Journal of International Development: Vol. 8, No. 6, 805–811 (1996)

A FORMAL NOTE ON NEW THEORIES OF INTERNATIONAL TRADE AND DEVELOPMENT[1]

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Abstract: Drawing upon the long-run solutions to a number of models in which there are economies of scale and differing degrees of intra-sectoral competition, conditions are found under which an industry's development will spread to further countries and under which the domestic industry should be supported by state intervention.

INTRODUCTION

In a recent review article, (Schmalensee 1992: p. 125) advizes that, 'every serious student of industrial economics should read John Sutton's *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*'. The purpose of this note is to draw upon Schmalensee's formalization of the Sutton theory to shed light on the relatively new theories of international trade, especially in the context of developing countries and whether they do nor do not have the potential to become newcomers in particular industries. As is well-known, these theories, by drawing upon the presence of economies of scale and scope, externalities or imperfect competition, seek to explain why more than one country might produce and trade in the same good, incurring transport and other costs, and violating classical theories concerning specialization.[2] Moreover, it can be posited that national policy to support the emergence of such internationally competing industries can be justified.

Sutton's work is of relevance, although it does not address issues of trade and policy, because it is primarily concerned with long-run solutions to domestic industrial structure in the presence of market imperfections. Specifically, industries are characterized by economies of scale, so that the Pareto-efficient outcome would only allow for one producer,[3] different intensities of market competition within the industries, and perfect entry into the industry in the long run. The last condition guarantees that long-run equilibrium is given by zero profit for each firm. However, reflection on the intensity of intra-sectoral competition gives rise to counter-intuitive results. For, the greater is competition within an industry, the less likely

[1] Thanks to anonymous referees for helpful comments and suggestions.
[2] See Baldwin (1992); Dornbusch (1992); Rodrik (1992); Ocampo (1986); Pack and Westphal (1986); and Greenaway (1991).
[3] This is unless there are genuine welfare improvements from product differentiation in the models in which this is the form taken by competition.

CCC 0954–1748/96/060805–07

is entry, since potential new firms are subject to lower levels of profitability. This contrasts with the ideal of perfect competition for which large numbers of firms and ease of entry are presumed.

The Sutton approach is concerned with how many firms emerge in such long-run equilibria and whether, as the ratio of market size to fixed costs (S/σ) increases, the equilibrium number of firms increases indefinitely. What is the relevance of this to new theories of international trade and development? Essentially, reflecting a long run tradition in trade theory, differences between countries are collapsed into differences between firms (or, as in Edgeworth boxes, differences between consumers). Consequently, what was previously a focus upon the equilibrium number of firms within a domestic industry can be interpreted as the equilibrium number of countries that enter an industry. Increases in the ratio S/σ can be interpreted as whether industrialization (or the spread of different industries) increases as the world market grows. Finally, where a distinction is drawn between a firm and a country is generally in the greater capability of the latter to adopt policies that enhance welfare even if at the cost of profit maximization which is the distinct and sole objective of the firm. In this context, policy can be understood in terms of whether it is worthwhile for a firm/country to support an industry and, in particular, to reserve the domestic market for itself—thereby running against the ideological and material pressures for liberalizing trade. Before running through the particular models involved, it is crucial to emphasize that they are based upon highly restrictive assumptions, a point taken up in the concluding remarks.

TYPE I MODELS

Schmalensee proposes a simple model to capture Sutton-type features. In Type I models, there are economies of scale as a result of exogenously imposed fixed costs. Assume that unit variable costs, c, are fixed but that there is competition between firms through product and price differentiation. For the purposes here, in pure form, the price differences are all that distinguishes the products whose differentiation is otherwise nominal. For perfect competition, the lowest price would command the whole market; assume, instead, that market share is inversely-related to own-price.[4] Schmalensee proposes the following as the ith firm's profit function:

$$\Pi_i = [p_i - c)S[p_i^{-e}/\sum_{j=1}^{N} p_j^{-e}] - \sigma$$

where N is the number of firms. The expression in square brackets gives market share as a negative function of own and positive function of other prices according to the parameter e. The higher (lower) is e, the more (less) competitive is the industry, as own market share changes more (less) for own-price movement. Here the firm's choice variable is taken as p_i, presuming other firms' prices are kept constant—a Cournot–Nash solution to Bertrand oligopoly.

Differentiating the profit function for p_i and setting it equal to zero, and using symmetry so that $p_i = p_j = p$, results after some manipulation in the equation:

$$(N - 1)e(p - c) = Np.$$

In the long-run, perfect entry guarantees a zero profit condition:

$$(p - c)S = N\sigma.$$

It follows that:

$$N = (cS/\sigma + e)/(e - 1).$$

In this case, the number of firms increases indefinitely with the ratio S/σ and, as e increases, N falls since price competition is tougher (sales more price-responsive) for higher values of e, and entry is deterred.

