Britain's Pattern of Specialization in Manufactured Goods with Developing Countries and Trade Protection

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This work in progress report is part of an inquiry being undertaken by the World Bank in conjunction with scholars from twelve industrial countries into the penetration of the markets of industrial countries by exports of manufactures from developing countries. The project seeks to establish the shares of industrial country markets held by the developing countries, changes in such shares in the 1970s, and why they vary among industry groups and countries. The aim is to assist developing and industrial countries to improve their policies through a better understanding of trade patterns and protectionist pressures.

This paper studies the influences determining the emergence of protectionist pressures in the industrial countries in response to market penetration by products from other countries, and analyses the trigger points for taking protectionist measures. The problem is approached in two stages. Firstly, an explanatory outline for the pattern of manufacturing trade is mapped. Secondly, an attempt is made to explain the determinants of protectionist reaction. It is found that there is a strong association between the pattern of trade with developing countries and variables relating to aspects of "human capital", a much weaker relationship between trade patterns with other groups of countries, and virtually none for changes in trade patterns over time. The measurement of what has been called the "new protection", the selective use of non-traditional forms of trade barriers, directed mainly at non-industrial country competitors, presented considerable technical difficulties. However, use of a dummy variable permitted an analysis which showed a protectionist response to trade patterns apparently designed to negate or frustrate trade changes based upon the UK's comparative advantage in trade with developing countries.

We would like to thank the participants in the workshop on market penetration held in Kiel in November 1979 for their comments.

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Introduction

In line with the objectives of the World Bank project as a whole, our aim is "to study the influences determining the emergence of protectionist pressures in the developed countries in response to market penetration by products from other countries and to analyse the "trigger points" for taking protectionist measures". The problem is approached in two stages. The first is to try to map out an explanatory outline for the pattern of manufacturing trade with developing countries (and the world as a whole). In effect, we seek to establish the current determinants of comparative advantage and changes in it. This work follows to some degree in well-trodden footsteps and as far as the UK is concerned takes advantage of recent advances in the presentation of UK trade data by industry and insights obtained in analytical work already done by Department of Industry economists. The second stage is to try to explain why a protectionist reaction is triggered in some industries to a greater extent than in others. The degree of protection afforded by the proliferation of non-tariff barriers is extremely difficult to measure in terms of tariff equivalents or any other continuous variable, and cruder measures have to be employed. An attempt was made to use 0-1 variables allowing a greater range of alternatives to reflect different degrees of severity of protection, in particular the use of quotas rather than tariffs, and 'semi-sensitive' rather than 'sensitive' tariff treatment under the GSP scheme.

Section 1 sets out the variables employed and data used. Section 2 deals with the methodology and results of a study of patterns of manufacturing specialisation with developing countries and other groups of countries. Section 3 deals with the methodology and results of a study of the inter-industry variation in UK protection as it applies to trade in manufactures in developing countries.

I. DATA USED

The analysis of both trade patterns and of the 'triggering' of trade protection is carried out using 87 3 digit non-food manufacturing (MLH) categories. The empirical foundations of the study rested upon the availability of trade data expressed in terms of manufacturing census categories so that hypotheses can be tested which relate trade patterns and their changes to industry and labour characteristics derived from the census. It is now possible to conduct such analysis for the UK as a result of the publication by the government for the years from 1970 of imports and exports expressed in terms of 3 digit MLH categories(1), of the estimation by Wells and Imber of import penetration and export sales ratios from 1968 to 1976(2) and latterly of the publications of more disaggregated and updated estimation of these ratios(3). These published sources provide imports and exports only in aggregate terms and the authors were fortunate to have unpublished data giving a geographical breakdown.

The sample excludes 17 items from the three digit list in addition to food items. The main criterion for exclusion is that the category of goods is predominately untraded, applying the criterion that exports and imports of a traded good together account for 10% of UK home consumption. This is however only a partial remedy; in trade with particular groups of countries for particular years the sample of items used to explain patterns of trade specialisation and trade protection contains a number of items which are not involved in trade either as imports or exports.

A substantial number of variables is used as dependent or independent variables in both exercises. The studies are distinct though the variables

are for the most part common to both. They are set out below in the context of the relevant hypotheses and formally defined in Appendix 1.

II. STUDY I - THE PATTERN OF SPECIALISATION

Refinement and testing of existing trade theory has given us a reasonably solid base from which to examine the pattern of UK manufacturing trade with developing countries. Much of this work points to the usefulness of a modified version of the Heckscher-Ohlin factor proportions theory in explaining patterns of trade: "a significant proportion of the variance in the commodity composition of trade in manufactured goods can be explained statistically by variations in three factor inputs, physical capital, human capital and labour. The proportion of variance explained goes as high as 45%...."(4). The crude factor endowment hypothesis (based on capital and labour alone) has been rendered inadequate by demonstration, and then repeated confirmation, of the Leontief paradox. Internationalisation of Leontief's work has been established that not only for the US, but for Canada, West Germany, Japan and in other "capital rich" economies, exports have a lower ratio of capital to labour than imports(5).

Data limitations have made tests difficult to apply to the UK but recent work, including that below, gives strong support for all trade in manufactured goods, and even for trade with non-oil ldcs, to the existence of this "paradox". There is a rich literature which this paper cannot pursue in any detail explaining and interpreting this paradox and which leads to doubt over its significance, if the factor endowments of supplying industries and other than two factors are considered. Suffice it to say that trade patterns have been more satisfactorily explained if 'human capital' is introduced. Human capital can in turn be split into two separate components, that

of the skill of the labour force and that of innovativeness. Wolter found for Germany that though both were a strong positive influence on German trade performance, innovativeness (measured by R & D expenditure) was particularly so(6). Subsequent testing of hypotheses about trade patterns has encompassed a wider range of explanatory variables including the degree of product differentiation, raw material use, and various aspects of industrial structure(7).

The predicted pattern of British trade is less likely to conform to the stereotype of an 'advanced' industrial country than some others. The UK has been through a long period of relative decline in manufacturing trade. The level of per capita income has sunk - relatively - to a point where this is now about half of some of its main trade rivals (US, Germany, Scandinavia). The capital stock is relatively old. There is much ancedote and some evidence to the effect that labour markets work more slowly than elsewhere, and in particular that the differential between skilled and unskilled work is inadequate to produce a rapid movement of resources towards activities utilising relatively large amounts of human capital. In such an economy present and future line of specialisation in trade is, if not indeterminate, certainly unclear.

The effects of this decline in relative performance can be subdivided into two(8). One is that British industrial trade performance increasingly fails - largely because of market malfunctioning - to reflect a comparative advantage in products utilising a high human capital content. The other is that Britain's comparative advantage is itself changing in the direction of goods which require less skill and inventiveness. The policy implications of these two interpretations of decline are radically different; the latter,

for example, implies that in the absence of bold policy initiatives to revise the quality of the labour force and to influence the direction of resources towards more technologically advanced activities, Britain's economically efficient trade pattern in manufactures will increasingly resemble that of the more advanced Southern European or Far Eastern newly industrializing countries (NICs). An analysis of changing trade patterns may help to illustrate whether the UK displays some of the characteristics of an advanced industrial economy (with developing countries). In other contexts, in trade with more advanced industrial economies, the U.K. is beginning to show some of the characteristics of a developing country.

Empirical testing of such hypotheses have been inhibited until very recently by the lack of a suitable UK data base, of trade flows expressed in terms of disaggregated industry groups (or vice versa) and also by the absence of suitably disaggregated capital stock estimates. Some tests have however now been carried out by Department of Industry economists, notably by Owen and White(9). They have tried to explain the pattern of UK manufactured trade for 1970, 1975 and 1976 (94 categories, non-food) with the world as a whole, the OECD, the EEC and developing countries. They used multiple regression analysis to explain variations in an index of trade performance by industry, which was measured by (trade balance ÷ UK apparent consumption). Their main conclusions, relevant to this paper, were:

(i) a model based on factor proportions and industrial structure characteristics achieved a good fit (R^2 = .39 to .41, for different years) for trade with developing countries.

(ii) there was strong confirmation of the Leontief paradox in UK trade with the world as a whole and with developing countries in

particular, ie, British revealed compararative advantage in trade with developing countries was in relatively labour intensive goods (in relation to capital).

(iii) British revealed comparative advantage in manufacturing trade with developing countries lay with industries which were high wage (the most significant factor) but labour intensive, used an above-average proportion of skilled and white collar personnel, were more highly concentrated in terms of ownership, more likely to be foreign owned and to have good industrial relations. The same factors appeared to explain trade patterns with the world as a whole, though less convincingly than for developing countries, while trade with the EC could not be explained at all in terms of the set of variables used. One factor which appeared to be unimportant in all contexts was the use of R & D.

As part of the present exercise these tests were conducted again but in a somewhat modified form, with a wider range of dependent and explanatory variables, more recent data and a more specific focus on UK-developing country trade.

The Hypothesis

The specific hypothesis is that the pattern of UK manufacturing trade can be explained by combinations of a) factor endowments: human and physical capital resources; b) characteristics of industrial structure - the degree of foreign ownership, or firm size - which, other things being equal, influence the relative trade performance of particular sectors; c) the regional concentration of manufacturing - as between UK regions with different factor endowments - influencing the extent to which inter-regional trade flows

serve as a substitute for international trade; d) the incidence of trade protection.

We would expect that a) and c) would be a dominant factors in trade with countries with the most radically different factor endowments, that is with developing countries, and b) in trade with comparable industrial economies. Over time we would expect relationships to be less clear-cut, reflecting the tendency of the UK to slide down the league of industrial countries, and also a large amount of government intervention with no obvious logic in terms of international specialisation.

Dependent Variables

The Owen White study used a measure of 'revealed comparative advantage' as an index of inter-industry trade performance. More alternative measures of trade performance are considered, in particular separating out exports and imports. The reasoning behind this was that a possibly misleading picture is created by the use of a measure of performance which includes trade balance as the numerator when there are many industries with substantial but roughly balanced intra-industry trade.

Four alternative measures of trade performance - export-sales ratio (ES), import penetration (IP), and two measures of revealed comparative advantage (RCA1 and RCA2) - were used. (For a definition of the variables see Appendix 1). Several problems arise in defining these variables. Firstly, domestic and foreign products in the same category may be different and non-competing. For example, imported carpets from developing countries and East European centrally planned economies are usually handwoven, catering for a different market to domestic production than imports in the same category

from industrial countries (which use quite different production techniques). But there is no clear cut dividing line between competing and non-competing products, and in the absence of an objective criterion - and suspecting this was not a major problem - we disregarded the problem except in the one obvious case of carpets. Secondly, where trade and production data are combined in a common index (eg, IP), the production (but not the trade) figure may be inflated by double-counting for industries where intra-industry sales are a high proportion of the total. For example, for cars, aerospace, shipbuilding and electronic components, domestic sales of intermediate products are often counted more than once, as components and as part of the final product. In order to minimise this distortion a more conventional measure of revealed comparative advantage which uses only trade data was used (RCA 1). But for contrast another measure which gave some weighting to domestic sales was also tried (RCA 2). This other measure was also used since the former measure "does not distinguish between significant trade balances and those without..... Moreover because they focus on traded products it could be that in some industries the independent variables which refer to the entire industry concerned are highly unrepresentative of the independent variable which apply to these particular products" (10).

