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COMPLETING THE INTERNAL MARKET IN THE EUROPEAN COMMUNITY: SOME INDUSTRY SIMULATIONS

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ABSTRACT*

Completing the Internal Market in the European Community: Some Industry Simulations

This paper studies the effects of changes in the internal market of the European Community in a partial equilibrium model of imperfect competition with economies of scale. The model is numerically calibrated to data on ten industries and the effects of two types of policy change are simulated. The first is a reduction in intra-EC trade barriers equivalent to a reduction in implicit tariffs by 2.5 percentage points; the second is the elimination of firms' ability to price-discriminate between different national markets. Sensitivity analysis of alternative ways of modelling firms' behaviour suggests that the results are reasonably robust. The simple reduction in intra-EC trade barriers generates modest welfare gains, but much more substantial gains are associated with integration of national markets into a single European market.

JEL classification: 420, 423, 610
Keywords: imperfect competition, non-tariff barriers, economic integration, European Community

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NON-TECHNICAL SUMMARY

The aim of the work reported here is to assess the likely economic effects of reducing barriers to trade within the European Community in a range of industries in which there may be significant economies of scale. The projections are based on a formal model of international trade, which treats firms as being imperfectly competitive: from a consumer's viewpoint, one firm's brand of a product is different from another firm's brand of the same product, so firms have a certain amount of freedom in setting the market prices of the goods they sell. A model of this nature may capture two effects of completing the internal EC market: increased exploitation of economies of scale, and the potential effects of market liberalization on competition.

The distinction between segmented and integrated markets plays a crucial role in our results. When firms treat different national markets as segmented, they set different prices in each market; but if they treat the different national markets simply as different parts of a single market, then the same price (transport costs aside) is charged in each national market. The behaviour of firms can shift significantly when markets which were segmented become integrated. The monopoly power conferred by a large shares in a firm's home market is greatly diminished if the share of the integrated international market is very much smaller. The single most striking result that we obtain in the paper is that a policy which succeeds in making firms treat the EC market as an integrated market is likely to have much larger welfare effects than a policy which simply reduces border barriers.

The model treats the world market for a product as being divided into six 'countries': France, the Federal Republic of Germany, Italy, the UK, the rest of the EC, and the rest of the world. It is a partial equilibrium model which describes the market for one good at a time and ignores interactions between markets for different goods and for inputs. We apply the model to a selection of ten relatively diverse industries. For each of the industries some estimates of economies of scale are available and some of the industries might be relatively strongly affected by the completion of the European market, e.g. because of the role of public procurement or technical standards. The numerical parameters of the model are based on trade and production data for 1982, and on estimates of scale economies and demand elasticities drawn from secondary sources. The model's parameters also have to be consistent with the large observed differences in firms' share of different national markets, the share of home firms typically being very much greater than that of foreign firms. These differences may be the result of non-tariff trade barriers (such as differences in national regulations), transport costs, differences in distribution networks, or consumer preference patterns. We suppose that transport costs are at an ad valorem level

of 10% and attribute the rest of the difference to unspecified barriers whose heights are described in terms of the percentage tariffs (import taxes) that would produce the same asymmetric trade pattern.

The first set of policy experiments whose effects we simulate using this model is based on a very conservative interpretation of what is involved in 'completing the internal market': the intra-EC implicit trade barriers are reduced in a manner equivalent to a reduction of 2.5 percentage points in average import tariffs. The first effect, is to increase the volume of intra-EC trade, consistently across industries. With a given number of firms, the increased import penetration makes markets more competitive and reduces prices, expands sales, and (except where there is a large increase in output) reduces profits. The effect on national outputs is to reinforce existing differences in trade patterns. In pharmaceuticals, for example, the UK expands and Italy contracts, while in electrical household appliances Italy expands and the UK contracts. The effect, averaged across the EC, of the output changes in each industry is to reduce the cost of production.

If the number of firms changes in response to profit changes, the usual outcome is for there to be a reduction in the total number of EC firms, so that average costs fall further as remaining firms increase in size. There are effects in all industries on EC trade outside the Community: extra-EC imports are replaced as the direct costs of intra-EC trade are reduced (trade diversion), while the reduction of EC costs and increase in competitiveness reduces EC prices, expands extra-EC exports (a form of trade creation) and further reduces extra-EC imports. The changes in average costs and the changes in welfare that result from the policy change are largest in industries which have significant returns to scale and a high proportion of output traded within the EC. The cost reduction and welfare gain are largest when there is entry and exit of firms, but the effect of entry and exit is significant only in the more concentrated industries.

We estimate the welfare gains as being in the range of 8% to 25% of the value of the additional trade created by the policy change, which is significantly less than the estimates of the order of 50% reported in Nicholas Owen's 1983 study of the economic effects of the EC (in a model that includes economies of scale). Our results are closer to those generated by the 1984 modelling exercise of Harris and Cox, who estimate, (using a model with scale economies), a welfare gain of 17.5% of the value of the trade created by multilateral liberalization of Canadian trade with the rest of the world.

We also explore the sensitivity of these results to some aspects of the specification of our model. We find the variation in results across different specifications of the model to be encouragingly small, especially in the light of the theoretical literature which presents examples in which changing assumptions about market structure can reverse the effects of policy interventions.

Our second set of policy experiments for the ten industries takes a much more dramatic view of what is involved in 'completing the internal market'. It is assumed not only that trade costs are reduced, as in the previous case, but also that firms treat the whole EC as a single integrated market and have no ability to price-discriminate between different 'national' markets. With this EC market integration, shares in 'national' markets are no longer of economic significance and all firms have quite small shares of the whole EC market, even in the more concentrated industries. Thus the change being modelled here is much more strongly pro-competitive than the earlier policy experiment. In most industries we find that there are much more substantial profit reductions and in all industries much greater gains to consumers in this than in the previous experiment. In the more concentrated industries, where firms had significant market power, the increase in the competitiveness of the market as a result of integration leads to welfare gains very much larger than those in the segmented market case: in these industries the impact on economic welfare of the reduction in trade costs combined with the shift to integrated markets is typically (with fixed numbers of firms) four times the size of the welfare gain from the reduction in trade costs alone. In most of these industries the welfare gain is between 1% and 4% of the value of aggregate consumption before the policy change.

The facts of industrial concentration, economies of scale and intra-industry trade provide a strong case for modelling many markets as being imperfectly competitive; only a modelling exercise based, like this one, on imperfect competition can hope to capture in a consistent fashion many key effects of policy changes in such markets. This model, however, is at best a crude approximation to the complexity of imperfectly competitive behaviour in the real world. Further, all of the results reported in the paper are of a partial equilibrium nature in that the analysis is conducted on an industry-by-industry basis. It is possible that the omission of some inter-industry interactions leads to a significant underestimate of the effects of policy changes.

We conclude that the gains from 'completing the internal market' differ substantially according to whether the phrase means simply moving the EC closer to being a true common market, or whether it is to be interpreted as the creation of a genuinely unified market on a scale greater than that in the United States. The policy implication of our results is that a major aim of EC competition policy should be to remove the sources of price differences between different national markets within the EC. Policies which achieve this would have more effect on economic welfare in the long run than policies aimed only at those barriers which more directly and obviously affect international trade.

1. Introduction: The achievement of the European Commission's objective of removing all artificial barriers to trade in goods within the European Community by 1992 should have two principal effects on economic welfare. There could be an increased degree of competition, possibly affecting the range of products offered to consumers, as well as prices; while changes in the size of firms could lead to fuller exploitation of economies of scale. These two effects seem likely to raise economic welfare within the EEC.

