Does Import Protection Act as Export Promotion?: Evidence from the United States

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Abstract

International trade theory has shown how domestic market protection in the presence of increasing returns can increase an industry's share of the export market. The empirical validity of this "import protection as export promotion" hypothesis, however, remains unverified. Using a cross-sectional data base of 213 commodities traded by the United States, this paper investigates the link between industries' protection from foreign competition and their export performance. Three findings cast doubt upon the empirical relevance of the theory. First, after controlling for the pattern of comparative advantage across industries under free trade, export market share is *negatively* related to the extent of home market protection. Second, this result is robust also among industries exhibiting the *strongest* increasing returns to scale, whether they take the form of static economies of scale, learning curves or R&D investments. Third, the marginal export promotion effect of trade barriers is consistently either *unrelated or negatively related* to the strength of economies of scale, the steepness of learning curves and the level of R&D intensity across industries. Five explanations are offered for the theory's failure to be confirmed empirically. These explanations revolve around the political economy of import protection, competition and integration of international markets, protection's failure to stimulate domestic production, inefficient entry in response to protection, and international technology spillovers and transfers.

I. Introduction

Businessmen and policy–makers frequently assert that a protected home market provides that country's producers with a relative cost advantage in their export markets. The United States, for example, has argued that Japan's export success in high–technology industries was assisted greatly by those firms' apparently privileged access to their domestic market. According to this argument, protection from foreign competition guarantees domestic firms a minimum scale of production and enables them to exploit economies of scale. Whether these scale economies arise from a declining marginal cost curve, learning–by–doing, or the ability to spread R&D investments over a larger base of output, the essential features of the argument remain unaltered. Protecting the domestic market will move displaced foreign competitors up their average cost curve and cause their market share in *each* market — whether protected or not — to fall. Domestic producers' increased scale pushes them down their average cost curve, further increasing their export market share. Reminiscent of the traditional infant industry argument, this "import protection as export promotion" (IPEP) argument recently has been used to justify protection of increasing returns industries including commercial aircraft, semiconductors, steel and telecommunications equipment.

At a theoretical level, the proposition that import protection may act as export promotion follows directly from its assumptions about how firms will respond to changes in their policy environment. An interesting question to ask, however, is whether the hypothesis is *empirically* valid. That is, empirically has import protection had the predicted export promoting effect in increasing returns to scale industries? Despite its important implications for international trade policy and the increased frequency of demands for protection that rely upon increasing returns arguments, however, to date the hypothesis has received virtually no direct empirical scrutiny.[1]

This paper tests the IPEP hypothesis' empirical relevance among import competing industries in the United States. Ideally, one would like to test whether changes in an industry's import protection induce subsequent changes in its export performance. The fact that rates of tariff and

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[1] Some recent attempts to illustrate the theory's implications with numerical simulations and the small empirical infant industry literature are summarized in Section II.B.

non–tariff protection have remained extremely stable for long periods (Lavergne (1983)), however, precludes such a time series analysis. This paper instead exploits the fact that the current inter–industry pattern of protection embodies the results of prior tariff negotiations and unilateral trade policy changes. Using a cross–section of over 200 U.S. industries, the paper asks whether historical changes in rates of protection have yielded the predicted positive correlation between import protection and export market share.

The paper is divided into two parts. First, I ask whether the export performance of 213 four–digit U.S. manufacturing industries has been assisted by their receipt of import protection. If the IPEP hypothesis is observed empirically, then after controlling for the inter–industry pattern of comparative advantage under free trade, industries with large, heavily protected home markets (relative to their foreign competitors) should tend to have larger shares of the world export market than less well protected industries. This test is performed for the full industry sample and then separately for industry subgroups displaying the strongest increasing returns to scale. I test also whether the marginal export promotion effect of import barriers is positively related to industry characteristics identified by the IPEP hypothesis as encouraging export promotion: the strength of static economies of scale, the steepness of learning curves, and the intensity of research activity.

The results of these three tests cast doubt upon the empirical relevance of the theory. Export market penetration is consistently either unrelated or negatively related to industries' relative tariff and non–tariff protection and home market size. This result holds both for the full industry sample and among those industries where economies of scale are strongest, learning curves are steepest, and opportunities for cost–saving innovations are greatest. I find also that the marginal export promotion effect of both tariff and non–tariff protection is consistently either unrelated or negatively related to the importance of static economies of scale, learning–by–doing and research investments to firms' production costs. The results indicate that industries considered to be attractive targets for strategic import protection have not displayed export promotion effects from existing protection.

The second half of the paper attempts to explain these results. I focus upon the empirical inadequacy of the theory's underlying assumptions about firms' trade policy environment and about their response to changes in that environment. First, as several contributors to the strategic trade policy literature have themselves recognized, protection is supplied disproportionately to industries with the "wrong" cost characteristics to yield export promotion effects. Second, international competition and integration of markets should eliminate cost reduction opportunities in increasing returns industries, leaving little to be exploited by policy intervention. Third, empirically protection typically has failed to stimulate domestic production, a necessary condition for exploitation of scale economies and export expansion. Fourth, rather than moving firms down their average cost curves, import protection often promotes inefficient entry and suboptimal firm scales among domestic producers. Finally, R&D and learning–by–doing intensive industries often are characterized by international technology spillovers or transfers, either of which can break the link between import protection and export promotion. These final four considerations indicate that even if import protection were targeted at the "correct" industries, other important obstacles to export promotion would remain.

The paper is organized as follows. Section II presents the import protection as export promotion hypothesis formally, traces its historical development, and offers evidence on economies of scale among United States industries. Section III explains how the empirical relevance of the IPEP hypothesis will be tested and presents the tests' findings. Section IV interprets these results and, drawing upon the existing empirical international trade and industrial organization literatures, it accounts for the IPEP hypothesis' failure to be validated empirically. A brief conclusion follows in Section V.

II. The Import Protection as Export Promotion Hypothesis

A. The Theoretical Argument

The IPEP hypothesis is illustrated most simply by Krugman's (1984) example of two firms competing in multiple markets under conditions of declining marginal costs.[2] Markets are assumed to be segmented and firms make distinct output choices in each market.[3] Firms' costs are a function of their aggregate rate of output. Let μ denote the home firm's marginal cost and μ^* denote that of the foreign firm. The presence of economies of scale implies that each firm's marginal cost of production is a decreasing function of its rival's marginal cost. To see this, suppose that the foreign firm lowered its rate of output in one market. The consequence would be an increase in that firm's marginal cost of serving each market. The home firm's optimal response would be to increase its rate of output (in each market), causing its own marginal cost to fall. The result is that the two firms' marginal costs are inversely related. Following Krugman (1984), Figure 1 plots the two marginal cost interaction schedules, $\mu(\mu^*)$ and $\mu^*(\mu)$. Diagrammatically, the industry equilibrium is established where the schedules intersect, at point E_0.[4] The corresponding initial industry equilibrium for firms' outputs is shown in Figure 2. Let x_j and x^*_j denote respectively the home and foreign firms' rates of output in market j. The initial equilibrium is given by the intersection of the two firms' reaction functions, $x_j(x^*_j)$ and $x^*_j(x_j)$, at point F_0.

INSERT FIGURES 1 AND 2 ABOUT HERE

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2 See also Brander (1988, pp. 31–36) for a summary discussion of strategic protection and its effects in the home market.

3 The assumption is required to prevent increasing returns from leading to a single supplier in the free trade equilibrium and to allow firms with differential marginal costs to coexist. The assumption's importance is discussed in Section IV.B.

4 Following Krugman (1984), I will assume that a unique, stable equilibrium exists. As drawn, this requires that the $\mu(\mu^*)$ schedule be steeper than than $\mu^*(\mu)$ schedule, implying that a firm's 'own' marginal cost effects dominate the 'cross' effects.