There were practical difficulties in obtaining a very disaggregated picture of trade patterns in terms of geographical regions for any year other than 1978. The following units were considered for 1970 and 1978: the world as a whole, developing countries (defined to exclude all OECD countries, all East European countries, Israel, Turkey, and including Communist Asian countries), subdivided into OPEC and non-OPEC; Japan and COMECON. Trade with the US and the EEC was considered for 1978 alone.

Independent Variables

(i) the choice of independent variables to represent factor endowments centered on proxies for human and physical capital. There are inherent difficulties in representing simply a multifaceted concept such as human capital and severe problems in measuring physical capital in the absence of capital stock data at the level of disaggregation with which we are working. The human capital endowment was represented by two of its principle components: the innovativeness of firms resulting from a high R & D effort, and skill in the workforce as a whole resulting from substantial training and experience of complex operations. The first (R & D) was represented by a measure of expenditure on R & D as a proportion of industry sales but the figures were aggregated to 32 categories and we had to assume that the same coefficients applied at a disaggregated level. The second was initially represented by a series of indirect measures taken from 1975 manufacturing census data. (The 1977 figures are now available but do not significantly affect the inter-industry differences). Within the considerable limitations of UK census data, these give necessarily rather unsatisfactory proxy measures of human capital for the sample of industries. The data used were the share of 'operatives' in the labour force (OPSH) (in effect the share of manual workers, skilled and unskilled, rather than clerical, managerial and scientific staff); the share of women employees (WMSH); and the average wage AVWAGE. For the last of these we elected to use the average annual earnings for the labour force as a whole rather than the average weekly manual wage employed by Owen and White since it seemed likely to incorporate, in a more comprehensive way, the human capital element in the industry work force (but any measure would be distorted by labour market imperfections). After experimenting with

these variables we were aware of the availability of a direct skill measure (SKILL) derivable from a 1970 population census classification of the work force of industries in terms of (five) social classes. Although this was superior to our proxy variables in that it measured skill directly, the differentiation is based on an arbitrary and somewhat questionable definition of skill. The boundary between semi-skilled and skilled is very important for our definition and the qualifications for admission to the "skill" category in the census did not appear particularly demanding. The most "skill"-intensive manufacturing industry on the population census scale was footwear and several textile trades, notably knitwear, were not far behind.

There were also difficulties in the calculations of physical capital intensity (K/L) since capital stock data do not exist in the form required. One possibility is to use a measure of capital stock which is inferred from accumulated depreciation over a specified period of years. This is the approach used by Owen and White drawing upon NEDO estimates. Another approach, which also uses flows over time as a substitute for stock, is to measure cumulative net capital investment over a fixed period, assuming that this correlates with capital stock. This is the method used here. These measures have obvious deficiencies but when tested there was a high correlation between them. A measure of value added per man was incorporated (VAPM). This should reflect the combined influence of human and physical capital, (but it has deficiencies - notably the use of a flow measure, affected strongly by inter-annual variations in profits). A final variation was to measure labour intensity in relation to output rather than capital stock, that is, the inverse of productivity (LAB).

(ii) We incorporated several variables intended to capture the influence of industrial structure. We would expect this to be important in explaining the pattern of trade with other industrial countries. We incorporated one measure of economies of scale, the average firm size (AFSZ). There has been a long history of official intervention in UK industry designed to promote amalgamations, the underlying assumption being that economies of scale are a significant influence on trade performance. Clearly this could be refined in various ways to allow for differences between plant and firm size, and the difference between average firm size and the degree of industrial concentration all of which represent different aspects of scale economies.

Another factor of possible importance is the degree of concentration of ownership (CONC), the hypothesis being that import penetration is less where the domestic producers are more organized along oligopolistic lines. Finally we consider foreign investment in UK industry (FINV). It would be a plausible hypothesis that industries highly penetrated by foreign investment have a higher degree of involvement in international trade, both in terms of export performance and import penetration, because of the facility of trade between subsidiaries. Unfortunately the measure is not entirely satisfactory since information is only available at an aggregated level (in 16, two-digit categories) and the assumption is made that the industrial subdivisions share the same coefficient as the larger categories.

(iii) in addition we incorporated a series of measures designed to reflect the regional distribution of employment in the UK. We would expect, a priori, that the pattern of comparative advantage in trade with developing countries would overlap with the UK regional structure of employment to the extent that

international trade is a partial substitute for inter-regional trade. The regions of the UK characterized by high unemployment should, if there is a functioning labour market, also have relatively low wages, and attract industries which use relatively more intensively labour which is more available and cheaper than elsewhere. Regional policy has been active, if erratic, and one of its aspects has been an attempt to subsidise labour in high unemployment regions by such devices as the Regional Employment Premium to attract or retain relatively labour intensive footloose industries. These are also the industries in which developing countries would be expected to have a comparative advantage. Unfortunately there data is not available on the detailed regional distribution of employment. The best available is a breakdown into 11 planning regions. We calculated three indices. One, RBSI, measured the share of employment by industry in those planning regions which are of above average unemployment and are major beneficiaries of regional assistance (N. Ireland, Wales, Scotland, the North of England). Another RBS2 also included 'intermediate' regions (Yorkshire and the North West). A third RBS3 measured crudely the degree of concentration of employment by region. These three variables are correlated with each other, but only RBS1 and RBS2 significantly.

(iv) interindustry differences in the extent of protection will clearly bias trade performance on the import side. The measurement of protection raises, however, complex issues which will be discussed below, and the use of a protection measure as an independent variable (PRMSA to PRMSE) is treated as part of the second study.

The Model

By assuming a linear relationship between our dependent and independent variables we can estimate multiple regression of the following form:

$$\left.\begin{matrix} IP \\ ES \\ RCA1 \\ RCA2 \end{matrix}\right\} = a + b\,(K) + c\,(HK) + d\,(IS) \qquad + e\,(RBS) + f\,(PRM) + \varepsilon$$

K is physical capital, HK is human capital, IS is industrial structure, RBS is regional bias in employment, PRM is protection. Each of these is represented by several variables in combination or independent of each other: a is a constant, b to i are regression coefficients and ε is the error term. The significance and sign of coefficients b to f should give us some indication of the force of a modified factor proportions model of international trade. But it should be stressed that these regressions are, at best, half of a test of trade theory. They also serve as a descriptive data analysis designed, by identifying factors which correlate significantly with trade patterns, to indicate likely sources of trade adjustment difficulty, permitting us to formulate hypotheses that can then be used for an analysis of protection.

Table 1: ESTIMATION OF REGRESSION COEFFICIENTS - DEPENDENT VARIABLE IS REVELAED COMPARATIVE ADVANTAGE
(n = 87)

Dependent Variable	AFSZ	R+D	K/L	VAPM	OPSH	WMSH	AVWAGE	RBSI	Const	R^2	F
RCA1 1978	.144	.0002	-2.02	-.244	-65.03	-.241	.719	-.168	53.80	.46	9.61
LDC+OPEC	(.721)	(.552)	(-1.53)	(-1.76)*	(-3.10)***	(-1.64)	(1.065)	(-1.60)	(1.92)		
RCA1 1978	-.163	.1553	-.288	-.101	-36.87	-.267	.404	-.181	30.32	.52	12.47
LDC	(-.114)	(.611)	(-.304)	(-1.02)	(-2.45)**	(-2.53)**	(.835)	(-2.40)**	(1.51)		
RCA1 1978	-.592	-.571	.427	.747	-3.23	.261	.633	.402	-2.92	.03	.39
Japan	(-.710)	(-.385)	(.772)	(1.295)	(-.369)	(.426)	(.228)	(.915)	(-.250)		
RCA1 1978	.610	.960	-.181	.111	-19.79	.182	-.354	.108	17.55	.07	.89
EEC	(.481)	(.426)	(-.216)	(-1.27)	(-1.48)	(.203)	(-.825)	(1.63)	(.987)		
RCA1 1978	-.347	-.184	.261	.220	21.39	.338	.834	-.391	-18.67	.19	2.68
USA	(-.559)	(-1.67)*	(.634)	(.497)	(3.27)***	(.738)	(.396)	(-.119)	(-2.14)**		
RCA1 1978	-.449	-.119	-.879	-.386	-5.33	.261	.256	.123	-2.39	.20	2.82
COMECON	(-1.14)	(-.169)	(-.336)	(-1.416)	(-1.29)	(.901)	(1.919)*	(.592)	(-.432)		
RCA1 1978	.158	-.118	-2.31	-.150	-103.99	.111	.154	-.167	48.68	.20	2.75
World	(.375)	(-.158)	(-.825)	(-.508)	(-2.35)**	(.359)	(1.076)	(-.752)	(.822)		
RCA1 1970	.148	.055	-2.42	-.385	-37.03	-.209	.161	-.351	8.83	.46	9.49
LDC+OPEC	(.749)	(.157)	(-1.84)**	(-2.86)***	(-1.78)*	(-.144)	(2.411)**	(-3.37)***	(.318)		
RCA1 1970	-.006	.016	-.735)	.327	-3.44	.0035	.0005	.018	.678	.04	.48
Japan	(-.148)	(.236)	(-.029)	(1.25)	(-.868)	(.126)	(.413)	(.898)	(.128)		
RCA1 1970	.547	.449	-.620	-.109	-8.286	.087	.450	.197	-4.982	.12	1.61
COMECON	(.866)	(.040)	(-1.482)	(-2.33)**	(-1.251)	(1.662)*	(2.111)**	(.592)	(-.563)		
RCA1 1970	.533	-.414	-6.01	-.726	-42.38	.251	.0274	-.666	1.232	.23	3.34
World	(1.139)	(-.498)	(-1.939)*	(-2.24)*	(-.863	(.730)	(1.730)*	(-2.704)***	(.018)		
RCA1 1978-70	-.0069	-.182	.380	-.391	.545	.163	-.208	-.023	.156	.05	0.58
LDC+OPEC	(-.298)	(-.445)	(.249)	(-.024)	(.226)	(.096)	(-.027)	(-1.879)*	(.048)		
RCA1 1978-70	-.175	-.754	2.003	.002	-46.89	.234	-.122	.029	53.88	.06	0.78
Japan	(-.593)	(-.014)	(1.023)	(1.152)	(-1.511)	(.108)	(-1.218)	(.190)	(1.300)		
RCA1 1978-70	-.846	-.174	.614	.386	.642	.014	-.579	-.123	-.271	.03	0.38
World	(-1.363)	(-.016)	(1.496)	(.886)	(.099)	(.316)	(-.276)	(-.377)	(-.031)		

* Significant at 10% confidence level.
** Significant at 5% confidence level.
*** Significant at 1% confidence level.
Note: T - statistic in brackets.