The aim of this paper is to investigate the size of these effects for a number of industries by undertaking simulations in a formal model. In order to capture the relevant effects we employ a model of trade under imperfect competition, in the tradition of Krugman [1979]. That is, firms operate under increasing returns to scale and produce goods that may be differentiated, and the ensuing industry equilibrium involves intra-industry trade. We generalise the Krugman model in the specification of technology, in the description of firms' behaviour, and with respect to the market structure within which firms operate. The model is one of partial equilibrium, and is calibrated to 10 separate industries in a world economy consisting of 6 countries (France, the Federal Republic of Germany, Italy, the United Kingdom, the rest of the EC, and the rest of the world). Details of the model and its calibration are given in sections 2 and 3 respectively.

We use the model to evaluate two different policy experiments. The first is a reduction in trade barriers between member states of the EC. This policy increases the volume of intra-EC trade, and is pro-competitive, as it increases import penetration in each national market. It results in increased firm scale, lower average cost, and welfare gains in each of our industries. The magnitude of these gains depends on returns to scale, the importance of trade and the degree of concentration in each industry, but the gains are generally modest.

The second experiment is more dramatic. We consider the effect of firms acting on an integrated EC-wide basis, rather than on a segmented national market basis. This removes the monopoly power that firms have in a particular market (e.g. their domestic market) and replaces it by an EC average degree of monopoly power. This is a strongly pro-competitive policy, and, for some industries, the gains are substantial. This second experiment seems to be much closer to the spirit of what is meant by "completing the internal market" than is a mere reduction in trade barriers. It is, however, questionable to what extent it is a policy experiment in a meaningful sense. Existing national trade restrictions imposed by individual EC members, together with the accompanying "article 115" controls on intra-EC trade[1] do undoubtedly play a role in maintaining national price differences by preventing arbritrage (see Pelkman, Wallace and Winters [1988]), and their removal would tend to reduce such price differences. Yet it seems unlikely that full market integration could be imposed merely be removal of these restrictions.

We conduct these experiments in a number of different variants of our model. For all experiments we derive results both when the number of firms is fixed, and when entry and exit of firms is possible. We also compare results for cases when each firms' product range is fixed with cases where firms can change the number of product varieties that they produce, thereby achieving economies of scope. In addition, we know from the theoretical literature that results may be sensitive to whether competition is Cournot or Bertrand (Eaton and Grossman [1986]). For all experiments we report both Cournot and Bertrand cases, although we regard Cournot competition as the more satisfactory, and treat it as our central case.

2. The model. In this section we describe our general model. Calibration of the model to particular industries is discussed in section 3, and policy experiments in the remainder of the paper. The model is one of partial equilibrium, operating at the level of a single industry. Subscripts on variables denote countries, and run from 1 to I, where I is the number of countries. The number of firms active in an industry in country i is denoted n_i, and all firms in country i are assumed to be symmetric. Product differentiation is permitted, and the number of product types produced by a single one of the country i firms is denoted m_i. These products are tradeable, and x_{ij} denotes the quantity of a single product type produced by a firm in country i and sold in country j, at price p_{ij}. In addition to the industries under study, the economy contains a perfectly competitive sector producing a tradeable output under constant returns to scale; this will be taken as the numeraire.

Demands in each country are derived from an aggregate welfare function. It is assumed that each country's welfare function is separable between the numeraire commodity and the differentiated products, so that we may construct a sub-utility function over differentiated products. The sub-utility function for country j will be denoted y_j, and will be assumed to be CES, as in Dixit and Stiglitz [1977][2] Consumers in country j may consume products which are produced in each country, so the number of product types available for consumption is $\sum_{i=1}^{I} n_i m_i$, and the sub-utility function is then,

$$(1) \quad y_j = \left[\sum_i a_{ij}^{1/\varepsilon} n_i m_i x_{ij}^{(\varepsilon-1)/\varepsilon} \right]^{\varepsilon/(\varepsilon-1)}, \quad \varepsilon > 1, \ j=1 \ldots I,$$

where the a_{ij} are parameters describing the preferences of a consumer in country j for products produced in country i. The sub-utility function y_j may be interpreted as a quantity index, dual to which is a price index, q_j taking the form,

$$(2) \quad q_j = \left[\sum_i a_{ij} n_i m_i p_{ij}^{1-\varepsilon} \right]^{1/(1-\varepsilon)}, \qquad j=1 \ldots I.$$

With preferences of this form consumer demands may be derived from a two-stage budgeting procedure. We assume that the marginal utility of income is constant and normalised at unity, so that the welfare obtained in country j from consumption of differentiated products may be written as a function of q_j alone. This indirect utility function will be assumed to be iso-elastic, and take the form,

$$(3) \quad V_j = b_j q_j^{1-\mu} / (\mu - 1), \qquad j=1 \ldots I.$$

where b_j is a parameter measuring the size of the market in country j. Demand for the quantity index of differentiated products may then be derived using Roy's identity to give,

$$y_j = b_j q_j^{-\mu}, \qquad j=1\ldots I. \tag{4}$$

Given total expenditure on differentiated products, $q_j y_j$, demand for individual product types depends on prices p_{ij}. We obtain demand functions,

$$x_{ij} = p_{ij}^{-\varepsilon} a_{ij} q_j^{\varepsilon} y_j = p_{ij}^{-\varepsilon} a_{ij} b_j q_j^{\varepsilon-\mu}, \qquad i,j=1\ldots I. \tag{5}$$

Each type of differentiated product is supplied by a single firm, and all firms in a particular country are assumed to be symmetric. The profits of a single firm in country i may be expressed as,

$$\pi_i = m_i \sum_j x_{ij}[p_{ij}(1-T_{ij}) - t_{ij}] - C_i(x_i, m_i), \qquad i=1\ldots I. \tag{6}$$

where T_{ij} and t_{ij} are ad valorem and specific costs associated with selling in market j; they may be interpreted either as taxes, or as transport costs. C_i is the firm's production cost function; it is increasing in both output per model, $x_i = \sum_j x_{ij}$, and in the number of model varieties produced, m_i.

In our base case we assume that markets are internationally segmented, so firms may choose sales in each national market separately. Profit maximisation with respect to x_{ij} gives first order conditions of the form,

$$p_{ij}(1-T_{ij})(1-1/e_{ij}) - t_{ij} = (1/m_i)\delta C_i/\delta x_i, \qquad i,j=1\ldots I. \tag{7}$$

The perceived elasticity of demand, e_{ij}, depends on both the elasticity of demand for a single differentiated product, and the perceived effect of the firm's action on industry aggregate supply. The latter effect depends on the anticipated response of other firms in the industry; if it is anticipated that other firms will change price by v_i% in response to a 1% own price change, then we have, (see appendix),

$$(8) \qquad e_{ij}(B) = \varepsilon - (\varepsilon - \mu)(v_i + (1-v_i)s_{ij}), \qquad i,j=1...I,$$

where s_{ij} is the share of a single representative firm from country i in market j. $v_i=0$ corresponds to Bertrand behaviour. If the anticipated response is that firms will change sales by v_i% in response to a 1% change in sales, then the elasticity is given by,

$$(9) \quad 1/e_{ij}(C) = 1/\varepsilon - (1/\varepsilon - 1/\mu)(v_i + (1-v_i)s_{ij}), \quad i,j=1...I,$$

where $v_i=0$ corresponds to Cournot behaviour.

