotion. Among the LDCs manufacturing arms, arms production does not seem to have a significantly depressing effect on overall exports and growth. A word of caution: the 10-year period 1974 to 1983 may be too short for a thorough consideration of the impact of weapons production and its possible adverse linkages; more detailed country studies show that, in the long term, the effects may be detrimental, particularly in terms of the absorptive capacity drag mentioned above.

38. The choice of appropriate technology is crucial. The technological leaders are all in the developed countries of the world; it is they who set the pace of technology. The manufacture of sophisticated weapons has a very high rate of obsolescence, prohibitive R and D expenditures and a highly capital intensive mode of production. Countries opting for IS strategies may wish to have the blueprints embodying the ("almost") latest techniques; the demand for the final product comes from the defence establishment which may be caught up in an arms race with a neighbour buying the latest weaponry off the shelf in international markets. Thus, the use of appropriate technology, which in reality may mean less advanced hardware, becomes difficult. What exporting countries have done is to produce relatively inexpensive and less sophisticated armaments, which may not necessarily be useful for their own needs, but can be sold to many other LDCs whose requirements are less demanding. The revenue receipts are then used to import the "best" weapons necessary for their own defence. Thus, an interesting multilateral trade relation is set up based on comparative advantage.

39. Overall, the import content of defence spending has an adverse impact on trade balance and competitiveness. Arms production may be useful in terms of spin-off and foreign exchange gains, particularly if based on export promotion and appropriate technology. The feedbacks on growth of trade problems are important.

IV. ECONOMETRIC MODEL

40. The standard method of analysing empirically the MILEX growth relation is to use a single equation of the form given below:

\[ g = a_0 + a_1 m = a_2 U \]

where "g" is growth rate, "m" is military burden, "U" is a vector of exogenous variables and "a_0", "a_1", and "a_2" are constant parameters. Using ordinary least squares estimation techniques, it is found that "a_1" is significantly positive, hence the postulated positive relationship between defence (burden) and growth (rate).

41. Choice of estimation method depends primarily on the (economic) theoretical model and the stochastic specification assumed. The major emphasis in the paper has been on the simultaneity of concepts and variables that characterize the military growth relationship. The econometric counterpart of this interdependence would be the simultaneity and high co-variances between the various equations. Thus, a simultaneous equation model is needed, estimated by full information methods such as three stage least squares or (full information) maximum

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likelihood. As will be seen below, four equations are estimated jointly, one each for growth, saving, trade and military. The final effect of defence on growth then comes out to be a complex functional combination of many parameters.

42. Looking at the growth equation by itself, or estimating the functional relations by only ordinary least squares, may not be appropriate from the author's point of view. The growth equation alone gives only one effect - the direct relation. It is when all the simultaneity is taken into consideration, by analysing the direct and indirect effects together, that one can see clearly the total impact of defence on growth.

43. The theoretical discussion in paragraphs 22-39 above on the defence growth relation suggests that an econometric model should allow for the following:

(a) A direct effect of military expenditure on growth; this works through (i) reallocation of investible capital; (ii) an absorptive capacity drag on co-operating resources; (iii) various spin-offs, modernization and technical progress; and (iv) aggregate demand creation. The first two are expected to have a negative impact, while the third and fourth could show positive effects;

(b) An indirect effect via saving rates, reflecting the fact that resource mobilization may be affected; thus the very propensity to save or the savings-income ratio may change with a greater defence burden;

(c) The explicit modelling of open economy considerations; spending on military budgets will change the trade balance which in turn affects saving and growth;

(d) Finally, the statistical endogeneity of military expenditure which is being determined simultaneously with the others.

The above indicates a four-equation simultaneous system, which may be necessary to examine the interaction of growth, savings, trade and the military. There will therefore be one equation each for growth rate, saving rate, trade balance as a share of GDP and defence burden.

44. To apply a model based on these considerations, a survey was made of 50 LDCs with a wide ranging but balanced distribution according to structural characteristics, geographical areas, political systems, strategic problems and so forth. The period covered by the survey was 1965 to 1973. The main reason for choosing this time period was that distortions caused by oil price shocks had not filtered through in this period.

45. The results of this exercise are summarized as follows: the effects of a change in military burden on growth, savings ratio and trade surplus are quite substantial. If military burden is reduced by one percentage point, growth would increase by more than one third of a per cent - not an insignificant amount. The effect on saving is even more dramatic. A 1 per cent reduction in military share in GDP releases resources which directly or indirectly increase the savings share by a massive two and a half times. Another way of interpreting this result is even...
more revealing. For the sample set, domestic investment share exceeded saving share by 2.29 per cent. Thus, foreign capital of the order of 2.29 per cent (of national output) had to be attracted to finance domestic capital formation. The econometric results of the survey indicate that LDCs would not need to rely on any foreign capital inflows (given the same amount of investment) if they could reduce their defence burden by 1 per cent. For example, the mean value of "m" was 4.5 per cent. Therefore, all foreign capital requirements could be eliminated and the countries could be self-sufficient in capital, if military burden declined to 3.5 per cent.