Figure 1

The Effects of Protection on Marginal Cost

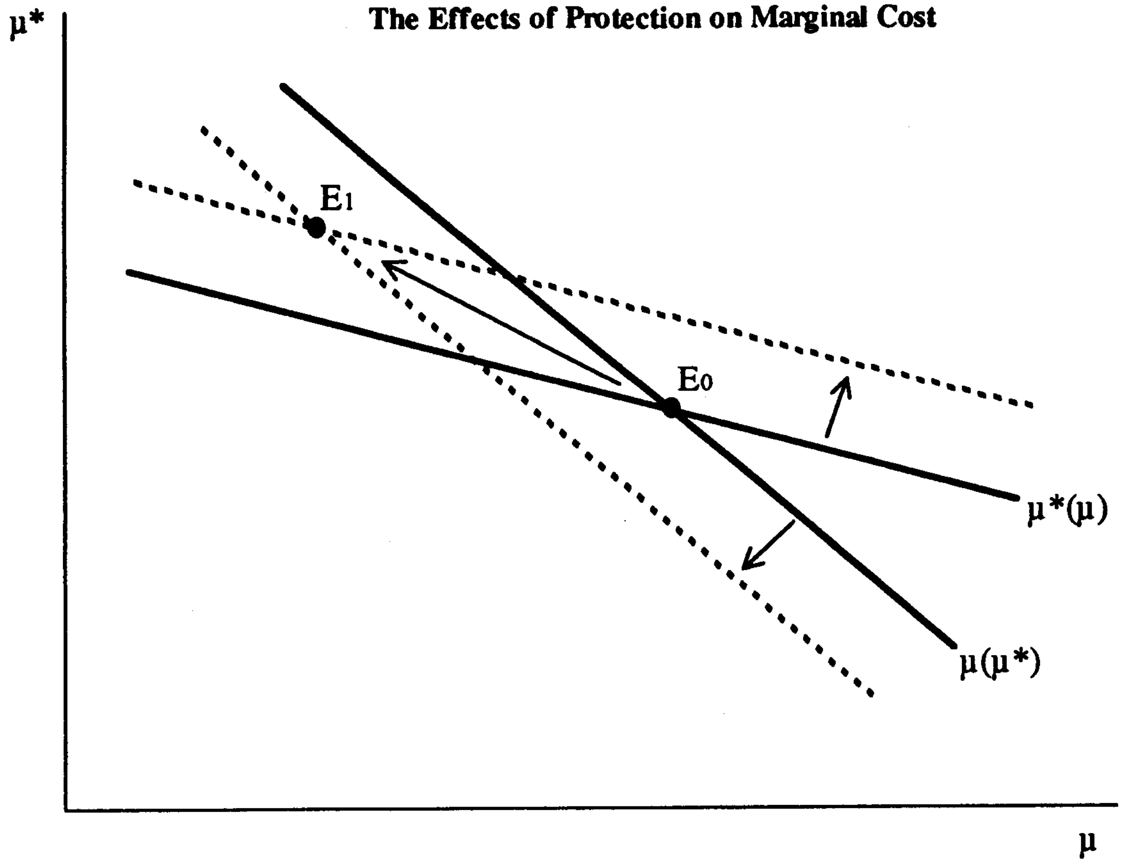
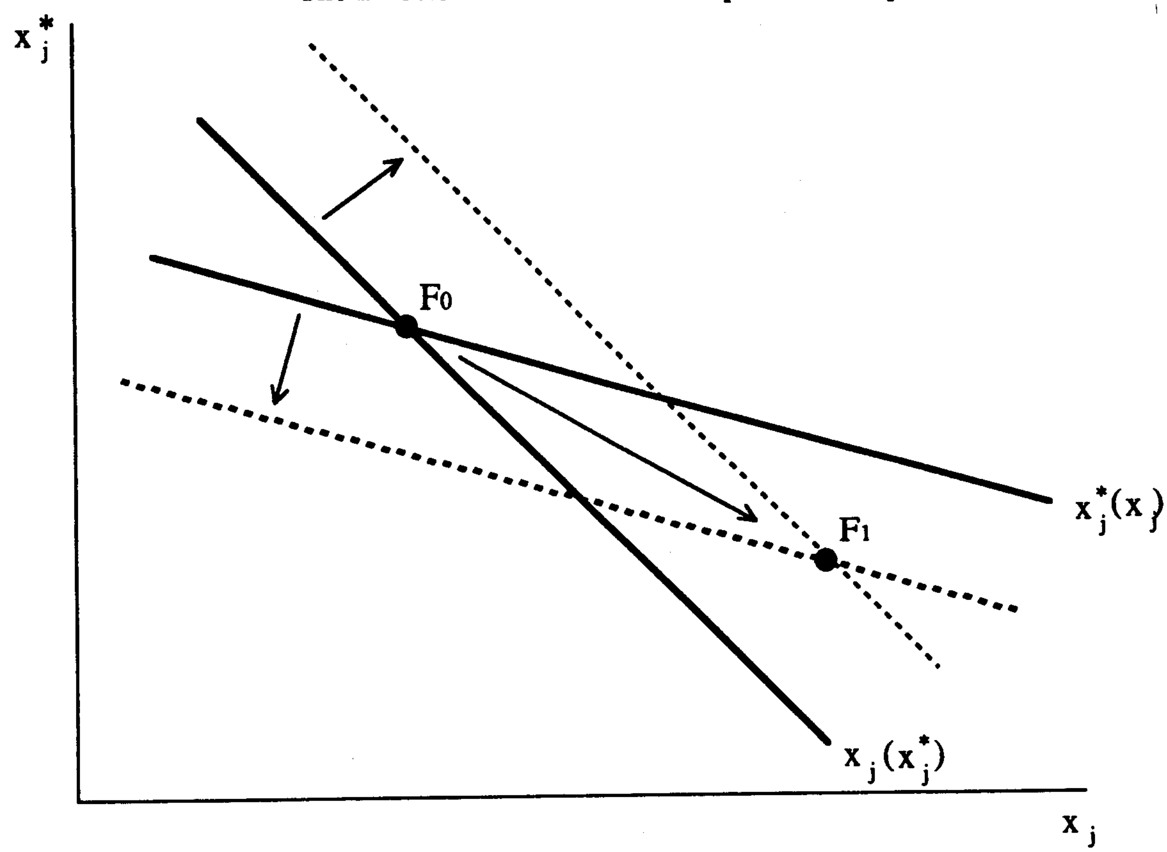


Figure 2

The Effects of Protection on Output in an Unprotected Market



Starting from the initial equilibrium at E_0 and F_0, consider a policy by the home government to restrict imports by a tariff or quota. The displaced foreign firm's sales in the protected market fall and, by dint of the increasing returns, its marginal cost rises. Importantly, the import barrier causes the displaced firm's marginal cost to rise in each market. Diagrammatically, the $\mu^*(\mu)$ schedule shifts rightward in Figure 1. At the same time, the protected home firm's secure access to its domestic market results in an output expansion and therefore a decline in its marginal cost. The $\mu(\mu^*)$ schedule therefore shifts leftward. The new industry equilibrium is obtained at point E_1, with a higher foreign marginal cost and lower home marginal cost. The effect of the import barrier on the firms' sales to a *non-protected* market j is seen in Figure 2. The changes in firms' relative marginal costs reinforce one another and cause the home firm's reaction function $x_j(x^*_j)$ to shift rightward, while the foreign supplier's schedule $x^*_j(x_j)$ shifts leftward. The new equilibrium at point F_1 is characterized by a higher rate of output for the home firm and a lower rate of production for the foreign supplier. Home market protection thereby raises the home firm's output share in each of its export markets.

Dynamic economies of scale from learning-by-doing work analogously. Excluding the foreign firm from the domestic market lowers its cumulative output and therefore raises its current (and future) marginal cost. The opposite is true for the protected firm: its cumulative output rises, lowering marginal cost for this and future periods. The result, as before, is an increase in export market share for the home country's supplier.[5] Competition in which firms can lower their marginal cost through R&D or other prior cost-reducing investments also can yield identical results. Here, the link between costs and output arises because the firm's investment incentive is directly proportional to its expected volume of sales. Protection of the home market will increase

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5 See Pomfret (1975) for an earlier analysis of how import protection policies can exploit dynamic learning economies to the advantage of domestic suppliers in imperfectly competitive markets. Pomfret also analyzes the static economies of scale example in detail. See Krugman (1984) for a subsequent treatment of these subjects, and for a discussion of the R&D-competition model. See Mayer (1984) for a "learning-by-using" explanation of infant industry export promotion.

the incentive of the home firm to invest in cost reductions at foreign competitors' expense, leading to increased sales for the home firm even in unprotected markets.[6]

B. The Theory's Development and Existing Evidence

The international economics literature contains many early discussions of how a firm's domestic volume of sales might affect its costs of selling abroad. Barker (1951, p. 276) and Kahn (1951, p. 287) argued that "the high volume normally attained from the home market has a favourable effect on the [firm's average] cost of production," and that this "contributes to the efficiency of export trade." More precise statements of this issue were provided subsequently by Basevi (1970, 1971), Frenkel (1971) and Pursell and Snape (1973) who analyzed the conditions under which domestic demand is a prerequisite for establishing an export industry under increasing returns.

