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3 Strategic Trade Policy in the European Car Market

Alasdair Smith

3.1 Introduction

The aim of this paper is to study the role of "strategic trade policy" in the European car market. This work derives from earlier partial-equilibrium modeling of trade policy in imperfectly competitive industries (Venables and Smith 1986; Smith and Venables 1988).

This is the third of a series of papers that adapts the earlier model to take account of the quantitative restrictions on imports in the European car market and allows not only for the effect on prices of such restrictions but also for the effect on the behavior of imperfectly competitive firms. The model is numerically calibrated to data on the European car market in 1988.

This model of the car market was used by Smith and Venables (1991) to study the ranking of policy instruments and to illustrate the interaction between quantitative restrictions and imperfect competition. The detailed implications of the model for the effects on likely policy changes in the European car market were discussed by Smith (1990).

These two earlier papers treated the industry as one with a given number of firms each of which produced a fixed number of different models of cars. Here I treat as endogenous the number of models produced by a firm. Then the trade

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policy of one country (or one group of countries) can affect the number of models produced by firms located in other countries, and this in turn affects the outcome of competition between firms. This is one way of capturing the essential idea of strategic trade policy, in the sense of policy which changes the relative competitive strengths of home and foreign firms.

I investigate whether the nature of the strategic policy effects are sensitive to the specification of the model, and find that they are, and whether strategic policy effects are strong enough to overturn "conventional" wisdom about the welfare effects of trade policy, and find that they are not.

3.2 The Model

The formal model is fully presented by Smith (1990) and Smith and Venables (1991). The principal features are described below, but detailed derivations are not given. There is an imperfectly competitive industry producing differentiated products. Firms, which each produce several different models of car, see the demand for their products as depending on the price of the individual model and also on the overall price of cars. The Dixit-Stiglitz (1977) representation of consumer choice in markets with differentiated products allows us to write the demand per model in market j for cars produced by firm i as

$$x_{ij} = (a_{ij} b_j)(p_{ij}/q_j)^{-\varepsilon}(q_j)^{-\mu}, \quad (1)$$

where a_{ij} and b_j are shift parameters describing the size of the market, p_{ij} is the price in market j of a model of car produced by firm i, and q_j is an aggregate price index for cars in market j (and is a constant elasticity function of the prices p_{ij} of all models sold). Then ε is the elasticity of demand with respect to the relative price of the individual model of car reflecting the extent to which there is substitutability in demand between different product varieties, while μ is the aggregate elasticity of demand for cars.

The Dixit-Stiglitz formulation is convenient as it gives rise to a demand function in which demand is a constant elasticity function of two prices. It is based on the assumption that each individual consumer chooses to buy some of each of the products on the market. This is not as appealing a description of consumer choice of cars as the Lancaster (1979) approach, in which the consumer chooses one product whose price and characteristics come closest to that consumer's needs. Anderson, de Palma, and Thisse (1989) have presented conditions under which the Dixit-Stiglitz model describes the behavior of the aggregate market, even if individual consumers' behavior is described by the Lancaster approach.

Competition between firms is modeled as a two-stage game. In the first stage of the game, firms choose model numbers, taking account of the effect of their choices on the second-stage equilibrium, and the outcome is a Nash equilibrium in model numbers.

The second stage is Cournot competition (modified to take account of quantitative restrictions on imports) in output, given model numbers. Firms maximize profits, taking account of the impact of scale economies on marginal costs, of the effect of taxes, tariffs, and transport costs on the wedge between producer and consumer prices, and of the effect of elasticity of demand in different markets on their marginal revenues. National markets are assumed to be segmented, so that firms can set different prices in different markets. A producer with a large market share in a particular national market sees its own behavior as having a strong influence on the overall price of cars in that market and thus perceives a relatively inelastic demand for its product; this leads such firms to have higher price-cost margins. Specifically, the first-order condition for a firm selling in a market in which there are no quantitative restrictions on sales is the standard equation of marginal revenue and marginal cost,

