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TRADE POLICY FOR THE MULTIPLE PRODUCT DECLINING INDUSTRY

by

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Abstract: Increasing returns to scale and scope in production technology combined with product substitutability in demand yields an environment where free trade may not maximize domestic country welfare. If not, there is an optimal tax on imports that depends on the cross-elasticity of demand between the products in the spectrum and on the degree of economies of scale and scope in technology. However, even if protection may be warranted in the short run, the long run solution is consistent with the theory of comparative advantage.

INTRODUCTION

Recent economic events of exchange rate appreciation and current account deficit have increased popular and political focus on the declining industries in the developed countries. The loss of jobs and national prestige has engendered a politically fueled search for a remedy to natural forces of economic change and development. Workers and management alike have demanded import protection, although plant mergers, labor retraining, and wage give-backs have also been used more recently to ameliorate the problem at its source.

Historically, the adage "free trade is best" captured the philosophy of most trade economists on the protection issue; trade theory models generally concluded that the force of comparative advantage that leads to the supplanting of developed country production by LDC imports was to the long run welfare benefit of both the developed countries and the LDCs. Sectoral welfare effects in the developed countries might appear to be to the contrary, but appropriate transfers from sunrise to sunset industries evidenced the net welfare gain to the nation as a whole of allowing market forces to act. However, the standard trade theoretical result depends significantly on strict assumptions of industry characteristics and structure. Specifically, it posits a cost structure with decreasing or constant returns to scale, marginal revenue equals marginal cost pricing rules, and independent product demand curves.

In recent years, international trade economists have borrowed industrial organization models to analyze the role of market structure in generating patterns of international trade.[1] Once the yoke of perfect competition was thrown off, authors began to analyze the interaction of market structure and various international trade policies, especially with regards to international competitiveness.[2] Other literature has focussed on deviations from the perfectly competitive model from the demand side using multi-product outputs.[3] This paper tries to merge these two strands by analyzing the domestic welfare impact of free trade and optimal trade policies for a declining industry that produces a product spectrum of outputs under conditions of economies of scope and scale.

Cursory examination of many declining industries suggests that their industry characteristics fit the stylized facts.[4] Due to both excess capacity and underlying production technology, these industries seem to exhibit declining costs of production. A second observation is that many of the industries produce a product spectrum of goods. The items are interrelated both on the supply side due to jointness in production technology, and, on the demand side, due to non-zero cross price elasticity of demand.

Readers familiar with the contestable markets literature will recognize an international analogue.[5] However, the international problem is more complex. On an item-by-item basis, within the product spectrum, there are international input cost differentials that alter the conditions of sustainability: marginal costs are lower in the LDCs in part because of cheaper labor. Therefore, clear foreign comparative advantage at the labor intensive end of the product spectrum weakens domestic efficiency arguments against relinquishing the contested part of the spectrum. But, the developed country industry may have a comparative advantage in producing the higher technology items in the spectrum. If the product spectrum can be split with relatively few production inefficiencies, the standard comparative advantage story holds and the developed country relinquishes the contested items to the lower cost producer. However, jointness in production technology and increasing returns to scale may imply that efficient, lowest cost production obtains only if the product spectrum is produced in its entirety. Under these conditions, efficiency gains from trade over only part of the product spectrum are not clear cut and comparative advantage in the production of one item within the spectrum is an insufficient guide for trade policy.

Another wrinkle is that the production of a product spectrum using joint input technology encourages pricing rules of thumb. When it is difficult in practice to equate product specific marginal costs and product specific marginal revenues, firms often resort to average cost pricing rules.[6] Trade conducted in this pricing environment may yield a policy ranking different from the standard comparative advantage model.

Even though domestic policies are the first defense against import penetration,[7] only trade policy for the declining industry is examined in this paper. We focus on the often second best set of trade policies because many of the first best industrial policies violate antitrust regulation, succomb to union pressures, or entail lump sum transfers that are politically infeasible.

Before presenting the formal model, the fundamental results will be summarized. First, the framework used here to analyze the declining industries embodies externalities that can cause free trade to be too much trade. When the country opens up to trade, demand substitutes toward the cheaper imported good. Higher average costs and prices result for the remaining domestically produced items in the spectrum because of the downward sloping cost curves and jointness in production technology. This post-trade price structure may not maximize country welfare. Even though the cheaper import generates an undisputable consumption gain, the production inefficiencies yield price increases on the other items in the product spectrum causing a consumption loss. The net gain or loss over the whole spectrum should determine appropriate trade policy. Restricting trade may be optimal for the domestic country.

The second important analytical result of the model is that as the declining industry's cost structure deteriorates,[8] protection levels fall if the industry had enjoyed protection. As the domestic industry becomes less competitive over successive items in the product spectrum, comparative advantage forces eventually eliminate the industry. Thus, even though there is more scope for aggressive trade policy in the short run, the long run result is consistent with standard comparative advantage trade theory.

The first section formalizes cost and demand characteristics of the industry and describes foreign competition. The next section formulates the open economy problem, determines whether free trade enhances welfare, and if not, analyzes optimal trade policy. An anatomy of policy choices with a deterioration of the cost structure of the domestic industry concludes the essay.

INDUSTRY AND DEMAND STRUCTURE

The economy is composed of two sectors. The heterogeneous goods sector (H) produces a product spectrum of output with economies of scale and scope. The products within the spectrum are imperfectly substitutable in consumption. We can think of the sector as composed of identical oligopolistically competitive firms where anti-trust regulation prevents both merger and excessive profits.* The all-other-goods sector (A) produces a necessity good under conditions of perfect competition and constant returns to scale.

Production Characteristics

There are N firms and I items in the product spectrum produced using K inputs. Costs of producing each product i exhibit increasing returns to scale in the output of i and economies of scope in the ouput of the other items in the spectrum as specified in the following generalized Cobb-Douglas cost dual.

$$(1) \quad TC_i = \prod_{k=1}^{K} R^i{}_k \; w_k \; G_i(q_{j \neq i}) \; q_i^{s_i}$$

$$s_i = 1 / \sum_{k=1}^{K} a^i{}_k < 1$$

$$G_i' < 0$$

The $a^i{}_k$ is the kth factor share for good i with factor price w_k and the appropriate factor price and share constant $R^i{}_k$. So long as the sum of the factor shares is greater than 1, the production function exhibits increasing returns in the output of product i. The negative derivative for the cross-output function G_i assures economies of scope in the output technology. Since the N firms are identical, and we assume in this essay no merger possibilities, equation (1) equally well describes the individual firm's costs and industry wide costs.