The implications of economies of scale for international trade policy also were recognized at an early date. The origins of the classical infant industry argument date back to Alexander Hamilton's *Report on Manufactures* published in 1791. The modern formulation of the 'permanent infant industry' argument is due to Frank Graham (1923, pp. 202–03) who argued that decreasing costs could justify permanent protection of a domestic industry. Graham argued further that strongly increasing returns would lead the industry eventually to exceed the demands of its home market, and that in this way protection would spur export growth (Graham, 1923, pp. 226–27).[7] Much more recently, Pomfret (1975), Krugman (1984) and Dasgupta and Stiglitz (1985) have shown analytically how international trade policy can exploit cost–based linkages between domestic demand and export trade to a firm's advantage.[8]

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6 Gruenspecht (1988, pp. 245–46), however, indicates how one form of trade protection – unilateral enforcement of the anti–dumping laws – can lead a firm to *reduce* its supply to unrestricted export markets. In this way, import protection can be export detering.

7 For a modern restatement and analysis of Graham's argument, see Ethier (1982). For a contemporary's critique of Graham, see Anderson (1936).

8 The use of market exclusion to raise rivals' costs of production also has been discussed in the industrial organization literature. See, for example, Krattenmaker and Salop (1986) for a

Support for the IPEP hypothesis has been provided by numerical simulation exercises. Krugman's (1987) simulation of high–technology industries displaying learning–by–doing finds that home market protection by one country increases sharply its firms' export market share. If the protection is anticipated abroad, its entry–promoting effect for domestic producers and entry–deterring effect for foreign producers can lead to complete domination of the market by the protected firms. Baldwin and Krugman's (1988a) simulations of the United States and Japanese semiconductor industries arrive at an identical conclusion. Secure access to the home market was found to be "crucial" not only in the development of Japan's domestic semiconductor industry, but also in moving Japanese producers down their learning curves and allowing them to enter the export market.[9] Similar qualitative results are found in simulation studies by Baldwin and Krugman (1988b) and Dixit and Kyle (1985) for commercial aircraft, by Venables and Smith (1986) for the refrigerator and footwear industries, and by Head (1990) for steel rail production.

Direct empirical evidence on the IPEP hypothesis is scarce. Pomfret (1975) cites Israel's import substitution policies during the 1950s as stimulating export growth in four sectors, cardboard, cement, plywood and tires. The discussion is limited, however, to offering suggestive evidence intended to illustrate the theory's relevance to actual circumstances, and no formal test is proposed or performed. Morrison (1976) reports a significant and positive relationship between export performance and an economy's marginal import propensity, and a negative but usually insignificant effect of tariff protection on export performance among the manufacturing sector of 45 developing countries. This paper complements Morrison's aggregate results by studying the micro–industry effects of import protection on export performance. Finally, a small empirical literature tests the classical infant industry hypothesis for developing economies. While anecdotal accounts of successful infant industry policies are numerous (see, for example, Westphal (1990)),

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discussion of input market exclusion. Brander and Spencer (1981) offer another example of a "neo–infant industry argument" in which tariff policy is employed to shift profits from established foreign suppliers to a nascent domestic industry.

9 See Moore (1990), however, for some conflicting empirical evidence.

the overwhelming conclusion from efforts to test the proposition empirically is that infant industry protection has not had the predicted effect (Bell, Ross–Larson and Westphal (1984)). In one of the most direct tests, Krueger and Tuncer (1982) find in the case of Turkish firms and industries no systematic relationship between the effective rate of protection and the rate of growth of output per input.

C. The Economies of Scale Assumption

Economies of scale make assume several forms: static, dynamic and R&D–based. This section discusses briefly the empirical evidence regarding each. The presence of static economies of scale in many sectors has been extensively documented. At the level of the firm, for example, Haldi and Whitcomb (1967, p. 382) found that over 70% of the manufactured products in their sample displayed increasing returns. For more than 15% of the products, firms' total costs rose at less than half the rate of their output. Estimates of manufacturing firms' long–run average costs by Johnston (1960) and Pratten (1971) confirm the prevalence of decreasing unit costs. At the industry level, Baldwin and Gorecki (1986) report that between one–half and two–thirds of their sample of 167 four–digit Canadian manufacturing industries displayed increasing returns. By contrast, less than two percent of the industries were characterized by decreasing returns to scale. Hall (1988) also finds evidence of strong economies of scale at the two–digit level among U.S. manufacturing industries.

Evidence on dynamic economies of scale suggests that learning curves appear in many industries. The Boston Consulting Group (1970) identified significant dynamic economies of scale in a wide variety of manufacturing industries including transistors, gasoline refining, gas ranges, television receivers, and beer. For these products, unit costs fall roughly 20% with each doubling in the firm's cumulative output. Learning also has been identified as an important source of average cost reductions in the metal, paper products, leather and chemicals industries (Sheshinski (1967)).

Import protection's ability to guarantee firms a minimum volume of sales should increase domestic producers' incentive to invest in R&D at their foreign competitors' expense. Bound *et. al.* (1984, pp. 28–29) report that, on average, U.S. manufacturing industries invest approximately 2.5% of their total sales revenues in research and development. In some industries such as professional and scientific equipment, aircraft and aerospace, communications equipment and pharmaceuticals, this share was as high as 4% to 6%. In these industries in particular, then, import protection should demonstrate the greatest strategic export promotion potential.

III. Tests of the Import Protection as Export Promotion Hypothesis

The discussion thus far suggests two tests of the theory's empirical relevance. First, after controlling for the pattern of comparative advantage across industries under free trade, industries with large and heavily protected home markets (relative to their foreign competitors) should tend to have larger shares of the world export market than less well protected industries. Section III.A tests this proposition first for the full industry sample and then for those industries displaying the strongest increasing returns. Second, the marginal export promotion effect from import barriers should be related positively to the strength of static economies of scale, the steepness of learning curves, and the intensity of research activity across industries. Section III.B tests this second implication.

A. The Link Between Trade Protection and Trade Flows

Variation across industries in export market share is explained most naturally by a country's pattern of comparative advantage. Because the IPEP hypothesis implies that strategic import protection can alter firms' relative costs, however, the appropriate control variable in the regression is a measure of comparative advantage across United States industries under conditions of free trade. After adjusting for "policy–free" comparative advantage, domestic and foreign producers should face different marginal costs of production only if they receive different rates of protection in their home market, or if one country's suppliers enjoy preferential access to a larger base of domestic customers.[10] Any differences between domestic and foreign firms' marginal costs in turn will be reflected in differences in export market share.

The theory recommends the following general relationship between export performance and import protection

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\begin{aligned}
\left(\frac{\text{U.S. EXPORTS}}{\text{WORLD EXPORTS}}\right)_i = \beta_0 &+ \beta_1 (\text{U.S. FREE TRADE COMPARATIVE ADVANTAGE})_i \\
&+ \beta_2 (\text{U.S. TARIFF} - \text{FOREIGN TARIFF})_i \\
&+ \beta_3 (\text{U.S. NTB} - \text{FOREIGN NTB})_i + \beta_4 \left(\frac{\text{U.S. MARKET}}{\text{FOREIGN MARKET}}\right)_i \\
&+ \varepsilon_i \ .
\end{aligned}
\tag{1}
$$

(U.S. EXPORTS / WORLD EXPORTS)$_i$ denotes the share of world exports for the *i th* commodity supplied by United States firms. This share is expressed as a function of the industry's measure of comparative advantage under free trade, the difference between its rate of tariff protection in the United States and abroad, the difference in non–tariff barrier (NTB) protection, and the size of the United States home market relative to the foreign home market. It is these differences in relative rates of import protection and home market size that the IPEP hypothesis predicts will be associated with successful export promotion. The null hypothesis is that coefficients β_2, β_3 and β_4 are positive.

