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The Costs of Non-Europe:
An Assessment based on a formal Model of
Imperfect Competition and Economies of Scale

by Alasdair Smith * and Anthony Venables **

Internal paper

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Introduction

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 partial equilibrium model of international trade in imperfectly competitive markets. 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 liberalisation on competition.

The next section presents a simple example of a model of international trade under imperfect competition, in an attempt to give a reasonably simple account of the essential nature of the more complex model used to produce the projections in this report. A full description of the actual model used (which is a development of the model described in Venables and Smith (1986)) is provided in a technical appendix.

Section 2 then describes the data to which the model is applied; and section 3 the "calibration" of the model to the data.

In section 4 the results of one policy experiment are described: a reduction in intra-EC trade barriers equivalent to a reduction in the cost of intra-EC trade of 2.5%. The effects on trade, output, production costs and economic welfare are determined. Section 5 considers the sensitivity of the results to changing our assumptions about firms' behaviour.

Section 6 describes the results of a more dramatic change in the intra-EC market structure, where in addition to the reduction in trade barriers, it is assumed that firms are no longer able to charge different prices in different national markets within the EC. This shift to an "integrated" market produces substantially larger economic effects than the earlier policy experiment.

1. Modelling trade under imperfect competition

The full model on which this exercise was based is set out in the technical appendix. It may, however, be helpful to see some of the essential economic features of that model displayed in a simpler example. Accordingly, as an introduction to the modelling exercise, in this section we present an artificially simple example of trade under imperfect competition. We also discuss some further aspects of the modelling of imperfect competition.

Suppose that there are two countries with identical demands for a particular homogeneous good. Let the demand y in either country be given by the following function of the consumer price p (in $)

$$y = 10000p^{-2}$$

which implies that the elasticity of demand is 2. The inverse demand function is

$$p = 100y^{-1/2}$$

Let the cost of producing quantity x of the good be

$$C = 7x + 111$$

which implies that the average cost is a decreasing function of output, so there are economies of scale. Suppose that a firm receives the consumer price p_1 in respect of sales in respect of sales in its home market, but receives $p_2(1-t)$ from a unit sold in its foreign market, where the fraction t represents the cost of selling across the border. Then the profits of a firm which sells x_1 at home and x_2 abroad will be

$$\pi = p_1x_1 + p_2(1-t)x_2 - 7(x_1+x_2) - 111$$

If the firm chooses x_1 and x_2 in the belief that the sales to both markets of all other firms are fixed, then differentiation of its profit function gives rise to two equations describing its optimal sales decisions in the respective markets

$$\begin{aligned} p_1(1-s_1/2) &= 7 \\ (1-t)p_2(1-s_2/2) &= 7 \end{aligned}$$

where the left hand side of each equation is the marginal revenue in the respective market, the right hand side is marginal cost, and s_i is the firm's share of the respective market. Note how marginal revenue depends both on the elasticity of demand and on the market share.

If t=0.2 and there are two firms in each country, then the outcome of profit maximising behaviour by the four firms will be a price of $9 in both countries, production of 5000/81 units of output by each firm, of which 8/9 is sold in its home market and 1/9 exported. Each firms then has 4/9 of its home market and 1/18 of its export market. It is easily checked that the firms' profit-maximising equations are satisfied and that supply equals demand in both markets at this price. It is also the case that firms' profits are virtually zero, so this is a long-run equilibrium.

If now t were reduced to zero, it is easily checked that if the four firms remain in existence, the price charged will fall to $8, and production of each firm will rise to 5000/64, of which half is sold in each market (so firms' shares of their home market falls from 4/9 to 1/4 and of their export markets rises from 1/18 to 1/4). There is a gain of consumer surplus of almost $139 in each of the two countries as a result of the price reduction, and each of the four firms suffers losses of almost $33; so in aggregate the reduction in trade costs brings about a rise in welfare. The price reduction is very much greater than the reduction in trade costs because the main effect of the change is that increased competition from imports considerably reduces the market power that firms have in their home markets and drives down prices.

The fact that firms are making losses implies that they will wish to exit from the industry. It is easily checked that if one firms exits (and since there are now no trade costs, the nationality of the exiting firm is irrelevant) then the remaining three firms increase their output to approximately 5000/53, enjoy lower costs, and make positive profits of just over $21 each. The price to consumers is higher at $8.40 than with four firms, and the consumer surplus gain is therefore lowered to a little over $79, and the aggregate welfare gain at approximately $222 in total exceeds the welfare gain of $146 in the previous case.

This example, simple though it is, illustrates some of the main features of the empirical model which follows. However, there is more involved in what we do below than a straightforward generalisation of the above example to encompass six countries, larger numbers of firms, and real world data.

The principal feature of the model we have used which is not illustrated in the above example is product differentiation: consumers having preferences between different varieties of the same product. This introduces two features into the model (both of which are discussed further in section 3 below): firms have to choose the number of varieties to produce; and their ability to set prices for individual varieties means that their marginal revenue now depends not just on market share and on the elasticity of demand for the product as a whole (as in the above example), but also on the elasticity of demand for the individual variety.

Casual empiricism suggests that product differentiation is an important feature of the markets for many manufactured products, and (as is explained in section 3 below) the data we use in our modelling give strong support to this view. The introduction of product differentiation thus enriches as well as complicates the model.

There are two further distinctions which play a role in the paper but are not explicitly illustrated in the example above.

The first is the distinction between "Cournot" and "Bertrand" competition. In the example we assumed that each firms supposed that other firms' *sales* were given when it decided how much to sell; and this is the Cournot hypothesis. An alternative, the Bertrand hypothesis, would be to assume that firms set their prices on the assumption that other firms *prices* are given. It is not very illuminating to look at the Bertrand hypothesis in the above example because, in the absence of product differentiation, Bertrand pricing degenerates to pricing at marginal cost. However, in models with product differentiation, Bertrand behaviour is compatible with imperfect competition, though it still leads to substantially more competitive pricing than does Cournot behaviour. We suggest below that the Cournot hypothesis may be the more attractive in the weight that it places on market shares as a determinant of firms' behaviour.

The second distinction plays a more crucial role in our results. In the example above, the removal of trade barriers had a very dramatic effect on the competitive structure of the model. We shifted from an equilibrium in which each market was dominated by two domestic firms with a small fringe of importers to an equilibrium in which all four firms (or after exit, all three firms) had equal market shares. Effectively the two markets, which previously were *segmented*, now behave as if they were a single *integrated* market. In the presence of product differentiation, removal of trade costs might not be sufficient to produce this outcome (consumers might, for example, have genuine preferences for home-produced varieties which give firms larger shares of home markets than of foreign markets). Further, without product differentiation, it is not possible to make the market integrated other than by setting trade costs to zero. In the model with product differentiation, however, it is possible without setting trade costs to zero to consider the effect of imposing on firms the requirement that they do not price discriminate between markets and charge the same factory-gate price to all consumers (though consumers in foreign markets still have to pay the trade cost on top of the uniform factory-gate price). This sort of policy has the same sort of strongly pro-competitive effect, even with positive trade costs, as did the removal of all trade costs in the example above, and for essentially the same reason: once firms look on the market as being a single integrated market, the market power that was conferred on them by asymmetrically large home market shares is diminished. The single most striking result that we describe below is that a policy which succeeded in making firms act on an EC-wide integrated market basis is likely to have much larger welfare effects than a policy which simply reduces border barriers.

