Food Marketing Policy Center

The Impact of Imports On Price-Cost Margins:
An Empirical Illustration

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Preface

This article decomposes the impact of imports on domestic price-cost margins into separate price and cost effects. Using data from 24 food-processing industries, the empirical results show that although the direct impact of imports on prices is always negative, a positive net impact on price-cost margins occurs in industries characterized by low own-price elasticity of demand and diseconomies of scale. Further results show that the disciplining effect of imports is more preponderant the lower the degree of domestic competition.

Key Words: Market power, imports, market structure, international trade, food industry.

1. Introduction

One of the oldest, well-established premises of international trade theory is that imports discipline domestic producers, i.e., they lower price-cost margins. This is also one of the central premises of industrial organization theory or of microeconomics for that matter: increased competition, whether foreign or domestic, lowers price-cost margins. Why then has empirical work on the impact of imports on domestic market power yielded mixed results? Although most empirical studies have found a negative relationship between an increase in imports (e.g., trade liberalization) and domestic price-cost margins, others have detected a positive association.[1] Are these results contradictory? What did some of the previous work not take into consideration?

This article tries to resolve some of the controversy by empirically implementing the model of Lopez and Lopez (1996), which demonstrated that both a positive and a negative impact of imports on price-cost margins can be theoretically justified. Using data from the food processing industries, it first estimates an econometric model that decomposes the impact of imports based on economies of scale, conjectural variation and demand elasticities and then simulates the impact of a one-percent increase in imports.[2] Econometric results lend strong support to the theoretical hypotheses: the disciplining effect is more likely in industries characterized by a high price flexibility with respect to imports, high own-price elasticity of demand, and strong economies of scale. Simulation results indicate that although a negative impact of imports on price-cost margins is the preponderant outcome, in nearly 29% of the industries analyzed, increased imports have a positive impact. These results are more likely to occur in industries characterized by weak economies of scale and price inelastic demands. Further results show that a disciplining effect is more likely the lower the degree of domestic competition, thus supplementing rather than contradicting the 'imports-as-market-discipline' hypothesis.

2. Theoretical Model

Let the maximand of a representative domestic firm be given by:

$$\pi_i = P(Q, M)\, q_i - C(q_i), \qquad (1)$$

where π_i is net returns of firm i, P is the price of the domestically produced good, Q is total domestic production, M is the level of imports, q_i is the firm's output, and C is variable cost. From the first-order conditions and under appropriate aggregation conditions, the industry's Lerner index is thus given by:

$$L = \frac{P - C'}{P} = \theta\left(\frac{1}{\eta} + \frac{\gamma}{\eta_M}\right), \qquad (2)$$

where θ is the domestic conjectural variation elasticity

$$[\theta_i = (dQ/dq_i)(q_i/Q)],$$

η is the absolute value of the domestic elasticity of demand

$$[\eta = -(d\log Q/d\log P)],$$

γ is the conjectural variation elasticity of imports with respect to domestic production

$$[\gamma = (d\log M/d\log Q)],$$

and η_M is the inverse of the price flexibility with respect to imports

$$[\eta_M = -(d\log M/d\log P)]$$

in absolute value.

Let foreigners behave in a Cournot-Nash fashion with respect to changes in domestic production ($\gamma = 0$) so that

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[1] Esposito and Esposito, 1972; Geroski, 1982; Neuman, Böbel, and Haid, 1985; Chou, 1986; De Ghellinck, Geroski, and Jacquemin, 1988; Choi, 1989; Levinsohn, 1993, and Ianchovichina et al., 2000, are among the authors who found a negative association between imports and price-cost margins, while other authors, such as Urata, 1979; Pagoulatos and Sorensen 1981; Nolle, 1991; Stålhammer, 1991, 1992; and Field and Pagoulatos, 1996, 1998, have detected a positive association. The possibility of a positive link between imports and domestic market power has also been shown by Geroski and Jacquemin (1981); Urata (1984); and Haubrich and Lambson (1986), who attribute such results to potential collusion between importers and domestic producers.

[2] The U.S. food manufacturing industry offers a good case study for examining the impact of imports on price-cost margins. First, like the rest of the manufacturing sector, it became subject to increased foreign competition over the past decades. Second, the degree of imperfect competition is substantial in this sector. Third, the parameters needed to implement and test the theoretical model are readily provided by previous studies since this sector has been analyzed extensively.

(2) simplifies to the well-known Lerner index for the domestic market $(L = \theta / \eta)$, as developed by Appelbaum (1982).