Equation (1) is estimated using export, protection and market size data for the period immediately following the Kennedy round of GATT negotiations. The industry sample contains

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10 Thus, relative rather than absolute home market size and import protection rates determine relative export performance according to the theory. If the economies of scale that protection seeks to exploit are static, then export promotion will require continual protection of the domestic industry. If scale economies enter dynamically, through learning–by–doing or R&D opportunities, the timing of protection need not coincide with increases in export market share. However, as long as unexploited cost reduction opportunities remain in the industry, supplemental import protection will have strategic value for domestic firms. Protection therefore will continue to be supplied. Regardless of the form that economies of scale assume, therefore, a positive correlation between import protection and export market shares is expected under the IPEP hypothesis.

data for 213 manufacturing industries at the four-digit SITC level.[11] The United States' share of world export markets in 1970 for each commodity (expressed in percentage form) was supplied by the U.S. International Trade Commission's (USITC) Industrial Characteristics and Trade Performance Database.[12] The measure of industry comparative advantage under free trade was taken from the USITC's *Protection in Major Trading Countries* (1975). It was estimated using the fitted values from a regression of industry value added per dollar of factor input (capital, production workers and non-production workers) on such variables as the industry wage rate, the real output growth rate and the import penetration rate. The fitted values from this regression were then deflated by the industry's effective tariff rate and evaluated at a zero rate of non-tariff protection. This "policy-free" comparative advantage measure is expressed as free trade dollars of value added per dollar of factor input.[13]

The United States and average foreign tariff rates in force during this period also were taken from the USITC's *Protection in Major Trading Countries*.[14] Data were available for both nominal and effective rates of protection. The average foreign tariff rate was calculated as a trade-weighted average of British, Canadian, European Community, and Japanese tariff rates.[15] Indices

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11 The objective of constructing as comprehensive a commodity-level data base as possible subject to data availability led to the sample date's selection. The 213 industries in the sample represent 70.0% of all manufacturing industry classifications in the Standard Industrial Trade Classification (SITC) index, the only criterion for their selection being data availability. The tariff and non-tariff rate data were converted from the Input-Output Standard Industrial Classification (I-O SIC) format to the SITC format for comparability. When more than one I-O SIC index value corresponded to a particular component in the SITC index, an import-weighted average was constructed. Import weights for these calculations were taken from U.S. Department of Commerce, Bureau of the Census (1974). In cases where data on import shares were unavailable, the simple average was substituted.

12 Ten countries are included in the "world" export measure: Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, the United Kingdom and the United States. Together, these ten countries accounted for 61.5% of actual world exports in 1970 (United Nations Conference on Trade and Development (1987, p. 2)).

13 For a more detailed description of the free trade comparative advantage index's construction, see U.S. International Trade Commission (1975, pp. 166–75).

14 Ray's (1981a) analysis of the determinants of U.S. tariff protection indicates little difference between using trade-weighted and unweighted average tariff rates. Trade-weighted tariff (and non-tariff) average series were selected for use here.

15 Leamer (1988, Table 3.1) finds that cross-commodity correlations of tariffs for pairs of developed countries typically exceed 0.7 and are frequently in excess of 0.9. The use of Canadian,

measuring non-tariff protection also were available from the same source.[16] A trade-weighted average index again was constructed for the four foreign jurisdictions. Finally, estimates of the United States and "world" home markets, measured by apparent domestic consumption, were constructed for each commodity using data from the USITC's Industrial Characteristics and Trade Performance Database and the United Nations' *Growth of World Industry* (1973).[17]

Table 1 reports the results from estimating equation (1) over the full sample of 213 manufactured goods.[18] Four alternative regression specifications are presented. Because the IPEP hypothesis provides little guidance about the precise form that the relationship between import protection and export promotion should assume, I consider both linear and quadratic specifications.[19] For each, I also report results based upon nominal and effective tariff rates. Table 1 indicates that the right-hand side variables explain between 10 and 15 percent of the total

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EEC, United Kingdom and Japanese tariff and non-tariff rate data therefore appears to be a suitable proxy for average non-United States tariff and non-tariff barriers among industrialized countries.

16 A detailed explanation of the non-tariff barrier index's components and construction is found in U.S. Tariff Commission (1974). Briefly, the International Trade Commission index includes the following types of non-tariff restrictions: quotas, import licensing requirements, voluntary export restraint agreements, import price floors and state trading requirements. For each industry, the index assigns a weight to 15 types of non-tariff barriers. These weights were chosen to reflect the barrier's relative effectiveness in limiting imports. The extent of non-tariff protection in an industry was then calculated by dividing the actual protection by the potential protection to be derived from all 15 non-tariff barriers. The index runs from 0 to 15, with higher values indicating more comprehensive non-tariff protection.

17 The size of a country's domestic market was measured by apparent domestic consumption, representing the maximum potential domestic sales volume that the protected firms could achieve in the absence of import competition. Apparent domestic consumption is defined as the value of shipments minus exports plus imports. For the United States, these data were supplied by the USITC's Industrial Characteristics and Trade Performance Database. For the "world" aggregate, gross output data from United Nations (1973, vol. 1) was used in the absence of shipments data.

18 Table 1 and subsequent tables report regression results based upon least squares estimation. Histogram plottings of the dependent variable, U.S. export market share by commodity, indicated significant variation between 0 and 100 percent and no clustering of the sample at either endpoint of the range. (The mean value for the dependent variable, in the full sample, was 17.27 and the mean standard deviation was 15.01.) These properties of the data indicated that least squares techniques were appropriate.

19 The quadratic terms preserve the original signs of the tariff and non-tariff rate difference variables in (1).

cross–industry variation in export market shares. While the adjusted–R^2 statistics are fairly low, they are not uncharacteristic for cross–sectional regressions of this form. Industry comparative advantage under free trade enters positively in each regression as predicted, although its level of significance is less than expected.

Most significantly, Table 1 indicates that industries receiving greater non–tariff protection than their foreign competitors, or in which United States producers enjoy preferential access to a larger domestic market, consistently have *smaller* shares of the world export market than do less well protected industries. The non–tariff and relative market size variables are significant at the 5% level or lower in each of the four regression equations.[20] The parameter estimates also are economically significant. For example, specification (1) indicates that a one–point increase in the United States' non–tariff barrier index (equivalent to a 6.67% increase in NTB coverage) leads to an absolute fall of 2.4% in firms' export market share, or a 12.7% decline relative to the industry's initial export market share. Specification (1) also indicates that, for given levels of tariff and non–tariff protection, a 10% increase in the relative size of the domestic market leads to a 2.9% decline in the U.S. industry's mean share of the world export market. Quantitatively similar results are found in the other three regression specifications. Finally, while relative tariff protection is never significant, it enters negatively in two of the four equations, again in contradiction with the expected relationship.[21]

INSERT TABLE 1 ABOUT HERE

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[20] To determine the total effect of each variable on export market share in the quadratic regressions, the parameter estimates were evaluated at the appropriate mean values. In specification (3), the total effect of non–tariff protection was –3.226 (t = –2.08) and for relative market size was –14.056 (t=–5.47). In specification (4), the total effect of non–tariff protection was –3.440 (t = –2.20) and for relative market size was –13.859 (t=–5.40).

[21] The total effect for relative tariff protection variable in specification (3) is –0.058 (t=–0.11), and in specification (4) is 0.010 (t=0.09).

Because the IPEP hypothesis focuses upon the importance of increasing returns to the link between import protection and export promotion, it is informative also to consider only those industries displaying the strongest static economies of scale, highest R&D intensities, and steepest learning curves. Equation (1) therefore was re-estimated for industries in the top one-half of the full sample as determined by their degree of static economies of scale, R&D intensity and learning-by-doing, alternatively. Estimates of static economies of scale, measured by the elasticity of value added (relative to the industry average) with respect to plant size, were taken from the USITC's Industrial Characteristics and Trade Performance Database.[22] Industry R&D intensity was proxied by the percentage of an industry's scientists and engineers engaged in research and development, and was taken from the same source.[23] Industry learning coefficients were taken from Sheshinski (1967) who estimated the elasticity of firm level productivity with respect to "experience," proxied by the firm's cumulative output.[24]

Tables 2 through 4 report the regression findings for the three sub-samples of the data set.[25] The results again provide no evidence that import protection has acted as export promotion by lowering protected firms' relative costs. Controlling for comparative advantage under free trade,

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[22] The economies of scale measure was estimated by the USITC as the value of the exponent in the regression equation $V = KN^{\alpha}$, where V is the ratio of value added in plants employing N persons to average value added for the industry and K is a constant. Parameter estimates were based upon 1967 Census of Manufacturing data.

[23] This measure was available at the two-digit level. Two-digit values were applied to each of the relevant four-digit industries. An alternative measure of R&D intensity, the percentage of total industry employment accounted for by scientists and engineers, was also considered. (This second measure was available at the three-digit SITC level.) The two measures yielded qualitatively identical regression results, and therefore only the results base upon first measure are reported here.

[24] Estimated learning curve coefficients were available from Sheshinski (1967) at the two-digit level and were repeated at the four-digit level in the sample.