2. Model coverage and data sources

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. The model has been applied to the following selection of three digit NACE industries:

242 cement, lime and plaster
257 pharmaceutical products
260 artificial and synthetic fibres
322 machine tools ..
330 office machinery
342 electric motors, generators, transformers, ..
346 electrical household appliances

351 motor vehicles and engines
438 carpets, carpeting, oilcloth, linoleum, ..
451 footwear ..

These sectors were chosen as a relatively heterogeneous group of industries, for all of which some estimates of economies of scale are available, and some of which might be relatively strongly affected by the completion of the European market, e.g. because of the role of public procurement or technical standards.

Data on bilateral international trade flows between these "countries" in each of the ten sectors listed above 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. Unfortunately, production data for the rest of the EC seem quite unreliable and for the rest of the world are unavailable. For each industry, therefore, values were chosen for production in these "countries" that gave them approximately the same ratio of production to total exports (for the rest of the EC) or to exports to the EC (for the rest of the world) as the average for the four individually identified EC countries. These numbers were required to complete the model; and the fact that they were estimated in a fairly arbitrary way means that great caution should be exercised in interpreting results relating to the rest of the EC or the rest of the world.

(Data for exports by the rest of the world to the EC were not available in the NACE-CLIO export tables and values were derived from the import tables, adjustments being made for observed systematic discrepancies between export and import data.)

Even though the trade data are classified by nace-clio, and even after the above adjustments, there remained evident problems in reconciling the trade and production data, presumably largely arising from the fact that the trade data refer to commodities classified to the relevant nace-clio groups while the production data refer to firms (though the treatment of re-exports is another potential source of discrepancies). Apparent domestic consumption of domestically produced goods was calculated by subtracting the value of exports from the value of production, but in three cases (office equipment (330) in the UK, and carpets (438) and footwear (451) in Italy) this gave a negative number. An arbitrary adjustment was made to the domestic production figure to bring domestic consumption into approximately the same relation to trade flows as for the other countries.

The first table in each section of Table 1 gives the six-by-six matrix of trade and consumption flows derived for each of the ten industries from the 1982 data. Each row of the matrix refers to the production of a country; and each column to the consumption of a country.

The model requires an estimate of the number of firms in each sector in each country. The Eurostat Structure and Activity of Production data on the size distribution of firms was used to calculate a Herfindahl index of concentration on the basis of which may be calculated the number of "representative" firms in each country. This is the number of equal-sized firms which would give rise to the same effective degree of market concentration as the observed distribution of unequal-sized firms. These numbers are reported for each industry in Table 1. Again, numbers for the rest of the EC and the rest of the world have had to be assumed, to make firm size equal to the average in the four individual EC countries.

It is evident that many of the ten nace-clio classes are too aggregated to be sensibly regarded as covering a single industry and in most cases we have modelled the industry as being divided into a number of equal-sized subindustries. For example, in electrical household appliances there are assumed to be five subindustries. Effectively this amounts to describing each subindustry by a commodity flow matrix and a set of firm numbers that are one fifth of the numbers reported in Table 1.

The model requires information on economies of scale, and we have used the information provided by Pratten (1987), summarising much of that information into two numbers for each industry: the effect on average cost of changing the output of each of the individual product varieties of a firm of minimum efficient scale while keeping the number of varieties constant; and the effect on average cost of changing the number of product varieties, keeping output per variety constant. The minimum efficient scale is taken to be the size of the average "representative" firm in the EC; and where Pratten provides independent information on this, it seems to suggest that this is not an unreasonable assumption. There is an additional aspect of scale economies to consider: the form of the cost function. The simplest form of cost function giving rise to economies of scale is the "linear" function in which there are fixed costs and constant marginal cost. However, in many industries it seems possible that economies of scale would take a form in which marginal cost as well as average cost falls with output, and the simplest form of function with this property is the "loglinear" function, which is a linear function of the logarithms of the variables. In our model we have used a cost function which is a weighted average of these two forms and the weights (based partly on Pratten's information, and partly on casual empiricism) are reported together with the other two scale economy numbers in Table 1.

Finally, we require an estimate of the elasticity of demand for the product of each industry. Here our sources are Piggott and Whalley (1985), Deaton (1975), Houthakker (1965) and Houthakker and Taylor (1970), and the numbers we use are reported in Table 1.

1982 was chosen as the base year for the projections because of the fact that industrial survey data for later years is incomplete. Even though from a macroeconomic viewpoint, 1982 was an atypical year for the European economy, we do not think that this fact will have any significant impact on the general nature of the results we obtain.

3. Calibration

The process of model "calibration" consists of finding a set of numerical parameters for the model which are consistent with the information presented in the previous section.

The first requirement is that firms' output decisions satisfy the condition that marginal revenue in each of the six markets equal the marginal cost of producing the good. The simplified model of section 1 shows how marginal revenue depends on market share and on the elasticity of demand for the product. The pattern of production and trade reported in Table 1 cannot, however, be described by such a simple model, for it would seem that firms are not exploiting their scale economies to the extent that they should. The model used (and described in more detail in the technical appendix) introduces an element not present in the model of section 1: consumers are supposed to distinguish between the different varieties of the same product. Now firms choose their sales levels taking account not only of the effect of their decision on total supply of the product and therefore on the price level of the product in general, but also of the effect that a change in sales has on the price that the firm can charge for its own specific variety of the product. Thus for each industry we calculate an elasticity which would make the data consistent with the hypothesis that the firms were maximising profits in a market with differentiated products.

Our central case is based on a "Cournot" version of the model and the relevant elasticities are reported in Table 1 immediately below "Cournot calibration". The larger the elasticity the less is the degree of product differentiation, and infinite elasticity corresponds to the case of no differentiation where consumers are indifferent between different varieties. Note the contrast between, say, pharmaceutical products (257) and artificial and synthetic fibres (260): the former has a much lower elasticity indicating a higher degree of product differentiation: the difference simply reflects the fact that pharmaceutical products has many more firms in spite of having stronger economies of scale. In most cases, the elasticities take intuitively appealing values, though office machinery (330) has an implausibly low degree of apparent product differentiation. (This may be related to the fact that in this industry the data for the UK are not very satisfactory and the skewed distribution of firm size in Italy may be affecting the estimate of "representative" firm size.)

Not only will different firms' products be differentiated, but one firm can produce different product varieties. There is then the issue of the extent to which we treat large firms as selling large numbers of product varieties or as having long production runs of individual varieties. In calibrating the data, having no information on this issue, we let all the variation in firm size be accounted for by the number of models produced by firms rather than by length of model run, so as to minimise the extent to which differences between firms are introduced into the model without being based on good evidence. In our central policy experiments, we suppose that firms do not change the number of models that they produce, but there are some experiments in which we do let firms vary their model numbers. In this event we need to have firms' model numbers explained by profit-maximising choice: where firms compare the cost of introducing a new model with the extra revenue that will be obtained in _all_ of the markets in which it is sold. When one firm makes this decision it is assumed to anticipate that other firms will react to a change in its number of models, and the "model conjectures" reported in Table 1 are the values of these assumed reactions which are consistent with the data; so, for example, in the case of artificial and synthetic fibres, in the Cournot calibration each firm assumes that a 1% change in the number of its models would bring about a 0.02% change in the number of models produced by all other firms.