Letting $\beta = P - C'$ and totally differentiating the left hand side of (2) we obtain:

$$dL = \frac{1}{P^2}\left\{\left(\frac{\partial \beta}{\partial Q}P - \beta\frac{\partial P}{\partial Q}\right)dQ + \left[\frac{\partial \beta}{\partial M}P + \frac{\partial \beta}{\partial Q}\frac{\partial Q}{\partial M}P + \beta\frac{\partial P}{\partial M} + \beta\frac{\partial P}{\partial Q}\frac{\partial Q}{\partial M}\right]dM\right\}. \quad (3)$$

Manipulating (3) and substituting (2) yields

$$\varepsilon_{LM} = K\delta_M\left[\frac{1}{\delta_M\eta_M} + \frac{1}{\eta} + (\frac{1}{\varepsilon} - 1)\right], \quad (4)$$

where ε_{LM} =*d*log *L/d*log *M* and is the elasticity of the Lerner index with respect to imports, *K*= *(L-1) / L* and its value is always negative since *(L - 1)/L= - C′/(P - C′) < 0*, ε is the returns to scale coefficient ($\varepsilon > 1$ for increasing returns to scale, $\varepsilon = 1$ for constant returns to scale, and $\varepsilon < 1$ for decreasing returns to scale), and δ_M is the net domestic quantity adjustment with respect to imports [$\delta_M = 2d\log Q / d\log M$].[3] It is also most reasonable to assume that $\delta_M < 0$, indicating that domestic firms reduce production after an increase in imports. Note that η and η_M are expressed in absolute values.

The expression in (4) indicates that the percent change in the Lerner index due to a one percent change in imports is the result of three effects:

The first effect comes from the direct impact of imports on price (K/η_M) and is always negative, yielding "a disciplining effect of imports." Furthermore, if marginal costs are constant or decreasing, an increase in imports will always lead to lower price-cost margins.

The second and third effects inside the brackets in (4) are conditioned on the domestic quantity adjustment δ_M. The second effect indicates that if domestic producers respond to increased imports by reducing the amount produced, this, by itself, yields higher prices and will have a positive effect on the Lerner index. The more price inelastic the domestic demand is, the larger the size of this effect as the domestic price will be more sensitive to domestic quantity adjustments.

The third effect in (4) is the impact of the change in domestic cost due to quantity adjustments. Given a reduction of domestic output as a result of greater imports, scales economies would be sacrificed if *e>1*, resulting in higher marginal costs and, thus, lower price-cost margins. On the other hand, if *e<1*, diseconomies could be avoided and the lower marginal costs would yield a positive effect on the Lerner index. Note that the expression *((1/e) - 1)* is the elasticity of marginal cost with respect to domestic production (Ferguson, 1979; Morrison, 1990).

The hypotheses to be tested are:

$\partial\varepsilon_{LM} / \partial\eta_M^{-1} < 0$ (direct effect on price),
$\partial\varepsilon_{LM} / \partial\eta^{-1} > 0$ (output adjustment effect on price),

and

$\partial\varepsilon_{LM} / \partial(\varepsilon^{-1} - 1) > 0$ (output adjustment effect on cost).

The first indicates that the more sensitive the domestic price is to imports, the more likely imports will have a negative impact on price-cost margins. The second and third hypotheses indicate that the lower the price elasticity of domestic demand or the degree of economies of scale, the more likely imports will have a positive impact on price-cost margins. The net impact of imports on price-cost margins is given by the sum of the three effects and can thus be positive or negative, depending on the industry characteristics and strength of each of these elements.

3. Empirical Model

The objective of the empirical analysis is to test the hypotheses suggested above and to estimate how the conduct and market structure components interact to determine the ultimate impact of imports on domestic price-cost margins. The empirical equation includes the determinants of the domestic Lerner index specified in log-linear form to isolate the elasticity of the Lerner index with respect to imports and the various effects discussed above.

As suggested in the theoretical model, the empirical analogue of equation (2) also assumes γ (the reaction of foreign producers to changes in domestic production) equal to zero. Then, using (2), $\log L = \log\theta - \log\eta$, we focus on the empirical variables that determine the conjectural variation elasticity and assume a constant price

[3] To simplify, assert that in equation (3), $\partial \log Q / \partial \log M \equiv d \log Q / d \log M$. This assumption does not alter the fundamental results.

elasticity of demand for the output of the industry.[4]

Next, we identify the variables determining the degree of collusion by domestic industries. First is the degree of industrial concentration. Ever since Cowling and Waterson's (1976) seminal work, there has been a well-established rationale for expecting industry price-cost margins to be positively related to the level of industrial concentration. Thus, drawing from the work of Field and Pagoulatos (1998) and Ståhlhammer (1992), the log of the four-firm concentration ratio (*CR*) is included as one of the determinants of the domestic conjectural variation elasticity. It is expected, therefore, that its coefficient will be positive, indicating a greater degree of collusion in concentrated industries.

Next, we introduce industry exports and imports as determinants of *q*. To adjust for size, exports and imports were measured as the value of their respective shares of domestic sales (XS, MS) as in Marvel (1980), Ståhlhammer (1991), and Field and Pagoulatos (1996). In essence, we use import penetration to measure imports across industries.[5] One could expect a negative coefficient for export intensity due to either price discrimination between domestic and foreign markets (Field and Pagoulatos, 1996) or better capacity utilization and exploitation of scale economies (Stahlhammer, 1991). The expected impact of imports on price-cost margins, and the subject of inquiry here, depends on the market structural variables discussed above. Thus, we now focus on the market structural variables of interest to the hypotheses to be tested. Following the theoretical analysis, we also include three slope shifters, allowing the log of MS to interact with the two price flexibilities (with respect to imports and domestic production) as well as the marginal cost elasticity.