[25] Industry comparative advantage under free trade enters positively and, with one exception, significantly in each of the economies of scale regressions in Table 2, indicating that the value added per input measure is a good proxy for comparative advantage due to (static) economies of scale. The free trade comparative advantage variable is positive but insignificant in each of the R&D intensity regressions (Table 3), and it enters negatively but is not at all significant in the learning-by-doing regressions (Table 4). Free trade value added per input appears to be a less reliable measure of firms' relative costs when cost differentials are due primarily to R&D investments or dynamic economies of scale.

industries' export market share is consistently either significantly negatively related or statistically unrelated to relative market size, and to cross–country differences in tariff and non–tariff protection.[26] Thus, even among industries identified in the recent literature as having cost characteristics that could potentially be exploited by strategic trade policy, preferential access to a large domestic customer base has not stimulated export market share. Instead, in many cases, secure access to a protected home market is associated with a smaller export market share than would be predicted by the industry's relative costs under free trade.

INSERT TABLES 2 THROUGH 4 ABOUT HERE

The parameter estimates in the sub–sample regressions also are economically significant. For example, among the most R&D–intensive industries (Table 3), specification (1) implies that a 1% increase in the absolute rate of U.S. tariff protection (holding foreign tariff rates constant) leads to a 0.38% absolute decline in the industry's share of the world export market, representing a 5.1% decline relative to its mean initial market share. Correspondingly, a one–point increase in the United States industry's non–tariff barrier index (equivalent to a 6.67% increase in NTB coverage) leads to an absolute fall of 2.1% in its firms' export market share, or a 28.2% decline relative to the industry's initial position. Lastly, a 10% increase in an industry's relative domestic market size is associated with a 12.6% decline in its mean share of the world export market. Quantitatively

26 This result is robust across all specifications in each of the three tables. The total effects for each of the three protection variables in the quadratic regressions are as follows:

Independent Variable	Table 2 Column 3	Table 2 Column 4	Table 3 Column 3	Table 3 Column 4	Table 4 Column 3	Table 4 Column 4
Tariff protection	–0.593 (–0.83)	0.016 (0.02)	–0.015 (–0.01)	–0.027 (–0.01)	–0.630 (–0.71)	–0.057 (–0.20)
Non–tariff protection	–0.436 (–0.24)	–0.352 (–0.19)	–2.222 (–0.49)	–3.345 (–0.73)	–4.462 (–1.98)	–3.707 (–1.62)
Relative home market size	–15.993 (–3.63)	–16.946 (–4.26)	–21.277 (–3.45)	–18.784 (–3.14)	–7.864 (–1.91)	–10.567 (–2.91)

similar results are found for the other three regression specifications in Table 3,[27] and for most of the regressions based upon industries with the strongest economies of scale (Table 2) and the steepest learning curves (Table 4). The most noteworthy of these three tables' findings is their uniform rejection of a positive link between import protection and export promotion.

B. The Marginal Export Promotion Effect of Trade Restrictions

If the IPEP hypothesis is observed empirically, the marginal export promotion effect from import barriers should be related positively to economies of scale, the steepness of learning curves and industry R&D intensity. This section uses a variable parameters model to test this prediction. The relationship between the marginal export promotion effect and industry cost characteristics is assumed to be non-stochastic and to take the form

$$(2) \qquad \beta_j = \delta_j + \gamma_j z_i \qquad j = 2, 3, 4$$

where z_i is, alternatively, a measure of the i^{th} industry's economies of scale, R&D intensity or steepness of the learning curve. Equation (1) can be rewritten as

$$(3) \qquad y_i = \beta_0 + \beta_1 x_{1i} + \sum_{j=2}^{4} \beta_j x_{ji} + \varepsilon_i,$$

where x_{1i} denotes industry i's free trade comparative advantage and x_{ji} (j = 2, 3, 4) denote the tariff, non–tariff and domestic market size regressors. Substituting (2) into (3) yields the variable parameters specification for estimation

$$(4) \qquad y_i = \beta_0 + \beta_1 x_{1i} + \sum_{j=2}^{4} \delta_j x_{ji} + \sum_{j=2}^{4} \gamma_j (x_{ji} z_i) + \eta_i.$$

Recalling equation (2), the coefficients γ_j measure the impact of industry cost characteristics upon the marginal export promotion effect of trade barriers. If the IPEP hypothesis' implied relationship is observed in practice, these three coefficients should enter (4) positively and significantly. As in the previous section, I consider both linear and quadratic specifications for (4). The results for the three sets of regressions by industry cost characteristic are reported in Tables 5 through 7.

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27 An exception is for effective tariff protection in column (2) of Table 3.

INSERT TABLES 5, 6 AND 7 ABOUT HERE

The variable parameters regression results provide little support for the IPEP hypothesis' second prediction. Focusing upon the interactive terms in each regression, with few exceptions the marginal export promotion effect from tariff or non-tariff protection or privileged access to a larger domestic market is independent of the degree of economies of scale, learning-by-doing or R&D intensity in each industry. In all but one of the linear regression specifications in the three tables, the individual interactive terms do not enter statistically significantly. In all cases, the interactive terms also are jointly insignificant.[28] In the single case where the marginal export promotion effect of protection is related to one of the industry cost characteristics (Table 6, Column 1), the direction of the relationship is opposite to that predicted by the IPEP hypothesis. In this case, relatively more R&D-intensive industries display smaller marginal export promotion effects from greater tariff protection.

In the quadratic regressions, the marginal export promotion effect of tariff protection consistently is independent of the strength of static economies of scale, the steepness of learning curves and research intensity across industries.[29] The marginal export promotion effect of non-tariff protection is independent of static economies of scale and R&D intensity, but it is strongly negatively related to the strength of industry learning effects.[30] Finally, the marginal export promotion effect of relative home market size is unrelated to static and dynamic scale economies,

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28 The F-test values for the null hypothesis that the three interactive variables' coefficients are each equal to zero are as follows: Table 5, Column 1: F = 1.34; Table 5, Column 2: F = 1.25; Table 6, Column 1: F = 0.15; Table 6, Column 2: F = 0.00; Table 7, Column 1: F = 0.15; and Table 7, Column 2: F = 0.46. For the F(3, 205) distribution, the critical values at the 1% and 5% levels of significance are 3.78 and 2.60, respectively.

29 The total effect for the interactive tariff variable in the quadratic regressions is as follows: Table 5, Column 3: -0.039 (t=-0.22); Table 5, Column 4: -0.006 (t=-0.10); Table 6, Column 3: 1.906 (t=0.36); Table 6, Column 4: -0.516 (t=-0.90); Table 7, Column 3: -0.610 (t=-0.68); and Table 7, Column 4: 0.021 (t=0.11).

30 The total effect for the interactive non-tariff protection variable in the quadratic regressions is as follows: Table 5, Column 3: 0.731 (t=1.66); Table 5, Column 4: 0.941 (t=1.45); Table 6, Column 3: 12.611 (t=0.79); Table 6, Column 4: -11.636 (t=-0.74); Table 7, Column 3: -6.209 (t=-2.47); and Table 7, Column 4: -11.121 (t=-3.14).

although positively and significantly correlated with R&D intensity across industries.[31,32] While this final result is consistent with the IPEP hypothesis, reasons unrelated to the protective effect of increased relative home market size could explain the positive correlation equally well. In sum, there is little evidence to suggest that the marginal export promotion effect of import protection varies systematically with industry cost characteristics identified by the theory as conducive to strategic trade policy intervention.

IV. Explaining the Empirical Results

Because the IPEP hypothesis' predictions follow directly from its assumptions about how firms will respond to changes in their policy environment, failure to confirm empirically these predictions implies that the assumptions underlying the theory are empirically incorrect. This section focuses upon five of those assumptions and indicates how their failure to be supported empirically can explain Section III's findings.[33]

A. Import Protection May be Awarded to the 'Wrong' Industries

Empirically, import protection is concentrated disproportionately in industries whose export promotion potential through increased scale are smallest. For example, Ray (1981a, Table 4; 1981b, Table 1) and Finger, Hall and Nelson (1982, Table 1) find that rates of tariff, non–tariff and administered protection are consistently negatively related to the importance of economies of scale across U.S. industries. Ray (1981a, Table 4) and Ray and Marvel (1984) find no consistent

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31 The total effect for the interactive relative market size variable in the quadratic regressions is as follows: Table 5, Column 3: –0.059 (t=–0.10); Table 5, Column 4: 0.193 (t=0.74); Table 6, Column 3: 9.462 (t=1.96); Table 6, Column 4: 11.198 (t=2.63); Table 7, Column 3: –1.033 (t=––0.78); and Table 7, Column 4: –1.422 (t=–0.57).