Finally, we have to find model parameters which are 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, of transport costs, of differences in distribution networks, or of consumer preference patterns. We suppose that transport costs are at an _ad valorem_ level of 10% and attribute the rest of the difference to differences in demand functions whose effect is described in the "tariff equivalent" tables within Table 1. These tables describe the tariff-equivalent values that non-tariff barriers would have to have if the underlying consumer demands for goods were uniform across different national producers and _all_ of the national bias in the observed trade pattern was attributed to trade barriers. (See the technical appendix for further details of the method of calculation.)

A "Bertrand" version of the model was calibrated also, and the elasticities and model conjectures are reported in Table 1, though not the tariff-equivalents (which are different from those of the Cournot calibration, but not remarkably so). Invariably, the model elasticity is lower in this case than in the Cournot case, simply because the Cournot version of the model gives more weight to market shares in the determination of marginal revenue. Bertrand behaviour by firms is inherently more competitive and the observed failure of firms fully to exploit their economies of scale has to be explained by a higher degree of product differentiation (lower model elasticity) and by more pessimistic model conjectures. In the cases of cement (242) and artificial fibres (260), the Bertrand calibration produces an implausibly high degree of product differentiation. We choose the Cournot case for our central projections because, even if it is based on too simplistic a model to capture all of the complexity of real world competitive interaction, it does give an intuitively appealing weight to market shares in describing firms' behaviour.

4. Simulation of reduced trade barriers

Our first set of policy experiments is based on a very conservative interpretation of what is involved in "completing the internal market": the intra-EC implicit trade barriers are reduced equiproportionately so as to reduce trade costs by 2.5% of the value of intra-EC trade. Thus in the case of artificial fibres, all the tariff equivalents were reduced by 13.5%, while in electrical household appliances, where the tariff equivalents were calibrated to be much higher, a 6.6% reduction in their value reduced trade costs by 2.5%. (In the case of footwear, where the calibration suggested the implicit barriers are already quite low, a 2.5% reduction produced implausible effects, and we have modelled the reduction as being 1%.)

The figure of 2.5% could be defended on the basis of Winters's estimate (Pelkmans, Wallace and Winters, 1988) that removal of border measures affecting intra-EC trade should generate direct cost savings of between 1% and 3% of trade. However, Winters also notes the existence of other distorting influences on trade, such as public procurement policies, subsidies and national standards, so our figure of 2.5% could be interpreted as taking a pessimistic view of the possibilities of substantial progress in reducing such distortions. It should, though, be noted that our results can be scaled proportionately to provide approximate estimates of the effects of changes in trade barriers different from the 2.5% reduction.

The effects projected by our model of this policy change are summarised for each of the ten industries in Table 2. Cournot behaviour is assumed and it is also assumed that firms do not change the size of their model ranges. Two sets of projections are reported: one for the case in which the number of firms is unchanged by the policy; and the second for the case in which entry and exit of firms is assumed to take place so as to restore profits to the levels in the base case before the policy change.

Consistently across industries, as one would expect, the first effect is to increase the volume of intra-EC trade, whether or not the number of firms is constant. With a given number of firms, the increased import penetration makes markets more competitive and reduces prices, expands sales, raises consumer surplus and (except where there is a large increase in output) reduces profits. The effect on national output is to reinforce existing differences in trade patterns, so, for example, in pharmaceuticals (257) the UK expands and Italy contracts, while in electrical household appliances (346) Italy expands and the UK contracts. The consistent effect of the output changes is to reduce the EC average value of the average cost of production in each industry.

When the number of firms is allowed to vary in response to profit changes, the usual outcome (with the exception of office machinery (330) in which there are substantial apparent differences in the degree of concentration in different countries) is for there to be a reduction in the total number of EC firms, so that average cost falls further as remaining firms increase in size. Thus in most industries (260, 330, 346, 350, for example), the average EC price falls by more when the number of firms is variable. The effect on consumer surplus is not necessarily as one would expect from looking at prices alone, because consumer surplus is affected also by the variety of products available, and that changes with the number of firms.

Exit of firms tends to raise concentration, but in the version of the model used to generate the projections presented here, the price-cost markup is calculated with the number of firms unchanged. The rationale for this procedure is that, although the model treats all firms in a country as identical, in reality firms differ in size and efficiency, and exit of the least efficient firms should have little effect on the remaining firms' perception of the intensity of the competition they face. (When the model is run with the alternative assumption that exit is fully reflected in the surviving firms' markups the results differ in some details in some industries, but the overall pattern of results is not greatly changed.)

Both with firm numbers fixed and variable, there are effects on extra-EC trade in all industries: 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 competitivity reduces EC prices, expands extra-EC exports (a form of trade creation) and further reduces extra-EC imports. The key effect on the EC as a whole of the policy change across the ten sectors are summarised in Table 3 which reports for both variants of the model the percentage change in output, the percentage change in average cost, the change in aggregate welfare (consumer surplus plus profit) as a fraction of the value of total consumption in the base case, and the ratio of welfare gain to intra-EC trade creation. For each industry, Table 3 also reports some key characteristics of the industry. ε, the calibrated value of the individual model elasticity, is high where different varieties of the product are close substitutes (as in 242 and 451) and low where there is strong product differentiation (as in 257 and 342). RS gives the increase in average cost when production runs are reduced to half their minimum efficient scale, so that high values indicate the existence of strong economies of scale, as in 257 and 350. TS gives the share on intra-EC trade in EC consumption and is low in those industries (242 and 342) which seem to have high transport costs. H is the EC average Herfindahl index, and is high in concentrated industries such as 330 and low in industries with many firms such as 342 and 451. DC is the direct cost saving associated with the policy change, expressed as a percentage of base consumption.

Table 3 shows the changes in average cost and the changes in welfare as a proportion of base consumption that result from the policy change. These changes are largest in industries 260, 330, and 350, which all have significant returns to scale and a high proportion of output traded within the EC. Only in those industries, with free entry/exit, do welfare gains exceed 1% of base consumption. It should also be noted that the cost reduction and welfare gain are largest when there is entry and exit, but the effect of entry and exit is significant only in the more concentrated industries and is negligible or negative in 322, 342 and 451. Comparison of the welfare gain with DC shows to what extent the welfare gains are "indirect", in the sense of resulting from adjustment in the market to the policy change, and to what extent they are simply the direct consequence of the reduction in trade costs.

The results of Table 3 show finally that the ratio of welfare gain to trade creation is strongly associated with the degree of returns to scale, exceeding 18% in the free entry case in the four industries, 242, 257, 342 and 350, with the greatest economies of scale, and dropping below 2% in footwear, where scale economies are least. (The fact that trade liberalisation generates welfare losses in the cement industry with a fixed number of firms is a reflection of the very high transport costs in this sector, so that the gains to consumers of increased competition are more than wiped out by the losses to firms.)

The ratio of welfare gain to trade created is a useful statistic to summarise the results of the models because it is not directly dependent on the precise nature of the policy experiment being modelled and can be used to compare our results with those of other studies. Owen (1983, pp.144-147) reports welfare gains of the order of 50% of the value of trade creation, in a study of the effects of the EC that takes account of economies of scale, in contrast with the numbers in our Table 3 which are mostly in the range of 8% to 25%. There seem to be three principal sources of the difference between our results and those of Owen: he assumes a much greater degree of economies of scale; he supposes that industries expand through expansion of existing firms but contract through exit; and he confines attention to uni-directional trade creation, ignoring intra-industry trade. Our results are closer to those generated by the modelling exercise of Harris and Cox (1984, p.114) who estimate in a model with scale economies a welfare gain of 17.5% of trade created by multilateral liberalisation of Canadian trade with the rest of the world.