$$p_{ij}T_{ij}(1 - (1/e_{ij})) = mc_i, \tag{2}$$

where $p_{ij}T_{ij}$ is the producer price and mc_i is the firm's marginal cost. The term $1/e_{ij}$, the firm's perceived inverse demand elasticity, is a weighted average of the inverses of the two demand elasticities which appear in the demand function:

$$1/e_{ij} = (1/\varepsilon)(1 - s_{ij}) + (1/\mu)s_{ij}, \tag{3}$$

where the weight s_{ij} is firm i's share in value terms of market j. This relation has the appealing feature of making firms perceive a less elastic demand for their product the larger their market share. A firm with a small market share takes almost no account of the elasticity of the aggregate market demand, while, at the other extreme, a monopoly perceives only the aggregate demand elasticity.

The model allows there to be a "voluntary" export restraint (VER) which limits the *share* that firms from one country may have in a particular national market (as Japanese firms are currently restricted in several European national markets. The model can alternatively allow there to be a restriction on the firms' overall market share in a group of national markets as a whole, as Japanese firms are in the near future to be restricted to a fixed share of the aggregate EC market).

Firms in markets that are not subject to sales restrictions are assumed to behave as Cournot competitors, and equations (2) and (3) apply. This assumption is also made about the behavior of the restricted firms in markets with sales restrictions. Where other firms are subject to restrictions on their market shares, however, an unrestricted firm is assumed to take account of the effect that a change in its sales will have on the sales of restricted firms. The effect of the share restriction on firms' behavior, derived in Smith and Venables (1991), is to replace in equation (3) above the unrestricted firm's actual value market share s_{ij} with the larger expression

$$\tilde{s}_{ij} = s_{ij} + n_r s_{rj} \frac{m_i x_{ij}}{\sum_{k \notin R} m_k x_{kj}}, \tag{4}$$

where n_r is the number of (equal-sized) firms subject to sales restraint in market j and s_{rj} the value market share of each, m_i the number of models produced by firm i, and R the set of restricted firms. Thus the second term in (4) is the product of the value market share of the restricted firms and the volume share taken by firm i of the sales of all the unrestricted firms. Clearly, firm i behaves as if its market share is larger than it actually is and perceives a more inelastic demand than it would in the absence of the VER. An extreme case is where all firms but firm i are subject to VERs, when (4) reduces to $\tilde{s}_{ij} = 1$. Because all other firms are constrained to fixed market shares, firm i can and will choose the perfectly collusive outcome. In the general case, the anticompetitive effect of the VER is less strong but still leads firms to set higher price-cost margins than they would in the absence of the VER.

Firms' cost functions are assumed to take the form

$$C(x,m) = c_1 + c_2 m + c_3 m x_4^{c}, \tag{5}$$

where x is output per model, and m is the number of models. The values of the parameters c_1, c_2, and c_c are permitted to vary between firms, but c_4 is assumed to be a positive number less than unity and constant across firms. This function displays economies of scale in two dimensions: defining variable cost as the element in cost which varies with output per model, average variable cost is a decreasing function of output per model, while the fixed cost per model is a decreasing function of the number of models.

The model is solved backwards: a solution for the second-stage game is derived from given model numbers, as described above, and then a Nash equilibrium in model numbers is found, taking into account the effects of model number choices on the second-stage equilibrium. An analytical description of the determination of model numbers has not been derived: the equilibrium is found numerically.

3.3 Data and Model Calibration

The model is calibrated to data for the world car market in 1988. The world is divided into eight markets: France, West Germany, Italy, the United Kingdom, Iberia (Spain and Portugal), the rest of the European Community (RoEC; an aggregation of Benelux, Ireland, Greece, and Denmark), EFTA, and the rest of the world (RoW). This level of country disaggregation is needed in order to model the differences in trade policy in 1988 between different members of the European Community and to allow for the fact that the Iberian countries were still in the process of harmonizing their trade policy with the common external tariff of the Community.