The equation that summarizes the empirical model based on equations (2) and (4) is:

$$\ln L = \alpha_0 + \alpha_1 \ln CR + \alpha_2 \ln XS + \ln MS[\alpha_3 \eta_M^{-1} + \alpha_4 \eta^{-1} + \alpha_5(\varepsilon^{-1} - 1)] - \ln \eta + \mu_1 \quad (5)$$

where μ_1 is an error term and other notation is as defined before. The $\alpha's$ are the parameters to be estimated. According to the hypotheses stated above, which stem from equation (3), the parameters of special interest are α_3, α_4, and α_5, and their expected signs are $\alpha_3 < 0 < \alpha_4, \alpha_5$. The expressions in brackets show the decomposed impacts of imports on price-cost margins and correspond to Kq_M times the terms in brackets in the theoretical equation (4).

By their very nature, the data required for such analysis are difficult to locate, calculate, or estimate. The field of application has thus been restricted to a group of 24 4-digit SIC US food manufacturing industries with data from 1992.[6] Details on the data sources, procedures, and the actual data used are given in the appendix. Bhuyan and Lopez (1997) provided values for the Lerner indexes, the price elasticities of demand, and returns to scale. Following Kimball-Field (1993), the price elasticities with respect to imports were estimated by regressing the domestic price on imports and production cost.

Given that the scale and price flexibilities are based on *a priori* estimates, they are bound to have measurement errors, which might yield biased and inconsistent parameter estimates for equation (5). To partially address this problem, as suggested by Greene (2000), we use instrumental variables in lieu of the estimates. To accomplish this, one equation for each instrumental variable was specified, and the estimated values from those equations were used as instruments.

The instrumental equation for the price flexibility with respect to imports included three regressors: the elasticity of substitution between domestic and foreign products (*ES*, from Lopez and Pagoulatos, 2001), the log of import penetration (*MS*), and foreign direct investment. The instrumental equation for the price elasticity of demand is based on the work of Pagoulatos and Sorensen (1986) and included as regressors the number of brands at the 4-digit level (*NB*), advertising intensity (*AI*), and percent of output sold to consumer outlets (*CO*). Finally, the instrumental

[4] For a model of determination of the price distribution of industrial demand see Pagoulatos and Sorenson (1986). Their work is used here in specifying instruments for the price elasticity of demand.

[5] Domestic sales is defined by apparent consumption, i.e., the value of domestic shipments minus the value of exports plus the tariff-adjusted value of imports. To adjust the values of imports to domestic prices, they were multiplied by $(1+\tau)$, where τ is the respective tariff or tariff-quota equivalent in the respective food industry. Note that this conversion brings the value of imports in line with the value of domestic shipments. Food industries protected by quotas rather than tariffs include cheese (SIC=2022), condensed and evaporated milk (2023), fluid milk (2026), and sugar (2061).

[6] Out of 36 food industries reported by Bhuyan and Lopez (1997), nine were dropped because they reported amounts of imports amounting to less then 1% of domestic sales (SICs 2021, 2024, 2026, 2032, 2041, 2043, 2048, 2075, 2087). Three more had missing values (SICs 2016, 2097, and 2098), leaving a usable sample of 24 observations. Note that, as in Bhuyan and Lopez (1997), two of the categories reported represent merged SICs: 2051=2051+2052 for bread and bakery, and 2061=2061+2062+2063 for sugar.

equation for economies of scale included the log of 4-firm concentration ratio (CR), the log of the value of shipments (*VS*, based on Caves et al., 1980), and a dummy variable for extreme values of scale estimates (SD).

Since the Lerner index, the dependent variable, is also an estimate, equation (5) was corrected by the standard error of the log of the Lerner index in order to weight the estimates by their significance levels. It turns out that the standard error is the inverse of the t-ratios of the original estimates. That is, the observations are weighted by the t-ratios of the untransformed Lerner indexes.[7]

To optimize the instrumental variables used for the flexibilities and scale variables, it seems plausible that the transformed Lerner index equation and the instrumental equations be joined in a simultaneous equation system. This system will also allow formal modeling to address the measurement errors of the regressors in (6) that are based on previous estimates. Thus, the equations to be estimated are:

Lerner Index:

$$\begin{aligned}(\ln L)/z = (&\alpha_0 + \alpha_1 \ln CR + \alpha_2 \ln XS \\ &+ \ln MS[\alpha_3 \eta_M^{-1} + \alpha_4 \eta^{-1} + \alpha_5(\varepsilon^{-1} - 1)] \\ &- \ln \eta + \mu_1)/z\end{aligned} \qquad (6)$$

Price Flexibility with respect to Imports:

$$\eta_M^{-1} = \lambda_0 + \lambda_1 ES + \lambda_2 \ln MS + \lambda_3 FDI + \mu_2, \qquad (7)$$