32 The F–test values for the null hypothesis that the three interactive variables' coefficients are each equal to zero in the quadratic specifications are as follows: Table 5, Column 3: F = 1.52; Table 5, Column 4: F = 2.05; Table 6, Column 3: F = 2.75; Table 6, Column 4: F = 4.14; Table 7, Column 3: F = 5.06; and Table 7, Column 4: F = 4.61. For the F(3, 205) distribution, the critical values at the 1% and 5% levels of significance are 3.78 and 2.60, respectively.

33 Baldwin (1982), Grossman (1988) and Spencer (1988) provide surveys of the sensitivity of trade policy predictions to the theory's assumptions.

relationship between industries' research intensities and their level of import protection. Furthermore, with only one exception, when these two variables are significantly correlated, R&D–intensive industries receive *less* protection than the manufacturing average.[34] Consistent also with these findings is the extensively documented negative correlation between measures of industry productivity and rates of import protection (Lavergne (1983), Finger, Hall and Nelson (1982), Ray (1981) and Takacs (1971)).

An empirically consistent explanation for why industries with relatively little export potential tend to receive higher levels of protection is offered by the political economy literature on trade barriers (Robert Baldwin (1988), Magee and Young (1987), Marvel and Ray (1983), Pincus (1975), Ray (1981a)).[35] The observed pattern of import protection across industries implies that the IPEP hypothesis is unlikely to be empirically relevant in the aggregate. Section III's finding that the marginal export promotion effect of import protection is most often unrelated to the strength of increasing returns across industries suggests further that the IPEP hypothesis also is not relevant empirically among those industries thought to display the greatest export potential from increased protection.

B. International Markets are Integrated and Competitive

An important assumption underlying the IPEP hypothesis is that firms operate in segmented and imperfectly competitive markets (see, in particular, Krugman (1984)). The assumption is necessary for economies of scale to remain incompletely exploited by firms in the absence of trade policy. If competition exists and if world markets are integrated, by contrast, firms will exhaust all internal economies of scale in the absence of policy intervention. Competition will ensure that

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34 The one exception is for non–tariff protection of Japanese firms, where more research intensive industries receive higher rates of protection, although this relationship is only statistically significant in the case of non–tariff barriers.

35 Several contributors to the strategic trade policy literature have themselves recognized the tensions that exist between the political economy of trade policy formation and the policy recommendations implied by the new theories (eg., Brander (1988), Grossman (1988), Spencer (1988)). See also Leamer (1988) for an excellent discussion of the simultaneity issue in cross–industry comparisons of trade barriers and trade performance.

firms are of efficient scale and operate at the minimum point on their long–run average cost curve. The potential role for trade policy to move domestic firms further down their average cost curves thereby is eliminated. There is substantial empirical evidence that many international product markets are competitive and well integrated (Eckbo (1976), Pindyck (1979), Dick (1990)). Under these conditions, firms will individually — and independently of government policy — find it profitable to exploit cost reduction opportunities.[36] To the extent that competition has exhausted the potential advantages of strategic trade policy, the link between import protection and export promotion will be weakened or eliminated.

A similar argument applies to economies of scale that are external to the firm. While individual firm size is a function of internal economies of scale, industry ownership structure is a function of scale economies external to the firm. By focusing upon changes in firm size rather than in industry composition, the IPEP hypothesis overlooks the role of competition in exploiting industry–level scale economies or other inter–firm externalities through horizontal merger. A trade policy designed to exploit industry economies of scale therefore will be redundant in a competitive market. This competitive explanation is consistent with Section III's finding that an industry's relative rates of protection have little or no impact upon observed export performance.

C. Import Protection May Not Stimulate Domestic Production

Import protection can have export promoting effects only if it leads domestic firms to expand their scale of production, allowing economies of scale to be exploited. The international economics literature identifies several reasons, however, why import protection may fail to stimulate domestic production. First, a tariff can raise *or* lower the protected good's price in the importing country — and therefore may stimulate *or* retard domestic production — depending upon the relative sizes of income elasticities of demand and price elasticities of supply in the two countries (Metzler (1949)).

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[36] Dick (1991) provides evidence for the semiconductor industry, often mentioned as a favorable target for strategic import protection, that firms' pricing and output decisions correctly internalize marginal cost savings from learning–by–doing. To the extent that firms exploit these cost reduction opportunities, the scope for strategic trade intervention is diminished.

Second, foreign suppliers may respond to trade barriers by altering the quality, composition or degree of processing of their exports with the effect of dampening the output–stimulating effects of protection (Aw and Roberts (1986)). Third, if protection is perceived to be temporary, foreign producers that have invested heavily to establish their presence in an export market may accept a lower profit margin rather than yield market share to domestic suppliers (Richard Baldwin (1988)). Fourth, if protection is applied in a discriminatory fashion against only some import sources, offsetting changes in international trade flows or patterns can dampen or nullify the effects of the trade restriction (Baldwin (1982)). Fifth, if shielding domestic producers from import competition facilitates collusion, domestic production could fall in response to trade protection, the presence of economies of scale notwithstanding (Staiger and Wolak (1989), Davidson (1984), Finger (1971)). Finally, if firms can exhaust economies of scale by capturing only a relatively small share of the domestic market, then even if import protection stimulates domestic production it may fail to lower firms' average costs of production further.[37]

Empirically, import protection appears not to have stimulated domestic production in many instances. Baldwin and Green (1988), who studied five cases of import relief under the escape clause, found that protection was uniformly ineffective in increasing domestic output or preventing further declines in depressed industries. They identified changes in the composition of imports, shifts in the location of supply, and quality upgrading as among the most important market responses by foreign firms that nullified the potential benefits to domestic producers from import protection. Hufbauer *et. al.* (1986) found only small increases in domestic production among industries receiving administered protection, a result attributed to offsetting responses both by domestic consumers and foreign suppliers. Section III's results are consistent with protection failing to stimulate domestic industry production and in turn export market share.

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[37] Evidence reported by Scherer (1975, pp. 22–27) indicates that the minimum efficient scale in many industries typically lies between 1% and 10% of total U.S. production.

D. Import Protection May Lead to Inefficient Entry

The IPEP hypothesis assumes that import protection will cause domestic suppliers to expand their scale of operation which, in the presence of economies of scale, will lead to a reduction in average costs. For import protection to lead to a reduction in firms' average costs under increasing returns, the expansion in industry output must come from an increase in existing firms' scales and not from an increase in the number of domestic suppliers. Horstmann and Markusen (1986) show, however, that under free entry and in the absence of price discrimination, import protection can promote inefficient entry that pushes each firm up its average cost curve. Tullock (1967) also explains how a reduction in import competition may induce rent–seeking by new entrants, again leading to higher average costs in the domestic industry. The reverse will be true for foreign suppliers. Their now diminished access to the protected overseas market reduces the profitability of remaining in the industry and, in a process of reverse rent–seeking, will induce inefficient foreign producers to exit. The increased home market protection may therefore increase relative efficiency among *foreign* producers due to changes in rent–seeking behavior by firms in both countries. In this case, import protection will be export–detering.

Empirical evidence supports the hypothesis that import protection may induce rent–seeking and inefficient entry. Baldwin and Gorecki (1983, 1986), for example, find that tariff reductions in Canadian manufacturing industries stimulated exit by some firms and led to a positive supply response among the remaining firms. Between 1970 and 1979, Canada reduced its tariffs on industrial goods by an average of 30%. Over those ten years, the average plant size among manufacturing firms increased by 33% and, by the end of the period, firms accounting for 30% of total 1970 manufacturing output had exited from the industry. Rationalization of plant scale was found to be particularly strong among the most heavily protected industries and among those displaying the strongest economies of scale. Eastman and Stykolt (1967) and Spencer (1988) also cite evidence for the Canadian and Australian economies that import protection encouraged sub–optimal firm scales. Section III's results are consistent with such an explanation. If an insulated home market promotes inefficient firm scales and higher average costs, domestic producers will be less successful in export markets. The result, therefore, will be the observed negative correlation between protection and export market share.

E. Protection with International Technology Spillovers or Transfers

For protection to stimulate export performance, reduction in units production costs must be appropriated, to the greatest extent possible, by domestic producers. International technology spillovers and licensing agreements, however, may cause an innovator to be only one of several firms adopting a cost–reducing technology. Technological improvements thus need not be well correlated with changes in firms' relative production costs and, hence, in their export market shares. International spillovers are particularly important in research and learning—by–doing intensive industries. Levin *et. al.* (1987) report that firms' success in protecting their product and process innovations is usually transitory. Intra–industry spillovers of learning–by–doing also are well documented (eg., Lieberman (1984)). The role of strategic trade policy is constrained by the fact that the very characteristics that make particular industries potentially attractive targets for export–promoting import restrictions — steep learning curves and high R&D intensity — also tend empirically to be associated with technology spillovers among firms.

