SUSTAINABLE AGRICULTURAL DEVELOPMENT: THE ROLE OF INTERNATIONAL COOPERATION

PROCEEDINGS
OF THE
TWENTY-FIRST
INTERNATIONAL CONFERENCE
OF AGRICULTURAL ECONOMISTS

Held at Tokyo, Japan
22–29 August 1991

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INTERNATIONAL ASSOCIATION OF
AGRICULTURAL ECONOMISTS
QUEEN ELIZABETH HOUSE
UNIVERSITY OF OXFORD

1992

Dartmouth

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General Equilibrium Effects of Trade Liberalization in the Presence of Imperfect Competition

INTRODUCTION

The impact of trade liberalization in developing countries is an important issue. Its practical relevance stems both from potential reforms if the GATT negotiations resume and from the heightened interest on the part of individual countries in unilateral policy reforms designed to rationalize their economies. The World Bank has also called for reform, not only because of trade restrictions, but also because of the many market distortions in these economies. Besides distortions related to externalities, the developing economies tend to be characterized by highly concentrated manufacturing sectors (see, for example, Kirkpatrick, Lee and Nixon (1984) and Rodrik (1988)). It is therefore surprising that trade liberalization in developing countries has tended to be evaluated in the context of perfectly competitive models. In surveying applications of computable general equilibrium (CGE) models to developing countries, Robinson (1989) cites only a few efforts which incorporate imperfectly competitive market structures (Condon and deMelo 1986; Devarajan and Rodrik, 1988, 1989).

In contrast to this relative paucity of empirical work, the last decade of research in international trade theory has focused heavily on the impact of trade policy in imperfectly competitive environments. Perhaps the major lesson to come out of this is that market structure assumptions are critical to policy analysis (Helpman and Krugman, 1989). For example, with imperfect competition and scale economies, it is possible for trade liberalization to lower welfare in an economy. This result is counter-intuitive in perfectly competitive models where the only distortions are price wedges created by policy. The excess profits and scale economies associated with imperfect competition imply that welfare effects of trade liberalization will also depend on the scale of production. Naturally, the latter effect depends on the extent to which imperfectly competitive sectors of the economy expand or contract. Because the intellectual foundation of many developing countries' trade policies rests on arguments about potential gains due to scale economies, this extension to the neo-classical analysis of trade liberalization is highly relevant and long overdue.