In addition to choosing sales of each model, each firm may choose the number of models it produces. If a firm introduces a model, then that model will be sold in all countries; the first order condition for profit maximisation with respect to the number of models is then

$$(10) \qquad \sum_j x_{ij}[p_{ij}(1-T_{ij})(1 - \Theta_{ij}) - t_{ij}] = \delta C_i/\delta m_i, \quad i=1...I.$$

The form of Θ_{ij} depends on two factors. The first is the perceived reactions of other firms. We permit each firm to hold non-zero conjectures about the response of other firms to a change in the number of models produced; that is, if a firm in country i increases the number of models it produces by 1%, then it conjectures that other firms will increase the number of models they produce by w_i%. Second, adding an extra model moves the demand curves for existing models; the value of this depends on whether this shift in demand affects price or quantity of existing models. If the output game is Bertrand, then we assume that price is held constant and quantity changes as new models enter. Θ_{ij} is then given by,

$$(11) \quad \Theta_{ij}(B) = \{(1-w_i)s_{ij} + w_i\}(\varepsilon-\mu)/\{e_{ij}(B)(\varepsilon-1)\}, \quad i,j=1...I.$$

If the output game is Cournot, then we assume that quantities are held constant and price changes as new models enter, and Θ_{ij} takes the form,

$$(12) \quad \Theta_{ij}(C) = \{(1-w_i)s_{ij} + w_i\}(\varepsilon-\mu)/(\mu(\varepsilon-1)), \quad i,j=1...I$$

This completes the characterization of equilibrium for cases in which the numbers of firms in each country are exogenously determined and markets are segmented. If there is free entry and exit of firms in each country then we have the additional industry equilibrium conditions that profits (equations (6)) are equal to zero.

We also consider a case in which a subset of markets are integrated. In this case firms set a single producer price, although international differences in consumer prices may remain, because of trade costs. This removes the ability of firms to price discriminate between different markets, and means that each firm has only one degree of freedom in its pricing. If p_i denotes the price charged by a firm from country i in its home market, then export prices, p_{ij} must satisfy

$$(13) \quad p_i(1 - T_{ii}) = p_{ij}(1 - T_{ij}), \quad i=1...I, \quad j=1...K,$$

where the first K markets are integrated, and, for simplicity, we assume that $t_{ij}=0$. (For a detailed comparison of segmented and integrated markets see Markusen and Venables [1988]).

With this restriction each firm has a single first order condition for its choice of sales in the K integrated markets. Equations (7) are replaced by equations of the form,

$$(14) \quad p_i(1-T_{ii})(1 - 1/E_i) = (1/m_i)\delta C/\delta x_i, \qquad i=1....I.$$

If behaviour is Bertrand then firms set price p_i given the price of other firms, and the perceived elasticity $E_i(B)$ is the weighted average,

$$(15) \qquad E_i(B) = \sum_{j=1}^{K} x_{ij}e_{ij}(B)/(\sum_{j=1}^{K} x_{ij}) \qquad i=1...I.$$

If behaviour is Cournot then each firm chooses its total sales to the K integrated markets given the total sales of the other firms. Each firms' output is divided between markets to meet demand, given the price relativities, (13). It is possible that a change in one firm's sales, given the total sales of other firms, may lead to changes in firms' sales in each separate market. Derivation of the Cournot elasticity $E_i(C)$ is complex, and is given in the appendix.

3. Calibration: The model is calibrated to the 3 digit industries listed in table 3. In order to illustrate the calibration and working of the model we concentrate on one particular industry, electrical household appliances (NACE 346), and merely summarise results for other industries. Full details of data, calibration and simulation for these industries are available on request from the authors.

The calibration procedure is as follows. First, values of parameters of the model are obtained from secondary sources, where these are available. Second, base year values of endogenous variables of the model are obtained. Third, values of the remaining parameters (and other endogenous variables) are calculated such that the base year observations are an equilibrium of the model.

(i) Parameters; The first set of parameters that we draw from secondary sources are those describing returns to scale. Our main source is the survey by Pratten [1987]. On the basis of this information we characterise economies of scale in the electrical household appliance industry as having the following two features: a firm of minimum efficient scale which halved the number of products in its range would experience an increase of 5% in the average cost of production; while if it halved the output of each of its products, its average cost would rise by 10%. The minimum efficient scale is assumed to be 200mECU (which is somewhat larger than the representative firm size assumed in the model as described below).

The literature does not offer clear guidance on the appropriate functional form for the cost function. There are two natural candidates. The first is a linear form (i.e., fixed cost plus constant marginal cost) in which case returns to scale become exhausted as firms become large. The second is log-linear, in which case successive increases in output are associated with continued reductions in average and marginal cost. We employ a weighted average of these functional forms so that costs are given by,

(16) $C_i(x_i, m_i) = c_i[z(c_0 + m_i c_m + m_i x_i) + (1-z)(m_i x_i^{\alpha})^{\beta}]$.

Parameters c_0, c_m and α, β are selected such that, for both the linear and the log-linear components, halving output (around mes) causes the average cost changes described above. The weights, z, are set such that 50% of marginal cost comes from each component of the cost curve. We assume that firms in all countries have the same cost functions[3].

The second set of parameters that we obtain from secondary sources are the industry elasticities of demand, μ. For these we used the surveys contained in Piggott and Whalley [1985], and econometric work of Deaton [1975] and Houthakker [1965] and Houthakker and Taylor [1970]. For electrical household appliances we take a representative value of μ of 1.75.

(ii) The base year endogenous variables required for calibration are the number of firms in each country, and the matrix of international trade and domestic sales, (i.e., the matrix with representative element $n_i m_i p_{ij} x_{ij}$, giving sales in country i of goods produced in country j). Data on international trade flows between the "countries" was obtained from the Eurostat NACE-CLIO trade tables for 1982. Domestic production statistics for the EC countries were obtained from the Eurostat Annual Industrial Survey. In fact production statistics for the rest of the EC seem quite unreliable, and no production statistics for the rest of the world were available. In both cases a value of production was assumed that made the ratio of their production to their exports (for the rest of the EC, all exports; for the rest of the world, exports to the EC) the same as this ratio in the total of the four individual EC countries. Similarly, firm size in the rest of the world was assumed to the same as the EC average. These numbers are needed to complete the numerical specification of the model, the fact that they have been created means that considerable caution should be exercised in interpreting the model's description of the rest of the EC and the rest of the world.

Even with these adjustments, there were some inconsistencies in the data, and three further adjustments were made to production estimates in order to deal with cases where the apparent consumption of domestic output was negative (U.K. output of office machinery (NACE 330), Italian output of footwear (NACE 451) and carpets (NACE 438)). Further details of data sources and adjustments are available on request.

Our estimate of the number of firms in each country is derived from the Eurostat Structure and Activity of Production data on the size distribution of firms. From this data we estimate the number of 'representative' size firms in each country on the basis of the Herfindahl index of concentration. The electrical household appliances industry covers a number of quite distinct products, and it is central to the model that we capture competitive interaction between firms at a disaggregate product level. We therefore divide the industry into a number of symmetric sub-industries; the model of section 2 operates at the level of one of these sub-industries, and the total industry is simply the sum of the sub-industries. We take the number of sub-industries to be 5; this number is chosen so that each sub-industry is of similar scale to the two largest

Table 1. Calibration

346 Domestic Electrical Appliances.

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	2660.24	93.24	67.19	92.58	94.27	226.09
G	286.74	2491.38	93.42	139.34	372.72	594.19
It	260.22	214.14	1539.39	253.44	186.59	429.62
UK	24.03	23.38	8.72	1405.86	77.00	126.91
RoEC	77.06	111.64	8.16	85.64	1635.48	215.76
RoW	187.55	192.49	41.26	200.89	175.59	3290.17

Number of firms=

22	34	27	36	22	42

Number of sub-industries= 5.

Herfindahl index of concentration=

0.134	0.095	0.143	0.063	0.101

Returns to scale.
% increase in average cost at 1/2 output per model, 10%
% increase in average cost at 1/2 number of models; 5%
Linear/loglinear weights; 0.5, 0.5;

Elasticity μ = 1.75.