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 Bertrand 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). 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.

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.

We have not undertaken formal sensitivity analysis with respect to parameters of the model such as the returns to scale parameters or the overall product demand elasticity. In the former case, the comparison of results for different industries gives a fairly clear indication of how changes in assumptions about scale economies would affect the conclusions (see the discussion of Table 3 in the previous section). In the latter case, it is evident from the formal structure of the model that variations in this elasticity within plausible ranges are most unlikely to have significant or systematic effects on the results of the model, being swamped by the efffects of differences in the model elasticity.

6. Simulation of market integration

Table 5 reports the results for the ten industries of a much more dramatic interpretation of what is involved in "completing the internal market". It is assumed 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.

The key to understanding the effect of this change in the market is to recall the role that market share plays in giving firms market power, especially in the Cournot version of the model. When different countries are treated by firms as being different markets, then the large share that firms typically have in their own domestic markets gives them the ability to charge higher prices to home consumers. With 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.

The results of the change are reported industry-by-industry in Table 5 and are summarised and compared with the previous, "segmented market", case in Table 6.

In several industries, the shift to integrated markets leads to a reduction in intra-EC trade, reported in the fourth row of each part in Table 6. This is the natural consequence of the reduction in firms' market power in their home markets leading to a reduction in their prices in those markets. More important, in most industries there are much more substantial loss of profits and in all industries much greater gains of consumer surplus in this experiment than in the experiment reported in Table 2. When in Table 6 we compare the two sets of Cournot experiments we find that in the more concentrated industries where firms had significant market power (242, 257, 260, 330, 346, 350) the increase in the competitivity of the market as a result of integration leads to welfare gains quite significantly larger than those in the segmented market case: the impact on economic welfare in these industries of the reduction in trade costs <u>combined</u> with the shift to integrated markets is typically (with fixed numbers of firms) <u>four times</u> the size of the welfare gain from the reduction in trade costs alone and in most of these industries the welfare gain is in the region of 1%-4% of base consumption.

The consequence of the profit change is that if entry and exit are permitted there is greater exit in most industries in the integrated market experiment, and again this implies that the welfare gains are much larger than in the free entry case when markets are segmented. The welfare gains are not invariably larger with free entry than they were with fixed numbers of firms, and most of the gains for concentrated industries are still in the range of 1% to 4% of base consumption but the gain rises to 12% in the motor industry when exit is permitted.

In the segmented market policy experiment, we reported welfare change as a fraction of intra-EC trade creation, but this is not now a meaningful statistic since a reduction in intra-EC trade can be the result of the policy change.

Table 6 also shows that market integration has little effect in those industries where concentration is low (machine tools and footwear) and has little effect in the Bertrand version of the model. This simply reflects the fact that market shares give little market power in these cases, so that a change in market structure which changes effective market shares has little real effect.

Conclusions

It is appropriate to precede our conclusions with a note about the limitations of the kind of exercise that we have undertaken here. We believe that the facts of industrial concentration, economies of scale, and intra-industry trade provide a strong case for modelling many markets as being imperfectly competitive; and only a modelling exercise based, as this one has been, on imperfect competition can hope to capture in a consistent fashion many key effects of policy changes in such markets. It will be clear from the earlier sections of the paper that we have more confidence in the "Cournot" versions of our model, since it seems to give an appropriate weight to market shares in describing equilibrium. Even this model, however, is at best a crude approximation to the complexity of imperfectly competitive behaviour in the real world.

All of the results reported above are of a partial equilibrium nature in that the analysis is conducted on an industry-by-industry basis. There are three possible important effects which are left out of such an approach. One is the effect of price changes of intermediate goods used as inputs in other industries; the second relates to changes in the prices of primary factors of production as different sectors compete for these factors; and the third is the possible effect of exchange rate changes resulting from the projected changes in trade patterns. We have not modelled such interactions, and our judgement is that including the latter two effects is unlikely to have a major impact on our results: there might be important changes in exchange rates and in factor prices, but the feedback effects into the goods markets are likely to be of second-order importance. The possible effects of intermediate goods price changes are harder to guess without actually developing a formal model that distinguishes between intermediate and final goods, and models the appropriate general equilibrium interactions. It is possible that the omission of such interactions leads to a significant underestimate of the effects of policy change.

What degree of confidence then should one have in our results? Different versions of the model produce fairly similar projections for the EC as a whole and this is encouraging. There is some reason to have greater confidence in our results for the EC as a whole than in our allocation of these results across countries. For example, in the free entry case we see that increased competition causes exit of firms in the EC as a whole, and the consequent changes in firm scale and average costs are very similar for firms in all countries. Which countries does the exit occur in? The results derived by the model come essentially from projection of existing patterns of trade, with the positions of net exporters being strengthened. However, if the actual effect of the reduction in intra-EC barriers was different from the equiproportionate reduction in tariff equivalents that we have modelled, the distribution between countries of the changes in output would be different, and it should be recalled that we have no information on the extent to which the apparent barriers represented by the tariff equivalents are the result of genuine differences in tastes as opposed to potentially removable artificial barriers.

In interpreting the results, one also needs to recall that they have been produced by assuming a reduction of 2.5% in intra-EC trade costs. If one believed that the scope for actual cost reductions were different from this, the projected effects on welfare and costs should be adjusted accordingly. Also we have reported above the figure for the welfare gain as a fraction of trade created, because this figure may remain a reasonable estimate even if trade is created by methods other than the reduction in tariff-equivalent barriers which we have modelled.

We have examined two interpretations of what is involved in "completing the internal market in the EC". 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, by modest though significant amounts. Our projections could be rescaled to provide approximate estimates of the effects of barrier reductions of a different size from the one we have modelled.

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 market power. This policy yields large welfare gains. It also causes large reductions in profit (and in the long run in the number of firms), and it is not clear to what extent there exist feasible changes in EC trade policy and competition policy that could actually being about such a change.

The gains from "completing the internal market" differ substantially therefore 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 that the U.S.A. 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. Successful policy of this nature would have more effect on economic welfare in the long run that policies aimed only at barriers more directly and obviously affecting international trade.

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Table 1; Calibration

242 Cement, lime and plaster

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	1860.32	33.12	7.45	1.97	14.50	114.54
G	4.35	1932.24	0.89	3.19	79.38	68.75
It	1.57	0.32	2138.09	0.02	0.43	41.17
UK	1.20	0.37	0.16	1212.33	4.20	26.14
RoEC	14.52	29.50	2.41	12.59	7369.62	302.66
RoW	0.28	12.73	7.41	1.47	4.76	1208.68

Number of firms=

13	17	19	10	60	10

Number of sub-industries= 1.

Returns to scale.
% increase in average cost at 1/3 output per model: 20%
% increase in average cost at 1/2 number of models: 0%
Linear/loglinear weights: 0.5, 0.5;

Elasticity = 0.6

Cournot Calibration;

Elasticity = 35.54.

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.19	0.22	0.32	0.15
G	0.27	0.00	0.27	0.31	0.11
It	0.29	0.30	0.00	0.41	0.24
UK	0.28	0.28	0.29	0.00	0.17
RoEC	0.27	0.23	0.28	0.31	0.00

Model Conjectures (%),
w = -6.8 -6.8 -6.8 -6.6 -7.1

Bertrand Calibration

Elasticity = 8.01.