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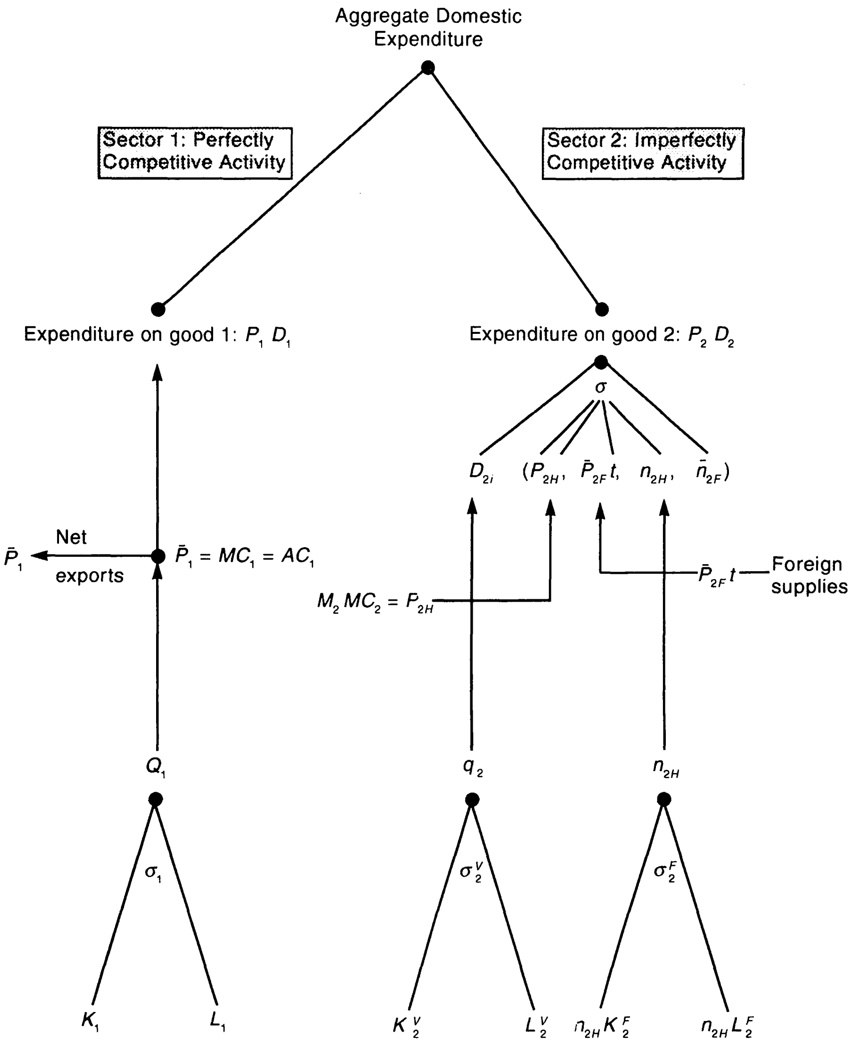
In addition to the normative ambiguity, the presence of imperfect competition and scale economies may also introduce ambiguity in the predicted changes in sectoral output. In this regard, consider the anticipated impact of across-the-board trade liberalization on agricultural output in a developing country with a typical pattern of trade distortions. In a perfectly competitive setting, trade liberalization would be expected to lead to an expansion of agricultural output, since lower income countries typically protect their manufacturing sectors more heavily than the farm sectors. However, when the tariff on manufacturing imports falls, it is possible that the optimal mark-up for imperfectly competitive firms will also fall. This in turn may lead those firms remaining in the industry after the tariff cut to move down their long-run average cost curves. This dampens the degree to which manufacturing contracts, and hence also lessens the expansion of agriculture. Indeed Devarajan and Rodrik (1988, 1989) have argued that, in the case of the Cameroonian economy, this may even cause agriculture to contract, rather than to expand.

The purpose of this paper is to subject this question to rigorous analysis. Is it possible that the conventional neo-classical wisdom regarding the fate of agriculture under trade liberalization could be reversed in the presence of the unexploited scale economies and imperfect competition in the non-agricultural economy? We begin with a theoretical analysis based on a two-sector model. This provides considerable guidance in assessing the empirical work to date. We then turn to a re-examination of the Devarajan and Rodrik results.

A FRAMEWORK FOR ANALYSIS

The question at hand may be addressed in its simplest form with a two-sector model. Sector 1, which may be thought of as agriculture, is an aggregation of all activities which produce a homogeneous product and operate roughly in accordance with the perfectly competitive paradigm. Output price equals marginal cost, and industry average total cost is not affected by changes in the number of firms. Sector 2, non-agriculture, is assumed to produce a product which is differentiated by firm. Furthermore, in order to enter the sector, firms are assumed to incur a fixed (recurrent) entry cost. When coupled with constant marginal costs, this gives rise to increasing returns to scale in the second sector. As profit maximizers, these firms will mark up price over marginal cost according to the inverse of the perceived elasticity of demand for their particular product.