Sutton interprets N as an upper bound on the number of firms that are liable to be found in the industry over time. Other factors, especially those influencing the competitive process, may prevent that bound from being realized—a monopoly over a patent, for example, or other forms of entry deterrence. Setting this aside, and presuming that S grows over time relative to σ as a reflection of world development, then the number of firms should grow over time. Of course, more than one of these may be attached to a single country, thereby demonstrating the advantages of being first-movers or incumbents. However, if there are locational advantages for domestic production (less transport costs, more sensitivity to local markets), the implication is that industries should become more widely spread over time.

Should government intervene to encourage this? The obvious policy variable is to reserve the domestic market for the home producer. This is worthwhile if domestic costs of production are lower than market price. The former is given by $c + \sigma/mS$, where m is the country's market share (which would include any exports that could be captured). Now $p = c + \sigma N/S$, so that it is worth reserving the domestic market and promoting the industry as long as $m > 1/N$. Once a country's consumption exceeds the output of a typical (long-run equilibrium) firm, infant industry protection is justified. Note that this is more likely as N increases which, as previously observed, occurs as S/σ increases and e falls. These are all appealing intuitively. The greater the world market (as a proxy for potential market for own output), the lower are fixed costs, or the less competitive is the industry internally, the more a domestic industry should be encouraged. This can also be seen from the solution for p which, after simple manipulation, is given by:[5]

$$[1 + 1/(e - 1)][c + \sigma/S]$$

p decreases with e and σ/S. If the industry is highly competitive, as e goes to infinity, the price falls to $c + \sigma/S$ and N falls to 1, yielding the Pareto-efficient outcome for which, of course, there is no incentive for another country/firm to replicate fixed costs. If the single firm attempted to exploit its monopoly, this would lead to competitive entry in the long run, as in perfect contestability.

TYPE II MODELS

Characteristic of the previous model is that all costs are exogenously given and there is solely price competition, apart from entry and exit, for a standardized

[4] The first model in the next section allows for 'genuine' product differentiation, with quality, and demand, potentially depending upon costs.

[5] Note that N and $p - c$ both increase with c, so that the higher are unit variable costs relative to S and σ, the greater the incentive to adopt policies to enter the market.

product. For Sutton, Type II models are ones in which there are also other forms of competition. Schmalensee ingeniously constructs a model of this sort. Suppose price is now given but that unit costs can be varied to influence the actual or perceived quality of the product. Profit is now given by:

$$\Pi_i = (p - c_i)S[c_i^e / \sum_{j=1}^{N} c_j^e] - \sigma.$$

Here firms can enhance product quality by increasing unit costs, and they increase market share by doing so in competition with other firms to a degree of intensity given by the parameter e. The higher (lower) is e, the more (less) responsive is market share to product-enhancing unit costs.[6] The condition for profit maximization, together with symmetry, yields:

$$(p - c)e(N - 1) = Nc$$

which together with the long-run zero profit condition for equilibrium, the same as previously, gives:

$$N = (pS/\sigma + e)/(1 + e).$$

The properties, not surprisingly, are as before with price competition. N falls to one as e increases and increases indefinitely with S/σ and p. For $e = 0$, the number of firms is given by pS/σ. Firms get no response from cost competition and so set $c = 0$. They enter until the pure profit out of the fixed price, p, is whittled away by the fixed costs that need to be covered.

Should a country intervene to enter the market in these circumstances? The answer depends once again on the price-cost margin exceeding the unit fixed costs of the reserved share of the market, m. It is worth supporting the industry if:

$$p - c > \sigma/mS$$

which, as before, is equivalent to $m > 1/N$. It is possible to add a further twist by examining the case at the opposite extreme to the one considered so far, for which additional endogenous costs are necessary to achieve market share. If, at the other extreme, these costs are perceived to be entirely spurious and need not be incurred if the domestic market is reserved, then the condition for intervening is simply that $m > \sigma/Sp$—more likely the higher are S and p and the lower is σ. This is also equivalent to the case where $e = 0$.[7]

A third model considered by Schmalensee allows fixed costs to vary by A over and above exogenous fixed costs given by σ. This might represent advertising expenditure (interpreted here as spurious) or research and development (interpreted as product and economy enhancing). Market share is increased through this expenditure, with both price and unit costs now also taken as given. Suppose firms maximize:

$$(p - c)S(A^e / \sum_{j=1}^{N} A_j^e) - A_i - \sigma.$$

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[6] One way of interpreting the given price, p, is as normal costs and profits, with c as the extra costs attached to product enhancement, whether real or not.

[7] Note that $\sigma > Sp$, otherwise, even with one firm, it is impossible to cover fixed costs even with $c = 0$. The equilibrium value of c is given by $(p - \sigma/S)e/(1 + e)$ which is positive for this condition.