Under conditions of increasing returns to scale and scope, proper assignment of costs to individual products is difficult in practice, so firms often resort to pricing rules of thumb that yield mark-up or average cost pricing for individual products.[10,11] While marginal cost pricing in the presence of global increasing returns yields losses, anti-trust regulation often will not allow firms to exit the industry, and profitable oligopoly structures exist where collusion is not obvious. Furthermore, empirical and theoretical industrial organization studies suggest that average cost pricing rules in fact are prevalent in increasing returns oligopolies and regulated industries. Therefore, average cost pricing is assumed.[12]

$$(2) \qquad P_i = AC_i = \prod_{k=1}^{K} R^i{}_k \; w_k \; G_i \; q_i^{s_i - 1}$$

Demand Characteristics

Representative consumer utility is CES across consumption of the products produced in the two sectors of the economy. The CES expenditure dual depends on each of the prices of the items in the spectrum, (P_i) (which will change as equilibrium quantity changes), the unchanging price of the composite good (P_a), and the utility level $u(H,A) = u^o$.

$$(3) \quad E(X_1, \ldots \quad , X_I, X_a) = \left(\sum_{i=1}^{I} P_i^r + P_a^r\right)^{1/r} u^o$$

r ranges from negative infinity (completely elastic, linear utility) where different consumption levels of the various goods are meaningless to consumer utility, to 1 (completely inelastic, Leontief utility) where utility is defined uniquely by minimum consumption levels of each of the goods.

Foreign Competition

The domestic industry faces foreign competition at some points in its product spectrum of I items. Foreign suppliers can undercut the domestic price of say item i because foreign production technology differences and input cost differentials yield a foreign average cost for i below the domestic average cost for i. However, because the foreign supplier does not use the same technology or input ratios, we assume it cannot profitably price below the domestic price on all items in the product spectrum.[13]

The foreign item i is a perfect substitute for the domestic item i, and the foreign producer satisfies all domestic demand for i at the market entry price. Therefore, once i is imported, domestic output of i ceases.[14]

TRADE POLICY

An item-by-item comparative advantage ranking may not yield the most efficient trade policy in this environment. Standard comparative advantage says cheaper foreign goods should be imported, thus yielding a welfare gain from trade. However, the interrelationship between the demand curves and output technology for the individual products creates a new dimension for comparative advantage. Price changes on all goods in the spectrum, not just the traded goods must be weighed when measuring gains from trade, and to determine if free trade is the welfare enhancing policy. Importing the foreign item at a lower price shifts demand from all other products. Given the cost characteristics, losing an item and demand reduction on other items unambiguously increases costs of producing all of the remaining items in the spectrum. With an average cost pricing rule, the equilibrium price of each remaining good must rise.[15] The essential trade policy decision weighs the consumption gains on product i, now imported at a lower price, against the consumption losses associated with increased prices of all remaining domestically produced items. If the consumption gain outweighs consumption losses, then allowing imports is the appropriate policy. But, if the losses outweigh the gain, then restricting imports is desirable.

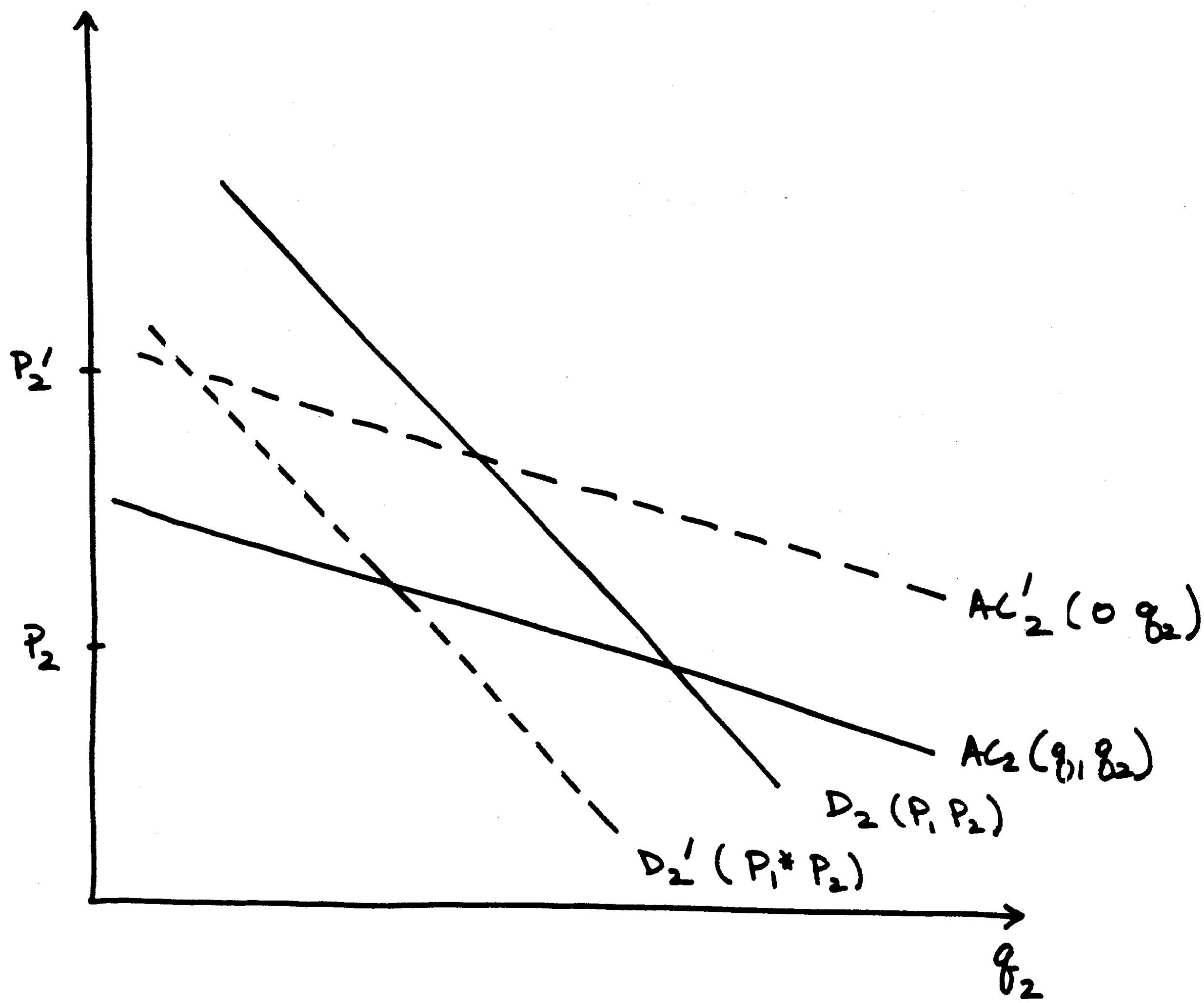
Distinguishing product spectrum comparative advantage from single product comparative advantage is necessary to determine appropriate trade policy. The domestic firm has what will be called "product spectrum comparative advantage" only if consumer utility is greater when restricting foreign competition leaves the domestic product spectrum intact. If there is a utility gain over the whole spectrum from importing just a portion of the spectrum, then the foreign firm must have "single product comparative advantage" in the production of the item most demanded using a utility measure. If this is the case, even if the domestic firm has single product comparative advantage in all the remaining items, it does not have product spectrum comparative advantage.