Essential features of this two-sector economy are portrayed in Figure 1. We assume that consumers devote a constant share of their disposable income to each of the two goods. However, composite good two is made up of many individual varieties. The demand for a representative home firm's output D_{2H} is a function of the prices of competing domestic (P_H) and foreign ($P_{2F}(1 + T) = P_{2F}t$) products. If the domestic market is small, and fully integrated into the world market, then it is reasonable to assume that both the number and the supply prices of foreign firms are unchanged by a perturbation in the local tariff. Thus the proportional change in the power of the tariff (t) equals the proportional change in the price paid by consumers for foreign varieties. The



Resource constraints

$$\bar{K} = K_1 + n_{2H}(K_2^V + K_2^F)$$

$$\bar{L} = L_1 + n_{2H}(L_2^V + L_2^F)$$

Budget constraint:

$$E_1 = \bar{P}_1 D_1 + P_2 D_2 = \bar{P}_1 Q_1 + P_{2H} n_{2H} q_2 + (t-1)\, n_{2F} D_{2F}$$

FIGURE 1 *The structure of the two-sector economy* demand for a representative domestic firm's output also depends on the number of varieties available (n_{2H} + n_{2F}). Finally, the elasticity of substitution among varieties of good two (σ) will prove to be an important parameter in this analysis. It must be greater than one if the domestic and imported varieties are to be gross substitutes in consumption.

In order to keep things simple, while capturing the essential features of many developing economies, we assume that sector two does not export any domestic production. In contrast, sector one is a net exporter, facing an exogenous world price for its product (P_1). Both sectors combine labour and capital inputs subject to a constant elasticity of substitution (σ_1 and σ_2). Furthermore, rather than beginning with a tariff-ridden initial equilibrium, and considering the impact of removing these distortions, we consider the mirror image of this experiment, namely the introduction of a tariff into an initially undistorted environment. This vastly simplifies the algebra without altering the intuition. Also, we will consider the case whereby the only border intervention is in section 2. (It is easy to modify the analysis to account for a simultaneous export tax or subsidy on good one). We will then ask how the introduction of imperfect competition alters the prediction that output in sector one will move in the opposite direction of the tariff on imports of good two. Is it possible that a lowering of the tariff on manufactures could cause agricultural output to fall, rather than expand?

NO ENTRY

Theoretical results: As identified by others (for example, Markusen and Venables, 1988), the predictions of this type of model depend on whether or not entry/exit is an option for firms in the imperfectly competitive sector. Accordingly, we consider both possibilities, beginning with the no-entry case. Rodrik (1988, p. 113) argues that this case is particularly relevant to the developing countries where: (a) 'industrial policies have typically been biased toward restricting entry, as investment in many manufacturing sectors are subject to complex licensing and financing arrangements'; (b) 'newcomers to preferred sectors often benefit from special incentive packages, of which latecomers are deprived'; and (c) 'the weakness of capital markets ... means that investment funds are typically internally generated'.

Proceeding with the no-entry case, we manipulate and solve the equations underlying Figure 1, obtaining the following expressions for the general equilibrium (proportional) changes in output per firm ($\hat{q}_2$) and sectoral output ($\hat{Q}_1$) following the introduction of a tariff on the imports of good 2. This yields equation (1):

$$(\hat{q}_2/\hat{t}) = (-\Delta_1/D)\ (\varepsilon^*_{2F} - \beta_{\text{MF}}),\ \text{and}\ (\hat{Q}_1/\hat{t}) = (\Delta_2/D)\ (\varepsilon^*_{2F} - \beta_{\text{MF}}) \qquad (1)$$

where $\Delta_1, \Delta_2 > 0$ are both intensity-weighted averages of the sectoral elasticities of substitution in production, and $D < 0$ is the determinant of the general equilibrium system. (See Hertel, 1991, for detailed derivations).

The common parenthetic term in (1) is made up of two parameters. The first, ε^*_{2F}, is the cross-price elasticity of demand for a representative domestic product in sector 2, with respect to a change in the foreign price (t in this case), compensated for the income effects of changing tariff revenue and excess profits. It is unambiguously positive for values of $\sigma > 1$. The second term, β_{MF}, is the elasticity of the optimal mark-up with respect to t. It is always positive. Furthermore, it can be shown that when $\sigma > 1$, then $\varepsilon^*_{2F} > \beta_{MF}$. This means that agricultural output will indeed be decreasing in the manufacturing tariff (that is, $\hat{Q}_1 / \hat{t} < 0$).