Table 2: ESTIMATION OF REGRESSION COEFFICIENTS - DEPENDENT VARIABLES ARE IMPORT PENETRATION AND EXPORT/SALES RATIOS

Dependent Variable	AFSZ	R+D	K/L	VAPM	OPSH	WMSH	AVWAGE	RBSI	Const	R^2	F
IP 1978 LDC	.252 (.442)	.953 (.941)	-.256 (-.679)	.0001 (.228)	14.360 (2.401)**	.1303 (3.110)***	.381 (.198)	.088 (2.942)***	-13.19 (-1.650)**	.50	11.18
ES 1978 LDC	.363 (.669)	.244 (2.538)**	-.506 (-1.409)	-.0002 (-.490)	-5.479 (-.963)	-.735 (-1.843)*	.705 (.038)	.018 (.618)	11.09 (1.458)	.24	3.50
IP 1978 World	.607 (.202)	1.510 (2.827)***	-1.554 (.780)	-.00002 (-.011)	-2.987 (-.094)	-.031 (-.140)	.577 (.568)	.105 (.666)	20.87 (.495)	.13	1.68
ES 1978 World	.115 (.431)	1.499 (3.193)***	-2.143 (-1.224)	-.0008 (-.664)	-48.43 (-1.746)*	-.429 (-.221)	.811 (.908)	.087 (.063)	52.95 (1.428)	.27	4.22
IP 1978 Japan	.046 (.499)	.099 (.606)	-.343 (-.561)	-.0009 (-1.436)	-2.098 (-.216)	-.048 (-.713)	-.002 (-.542)	-.040 (-.825)	10.392 (.801)	.03	.39
ES 1978 Japan	.020 (.018)	.582 (2.147)**	..172 (1.83)*	-.0002 (-2.235)**	-4.688 (-1.698)*	.0060 (.618)	.0003 (.432)	-.0095 (-1.35)	4.763 (2.006)**	.15	1.68
IP 1978 USA	.927 (1.535)*	.607 (5.663)***	-.927 (-2.318)**	-.0002 (-.431)	-20.312 (-3.207)***	.272 (.613)	.003 (1.297)	-.246 (-.077)	12.48 (1.475)	.48	10.34
ES 1978 USA	.0365 (.858)	.339 (4.430)***	-.393 (-1.387)	-.003 (-1.06)	-.176 (-.039)	-.178 (-.564)	.418 (.287)	.005 (.205)	2.688 (.488)	.24	3.58
IP 1978 COMECON	.119 (.904)	-.523 (-.253)	-.170 (-.196)	.00001 (.145)	.848 (.613)	-.178 (-1.845)*	-.660 (-1.48)	.556 (.803)	2.023 (1.080)	.09	1.13
ES 1978 COMECON	-.108 (-.613)	-.155 (-.496)	-.964 (-.082)	-.0002 (-1.63)	-2.12 (1.14)	-.571 (-.440)	.777 (1.303)	.539 (.580)	.958 (.387)	.21	3.09
IP 1978 EEC	-.698 (-.457)	.487 (1.794)*	-.483 (-.048)	.0005 (.565)	-15.452 (-.964)	.231 (.211)	.586 (1.134)	-.454 (-.564)	11.943 (.551)	.17	2.33
ES 1978 EEC	-.283 (-.231)	.564 (2.595)**	-.171 (-.211)	.0008 (.901)	-19.862 (-.545)	.108 (1.206)	.569 (1.377)	-.013 (-.208)	9.817 (.572)	.13	2.94
IP 1978-70 LDC+OPEC	.079 (1.054)	.138 (1.037)	-.905 (-1.819)*	-.0010 (-1.905)*	-2.315 (-.940)	.359 (.651)	.229 (.904)	.135 (3.413)***	-3.136 (-.298)	.16	2.18
ES 1978-70 LDC+OPEC	.104 (.688)	.292 (1.092)	-.140 (-1.405)	-.000 (-.195)	-.218 (-.138)	.121 (1.096)	.278 (.597)	.144 (1.816)*	-.140 (-.067)	.11	1.44
IP 1978-70 Japan	.599 (1.157)	.107 (1.167)	-.677 (-1.978)**	-.0009 (-2.488)**	6.257 (1.152)	.166 (.436)	.339 (1.940)*	-.124 (-.457)	-9.411 (-1.297)	.12	1.57
ES 1978-70 Japan	-.321 (-1.301)	-.339 (-.071)	.222 (1.360)	-.0003 (-1.469)	2.320 (.896)	.115 (.636)	-.251 (-.300)	-.184 (-1.421)	-.520 (-.150)	.08	.98
IP 1978-70 COMECON	.306 (1.739)*	-.898 (-.029)	-.108 (-.093)	-.001 (-.877)	11.567 (.627)	-.125 (-.967)	-.863 (-.614)	.176 (1.902)*	-4.32 (-.175)	.24	3.57
ES 1978-70 COMECON	.117 (.270)	-.271 (-.351)	-.180 (-.628)	-.0003 (-1.025)	-5.595 (-1.229)	-.501 (-1.572)	-.143 (2.576)**	.588 (2.576)**	-9.521 (-1.565)	.11	1.42
IP 1978-70 World	.008 (.870)	.013 (.757)	-.133 (-2.091)**	-.119 (-1.755)*	2.575 (2.555)**	.0188 (2.662)**	.001 (3.022)***	-.009 (-1.906)*	-3.338 (-2.478)**	.21	3.10
ES 1978-70 World	-.007 (-.868)	.190 (1.399)	.004 (.071)	.710 (1.330)	.385 (.479)	.002 (1.805)*	.003 (1.363)	.050 (1.235)	-.970 (-.903)	.11	1.36

* Significant at 10% confidence level
** Significant at 5% confidence level
*** Significant at 1% confidence level

Note: T-statistic in brackets

Table 3: ESTIMATION OF REGRESSION COEFFICIENTS; USE OF ALTERNATIVE MEASURES INCLUDING SKILL AS INDEPENDENT VARIABLES
(n = 87)

Dependent variables	SKILL (share of unskilled)	K/L	R+D	LAB	RBSI	Const.	$\bar{R}^2$	F
IP 1978 LDC	.120*** (.044)					-.375 (1.555)	.09	8.577
	.121*** (.0413)	.0410 (.129)				-.482 (1.599)	.07	4.29
	.109*** (.039)	.001 (.121)		59.304*** (16.464)		-4.772** (1.912)	.19	7.59
ES 1978 LDC	-.0605* (.0325)					6.743*** (1.235)	.03	3.448
	-.055* (.0316)		.261*** (.099)			6.069*** (1.221)	.09	5.337
	-0.056* (.0318)		.254** (.097)	9.876 (13.473)		5.354*** (1.569)	.09	3.715
							R^2	
IP 1978 World	-.241 (.161)		1.459*** (.506)	120.980* (68.229)		28.479*** (7.972)	.15	4.956
ES 1978 World	-1.665* (.841)		1.702 (3.538)	46.478 (65.233)		35.747*** (7.578)	.17	5.687
IP 1978 USA	-.102*** (.036)		.688*** (.114)	-1.845 (15.416)		6.605*** (1.790)	.36	15.771
ES 1978 USA	-.0422* (.022)		.318*** (.069)	31.338*** (9.433)		1.279 (1.075)	.38	12.864
IP 1978 EEC	-.123 (.089)	1.260 (.871)	.582** (.271)		.0683 (.0804)		.11	2.123
ID 1978 COMECON	-.015** (.007)		-.024 (.022)	6.554** (3.033)		.680 (1.980)	.10	2.982

* Significant at 10% confidence level
** Significant at 5% confidence level
*** Significant at 1% confidence level

Table 4: ESTIMATION OF REGRESSION COEFFICIENTS, USE OF ALTERNATIVE MEASURES INCLUDING FOREIGN INVESTMENT AS INDEPENDENT VARIABLES

(n=87)

Dependent Variables		FINV	CONC	SKILL	R+D	K/L	RBSI	Const	R^2	F
RCA 1	1978	.645***	.227***	-.391***	-.267	-1.144*	-.377	10.44*	.44	10.49
	LDC+OPEC	(.196)	(.079)	(.118)	(.367)	(.616)	(.110)	(5.54)		
RCA 2	1978	1.162***	.241	-.032	-.442	-1.470	-.229	-14.083	.16	2.59
	World	(.419)	(.170)	(.252)	(.787)	(2.531)	(.236)	(11.878)		
RCA 2	1978	-.116	-.068**	.022	-.172	.162	.009	-.111	.11	1.631
	USA	(.064)	(.026)	(.038)	(.119)	(.201)	(.036)	(1.807)		
IP	1978	-.136*	-.020	-.073*	.302**	-.268	.105	2.656	.246	4.305
	LDC+OPEC	(.073)	(.029)	(.044)	(.136)	(.229)	(.136)	(2.055)		
IP	1978	.293	.216*	-.281*	1.179	-1.560*	.129	26.503**	.187	3.028
	World	(.282)	(.115)	(.170)	(.530)	(.892)	(.159)	(7.995)		
IP	1978	.145**	.462**	-.112***	-.563***	-.436**	.002	0.762	.462	11.333
	USA	(.059)	(.188)	(.036)	(.112)	(.188)	(.034)	(1.693)		
IP	1978	.318**	.104*	-.156*	.326	.505	-.005	11.267***	.202	3.330
	EEC	(.146)	(.059)	(.088)	(.276)	(.40)	(.082)	(4.136)		
IP	1978-70	.128*	.037	-.052	.059	-.635***	.165***	.753	.234	4.039
	LDC+OPEC	(.060)	(.028)	(.042)	(.137)	(.221)	(.039)	(1.985)		
IP	1978-70	-.5017**	-.0016	.006	-.013	.005	-.011**	.995***	.119	1.776
	World	(.0098)	(.006)	(.000)	(.018)	(.031)	(.005)	(.272)		

* Significant at 10% confidence level.
** Significant at 5% confidence level.
*** Significant at 1% confidence level.

Note: Standard error in brackets.

Table 5: CORRELATION BETWEEN DEPENDENT VARIABLES IN REGRESSION ANALYSIS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. IP 1978 LDC	1.00	-.08	.32**	.13	.26**	-.01	.00	.05	-.05	.16	-.08	.04	.11	.24*	.03	.01
2. ES 1978 LDC		1.00	.13	.04	.33**	.73**	.03	-.05	.44**	.61**	.57**	.35**	-.09	.35**	.15	.26**
3. IP 1978-70 LDC+OPEC			1.00	.22*			.12									
4. ES 1978-70 LDC+OPEC				1.00				.72**								
5. IP 1978 World					1.00	.84**	.00									
6. ES 1978 World						1.00		.03								
7. IP 1978-70 World							1.00	.32**								
8. ES 1978-70 World								1.00								
9. IP 1978 USA									1.00	.57**						
10. ES 1978 USA										1.00						
11. IP 1978 EEC											1.00	.85**				
12. ES 1978 EEC												1.00				
13. IP 1978 COMECON													1.00	-.02		
14. ES 1978 COMECON														1.00		
15. IP 1978 Japan															1.00	.26**
16. ES 1978 Japan																1.00

* Indicates significant at 5% confidence level.
** Indicates significant at 1% confidence level.