Two good product spectrum

So as to obtain simple analytical results, collapse the H sector product spectrum into two items 1 and 2. The autarchy price set is $(P_1,P_2,1)$ where $P_a=1$. Assume that the foreign country produces item 1 more cheaply and its market entry price is P^*_1. Imports satisfy demand at P^*_1 less than P_1. Therefore the free trade price set is $(P^*_1,P'_2,1)$ where P'_2 is the post-trade price of the remaining domestically produced item. (See figure 1).

The measure of foreign cost advantage, and therefore

figure 1



price reduction on item 1 when trade opens up, is defined as n where

(4) $n = P^*_1/P_1$; $0 < n < 1$

Increasing n means that the foreign product is less advantageously priced and $n = 1$ implies no foreign cost or price advantage on item 1.

Using the expenditure dual, and holding utility constant at u^o, we can determine whether free trade or autarchy is welfare improving by comparing autarchy expenditure with free trade expenditure.[16]

(5) $E_a = (P_1^r + P_2^r + 1)^{1/r}\ u^o$

$E_f = (P^{*r}_1 + P'^r_2 + 1)^{1/r}\ u^o$

$D = E_a - E_f$

E_a is autarchy expenditure. E_f is expediture in free trade that achieves the same utility level. D is the difference between the two expenditure levels that achieves the same target utility level.

If D is greater than zero, then expenditure to reach u^o is greater in autarchy than with free trade. The appropriate policy allows the import of item 1 since the consumption benefits outweigh the consumption losses on item 2. While the domestic firm has comparative advantage in producing item 2, it loses product spectrum comparative advantage: extracting item 1 from the product spectrum and producing it more cheaply overseas yields an expenditure reduction and implied utility gain.

If D is less than zero, then free trade expenditure exceeds autarchy expenditure and the appropriate trade policy restricts the import of item 1. Free trade causes a great enough increase in P_2 to outweigh the consumption gains implied by P^*_1. Therefore, even though the foreign industry has single product comparative advantage in item 1, the domestic industry must have product spectrum comparative advantage.

The post-trade change in the price of item 2 has three major elements: the cross-price elasticity of demand, which is composed of the utility elasticity of subsitution between products in the consumption basket and the effect on the level of utiltity of price changes; the output elasticity of average cost, which is composed of the scale and scope elasticities of output; and the measure of foreign cost advantage.

Demand shifts are measured by the cross-price elasticity of demand

$$(6) \qquad e_{12} = \frac{\partial q_2}{\partial P_1}\frac{P_1}{q_2} = \frac{(1-r)\ P_1^{\,r}}{(P_1^{\,r} + P_2^{\,r} + 1)} + i_1$$

e_{12} is positive for substitute goods so long as the price effects on the level of utility, as measured by i_1, are not too large.[17] When $r = -\infty$, $e_{12} = \infty$ representing perfectly linear utility and infinite cross elasticity of demand. When $r = 1$, $e_{12} = 0$; the Leontief utility implies zero cross elasticity of demand. Therefore, e_{12} embodies information on both the magnitude of demand shift and the extent to which items are substitutable in utility. Increasing e_{12} implies a bigger demand curve shift (given any price change), but also that differentiating between items 1 and 2 in utility is more difficult.

The average cost elasticity of output describes characteristics of the cost function for good 2. Keeping q_1 constant, we measure the movement along the average cost curve for good 2 given q_1 that corresponds to pure scale elastcity of output. The more important are scale elastiticities, the steeper the average cost curve. (Refer to figure 2.)

$$(7) \quad s_2 - 1 = \frac{\partial AC_2}{\partial q_2} \frac{q_2}{AC_2} \Bigg|_{q_1}$$

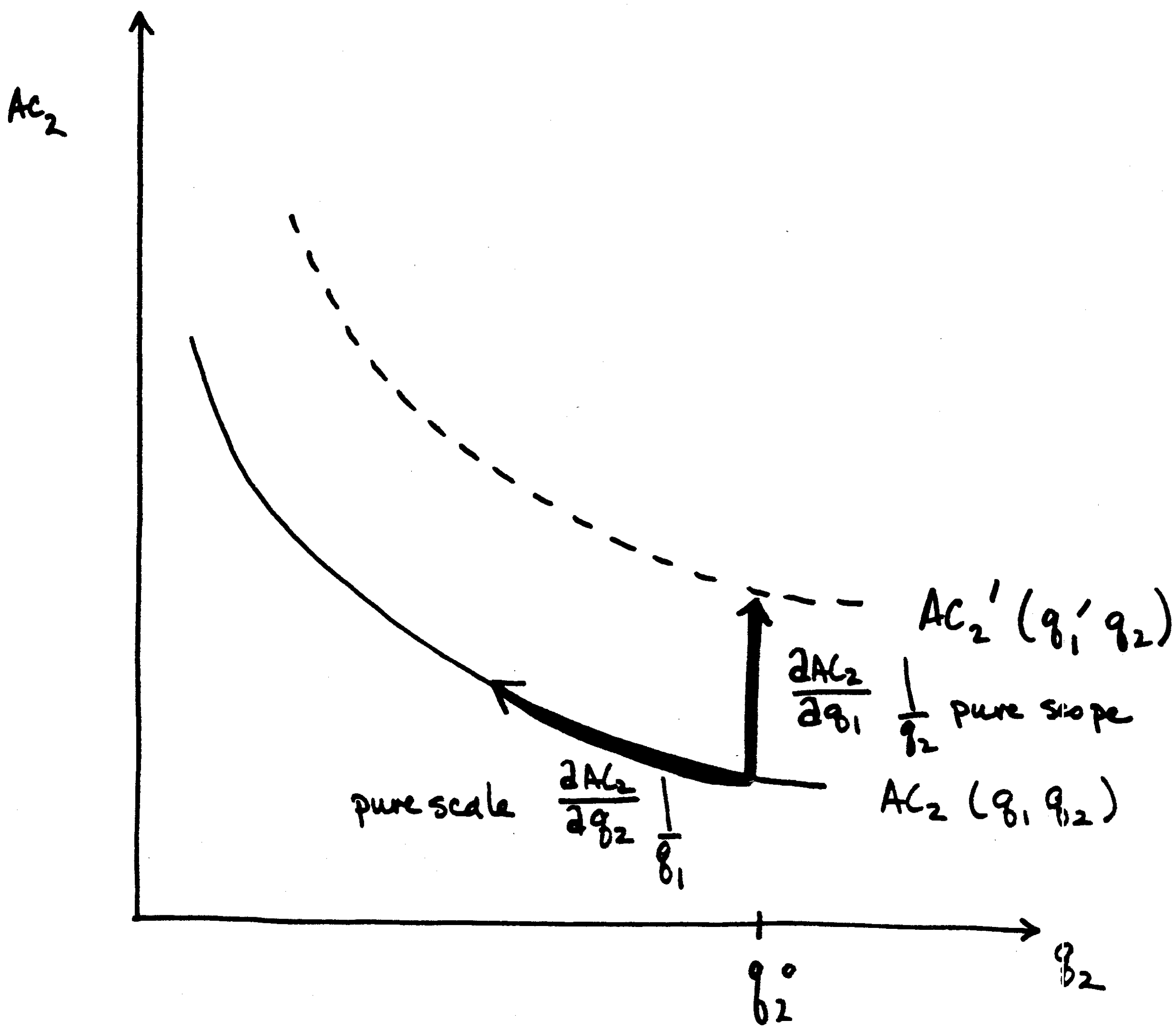
Keeping q_2 constant, and changing q_1, we measure the shift in the average cost curve for good 2 that corresponds to pure scope elasticity for output for good 2. The greater the importance of scope in the production process, the greater the shift in the average cost curve when q_1 changes.