Cournot Calibration;
Elasticity ε_C = 10.77.

Tariff equivalents, %;

	F	G	It	UK	RoEC
F	0	31	34	34	34
G	27	0	33	33	24
It	25	23	0	25	27
UK	36	33	40	0	28
RoEC	32	25	44	31	0

Model Conjectures (%),

	F	G	It	UK	RoEC
w =	6.5	6.3	6.4	6.3	6.4

Bertrand Calibration
Elasticity ε_B = 7.78.

Model Conjectures (%),

	F	G	It	UK	RoEC
w =	62.6	62.0	62.1	61.7	62.3

narrowly defined product groups in the industry -- washing machines and refrigerators. Table 1 reports the number of 'representative' firms, and also the Herfindahl index of concentration for each of the sub-industries, for each market, (including sales by foreign firms). The index provides a useful measure of competitiveness; its reciprocal is a measure of the number of equal sized firms which are 'equivalent' to the actual distribution of firms. As a single summary measure of competition in each industry we refer below to the EC average of these indices; for electrical household appliances, this average is 0.11.

(iii) Given the information above, remaining parameters are calibrated so that the model supports the observations as an equilibrium. Industry equilibrium requires that firms set marginal revenue equal to marginal cost (equations (7)), and that industry profits are equal to zero. With increasing returns to scale marginal costs are less than average cost, so, for these two conditions to hold simultaneously, price must be above marginal cost, i.e., firms must have a significant degree of monopoly power. This power may be derived from two sources. The first is that firms may anticipate that an increase in their output will increase industry aggregate supply and hence reduce price; the second is that each firm has monopoly power over its own varieties of differentiated product (see equations (7)-(9)).

If we assume that there is no product differentiation, then price-cost margins must be supported by non-zero conjectures, that is by values of v_i in either equation (8) or

(9). This is the calibration technique followed by Dixit [1987], Krugman [1987], and Laussel et.al. [1987], but we regard it as inappropriate for two reasons. First, firm level product differentiation does seem to be a characteristic of our industries (because of transport costs, if not innate product characteristics). Second, conjectural variations are widely recognised to be an unsatisfactory way of capturing interaction between firms; this applies particularly if we require that the conjectures remain unchanged as policy experiments are conducted. We therefore proceed by permitting the possibility that firms produce differentiated products. The question is then how much of firms market power is due to differentiation, and how much to firms' perceived ability to change industry aggregates? We do not have a good measure of the extent of product differentiation in each industry, so we proceed by looking at two cases. The first is to impose Cournot behaviour on the output game, and calibrate for a value of ε consistent with EC average price-cost margins. Using equations (9) with $v_i = 0$ we obtain $\varepsilon = 10.77$. The second is to impose Bertrand behaviour on the output game, and calibrate for ε. Using equations (8) with $v_i = 0$ we obtain $\varepsilon = 7.78$. The lower elasticity in the Bertrand case is due to the fact that Bertrand behaviour is inherently more competitive, so leaves more of the required price-marginal cost margin to be attributed to product differentiation. Notice that, in each of these cases we calibrate a single elasticity rather than country specific conjectures, v_i. Profits in each country may therefore differ from zero, although we impose that total profits in the EC are zero; and the range of these variations in calibrated profits is from a loss equal to -6.51% of sales in the U.K. to profits of 3.4% of sales in France.

Firms in different countries differ in size, and may produce different numbers of models. For the base case we assume that all firms have the same output per model, and let the observed variations in firm size be attributed to different numbers of models produced. In some of our simulations we hold the number of models per firm constant; differences in the number of models per firm may then be interpreted simply as a device to account for variations in firm size[4]. However, we also consider cases in which the number of models per firm, m_i, may change; choice of m_i must then be consistent with profit maximisation. We achieve this by resorting to non-zero conjectures, w_i, which are calibrated to ensure that the first order conditions for profit maximisation with respect to m_i hold. In the Cournot variant of the model firms anticipate that adding an extra model will cause price changes at given volume. The conjectures w_i are solved from equations (10) and (12), and the values of the conjectures so derived are small, (see table 1). In the Bertrand variant firms anticipate changes in the volume of sales of existing models, at given prices. We then use equations (10) and (11), and obtain positive and quite large values of w_i (table 1).

Calibration also requires that we find parameters to support differences in firms' shares in different national markets. Firms located in each country have smaller shares of their export markets than they do of their domestic market.

This may be due to differences in consumer preferences, or distribution networks, to transport costs or to trade barriers. It is convenient to aggregate all these into a single ad valorem "tariff equivalent" form, whose values are given (for the Cournot variant of the electrical household appliance industry) in table 1. Calibration proceeds by assuming ad valorem transport costs of 10%, and attributing the remainder of the "tariff equivalent" to the demand parameters, a_{ij}. Finally, demand parameters, b_j, are calibrated to equate total sales in each market with their observed values.

4. Reduced trade barriers: In this section we model a move towards 'completion of the internal market' as a reduction in the cost of intra-EC trade. We assume that this trade liberalisation takes the form of an equiproportionate reduction in intra-EC tariff equivalent trade barriers. The size of these reductions is chosen so that the direct cost saving achieved by the policy is equal to 2.5% of the value of base level intra-EC trade. Winters (chapt. 2 of Pelkman, Wallace and Winters, [1988]) suggests that the removal of border measures affecting intra-EC trade should generate direct savings of between 1% and 3% of gross trade. He also, however, identifies other restrictions on free trade, such as public procurement policies, subsidies, and national standards; these are difficult to quantify, but it is possible that our figure of a 2.5% reduction in trade costs is too low. Our results may be scaled up to provide estimates (i.e., first order

approximations) of the effects of larger reductions in trade costs.

For the electrical household appliance industry this experiment involves reducing the tariff equivalents from an average of 31%, to an average value of 28.5%. Table 2 reports the effect of the experiment on this industry. We assume Cournot behaviour and a constant model range; the consequences of removing these assumptions are examined in section 5. Consider first the case in which the number of firms is held constant. The first effect of the policy change is to increase the volume of intra-EC trade by 22.1%. This increased import penetration raises competitiveness in each market, as measured by the reductions in the Herfindahl concentration indices. The increased competition reduces prices, so expanding sales, raising consumer surplus, but reducing profits (except where the output expansion is sufficiently large). The national distribution of the increased production is broadly a projection of existing trade patterns, with Italy expanding the most, and the U.K. contracting. The expanded production reduces average costs, the EC average cost reduction being a modest 0.32%. Welfare, defined as the sum of profits and consumer surplus, rises by an amount equal to 0.64% of base consumption, of which 0.49% is the direct cost saving due to the reduction in trade barriers and 0.15% arises indirectly from adjustment in the industry. A useful indicator of the gains from the policy is provided by the ratio of the welfare change to the change in the value of trade: table 2 reports that 14.8% of the trade creation is pure welfare gain.

Table 2; Reduction in Trade Barriers

348; Electrical Household Appliances: (Cournot; models per firm constant)

Production and welfare change by country

	Fixed no. of firms				Variable no. of firms			
	Δ output %	Δ consumers' surplus, mECU	Δ profit mECU	Δ Herfindahl index %	Δ output %	Δ consumers' surplus, mECU	Δ number of firms	Δ Herfindahl index %
France	0.75	33.2	-16.9	-8.02	-0.44	25.1	-1	-3.88
Germany	4.32	24.4	-0.4	-5.15	6.33	28.0	0	-4.83
Italy	6.40	18.6	0.5	-5.96	8.89	21.8	0	-6.45
U.K.	-4.93	20.3	-11.2	-12.3	-8.14	10.6	-5	-4.63
R of EC	-0.59	29.2	-13.5	-10.4	-3.63	20.0	-2	-5.35
EC	2.09	125.8	-41.6		2.08	105.5	-8	

EC aggregates

	Δ EC output %	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	2.09	22.1	1.1	-7.6	-0.32	0.64	14.8
Variable no. of firms	2.08	24.7	0.6	-5.8	-0.93	0.81	16.7

If the number of firms is permitted to vary, then exit occurs to restore profits to their base level[5]. The effect of this is to increase firm scale, so giving a reduction in average costs of 0.93%. However, exit also goes part way to restoring concentration to its base level; prices rise and consumers' gains, while still positive, are reduced. Combining consumer and producer surplus, we see that the welfare gain from the policy now rises to 0.81% of base consumption, and the ratio of welfare gain to increased trade is 16.7%.