While it appears that our conventional wisdom regarding the qualitative effect of tariff reform in the presence of imperfect competition will not be reversed in this case, the presence of β_{MF} in (1) warrants some additional discussion. This has been termed the 'pro-competitive' effect of tariff reform; as the tariff comes down, so does the optimal mark-up in sector 2. It can be shown that the absolute value of the quantity changes in (1) are decreasing functions of β_{MF}. This leads to some interesting and useful observations, since β_{MF} depends on the conjectures of individual firms about the reactions of their rivals. The two well-defined cases which economists typically use as benchmarks are the Cournot conjecture, whereby firms assume rivals hold quantities constant and adjust price, and the Bertrand conjecture, whereby it is rivals' prices that are assumed to remain constant. It can be shown that the Cournot case is more 'collusive' in the sense that it generates larger optimal mark-ups. It is also the case that β_{MF} is larger under the Cournot conjecture.

Of course, there is yet another, even more collusive case, which has been explored by Harris (1984). He terms this the case of 'focal point pricing', whereby domestic firms uniformly price their products just below the tariff-inclusive price of competing imports. Although this pricing rule is somewhat *ad hoc*, it provides an interesting benchmark because β_{MF} is equal to one and, for a given number of firms, the optimal mark-up falls in the same proportion as the tariff. At the other extreme is the case where mark-ups do not change at all – as would be the case under perfect competition. In sum, the change in agricultural output following a change in the manufacturing tariff is dampened by the presence of imperfect competition in the latter sector. The more collusive the manufacturing sector, the smaller the subsequent change in the two sectors' outputs.

Empirical illustration

At this point it is instructive to pause for a moment and consider some numerical examples. Table 1 presents a variety of results based on the Cameroon data base utilized by Devarajan and Rodrik. To begin with, we alter the model of imperfect competition to conform with Figure 1. This entails 'recalibrating' each of the five tradable, imperfectly competitive sectors. We choose to assume the same representative firm's share of the market (column one) as Devarajan and Rodrik. The resulting optimal Bertrand mark-up and the implied elasticity of substitution among differentiated products are reported in the next two columns. This is followed by the uncompensated elasticity of demand

TABLE 1 *Results of calibration exercise for imperfectly competitive sectors and effect of tariff on domestic sales under Bertrand conjectures and no entry/exit (implications of Devarajan and Rodrik specification in parentheses)*

	Repr. firm's share: θ_{iH}/n_{iH}	Optimal domestic mark-up P_{iH}/MC_i	Elast. of subst.: $\sigma(\sigma_A)$	Demand elasticity: ε_{iF}	Mark-up elasticity: β_{MF}	Domestic sales per firm		
						$(\hat{q}_i^{PE}/\hat{t})$	General equilibrium effects of *ATB* lib.*	
							$\beta_{MF} \neq 0$	$\beta_{MF} = 0$
							Percentage change	
Food processing	0.295	1.29[a]	5.23	1.13[b]	0.23[c]	0.73[d]	n.a.	n.a.
		(1.62)	(1.25)	(0.07)	(0.01)	(0.06)	(2.3)	(2.4)
Consumer goods	0.241	1.39	4.30	0.82	0.22	0.49	n.a.	n.a.
		(1.43)	(1.25)	(0.06)	(0.01)	(0.05)	(−1.3)	(−1.6)
Intermediate goods	0.163	1.29	5.26	1.86	0.25	1.29	n.a.	n.a.
		(1.57)	(0.50)	(−0.22)	(0.05)	(−0.26)	(8.4)	(7.9)
Cement and base metals	0.102	1.30	4.54	2.37	0.19	1.83	n.a.	n.a.
		(1.91)	(0.50)	(−0.34)	(0.03)	(−0.33)	(11.9)	(11.3)
Capital goods	0.012	1.41	3.49	2.38	0.03	2.28	n.a.	n.a.
		(1.49)	(0.75)	(−0.24)	(0.00)	(−0.24)	(−4.4)	(−4.9)