$$(8) \quad g_2/(\partial q_1/q_1) = \frac{\partial AC_2}{\partial q_1} \frac{q_1}{AC_2} \Bigg|_{q_2} = \frac{\partial G_2(q_1,q_2)}{dq_1} \frac{q_1}{G_2}$$

$$g_2 = \frac{\partial G_2}{G_2}$$

When we introduce shifts in the demand for good 2 that result from cheaper imports of good 1, a combination of a shift in the average curve curve and a movement along the new average cost curve determine the post-trade average cost of producing good 2 and given the pricing rule, the post-trade price of good 2.

figure 2


AC_2
$AC_2'(q_1' q_2)$
$\frac{\partial AC_2}{\partial q_1}\Big|_{q_2}$ pure slope
pure scale $\frac{\partial AC_2}{\partial q_2}\Big|_{q_1}$
$AC_2(q_1 q_2)$
q_2^0
q_2

Let us open the economy to trade and determine the post-trade price of good 2. With trade, P_1 falls to P^*_1. Equating changes in quantities on both the demand and supply sides of the market, we derive, after some manipulation, the post-trade price of good 2.

$$(9) \quad P'_2 = P_2 \left\{ 1 + \frac{(s_2-1)e_{12}(n-1)}{q_2} + g_2 \right\}$$

The post-trade price of good 2 is higher the greater the cross price elasticity of demand (e_{12}), the greater the scale elasticity of output (s_2-1), and the more important the elastiticy of scope (g_2).

Substituting P'_2 into the expenditure difference identity (7) yields a behavioral specification.

$$(10) \quad D = \{P_1^r + P_2^r + 1\}^{1/r} u^o$$

$$- \{(nP_1)^r + (P_2[1+\frac{(s_2-1)e_{12}(n-1)}{q_2}+g_2])^r + 1\}^{1/r} u^o$$

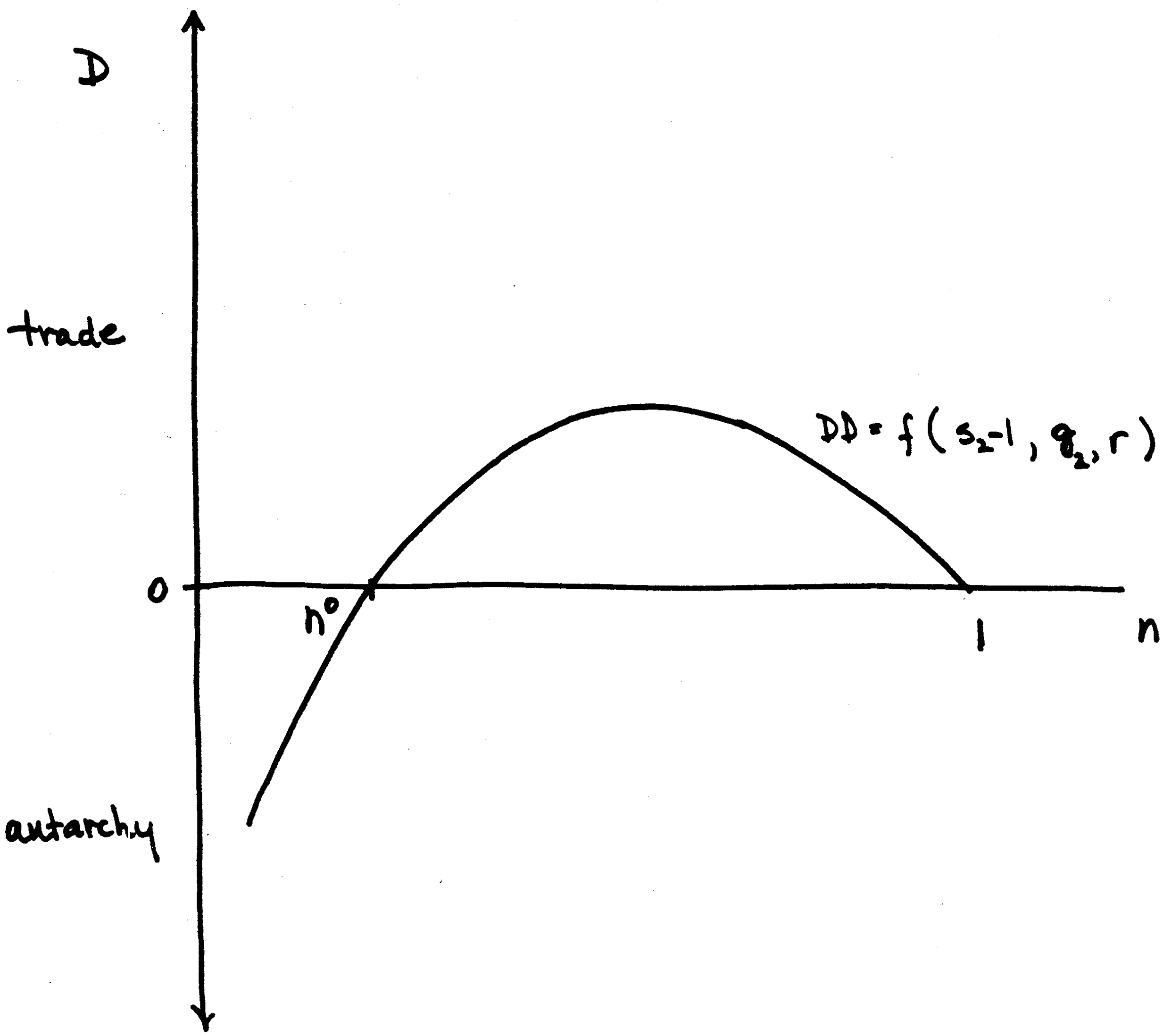
The foreign cost advantage (n), the cost structure (g_2, s_2-1), and the cross- price elasticity (e_{12}), (as well as initial prices and quantities), all together determine the sign of D and whether trade increases welfare as measured by expenditure on the basket of goods.[16] When the cross-price elasticity of demand is at its extremes -- no demand shift when $e_{12}=0$ and infinite demand shift when $e_{12}=-\infty$-- the expenditure difference function is unambiguously positive, suggesting a free trade policy in either of these cases.[17] But, it is at elasticities between the extremes that trade-offs between consumption gains and production losses appear and there may be scope for trade policy instead of pure free trade.