Table 2 also reports the effect of the trade liberalisation on the external trade of the EC. Imports fall as a result of the policy, and there is a small rise in exports. There are two reasons for these changes. First, the direct effect of the policy is to reduce the prices of intra-EC imports, so switching expenditure away from extra-EC imports. Second, the expanded EC output reduces firms' marginal costs, so reducing EC producers' prices both inside and outside the EC and leading to the rise in exports.

Table 3 reports a summary of the results of this experiment for all 10 industries, and additionally gives some key characteristics of each industry. For each industry, the table reports the increase in average costs at half MES (denoted RS), the share of intra-EC trade in EC consumption (denoted TS), the EC average Herfindahl concentration index (H), and the direct cost saving of the policy, expressed as a % of base consumption (DC). The calibrated value of ε is also reported; it ranges from high values of 35 and 53 in cement (242) and footwear (451)[6], to lows of 5.8 and 7.3 in

Table 3: Reduction in Trade Barriers

All Industries (Cournot, models per firm constant)

	Δ output %	Δ average cost %,	Δ welfare% consumption	Δ welfare% Δ int-EC trade
242; Cement, lime and plaster:				
ϵ=35.5, RS=20%, TS=1.6%, H=0.066, DC=0.04%				
Fixed no. of firms	0.24	-0.03	-0.1	-5.0
Variable no. of firms	0.58	-0.93	0.64	22.1
257; Pharmaceutical products:				
ϵ=5.8, RS=22%, TS=10.0%, H=0.050, DC=0.25%				
Fixed no. of firms	0.37	-0.08	0.29	21.8
Variable no. of firms	0.30	-0.15	0.30	22.5
260; Artificial and synthetic fibres:				
ϵ=21.5, RS=10%, TS=36.4%, H=0.050, DC=0.91%				
Fixed no. of firms	4.19	-0.51	0.99	13.0
Variable no. of firms	6.61	-2.45	1.84	14.0
322; Machine tools:				
ϵ=13.6, RS=7%, TS=22.4%, H=0.004, DC=0.56%				
Fixed no. of firms	1.67	-0.12	0.84	13.8
Variable no. of firms	2.66	-0.05	0.82	11.4
330: Office Machinery:				
ϵ=32.8, RS=10%, TS=23.6%, H=0.120, DC=0.59%				
Fixed no. of firms	10.4	-0.98	0.88	8.0
Variable no. of firms	12.5	-2.48	1.45	10.7
342: Electric motors, generators etc:				
ϵ=7.35, RS=15%, TS=8.8%, H=0.022, DC=0.22%				
Fixed no. of firms	0.37	-0.05	0.29	19.0
Variable no. of firms	0.31	-0.09	0.29	18.4
346; Electrical Household Appliances:				
ϵ=10.77, RS=10%, TS=19.6%, H=0.110, DC=0.49%				
Fixed no. of firms	2.09	-0.32	0.64	14.8
Variable no. of firms	2.08	-0.93	0.81	16.7
350; Motor vehicles:				
ϵ=13.32, RS=16%, TS=24.8%, H=0.199, DC=0.62%				
Fixed no. of firms	3.36	-0.56	0.83	17.9
Variable no. of firms	3.64	-1.51	1.34	25.5
438; Carpets, linoleum etc.:				
ϵ=21.4, RS=6%, TS=18.8%, H=0.031, DC=0.47%				
Fixed no. of firms	2.51	-0.17	0.67	8.0
Variable no. of firms	2.70	-0.49	0.76	7.5
451: Footwear				
ϵ=53.3, RS=2%, TS=27.0%, H=0.010, DC=0.27%				
Fixed no. of firms	3.21	-0.03	0.35	3.1
Variable no. of firms	3.44	-0.03	0.40	1.6

pharmaceuticals (257) and electric motors (342). The implication that different firms' products are very close substitutes in the first two industries while product differentiation is much more significant in the latter two seems in accordance with casual empiricism.

A number of remarks may be made about the results presented in table 3. First, the ratio of welfare change to trade creation is highly correlated with the degree of returns to scale in the industry. This ratio exceeds 18% in the free entry case in four industries, cement (242), pharmaceuticals (257), electric motors (342) and motor vehicles (350), and these are the four industries in our sample with the greatest returns to scale. The ratio is lowest, dropping to under 2% for footwear (451), the industry with the least returns to scale. (A negative welfare gain is recorded for the cement industry when the number of firms is fixed, reflecting the very high transport costs in this industry; the theoretical possibility of losses from trade when there are high transport costs having been demonstrated by Brander & Krugman [1983]).

Second, the change in average costs and the change in welfare expressed as a proportion of base consumption are largest in artificial fibres (260), office equipment (330), and motor vehicles (350). This is explained by the fact that each of these industries has significant returns to scale together with a high proportion of their output traded within the EC (TS exceeds 20% for each of these industries). The effect of the reduction in trade barriers is therefore relatively large in these industries.

Third, the cost reduction and welfare change is (in all cases except one) larger when free entry and exit is permitted. It is only with free entry that we observe welfare gains greater than 1% of base consumption, (in artificial fibres (260), office machinery (330) and motor vehicles (350)), and associated reductions in average costs ranging up to 2.5%. The reason for this is that increased competition reduces profits, causing exit of firms and hence raising the scale of remaining firms. This pro-competitive effect is smaller, the more competitive is the industry originally. Thus, in machine tools (322), electric motors (342) and footwear (451), the three industries with Herfindahl indices below 0.025, we see very small, or negative, further gains from free entry.

We have quoted results on the ratio of welfare gain to trade created because this is a ratio which can easily be used to compare our results with those of other studies. Owen [1983] reports welfare gains of the order of 50% (pp. 144-147) of the value of trade created, in contrast with the numbers in our tables 3 and 4 which are mostly in the range of 8% to 25%[7]. Our results are much closer to those generated by the modelling exercise of Harris and Cox ([1984], p.114), who estimate a welfare gain of 17.5% of trade created by multilateral liberalisation of Canadian trade.

5. Sensitivity: The preceding section assumed Cournot behaviour and a fixed number of models per firm. While we regard this as our central case, in this section we report the

effects of replacing Cournot behaviour by Bertrand, and of removing the assumption that the number of models is fixed.

The difference between Cournot and Bertand behaviour is that the latter is more competitive in the sense that each firm's actions have less impact on the industry price indices. As noted in section 3 this implies that the calibrated elasticities are lower in the Bertrand case than in the Cournot case, these being reported in table 4 as ε_B and ε_C. Notice that for industries in which the Herfindahl index is very small (for example 322) the two elasticities are similar. Where the Herfindahl index is large the elasticities may be very different. Thus in the cement industry (242) the Cournot elasticity is 35.5, and the Bertrand 8. It seems likely that Bertrand behaviour overestimates the level of competition in this industry, and consequently attaches more weight to product differentiation than is plausible.