Price Elasticity of Demand:

$$\eta = \pi_0 + \pi_1 AI + \pi_2 CO + \pi_3 NB + \mu_3, \qquad (8)$$

Economies of Scale:

$$\varepsilon = \xi_0 + \xi_1 \ln CR + \xi_2 \ln VS + \xi_3 DS + \mu_4, \qquad (9)$$

where *z* is the inverse of the original t-ratios for the Lerner indexes published by Bhuyan and Lopez (1997) and other notation is as defined before (all data are provided in the appendix). The endogeneous variables are ln *L*, η_M^{-1}, η, and ε. The exogeneous variables are *z*, ln *CR*, ln *XS*, ln *MS*, *ES*, *FDI*, *AI*, *NB*, *CO*, *DS*, and ln *VS*. The parameters to be estimated are the αs, λs, πs, and ξs. The system of equations given in (6)-(9) was estimated with 1992 data for 24 industries at the 4-digit SIC level using nonlinear three-stage least squares. The SHAZAM 8.0 software was used for all estimations. The results are presented in the following section.

4. Empirical Results

Table 1 presents the parameter estimates and selected statistics for the system of equations (6) through (9). The main results of interest are those for equation (6). In general, these results conform to *a priori* expectations. All the estimates in the Lerner index equation have the expected signs. The more concentrated an industry is, the larger the degree of oligopoly power or the size of the price-marginal cost markup. The negative sign for the coefficient of export intensity is consistent with the finding of Stålhammer (1992), accounting for the fact that as industries become more export oriented, they are better able to exploit economies of scale and to operate on smaller price cost margins.

The signs and the t-ratios of the three slope shifters of the log of *MS* support the hypotheses stated above. Specifically, the empirical results confirm that the larger the price flexibility is with respect to imports, the larger the disciplining effect of imports. A one-percent increase in imports induces a disciplining effect equivalent to 0.72% of the price flexibility with respect to imports. At the same time, the results for the corresponding instrumental equation (7) indicate that the price flexibility itself is proportional to import penetration, to the degree of substitutability between home and foreign goods and to foreign direct investment (although only the coefficient for

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[7] Note that since the dependent variable is a transformation of the original Lerner index estimates of Bhuyan and Lopez (1997), the standard errors have to be transformed as well. As the dependent variable is the logarithmic of the Lerner index, the standard error of the transformed variable is approximated by a first-degree Taylor series expression based on the standard errors of the Lerner indexes published by Bhuyan and Lopez. Following Rice (1995, p. 149), we then apply the delta method to linearize the transformed distribution based on a first-degree Taylor series expansion. For example, we are interested in the mean and variance of Y, which is related to *X* in some known way. The first-order approximation is $Y = g(X) \approx g(\mu_x) + (X - \mu_x)g(\mu_x)$, and $\mu_y \approx g(\mu_x)$, and $\sigma_Y^2 \approx \sigma_X^2[g'*(\mu_X)]^2$. Applying these relations to the Lerner index, ln*L*=log(*L*), so that ln*L*$\approx \log(\bar{L})$ and $\sigma_{\ell nL}^2 = \sigma_L^2/\bar{L}^2$. Since we are interested in deflating equation (5) by the standard error of ln*L*, then $\sigma_{\ell nL} = \sigma_L / L = 1/t_L$, the inverse of the t-statistics, which is equivalent to multiplying both sides of the equation (5) by the t-ratios of the original data based on the natural value of the Lerner index.

import penetration was statistically significant at the 95% level).

The results also confirm that there is a strong and indirect relationship between the price elasticity of demand (that is, a direct relationship with its inverse--the price flexibility with respect to domestic production) and the impact of imports on the Lerner index. Recall that this impact is conditioned on domestic quantity adjustments. As a result of these adjustments, the domestic price-cost margin increases by approximately 0.063% of the price flexibility with respect to domestic production after a one-percent increase in imports. That is, as domestic output is reduced after an increase in imports, there is a countervailing domestic reaction that tends to offset part of the price decrease due to a greater volume of imports. The more inelastic demand is, the greater the effect of domestic adjustments on price. Although that coefficient may seem low in comparison to that for the price flexibility of imports, one should keep in mind that food products are usually characterized by inelastic demand, which would magnify the effect of producer reactions on the domestic price.

As hypothesized, the results also show a positive relationship between marginal cost elasticity and the impact of imports on the Lerner index. That is, the cost adjustment effect has a positive impact for industries with diseconomies of scale and a negative impact for industries with economies of scale. This effect is proportional to 42.6% of the marginal cost elasticity. In sum, the econometric results lend strong support to the hypotheses suggested above.

Table 2 presents the decomposed and net impacts of imports on price-cost margins for each of the 24 industries in the sample. The overall effect of imports on price-cost margins is the sum of the three effects (imports on price, output adjustment on price, and cost adjustments). The elasticity of the Lerner index with respect to imports for each industry is calculated as

$$e_{LM} = \partial \ln L / \partial \ln MS$$
$$= -0.724 / h_M + 0.063 / h + 0.426(e^{-1} - 1).$$

Negative overall impacts were found in 17 industries (71% of the sample) confirming the disciplining effect of imports, while in the remaining 7 (29%), imports had a positive or counter-competitive effect. The mean average value of the overall impact was -0.060 while the sales-weighed average was -0.055, indicating that the disciplining effect is somewhat more prevalent in smaller industries.