The most crucial element determining how expenditure changes with the foreign price level given the cost characteristics is whether the cross-price elasticity of demand is small or large. In the most general terms, if this elasticity is large, (which implies a high degree of substitutability between the products in the spectrum), then trade is more likely to reduce expenditure on the consumption basket if the foreign price is not too low, and the economies of scale and scope are not too large; if the foreign price is very low, but the cost economies are important, then the consumption gain on product 1 is likely to be outweighed by technology induced consumption losses associated with product 2.

There are many variables here that affect the trade policy choice -- too many to fully analyze and catalogue their individual effects on trade policy. Therefore, we will divide them into three catagories: the utility characteristics, which will be held fixed for the remainder of the analysis and for which we examine only the case of elastic demand ($r<0$ [20]); cost characteristics, which will be the main variable used to describe how an industry declines; and the foreign cost advantage, which is the key exogenous piece of data and which, given all domestic characteristics, will determine the appropriate trade policy.

This manner of structuring the problem is depicted in figure 3. The figure diagrams the difference function D

figure 3



against the foreign cost advantage n (which ranges from 0 to 1). There is a family of functions each drawn for a unique set of pre-trade initial conditions (prices and output levels), cost characteristics (g_2 and s_2-1), and utility characteristics (r). Above the horizontal axis, D is greater than zero and trade reduces expenditure. For the (s_2-1,g_2,r,n) combinations such that D is below the axis, trade increases expenditure so an autarchy policy dominates trade.

The DD curve must intersect the horizontal axis twice. At n=1, $P_1=P^*_1$, and $P_2=P'_2$ so $E_a=E_f$ and D=0; free trade and autarchy expenditures are identical since there is no foreign price differential. The other intersection is n^o defined implicitly when D equals 0 and where the consumption benefits of importing good 1 just balance the cost induced consumption losses on good 2.[21]

Given any DD function, a foreign price lower than n^o (shown as $n<n^o$) implies a large consumption gain on good 1, but nevertheless too much of a demand shift that causes large price increases for item 2 that outweigh the import consumption gains thus yielding a higher overall expenditure: trade should not be allowed. However, so long as the foreign price is such that n lies between n^o and 1, importing does not shift the demand curve for good 2 too much; consumption benefits from imports outweigh losses from the increased domestic price of good 2 and trade reduces expenditure.

OPTIMAL TRADE POLICY

The DD curve reaches a maximum at some foreign cost advantage n^* where the maximum positive benefits from trade are obtained by the domestic country. At n^*, the country receives consumption benefits of importing at P^*_1 less than P_1, but the import price is not so low as to cause demand shifts that yield increased consumer expenditure on the basket. From the standpoint of the domestic country, the optimal foreign price for good 1 is n^*P_1.

Define this optimal post-trade domestic price of good 1 as P^{**}_1. P^{**}_1 is obtained from the actual foreign price of P^*_1 $(=nP_1)$ via an import surcharge, import consumption tax, tariff, quota, or subsidy (although we reject the subsidizing of foreign imports as a realistic policy option). We can derive this optimal wedge from the optimal foreign cost differential (n^*) and the actual foreign price via the identity

$$(11)\quad P^{**}_1 = n^*P_1 = (1+t^*)nP_1$$

Solve for the optimal wedge by rewriting equation (10) to include the tax

$$(12)\quad D = \{P_1^{\,r} + P_2^{\,r} + 1\}^{1/r}\, u^{o}$$

$$- \left\{(TnP_1)^r + \left(P_2\left[1+\frac{(s_2-1)e_{12}(n-1)}{q_2}+g_2\right]\right)^r + 1\right\}^{1/r} u^{o}$$

where $T = 1+t$ and TnP_1 is the domestic tax-ridden price of the imported good.

Optimizing (12) with respect to T, yields the wedge that maximizes trade benefits for the domestic country.

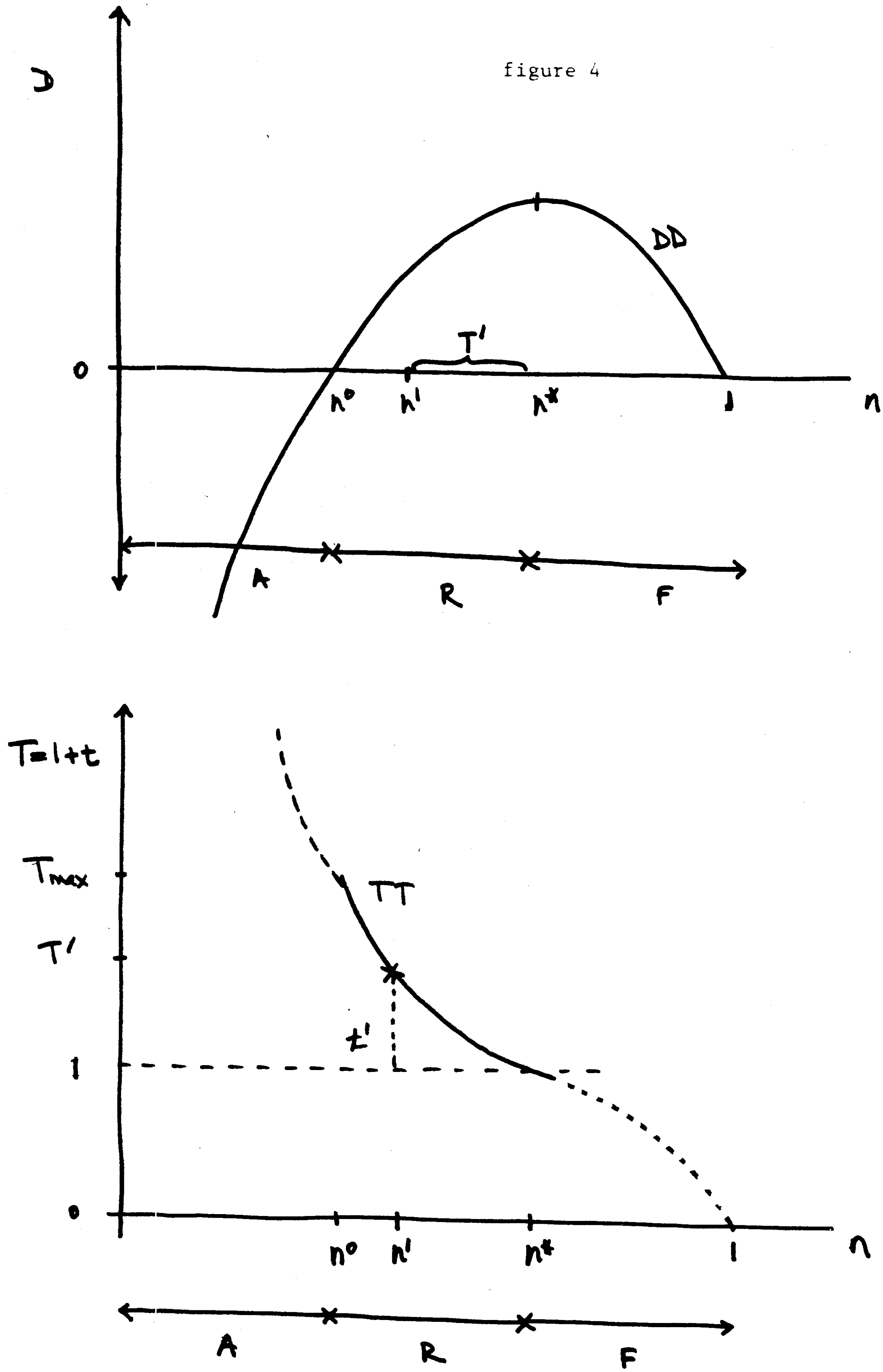
$$(13)\quad T = \frac{\left\{\dfrac{-(s_2-1)e_{12}}{q_2}\right\}^{1/(r-1)} \left\{1+\dfrac{(s_2-1)e_{12}(n-1)}{q_2} + q_2\right\}}{n\left\{\left[\dfrac{P_1}{P_2}\right]^{r/(r-1)} + \left[\dfrac{-(s_2-1)e_{12}}{q_2}\right]^{r/(r-1)}\right\}}$$