Model Conjectures (%),
w = -6.8 -6.9 -6.8 -6.8 -6.9

257 Pharmaceutical Products

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	5275.79	164.31	52.71	71.03	167.37	821.89
G	59.10	4914.07	140.17	110.48	266.93	1138.45
It	45.52	67.50	4015.36	20.44	45.82	487.57
UK	84.29	87.27	92.64	3399.65	267.02	1119.32
RoEC	117.47	234.80	71.16	138.07	2016.25	784.49
RoW	237.99	409.20	243.47	206.25	426.09	18558.51

Number of firms=

135	71	88	46	50	298

Number of sub-industries= 5.

Returns to scale.
% increase in average cost at 1/2 output per model; 22%
% increase in average cost at 1/2 number of models; 5%
Linear/loglinear weights; 1.0, 0.0;

Elasticity = 0.8

Cournot Calibration;

Elasticity = 5.8

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.53	0.64	0.62	0.51
G	0.61	0.00	0.55	0.59	0.46
It	0.61	0.58	0.00	0.69	0.60
UK	0.55	0.56	0.56	0.00	0.42
RoEC	0.49	0.42	0.56	0.50	0.00

Model Conjectures (%),

w =	-0.6	-0.6	-0.6	-0.6	-0.6

Bertrand Calibration

Elasticity = 4.72.

Model Conjectures (%),

w =	17.9	17.9	17.9	17.9	17.9

260 Artificial and synthetic fibres

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	288.66	81.53	79.05	27.38	80.23	152.95
G	177.92	432.34	175.12	153.30	323.55	649.07
It	100.28	83.25	779.21	67.17	119.26	307.33
UK	6.98	26.63	19.42	822.01	63.62	84.73
RoEC	106.47	186.43	79.47	121.18	612.48	127.15
RoW	90.57	140.18	110.96	172.77	172.38	1524.21

Number of firms=

5	13	10	7	8	15

Number of sub-industries= 1.

Returns to scale.
% increase in average cost at 1/2 output per model: 10%
% increase in average cost at 1/2 number of models: 3%
Linear/loglinear weights: 0.5, 0.5:

Elasticity = 0.5.

Cournot Calibration:

Elasticity = 21.54.

Tariff equivalents:

	F	G	It	UK	RoEC
F	0.00	0.06	0.16	0.28	0.14
G	0.17	0.00	0.17	0.24	0.11
It	0.19	0.10	0.00	0.27	0.16
UK	0.29	0.14	0.24	0.00	0.17
RoEC	0.17	0.03	0.19	0.23	0.00

Model Conjectures (%),
w = -2.0 -2.1 -2.0 -1.9 -2.0

Bertrand Calibration

Elasticity = 8.71.

Model Conjectures (%),
w = 25.9 30.0 25.9 25.9 25.9

322 Machine Tools.

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	580.27	88.60	35.87	33.77	57.54	495.95
G	330.86	2456.86	164.38	214.00	350.09	2519.82
It	135.41	123.93	1171.60	46.37	52.12	635.68
UK	49.86	62.82	24.51	758.40	88.77	713.34
RoEC	70.71	132.02	19.81	53.02	621.86	298.21
RoW	298.42	653.72	184.04	358.78	270.74	8899.08

Number of firms=

79	204	115	186	62	556

Number of sub-industries= 1.

Returns to scale.
% increase in average cost at 1/2 output per model; 7%
% increase in average cost at 1/2 number of models; 1%
Linear/loglinear weights; 0.8, 0.2;

Elasticity = 1.1

Cournot Calibration;

Elasticity = 13.55.

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.13	0.21	0.20	0.18
G	0.15	0.00	0.21	0.18	0.16
It	0.14	0.14	0.00	0.21	0.21
UK	0.19	0.17	0.25	0.00	0.16
RoEC	0.15	0.09	0.24	0.16	0.00

Model Conjectures (%),

w =	0.1	0.1	0.1	0.1	0.1

Bertrand Calibration

Elasticity = 13.25

Model Conjectures (%),

w =	14.3	14.3	14.3	14.2	14.3

330 Office Machinery.

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	3642.39	392.97	141.28	227.18	242.39	646.68
G	682.03	3022.19	293.57	436.08	433.08	1203.24
It	293.86	208.78	2473.85	168.27	154.96	469.18
UK	387.60	372.85	194.51	1431.41	381.00	990.72
RoEC	317.24	436.91	111.30	551.71	2889.95	665.74
RoW	1434.56	1659.24	551.99	1828.86	1348.03	17123.55

Number of firms=

9	17	6	20	14	70

Number of sub-industries= 2.

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: 0.8, 0.2;

Elasticity = 0.90.

Cournot Calibration:

Elasticity = 32.77.

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.10	0.30	0.10	0.10
G	0.16	0.00	0.28	0.08	0.12
It	0.16	0.11	0.00	0.10	0.14
UK	0.16	0.10	0.28	0.00	0.11
RoEC	0.18	0.10	0.30	0.07	0.00

Model Conjectures (%).
w = -2.4 -2.5 -2.4 -2.5 -2.5

Bertrand Calibration

Elasticity = 10.90

Model Conjectures (%).
w = 40.4 40.3 40.4 40.2 40.3

342 Electric motors, generators, etc.

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	7106.81	218.95	110.10	90.06	174.80	1361.29
G	449.10	15428.51	247.86	234.17	553.78	2540.48
It	117.51	92.39	2170.80	37.78	51.95	789.58
UK	80.25	96.94	38.02	2219.60	165.41	1516.68
RoEC	105.06	190.88	45.59	88.66	3559.12	548.73
RoW	341.42	794.04	241.08	519.74	445.86	28778.40

Number of firms=

65	186	46	121	53	362

Number of sub-industries= 3.

Returns to scale.
% increase in average cost at 1/2 output per model: 15%
% increase in average cost at 1/2 number of models: 5%
Linear/loglinear weights; 0.8, 0.2;

Elasticity = 1.1

Cournot Calibration;

Elasticity = 7.35

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.42	0.49	0.48	0.46
G	0.44	0.00	0.48	0.46	0.42
It	0.39	0.40	0.00	0.46	0.47
UK	0.44	0.41	0.50	0.00	0.38
RoEC	0.43	0.36	0.50	0.41	0.00

Model Conjectures (%),

w =	3.0	3.0	3.0	3.0	3.0

Bertrand Calibration

Elasticity = 6.77.

Model Conjectures (%),

w =	27.5	27.4	27.3	27.3	27.3

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.

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 = 1.75.

Cournot Calibration:

Elasticity = 10.77.

Tariff equivalents:

	F	G	It	UK	RoEC
F	0.00	0.31	0.34	0.34	0.34
G	0.27	0.00	0.33	0.33	0.24
It	0.25	0.23	0.00	0.25	0.27
UK	0.36	0.33	0.40	0.00	0.28
RoEC	0.32	0.25	0.44	0.31	0.00

Model Conjectures (%).

w =	6.5	6.3	6.4	6.3	6.4

Bertrand Calibration

Elasticity = 7.78.

Model Conjectures (%).

w =	62.6	62.0	62.1	61.7	62.3

438 Carpets, linoleum etc.

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	477.79	27.71	13.91	13.29	25.28	65.02
G	72.31	591.81	34.60	34.27	131.85	237.66
It	45.13	32.70	151.78	18.95	17.32	84.32
UK	19.69	32.58	6.15	969.97	52.50	130.80
RoEC	232.12	382.06	37.02	213.31	3201.47	392.93
RoW	88.15	536.41	65.52	123.87	102.06	4741.82

Number of firms=

25	30	15	52	165	210

Number of sub-industries= 1.