The producers are divided into eight groups: French (two producers, Peugeot and Renault), Volkswagen (VW), Fiat, Rover, the U.S. multinationals in Europe (Ford and General Motors [GM] in Europe, who are treated as entirely independent of their American parents), the "specialist" producers (Mercedes, BMW, Volvo, Saab, Jaguar, and Porsche), the Japanese, and the rest of the world (who are mainly the North American producers). This level of producer disaggregation allows the model to capture the strong differences which exist in national sales patterns. Within each group, firms are assumed to be identical. In the case of the French and the Americans in Europe, this is very close to reality: in each pair the firms are of roughly equal size and have similar sales patterns. The specialists and the Japanese are more heterogenous; calculation of Herfindahl indices suggests it is appropriate to assume the existence of three equal-sized specialist manufacturers and four equal-sized Japanese firms.

Table 3.1 summarizes the shape of the European car market in 1988. The top two sections of the table show sales in the eight markets and the distribution of those sales by producer group, based on registration data in the *Automotive Industry Data 1989 Car Yearbook* (1990). Both the rest of the world market and the sales in Europe by non-Japanese non-European producers—(Other (N) in table 3.1)—are included only to close the model and no attention has been given to accurate modeling of the non-European markets. Therefore, in the discussion of the effects of policy changes, the effects both on "other" producers and in the rest of the world market are ignored. There is no attempt to explain in this paper the model-number choices of Rover or the European "specialist" producers (so they do not enjoy "strategic" policy effects), and they are aggregated in tables as Other (E) even though they are treated as separate groups in the numerical modeling.

The shares of Japanese producers in the different markets display the effects of trade restrictions. In our base year of 1988, there were restrictions on imports from Japan to France, Italy, the United Kingdom, Portugal, and Spain. Since 1977, Japanese imports were restricted to 3 percent of the French market

Table 3.1 The European Car Market, 1988

	France	Germany	Italy	United Kingdom	RoEC	Iberia	EFTA	RoW
Market sales total (million) cars								
	2.2	2.8	2.2	2.2	1.1	1.3	1.2	17.2
Market shares (%):								
French	63.2	6.7	14.8	12.6	18.3	38.0	9.3	2.6
VW	8.6	29.4	11.7	5.9	13.0	17.5	14.2	1.6
Fiat	7.2	4.7	59.9	3.7	5.3	9.7	5.2	0.0
Ford/GM	11.3	25.4	6.9	40.1	22.5	26.9	19.2	0.6
Japanese	3.0	15.2	0.9	11.4	26.6	2.1	31.9	39.0
Other (E)	5.5	17.9	4.5	22.9	9.6	5.2	17.7	2.8
Other (N)	1.3	0.8	1.2	3.4	4.6	0.6	2.5	53.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Estimated sales value (billion ECU)								
	26.2	28.9	25.2	25.3	17.1	16.2		
EC total			138.9					

and 11 percent of the U.K. market. (The 11.4 percent Japanese share of the U.K. market shown in table 3.1 includes a small number of U.K.-produced cars, but in the model all "Japanese" cars are treated as imports.) Italy, Spain, and Portugal have long-standing and tight limits on Japanese imports. Both the Italian and Iberian restrictions are modeled, like the French and U.K. restrictions, as limiting Japanese market shares. This is not strictly accurate, but the levels to which Japanese imports are restricted in these markets are so low that the distinction between levels and shares is of little significance. In other EC markets (including Germany) there are no explicit restraints on Japanese sales, and we have assumed no VERs in Germany or the RoEC.

Calibration of the model to this data requires assumptions about cost and demand elasticities and about taxes, tariffs, and transport costs. As in the previous work with this model, a value of 1.5 is chosen for μ, the aggregate industry elasticity of demand, and a value of 4 for ε, the elasticity of demand for an individual model of car. For justification of these elasticity choices and further details on taxes, tariffs, and transport costs, see Smith (1990).

In earlier work (Venables and Smith 1986; Smith and Venables 1988), variation in numbers of models per firm was used as a device to account for the difference in the scale of different firms. In the case of the car industry, however, it is possible to give a concrete interpretation. The Ludvigsen study for the European Commission (Ludvigsen Associates Limited 1988) centered its description of scale economies on the concept of a "platform," essentially a floor plan on which a family of cars can be based. The Ludvigsen information on the numbers of platforms per producer gives the model numbers shown in table 3.2 (where, however, the model numbers for Japanese producers are simply assumed). Ludvigsen provides information about the relation between variable costs and scale and output per platform that suggests that average variable cost declines by 5 percent for every doubling of output per platform, and this property is satisfied by choosing $c_4 = 0.925$ for all firms. Ludvigsen provides much sketchier information about fixed costs, and the rest of the parameters of the cost function are calibrated in a way described below.

