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The Effect of U.S. Antidumping Law on Firms' Market Power: An Empirical Test

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Abstract. An empirical version of the Lerner index is used to investigate the market power effects of U.S. firms seeking protection under current antidumping law. The market power consequences are examined for each of the three possible resolutions of an antidumping investigation: petition for relief accepted (and duties levied), petition rejected, or petition withdrawn. For each outcome an industry case study is presented and the market power analysis conducted. The results contained herein support the hypothesis that U.S. firms receiving protection enhance their domestic market power, while firms having their petition rejected experience a decrease in market power. The evidence is less clear for plaintiffs who withdraw their antidumping petition prior to its final resolution.

Key words: Dumping, antidumping law, market power, protectionism.

I. Introduction

Commensurate with the multilateral tariff reductions that have occurred over the last several decades, countries increasingly have sought relief from imports through administered protection programs. Of these, the use of antidumping law constitutes the most prevalent form of protectionism both in the U.S. and abroad.[1] Some view such protection as being a remedy for the "unfair" actions of foreign firms. Under this view, antidumping duties are seen as not being protectionist but rather as being necessary to promote "fair" trade. Others, however, argue that such laws assist domestic firms in obtaining import relief discreetly rather than through more politically-visible means. Under this view the popularity of antidumping law is due more to the rent-seeking behavior of domestic firms rather than to the unfair trading practices of their foreign rivals, and the resulting diminution of foreign competition allows for an increase in the market power of the protected firms resulting in both allocative and productive inefficiencies. If supracompetitive benefits accrue to

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[1] Antidumping laws are also the primary instrument of protection in the E.U., Canada, and Australia (see Messerlin, 1991). Palmeter (1989), DeVault (1990), Prusa (1990, 1991, 1992), Boltuck and Litan (1991), Bovard (1991), Anderson (1993), and McGee (1993) all discuss the popularity of current U.S. antidumping law.

firms using this form of protection they ought to be measurable. Such an empirical analysis is absent from the existing literature.

This paper presents an industrial organization framework to investigate the market power consequences (based upon the Lerner index) of U.S. firms seeking protection under current antidumping law. This is accomplished by employing a firm-level empirical test for the difference between price and marginal revenue which will be positive if a firm exercises market power.[2] The market power consequences are examined for each of the three possible resolutions of an antidumping investigation: petition accepted (and duties levied), petition rejected, or petition withdrawn. For each outcome an industry case study is presented and the market power test conducted. The results contained herein support the notion that U.S. firms receiving protection under the antidumping statute enhance their domestic market power, while firms having their petition rejected experience a decrease in market power. The evidence is less clear for plaintiffs that withdraw their antidumping suit prior to the completion of the investigation.

The paper is organized as follows. Section II briefly reviews U.S. antidumping law. Section III presents a theoretical discussion of how firms' market power is thought to be affected by the use of antidumping law. Section IV specifies the "market power test" to be employed and reports the results of the empirical estimation. A short conclusion completes the paper.

II. U.S. Antidumping Law

According to U.S. trade law, a foreign firm is "dumping" when it sells a product in the U.S. market at prices below *either* the average price charged on a comparable product in the nation of manufacture (or some other non-U.S. market) *or* below the average total cost of production of the product. While dumping may be nothing more than international price discrimination, it is often viewed as consisting of sales at "less-than-fair-value" and is seen as a realization of the predatory intent of the foreign seller. U.S. antidumping law, as well as current World Trade Organization (WTO) antidumping rules, allows for duties to be imposed when imports are found to be both unfair (i.e., dumped) and injurious to the domestic-competing industry.[3] Since the Uruguay Round essentially adopted existing antidumping procedures currently in use by the U.S. and the European Union, the incentives to use this type of protection most likely will continue under the WTO. The continued use of antidumping law, particularly in response to the tariff-reduction and trade-liberalization measures embodied in the Uruguay Round, seems inevitable.[4]

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[2] This market power test is a variation of the model developed by Martin (1988a).

[3] Effective January 1, 1995, the Uruguay Round of multilateral trade negotiations transformed the GATT into the World Trade Organization, a permanent institution which essentially codified the numerous trade pacts that had been negotiated under the GATT.