If economies of scale are non-existent ($s_2-1=0$) or if the utility function is Leontief or linear ($r=1, e_{12}=0: r=-\infty, e_{12}=\infty$), then the optimal foreign price for good 1 is zero; since we are, in effect, choosing the foreign price, this comes as no surprize. However, an examination of the wedge in an environment of the economies of scale and scope and with intermediate values of utility substitution yields more interesting conclusions.

Figure 4 shows the relationship between the trade policy diagram and the tax diagram drawn for values of T and n. Like the DD curve, there are a family of TT curves uniquely drawn for initial conditions, cost, and utility characteristics. But the TT curve is unambiguously downward sloping. The smaller the foreign cost advantage ($n \to 1$) the lower the tax that achieves the optimal domestic price of good 1 from the actual foreign price.

We can construct the TT curve from points on the DD curve. It is well-defined for any foreign cost advantage n between n^* and n°. Here, given a foreign cost advantage, say n' (in figure 4), there is an optimal tax T' given by equation (13). The boundaries of the well-defined curve are n^* and n°.

figure 4



The maximum of the DD curve is at n^*. If the actual foreign cost advantage equals n^*, then the tax rate necessary to obtain maximum trade benefits is zero and T=1. At foreign cost advantage n° and below, autarchy is the expenditure minimizing policy. The wedge defined at n° prevents trade and as n falls below n°, the prohibitive rate rises at an increasing pace keeping the domestic industry protected in autarchy: the TT curve then shows the shadow value of keeping the industry protected. If n lies between n^* and 1, the tax rate is actually negative, suggesting a subsidy.

In summary, there are three trade policy regions -- autarchy (A), free trade (F), and restricted trade (R)-- demarked by n° and n^*. For n less than n°, autarchy, achieved via a prohibitive wedge, is the best policy. Even though there are substantial benefits generated by the low foreign price, it causes too much demand shift and (given cost characteristics s_2-1 and g_2, and elasticity r), expenditure to reach u° in trade exceeds expenditure in autarchy. For n greater than n^*, trade benefits are as large as possible. Therefore, free trade minimizes expenditure. It is for a foreign cost advantage between n^* and n° that there is scope for a trade restriction that yields lower expenditure and thus higher utility than either autarchy or free trade. For all n between n° and n^*, there is an appropriate trade barrier that brings the actual foreign price up to the trade maximizing price.

These results have important implications for the foreign producer. If its cost advantage is below n°, it should voluntarily raise prices up to the boundary so as to be allowed to enter the domestic market. If its cost advantage lies between n^{o} and n^{*}, then it should increase prices until P^{**}_{1} is reached and reap profits instead of allowing the domestic country to earn tax revenues. Voluntary restraint agreements perhaps are an example of this kind of behavior that satisfies both the importer and the domestic country. Even though the price of good 1 is above its free trade level, the expenditure over the whole consumption basket is lower.

ANATOMY OF COST CHANGES AND THE OPTIMAL TARIFF

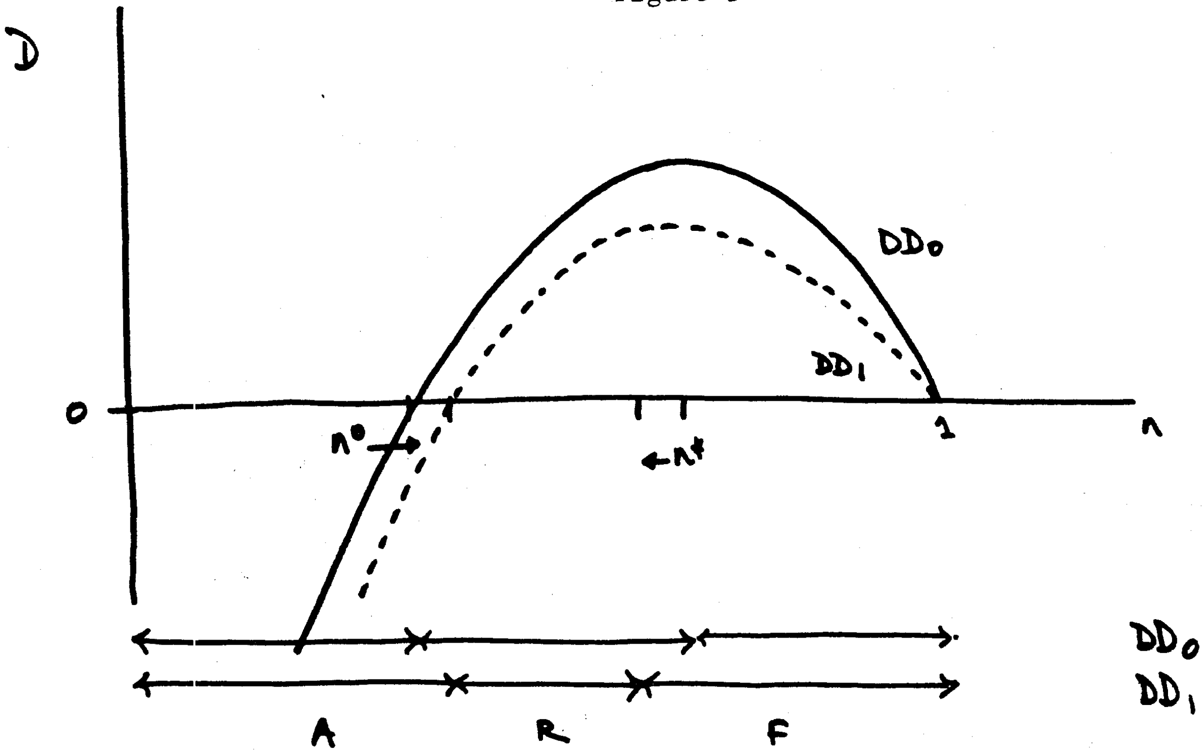
How does the tariff rate change and the size of the regions change when the cost/output tradeoffs worsen for the domestic country? The exercise yields a conclusion supporting standard comparative advantage theory in the long run, but offers more opportunity for aggressive trade policy in the short run.