46. Finally, the trade effects are also massive, particularly if compared to the actual values. For example, the actual share of trade balance was -1.08 per cent. The result demonstrates that if military burden declined from 4.5 per cent (actual) to 3.5 per cent (postulated), the trade balance share could move from a deficit of -1.08 per cent to a surplus of 3.94 per cent of GDP. Thus, there would be substantial gains in competitiveness if one assumes that trade surpluses are beneficial for the economy, particularly under fixed exchange rates and with limited ability to borrow abroad.

47. The empirical results and the counter-factual analysis all clearly demonstrate that defence expenditure as a share of the national product has an important and significantly negative effect on growth, capital formation and trade competitiveness. Using a relatively complicated econometric model, based on the interdependence of defence, growth and concomitant factors, and utilizing the predictions of economic theory to specify relationships, it was found that an increase in military burden reduces growth over a cross-section of LDCs, even though there are some positive effects.

V. NON-LINEARITIES IN THE MILEX GROWTH RELATIONSHIP

48. It has been seen that when all the simultaneous and interdependent relationships between military burden and growth are taken into account, the net effect is negative although some positive, and possibly important, channels are present. One question still remains: why is it that single equation estimates, for some studies, reveal positive defence effects (on growth), while in other studies the effect comes out to be negative? Sample and specification sensitivity cannot explain adequately these variations. A deeper economic analysis is needed.

49. One should concentrate, therefore, on the relation between military burden and growth only, leaving out the savings and trade balance relations. As discussed earlier, the coefficient of defence in this growth equation reflects the roles of: (a) allocation; (b) spin-off, in the form of modernization, technical progress and absorptive capacity effects; and (c) aggregate demand. The coefficient is therefore a composite term reflecting an aggregate effect of five specific channels; given the current state of data availability and model-building it is not possible to disaggregate any further. Two of these - allocation, absorptive capacity - show that defence reduces growth. The remaining three - modernization, technology and demand creation - reveal how military spending may help the economy to grow. The cross-section estimate in the previous section demonstrates that the
positive impact dominates the negative one in general. But it is also possible, given the developmental spread of the sample set of countries, that the relation may not be uniform; certain types of economies may respond in specific ways while others may behave differently. In principle, a subgrouping of countries could be more informative since the estimated impact may change or reverse sign.

50. The basic issue is quite important. The question is posed whether an increase in the military burden raises or lowers the economic growth rate. Therefore a monotonic relation is being sought between growth and the defence burden. The simplest case is the linear one where the empirical researcher would like to claim that countries with a high defence burden have a low (or high) rate of growth. But what if the relations are not unidirectional or, alternatively, are non-monotonic or non-linear? Suppose countries with high and low development show the same sort of effects (though possibly for different reasons), while economies with a medium level of development have an opposite relationship between the two variables of growth and defence.

51. It is necessary to subgroup countries to observe whether the impact of defence is reversed as one moves from one set of countries to another. Geographical classification, the usual method, is ad hoc and has no rigorous economic basis. The main criterion should be "levels of development", an idea difficult to quantify. The World Bank classification of low, medium and high per capita income countries has been used in some cases where asymmetric effects were found for the single equation defence-growth relation only. In low- and high-income countries, military expenditure increased growth; in middle-income countries the situation was reversed.

52. There are two problems in such a method of discriminating between developing economies. Per capita incomes converted into comparable United States dollars, the conversion being done by official nominal exchange rates, do not reflect the "true" level of incomes and domestic purchasing power of the residents of the economy. It is now generally accepted that the level of income, measured in exchange rates, is an underestimate if the economy has large non-monetary sectors, or a sizeable amount of its output is not traded internationally, or non-marketed transactions and earnings are important elements of consumption baskets. Incomes measured in purchasing power parities (PPP) are much more reliable indicators of domestic expenditures, welfare and state of development. Countries should ideally be differentiated by incomes converted to PPP, as an indicator of the level of development.

53. The second problem is that the division, of low, medium and high (incomes), is exogenously and independently specified without due consideration to the mechanics of the model itself. Ideally, country selection should be on the basis of the problem under discussion. "Low", "medium" and "high" are relative concepts and a uniform definition tends to be arbitrary in terms of the issues being discussed. Thus, country classification in this case should be dictated by the theoretical implications of the defence growth relationship.