International markets for technology also can break the link between import protection and export promotion by providing firms with alternatives to in–house adoption of cost–saving innovations. In many industries, firms license proprietary technologies to competitors. In the semiconductor industry, which has often been cited as among the most attractive targets for strategic import protection (Baldwin and Krugman (1988), Krugman (1987)), inter–firm and international technology licensing agreements are particularly common (Haklisch (1986)). To the extent that the benefits from scale economies can be licensed or sold, or provided that the firm in which they reside can be purchased, all firms in the industry face the same costs of production.[38]

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[38] The fact that a firm may choose not to license its cost–reducing innovation to competitors, or not to sell its acquired learning from production experience, therefore represents an opportunity cost to the firm (Demsetz (1982)). When correct account is made of the opportunity cost of

This breaks the potential link between protection–induced R&D effort and export expansion by those same firms.

Section III's results are consistent with technology transfers and/or spillovers in international markets. Tables 3 and 4 in particular indicate that among industries with the steepest learning curves and highest R&D intensities, export market shares are either uncorrelated or negatively correlated with the level of home market protection. Inter–firm spillovers or transfers of acquired experience and research results are consistent with this finding.

V. Conclusion

While the international trade and strategic trade policy literatures have provided a theoretical foundation for why import protection could act as export promotion, industrial organization theory and the empirical international trade literatures suggest several reasons why in practice this link may be broken. This paper finds that among United States industries, import protection has not been export promoting. To the contrary, greater import protection is associated most frequently with weaker export performance. Industry cost characteristics thought to assist strategic export promotion were found frequently to have the opposite effect.

Five explanations were offered for the failure to confirm empirically the IPEP hypothesis: (1) empirically, protection is awarded to industries with little export promotion potential, (2) competition in international markets reduces the potential role of strategic trade policy, (3) protection may fail to stimulate domestic production, (4) protection may lead to inefficient entry, and (5) inter–firm technology transfers or spillovers can eliminate export–promotion effects. These final four considerations indicate that even if import protection were targeted at the "correct" industries, other important obstacles to export promotion would remain. Thus, while the import

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adopting cost–reducing technologies, strategic trade policy cannot create cost differentials across firms.

protection as export promotion hypothesis remains a theoretical possibility, its empirical relevance has yet to be established.

Table 1

Does Import Protection Act as Export Promotion?

(Results for the full sample: 213 manufactures)

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
U.S. Tariff – Foreign Tariff (Nominal)	0.239 (1.04)	...	–0.017 (–0.04)	...
U.S. Tariff – Foreign Tariff (Effective)	...	–0.046 (–0.79)	...	0.004 (0.03)
U.S. NTB Rate – Foreign NTB Rate	–2.350 (–3.38)	–2.036 (–2.74)	–3.156 (–2.19)	–3.330 (–2.29)
U.S. Home Market / Foreign Home Market	–5.371 (–4.09)	–5.093 (–3.85)	–17.963 (–5.16)	–17.783 (–5.12)
U.S. Tariff – Foreign Tariff (Nominal), Squared	...	...	0.010 (0.40)	...
U.S. Tariff – Foreign Tariff (Effective), Squared	...	...	...	–0.55 E–3 (–0.62)
U.S. NTB Rate – Foreign NTB Rate, Squared	...	...	0.166 (0.57)	0.262 (0.87)
U.S. Home Market / Foreign Home Market, Squared	...	...	1.934 (3.86)	1.942 (3.91)
U.S. Comparative Advantage Under Free Trade	27.198 (1.50)	21.115 (1.19)	22.718 (1.27)	22.014 (1.26)
Constant	19.728 (5.79)	19.790 (5.81)	29.724 (7.08)	29.478 (7.03)
Adjusted R^2	.096	.111	.146	.149
F statistic	6.62	6.49	6.17	6.30

Notes: t–statistics appear in parentheses below.
The critical values for the F(4, 208) and F(7, 205) distributions at the 1% level are 3.41 and 2.73.

Table 2

Does Import Protection Act as Export Promotion?: Evidence for Industries with the Strongest Static Economies of Scale

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
U.S. Tariff – Foreign Tariff (Nominal)	0.224 (0.82)	...	–0.503 (–0.88)	...
U.S. Tariff – Foreign Tariff (Effective)	...	0.008 (0.07)	...	–0.020 (–0.09)
U.S. NTB Rate – Foreign NTB Rate	–1.640 (–1.88)	–1.426 (–1.61)	–0.455 (–0.26)	–0.371 (–0.21)
U.S. Home Market / Foreign Home Market	–9.523 (–3.89)	–9.143 (–3.75)	–23.367 (–2.60)	–26.342 (–3.61)
U.S. Tariff – Foreign Tariff (Nominal), Squared	...	...	0.018 (0.50)	...
U.S. Tariff – Foreign Tariff (Effective), Squared	...	...	...	–0.004 (–0.76)
U.S. NTB Rate – Foreign NTB Rate, Squared	...	...	–0.091 (–0.28)	–0.090 (–0.28)
U.S. Home Market / Foreign Home Market, Squared	...	...	3.546 (1.47)	4.520 (2.53)
U.S. Comparative Advantage Under Free Trade	61.201 (2.30)	55.235 (2.05)	52.377 (1.92)	29.599 (4.17)
Constant	18.227 (3.49)	18.353 (3.48)	27.909 (3.70)	35.319 (6.63)
Adjusted R^2	.139	.133	.152	.164
F statistic	5.28	5.08	3.71	3.96

Notes: The sample size is 107 industries. t–statistics appear in parentheses below. The critical values for the F(4, 102) and F(7, 99) distributions at the 1% level are 3.51 and 2.82. Economies of scale are measured by the exponent in the regression equation $V = KN^{\alpha}$, where V is the ratio of value added in plants employing N persons to average value added for the industry and K is a constant. The average scale economy coefficient for the sub–sample was 0.095, with maximum and minimum values equalling 0.556 and 0.026, respectively. (For the full industry sample, the mean, maximum and minimum values were, respectively, 0.024, 0.556 and –0.040.)

Table 3

Does Import Protection Act as Export Promotion?: Evidence for the Most R&D–Intensive Industries

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
U.S. Tariff – Foreign Tariff (Nominal)	–0.381 (–0.99)	. . .	–0.234 (–0.18)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	0.016 (0.17)	. . .	–0.026 (–0.13)
U.S. NTB Rate – Foreign NTB Rate	–2.094 (–1.47)	–2.470 (–1.78)	–2.253 (–0.48)	–3.399 (–0.72)
U.S. Home Market / Foreign Home Market	–10.401 (–3.08)	–10.332 (–3.04)	–46.843 (–2.70)	–39.241 (–2.30)
U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	–0.059 (–0.29)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	0.12 E–3 (0.05)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	0.344 (0.20)	0.606 (0.35)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	14.143 (2.15)	11.317 (1.74)
U.S. Comparative Advantage Under Free Trade	36.209 (1.24)	44.025 (1.54)	38.699 (1.24)	44.800 (1.49)
Constant	22.997 (3.74)	22.373 (3.64)	41.865 (3.97)	37.488 (3.54)
Adjusted R^2	.129	.121	.146	.125
F statistic	4.92	4.64	3.58	3.17

Notes: The sample size is 107 industries. t–statistics appear in parentheses below. The critical values for the F(4, 102) and F(7, 99) distributions at the 1% level are 3.51 and 2.82. R&D intensity is measured as the percentage of an industry's scientists and engineers engaged in research and development. For the sub–sample, the average index value was 0.396, with the maximum and minimum values equalling 0.486 and 0.336, respectively. (For the full industry sample, the mean, maximum and minimum values were, respectively, 0.329, 0.486 and 0.151.)