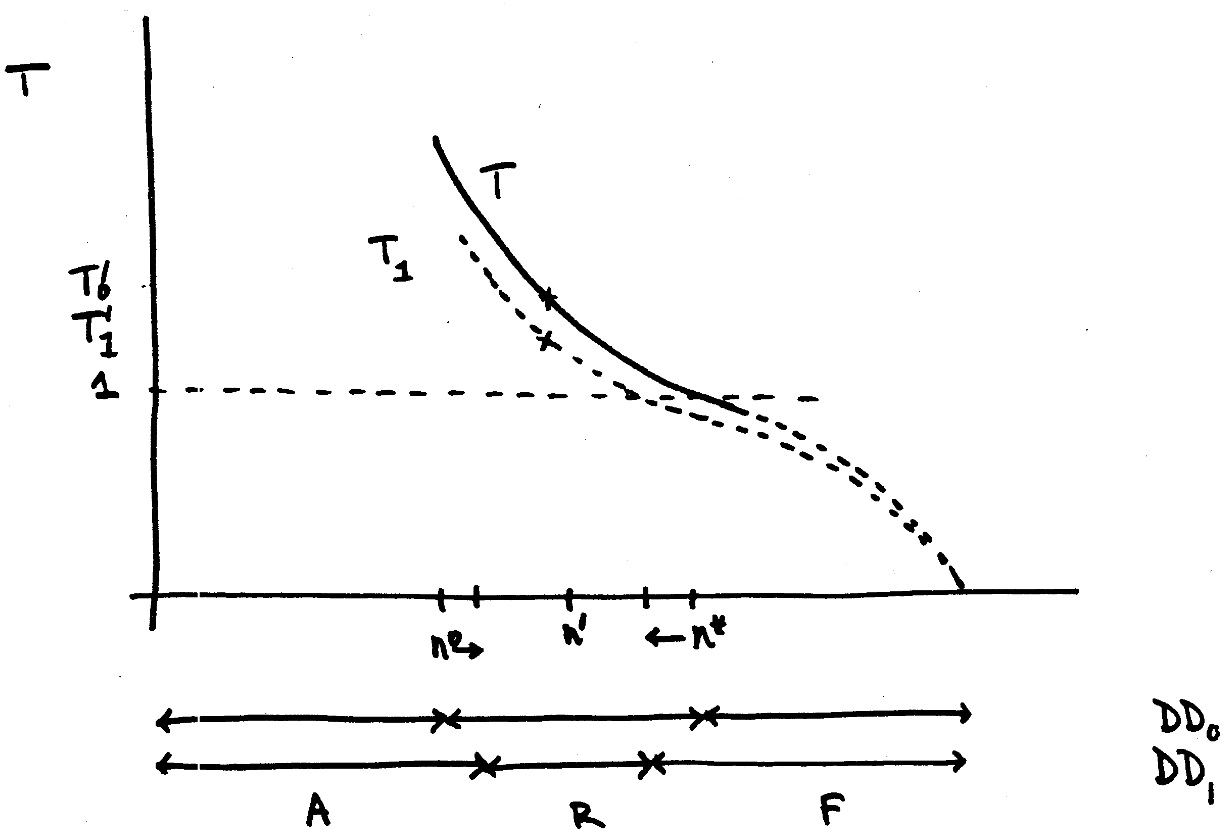
First, worsened cost/output tradeoffs reduce the scope for trade restrictions. There is a smaller range of foreign prices such that a restrictive or autarchic policy minimizes expenditure. This implies that the range of foreign cost advantage where free trade yields the highest utility is unambiguously wider. There is also however, an expanded set of foreign prices yielding the autarchy policy. The restricted trade area is squeezed.

Second, a worsened cost/output tradeoff for the domestic industry unambiguously reduces the tax protection, if the imported item was subject to a tax. Given a foreign price, minimizing expenditure when cost/output tradeoffs worsen requires more consumption gains from the imported item. Any tax imposed on the foreign price must fall. Therefore, even if an industry petitioned and received protection from imports in the early stages of decline, it cannot expect increased protection as it continues to decline. A declining industry receives less and less protection as it loses product spectrum comparative advantage. Referring to figure 5, a more apparent cost/output tradeoff shifts n^{o} right, n^{*} shifts left squeezing the R region: both the DD and TT curves rotate downward.[22] But note that the sum of the A and R regions shrink with a net expansion of the T region: there is a greater range of foreign cost advantages such that free trade is the optimal policy. T', the tariff associated with a foreign cost advantage n', falls unambiguously: the price protection afforded the domestic industry is reduced.

The domestic industry's profits must be squeezed by this cap since the firm cannot pass on the assumed cost increase without losing additional demand for good 2. Eventually the reduced profitability leads to the complete demise of the domestic industry unless it can restructure its cost characteristics. Thus we assure the long run shifting of all the products in the spectrum to the foreign producer.

figure 5





CONCLUSIONS

A world with heterogeneous products that are substitutable in demand and produced with economies of scale and scope modifies conventional trade theory wisdom that free trade is best. Increasing returns combined with demand substitutability creates the externality whereby there can be welfare worsening excessive trade. Individual consumer maximization over the perceived foreign and domestic price set leads to changes in the domestic prices that can yield a higher expenditure for the whole consumption basket. In such a case, an import tax on the foreign product keeps demand substitution below its free market level. Trade volume falls to a level such that expenditure is minimized.

Analyzing the function that is defined as the difference between the pre- and post-trade expenditure on the consumption basket reveals distinct ranges of foreign prices where the expenditure minimizing policy is autarchy, free trade, or restricted trade. The difference function and the policy regions are uniquely specified for cost characteristics, utility parameters, and initial conditions. Introducing the foreign price data determines in which region is the economy and the appropriate policy.

As the industry cost/output tradeoffs worsen in its decline, the appropriate policy response reduces protection. The range of foreign prices where free trade is the expenditure minimizing policy widens. Therefore, while appropriate policy might include protection in the early stages of industry decline, as costs increase the industry as a viable entity fades. Protection is lifted with forces of comparative advantage dictating trade policy.