[4] Schott (1994) presents a thorough discussion of this issue. Horlick and Shea (1995) present a thorough analysis of the WTO's Antidumping Code and Palmeter (1995) discusses the implementation of this agreement in the U.S.

During the 1980s an unprecedented number of antidumping petitions were filed by U.S. firms against their foreign competitors, with the majority of these petitions not being rejected by trade officials. Rather, the bulk of these cases have resulted in either the petition being accepted (and duties levied) or the petition being withdrawn by the plaintiffs after a negotiated outcome is reached with the defendants.[5] The 1980s is a period of particular interest because it follows the passage of The Trade Agreement Act of 1979. This Act was the first major revision of U.S. antidumping law since the passage of the Antidumping Act of 1921 (the first substantial U.S. antidumping law) and basically rewrote the statute. It was not until the Trade Agreement Act of 1979 that U.S. protection-seekers began to rely heavily on the antidumping statute. It has been argued in the literature that the popularity of the current statute stems from the fact that it is biased against foreign defendants, and has been misused by protection-seekers in this country resulting in economically inefficient outcomes.[6]

The U.S. Department of Commerce's International Trade Administration (Commerce) and U.S. International Trade Commission (ITC) jointly administer antidumping law. The role of Commerce is to determine whether foreign merchandise is being sold in the U.S. at less-than-fair value (LTFV) and, if so, to estimate the margin of dumping. Commerce issues both a preliminary and final LTFV determination. The role of the ITC is to determine whether an industry in the U.S. is being injured by reason of the LTFV imports. The ITC is required to issue both a preliminary and final injury determination. If Commerce determines that a foreign firm is dumping and the ITC decides that a domestic industry has been injured, an antidumping order is issued which levies a duty on the subject imports equal to the margin of dumping.

U.S. firms seeking protection may prefer antidumping law because Commerce's procedures are biased toward higher dumping margins, and therefore higher antidumping duties, than may be warranted. Boltuck and Litan (1991) enumerate the methodological flaws inherent in the calculation of dumping margins by Commerce. These authors illustrate that the existence or nonexistence of dumping frequently is an artifact of the methods used by Commerce. These practices which result in an upward bias for dumping margins, coupled with the fact that Commerce defines dumping to exist whenever their estimated margin equals or exceeds one-half of one percent of the U.S. price, almost always guarantees that foreign defendants are guilty of selling at LTFV. In fact, during the 1980–1991 period, only 6% of all antidumping petitions filed were rejected because Commerce determined

[5] Anderson (1993) reports that the number of outstanding antidumping orders increased from 84 at the end of 1980 to 197 at the end of 1990. Finger (1993) finds that from the passage of the first substantial U.S. antidumping law in 1921 through 1967 (the conclusion of the Kennedy Round of multilateral trade negotiations), the U.S. government had conducted a total of 706 antidumping investigations with all but 75 resulting in a negative determination. In contrast, during the 1980–1991 period, 541 antidumping petitions were filed with less than 40% being rejected by trade officials.

[6] See Palmeter (1989), Bovard (1991), Boltuck and Litan (1991), Prusa (1990, 1992), Nivola (1993), and McGee (1993) for a discussion of this issue.

foreign sales were *not* made at LTFV. When petitions are rejected, it is usually for a lack of injury rather than a finding of no dumping. Domestic firms, cognizant that Commerce's procedures favor their allegations of dumping, have liberally used antidumping law against foreign rivals subsequent to the 1979 Act.[7]

There are three possible outcomes of an antidumping investigation: petition accepted (and duties levied), petition rejected, or petition withdrawn. An investigation is terminated upon (1) an ITC preliminary negative injury determination, (2) a final negative LTFV determination by Commerce, or (3) an ITC final negative injury determination. At any time subsequent to Commerce's preliminary LTFV determination, current antidumping law allows an investigation to be terminated by either having the plaintiff *withdraw* the petition or having the petition *suspended* by means of a government sanctioned agreement between domestic and foreign producers (and possibly the foreign government).