What difference does Bertrand behaviour make for the effects of the reduction in trade barriers? The policy works by increasing import penetration, and hence reducing firms' shares in their domestic markets, and so increasing competitiveness. With Bertrand behaviour these changes in market share have less effect on price (as price-cost margins are largely accounted for by product differentiation); the policy therefore leads to smaller price reductions. The smaller magnitude of price reductions means that demand and output increase by less than in the Cournot case, this being accentuated by lower price elasticities. Smaller output changes lead to smaller reductions in average costs (table 4).

Table 4: Sensitivity Analysis

	Cournot				Bertrand			
	Models constant		Models variable		Models constant		Models variable	
	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms
242: Cement, lime and plaster: $\epsilon_C = 35.5, \epsilon_B = 8.0$, RS=20%, TS=1.6%, H=0.066								
Δ EC output %	0.24	0.58			0.00	0.10		
Δ average costs %	-0.03	-0.93			-0.00	-0.01		
Δ welfare%consumption	-0.1	0.64			0.04	0.04		
Δ welfare%Δ int-EC trade	-5.0	22.1			11.1	11.1		
257 Pharmaceutical products: $\epsilon_C = 5.8, \epsilon_B = 4.7$, RS=22%, TS=10.0%, H=0.05								
Δ EC output %	0.37	0.30	0.45	0.42	0.22	0.25	0.27	0.27
Δ average costs %	-0.08	-0.15	-0.02	-0.15	-0.05	-0.03	-0.02	-0.03
Δ welfare%consumption	0.29	0.30	0.31	0.44	0.33	0.34	0.36	0.37
Δ welfare%Δ int-EC trade	21.8	22.5	23.1	32.6	29.2	30.1	31.8	32.7
260; Artificial and synthetic fibres: $\epsilon_C = 21.5, \epsilon_B = 8.7$, RS=10%, TS=36.4%, H=0.050								
Δ EC output %	4.19	6.61			1.39	2.74		
Δ average costs %	-0.51	-2.45			-0.17	-0.14		
Δ welfare%consumption	0.99	1.84			1.21	0.97		
Δ welfare%Δ int-EC trade	13.0	14.0			21.4	9.3		
322; Machine Tools: $\epsilon_C = 13.55, \epsilon_B = 13.24$, RS=7%, TS=22.4%, H=0.004								
Δ EC output %	1.67	2.66	2.87	2.79	1.60	2.65	2.92	2.66
Δ average costs %	-0.12	-0.05	-0.05	-0.04	-0.12	-0.02	-0.06	-0.01
Δ welfare%consumption	0.84	0.82	0.86	0.86	0.85	0.83	0.86	0.84
Δ welfare%Δ int-EC trade	13.8	11.4	11.7	12.1	14.2	11.7	11.0	11.9
330; Office Machinery: $\epsilon_C = 32.8, \epsilon_B = 10.9$, RS=10%, TS=23.6%, H=0.12								
Δ EC output %	10.4	12.5	13.3	12.4	2.64	3.80	4.70	4.06
Δ average costs %	-0.98	-2.48	-0.49	-1.95	-0.25	-0.10	-0.24	-0.10
Δ welfare%consumption	0.88	1.45	0.62	1.65	0.92	0.98	1.14	1.09
Δ welfare%Δ int-EC trade	8.0	10.7	5.4	13.2	17.1	16.2	15.1	18.2
342; Electric motors, generators, etc: $\epsilon_C = 7.35, \epsilon_B = 6.77$, RS=15%, TS=8.8%, H=0.022								
Δ EC output %	0.37	0.31	0.41	0.46	0.29	0.28	0.30	0.31
Δ average costs %	-0.05	-0.09	-0.02	-0.09	-0.05	-0.01	-0.01	-0.02
Δ welfare%consumption	0.29	0.29	0.31	0.39	0.31	0.31	0.33	0.33
Δ welfare%Δ int-EC trade	19.0	18.4	20.0	24.9	21.7	21.1	22.3	22.5
346; Electrical Household Appliances: $\epsilon_C = 10.7, \epsilon_B = 7.8$, RS=10%, TS=19.6%, H=0.11								
Δ EC output %	2.09	2.08	2.52	3.01	1.29	1.30	1.61	1.55
Δ average costs %	-0.32	-0.93	-0.32	-0.85	-0.20	-0.22	-0.26	-0.21
Δ welfare%consumption	0.64	0.81	0.69	1.37	0.72	0.71	0.79	0.88
Δ welfare%Δ int-EC trade	14.8	16.7	12.2	26.7	20.6	17.7	13.9	21.7
350; Motor Vehicles: $\epsilon_C = 13.3, \epsilon_B = 7.2$, RS=16%, TS=24.8%, H=0.199								
Δ EC output %	3.36	3.64	3.70	5.48	1.71	1.90	3.25	2.42
Δ average costs %	-0.56	-1.51	-0.28	-1.83	-0.29	-0.41	-0.50	-0.41
Δ welfare%consumption	0.83	1.34	0.76	2.56	0.91	0.89	0.82	1.29
Δ welfare%Δ int-EC trade	17.9	25.5	15.5	47.8	25.7	21.7	13.3	32.1
438; Carpets, linolum, etc.: $\epsilon_C = 21.4, \epsilon_B = 17.6$, RS=6%, TS=18.8%, H=0.031								
Δ EC output %	2.51	2.70			1.74	2.21		
Δ average costs %	-0.17	-0.49			-0.12	-0.06		
Δ welfare%consumption	0.67	0.76			0.71	0.74		
Δ welfare%Δ int-EC trade	8.0	7.5			9.5	8.5		
451; Footwear: $\epsilon_C = 53.3, \epsilon_B = 42.4$, RS=2%, TS=27%, H=0.01								
Δ EC output %	3.21	3.44			1.93	2.53		
Δ average costs %	-0.03	-0.03			0.0	0.22		
Δ welfare%consumption	0.35	0.40			0.41	0.38		
Δ welfare%Δ int-EC trade	3.1	1.6			4.0	2.0		

However, despite the smaller savings in production cost, we see that, when the number of firms is fixed, the welfare gains from the policy are greater in the Bertrand case then in the Cournot case. This is because the increase in trade (which incurs transport costs) is less in this case, and because lower values of ε imply greater consumer gains from the reduction in import prices.

A second consequence of the smaller price reduction in the Bertrand case is that the policy reduces profits by less. When the number of firms is variable there is therefore less exit from the industry (and may be entry as total industry output rises), so leading to smaller reductions in average cost. The welfare gains are now also smaller, on average, although this difference is ambiguous due to lower trade costs and increased product variety, with more firms remaining in the Bertrand case.

The second dimension of sensitivity analysis explored in table 4 is to let the number of product varieties produced by each firm change. This experiment is meaningful only if there is a significant degree of differentiation in consumer demand between products varieties, or there are significant economies of scope. Table 4 therefore does not report results for the "models variable" case for the four industries (242, 260, 438, and 451) where a high value of ε indicates little product differentiation, and our information on economies of scale implies that there is little cost reduction obtained by expanding the number of models produced at given output per model. For the six industries in which this is a meaningful experiment, table 4 shows that the results of the policy are affected in three ways. First, changes in output are now generally (but not invariably) larger, due to the fact that firms have an additional instrument with which to respond to the policy change. Second, the fall in average costs is now generally (but not invariably) smaller. Firms shorten their production runs as they expand their model range. There are economies of scope, but these are smaller than returns to scale in production of a particular model. Third, the welfare gains from the policy are now generally (but not invariably) larger, as the smaller average cost reductions are compensated for by the benefits of increased product variety. The welfare difference is particularly marked in two industries, electrical household appliances (346) and motor vehicles (350), these both being industries in which economies of scope are assumed to be relatively significant.