Ludvigsen also provides some information on the prices of cars of different types in different markets. German market prices are used as the base for calibrating prices, on the grounds that, of the markets for which Ludvigsen provides price data, this is the least distorted by taxes and protection. Assuming

Table 3.2 The European Car Market, 1988: Production and Sales

	Sales (million)	Models per Firm	Firm Numbers	Sales per Model (thousand)
French	3.443	7	2	245
VW	2.205	7	1	315
Fiat	1.929	6	1	321
Ford/GM	2.935	5	2	293
Japanese	8.190	6	4	341

that the distribution of cars of different types (utility, small, lower-medium, etc.) in each firm's output is the same as in the firm's German sales gives a price for each producer group's "typical" car in Germany, then a price in each of the other markets is derived from the model. These prices are reflected in the estimated sales values reported in the third section of table 3.1.

The calibration of the model then consists of the choice of firm-specific marginal cost parameters c_3 to reproduce the German prices and, in the absence of VERs, the choice of parameters to scale the demand functions to observed sales, that is to say, to explain the pattern of sales displayed in table 3.1. However, in markets where VERs are in operation we have no observations on Japanese market shares in the absence of constraints and therefore infer these demand parameters from information about unrestricted markets, as described in detail in Smith (1990).

Finally, the parameters c_2 are calibrated to make the actual model numbers shown in table 3.2 optimal for the French, German, Italian, "American-European," and Japanese producers. (The peculiar features or the lack of information about the other producers made it unreasonable to assume that model numbers were chosen by these firms in the same way as by the mass-market producers.) For each producer a range of possible values of c_2 was found by simulating new equilibria in which that producer had one more and one fewer model than in the base case and calculating the values of the cost parameter consistent with the base case being optimal. (In all cases, the profit function was locally concave in model numbers, so the base could be calibrated as an optimum.)

The results of this calibration do not allow the choice of the same value of c_2 for all firms (nor do they allow c_2 to be chosen proportionally to the firm-specific marginal cost factors c_3). However, from the ranges of values compatible with the base it was possible to choose values implying a cost of 400 million ECU per year per model for French and Japanese producers and of 475 million ECU per year for all others. For all firms but the Japanese these parameters imply that the cost associated with model numbers (c_2m) are in the range of 26–28 percent of variable cost, and this ratio is not inconsistent with the vague information given by Ludvigsen on these matters. (For the Japanese firms, the proportion is 18.5 percent.) There is, of course, an element of arbitrariness about these choices, and the implications of this arbitrariness are explored below.

The values of c_1 play no role in the policy simulations below, since changes in firm numbers are not considered. If such changes were permitted, it would be natural to choose c_1 to make the base a zero-profit free-entry equilibrium.

3.4 VERs as a Strategic Trade Policy for the European Community

In this section, I address the question of whether the national VERs on Japanese imports can be seen, from the viewpoint of the European Community as a whole, as an effective strategic trade policy.

Table 3.3 **National VERs, Model Numbers Fixed**

	France	Germany	Italy	United Kingdom	RoEC	Iberia	EC Total	EFTA
Japanese market shares								
Initial	19.1	20.4	21.5	22.2	34.1	16.1	21.5	
Final	3.0	19.4	0.9	11.4	32.7	2.1	10.9	
Welfare changes (million ECU per year)								
Consumer surplus	−2,345.2	32.0	−3,873.2	−1,446.4	−16.0	−1,276.8	−8,925.6	−14.1
Tax revenue	−256.5	1.9	−322.7	−144.7	−2.9	−179.1	−904.0	−1.2
CET revenue	6.4	0.0	8.9	10.3	0.3	26.9	52.8	0.0
	French	VW	Fiat	Ford/GM	Other(E)		EC Total[a]	Japanese
Profits	1,271.2	354.9	1,315.4	564.2	379.5		3,603.1	−1,529.6
Total[b]							−6,173.1	
Total (excluding tax)[c]							−5,269.1	

[a]Equals sum of profits for French, VW, Fiat, and Other(E) plus one-half of profits for Ford/GM.
[b]Equals sum of EC total consumer surplus, tax revenue, CET revenue, and profits.
[c]Equals sum of EC total consumer surplus, CET revenue, and profits.