Returns to scale.
% increase in average cost at 1/2 output per model: 6%
% increase in average cost at 1/2 number of models: 3%
Linear/loglinear weights: 0.5, 0.5;

Elasticity = 0.95.

Cournot Calibration:

Elasticity = 21.4

Tariff equivalents:

	F	G	It	UK	RoEC
F	0.00	0.11	0.16	0.17	0.13
G	0.13	0.00	0.15	0.16	0.09
It	0.09	0.08	0.00	0.13	0.12
UK	0.18	0.13	0.22	0.00	0.13
RoEC	0.32	0.25	0.44	0.31	0.00

Model Conjectures (%).

w =	1.0	1.0	1.0	1.0	1.0

Bertrand Calibration

Elasticity = 17.59

Model Conjectures (%).

w =	36.6	36.6	36.5	36.5	36.6

350 Motor Vehicles

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	22702.28	1342.23	1644.29	858.53	1397.31	4834.67
G	3136.92	23571.78	1988.86	2877.10	4932.93	15737.12
It	1028.58	625.97	8873.40	311.21	333.78	2057.77
UK	478.23	639.63	305.56	10053.23	817.55	3486.90
RoEC	1223.58	2108.70	615.11	1533.90	11507.32	1237.59
RoW	1908.76	1696.23	887.25	1855.49	2618.98	35034.30

Number of firms=

2	5	2	3	2	4

Number of sub-industries= 1.

Returns to scale.
% increase in average cost at 1/2 output per model; 16%
% increase in average cost at 1/2 number of models; 8%
Linear/loglinear weights; 0.5, 0.5;

Elasticity = 1.63

Cournot Calibration;

Elasticity = 13.32.

Tariff equivalents;

	F	G	It	UK	RoEC
F	0.00	0.24	0.32	0.32	0.31
G	0.34	0.00	0.35	0.27	0.25
It	0.30	0.21	0.00	0.31	0.32
UK	0.36	0.22	0.37	0.00	0.28
RoEC	0.32	0.15	0.35	0.23	0.00

Model Conjectures (%),

w = -5.1 -4.6 -4.8 -4.6 -4.8

Bertrand Calibration

Elasticity = 7.2

Model Conjectures (%),

w = 33.0 35.0 33.0 35.0 35.0

Table 2; Reduction in Trade Barriers
Segmented Markets
242 Cement, lime and plaster: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	1.75	12.2	-15.4	2.33	24.0	-1
Germany	-1.01	10.4	-15.2	18.6	51.7	-4
Italy	-0.99	1.7	-3.7	-0.81	9.8	-1
U.K.	-4.0	9.5	-17.4	-2.16	17.9	-1
R of EC	-1.10	10.2	-7.6	-3.66	-8.8	1
EC	0.24	43.9	-59.3	0.58	94.5	-7

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	128.5	0.4	-10.7	-0.42	-0.03	-0.1	-5.0
Variable no. of firms	180.6	0.0	-33.6	-0.93	-0.93	0.64	22.1

257 Pharmaceutical products: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	0.46	12.3	1.40	0.60	14.4	0
Germany	0.42	19.5	-3.4	0.44	16.8	0
Italy	-0.22	16.2	-8.2	-0.42	7.9	-1
U.K.	0.52	18.3	-6.3	0.30	13.2	0
R of EC	0.68	20.8	-2.7	0.42	17.8	0
EC	0.37	87.2	-19.1	0.30	70.0	-1

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	13.3	0.0	-2.0	-0.16	-0.08	0.29	21.8
Variable no. of firms	13.3	-0.3	-1.6	-0.15	-0.15	0.30	22.5

451 Footwear

Production/Consumption matrix, 1982 mECU.

	Fr	G	It	UK	RoEC	RoW
Fr	1964.10	107.87	21.51	42.53	102.85	260.93
G	42.76	1238.02	10.22	15.25	126.07	239.68
It	535.04	864.89	1264.14	358.25	446.59	1489.36
UK	10.62	11.01	7.25	1134.15	83.63	94.84
RoEC	20.00	87.31	2.41	30.77	689.88	103.60
RoW	291.47	581.40	78.56	350.28	246.99	4298.87

Number of firms=

94	71	465	65	42	388

Number of sub-industries= 1.

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

Elasticity = 0.70.

Cournot Calibration:

Elasticity = 53.29

Tariff equivalents:

	F	G	It	UK	RoEC
F	0.00	0.06	0.08	0.08	0.06
G	0.07	0.00	0.08	0.09	0.05
It	0.03	0.02	0.00	0.05	0.04
UK	0.09	0.09	0.08	0.00	0.05
RoEC	0.07	0.04	0.09	0.07	0.00

Model Conjectures (%).

w =	1.3	1.3	1.3	1.3	1.3

Bertrand Calibration

Elasticity = 42.46

Model Conjectures (%).

w =	99.3	99.3	99.3	99.3	99.3

Segmented Markets
330 Office Machinery: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	3.31	112.4	-63.4	-21.3	91.4	-3
Germany	13.4	50.0	10.9	33.6	64.8	3
Italy	4.37	148.9	-113.1	-25.0	129.0	-2
U.K.	-21.3	37.3	14.4	78.9	60.9	11
R of EC	8.24	58.7	-17.3	-11.6	49.7	-3
EC	10.4	407.4	-168.4	12.5	396.0	6

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	44.5	5.9	-25.9	-1.67	-0.98	0.88	8.0
Variable no. of firms	57.2	12.3	-27.5	-2.48	-2.48	1.45	10.7

342 Electric motors, generators, etc: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	0.09	26.6	-7.0	-0.02	19.9	0
Germany	1.01	22.6	17.3	1.49	46.8	2
Italy	-0.56	19.3	-7.7	-1.98	10.1	-1
U.K.	-0.06	15.7	-1.5	0.04	14.4	0
R of EC	-0.86	30.0	-11.3	-2.26	14.8	-2
EC	0.37	114.2	-10.2	0.31	106.1	-2

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	17.3	0.1	-2.3	-0.08	-0.05	0.29	19.0
Variable no. of firms	17.9	-0.2	-1.9	-0.09	-0.09	0.29	18.4

Segmented Markets
260; Artificial and Synthetic fibres: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	2.37	18.7	-6.8	-56.3	16.1	-3
Germany	14.6	8.0	11.4	87.9	15.9	10
Italy	1.77	22.7	-14.2	-13.6	21.1	-3
U.K.	-6.71	35.7	-30.7	-21.4	31.9	-2
R of EC	-0.14	20.8	-8.90	-41.7	20.0	-4
EC	4.19	105.9	-49.2	6.61	105.0	-3

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	20.4	2.0	-24.2	-1.29	-0.51	0.99	13.0
Variable no. of firms	36.9	10.5	-23.2	-2.45	-2.45	1.84	14.0

322 Machine Tools: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	-0.58	16.8	-0.9	-18.4	11.9	-15
Germany	4.1	11.3	13.5	18.6	36.4	38
Italy	-0.02	12.2	-1.0	-4.49	9.7	-6
U.K.	-0.18	13.1	-0.5	-6.47	11.0	-13
R of EC	-2.30	17.8	-2.3	-29.6	8.9	-19
EC	1.67	71.2	8.8	2.66	78.8	-15

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	27.1	0.3	-8.5	-0.05	-0.12	0.84	13.8
Variable no. of firms	32.0	2.7	-9.4	-0.05	-0.05	0.82	11.4