54. The effect of military burden on growth varies non-linearly with per capita income, properly deflated by PPP; the latter can be termed real income. The
relation is an inverted U-shaped one, starting from the negative axis, reaching a maximum in the positive quadrant and then falling towards negative values. Thus, for very low real income, the effect of defence on growth is negative. For middle level (medium), real income, the effect is positive. For high real income countries, it becomes negative again. The result is consistent with those obtained for member countries of OECD where it has been shown that defence burden reduces investment and growth significantly. Thus, high-income developing countries tend to behave similarly to developed economies.

55. It is interesting to analyse the reasons for this non-linear relation between defence and growth. It is implicitly assumed that real income (in terms of PPP) is an indicator of developmental resources within the economy. Thus, the three groups delineated by the data and model, corresponding to low, medium and high per capita real income (measured by PPP), have a rough correspondence to low, medium and high levels of development. Of the five channels mentioned above, through which the defence-growth nexus works, some are more relevant than others, depending on the level of development. The following table gives the details.

<table>
<thead>
<tr>
<th>Level of development</th>
<th>Channel of military spending a/</th>
<th>Positive or negative effects (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Allocation</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Modernization</td>
<td>Positive</td>
</tr>
<tr>
<td>Medium</td>
<td>Allocation</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Modernization</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Technical progress</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Absorptive capacity</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Demand creation</td>
<td>Positive</td>
</tr>
<tr>
<td>High</td>
<td>Technical progress</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Absorptive capacity</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Demand creation</td>
<td>Positive</td>
</tr>
</tbody>
</table>

a/ Affecting growth directly.

56. The statistical results imply that, for development, the negative resource allocation effect dominates the benefits from modernization that may be derived from the military. At the other extreme, nations with high levels of development may benefit from demand creation and technological spin-off, particularly if they are arms producers. The empirical estimates imply, however, that the overall impact of defence is negative, presumably because the absorptive capacity drag is
dominant. Countries in the middle, as expected, are affected by all the factors. Again, the numerical results above indicate that the net effect for these countries tends to be positive. There are sufficient resources to counteract the negative allocation effects of a loss in productive investment. The military is not sophisticated enough to claim a large share of absorptive capacity. Thus, the three positive channels dominate.

57. The research on non-linearities is in its infancy; the results, based on this study are, to the best of knowledge, the first to deal with such issues, predicting impact reversals with poor and rich countries having negative effects while economies in the middle tending to benefit from military spending. This has implications for the temporal movements of the parameters. As LDCs grow richer, some of the negative defence effects may become weaker.

58. The results are interesting and demonstrate why, in a cross-section sample, it is possible to get positive effects on growth from defence spending, particularly if medium development countries dominate the country set chosen for analysis. But it must be stressed unequivocally that this is only a single equation relation which completely ignores both mobilization and trade effects. These always tend to have strong negative influence on growth. The final impact, considering all possible channels, is expected to be detrimental, as shown in paragraphs 40 to 47 above.

VI. CONCLUDING REMARKS

59. The effect of defence expenditure on growth in developing countries is complex because it works through many interrelated channels and encompasses a wide range of variables that are important for the developmental process. It is possible to identify important positive impacts of military spending on growth in terms of quantitative and qualitative routes. The problem is not a simple guns and butter issue where a trade-off must exist in economic terms. Thus, the research programme needs to be taken into consideration.

60. Corresponding to the theoretical interdependence there will be interconnections from the points of view of statistics and estimates. Therefore, the econometric model has to be specified formally to handle these interrelationships and simultaneity.

61. The problem has been approached by specifying a comprehensive growth-theoretic framework, taking account of the myriad factors involved in the process, both for a closed and an open economy. This identifies theoretically the variables and channels that may be important. The empirical part then uses full information methods (three stage least squares) to estimate the relevant parameters. The overall effect then takes into account all the interconnections that may be identified. The use of small macro models with simultaneous equations is not common in the statistical literature on the defence-growth relation. Future research and extensions, particularly for single countries with time series data, are therefore desirable. It is intended to pursue this avenue of analysis further.
62. In addition, non-linearities are considered, because of their importance, although difficult to handle empirically. The analysis, outlined here, emphasizes that country divisions and subgroupings should be model specific and be determined endogenously by the dictates of the problems concerned, rather than arbitrarily specified from outside.

63. The overall conclusions are given below:

Defence does have positive effects in developing economies despite the loss of resources to unproductive consumption. This must be due to a whole host of spin-offs. The aggregate or net effect, however, is undoubtedly negative. Economic theory cannot predict a priori the final outcome of increasing defence burden, on growth. Therefore more econometric evidence is required. The balance of that evidence predicts that, taking into account all the relevant channels, the final impact of military expenditure on growth related factors is negative. The quantitative values of the multipliers are high and the sensitivity of the empirical results are robust. The economic cost benefits conducted here imply that the price and cost of militarization may be prohibitive and disarmament offers an economic and productive alternative.