Tables 3.3 and 3.4 show the effects of the restraints on Japanese imports under alternative assumptions about variation in firms' model numbers. The base case on which the model is calibrated is one with import restrictions in place in France, Italy, the United Kingdom, and Iberia. However, for expositional convenience the tables present the simulation results as the imposition of such restrictions. Table 3.4 shows the effects of moving from the simulated equilibrium with no import restrictions back to the base equilibrium with import restrictions. Table 3.3 shows the same change but with firms' model numbers fixed at the level of the no-restriction simulation. Thus table 3.3 has no "strategic trade policy" effects.

The dramatic reductions in the market share of Japanese producers in table 3.3 are associated with large reductions in Japanese sales and associated price increases in the restricted markets. Non-Japanese firms raise their prices a little as their market power increases. In the unrestricted markets there are only small redistributions of market share, as Japanese firms' marginal costs rise a little and non-Japanese firms' marginal costs and prices fall a little. The effects on firms' profits and on consumer surplus are shown in the lower part of table 3.3: large reductions in consumer surplus in the restricted markets, large increases in the profits of European producers, especially those with large market shares in the most restricted markets. There are also changes in tax revenue (which are separately shown in the table as sales tax revenue and revenue from the common external tariff [CET] of the European Community).

There are ambiguities in the summation of the welfare effects of these changes. The multinationality of production makes it undesirable to count, say, the profits, of Peugeot and Renault as gains to France, since some of these profits may go to workers and managers in Spain and the United Kingdom. At the level of the European Community as a whole, however, this problem exists only for Ford and GM. Arbitrarily, I count half of their profit change as accruing to the European Community. Whether tax revenue should be counted as a gain depends on whether one sees the taxes as creating or correcting distortions, but we can ignore this problem since the treatment of tax revenue never makes a qualitative difference to results.

In brief, table 3.3 shows the welfare losses to European consumers from the import restrictions greatly outweighing the welfare gains to European producers. There are also negative effects on Japanese profits. The results are derived in a model in which imperfect competition is given a key role, and the implications of the interaction between imperfect competition and quantitative import restrictions are spelled out in Smith and Venables (1991), but the general shape of the results is not dissimilar to those that would be derived in a conventional model of perfect competition.

Table 3.4 incorporates strategic effects. The imposition of the VERs leads to an increase in model numbers by one each by the two French producers, the two "American-European" producers, and VW, while each of the Japanese producers reduces its model numbers by two. There is a marked effect on con-

Table 3.4 **National VERs, Model Numbers Variable**

	France	Germany	Italy	United Kingdom	RoEC	Iberia	EC Total	EFTA
Japanese market shares								
Initial	19.1	20.4	21.5	22.2	34.1	16.1	21.5	
Final	3.0	15.2	0.9	11.4	26.6	2.1	9.3	
Welfare changes (million ECU per year)								
Consumer surplus	−1,399.4	241.9	−3,340.8	−717.0	−90.9	−662.9	−5,969.1	−132.3
Tax revenue	−153.1	14.8	−278.4	−71.7	−16.2	−93.0	−597.6	−11.0
CET revenue	3.9	−0.3	7.6	5.4	1.2	14.1	31.9	0.0

	French	VW	Fiat	Ford/GM	Other(E)	EC Total[a]	Japanese
Profits	996.4	323.1	1,077.0	444.6	308.9	2,927.7	−1,655.8
Total[b]						−3,607.1	
Total (excluding tax)[c]						−3,009.5	

[a]Equals sum of profits for French, VW, Fiat, and Other(E) plus one-half of profits for Ford/GM.

[b]Equals sum of EC total consumer surplus, tax revenue, CET revenue, and profits.