Table 6: Correlation Coefficients From Matrix of Protection Measures and Explanatory Variables

	IP^{1978}_{LDC}	ES^{1978}_{LDC}	$IP^{1978-70}_{LDC}$	$ES^{1978-70}_{LDC}$	AFSZ	CONC	FINV	$CHOT^{78-70}$	EMP^{78-70}	LAB	R & D	K/L	SKILL	AV WAGE	VAPM	OPSH	WMSH
IP^{1978}_{LDC}	1.00	-.06	.32**	.13	-.07	-.02	.19	-.09	-.12	.36**	.13	-.18	.30**	-.48**	-.25**	.48**	.53**
ES^{1978}_{LDC}		1.00	.30**	.04	-.10	.19	.31**	-.09	.05	-.19	.29**	-.13	-.25**	.27**	-.02	-.31**	-.33**
$IP^{1978-70}_{LDC}$			1.00	.22*	-.06	.14	.10	.03	-.01	.22*	.12	-.10	-.01	-.01	-.14	.03	.04
$ES^{1978-70}_{LDC}$				1.00	-.13	-.03	-.07	.13	.05	.22*	.12	-.18	.11	-.17	-.15	.09	.19
AFSZ					1.00	.21*	.33**	.49**	-.11	-.30**	-.02	.88**	-.03	.33**	.89**	-.01	-.17
CONC						1.00	.30**	-.10	-.17	-.31**	.15	.33**	.26**	.50**	.31**	-.27**	-.34**
FINV							1.00	.36**	.10	-.34**	.24**	.35**	.16**	.26**	.49**	-.66**	-.28**
$CHOT^{78-70}$								1.00	.51**	-.32**	-.01	.46**	-.10	.18	n.a.	-.26**	-.02
EMP^{78-70}									1.00	-.08	.14	-.09	-.09	.08	.01	-.26**	-.02
LAB										1.00	.08	-.51**	.08	-.55**	.08	.45**	.07
R & D											1.00	-.01	-.06	.11	.05	.17	-.03
K/L												1.00	.04	.52**	.52**	-.20	-.31**
SKILL													1.00	-.48**	.05	.37**	.54**
AV WAGE														1.00	.56**	-.57**	-.86**
VAPM															1.00	-.41**	-.10
OPSH																1.00	.43*
WMSH																	1.00

Table 7: Actual and Predicted Import Penetration and Export Sales Ratios from Regression Analysis

Product	Actual (%)	Predicted (%)	Difference
IP 1978 LDC +OPEC			
Radio & Electronic components	4.6	13.8	-9.2
Made up textiles	3.5	9.7	-6.2
Spinning of Textiles	2.6	7.7	-5.1
Pottery	1.6	6.6	-5.0
Telegraph apparatus	0.2	5.0	-4.8
Shipbuilding	0.6	5.4	-4.8
Woollens	2.4	7.1	-4.7
Domestic appliances	0.3	5.1	-4.8
Brushes & brooms	1.8	6.4	-4.6
Other electrical goods	1.0	5.6	-4.6
Paper & board n.e.s.	0.1	4.4	-4.3
Mens' tailored wear	8.1	12.3	-4.2
Aerospace	(23.8)	9.3	(+14.4)
Leather goods	21.3	8.3	13.0
Clocks	23.3	12.0	11.3
Woven cloth	16.4	6.4	10.0
Machine tools	11.7	1.6	10.1
Shirts	24.0	14.0	10.0
Leather	12.0	3.0	9.0
Toys & games	13.6	7.6	6.0
Other basic metals	6.0	0.8	5.2
Handtools	4.5	0.0	4.5
ES 1978 LDC +OPEC			
Computers	5.4	19.9	-14.5
Misc. wood manufactures	1.7	10.8	-9.1
T[illegible]	2.1	11.4	-9.2
Radio & electrical components	11.5	21.2	-9.8
Furniture	2.7	10.4	-7.7
Paper & board	2.1	9.2	-7.1
Printing & books	2.8	9.7	-6.9
Leather	2.7	9.0	-6.3
Machine tools	4.8	10.8	-6.0
Paint	7.7	13.6	-5.9
Plastic n.e.s.	0.9	6.8	-5.9

Results

Tables 1 to 4 summarise the main regression results. There was virtually no difference in the results where RCA1 or 2 was used as the dependent variable, and so only one set of results is set out in Table 1. However there were some striking contrasts from running the export and import performance ratios separately and so these results are reproduced in some detail. Consideration of export and import performance separately is of considerable importance when contrasting trade patterns with economies of quite different economic structures. As the table below (derived from Table 5) shows, the structure of UK exports and imports overall is very similar, reflecting the considerable amount of intra-industry trade, but for trade with developing countries (and centrally planned ones) there is little overlap, with Japan in an intermediate position. At the margin, however, developing countries are developing a more overlapping structure; the rest of the world, apparently, less so.

Coefficients of Correlation Between Manufacturing Export Sales and Import Penetration

Ratios (N = 87)

		(Level) 1978	(Change) 1970 to 1978
Trade with:	Developing countries	-.06	.22*
	COMECON	-.02	.22*
	World	.84**	.32**
	EC	.85**	
	USA	.57**	
	Japan	.26*	

* significant at 5% confidence level

** significant at 1% confidence level

As in the Owen/White study, an analysis of UK-developing country trade in terms of the main explanatory variables accounted for around half of the variance. The same set of variables `explained` UK trade with the world as a whole, with the US and with COMECON, to the extent of an overall goodness of fit, measured by R^2, of around 0.2. The pattern of trade with the EC, however, had no obvious rationale, and the same was true (more surprisingly) of Japan which suggests that these countries now have an economic structure very similar to the UK giving little or no scope for specialization based on factor endowments. Consideration of changes over time (1978-80) gave generally poor fits for equations seeking to explain changes in revealed comparative advantage but a clearer picture emerged when ES and IP were considered. The main, detailed, conclusions were as follows:

(i) there was confirmation of the `Leontif paradox` operating in UK manufacturing trade with developing countries. The K/L coefficient has a negative sign (statistically significant) for revealed comparative advantage, and so does VAPM. Both coefficients remain negative and statistically significant for changes over time. Breaking down the UK-developing country trade relationship shows that the pattern of both UK exports and imports (and for change over time) is biassed to relatively labour intensive goods, with respect to capital. In general the pattern of trade over time, and at one point of time, is at variance with the traditional two-factor, capital-labour, Heckscher-Ohlin picture of world trade. A much more probable explanation is that is is human capital which is the decisive influence on trade patterns.

Somewhat more orthodox conclusions are available from use of a measure of labour intensity (LAB) which excludes reference to capital stock. Britain's revealed comparative advantage in trade overall lies in less labour intensive industries (the coefficient having a high confidence level). Developing country import penetration (and also imports from COMECON and the world as a whole) is high in industries with high relatively labour intensity, while the opposite is true of our trade with the USA. UK exports are also - by the sign of the coefficient - relatively labour intensive, especially in trade with the USA, but other then in UK-US trade, significance levels are low.

(ii) We have used a variety of measures to explain different aspects of human capital, none of them comprehensive and some of them partially defective. One finding which contradicts directly the Owen/White results is the great importance of R & D. This only become apparent when imports and exports are considered separately. UK exports to the World, the EC, the US and developing countries all show a positive R & D coefficient at very high confidence levels (1%), and almost the same degree of significance can be attached to R & D in imports from the World the EEC and the US. This factor loses its significance in RCA measures since intra-industry trade is large in the industries where R & D is important, producing sectoral trade balances which are small in relation to total trade (and consumption).

One variable which also emerged as having strong statistical properties was the share of manual workers in the labour force.

There was, as expected, a strong negative correlation between UK RCA with developing countries and OPSH, and a strong positive correlation between OPSH and the structure of developing country manufactured imports (both significant at a 1% confidence level). The relations were exactly reversed for UK-US trade at the same level of statistical significance. The UK's RCA with the world as a whole and with the EC did however show the positive influence of human capital as measured by the share of non-manual labour. Over time the pattern of trade is less easily interpreted; OPSH is not a significant factor in changes in UK-developing country trade. It is worth recalling the OPSH is a somewhat ambiguous measure of human capital (it implies that the work of teenage typists has a higher human capital content than that of highly skilled and experienced lathe operators). The measure, OPSH, was questionable from another point of view. There is very little variation in OPSH (the standard deviation is only one eighth of the mean). A rather better proxy measure of human capital is the share of women in the labour force of a given industry (WHSH) since family traditions and, on occasions, overt discrimination have dictated that women are generally found in occupations with relatively low ('pin money') wages, low skill (and as a cause and effect of the low skill) rapid turnover and little responsibility. The share of women in the industrial labour force is, predictably, a highly significant factor (at 1% confidence level) in explaining ES, IP, and RCA measures of UK-developing country trade performance (developing countries having a strong comparative advantage in industries which employ an above average share of women). But there is no strong evidence

that this is an important factor in trade with other geographical areas, or in explaining changes over time. Finally, there is the measure AVWAGE. This had generally poor statistical properties in almost all the equations except for 1970 when the signs for trade with developing countries and the world as a whole were as predicted, and statistically significant at a high confidence level. We have already explained that such are the mysterious ways of the British labour market that not too much could reasonably have been expected from the AVWAGE measure. In retrospect we would probably have been wiser to have taken a more sensitive indicator - such as the average weekly manual wage - of the price of labour.

The various human capital measures, whatever their differences and deficiencies can be seen from Table 6 to be highly correlated with each other. This suggested to us that multi-collinearity may have influenced individual coefficients. Taking all four measures together however there is strong support for the view that human capital (or at least certain aspects of it) is the basis of Britain's current comparative advantage with developing countries, and also with the world as a whole, but it appears to play a small role in explaining UK-developing country trade pattern changes over time, at least for the period which we have considered. In terms of the contribution which the variables make individually to 'explaining' the pattern of trade with developing countries, the share of women in the labour force emerges as substantially the most important, from a consideration of (adjusted) R^2. For the dependent variable $IP^{1978}_{LDC\ (non\text{-}oil)}$ R^2 was 0.50,

ie, 50% of the variance was explained' by the sum of the influences of the variables in the equation. But 33% was accounted for by WMSH alone. For RCA2 $^{1978}_{LDC}$ with an R^2 of 0.52, 36% of variance was accounted for by the share of women in the labour force.

The importance of a high share of women in the labour force is not inherently significant; it is a proxy for underlying economic explanations. The most probable of these is that of all the human capital variables the share of women in the labour force comes closest to representing the degree of skill. The virtual absence of women from apprenticeship schemes in the engineering industry and from the technological professions makes this a plausible explanation. We repeated the analysis with an equation of reduced form and with the direct skill measure (SKILL). The measure was of the right sign and high significant statistically, though the R^2 level was poor in relation the preceding equations using a combination of proxy measures for skill. The reduced equations for trade with the USA and with the world as a whole (for IP and ES separately) have as good a fit as the earlier longer equations and each show skill to correlate significantly with both high export sales ratios and high import penetration. The relationship for changes over time are not very enlightening except to identify skill as a significant factor in the UK's pattern of trade with developing countries over time as well as at one point in time.