Finding a positive association between imports and price-cost margins in some cases might seem counterintuitive, contradicting the conventional view that imports erode the profitability of domestic firms. However, an increase in imports will lead to a decrease in price and demand for the domestic good. This decrease in demand will lead to a decrease in the domestic quantity supplied. With the lower amount supplied, there is a countervailing positive effect on price and a decline in marginal costs if there are diseconomies of scale, both of which exert pressure to increase price-cost margins. The combination of these effects can lead to higher mark-ups in the face of rising imports, especially if demand is price inelastic and there are strong diseconomies of scale.

One final aspect of the disciplining effect of imports that has been tested in the literature with mixed results is the influence of the degree of domestic competition on the disciplining effect. The "imports-as-market-discipline" hypothesis suggests that imports erode price-cost margins more efficiently in noncompetitive industries. To test for this hypothesis, the net impacts of a one-percent increase in imports from Table 2 $(\hat{e}_{LM})$ were regressed on the Lerner index (L) for the industries in the sample. The results indicate that the disciplining effect of imports is more pronounced in non-competitive industries in consistency with the hypothesis.[8] Thus, our analysis supplements rather than contradicts the results of Levinsohn's (1993) and other who reasserted the "imports-as-market-discipline" hypothesis.[9]

5. Concluding Remarks

This article decomposed the impact of imports on domestic price-cost margins into separate price and cost effects using data from 24 U.S. food-processing industries for 1992. The econometric results support the theoretical hypotheses that the price-cost margins are more likely to

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[8] The following OLS results were obtained:

$$\hat{e}_{LM} = =0.131(1.353)\text{-}0.641L(\text{-}2.359)$$

The coefficient of determination (which is simply the square of the correlation coefficient) was somewhat low at 0.188. The t-ratios are presented in parenthesis. Nonetheless, these simple results indicate a negative and significant association between the impact of imports and the degree of competition.

[9] It should be noted that Levinsohn (1993) found mixed results on the impact of trade liberalization (positive and negative effects on markups) for industries that were perfectly competitive. This is not surprising since competitive industries are already disciplined by domestic competition, leaving little or nothing for imports to discipline. His analysis rather focused on five Turkish industries that faced significant changes in trade protection: three industries that were imperfectly competitive in which trade was liberalized and two industries where protection increased significantly.

be disciplined when there is a larger price flexibility with respect to imports (implying higher import penetration and/or substitution between the home and foreign products), lower price elasticity of demand, and lower economies of scale. By the same token, a counter-competitive effect or a positive impact of imports on price-cost margins can occur in industries characterized by price inelastic demands and diseconomies of scale.

Simulation results show that, on balance, imports have a negative impact on price-cost margins or a disciplining effect for the sample analyzed. For seven (29%) industries, however, a positive effect was found, consistent with the weak economies of scale and low elasticities of demand in those industries. Further results show that the disciplining effect is more pronounced in oligopolistic industries. That is, a positive effect is more likely in quasi-competitive industries, confirming some of Levinsohn's (1993) results. Overall, the results do not refute the disciplining effect of imports found by Levinsohn (1993) and others but rather supplement and reconcile some of the seemingly conflicting empirical evidence.

Given the limitations of the data, which have been restricted to a small group of industries, it is difficult to extrapolate broader generalizations from a case study of this sort. However, the results obtained constitute, with all due caution, a promising point of departure for future empirical research along these lines targeting a broader set of industries.

References

Appelbaum, E. 1982. The Estimation of the Degree of Oligopoly Power. *Journal of Econometrics* 19: 287-299.

Bartelsman, E.J. and W. Gray. 1996. *The NBER Manufacturing Productivity Database.* National Bureau of Economic Research, Technical Working Paper No. 205, Cambridge, MA.

Bhuyan, S. and R.A. Lopez. 1997. Oligopoly Power in the Food and Tobacco Industries. *American Journal of Agricultural Economics* 79: 1035-43.

Caves, R.E., M.E. Porter, A.M. Spence, and J.T. Scott. 1980. *Competition in the Open Economy: A Model Applied to Canada.* Cambridge: Harvard University Press.

Choi, E.K. 1989. *Three Essays on the Effects of Foreign Competition on the Relation between Market Structure and Performance.* Unpublished Ph.D. dissertation. Georgetown University.

Chou, T-Ch. 1986. Concentration, Profitability and Trade in a Simultaneous Equation Analysis: the Case of Taiwan. *The Journal of Industrial Economics* 34: 429-443.

Cowling, K. and M. Waterson. 1976. Price-Cost Margins and Market Structure. *Economica* 43: 267-74.