*Economist, Federal Reserve Board. This paper is a revision of part of my doctoral dissertation completed at MIT and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or other members of its staff.

1. For the most comprehensive review, see Helpman and Krugman and references to earlier work contained therein.

2. See Spencer and Brander on R&D rivalry, and Brander and Spencer on export subsidies in particular.

3. See the chapters on differentiated products in Helpman and Krugman.

4. Grossman's (1982) evidence supports the product spectrum characteristic of the United States declining firm. His results suggest that the NICs use aggressive export promotion to encourage output of one item of the spectrum. The NICs each choose a different item, thus not competing directly with each other, but forcing the domestic industry to fight import penetration at many points of the spectrum.

5. If there is no domestic price set sustainable in the face of foreign competition, the domestic firm loses the contested markets to the foreign producer just as in the domestic model the entrant captures part of domestic demand.

6. Scherer, pages 195-190, discusses types of and reasons for the widespread use of non-marginal cost based pricing rules.

7. Baumol, Panzar, and Willig detail the theoretical underpinnings of domestic industrial policy. Basically, economies of scope and scale in production yield cost advantages to merger. In addition, if excess capacity is of key importance for the declining industry, then merger or exit that eliminates redundant fixed capital is the first defense against foreign competition. Labor productivity improvements are appropriate if foreign producers have advantages in marginal costs. Johnson's seminal work details the welfare effects of using first and second best policies.

8. Deteriorates means that economies of scale and scope measures indicate more extreme tradeoffs between cost and quantity produced.

9. The oligopoly industrial structure yields each firm operating at above minimum efficient scale. Thus the production of each firm is characterized by increasing returns to scale even in the absence of explicit increasing returns to scale technology.

10. While the Cobb-Douglas functional form cannot specify item specific or product spectrum general non-marginal costs, it has constant elasticity properties that make it the best

functional form for this analysis.

11. The theoretically correct price set for the heterogeneous goods case is the set of Ramsey prices (see Baumol and Bradford) that exploits the cross elasticity of demand. These prices represent a marginal cost markup rule with a level of profits set by a constraint on the Lagrangian. The fundamental results of the analysis are upheld. In fact, any pricing rule that allows for either an interrelationship between the demand curves or the cost curves yields the same broad conditions as the simple average costs pricing rule employed here.

12. Scherer, pp. 194-200. Other references on average cost pricing rules include: Areeda and Turner, Joskow and Klevorick, Williamson, Joskow and Noll, Joskow (1976) and (1973), Kahn, and Schmalensee.

13. The foreign production function could have economies of scope and scale just as for the domestic producer, or it could be Cobb-Douglas constant returns to scale. All we require is that at the pre-trade demand levels, the foreign price lies below the domestic price. However, we assume that the foreign producer operates at efficient scale; i.e. on the flat portion of the cost curve if there exists economies of scale or where average cost equals marginal cost if there are costant returns to scale. Therefore, foreign price is exogenous of quantity produced. This simplification ignores the contention that foreign entrepreneurs over-build capacity, assuming that they can capture enough export demand via strategic pricing and thereby move down the average cost curve onto the flat portion. See Mann (1984). Since we do not allow such pricing strategies for the domestic firms, we must have the foreigners play by the same rules.

Of course, if the foreign producer can price below the domestic average cost for all items in the spectrum then the importer has product spectrum comparative advantage and the domestic industry disappears.

14. We could relax the assumption of perfect substitutability between the domestic and foreign product by employing a Salop circle, measuring the similarity between the foreign and domestic product as the distance around the unit circle from the optimally placed domestic product to the substitute import. While this addition will not alter the broad characteristics of the results, it does increase the likelihood of trade protection being the optimal policy, and it does imply that the domestic firm continues to produce the product even as a substitute is being imported. The difference between the optimally designed domestic product and the import effectively raises the price of the import thus reducing the consumption gains generated by trade.

15. We must assume that, because of stockholders and other capital market constraints, the firm will not take losses and keep it prices below cost in an effort to retain market

share.

16. We can hold utility constant throughout the exercise because the property of the CES utility function leads to the gain in utility coming from a reduction in P_1 exactly offsetting the loss in utility coming from an increase in P_2.

17. This assumption is analagous to assuming that income does not outweigh subsitution effects.

$$i_1 = \frac{\partial U \; P_1}{\partial P_1 \; U}$$

18. We can guarantee that all products (1,2,a) are produced in equilibrium by assuming that the scale elasticity of output (s) is the same for products 1 and 2. We need not assume that the scope elasticity is the same. In this case, stability requires that

$$\frac{1}{r-1}\left[\frac{X_1}{X_2}\right]^{(2-r)/(r-1)} < s\left[\frac{G_1}{G_2}\right]\left[\frac{q_1}{q_2}\right]^{s-1}$$

where $s_1=s_2=s$ is assumed for closed form solution. In this case, since $r-1 < 0$ always, the condition always holds.

19. If demand is completely elastic, then although the P_2 increase is large, since utility is linear between items 1 and 2, the consumer buys only item 1 at the lower imported price and eliminates item 2 from her consumption basket. Expenditure to reach u is unambigously lower with free trade. If demand is completely inelastic, then there is no demand shift, cost structure is irrelevant and the consumer enjoys a lower price of item 1, without affecting P_2.
Therefore, free trade expenditure is unambiguously lower.

To support these proposition, refer to the definitions of D and P'_2 (equations (9) and (10)). If demand is competely inelastic, $e_{12}=0$, $P'_2=P_2$, and $D>0$. If demand is completely elastic, $e_{12}=oo$, $dq_2=-q_2$, $(s_2-1) < 0$, and therefore, $P_2 \dashrightarrow 0$, so $D > 0$.

20. See Mann (1985) for the case of the inelastic utility.

21. Appealing to Grossman's (1982) paper, foreign firms target the lower priced end of the product spectrum first so that $P_2>P_1$. Therefore, $P'_2>P^*_1$ is assured. The condition that must hold for $dD/dn>0$ given $e_{12}>0$ but not too large is

$$\left[\frac{P^{*}_{1}}{P'_{2}}\right]^{r-1} < \frac{\partial P_2}{\partial P_1}$$

or

$$\frac{P_1}{P_2} < \left\{n\left(1+\frac{(s_2-1)e_{12}(n-1)}{q_2}+g_2\right)\right\}^{(r-1)/r}\left\{\frac{-(s_2-1)e_{12}}{q_2}\right\}^{1/r}$$

So long as s_2-1 is not too small, $\partial P_2/\partial P_1>1$ and the condition holds. As $n \dashrightarrow 1$, the sign changes to yield the shape of the DD curve.

22. The sign of $\partial D/\partial(-(s_2-1))$ and $\partial T/\partial(-(s_2-1)) < 0$ for $r<0$ is unambiguously positive.

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