(iii) of the 'structural' factors incorporated in the equation, the average size is statistically insignificant in almost every

context. There is moreover no discernable pattern in the signs of the coefficients. The same was true of the concentration measure. The foreign investment factor was more significant and a separate table (Table 4) brings out its influence more explicitly. The share of foreign investment in UK industry was a significant factor in the equations which had as their dependent variable the revealed comparative advantage of the UK in trade with developing countries and with the world as a whole, and also (but with the opposite sign) for trade with the US. Import penetration by imports from the US, the EC and Japan but not developing countries - which had the opposite sign - was also associated with a high foreign investment factor in UK industry.

(iv) We were struck by the significance of the regional variable in UK-developing country trade. Import penetration from developing countries and (inversely) UK revealed comparative advantage with developing countries were highly correlated (at a 1% confidence level) with the share of employment in economically weak UK regions. Moreover there was an equally significant coefficient for changes in trade patterns over time, reinforcing the foregoing tendency. This was a factor largely specific to UK-developing country trade, and where the regional factor appeared significant elsewhere (eg for example in changes in UK import penetration from world sources) the influence was in the opposite direction. Different regional measures gave broadly similar results, through the tighter definition of the 'regional problem' gave the strongest statistical confirmation (despite the exclusion of the textile areas of Yorkshire and

Lancashire). We have to be careful in attributing causality since the relationship between the UK regional distribution of employment and UK-developing country trade patterns is both indirect and two-way, but the existence of strong correlation is itself important in policy as well as theoretical terms. It strongly suggests that the periphery of the UK national economy and the peripheries of the world economy are in direct competition.

(v) we conducted a detailed examination of the residuals to probe for interesting anomalies, and to see if other explanatory factors might have been overlooked (Table 7). Out of the group of 12 industries which appear to have experienced substantially less import penetration from developing countries than their industry characteristics would have led one to predict, 5 are textile items which suggests that the protection of the textile industry has had some restraining effect, and another, shipbuilding, is also a protected industry (albeit by subsidies). Of the remainder, four are from the parts of the electrical engineering industry where unskilled assembly work is important (electronic components, domestic appliances, 'other' electrical goods and telephone and telegraph apparatus). One explanation could be competition from 'low cost' OECD sources, such as Spain and Italy (in domestic appliances for example). Another is the very limited degree of overseas investment by British firms in industries such as electronic components which have elsewhere migrated to developing countries (for example, from the Federal Republic of Germany and the US). Pottery is difficult to

transport in large quantities and considerations of design and quality are also important. We have no ideas to volunteer on brushes and brooms!

Amongst the industries which have experienced 'above normal' import penetration by developing countries, several are interesting cases of industries which have apparently adjusted relatively easily and more or less willingly to developing country import competition and might repay the attention of future case study work: leather goods, clocks (although there are definitional questions here in digitals versus clockwork), sports goods, toys and games. Two others, shirts and woven cotton fabrics, are known to have experienced exceptionally high import penetration and a major objective of MFA renegotiation was to shield them from further competition. Another is a statistical anomaly - aerospace - caused, we suspect, by treating aircraft brought in for service and repair as 'imports'. Finally the high import penetration recorded for handtools and machine tools may be a harbinger of changes to come as some of the more 'advanced' developing countries - Korean, India, Taiwan - move up the human capital ladder away from traditional labour intensive goods to non-traditional (but also labour intensive) metal working.

On the export side, it is noteworthy that the most significant 'underachiever' is computers, and another is electronic components (to the extent that processes use high R & D rather than large amounts of unskilled labour). In both cases the industries are recognised by British, and other governments, as candidates for 'infant industry' protection by subsidy and import controls. Several of the remainder in this category (wood manufacture, timber, furniture, leather, paper and board) probably owe their positions

on the list to the failure of the model which we have used to reflect the importance and availability of domestic raw materials (for which we cannot conceived of a satisfactory direct or dummy measure utilising UK data). We are mainly interested, in this exercise, in trade with developing countries rather than with the world as a whole, but the residuals for UK revealed comparative advantage with the world as a whole suggest that 'poor' performance (resulting from 'above normal' import penetration or 'below normal' exports) is most striking for the same industries which perform 'badly' in trade with developing countries (computers; machine tools, textile weaving, watches and clocks, timber and paper products) but with some additions (office machinery, photography and copying equipment). We hasten to add that this analysis of residuals has to be treated cautiously in terms of policy significance. it is not a coin-in-the-slot guide to which industries need remedial government intervention. The analysis is descriptive, not normative. And although the 'fits' of the equations were good by the standard to cross-section regression, we were able to explain less than half of the total variation in the dependent variable for UK-developing country trade patterns.

Pulling together the main results of the study of patterns of UK-developing country manufacturing trade, some policy conclusions which emerge, though we present them with caution. To the extent that this trade affects particular groups of British workers through import competition it presents a particular problem for industries with a high share of unskilled and manual workers, generally badly paid and predominantly women, and especially in industries which are well represented in problem regions (all these being correlated). But the establishment of a statistically significant relationship between trade patterns and these variables tells us nothing about how

important the developing country 'adjustment problem' is in relation to the other influences on employment and income change. And it tells us nothing about the time period over which the adjustment problem has to be faced. (Indeed, over the period which we considered, 1970-78, the industry characteristics did not emerge as significant correlates of changing trade patterns.) To understand more clearly what 'triggers' protection, these factors and others have to be considered. To this we now turn.

III. STUDY 2. STATISTICAL ANALYSIS OF PROTECTIONIST ACTIONS

Attempts to explain variation in protectionist pressure among industries have acquired increasing interest and topicality with the proliferation of selective import restraints directed in large part at products from newly industrialising countries: the so-called "new protectionism"[11]. As recent summary papers by Baldwin and Balassa have made clear, the most plausible explanations of protectionist pressure are unlikely to be simple but entail a considerable number of influences, both political and economic, not all of which are susceptible to measurement.[12] One reason for looking with particular interest at the UK is that its trade policy, within the last five years, has undergone considerable transformation from being one of the most liberal in Europe (in relation to trade with developing countries) to one of the least (though it may now be reverting back). Many of the questions raised by this change cannot of course be answered by means of a cross-section study of protection among UK industries. Such a study could not explain the ways in which Britain differs in circumstance and policy from other industrialised countries. It cannot explain the political and economic changes which have

taken place over time. But as long as the general problems of the British economy take an industry-specific form, in terms of trade policy, it is important to try to understand what determines the specific form.

The Hypothesis

The reasons why one industry is more successful than another in mobilizing government support for protectionist measures directed specifically at developing countries, are often given in terms of the excessive speed of adjustment demanded of the industry, and in particular the effects of loss of employment in the industry. Both of these are no doubt important but there are also other factors, connected with the industry's capacity for political lobbying or the interests of capitalists and remaining workers in the industry, which may be more important. Inertia - the reluctance of governments to risk unpopularity by removing controls already in place - may be more important still. One could formulate two alternative hypothesis. One is that interindustry variations in the incidence of protection (and changes in it) reflects a wish by governments to minimize short run adjustment costs for labour. Were this the case, the rate of change in import penetration, and of employment in the industry, could emerge as significant factors explaining the incidence of protection. Another is that protection is not primarily a response to adjustment difficulties but of a result of efforts by capital and labour which is employed in the industry permanently to change the distribution of income in their favour. If this were so we would expect the greatest pressure for protection from those industries for which high levels of import penetration (rather than rates of change) undermine wages and profits, and for given levels of import penetration from high wage industries and industries where capital assets are large in relation to the number of workers.

Dependent Variables

There are considerable practical difficulties in measuring and specifying the 'triggering' of protection. The problems are complicated in the case of the UK by the fact that pressures for protection occur at the national-level but measures are, for the most part, implemented at the EC level. The pressures, moreover, are difficult to trace even at the national level. Decision making in the UK is not noted for transparency. There is no equivalent to the U.S. International Trade Commission whose voting patterns represent a possible measure of protectionist pressure. At a Community level the resolution of competing national interests occurs in a manner not, at first sight, susceptible to rigorous analysis. The protectionist measures which emerge have in practice included some apparently at British instigation (textiles) and some despite British opposition ('sensitive' tariff treatment of plywood and hand knotted carpets). But there is no concrete evidence to support even qualified assertions of this kind.

If we concentrate solely on quantifiable actions and ignore the unquantifiable pressures there are still considerable difficulties. Statistical measurement has understandably concentrated upon tariffs as an index of protectionist action. Some of the most important recent studies of the political economy of protectionism, by Anderson, Caves and Helleiner for example have sought to explain variation in measures of nominal and effective protection (which can incorporate subsidies as well as tariffs). 13 This may be appropriate in countries where the tariff is the main instrument of commercial policy (as in Australia) and for consideration of trade between the OECD countries which have managed, by and large, to outlaw quantitative restrictions on trade among themselves. But even the use of tariff, and

equivalent, measures in this context has not always proved very rewarding. One study of effective protection in the UK, by Oulton, was not able to find any explanatory factors which significantly accounted for inter-industry variations. 14 He concluded that the variations were mainly accounted for by changes which had occurred in the 1930s, successive rounds of tariff negotiations having broadly preserved the inter-industry differentials while reducing the overall tariff level. Attempts have been made, notably by Cheh, to explain (successfully) the change which did occur in rounds of tariff negotiations - which concerned developing countries only indirectly - in terms of relative adjustment costs within labour force. 15 When analysing protectionist action against manufactured imports from developing countries use of tariff-based measures for analysis, nominal or effective, is unlikely to be productive. First, a major characteristic of the new protectionism is the use of non-tariff measures, notably 'voluntary export restrictions'. The use of VERs makes difficult even an indirect measure of the tariff equivalent. This is because the difference between the cif price of imports subject to controls and domestic ex-factory prices (a reasonable measure of the tariff equivalent of a QR where imports and import substitutes are identical products and transport costs are small) would fail to incorporate the element of monopoly rent which accrues to exporters under VER's. Secondly, even where tariffs are the main instrument of protection, conventional measures of nominal or effective rates are unlikely to capture adequately the way in which tariffs operate. This is because of the operation of generalised and specific tariff preference schemes. Under the EC's General Scheme of Preferences (GSP) some of the imports of a product into the EC from developing countries will

often be dutiable and the rest not, the relative magnitudes varying from one part of the year to another, from one country to another (both country of origin and destination) and from one sub-product to another. The rules which determine the extent of nondutiable access are highly complex. Long books have been written merely describing the system, let alone analysing it.[16] Complex though it is, a few broad categories can be discerned. Many products enter the Community virtually duty free: 'non-sensitive' items under the GSP. Others enjoy virtually no tariff relief despite elaborate mechanisms to give a small degree of duty-free access: 'sensitive' products. Yet others are in an intermediate stage, 'semisensitive' items. This breakdown ignores the additional element of complexity added by according different treatment to different groups of developing countries (Lome, Mediterranean etc.).