Notes: [a]P_{iH} is the price received by the firm *net of* indirect taxes.
[b]$\varepsilon_{iF} = (1 - \theta_{iH})(\sigma - 1) = \theta_{iF}(\sigma - 1)$. In the Armington case, replace σ with σ_A. ε_{iF}* is estimated using the Cameroon model.
[c]$\beta_{MF} = (1 - \sigma)^2\, \theta_{iH}\theta_{iF}/d_H^B$, where $d_H^B = \eta_{iH}^B\,(\eta_{iH}^B - 1)$. In the Armington–Cournot case, replace σ with σ_A, and d_H^B with $d_H^A = (\eta_{iH}^A/n_{iH})\,(\eta_{iH}^A - 1)$
[d]Results in this column are obtained by applying equation (2).
*ATB lib. = across-the-board liberalization.

for a representative domestic firm's product with respect to the price of foreign competitors. It is generated on the premise that composite domestic expenditure on the good in question is held constant. The elasticity of the optimal domestic mark-up with respect to the foreign price is also reported, and it is this pro-competitive effect which distinguishes the perfectly and imperfectly competitive models.

To evaluate the empirical significance of the pro-competitive effect which tariff reform has on mark-ups, β_{MF} must be compared to ε_{iF}. In particular, consider the impact of a tariff cut on output per firm in partial equilibrium (that is, with marginal cost and composite expenditure on i fixed). This is given by:

$$\hat{q}_i^{PE}/\hat{t} = (\varepsilon_{iF} - \beta_{MF})/1 + \beta_{MF}). \tag{2}$$

Using (2), partial equilibrium results for each of the five sectors are calculated and reported in the next column of Table 1. Since their perfectly competitive analogue is given by $\beta_{MF} = 0$, that is, $\hat{q}_i^{PE}/\hat{t} = \varepsilon_{iF}$, we can see that the pro-competitive effect is indeed significant. For example, in the case of consumer goods, the perfectly competitive model estimates a 0.82 per cent fall in domestic sales/firm for each 1 per cent fall in foreign price. If this industry were, in fact, characterized by product differentiation and Bertrand conjectures, then domestic consumer goods sales/firm would only fall by 0.49 per cent. In other words, the perfectly competitive model would overstate the decline in output per firm by 79 per cent! (That is $((0.82 - 0.49)/(0.49)) \times 100\% = 79\%$.) Note, furthermore, that these discrepancies would be even greater in the case of a more collusive industry (for example, the Cournot case with product differentiation).

Table 1 also reports some information on the Devarajan and Rodrik formulation of imperfect competition in Cameroon. Rather than differentiating all firms products symmetrically, they adopt the 'Armington' specification whereby foreign and domestic products are treated as fundamentally different. They then proceed to assume that domestic products are homogeneous, with domestic mark-ups resulting from Cournot behaviour. Export markets are segmented in their formulation and the associated mark-ups are negligible. Thus, given the same level of profits, initial domestic mark-ups must be higher than in the integrated markets formulation which we have employed. This may be seen by examining the parenthetic entries in the second column of Table 1. For example, the Devarajan and Rodrik domestic mark-up on processed food (P/MC) products is 1.62, as opposed to the integrated markets mark-up of 1.29.

The elasticity of substitution between domestic and foreign goods in the Devarajan and Rodrik model is given in the third column of Table 1. Note that it is quite small, indicating that they are assumed to be poor substitutes. Indeed, the values of $\sigma < 1$ for the last three industries causes domestic and foreign goods to be *gross complements* when domestic expenditure on the Armington composite is held constant. This means that a fall in the tariff on intermediate goods, for example, will increase domestic sales per firm in partial equilibrium! Following equation (2), we see that this is reinforced by the pro-competitive effect. Consequently, $\hat{q}_i^{PE}/\hat{t} < 0$ for these three industries.