Overall, we regard the variation in results across different variants of the model as surprisingly small. From the theoretical literature we know that it is possible to construct examples where assumptions on market structure reverse the effects of policy. A sign change of this type is observed in the cement industry (242), but this is readily explicable in terms of the high transport costs in this industry. Apart from this, not only the sign, but also the order of magnitude of the welfare gains, and the ranking of industries by welfare gain are fairly stable across industries.

6. Integrated markets: The second policy experiment we

undertake is one in which, in addition to the reduction in tariff equivalents, we require that price differences between markets are equal to trade costs, so forcing firms to act on an integrated rather than segmented market basis. In order to understand the effects of this change, note that firms generally have a larger share of their domestic market than they do of foreign markets (see e.g. table 1). This is reflected in firms setting price-cost margins higher in domestic markets than they do in foreign markets in order to exploit this market power, and in relatively high values of Herfindahl concentration indices. When markets are integrated price-cost margins (cost inclusive of trade costs) must be the same in all markets, and the relevant measure of concentration is the Herfindahl index for the EC as a whole. This causes a reduction in firms' domestic market prices, and in the degree of concentration. Essentially, firms lose the ability to price high in their relatively captive domestic markets.

These changes have two effects. First, the reduction in domestic prices causes demand to switch towards domestic producers, and so tends to reduce the volume of intra-EC trade. This is illustrated for the electrical household appliances industry in table 5, where we see that, (with a fixed number of models and Cournot behaviour), intra-EC trade falls by 23%. As trade is reduced, so production increases in net importing countries (notably the U.K. and the rest of the EC), while it falls in Italy. Second, the loss of domestic market power and the associated price fall cause large changes in welfare. When the number of firms is held constant, consumers' surplus rises

Table 5; Integrated Markets

346; Electrical Household Appliances: (Cournot; models per firm constant)

Production and welfare change by country

	Fixed no. of firms				Variable no. of firms			
	Δ output %	Δ consumers' surplus, mECU	Δ profit mECU	Δ Herfindahl index %	Δ output %	Δ consumers' surplus, mECU	Δ number of firms	Δ Herfindahl index %
France	13.6	145.1	-63.3	-72.6	25.3	185.7	-9	-41.1
Germany	1.5	81.9	-52.4	-61.4	4.3	84.7	-14	-34.8
Italy	-0.8	89.7	-62.6	-74.3	-0.9	79.6	-13	-42.1
U.K.	13.6	52.6	-22.3	-41.5	15.4	46.0	-14	-23.5
R of EC	20.2	100.5	-34.4	-63.7	26.4	107.9	-8	-36.1
EC	8.1	469.9	-234.9		12.7	503.9	-59	

EC aggregates

	Δ EC output %	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	8.1	-23.0	2.4	-24.4	-1.15	1.79	-
Variable no. of firms	12.7	-24.5	-12.6	-23.6	-9.04	3.85	-

Table 6; Integrated Markets

All Industries: (Models per firm constant)

	Cournot				Bertrand			
	Segmented		Integrated		Segmented		Integrated	
	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms	Fixed no. of firms	Var. no. of firms
242: Cement, lime and plaster: $\epsilon_C = 35.5, \epsilon_B = 8.0$, RS=20%, TS=1.6%, H=0.066								
Δ EC output %	0.24	0.58	1.32	0.03	0.00	0.10	0.01	0.02
Δ average costs %	-0.03	-0.93	-0.12	0.09	-0.0	-0.01	-0.0	-0.02
Δ welfare%consumption	-0.1	0.64	0.22	-0.1	0.04	0.04	0.04	0.04
Δ int-EC trade %	128	180	-78	-43.1	22.5	22.5	16.8	16.8
257 Pharmaceutical products: $\epsilon_C = 5.8, \epsilon_B = 4.7$, RS=22%, TS=10.0%, H=0.05								
Δ EC output %	0.37	0.30	3.32	2.13	0.22	0.25	0.24	0.28
Δ average costs %	-0.08	-0.15	-0.73	-3.43	-0.05	-0.03	-0.05	-0.02
Δ welfare%consumption	0.29	0.30	1.11	1.45	0.33	0.34	0.33	0.34
Δ int-EC trade %	13.3	13.3	-16.1	-16.5	11.3	11.3	6.7	6.7
260; Artificial and synthetic fibres: $\epsilon_C = 21.0, \epsilon_B = 8.0$, RS=10%, TS=36.4%, H=0.050								
Δ EC output %	4.19	6.61	9.59	7.18	1.39	2.74	1.43	2.76
Δ average costs %	-0.51	-2.45	-1.77	-1.04	-0.17	-0.14	-0.18	-0.14
Δ welfare%consumption	0.99	1.84	4.14	2.91	1.21	0.97	1.21	0.97
Δ int-EC trade %	20.4	36.9	-56.5	-48.0	15.5	28.8	13.7	27.2
322; Machine Tools: $\epsilon_C = 13.6, \epsilon_B = 13.2$, RS=7%, TS=22.4%, H=0.004								
Δ EC output %	1.67	2.66	2.05	2.86	1.60	2.65	1.60	2.65
Δ average costs %	-0.12	-0.05	-0.16	-0.10	-0.12	-0.02	-0.12	-0.01
Δ welfare%consumption	0.84	0.82	0.86	0.83	0.85	0.83	0.85	0.83
Δ int-EC trade %	27.1	32.0	24.6	29.4	26.8	31.6	26.6	31.3
330; Office Machinery: $\epsilon_C = 32.8, \epsilon_B = 10.9$, RS=10%, TS=23.6%, H=0.12								
Δ EC output %	10.4	12.5	27.3	27.2	2.64	3.80	2.67	3.96
Δ average costs %	-0.98	-2.48	-2.71	-2.59	-0.25	-0.10	-0.26	-0.08
Δ welfare%consumption	0.88	1.45	3.88	3.43	0.92	0.98	0.91	0.98
Δ int-EC trade %	44.5	57.2	-64.0	-51.0	22.8	25.7	17.5	21.0
342; Electric motors, generators, etc: $\epsilon_C = 7.35, \epsilon_B = 6.77$, RS=15%, TS=8.8%, H=0.022								
Δ EC output %	0.37	0.31	1.72	1.06	0.29	0.28	0.30	0.30
Δ average costs %	-0.05	-0.09	-0.26	-1.30	-0.05	-0.01	-0.05	-0.01
Δ welfare%consumption	0.29	0.29	0.52	0.53	0.31	0.31	0.31	0.31
Δ int-EC trade %	17.3	17.9	2.5	4.0	16.2	16.7	14.1	14.6
346; Electrical Household Appliances: $\epsilon_C = 10.7, \epsilon_B = 7.8$, RS=10%, TS=19.6%, H=0.11								
Δ EC output %	2.09	2.08	8.08	12.7	1.29	1.30	1.33	1.38
Δ average costs %	-0.32	-0.93	-1.15	-9.04	-0.20	-0.22	-0.19	-0.16
Δ welfare%consumption	0.64	0.81	1.79	3.85	0.72	0.71	0.72	0.72
Δ int-EC trade %	22.1	24.7	-23.0	-24.5	17.8	20.5	9.5	10.9
350; Motor Vehicles: $\epsilon_C = 13.3, \epsilon_B = 7.2$, RS=16%, TS=24.8%, H=0.199								
Δ EC output %	3.36	3.64	10.5	26.4	1.71	1.90	1.67	1.95
Δ average costs %	-0.56	-1.51	-1.72	-16.9	-0.29	-0.41	-0.27	-0.13
Δ welfare%consumption	0.83	1.34	4.09	12.1	0.91	0.89	0.92	0.9
Δ int-EC trade %	18.7	21.2	-61.4	-61.0	14.3	16.5	0.8	2.7
438; Carpets, linoleum, etc: $\epsilon_C = 21.4, \epsilon_B = 17.6$, RS=6%, TS=18.8%, H=0.031								
Δ EC output %	2.51	2.70	4.46	4.86	1.74	2.21	1.75	2.22
Δ average costs %	-0.17	-0.49	-0.30	-2.79	-0.12	-0.06	-0.13	-0.06
Δ welfare%consumption	0.67	0.76	0.75	0.97	0.71	0.74	0.71	0.74
Δ int-EC trade %	45.0	53.7	26.7	34.8	39.6	46.5	39.1	45.9
451; Footwear: $\epsilon_C = 53.3, \epsilon_B = 42.4$, RS=2%, TS=27.0%, H=0.009								
Δ EC output %	3.21	3.44	5.53	4.0	1.93	2.53	1.93	2.53
Δ average costs %	-0.03	-0.03	-0.26	-1.36	0.0	0.22	0.0	0.22
Δ welfare%consumption	0.35	0.40	0.46	0.64	0.41	0.38	0.41	0.38
Δ int-EC trade %	41.4	92.7	0.0	25.5	37.7	70.6	37.6	70.4