The approach adopted here is to divide the UK industrial groups into four according to the severity of protection currently accorded against competition from developing countries: products enjoying protection through quantitative restrictions; products with 'sensitive' tariff status or else dutiable but excluded from the GSP scheme; 'non-sensitive' items which enjoy virtually unrestricted market access to the UK; semi-sensitive products. Different combinations of categories were used to form different 0-1 variables ('unprotected' and 'protected') and several techniques were used to try to explain the variation in a protection measure which had this noncontinuous form. It needs however to be stressed that the process of classification was somewhat rough and ready. Products were allocated to categories if 50% or more of developing country imports in that category of products attracted the treatment described. There are enormous data problem stemming from the fact

that UK industry data is grouped into 3 digit categories while trade policy measures can be traced only in terms of highly disaggregated tariff items. A two stage data transformation had to be made, from 3 digit industrial categories to 5 digit SITC trade categories, and then to a (usually 6 or 7 digit) Brussels Tariff Nomenclature (BTW) list. If carried out with precision, such a task would be of mammoth proportions, scarcely justified by the somewhat approximate character of the exercise. Fortunately the task was facilitated by the fact that many of the categories were self-evident. But there were some difficult cases. For example, current (1978) UK imports of footwear from developing countries are roughly equally divided in value between those subject to quantitative restrictions (from Korea and Taiwan) and those which are tariff 'sensitive'. One or two categories such as 'electronic components' have a multitude of sub-divisions accorded different treatment ranging from tariff 'sensitive' (transistors, valves, integrated circuits) to 'non-sensitive'. An attempt was made to apply a consistent weighting but in the unhappy knowledge that the weighting method could not be neutral, and that any trade weighted criterion would reflect the influence of trade restricting measures on trade flows. Another problem was that not all trade policy measures fell within the four categories above subsidies (eg to ship building) or countervailing, anti-dumping, duties. These were allocated in a way that seemed most comparable in terms of effects: subsidies to shipbuilding or anti-dumping duties on Brazilian shoes were treated in effect as equivalent to the imposition of a tariff. Less than total precision is therefore claimed for our four alternative measures of protectionist action. These define protection in terms of a 0-1-2-3 variable which incorporates each of the four

categories (PRMSA), and 0-1 variables which classify as 'protected' products which attract quantitative restrictions (PRMSD), sensitive tariff treatment ($PREMS^B$) or semi-sensitive treatment ($PRMS^C$) (Table 8).

A final point is that protective action has a two way relationship with at least some of the factors which help to explain it. The level of, and rate of change in, import penetration help to explain, but are also in part explained by, the structure of protection. Even more, changes in the structure of protection will influence trade performance by industry. In order to capture this dynamic element, however inadequately, a 0-1 variable for change in protection was adopted (PRMSE). Not a great deal is claimed for this variable since it measures in a very rough and ready way some extremely complex changes that have taken place consequent upon UK entry to the EC, in addition to some restrictions more obviously protective in intention (eg a tightening of textile quotas).

Independent Variables

Many possible factors, representing aspects of different hypotheses about economic and political behaviour, can be used to try to interpret protection. Anderson suggests a couple of dozen. We have tried to group possible explanatory factors into rough categories representing variations between industries in the pressure for adjustment, in the ability to adjust, and in the ability to mobilise political pressure, to secure or retain economic rent by operating in a protected environment.

Other things being equal it is probable that variations in protectionist pressure between industries will be related to the differential pressure on these industries to adjust. The demand for industries to adjust

Table 8: Classification of Industries in terms of Protection Measures

MLH	Name	PRMSA	Comments
261	Oil refining	1	
263	Lub oils	1	
271	Gas chemicals	0	Some minor tariff items
272	Pharmaceuticals	0	
273	Toilet preparation	0	As 271
274	Paint	0	
275	Soap	0	
276	Resins	0	As 271
277	Dyes	0	
278	Fertilisers	0	
279	Miscellaneous Chemicals	0	
311	Iron and steel	3	Quotas being introduced
311	Steel tubes	1	
321	Aluminium	2	Main items not in GSP
322	Copper	1	Main items semi-sensitive
323	Other non-ferrous	0	Some minor tariff items
331	Agriculture machinery	0	
332	Machine tools	0	
333	Pumps and valves, etc.	0	
334	Industrial engines	0	
335	Textile machinery	0	
336	Construction equipment	0	
337	Mechanical handling	0	
338*	Office machinery	0	Major item - calculators - semi-sensitive in GSP.
339	Other machinery	0	
341	Process plant	0	
349	Other mechanical engineering	0	
351	Photographic copying	0	
352	Watches and clocks	0	Some minor tariff items
353	Surgical equipment	1	
354	Scientific equipment	0	
361*	Electrical machinery	1	One major item - circuit breakers - uncertain classification
362	Wires and cables	1	
363	Telegraphic apparatus	0	
364	Components	2	Major items - transistors & valves - sensitive or quota.
365	Broadcasting equipment	2	Major items - radios, TV - tariff sensitive or quota.
366	Computors	0	
367	Electronic capital goods	0	
368	Appliances	0	
369*	Other electrical	0	Uncertain classification
370*	Ships	2	Subsidy treated as tariff
380	Tractors	0	
381	Cars	0	
382	M/Cycle - bicycle	0	
383	Aerospace	0	
384	Railway vehicles	0	
390	Small tools	0	

Table 8 - continued

391	Hand tools	0	
392	Cutlery	1	
393	Bolts, nuts	0	
394	Wire	0	
399	Metal industry n.e.s.	0	Small tariff items
411	Man made fibre	1	Under surveillance
412	Spinning textiles	3	MFA
413	Weaving	3	MFA
414	Woollens	3	MFA
415	Jute	3	Bilateral quotas
416	Rope and twine	2	
417	Hosiery	3	MFA
418	Lace	2	Embroidery sensitive, lace non-sensitive under GSP
419*	Carpets	2	Sensitive but only Belgian interest in tariffs in EEC's GSP.
421	Made up rugs	2	
422	Narrow fabrics	3	MFA
431	Leather	2	
432	Leather goods	2	
441	Weather proof outerwear	3	MFA
442	M & B tailored outerwear	3	MFA
443	Womens' tailored outerwear	3	MFA
444	Shirts, etc. underwear	3	MFA
445	Dresses, etc. underwear	3	MFA
446	Hats, caps, etc.	0	
449	Dress industries n.e.s.	3	MFA
450*	Shoes	3	Equal weight of quotas and tariffs
461	Refractory, etc.	0	Minor tariff items only
462	Pottery	0	Minor tariff items only
463	Glass	0	Minor tariff items only
471*	Timber	1	Some imports tariff sensitive (eg plywood).
472	Furniture	2	
475	Wood containers	1	
479	Miscellaneous wood	0	Some tariff items
481	Paper and board	0	
489	Other printing	0	
491	Rubber	0	Some rubber goods difficult to classify
492	Linoleum	0	
493	Brush and broom	0	
494	Toys, sports goods	1	
495	Stationers' goods	0	
496	Plastic products	0	
499	Miscellaneous manufactures	1	Very mixed. Some non-sensitive

* Indicates case which presented difficult classification problems

to developing country competing imports will depend, first of all, on the rate of change of import penetration, measured by $IP_{LDC}^{1978-70}$, or by the same measure calculated over a different period and for different groups of countries. An additional and offsetting fact could be $ES_{LDC}^{1978-70}$. This implies that the demand for adjustment in the given industry is being reduced, in part, by offsetting changes on the export side (but the firms benefiting may be located elsewhere and it is arguable that it is 'gross', not 'net' import penetration which is relevant in considering the demand for adjustment). Other things again being equal there will be greater job displacement the higher the labour output ratio, LAB; the more labour intensive the industry (in relation to output) the greater, in crude terms, the need for adjustment by the labour force. Trade with developing countries is, however, but one factor however imposing involuntary unemployment, others being changes in demand, technological advance and trade with other countries. We do not propose to look at these factors individually. The rate of change in employment in the industry EMP^{1978} is taken to be a measure of their cumulative effect (on labour). It is a reasonable working hypothesis that the greater the overall pressure to change, the greater the resistance to any individual influence. We would expect on the basis of adjustment pressures the incidence of protection to correlate with $IP_{LDC}^{1978-70}$, LAB and EMP 1978-70 and inversely with $ES_{LDC}^{1978-70}$.

Resistance to trade induced change is also likely to be greater to the extent that the process of adjustment is more difficult than in other industries. One factor involved is the training and skill of the labour force. Manual workers will normally have greater difficulty in finding alternative

employment since they have more restricted options (but on the other hand skilled workers and executives may be less mobile because of a wish to use specific skills, and because of higher expectations of alternative jobs). OPSH and SKILL should capture these effects. Women are likely to be less geographically mobile than men, and therefore less able to adjust to industrial change (WMSH). The elderly are also likely to be less geographically mobile and immigrants will face greater barriers to re-entry into the labour force but we have no data to test propositions related to either category. Employees with low wages (AVWAGE), and expectations of low wages, may also be less mobile partly because they have less incentive to take any further work (relative to what they can receive from unemployment benefit). Finally there is the extent to which additional unemployment is created in areas where unemployment is already above average, or where employment is regionally concentrated. In both cases, the adjustment problem would be more difficult for labour.

The capacity of firms to adjust may well depend substantially on their size, (AFSZ) which one would expect to be related to the ease of obtaining finance for bridging and diversification purposes. Other factors are the product diversity of firms and the degree of internationalisation of production. Neither of these seemed to us to be capable of satisfactory measurement though FINV should give us some indication of the extent of internationalisation of capital. We would also expect that protectionist pressure would be inversely related to value added per employee (VAPM) which will reflect both wage and profit levels. The role of wages we have discussed. Profitability would also be a factor in an industry's ability and willingness to accommodate change without protection. CHOT (the growth of output) is a possible proxy

for profitability and as such would vary inversely with protection. To summarise these points, if protectionist pressure is greatest where the capacity to adjust is least, we would expect the incidence of protection; to vary inversely with AFSZ, CHOT, FINV and VAPM, AVWAGE, OPSH and directly with the share of unskilled workers in the labour force (SKILL) and women (WMSH).

Over and above the pressures created by the demand to adjust and economic and social factors making for resistance to adjustment, political considerations may be an additional influence. Political pressures are, in many respects, likely to reinforce the factors described above. For example the more labour intensive the industry (relative to output), the more votes directly involved preportionately. Regional concentration may also facilitate political mobilization. The size of the industry in employment (EMP^{78}) terms could be a political factor though it has no economic significance. In other respects, political pressures may work in the opposition direction to those already suggested above; for example, we would expect men to resist painful industrial change more vigorously than women (many of whom are second earners in a family). Other factors are important but cannot easily be measured. One is union strength. But in the UK, unions cut across industrial boundaries and there is no meaningful measure of the effectiveness of union representation at the level of industry categories which we have chosen. Another is the relationship between the geographical distribution of employment and the distribution of marginal parliamentary seats. Political boundaries unfortunately do not always correlate with our regional categories. The above factors relate to the political organisation of labour. Capital can also organise to defend its interests to an extent which will vary in proposition to average firm size, to the degree of concentration (CONC), the strength

of its interest in terms of fixed capital assets, and the degree of national cohesiveness of capitalists in the industry.

Finally there is the role of a high level of import penetration (IMP^{78}_{LDC}). This has two possible aspects. The first is that it is related to adjustment pressure. From a high initial level of import penetration a given growth of imports will have a greater absolute impact on jobs in the competing domestic industry. Second there are distributional implications. High levels of import penetration will usually represent a high degree of competition in the home market, and therefore pressure on wages and profits which protection is designed to counter. ES^{78}_{LDC} will work in the opposite direction.