Segmented Markets
438 Carpets, linoleum etc.: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	-21.2	13.7	-5.8	-52.4	6.4	-15
Germany	11.6	14.6	0.8	32.4	19.2	6
Italy	-0.37	6.2	-1.8	-21.3	4.8	-5
U.K.	-12.0	11.1	-5.6	-18.8	6.3	-15
R of EC	7.66	16.2	2.7	10.6	22.0	11
EC	2.51	62.0	-9.8	2.70	58.8	-18

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	45.0	1.8	-16.7	-0.30	-0.17	0.67	8.0
Variable no. of firms	53.7	2.3	-17.2	-0.49	-0.49	0.76	7.5

451 Footwear: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	-0.32	11.5	-4.4	-24.1	8.6	-31
Germany	-5.46	12.2	-3.3	-62.7	8.0	-47
Italy	15.9	4.2	4.6	72.0	13.7	311
U.K.	-15.0	10.6	-6.4	-57.2	5.2	-41
R of EC	-12.7	13.3	-4.6	-80.3	7.2	-35
EC	3.21	51.8	-14.0	3.44	42.8	157

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	41.4	3.8	-21.3	-0.15	-0.03	0.35	3.1
Variable no. of firms	92.7	17.9	-14.7	-0.03	-0.03	0.40	1.6

Segmented 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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	0.75	33.2	-16.9	-0.44	25.1	-1
Germany	4.32	24.4	-0.4	6.33	28.0	0
Italy	6.40	18.6	0.5	8.89	21.8	0
U.K.	-4.93	20.3	-11.2	-8.14	10.6	-5
R of EC	-0.59	29.2	-13.5	-3.63	20.0	-2
EC	2.09	125.8	-41.6	2.08	105.5	-8

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	22.1	1.1	-7.6	-0.62	-0.32	0.64	14.8
Variable no. of firms	24.7	0.6	-5.8	-0.93	-0.93	0.81	16.7

350 Motor vehicles: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	2.26	524.9	-315.3	1.36	482.3	0
Germany	5.79	224.5	61.0	10.7	309.4	0
Italy	1.26	307.4	-174.7	-3.10	257.1	0
U.K.	-0.46	234.1	-123.3	-4.76	185.0	0
R of EC	2.72	337.7	-125.6	-1.85	297.7	0
EC	3.36	1628.6	-678.0	3.64	1531.5	-1

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption	Δ welfare% Δ int-EC trade
Fixed no. of firms	18.7	1.2	-13.2	-1.07	-0.56	0.83	17.9
Variable no. of firms	21.2	1.4	-11.7	-1.51	-1.51	1.34	25.5

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

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		
[illegible]7 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	[illegible].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		

Table 5 Reduction in Trade Barriers
Integrated Markets
242 Cement, lime and plaster: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	-0.59	66.9	-60.8	-4.37	-6.5	0
Germany	2.45	88.3	-76.9	-3.73	-3.8	0
Italy	1.39	33.2	-30.0	0.23	-0.3	0
U.K.	3.76	60.4	-51.7	-3.66	-2.37	0
R of EC	1.13	41.8	-38.4	2.48	9.20	0
EC	1.32	290.6	-257.8	0.03	-14.4	1

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-78.0	0.8	-56.9	-1.81	-0.12	0.22
Variable no. of firms	-43.1	-0.01	5.9	0.09	0.09	-0.1

257 Pharmaceutical products: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	1.19	91.8	-68.4	1.59	33.9	-10
Germany	3.10	182.7	-119.5	1.77	82.0	-10
Italy	3.43	113.0	-75.5	3.46	44.7	-10
U.K.	3.74	234.5	-154.1	-0.41	123.3	-10
R of EC	7.21	104.7	-48.3	5.76	56.5	-5
EC	3.32	726.7	-465.7	2.13	340.3	-47

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-16.1	0.0	-15.7	-2.50	-0.63	1.10
Variable no. of firms	-16.5	-11.5	-7.7	-0.83	-0.83	1.45

Integrated Markets
260; Artificial and Synthetic fibres: (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 output , %	Δ consumers' surplus, mECU	Δ number of firms
France	80.1	74.7	-0.7	33.7	36.4	1
Germany	-52.6	7.4	-41.4	-33.0	-12.8	-3
Italy	13.1	80.2	-34.5	41.7	93.5	-2
U.K.	53.1	132.4	-30.8	21.7	38.0	1
R of EC	30.3	57.4	-8.9	4.63	10.4	1
EC	9.60	352.2	-116.2	7.18	165.6	-1

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-56.5	-2.5	-57.8	-2.60	-1.77	4.14
Variable no. of firms	-48.0	-2.2	-47.5	-1.04	-1.04	2.91

322 Machine Tools: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	0.74	17.8	-1.40	-16.2	12.1	-15
Germany	3.62	12.3	11.6	18.4	36.2	39
Italy	0.98	15.9	-3.4	-5.57	10.0	-10
U.K.	0.32	13.5	-0.90	-5.40	11.0	-12
R of EC	-0.10	19.6	-3.0	-28.2	9.3	-20
EC	2.05	79.1	2.9	2.86	78.5	-18

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	24.6	0.3	-10.0	-0.14	-0.16	0.86
Variable no. of firms	29.4	2.6	-10.3	-0.10	-0.10	0.83

Integrated Markets
330 Office Machinery: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	44.2	389.6	-4.5	21.5	187.0	1
Germany	19.5	145.1	-33.0	15.9	94.4	1
Italy	15.3	373.3	-32.6	15.3	361.7	0
U.K.	21.3	59.4	-13.1	20.5	34.1	2
R of EC	33.1	213.5	-43.0	61.0	277.4	-3
EC	27.3	1181.1	-126.2	27.2	954.6	0

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-64.0	11.9	-66.1	-3.23	-2.71	3.88
Variable no. of firms	-51.0	11.7	-68.2	-2.70	-2.70	3.43

342 Electric motors, generators, etc: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	2.21	144.4	-91.6	0.86	54.7	-8
Germany	0.44	62.0	-32.2	1.54	51.4	-3
Italy	4.32	77.4	-42.3	-1.08	29.0	-8
U.K.	1.51	32.3	-14.5	1.09	18.5	-5
R of EC	4.69	105.1	-53.1	0.89	37.2	-8
EC	1.72	421.2	-233.7	1.06	190.8	-32

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	2.5	0.4	-8.1	-0.83	-0.26	0.52
Variable no. of firms	4.0	-4.4	-3.8	-1.3	-1.30	0.53

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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	13.6	145.1	-63.3	25.3	185.7	-9
Germany	1.49	81.9	-52.4	4.34	84.7	-14
Italy	-0.81	89.7	-62.6	-0.92	79.6	-13
U.K.	13.6	52.6	-22.3	15.4	46.0	-14
R of EC	20.2	100.5	-34.4	26.4	107.9	-8
EC	8.08	469.9	-234.9	12.7	503.9	-59

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-23.0	2.4	-24.4	-2.88	-1.11	1.79
Variable no. of firms	-24.5	-12.6	-23.6	-9.04	-9.04	3.85

350 Motor vehicles: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	12.5	2172.4	-389.0	54.4	6105.9	-1
Germany	-9.7	555.4	-639.5	-12.3	1551.2	-3
Italy	29.3	914.3	19.6	59.1	2118.9	-1
U.K.	35.5	803.6	-86.4	44.2	1463.0	-1
R of EC	33.0	1353.1	-44.8	57.4	2502.7	-1
EC	10.5	5798.6	-1140.1	26.4	13741.7	-8