With symmetry, this gives:[8]

$$(p - c)eS(N - 1) = AN^2.$$

Together with the zero long-run profit condition:

$$(p - c)S = AN + \sigma N.$$

This leads to a quadratic in N:

$$(\sigma/S)N^2 - (p - c)(1 - e)N - (p - c)e = 0.$$

This gives relatively complicated solutions for N, but it is possible to examine what happens as S/σ increases indefinitely. For $e \leqslant 1$, N increases indefinitely.[9] But, for $e > 1$, as (σ/S) tends to zero and the quadratic term can be set aside,[10] so N tends to $e/(e - 1)$. This does lead to an upper bound on the number of firms. In other words, for $2 > e > 1$, fixed cost competition is so tough that the number of firms cannot rise above $1 + 1/(e\text{-}1)$ however large the market size grows relative to exogenous fixed costs. This is unlike the previous cases, where N increases indefinitely with S/σ so that $m > 1/N$ ultimately. Instead, for $2 > e > 1$, N cannot exceed $e/(e\text{-}1)$. If $m > (e - 1)/e$, i.e. $m > 1 - 1/e$, then it will not be worth entering the sector, no matter how large the world market, or even the price–cost difference, $p - c$. The reason is that the internal competition through endogenous fixed costs is so great that profitability is gobbled up however advantageous are these parameters. This seems to capture very well and very simply the notion of a technological or product lead. Number of firms will be very low for highly responsive market share either to advertising expenditure (as in coke) or to research and development (electronics)—or some combination of the two (as in electronic games). For the first case, it might be possible to avoid the endogenous fixed costs or, in the second case, write them off as developmental gains. Then, the domestic market should be supported if $m < \sigma/(p - c)S$ – a much less stringent condition, as endogenous fixed costs, A, do not have to be covered, and which is automatically satisfied as S/σ increases.

CONCLUDING REMARKS

The purpose of this note has been to formalize, as simply as possible, theories of trade and development in the presence of market imperfections. No claim is made for the realism of the models presented—they are much too simplistic. But, using S as a proxy for world development, and σ as a proxy for economies of scale, etc, it has been shown that development will spread as S increases. This is more so the higher the ratio of S/σ and the less competitive are industries internally (for this increases long-run equilibrium number of producers). Moreover, it will be worthwhile to intervene to protect domestic market share and to capture a share of world trade, the more firms there already are in the industry.

There is, however, an exception when competition through fixed costs is especially fierce. This might prove a barrier to the long-run number of firms, and

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[8] e must lie between 0 and 2 for second order conditions to hold.

[9] This is most readily seen by rewriting the quadratic in $1/N$.

[10] As long, as is the case for $e > 1$, the positive solution for N does not increase indefinitely.

other countries might not enter production no matter how large the world or their own domestic market. In this case, if the fixed costs need not be incurred as they represent attempts to shift demand without real product enhancement, or if they can be written off socially as contributing to developmental goals, as for R&D etc, then support to domestic production may become attractive once more as market size grows.

These are, of course, extremely powerful results, readily realized in terms of a few parameters such as S, σ, and e. The power and simplicity of the analysis is a source of strength and weakness. The strength derives from the ease with which *laissez-faire* nostrums of emphasising the benefits of free trade are overturned. This can be done by incorporating the impact of scale economies and market imperfections. The weakness follows from the lack of realism in the assumptions which render the theory, rather than the strategic outlook it permits, inoperable as an immediate guide to policy. Technology cannot be so simply specified in terms of overhead and unit costs, and nor can demand by the parameters, S and e. Oligopolistic behaviour is notoriously difficult to model unless one aspect of behaviour, Bertrand pricing as here for example, is treated in isolation from others. And, even then, outcomes are contingent upon game-theoretic specification of entrepreneurial behaviour which is open to doubt and variability.

The analysis is also confined to a single sector, a partial equilibrium in which the externality effects with other sectors are precluded. Support for one industry might be at the expense of another with potentially higher gains for the same resource costs—although intervention here is based upon the idea that unit domestic resource costs of production may be able to better imperfectly competitive world prices. It is also possible that inter-sectoral dynamics could be positively promoted. But these are matters that lie outside the scope of the models.

In this context, it is worth recognising that the weaknesses for the purposes adopted here are no less than for those for Sutton's own areas of application. On the basis of such models, he feels able to engage in extensive quantitative analysis of a wide range of food industries, across numerous countries and for long periods of time. The formal discussion is complemented by more specific commentary around a wide set of other influences on intra- and inter-sectoral competition. There is no reason why similar exercises should not be employed in the formulation of industrial policy, whether in a developing country context or not. The results will be as good as the original assumptions underlying the model, together with the acumen employed in the more qualitative understanding.

Elsewhere (Fine 1994), it has been shown that extensions to introduce further factors on terms set by the model (other forms of competition, for example), have the effect, not surprisingly, of modifying the results without fundamentally altering them. It is as if S, σ, and e take on different values according to the presence of other parameters representing the additional factors. Of more concern is the nature of the models themselves which tend to suffer both from being organised around equilibrium and around the 'horizontal' competition of intra-sectoral relations. For the meaningfulness of equilibrium within the models at least presupposes that it be attained before the parameters shift on which it is based. This is dubious in practice given the dynamism of industrial development. The latter, or industrialization by entry into new sectors, involves the frequent growth and restructuring of vertically (dis)integrated factors—from production, technology, finance, distribu-

tion, management and training and functioning of the labour market through to consumption.[11] Traditional and even new industrial economics seems ill-equipped to incorporate all of these factors satisfactorily although, where they do, the case for industrial policy is strengthened.

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[11] For the need to analyse sectoral developments in these terms, see Fine and Leopold (1993).