by 3.6% of base consumption, and profits fall by 1.8% (table 5). The net welfare gain of 1.79% of base consumption is nearly three times larger than the gain from reduced tariff barriers with segmented markets.

When entry and exit is permitted, then the reduction in profits leads to very significant exit - over 40% of European firms cease production. Coupling this with the increase in overall sales caused by the price reductions, remaining firms nearly double in scale, and average costs fall by 9%. Welfare is then raised by 3.8% of base consumption, nearly five times the gain recorded when markets remained segmented.

Table 6 reports the effect of this experiment across all ten industries, and for Bertrand as well as Cournot behaviour; segmented market results are also reported for purposes of comparison. As would be expected, the integration of markets only has dramatic effects when, in the base case, firms have significant market power in their domestic economy (associated with high Herfindahl indices), and when this market power is exploited (behaviour is Cournot rather than Bertrand). In the Bertrand case the welfare effects of market integration are negligible, as is the case with Cournot behaviour in the most competitive industries in the sample (e.g., 322, machine tools). However, in other industries welfare gains from integration are very significant, reaching a peak of 12% of base consumption when exit is allowed in the motor vehicle industry.

7. Conclusions: It is appropriate to sound a note of caution

in conclusion. The industries that we have studied clearly have features which can be captured only in a model of imperfect competition. The models which we have used in this analysis do capture some important aspects of imperfectly competitive behaviour in an intuitively appealing way but they are nevertheless at best a crude approximation to the complexity of real-world competitive interaction.

We have examined two routes towards the completion of the internal EC market. The first treated the policy as a quantitative change, involving small reductions in barriers to trade. This change resulted in increased import penetration in each country, so increasing competition and raising welfare - although by modest amounts. The second policy change involved a qualitative change in firms behaviour: forcing firms to act on a European wide "integrated market" basis, so removing firms' ability to exploit their domestic markets. This policy yields large welfare gains. It also causes large reductions in profit (and in the long run, exit of firms), and it is not obvious that there exist feasible changes in EC trade policy and competition policy that could impose such a change. In practise policy may be expected to be some combination of our two experiments. As barriers are cut, so firms' ability to act in a segmented market manner may be reduced. However, presenting the two policy experiments separately is instructive. It highlights the fact that, while some gains can be derived from moving the EC closer to being a full customs union, more significant welfare gains may be obtained from the creation of a genuinely unified European market.

Appendix

1) Perceived elasticities; The elasticities $e_{ij}(B)$ and $\Theta_{ij}(B)$ are obtained by differentiating demand functions (5) with respect to p_{ij} and m_i, respectively, and incorporating changes through the price index, q_j, equation (2).

The elasticities $e_{ij}(C)$ and $\Theta_{ij}(C)$ are obtained by differentiating the inverse demand functions, which may be written as

$$p_{ij} = x_{ij}^{-1/\varepsilon} a_{ij}^{1/\varepsilon} b_j^{1/\mu} y_j^{1/\varepsilon - 1/\mu}$$

and incorporating changes in the sub-utility function, y_j, equation 1.

2) Integrated markets; Let a single firm (denoted *) in country k change its sales in the integrated markets by proportion $\left[\widehat{\sum_{j=1}^{K} x^*_{kj}}\right]$. ($\hat{}$ denotes a logarithmic derivative). Its prices are constrained by equation (13), but may move equiproportionately by amounts $\hat{p}^*_k$. Let **X** be the matrix $x_{ij}/\sum_{j=1} x_{ij}$ i=1..I, j=1..K $\hat{q}$ be the vector of log derivatives of the vector with elements q_j, and δ_k be a vector with 1 in the kth row, and zeros elsewhere. Differentiating the demand functions and adding gives,

$$\left[\widehat{\sum_{j=1}^{K} x^*_{kj}}\right] = -\varepsilon \hat{p}^*_k + (\varepsilon-\mu)\delta_k^T \mathbf{X}\hat{\mathbf{q}} \qquad \text{(A1)}$$

For firms that do not change their total sales we have,

$$0 = -\varepsilon \hat{\mathbf{p}} + (\varepsilon-\mu)\mathbf{X}\hat{\mathbf{q}}, \qquad \text{(A2)}$$

where **p** is the log derivative of the vector with elements p_i. From the definition of the price indices, (2),

$$\hat{\mathbf{q}} = \mathbf{S}^T[\mathrm{diag}(\mathbf{n} - \delta_k)\hat{\mathbf{p}} + \delta_k \hat{p}^*_k] \qquad \text{(A3)}$$

where diag(.) denotes the diagonal matrix formed from the vector, and **S** is the matrix,

$$\mathbf{S} = (m_i p_{ij} x_{ij}) / \sum_{j=1}^{I} m_i p_{ij} x_{ij}$$

Using (A2) and (A3) in (A1) gives,

$$-E(C)_k =$$

$$\left[\widehat{\sum_{j=1}^{K} x^*_{kj}}\right] / \hat{p}^*_k = -\varepsilon + \delta_k^T \left\{ \left[\mathbf{X}^T \mathbf{S}\right]^{-1} / (\varepsilon-\mu) - \mathrm{diag}(\mathbf{n} - \delta_k)/\varepsilon \right\}^{-1} \delta_k$$

FOOTNOTES

(1) Article 115 of the Treaty of Rome permits countries to suspend the free circulation within the EC of extra-EC imports, in order to support national import restrictions.

(2) These preferences may be used for intermediate as well as for final goods, see Ethier [1982].

(3) We make no distinction between capital and other components of cost. This is equivalent to assuming perfect markets for used capital goods.

(4) This minimises the extent to which differences in firms' output levels cause differences in the the slope of their cost functions (evaluated at base output). This is desirable, given the quality of our estimates of firm size.

(5) Throughout, we shall assume that profits are restored exactly to zero, even if this involves fractional firms. We believe that this gives a more accurate picture of expected changes caused by the policy. In addition, it avoids non-uniqueness problems associated with an integer entry and exit procedure.

(6) Footwear also has very low tariff equivalents - some elements of the matrix being less than 2.5%. Because of this we model trade liberalisation in this industry as a reduction in tariff equivalents bringing a cost saving of 1% of base trade.

(7) There seem to be three principal sources of the difference between Owen's results and ours: Owen assumes considerably greater economies of scale than we do; he treats entry and exit asymmetrically, letting industries expand through expansion of existing firms but contract through exit; and he confines attention to uni-directional trade creation, ignoring the possibility that trade increases will involve intra-industry trade.

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