[c]Equals sum of EC total consumer surplus, CET revenue, and profits.

sumer welfare: the increase in model variety combined with price increases that are generally lower than when model numbers are fixed reduces the loss in consumer welfare to 6,000 million ECU per year in table 3.4, compared with 9,000 million in table 3.3. However, not only is this loss still in excess of the gains to European producers, the producers' gains are actually lower in table 3.4 than in table 3.3. The VERs are counterproductive as a strategic trade policy in shifting profits toward European producers.

The reason for this is easy to see. The change in model numbers is optimal for each individual producer, taking the other producers' model numbers as given, but the change in all producers' model numbers is profit-reducing, as intensified competition among European producers more than outweighs the beneficial effects of the reduction in Japanese competition. This is an example of the problem identified by Dixit (1984) of the weakening of the strategic case for import restrictions as the number of "home" firms increases.

When we look at policy from an EC point of view it might seem more natural to look at an EC-wide strategic trade policy rather than the EC-wide effects of national trade policies. I have shown results for the latter in this section because the national trade policies are the actual policies currently in place, but policy simulations for an EC-wide VER have been carried out. There are significant differences in the cross-country distribution of effects: EC-wide restrictions impose larger costs on consumers in markets unaffected by present national restrictions and lower costs on consumers in markets where tight national restrictions are replaced by a looser EC-wide restriction, and they give greater benefits to producers whose output is spread across the EC markets and less to those whose sales are concentrated in the presently restricted national markets. However, at the EC level the welfare results are remarkably similar to those reported in tables 3.3 and 3.4, so the details are not reported here.

3.5 A National VER as Strategic Trade Policy

Tables 3.5 and 3.6 explore the effectiveness of a VER for a single country, France. As in the previous section, the tables present the results in the form of the effects of the imposition of the VER. Table 3.5 shows the effects of imposing a VER on Japanese imports into France, with other national VERs in place and with producers' model numbers fixed at the equilibrium level with no French VER. Table 3.6 looks at the same policy experiment, but now with producers' model numbers variable (so that the endpoint of the policy experiment, as in table 3.4, is the base on which the model was calibrated).

Table 3.5 shows the French VER imposing costs on consumers greatly in excess of the gains to French producers, indeed greatly in excess of the gains to all European producers. Table 3.6 introduces the strategic effects: the imposition of the French VER has the effect of reducing Japanese model numbers by one per producer and raising VW's model numbers by one.

It is a little surprising that the producer which expands its model range as a

Table 3.5 **French VER, Model Numbers Fixed**

	France	Germany	Italy	United Kingdom	RoEC	Iberia	EC Total	EFTA
Japanese market shares								
Initial	16.0	17.3	0.9	11.4	29.6	2.1		12.5
Final	3.0	17.1	0.9	11.4	29.2	2.1		10.0
Welfare changes (million ECU per year)								
Consumer surplus	−2,002.9	4.5	29.9	29.8	−4.6	21.5	−1,921.8	−4.4
Tax revenue	−219.1	0.3	2.5	3.0	−0.8	3.0	−211.1	−0.4
CET revenue	5.1	0.1	0.0	−0.2	0.0	−0.2	4.8	0.0

	French	VW	Fiat	Ford/GM	Other(E)	EC Total[a]	Japanese
Profits	660.2	57.0	45.2	84.4	53.1	857.7	−315.2
Total[b]						−1,270.4	
Total (excluding tax)[c]						−1,059.3	

[a]Equals sum of profits for French, VW, Fiat, and Other(E) plus one-half of profits for Ford/GM.

[b]Equals sum of EC total consumer surplus, tax revenue, CET revenue, and profits.

[c]Equals sum of EC total consumer surplus, CET revenue, and profits.