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-61.4	2.0	-40.7	-2.58	-1.72	4.09
Variable no. of firms	-61.0	-16.7	-63.5	-16.9	-16.9	12.1

Integrated Markets
438 Carpets, linoleum etc.: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	4.12	21.4	-8.0	-24.2	13.0	-18
Germany	32.9	20.2	-1.1	30.8	21.6	-7
Italy	25.9	11.0	-3.7	-3.73	8.0	-9
U.K.	0.70	20.1	-10.0	-9.67	12.0	-31
R of EC	-3.21	1.0	6.9	7.01	20.7	-43
EC	4.46	73.7	-15.9	4.86	75.4	-109

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	26.7	5.9	-24.3	-0.50	-0.30	0.75
Variable no. of firms	34.9	-4.5	-20.2	-2.79	-2.79	0.97

451 Footwear: (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 output %	Δ consumers' surplus, mECU	Δ number of firms
France	16.4	22.2	-9.7	2.19	18.7	-57
Germany	26.7	17.0	-3.9	-2.58	14.7	-40
Italy	-15.6	-2.1	1.1	12.2	6.0	-36
U.K.	18.2	20.4	-9.6	-7.10	14.5	-46
R of EC	31.9	20.1	-5.6	-6.82	14.9	-29
EC	5.53	77.6	-27.6	4.00	68.7	-207

EC aggregates

	Δ intra-EC trade %	Δ extra-EC exports %	Δ extra-EC imports %	Δ price% (EC ave)	Δ average costs %	Δ welfare% consumption
Fixed no. of firms	-0.1	-1.8	-34.7	-0.50	-0.26	0.46
Variable no. of firms	25.5	-3.2	-25.1	-1.36	-1.36	0.64

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

The costs of non-Europe: an assessment based on a formal model of imperfect competition and economies of scale

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and
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TECHNICAL APPENDIX

The model underlying the projections presented in the paper is one of partial equilibrium, operating at the level of a single industry. There are a number of countries, indexed by $i=1,..,I$, in which firms are located, and these countries also constitute separate product markets. Each firm is assumed to be located in only one country and the number of firms active in an industry in country i is denoted n_i, all firms in country i being 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 is 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, this sub-utility function representing the aggregate quantity of the product consumed. The sub-utility function for country j is denoted y_j, and is assumed to be of the constant elasticity of substitution (CES) form, as in Dixit and Stiglitz [1977]. Consumers in country j may consume products which are produced in each country, so the number of product types available for consumption is $\Sigma n_i m_i$. The sub-utility function, or aggregate volume index, is then

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

where the a_{ij} are parameters describing the preferences of a consumer in country j for products produced in country i. It is then possible to show that the aggregate price level of the product is given by the function

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

Demand in country j for the aggregate product is assumed to be a function only of the aggregate product price level and to have constant elasticity of demand μ so that

$$y_j=b_j q_j^{-\mu} \tag{3}$$

where b_j is a parameter measuring the size of the market j, and it then follows that demand for individual product varieties is given by

$$x_{ij}=a_{ij}(p_{ij}/q_j)^{-\varepsilon} y_j=p_{ij}^{-\varepsilon} a_{ij} b_j q_j^{\varepsilon-\mu} \tag{4}$$

Each type of differentiated product is supplied by a single firms 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

$$\pi_i=m_i\sum_j x_{ij}[p_{ij}(1-T_{ij})-t_{ij}]-C_i(x_i,m_i) (i=1,..,I) \tag{5}$$

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, $x_i = \Sigma x_{ij}$, 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

$$p_{ij}(1 - T_{ij})(1 - \frac{1}{e_{ij}}) - t_{ij} = \frac{1}{m_i}\frac{\delta C_i}{\delta x_i} \qquad (i,j=1,..,I) \tag{6}$$

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 hold their price constant when firm i alters its price (the Bertrand hypothesis), then it follows from the equations (5) above that

$$e_{ij} = e_{ij}(B) = \varepsilon - (\varepsilon - \mu)s_{ij} \tag{7}$$

where sij is the share of a single representative firm from country i in market j. If the anticipated response is that other will hold their sales constant when firm i changes its sales (the Cournot hypothesis), then the elasticity is given by

$$\frac{1}{e_{ij}} = \frac{1}{e_{ij}(B)} = \frac{1}{\varepsilon} - (\frac{1}{\varepsilon} - \frac{1}{\mu})s_{ij} \tag{8}$$

(this elasticity being calculated from the inverse demand functions corresponding to equations (5) in which the p_{ij} are written as functions of the x_{ij} and of the y_j.

In some of the cases modelled, it is assumed that 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

$$\sum x_{ij}\left[p_{ij}(1 - T_{ij})(1 - \theta_{ij}) - t_{ij}\right] = \frac{\delta C_i}{\delta m_i} \qquad (i=1,..,I) \tag{9}$$

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 effects 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

$$\theta_{ij} = \theta_{ij}(B) = \{(1-w_i)s_{ij} + w_i\}\frac{\varepsilon - \mu}{e_{ij}(B)(\varepsilon-1)} \tag{10}$$

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

$$\theta_{ij}=\theta_{ij}(C)=\{(1-w_i)s_{ij}+w_i\}\frac{\varepsilon - \mu}{\mu(\varepsilon-1)} \tag{11}$$

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 (5)) 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 differnces 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

$$p_i(1 - T_{ij}) = p_{ij}(1 - T_{ij}) \qquad (i=1,..,I;j=1,..,K) \tag{12}$$

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 (8) are replaced by equations of the form

$$p_i(1 - T_{ii})\left(1 - \frac{1}{E_i}\right) = \frac{1}{m_i}\frac{\delta C}{\delta x_i} \tag{13}$$

If behaviour is Bertrand then firms set price p_i given the price of other firms, and the perceived elasticity E_i is a weighted average of the elasticities of demand in the individual markets constituting the integrated market. If behaviour is Cournot, each firms chooses its total sales to the integrated markets given the total sales of the other firms, and each firm's output is divided up between the individual national markets making up the integrated market so as to meet demand, given the fixed price relativities. In this case the elasticity E_i is a complicated expression which is not given here.

There are two further technical points on which further elaboration may be helpful: the choice of functional form of the cost function, and the calculation of "tariff-equivalent" trade barriers.

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

$$C(x_i,m_i) = c_i[z\{c_0 + m_i c_m + m_i x_i\} + (1-z)\{m_i x_i^{\alpha}\}^{\beta}] \tag{14}$$

Thus the linear component of the cost function has the weight z, and the loglinear component the weight 1-z. The values of the c_i parameters are selected so that average cost changes with changes in x_i and m_i in ways consistent with the information provided by Pratten [1987].

Finally, a note on the calculation of "tariff equivalents" of observed asymmetries in trade patterns. It follows from (4) that the ratio between expenditure in country j on goods produced in country i and those produced in country j is

$$\frac{p_{ij}x_{ij}}{p_{jj}x_{jj}} = \frac{a_{ij}p_{ij}^{1-\varepsilon}}{a_{jj}p_{jj}^{1-\varepsilon}} \tag{15}$$

The tariff equivalents are calculated simply as the tariff rates by which the prices p_{ij} would have to be adjusted (in addition to the 10% transport cost assumed) to make the observed market shares consistent with $a_{ij}=a_{jj}$.

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