DeGhellinck, E., P.A. Geroski, and A. Jacquemin. 1988. Inter-industry Variations in the Effect of Trade on Industry Performance. *Journal of Industrial Economics* 37: 1-19.

Esposito, L. and F. Esposito. 1971. Foreign Competition and Domestic Industry Profitability. *Review of Economics and Statistics* 4: 343-53.

Fergunson, C.E. 1979. *The Neoclassical Theory of Production and Distribution.* London: University Press.

Freenstra, R.C. 1996. NBER Trade Database, Disk 1: U.S. Imports, 1972-1994 Data and Concordances. NBER Working Paper No. 5515. Cambridge, Massachusetts.

Field, M.K. and E. Pagoulatos. 1998. “Foreign Trade Elasticities and Import Discipline.” *Applied Economics* 30: 105-111.

____. 1996. International Trade, Market Structure, and Cyclical Fluctuations in U.S. Food Manufacturing. In P. Abbot and I.M. Sheldon, eds., *Empirical Studies of Industrial Organization and Trade in the Food Industries*. Boulder, CO: Westview Press.

Geroski, P.A. 1982. Simultaneous Equations Models of the Structure-Performance Paradigm. *European Economic Review* 19: 145-158.

Geroski, P.A. and A. Jacquemin. 1981. Imports as a Competitive Discipline. *Recherches Economiques de Louvain* 47: 197-208.

Greene, W.H. 2000. *Econometric Analysis.* Princeton, New Jersey: Prentice-Hall.

Haubrich, J.G. and V.E. Lambson. 1986. Dynamic Collusion in an Open Economy. *Economic Letters* 20: 75-78.

Ianchovichina, E. 2000. The Procompetitive Effects of Foreign Competition on Domestic Markups. *Review of International Economics* 81: 134-148.

Kimball-Field, M.A. 1993. *Foreign Trade and Market Power Over the Business Cycle.* Ph.D. dissertation, University of Connecticut.

Levinsohn, J. 1993. Testing the Imports-as-Market-Discipline Hypothesis. *Journal of International Economics* 35:1-22

Lopez, E. and R.A. Lopez. 1996. Market Structure and the Impact of Imports on Price-cost Margins. *Review of Industrial Organization* 11: 107-113.

Lopez, E. and E. Pagoulatos. 2001. The Size and Determinants of the Elasticity of Substitution between Domestic and Foreign Food Products. Unpublished manuscript, University of Connecticut, May.

Marvel, H.P. 1980. Foreign Trade and Domestic Competition. *Economic Inquiry* 18: 103-122.

Morrison, C.J. 1990. Market Power, Economic Profitability and Productivity Growth Measurement: An Integrated Approach. Working Paper 3657, National Bureau of Economic Research, Cambridge, MA.

Neuman, M., I. Böbel, and A. Haid. 1985. Domestic Concentration, Foreign Trade and Economic Performance. *International Journal of Industrial Organization* 3: 1-9.

Nolle, D. 1991. An Empirical Analysis of Market Structure and Import and Export Performance for U.S. Manufacturing Industries. *Quarterly Review of Economics and Business* 31: 59-78.

Pagoulatos, E. and R. Sorensen. 1986. What Determines the Elasticity of Industry Demand? *International Journal of Industrial Organization* 4: 237-250.

____. 1981. A Simultaneous Equation Analysis of Advertising, Concentration, and Profitability. *Southern Economic Journal* 47(3).

Rice, J.A. 1995. *Mathematical Statistics and Data Analysis*, 2nd ed. Belmont, CA: Duxbury Press.

Ståhlhammer, N.O. 1991. Domestic Market Power and Foreign Trade. *International Journal of Industrial Organization*, 9: 407-424.

Ståhlhammer, N.O. 1992. Concentration, Prices and Profitability in the Swedish Manufacturing Industry. In Y. Bourdet, ed., *Internalization, Market Power and Consumer Welfare*. London: Routledge.

Urata, S. 1984. Price-Cost Margins in an Oligopolistic Market. *Economic Letters* 15: 139-144.

____. 1979. Price-Cost Margins and Foreign Trade in U.S. Textile and Apparel Industries. *Economics Letters* 4: 279-282.

U.S. Department of Commerce, Bureau of Census. 1996. *1992 Census of Manufacturers: General Summary*. Washington, D.C.: Government Printing Office.

U.S. International Trade Commission. 1990. *Estimated Tariff Equivalents of U.S. Quotas on Agricultural Imports and Analysis of Competitive Conditions in U.S. and Foreign Markets for Sugar, Meat, Peanuts, Cotton, and Dairy Products.* USITC Publication No. 2276. Washington, D.C.

Table 1. Parameter Estimates for the Lerner Index and Instrumental Equations, U.S. Food Manufacturing Industries, 1992.