Table 3.6 **French VER, Model Numbers Variable**

	France	Germany	Italy	United Kingdom	RoEC	Iberia	EC Total	EFTA
Japanese market shares								
Initial	16.0	17.3	0.9	11.4	29.6	2.1	12.5	
Final	3.0	15.2	0.9	11.4	26.6	2.1	9.3	
Welfare changes (million ECU per year)								
Consumer surplus	−1,898.6	16.7	196.7	64.5	−162.8	130.0	−1,653.5	−121.6
Tax revenue	−207.7	1.0	16.4	6.5	−28.9	18.2	−194.5	−10.1
CET revenue	5.0	0.1	−0.4	−0.1	1.4	−1.9	4.1	0.0
	French	VW	Fiat	Ford/GM	Other(E)		EC Total[a]	Japanese
Profits	641.6	147.5	−9.4	86.2	113.4		936.2	−365.8
Total[b]							−907.7	
Total (excluding tax)[c]							−713.2	

[a]Equals sum of profits for French, VW, Fiat, and Other(E) plus one-half of profits for Ford/GM.

[b]Equals sum of EC total consumer surplus, tax revenue, CET revenue, and profits.

[c]Equals sum of EC total consumer surplus, CET revenue, and profits.

result of the French VER should be a German producer rather than a French producer, but given the levels of the parameter c_2 chosen in the calibration, this turns out to be the (unique) equilibrium.

The first point to be made, then, is that there is no guarantee in a many-country world that the benefits of a strategic trade policy imposed by one country will accrue to that country's own producers.

Second, the location of the strategic effects are quite sensitive to the values of c_2 chosen in the calibration. The assumption that the base is an equilibrium gave us a range of values from which to choose c_2 for each producer, but the actual choice was arbitrary. The location of the strategic effects is therefore sensitive to an aspect of model specification on which we are ill informed.

Finally, even if we were to pretend that VW is a French firm, table 3.6 makes no case for a French VER as a strategic trade policy. The changes in model numbers as the Japanese producers contract and VW expands reduces the cost of the VER to French consumers from 2,000 million ECU per year to 1,900, but it raises the effect on VW's profits only from 57 to 147 million ECU, and all of the profit gains are still far short of the losses to consumers.

3.6 Conclusions

When numerically calibrated models are used to analyze economic policy, data are used only to calibrate and not to test the model. Thus much depends on the prior specification of the model, and it is not clear how much confidence one should have in the detailed results. At best, the numerical results presented in this paper should be taken as illustrations of possible orders of magnitude associated with the effects discussed in the theoretical model rather than as precise numerical predictions.

Concern about sensitivity to prior specification and to the parameter values used in the calibration can be fully allayed by very systematic sensitivity analysis. I have not conducted a systematic sensitivity analysis with respect to model specification, but we have seen that the general nature of the results is not greatly altered by changing the crucial assumption about whether firms' model numbers are exogenous or endogenous. I have undertaken only very limited sensitivity analysis with respect to model parameters. The details are not reported here, but again the conclusion is that the general shape of the result remains unchanged as parameter values change.

However, one crucial aspect of the results discussed in this paper does depend on model specification: how firms' model numbers change in response to policy changes turns out to be very sensitive to the "cost per model" parameter in firms' cost functions. Thus both the location and the very existence of the "strategic trade policy" effects in this model depend sensitively on a modeling choice that has to be made with a degree of arbitrariness at the calibration stage.

Even leaving aside the issue of sensitivity, the results presented here cast doubt on the case for strategic trade policy. The effects on increased competition among "home" firms may wipe out the expected benefits of a strengthened strategic position in competition with "foreign" firms. In a many-country world with multilateral trade flows, the beneficiary of one country's strategic trade policy may be another country's producer. Finally, in the cases discussed in this paper, the "strategic" effects of trade policy are greatly outweighed by more traditional effects.

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Comment James Levinsohn

The European car market is complex. There are several European producers, a few big American players producing in Europe, and of course Japanese imports. The menu of plausible trade policies to be investigated is long and also complex. For example, quotas on Japanese imports might be set individually

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for each European country, or there might be a quota on total European imports from Japan. The quota might be in value terms, or it might be in terms of physical units. Many European countries have very disparate domestic tax structures that in effect act as trade barriers. These seemingly domestic policies are also candidates for trade policy reform in the European automobile market. In short, modeling trade policy for the European car market is tricky business. Alasdair Smith does a very admirable job coming up with answers to some very relevant and very hard questions.