It should also be pointed out that the pro-competitive effect is very small for all of the industries in the Devarajan and Rodrik specification. This is because the numerator of β_{MF} involves $(1 - \sigma_A)^2$ and the values of σ_A are relatively close to one in this model. This raises serious concerns about Devarajan and Rodrik's assertion of the importance of this pro-competitive effect in reversing the conventional wisdom regarding the fate of agriculture under trade liberalization. Comparison of the final two columns of Table 1 confirm this suspicion. The first of these sets of general equilibrium results for across-the-board elimination of tariffs in the Devarajan and Rodrik model is taken from their basic model with increasing returns to scale and no entry. As can be seen here, three of the five imperfectly competitive sectors expand.

In their paper, Devarajan and Rodrik compare this model to one in which the imperfectly competitive sectors are *recalibrated* and treated as perfectly competitive sectors. This poses a serious comparability problem, since excess profits are now treated as payments to a fictitious 'fixed factor'. The presence of such a fixed factor now serves to significantly restrain supply response in these manufacturing sectors. A further complication has to do with the asymmetric treatment of export supplies between perfectly and imperfectly competitive sectors. In the former case, domestic and export products are treated as imperfect substitutes, while the imperfectly competitive sectors' outputs may be freely shifted between the two markets. Thus their comparison of trade liberalization results in the presence of perfect and imperfect competition is confounded by the simultaneous use of two different specifications of technology, factor mobility and product differentiation. It turns out that the latter distinctions, not the presence of imperfect competition, are what cause the two sets of results to diverge.

A more straightforward method for isolating the pro-competitive effect of trade liberalization is simply to fix the imperfectly competitive firms' mark-ups, that is set $\beta_{MF} = 0$. The trade liberalization results in this case are presented in the final column of Table 1. As anticipated by the partial equilibrium analysis, they differ little from the results with the pro-competitive effect present. This carries over to all of the other variables in the model, including agricultural output. In sum, as demonstrated in Table 1, the pro-competitive effect of tariff reform (when entry/exit is restricted) is potentially an important empirical phenomenon. However, Devarajan and Rodrik are mistaken to argue that it is this effect which causes a reversal of the 'conventional wisdom' in their model. Indeed, theoretical results suggest that this type of qualitative reversal is unlikely.

ENTRY

Theoretical results

Once entry/exit of domestic firms in response to changing profitability is permitted, an additional constraint is placed on sector 2, namely a zero profit condition. Thus price determination may be characterized as follows:

$$A\hat{V}C_2 + \hat{M}_2 = \hat{P}_{2H} = A\hat{T}C_2\ (\hat{q}_2 = 0) - \Omega_{F2}\hat{q}_2 \tag{3}$$

The left-hand side of (3) asserts that the sum of the proportional changes in average variable cost and the optimal mark-up must equal price. It follows from the optimal mark-up condition in Figure 1, along with the assumption of constant returns to scale in variable inputs (that is, $M\hat{C}_2 = A\hat{V}C_2$). The right-hand side of (3) is the zero profit condition, where the change in average total cost is decomposed into two parts: that obtained by holding scale constant, and that attributable to changes in scale ($-\Omega_{F2}\hat{q}_2$ where Ω_{F2} is the cost share of fixed factors in the second sector).

Equation (3) simplifies considerably if we assume, for the model outlined in Figure 1, that variable and fixed costs exhibit the same capital-labour intensities, in which case:

$$A\hat{V}C_2 = A\hat{T}C_2\ (\hat{q}_2 = 0) \text{ and so } \hat{q}_2 = -\Omega_{F2}^{-1}\hat{M}_2$$

That is, output per firm must always move in the opposite direction of the mark-up. However, the change in the optimal mark-up as a function of the tariff is ambiguous in the presence of entry/exit. The reason for this ambiguity is the fact that the induced change in the number of domestic firms works in the opposite direction of the 'pro-competitive' effect identified in the previous section. While a drop in the tariff lowers the price of competing foreign products and thereby lowers domestic firms' optimal mark-ups, it also has the effect of driving some domestic firms out of the industry. Since the representative firms' optimal mark-up is a decreasing function of the number of competitors, this second effect works to raise mark-ups.