III. Theoretical Considerations

A growing literature examines the efficiency and welfare implication associated with the introduction of antidumping law. This literature illustrates theoretically that antidumping law either facilitates tacit collusion among rivals or enhances the market power of the plaintiffs due to the constraint placed upon foreign competitors. Since the presence of actual or potential foreign competition exerts market discipline upon U.S. producers, introduction of antidumping law (and any subsequent duties) reduces this desirable disciplinary effect. Commensurate with either the increased collusion or the diminished imports is a general deterioration in the national welfare of the policy-active country.[8] Prusa (1992) proposes that U.S. firms which initiate and then *withdraw* an antidumping petition prior to the resolution of the case do so only after negotiating a collusive arrangement with the defendants. As a result, these plaintiffs are suspected of using antidumping law strategically in order to augment their market power. In Nieberding (1997), a single-period duopoly model is presented in order to illustrate the anticompetitive aspect of antidumping law and to examine the effect of this type of protection on the protected-firm's Lerner index. It is found that under constant or decreasing marginal cost with Cournot conjectures (and under constant marginal costs with Bertrand conjectures), the Lerner index of the domestic firm increases with the introduction of antidumping law.

Another consideration is the possible *strategic* effects associated with antidumping law. Reitzes (1993) and Fischer (1992) present models that examine the strate-

[7] For a more detailed discussion of statutory biases contained in U.S. antidumping law, see Palmeter (1989), DeVault (1990), Bovard (1991), Lindsey (1992), McGee (1993).

[8] For a theoretical or an empirical treatment of how foreign suppliers discipline U.S. firms, see Marvel (1980) and Feinberg and Shaanan (1994), respectively. Various theoretical models have been developed in the literature illustrating how the introduction of antidumping law affects the domestic market and welfare (see Staiger and Wolak, 1991; Prusa, 1992, 1994; Webb, 1992; Fischer, 1992; Reitzes, 1993).

gic behavior of firms in the context of a two-period game. Fischer endogenizes the probability of obtaining protection in the domestic market while Reitzes relies on policy makers to select the probability of enforcement. Because antidumping law represents a credible threat to impose future duties based upon the current disparity between domestic-market and foreign-market prices, firms may find it profit-maximizing to behave strategically. That is, with an antidumping law in place, it can be shown that the domestic firm has an incentive to increase output (i.e., lower the domestic-market price) in the first period thereby increasing the dumping margin and thus the probability of duties in the second period. This may be profit-maximizing for the domestic firm as expected second-period profits depend on the probability of receiving protection. The focus of such models is the behavior of firms in the first period *prior* to the imposition of duties. This allows the authors to focus on the strategic effects of antidumping law. Section IV below abstracts from such *ex ante* strategic considerations, and focuses *empirically* on how the plaintiff firm's market power (based upon the Lerner index) changes under each of the three possible resolutions of an antidumping investigation.

IV. Empirical "Market Power" Evidence

Using trade volume data, Prusa (1992) finds that U.S. plaintiffs that had had their antidumping petition accepted by trade officials resulted in a significant decrease in the volume of trade for that industry in the following year. A similar decline in the volume of trade occurred in those industries where plaintiffs withdrew their petition prior to the final resolution of the investigation. Prusa suggests that since petition withdrawals had essentially the same effect on the growth in the value of trade as did levying duties, these settlement agreements grant significant market power to domestic firms.[9] Prusa also found that U.S. firms that had had their petitions rejected experienced a significant increase in the volume of trade for that industry in the following year thereby diminishing the market power of domestic firms. These conclusions are based solely upon trade volume data. A more precise way to investigate the market power effects would be to use firm-level profit data (as done below).

1. The Empirical Model

Much of the previous empirical work concerning "market power" took the form of testing the profits-concentration relationship using cross-sectional data for a large sample of industries in a given year. Such studies investigated the relationship between variations in industry profitability and various indicators of industry structure and conduct. The theoretical underpinnings for this approach was the "structure-conduct-performance" paradigm pioneered by Edward Mason and Joe

[9] In contrast to Prusa, Staiger and Wolak (1994) find that there are not substantial trade restrictions associated with antidumping investigations that are terminated due to petition withdrawal.