There are many standards by which the results of this paper might be judged. The most compelling of these, though, is to ask how one could improve on the paper *conditional on having to actually come up with answers.* There are plenty of detailed econometric methodologies to estimate demand and oligopoly pricing in the automobile market. Could these methodologies be readily applied to a market characterized by the many countries and potential policies in the European market? Probably not. When the questions addressed become as complex as those Smith poses in this paper, empirical effects are unlikely to get beyond the simulation methodology.

I would like to address two issues in the remainder of my comments. First, if the complexity of the issues addressed forces the researcher to use a simulation methodology, are there margins on which to improve? Second, even in the perfect simulation model, how much trust should we place in the results?

Smith is one of the pioneers in modeling trade policies with imperfect competition. Our search for margins on which to improve is brief since the job is done right. There are, though, two possible improvements. First, many of the policies that are analyzed in the paper are related to the broad changes associated with 1992. Pan-European quotas are an example. The policies associated with 1992 are not likely to come as surprises. By 1992, only economists with good memories will remember how many "1992" conferences they attended in the four years preceding that date. When broad changes in the economic environment are expected far in advance, thinking firms will act to preclude adverse effects that the changes might bring. Japanese auto firms are no exception, and modeling preemptive behavior in the simulation model would be nice. Specifically, direct foreign investment by Japanese firms in Europe is important and might be profitably added to the model. This is especially so if, as in the United States, Japanese production via direct foreign investment does not count against any quota. Also, if a quota is to be based on the prequota market share, predatory pricing becomes an important consideration. This entails an increase in European consumer surplus that, it seems, could be important when analyzing the welfare effects of policies.

Second, the Dixit-Stiglitz utility function seems a strange approach to modeling automobile demand. While it provides a nice representation of preferences when confronted with a menu at a Chinese restaurant, the love-of-variety approach is probably not appropriate to modeling the demand for automobiles. Rather, the Lancasterian approach in which consumers buy one unit of the good and choose the unit nearest their ideal variety seems more appropriate. The demand and oligopoly-pricing equations that fall out of this approach are admittedly more complicated than those of the Dixit-Stiglitz approach, but since the model is simulated instead of estimated, this problem is not insurmountable.

Smith's simulation model is very complete and carefully constructed. Suppose he were to somehow also adopt a Lancasterian approach while simultaneously modeling the model-firm behavior resulting from the expectation of 1992. How much trust should we place in the answers that this model would provide? Put another way, what can we learn from even the very best that the simulation methodology has to offer? Here I am skeptical about the marginal product of simulation studies. My reasons are twofold.

The inputs to the simulation model—elasticities, costs, as well as other parameters estimated elsewhere—have standard errors associated with them. When the inputs to the simulation model have standard errors, so should the outputs. The multiplicative nature of probabilities is such that even if we are reasonably confident about the point estimates of several inputs, the solutions to the simulation model will often have, by econometric standards, huge standard errors. Varying one parameter at a time and re-solving the model for each parameter value, as is often done in sensitivity analysis for simulation models, is not enough. If the solutions of simulation models are to be credible, standard errors should accompany the solution values.

If the above reason for some healthy skepticism is basically a statistical argument, the other cause of skepticism is an economic story. Myriad recent theoretical papers have investigated how trade policy works in imperfectly competitive markets. A key lesson that has been learned is that the effects of a given trade policy frequently hinge critically on firms' modes of market conduct. This is troubling since the mode of market conduct is seldom observable. The policies investigated by Smith in this paper are also sensitive to market conduct. In this case, Cournot behavior is assumed. Since signs, not just magnitudes, of the effects of policy often depend on the mode of market conduct, it would be nice to see reference to some estimates of the mode of conduct in the European auto industry. If such estimates do not already exist, this is one parameter that especially seems worth estimating.

The bottom line is that once we constrain ourselves to coming up with answers to very complex questions (in a reasonable amount of time), we perhaps lock ourselves into a methodology which will not allow terribly precise estimates. An alternative is to ask simpler questions and get more precise answers. This trade-off is a judgment call. Having decided on asking the big-picture questions, Smith does a very nice job coming up with the best answers that his methodology will allow.

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