Since the ambiguity in mark-ups translates directly into ambiguity in output per firm, it is hardly surprising that we are unable definitively to sign the change in the price charged for domestically produced, differentiated products. This is yet another manifestation of the maxim that, 'in the presence of imperfect competition, anything can happen'. *But these are not the variables of interest in the analysis at hand.* Rather, we want to sign the change in agricultural output as a function of the non-agricultural import tariff. This, in turn, depends on the change in marginal revenue for a representative domestic firm in sector 2, relative to the exogenous price of sector one's output. It can be shown that, regardless of whether P_{2H} falls, the mark-up falls more rapidly. Thus MR_2/P_1 rises and Q_1 falls with $\hat{t} > 0$. In summary, based on the theoretical model outlined in Figure 1, we are able to conclude the following: when entry/exit is permitted, agricultural output will always move in the opposite direction of the tariff on imports of the differentiated non-agricultural product. It should be noted that this finding is also robust to the form of conjectures postulated.

Empirical findings

Now let us return to the Cameroon model once again. At this point it is relevant to re-examine (3) in the light of the differences between the abstract framework outlined in Figure 1 and the complexity of this empirical model. The most striking difference is in the composition of industry costs. While Devarajan and Rodrik do assume that the relative capital–labour intensity of fixed and variable costs is the same, the presence of *intermediate inputs* in the variable cost component now causes the rates of change in AVC_i and $ATC_i(\hat{q}_i = 0)$ to diverge. In particular, since the first-round effect of tariff elimination is to lower the cost of imported goods, and since these represent a sizable share of variable costs, especially in some of the manufacturing sectors, AVC_i falls much faster than ATC_i $(q_i = 0)$. Furthermore, since optimal mark-ups are relatively insensitive to the tariff (Table 1), and since the equilibrating change in firm numbers is small (Devarajan and Rodrik), $M_i \cong 0$. Thus output per firm must increase significantly in order to preserve the two equalities in (3).

Now consider the implications of (3) when manufacturing activity exhibits perfect competition, and hence operates under locally constant returns to scale. In this case $M_i = 1$, $\hat{M}_i = 0$; that is, there is no mark-up over marginal cost. Furthermore, $\hat{AVC} = \hat{ATC}$, and $\Omega_{F2} = 0$. Thus the complement of capital and labour in variable costs is larger, so that when the price of imported intermediate goods falls, the change in the index of average variable costs will be dampened, relative to the case where some of this capital and labour is fixed. Thus the partial equilibrium supply price falls less, and output is lower in the post-liberalization equilibrium. However, the resource-pull effect and hence the implications for agricultural output in these two models will be less dissimilar. This is because the expansion in output per firm under increasing returns to scale requires fewer primary inputs per unit of incremental output.

SUMMARY AND CONCLUSIONS

In summary, we believe that the presence of imperfect competition and unexploited scale economies in the non-agricultural economy can have important implications for the level of agricultural output following across-the-board trade liberalization. The theoretical results in this paper show that a reversal of the direction of change in agricultural output (as compared to predictions based on the perfectly competitive paradigm) is unlikely. However, the degree of adjustment required in both sectors will be less, the more collusive is the non-farm sector. The magnitude of these pro-competitive effects depends importantly on the nature of consumer preferences over domestic and foreign varieties: do consumers distinguish a product by firm, or by country of origin? The divergence in predictions also depends significantly on the source and extent of unexploited scale economies. If these derive from a fixed primary factor requirement, then tariff reform can have a strong stimulative effect on those sectors which also rely heavily on imported intermediate inputs.

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