Variable	Notation	Parameter	Est. Coef.	T-ratio
Lerner Index:	lnL			
Intercept	1	a_o	-2.871	-11.229***
Concentration ratio	lnCR	a_1	0.225	2.085**
Export Share	lnXS	a_2	-0.339	-5.112***
Import Impacts:				
Direct Effect on Price	$\ln MS*\eta_M^{-1}$	a_3	-0.724	-4.565***
Output Effect on Price	$\ln MS*\eta^{-1}$	a_4	0.063	2.579***
Output Effect on M. Cost	$\ln MS*(\varepsilon^{-1}-1)$	a_5	0.426	5.163***
Instrumental Equations:				
Price Flexibility w.r.t. Imports:	η_M^{-1}			
Intercept	1	l_0	0.338	2.231**
Elast. of Substitution	ES	l_1	0.102	1.179
Import Share	lnMS	l_2	0.077	2.095**
Foreign Direct Invest.	FDI	l_3	0.008	1.484
Price Elast. of Demand:	h			
Intercept	1	p_0	0.298	3.6664***
Adv. Intensity	AI	p_1	-3.313	-2.502***
Percent Sales to Cons.	CO	p_2	0.005	2.932***
Number of Brands	NB	p_3	0.001	0.222
Economies of Scale:	e			
Intercept	1	x_0	0.733	1.811*
Concentration Ratio	lnCR	x_1	0.108	1.105
Log of Size	lnVS	x_2	0.048	1.011
Scale Dummy	SD	x_3	0.767	4.159***

Notes: *** = Significant at the 99 percent level. ** = Significant at the 95 percent level.
* = Significant at the 90 percent level. N=24. The estimated system of equations corresponds to equations (6) through (9).

Table 2. Decomposition of the Impacts of Imports, 1992.

SIC	Industry	Imports on Price $\left[\hat{a}_3 \cdot \frac{1}{h_M}\right]$	Output Adjustment on Price $\left[\hat{a}_4 \cdot \frac{1}{h}\right]$	Output Adjustment on Cost $\left[\hat{a}_5 \cdot \left(\frac{1}{e} - 1\right)\right]$	Net Effect $\hat{e}_{LM}$
2011	Meat Packing	-0.077	0.117	-0.157	-0.117
2013	Saus. & Prep Meats	-0.273	0.089	-0.022	-0.206
2022	Cheese	-0.175	0.123	-0.064	-0.116
2023	Cond. & Evap. Milk	-0.053	0.191	-0.206	-0.068
2033	Canned Fruit & Veg.	-0.125	0.085	0.018	-0.021
2034	Dried Fruit & Veg.	-0.118	0.144	0.141	0.168
2035	Pickled Sauces	-0.068	0.095	-0.145	-0.118
2044	Rice Milling	-0.146	0.211	0.037	0.102
2046	Wet Corn Milling	-0.285	0.188	-0.012	-0.109
2047	Pet Food	-0.149	0.508	0.210	0.569
20512	Bread & Bakery	-0.081	0.094	0.169	0.182
206123	Refined Sugar	-0.086	0.140	-0.049	0.005
2065	Candy & Confect.	-0.041	0.127	0.122	0.208
2066	Chocolate & Cocoa Pr.	-0.250	0.119	0.062	-0.069
2067	Chewing Gum	-0.250	0.380	0.306	0.436
2076	Vegetable Oil Mills	-0.313	0.132	-0.079	-0.260
2077	Anim. & Marine Fats	-0.689	0.132	-0.026	-0.582
2079	Lard & Cooking Oils	-0.271	0.144	-0.113	-0.239
2082	Malt Beverages	-0.173	0.120	-0.122	-0.175
2085	Distilled Liquor	-0.533	0.157	-0.108	-0.483
2086	Soft Drinks	-0.032	0.113	-0.182	-0.101
2091	Canned & Cured Seafoods	-0.284	0.112	-0.011	-0.182
2092	Fresh Fish Proc.	-0.356	0.094	0.044	-0.218
2095	Roasted Coffee	-0.025	0.118	-0.129-0.036	
	Mean Values	-0.202	0.156	-0.013	- 0.060
	Weighted Mean Values	-0.137	0.129	-0.047	-0.055

Appendix

Lerner Index (L), Price Elasticity of Domestic Demand (h), and Economies of Scale (e): These data came from Bhuyan and Lopez (1997) who used a New Empirical Industrial Organization (NEIO) model to estimate these values for each food processing industry at the 4-digit SIC level. They estimated the elasticity of demand using a double-log model and economies of scale using a translog cost function. The standard error of the estimates were, in general, small. All the estimated elasticities of demand were significantly different from zero at the 99% level.

Price Flexibilities with respect to Imports (h_M^{-1}): These values were obtained by regressing the log of domestic output on the log of import price indexes and the log of domestic cost, follwing Kimball-Field (1993). Data at the 4-digit SIC level was used for the 1978-92 period. Martha Kimball-Field gracefully provided the price elasticity estimate for SIC 2011 (meat packing) which was much more plausible than the one obtained from our regression.