Our predictions, from the above analysis, of the likely relationship between the incidence of protection and explanatory variables would be that protection would be more likely to occur the higher the level of import penetration (IP^{78}_{LDC}) and the rate of change of import penetration (IP^{78-70}_{LDC}) and inversely with the level of the export sales ratio (ES^{78}_{LDC}) and its rate of change (ES^{78-70}_{LDC}). Protection would be more likely the greater the concentration (CONC), the lower the penetration by foreign capital (FINV) the larger the industry (EMP^{78}), the greater the decline in sectoral employment (EMP^{78-70}), the slower the growth in output in the industry ($CHOT^{78-70}$), the higher the labour-output ration (LAB), and the greater the concentration of employment in regions with above average unemployment (RBS1). Other factors would be more ambiguous. We would expect a positive correlation with the share of women and manual workers in the labour force (WMSH, OPSH, SKILL) to the extent that these categories are likely to have greater adjustment problems, but a negative correlation to the extent they are

likely to have less bargaining power. We would expect capital and highly trained manpower to have higher bargaining power ($\frac{K}{L}$, R + D) but less serious problems of adjustment than labour in general and the unskilled in particular. The highly paid have more to protect but probably also have a greater range of attributes to facilitate reabsorbtion in the labour force, if displaced. Small firms are likely to want protection more but are less capable of organising to achieve it (AFSZ). When we come to interpret the results we have to be careful to the extent that many of these factors related the capacity to adjust, are, as we already know, correlated with import penetration itself, and may in any statistical analysis reflect this correlation rather than association based on lobbying activity.

Methodology

The initial approach was to extend the regression analysis using the protection measures as dependent variables in a regression equation incorporating most of the factors which seem, at first sight, likely to be able to explain inter-industry variations in the pattern of protection. See Appendix 3 Note (1).

A variation in the analysis was to run the protection measures as additional independent variables with those already used to interpret the pattern of comparative advantage and changes in it. The purpose of this exercise is to try to detect the existence of feedback; protection is not only influenced by the pattern of trade, but helps to influence it (for a note on the statistical implications see Appendix 3(2).

Because of the limitations of regression analysis we used discriminant analysis to isolate the distinctive contributions of the various explanatory factors.

Results

For the regressions with protection measures as independent variables the coefficients from adding three of the four protection measures are summarised in Table 9. From PRMS to D the incidence of protection is positively related to levels of import penetration, but not to the change in levels of import penetration. The protection measures emerge as highly significant statistically, in the equations for which levels of import penetration are the dependent variables and for which there was not a great deal of difference among the various protection variables. The change in protection variables, PRMSE, gave virtually the same results. What these results suggest is that there is no major feedback from the incidence of protection to the changing pattern of trade. This would have been indicated by a statistically significant coefficient and a negative sign; the signs are correct in each case, except for PRMSE, but none of the coefficient are significant at reasonable confidence levels. It is possible that the time lag before changes in trade policies affect the structure of trade are succiently long that our regressions do not capture any effects.

The equations in which the protection measure is the dependent variable have a reasonable 'goodness of fit' (Table 10). The linear relationship between one of the dummy variables and the set of independent variables produces an R^2 of 0.55. The R^2 may however be misleadingly high since IP_{78}^{LDC} is included in the equation as well as several correlates of it. Moreover, as we have already indicated, the T-tests of significance have to be interpreted cautiously. The factors which emerge as important are those most closely related to the level of developing country import penetration (share of women, share of manual workers, regional bias) with one other factor which

Table 9. Use of Protection Measures as Independent Variables with Import Penetration as Dependent Variables in Regression

Dependent Variable	FINV	K/L	R+D	RBSI	SKILL	CONC	PRMS (B) (C) (D) (E)	CONST	R^2	F
							PRMS B			
$IP^{1978-1970}_{LDC+OPEC}$	.116 (.082)	-.628** (.223)	-.058 (.137)	.167*** (.040)	-.047 (.045)	.035 (.029)	-.541 (1.727)	-.575	.23	3.42
$IP^{1978}_{LDC+OPEC}$	-.028 (.083)	-.314 (.225)	.223 (.138)	.0835** (.041)	.044 (.045)	-.012 (.030)	3.646 (1.736)**	1.409	.30	4.72
							PRMS C			
$IP^{1978-70}_{LDC+OPEC}$	.118 (.076)	-.614*** (.229)	.054 (.133)	.116*** (.040)	-.047 (.044)	.035 (.029)	-.548 (1.350)	-.525	.23	3.43
$IP^{1978}_{LDC+OPEC}$	-.0481 (.076)	-.388 (.228)*	.258 (.133)*	.092 (.040)**	.049 (.044)	-.017 (.029)	3.175 (1.348)**	1.294	.29	4.53
							PRMS D			
$IP^{1978-70}_{LDC+OPEC}$	.098 (.076)	-.625 (.220)***	.053 (.131)	.179** (.041)	-.027 (.048)	.030 (.029)	-2.33 (2.10)	-.745	.24	3.63
$IP^{1978}_{LDC+OPEC}$	-.057 (.079)	-.277 (.223)	.289 (.133)**	.074 (.042)*	.029 (.048)	-.016 (.030)	4.387 (2.130)**	2.618	.28	4.29
							PRMS E			
$IP^{1978-70}_{LDC+OPEC}$	.143 (.079)	-.650*** (.225	.032 (.137)	.164*** (.040)	-.058 (.045)	.041 (.030)	.639 (1.725)	-.962	.24	3.42
$IP^{1978}_{LDC+OPEC}$	-.026 (.078)	-.350 (.223)	.206 (.136)	.098** (.039)	.0362 (.045)	-.009 (.029)	4.378** (1.712)	1.253	.30	4.72

Note: Standard error in bracket.
* Significant at 10% confidence level.
** Significant at 5% confidence level.
*** Significant at 1% confidence level.

Table 10: USE OF PROTECTION MEASURE AS DEPENDENT VARIABLE IN REGRESSION ANALYSIS

Dependent Variables	$IP^{1978}_{LDC+OPEC}$	$ES^{1978}_{LDC+OPEC}$	$IP^{1978-70}_{LDC+OPEC}$	$ES^{1978-70}_{LDC+OPEC}$	AFSZ	EMP^{78}	EMP^{78-70}	RBSI	R+D	LAB	OPSH	WMSH	$CHOT^{78-70}$	K/L	Const	R^2	F
PRMSB	.009 (1.016)	-.006 (-1.10)	-.148 (-1.989)**	-.042 (-1.202)	-.003 (-.538)	.145 (.273)	.418 (1.027)	.007 (2.661)***	.009 (1.004)	-.210 (-.131)	1.503 (2.841)***	.007 (2.625)***	-.0009 (-1.197)	.024 (.721)	-.974 (-2.148)**	.55	6.3
PRMSC	.015 (1.413)	.005 (-.719)	-.119 (-1.99)**	.062 (1.384)	.007 (1.103)	-.0005 (-.842)	.555 (1.09)	.006 (1.729)*	.003 (.278)	-.686 (-.342)	1.487 (2.237)**	.003 (1.077)	-.015 (-1.55)	.0001 (.002)	-.483 (-.850)	.42	3.8
PRMSD	.006 (.954)	.002 (.267)	-.012 (-2.722)**	.018 (.668)	.001 (-.273)	.0008 (2.035**)	-.046 (-.142)	.008 (3.729)***	-.008 (-1.194)	-1.927 (-1.532)	.609 (1.463)	.009 (4.729)***	-.001 (-1.879)*	-.0001 (-.037)	-.460 (1.291)	.59	7.4

Note: T-statistic in brackets.

PRMSB is dummy variable 0-1 where 0 is no protection
1 is sensitive tariff protection or quotas or VERs.

PRMSC is dummy variable 0-1 where 0 is no protection
1 is all forms of tariff or non-tariff protection.

PRMSD is dummy variable 0-1 where 0 is no protection
1 is quotas or VERs.

may be independent, the growth of output (inversely). The other statistically significant factor is the rate of change of import penetration but the signs are wrong (if protection is a response to high rates of change of import penetration).

The results of the discriminant analysis are set out in Tables 11 and 12. There is a very neat and conclusive differentiation between the 'protected' and 'unprotected' categories. The difference between group centroids on all measures was quite distinct and increased, step wise, as we progress from the categories incorporating the lightest protection (semi-sensitive tariff treatment), PRMSC, through PRMSB to PRMSD (quotas). The probability of correct allocation was extremely high (90% or over for when the maximum number of variables was included in the discriminant function). The differentiation between categories was also clear for the change in protection variable (PRMSE). Secondly, the analysis can be used to identify variables which appear particularly important. The strongest factors are those industry characteristics which correlate with developing country comparative advantage, notably the share of women, the average wage, the regional bias and (for tariff protection) the share of manual workers. (SKILL) for which some of the above are proxies also showed up strongly using the direct measure in two of our cases. When we dropped the various factors which correlated with import penetration we lost only a little of the overall explanatory power of the discriminant function and the level of import penetration itself emerged as substantially the most important factor (or comparative advantage if import penetration and export sales ratios are combined).

There was little or no evidence that the extent of, or change in, the extent of protection had very much to do with the pace of adjustment

Table 11: DISCRIMINANT FUNCTIONS FOR PROTECTION MEASURES

	Combination 1			Combination 2			Combination 3			Combination 4		
	PRMSB	PRMSC	PRMSD	PRMSB	PRMSC	PRMSD	PRMSB	PRMSC	PRMSD	PRMSB	PRMSC	PRMSD
Tests of Significance												
Wilks Lamada	.4472	.5759	.4092	.6053	.6590	.6461	.461	.590	.436	.739	.766	.793
Chi Square Approx.	62.768	43.043	69.697	40.414	33.582	35.205	60.167	41.736	65.651	24.668	21.703	18.910
Significance (85 Degrees of Freedom) (% Probability of Equal Centroids)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	0.008
Discriminant Functions												
IP 1978 LDC+OPEC	-.229	-.365	-.209	-.830	-.794	-.855						
ES 1978 LDC+OPEC	.229	.163	-.051	.638	.479	.531						
RCA2 1978 LDC+OPEC							.185	.202	-.029	.931	.798	.85
IP 1978-70 LDC+OPEC	.373	.427	.385	.379	.442	.399						
ES 1978-70 LDC+OPEC	-.209	.274	-.112	-.363	-.379	-.343						
RCA2 1978-70 LDC+OPEC							-.313	-.384	.044	-.199	-.292	.152
AFSZ	.220	-.514	-.112	.004	-.540	-.063	.129	-.664	-.163	-.037	-.628	-.012
EMP 1978-70	-.236	-.285	.032	-.032	-.108	.366	-.262	-.319	-.022	-.101	-.171	.286
EMP 1978	.047	.168	.347	-.089	.122	-.229	-.052	.782	-.339	.008	.233	-.133
LAB	.031	.041	.347	-.307	-.211	-.118	.222	.297	.399	.414	-.306	-.300
CHOT 1978-70	.320	.474	.486	-.177	.408	.089	.849	.515	.582	.272	.524	.289
R+D	-.183	-.057	.207				-.196	-.119	.187			
OPSH	-.642	-.578	-.320				-.769	-.736	-.396			
K/L	-.312	.001	-.015				-.213	.182	-.020			
WMSH	-.615	-.288	-1.039				-.720	-.419	-1.198			
RBSI	-.520	-.380	-.704				-.545	-.451	-.637			
Group Centroids												
Unprotected	.678	.730	.520	.493	.618	.321	.660	.709	.493	.363	.469	.221
Protected	-1.787	.986	-2.712	-1.293	-.827	-1.672	-1.731	-.959	3.528	-.952	-.635	-1.153
Classification (% probability of correct allocation)												
Unprotected	92	92	92	87	84	86	90	84	93	86	76	74
Protected	83	73	93	71	67	78	83	76	100	79	65	86
Overall	90	84	92	83	77	85	89	80	94	84	71	76