Table 4

Does Import Protection Act as Export Promotion?: Evidence for Industries with the Steepest Learning Curves

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
U.S. Tariff – Foreign Tariff (Nominal)	0.402 (1.06)	. . .	–0.347 (–0.53)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.125 (–1.05)	. . .	–0.081 (–0.35)
U.S. NTB Rate – Foreign NTB Rate	–2.222 (–2.37)	–1.491 (–1.57)	–4.121 (–2.11)	–3.364 (–1.70)
U.S. Home Market / Foreign Home Market	–3.028 (–1.70)	–3.232 (–1.82)	–10.176 (–1.84)	–13.768 (–2.81)
U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	0.054 (1.02)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	–0.002 (0.32)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	0.360 (0.98)	0.362 (0.99)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	1.045 (1.52)	1.445 (2.30)
U.S. Comparative Advantage Under Free Trade	–7.377 (–0.28)	–15.072 (–0.57)	–4.919 (–0.18)	–7.340 (–0.28)
Constant	22.762 (4.63)	22.789 (4.64)	26.830 (4.11)	29.964 (4.90)
Adjusted R^2	.050	.050	.077	.080
F statistic	2.35	2.35	2.21	2.27

Notes: The sample size is 103 industries. t–statistics appear in parentheses below.
The critical values for the F(4, 98) and F(7, 95) distributions at the 1% level are 3.51 and 2.82.
Learning curve coefficients are estimated as the elasticity of firm level productivity with respect to "experience," proxied by cumulative output. The two–digit level estimates were taken from Sheshinski (1967) and were repeated at the four–digit level in the sample. For the sub–sample, the average learning curve coefficient was 0.277, with the maximum and minimum values equalling 0.510 and 0.107, respectively. (For the full industry sample, the mean, maximum and minimum values were, respectively, 0.154, 0.510 and –0.023.)

Table 5

The Effect of Static Economies of Scale on Marginal Export Promotion from Import Protection

(Results for the full sample: 213 manufactures)

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
Non-interactive Variables				
Constant	19.456 (5.72)	19.601 (5.75)	29.682 (6.36)	31.335 (7.03)
U.S. Comparative Advantage Under Free Trade	26.873 (1.48)	21.046 (1.18)	19.015 (1.04)	20.149 (1.13)
U.S. Tariff – Foreign Tariff (Nominal)	0.167 (0.57)	. . .	–0.263 (–0.40)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.029 (–0.47)	. . .	0.046 (0.40)
U.S. NTB Rate – Foreign NTB Rate	–2.784 (–3.71)	–2.580 (–3.14)	–4.777 (–2.79)	–4.799 (–2.80)
U.S. Home Market / Foreign Home Market	–4.896 (–3.64)	–4.632 (–3.44)	–17.412 (–4.08)	–19.943 (–5.07)
U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	0.053 (0.61)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	–0.75 E–3 (–0.78)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	0.518 (1.36)	0.505 (1.30)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	1.852 (2.92)	2.299 (4.08)
Interactive Variables				
U.S. Tariff – Foreign Tariff (Nominal)	0.657 (0.31)	. . .	–1.765 (–0.33)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.145 (–0.20)	. . .	–0.562 (–0.32)
U.S. NTB Rate – Foreign NTB Rate	10.477 (1.27)	11.339 (1.31)	43.102 (1.70)	34.448 (1.53)
U.S. Home Market / Foreign Home Market	–7.605 (–0.89)	–6.966 (–0.81)	–0.239 (–0.01)	–11.316 (–0.77)

U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	–0.056 (–0.08)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	–0.028 (–0.51)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	–11.101 (–1.25)	–5.670 (–0.75)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	–10.027 (–0.09)	9.348 (1.39)
Adjusted R^2	.100	.097	.139	.149
F statistic	4.38	4.26	3.64	2.68

Notes: t–statistics appear in parentheses below.
The critical values for the F(7, 205) distribution at the 1% and 5% levels are 2.64 and 2.01, respectively. The critical values for the F(13, 199) distribution at the 1% and 5% levels are 2.18 and 1.75, respectively.

Table 6

The Effect of R&D Intensity on

Marginal Export Promotion from Import Protection

(Results for the full sample: 213 manufactures)

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
Non-interactive Variables				
Constant	21.250 (6.11)	19.993 (5.65)	33.735 (6.92)	33.892 (7.18)
U.S. Comparative Advantage Under Free Trade	24.718 (1.38)	20.976 (1.18)	18.714 (1.03)	13.852 (0.79)
U.S. Tariff – Foreign Tariff (Nominal)	3.372 (3.20)	. . .	–0.063 (–0.02)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	0.246 (0.75)	. . .	0.353 (0.77)
U.S. NTB Rate – Foreign NTB Rate	–2.304 (–0.58)	0.220 (0.05)	6.052 (0.45)	5.471 (0.42)
U.S. Home Market / Foreign Home Market	–2.751 (–1.08)	–4.439 (–1.75)	–32.039 (–3.96)	–33.396 (–4.77)
U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	0.321 (0.69)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	–0.006 (–0.71)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	–4.114 (–1.03)	–3.827 (–0.97)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	3.063 (2.92)	3.036 (3.23)
Interactive Variables				
U.S. Tariff – Foreign Tariff (Nominal)	–9.876 (–3.02)	. . .	1.190 (0.12)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.948 (–0.92)	. . .	–1.346 (–0.90)
U.S. NTB Rate – Foreign NTB Rate	0.275 (0.02)	–7.131 (–0.57)	–32.149 (–0.74)	–29.517 (–0.70)
U.S. Home Market / Foreign Home Market	–11.870 (–1.22)	–2.714 (–0.28)	28.764 (1.59)	32.013 (2.03

U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	–1.134 (–0.70)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	0.020 (0.70)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	14.595 (1.10)	13.811 (1.05)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	–0.011 (–0.00)	0.991 (0.19)
Adjusted R^2	.125	.087	.181	.179
F statistic	5.31	3.88	4.60	4.55

Notes: t–statistics appear in parentheses below.

The critical values for the F(7, 205) distribution at the 1% and 5% levels are 2.64 and 2.01, respectively. The critical values for the F(13, 199) distribution at the 1% and 5% levels are 2.18 and 1.75, respectively.

Table 7
The Effect of Learning-by-Doing on Marginal Export Promotion from Import Protection

(Results for the full sample: 213 manufactures)

Regressors	Dependent Variable: U.S. World Export Market Share, by Industry			
	Regression Specification			
	(1)	(2)	(3)	(4)
Non-interactive Variables				
Constant	19.824 (5.64)	19.886 (5.70)	27.662 (6.08)	29.307 (6.78)
U.S. Comparative Advantage Under Free Trade	27.438 (1.48)	20.899 (1.17)	23.452 (1.28)	21.225 (1.21)
U.S. Tariff – Foreign Tariff (Nominal)	0.258 (0.71)	. . .	0.176 (0.24)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.042 (–0.57)	. . .	–0.068 (–0.37)
U.S. NTB Rate – Foreign NTB Rate	–2.285 (–1.82)	–2.007 (–1.48)	2.880 (0.96)	8.574 (2.13)
U.S. Home Market / Foreign Home Market	–6.068 (–3.20)	–5.638 (–3.10)	–15.435 (–3.01)	–17.148 (–3.71)
U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	–0.039 (–0.52)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	0.002 (1.31)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	–1.604 (–2.15)	–3.450 (–2.80)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	1.758 (1.24)	2.234 (1.73)
Interactive Variables				
U.S. Tariff – Foreign Tariff (Nominal)	–0.010 (–0.00)	. . .	–2.495 (–0.63)	. . .
U.S. Tariff – Foreign Tariff (Effective)	. . .	–0.073 (–0.13)	. . .	–0.024 (–0.02)
U.S. NTB Rate – Foreign NTB Rate	–0.097 (–0.02)	0.201 (0.03)	–35.906 (–2.43)	–63.849 (–3.12)
U.S. Home Market / Foreign Home Market	3.828 (0.50)	3.019 (0.45)	–7.870 (–0.68)	–7.786 (–0.76)

U.S. Tariff – Foreign Tariff (Nominal), Squared	. . .	. . .	0.360 (0.71)	. . .
U.S. Tariff – Foreign Tariff (Effective), Squared	. . .	. . .	. . .	–0.015 (–0.68)
U.S. NTB Rate – Foreign NTB Rate, Squared	. . .	. . .	10.333 (2.64)	19.602 (3.12)
U.S. Home Market / Foreign Home Market, Squared	. . .	. . .	0.580 (0.11)	–0.713 (–0.15)
Adjusted R^2	.085	.082	.154	.173
F statistic	3.80	3.72	3.97	4.42

Notes: t–statistics appear in parentheses below.
The critical values for the F(7, 205) distribution at the 1% and 5% levels are 2.64 and 2.01, respectively. The critical values for the F(13, 199) distribution at the 1% and 5% levels are 2.18 and 1.75, respectively.

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