Imports (MS) and Exports (XS): Data on the CIF values of imports and the FOB values of exports at the 4-digit SIC level came from Freenstra (1996). Tariff rates to adjust the import values to domestic values were also derived from Freenstra by dividing the collected duties by the CIF values of imports. For industries protected by import quotas, the tariff equivalents were used (U.S. International Trade Commission, 1990). The adjusted values of imports and the FOB values of exports were then divided by domestic sales, defined by value of domestic shipments minus exports plus tariff-adjusted values of imports. The values of shipments were obtained from Barstelman and Gray (1996).

Concentration Ratios (CR) and Value of Shipments (VS): The values for the concentration ratios, wages and average establishment size came from the *1992 Census of Manufactures.* The values of domestic shipments came from the NBER database by Barstelman and Gray (1996). Following Field and Pagoulatos (1998), the concentration ratio is corrected by the value of shipments over market size (or apparent consumption, defined above) in order to adjust them for trade flows. One industry (SIC 2076) had a corrected concentration ratio of 1.16 due to the fact that exports were unusually large. Using an uncorrected concentration ratio or setting led to only hyper-marginally different results. For consistency, all concentration ratios are trade-adjusted.

Percent Sales to Consumers (CO), Foreign Direct Investment (FDI), Advertising Intensity (AI) and Number of Brands (NB): These data were taken from Pagoulatos and Sorensen (1986). The advertising variable is expressed as advertising expenditures divided by market size (rather than just domestic value of shipment) to adjust them for trade flows.

Table A1. Data Used

Obs. No.	SIC	L	t_L	CR	XS	MS	h_M^{-1}	h	e	DS	ES	FDI	AI	CONS	NB	VS
01	2011	0.415	6.245	0.511	0.070	0.049	-0.108	-0.528	1.585	0	0.53	0.60	0.01	60	45	50434
02	2013	0.210	9.355	0.256	0.070	0.046	-0.379	-0.694	1.055	0	0.64	5.00	0.01	82	232	19972
03	2022	0.254	1.271	0.408	0.003	0.031	-0.242	-0.503	1.178	0	1.25	7.94	0.03	60	114	18351
04	2023	0.593	11.090	0.424	0.065	0.079	-0.074	-0.324	1.938	1	0.28	20.59	0.03	56	49	7541
05	2033	0.242	5.730	0.253	0.034	0.098	-0.173	-0.728	0.959	0	0.69	8.63	0.02	70	271	15065
06	2034	0.081	1.117	0.443	0.215	0.080	-0.163	-0.430	0.751	0	1.03	10.95	0.06	44	42	2853
07	2035	0.530	9.034	0.405	0.028	0.041	-0.095	-0.656	1.515	0	0.54	12.66	0.08	81	115	6398
08	2044	0.109	3.167	0.778	0.662	0.106	-0.202	-0.294	0.920	0	0.83	9.26	0.08	76	25	1650
09	2046	0.164	0.465	0.867	0.232	0.044	-0.396	-0.330	1.029	0	1.96	38.90	0.01	25	19	7045
10	2047	0.115	2.854	0.603	0.060	0.020	-0.207	-0.122	0.670	0	1.47	19.80	0.03	48	170	7023
11	2051	0.219	6.746	0.449	0.008	0.011	-0.113	-0.661	0.716	0	0.84	8.80	0.03	80	255	28501
12	2061	0.330	9.418	0.602	0.033	0.161	-0.120	-0.443	1.130	0	0.95	0.60	0.01	26	36	6564
13	2065	0.160	10.683	0.456	0.096	0.083	-0.057	-0.489	0.778	0	1.54	7.91	0.05	77	128	10207
14	2066	0.211	8.383	0.756	0.081	0.072	-0.348	-0.521	0.873	0	0.78	17.02	0.04	77	61	3106
15	2067	0.147	0.936	0.939	0.030	0.052	-0.347	-0.163	0.582	0	1.33	28.66	0.06	77	31	1106
16	2076	0.278	6.705	1.116	0.511	0.257	-0.434	-0.471	1.227	0	0.89	0.01	0.03	34	1	666
17	2077	0.296	8.215	0.515	0.462	0.070	-0.956	-0.469	1.065	0	0.88	0.01	0.02	34	1	1858
18	2079	0.388	10.384	0.303	0.032	0.167	-0.376	-0.430	1.359	0	1.50	12.54	0.04	34	88	4830
19	2082	0.489	6.196	0.748	0.012	0.053	-0.240	-0.515	1.401	0	0.025	0.01	0.05	66	84	17340
20	2085	0.571	13.916	0.476	0.079	0.311	-0.740	-0.394	1.339	0	1.09	21.45	0.03	66	420	3394
21	2086	0.595	10.198	0.369	0.007	0.010	-0.044	-0.550	1.745	1	0.24	7.74	0.07	90	150	25416
22	2091	0.153	3.825	0.207	0.361	0.649	-0.394	-0.552	1.027	0	1.05	2.05	0.01	57	20	969
23	2092	0.092	8.970	0.095	0.146	0.648	-0.494	-0.660	0.907	0	1.05	7.41	0.01	57	20	7039
24	2095	0.507	8.642	0.656	0.022	0.028	-0.035	-0.527	1.433	0	0.67	16.10	0.05	77	89	5294

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