Table 12: DISCRIMINANT FUNCTIONS FOR PROTECTION MEASURES
(A Variation on Table 11)

	PRMSB	PRMSC	PRMSD	PRMSE	PRMSE
Tests of Significance					
Wilks Lamada	.417	.572	.435	.510	.663
Chi Square Approx.	66.444	42.406	63.191	51.145	32.607
Significance (84 Degrees of Freedom) (% Probability of Equal Centroids)	.000	.000	.000	.000	.000
Discriminant Functions					
IP 1978 LDC+OPEC	-.392	.532	-.427	.475	-.903
ES 1978 LDC+OPEC	.165	-.159	-.006	-.166	.64
IP 1978-70 LDC+OPEC	.176	-.270	.328	-.004	.27
ES 1978-70 LDC+OPEC	-.219	.254	-.116	.122	-.313
AFSZ	.135	.643	-.124	-.088	-.057
CONC	-.030	-.156	.227	-.346	
LAB	.295	-.245	.143	-.249	-.031
K/L	-.596	.102	-.084	.543	
FINV	.698	-.420	.414	-.672	
R+D	-.284	.106	.086	.323	
EMP 1978	-.158	-.105	-.300	.195	-.157
EMP 1978-70	-.142	.198	.110	.298	.314
SKILL	.021	.144	-.540	.482	
AV WAGE	1.003	-.401	.374	-.378	
CHOT 1978-70	.253	-.497	.224	-.228	.313
RBSI	-.329	.227	-.528	-.006	
Group Centroids					
Protected	.706	-.702	.496	.498	.36
Unprotected	-1.933	1.007	-2.552	1.882	-1.36
Classification (% probability of correct allocation)					
Unprotected	93	86	90	84	89
Protected	91	71	85	83	71
Overall	92	80	90	84	82

facing the labour force. The level of import penetration was consistently more important than the rate of change. The rate of change of employment did not show up as important. The idea propagated by governments that protection is mainly used as a safeguard against 'sudden rushes' of imports, to assist workers faced with over-rapid employment decline, is not supported by evidence from currently operational protective measures (unless the 'sudden rushes' occurred some time ago, and the protective measures have just been left in place). One factor which does consistently show up as particularly important is the role of foreign investment in UK industry. This which may suggest a significantly greater degree of adaptability for foreign firms. Other characteristics of industrial structure, firm size or concentration, for example, were, for most of the variables and most combinations, unimportant. Nor is there a great deal of evidence that factors associated with sector-specific political lobbying - such as the size of the industry - have much independent influence. Developing country manufactured imports are being resisted across the board; wherever their comparative advantage is greatest, the resistance is greatest.

We should stress that the conclusions must be regarded as tentative. In particular it is difficult to unscramble the effects of trade performance *per se* and the factors which correlate with it but may have an independent influence. We have for example shown that there is an association between import penetration by developing countries and the regional 'bias' of employment in the industries most affected, but there is also a direct political link with protection to the extent that Lanchashire and West Yorkshire, the main centres of textiles production, have a considerable concentration of

politically marginal constituencies. The allocation of protection measures was crude and necessarily built around the three digit industrial classification scheme. In some contexts policy decisions are taken at a more aggregated level (textiles and clothing), and in others at a more disaggregated level (within office machinery for example, digital machines and typewriters are 'non-sensitive', while calculators are 'semi-sensitive' in tariff terms). A particularly serious distortion has been introduced by treating textiles and clothing branches as distinct for policy purposes. They account for about half of the protected items but, in practice, are considered politically as being represented by one main lobby. They are also linked through interindustry transactions. While our analysis gives a snap shot of the pattern of protection at one point of time, we are not able to trace the sequence of events which led to protection being triggered. It would in any event be extremely difficult to quantify the changes which have taken place, the most significant being the tightening of quotas (for textiles and clothing) within categories already subject to quantitative restraint. Case study work at industry level will be necessary to complement the analysis.

If we are however correct in inferring that there is strong generalised resistance in the UK (and probably in the EC as a whole, since the measure are at EC level) to industrial specialisation with developing countries, then there is a fundamental problem. We are dealing with more than an 'adjustment problem' presented by particular groups caught up in a process of adjustment which is too fast or painful in their particular case - problems which can in principle be handled by means of special schemes to aid injured parties. We suspect that the UK government, and its European partners, have

not passsed through the psychological political barrier of accepting that developing country manufactured exports, beyond a token level, can be in their interest as well as that of the exporting developing countries.

The absence of negotiating machinery to ensure trade liberalisation, and an agreed set of 'rules of the game' for manufacturing trade with developing countries - other than restraint agreements such as the MFA - must be a significant factor in ensuring the UK trade policy vis-a-vis developing countries has been allowed to acquire and retain an essentially negative character. Another is a reluctance to contemplate removal of protection once it has served an initial purpose of slowing down an adjustment problem in the past.

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Appendix 1

Definitions

X_i = Exports, I_i = Imports, S_i = Sales of domestic production where subscript i is industry, subscript r is region.

Variables

1. Indices of Trade Performance (%)

a) The Export-Sales Ratio (ES^r)

$$ES_i^r = \frac{X_i}{S_i}$$

b) Import Penetration (IP^r)

$$IP_i^r = \frac{I_i}{S_i + I_i - X_i}$$

c) Revealed Comparative Advantage (RCA)

i) $$RCA1_i^r = \frac{X_i - I_i}{X_i + I_i}$$

ii) $$RCA2_i^r = \frac{X_i - I_i}{S_i + I_i - X_i}$$

2. Indices of the Rate of Change of Trade Performance

For each of the above indices of trade performance a rate of change index was derived in the following typical form

$$ES_r^{1978-70} = \frac{(ES_i^r)_{1978} - (ES_i^r)_{1970}}{(ES_i^r)_{1970}}$$

3. Measures representing factor endowments.

a) Share of 'operatives' in the labour force ($OPSH_i$):

The share of manual workers, skilled and unskilled as a proportion of the total labour force.

b) Share of women employees in the labour force ($WMSH_i$).

c) The average annual wage of the labour force ($AVWAGE_i$).

d) $SKILL_i$ (percentage of unskilled and semiskilled workers in the labour force).

e) Research and Development (R + D)

$$R + D_i = \frac{(\text{R and D expenditure})_i}{S_i}$$

f) Capital - Labour Ratio $\left(\frac{K}{L_i}\right)$

$$\left(\frac{K}{L}\right)_i = \frac{\text{Net investment over 1970 to 1975}}{\text{Employment in 1975}}$$

g) Value added per man ($VAPM_i$).

h) Numbers of workers per unit output (LAB_i).

4. Measures of industrial structure

a) The average firm size ($AFSZ_i$); measured in terms of average sales.

b) concentration of ownership ($CONC_i$): measured by the share of output accounted for by the five largest firms in the industry

c) Foreign investment ($FINV_i$), proportion of sales accounted for by subsidiaries of foreign firms.

5. Measures of the regional distribution of employment in the UK (RBS)

a) $RBSI_i$

This is a measure of the share of employment in industry i in those planning regions which are of above average unemployment and are major beneficiaries of regional assistance (N. Ireland, Wales, Scotland, North England)

b) $RBS2_i$

This measure was defined similarly to RBS1, but 'intermediate' regions (Yorkshire and the North West) were also included among the planning regions of above average unemployment

c) $RBS3_i$

This measures the degree of concentration by region.

6. Protection measures, PRMSCA to E are dummy variables derived as in Table 7.

7. Other variables used

a) the rate of change of employment in the industry $(EMP^{78-70})_i$

$$(EMP_i)^{78-70} = \frac{(EMP_i)_{78} - (EMP_i)_{70}}{(EMP)_{70}}$$

b) $CHOT_i^{78-70}$ - growth of output in the industr

$CHOT_i^{78-70}$

$$\frac{(S_i \quad 78) - (S_i \quad 70)}{(S_i \quad 70)}$$

c) EMP^{78}: size of the labour force.

Appendix 2

Note on Sources of Statistical Information

1. The data base rests on the availability of UK trade statistics translated into three-digit (MLH) industrial categories.

   The original presentation of UK import penetration (and export sales) data by sector was by J. D. Wells and J. C. Imber in Economic Trends August 1977. The ratios which they estimated for 1968-1976 are now regularly up-dated in Business Monitor MQ12 while from time to time summaries are presented in British Business (eg 14 March 1980). Trade data in terms of industrial categories but without ratios is now regularly presented in Business Monitor MQ10. The authors of this study were fortunate to have unpublished Department of Industry Statistics detailing trade in 3-digit MLH categories by region, that is developing countries, COMECON etc.

2. Many of the variables used were computed from the main Census of Production (Business Monitor PA 1000) for years 1970 to 1977.

   There were LAB, $\frac{K}{L}$, OPSH, AVWAGE, VAPM, CHOT).

3. Other Census of production documents were used for other variables. Some were derived from PA 1002 (Establishment Analysis). Vol. 1 (AFSZ) and Vol. 2 (CONC; FINV). Latest summary tables relate to 1975.

4. R & D was calculated from published Department of Industry statistics and relate to 1975.

5. WMSH was calculated from the 1978 figures published in the Department of Employment Gazette. The Gazette (Dec. 1977) was also the source of material for the regional variables. Various Gazettes were used to calculate EMP^{78-70} and EMP^{78}.

6. SKILL was calculated from the UK Census of Population 1971 (10% sample) Economic Activity Part IV.

Appendix 3

Comments on Statistical Techniques

1. Since the dependent variable is dichotomous, the analysis was carried out using the linear probability model and discriminant analysis. However, the following points should be noted:

   a) the linear probability model has two drawbacks:

      i) the error term is heteroscedastic. This results in a loss of efficiency in parameter estimates.

      ii) the predicted values of the dependent variable may lie outside the 0 - 1 interval. This is of course inconsistent with the definition of the dependent variable or the interpretation of the predicted dependent variable as a probability. This problem can be overcome by using logit. We were unable to use the technique as we did not have access to a computer program when we began the project.

   b) Tests were not carried out to check the two assumptions namely multivariate normal distribution and equal variance - invariance matrices within each group.

2. A single equation model has been used for each study. However we can expect the extent of import penetration to influence the taking of protection measures and, conversely. Hence a simultaneous equation model is more appropriate.

A detailed discussion of the consequences of the above can be found in for example Pindyck and Rubinfeld: Econometric Models and Economic Forecasts.

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