Bain. According to this model, the structure of a particular market (exogeneously determined) leads to firm conduct within that market which determines market performance. As pointed out by Tirole (1990), though, the relationships that emerge from regressions based upon this paradigm must be viewed at best as "descriptive statistics" and not as causal relationships. Measures of performance (such as industry profitability), conduct (such as R&D or advertising expenditures), and structure (such as concentration) are jointly endogenous and must be determined simultaneously.[10] As a result of this simultaneity bias, the positive correlations found in these inter-industry cross-sectional studies between various measures of market conduct and profitability are difficult to interpret. In response to the inadequacies of the structure-conduct-performance model, more recent empirical research into the nature of market power has been at either the firm level or single-industry level. This approach avoids the shortcomings inherent in the structure-conduct-performance paradigm, and also allows one to separate the influence of firm market share and industry concentration on firm profitability.[11]

The firm-level regression that is estimated below is

$$PCM_i = \beta_0 + \beta_1 MS_i + \beta_2 KSR_i + \beta_3 ISR_i + \beta_4 NSR_i + \beta_5 D_i + \beta_6 D_i MS_i + \varepsilon_i \quad (1)$$

where PCM_i is the firm profit–sales ratio (or price–cost margin), MS_i is the firm market share, KSR_i is the firm capital stock–sales ratio, ISR_i is the firm ratio of interest expense to sales, NSR_i is the firm ratio of receipts from new stock issue to sales, and D_i is a dummy variable equal to 1 after the antidumping petition resolution and 0 before the antidumping petition resolution.

All firm-specific variables in Equation (1) except capital stock were obtained from *Compustat* (quarterly observations).[12] Since accounting measures of capital stock are likely to be imprecise estimates of the economic value of such assets, capital stock values were obtained in much the same way as Martin (1988a): namely, a base year *Value Line* accounting figure for capital stock is used, assuming depreciation according to the economic depreciation rates of Hulten and Wycoff (1981), adjusting for inflation according to the GNP deflator, and using *Value Line* figures for investment.[13] Appendix A provides various descriptive statistics for the firm-level variables used in the case studies below.

[10] See Martin (1979) and Geroski et al. (1987) for studies addressing this simultaneity problem.

[11] Problems associated with using cross-sectional, inter-industry data that generate spurious correlations between industry profitability and concentration are well-documented in the literature. Martin (1988b) and Tirole (1990) discuss the estimation and interpretation problems inherent with inter-industry cross-sectional studies of market power, while Scherer and Ross (1990) provide a thorough treatment of the empirical literature on market structure and performance. Shepherd (1972) and Ravenscraft (1983) confirm that the effect of own-market share on firm profitability dominates industry concentration effects.

[12] Standard & Poor's *Compustat* is a financial database which tracks the performance of the majority of publicly-traded companies in the United States.

[13] *Value Line Investment Survey's Ratings and Reports* contains detailed analysis on over 1700 stocks which are classified into 91 industry groups.

The interested reader may consult Martin (1988a) for the detailed derivation of the theoretical model underlying Equation (1). The model considers both input and financial markets, does not assume *a proiri* constant returns to scale, and is developed with consideration given to both the cost and demand conditions faced by a firm. One advantage of this model is that it establishes a link between a firm's price-cost margin and market share in the course of profit maximization, and justifies the use of the price-cost margin on its own as a measure of firm profitability rather than as a proxy variable.

On the demand side in Martin's model, an oligopolistic industry is assumed to face a constant-elasticity (inverse) demand curve

$$P = a(Q^{-i} + q_i)^{-1/\varepsilon} \tag{2}$$

where firm i's output is denoted by q_i, industry output (less that of firm i) is denoted Q^{-i}, P represents unit price, and ε represents demand elasticity. To capture possible firm interaction, a conjectural elasticity term (α) is introduced.

$$\alpha = \frac{q_i}{Q^{-1}} \frac{dQ^{-i}}{dq_i} \tag{3}$$

This parameterizes the reactions that a firm expects from its rivals in response to its own actions and will be positive if the firm expects its rivals to restrict output when it restricts output. Incorporating Equations (2) and (3) into the firm's profit-maximization problem yields an expression for the firm's marginal revenue

$$MR = P\left(1 - \frac{\alpha + (1-\alpha)MS_i}{\varepsilon}\right) \tag{4}$$

where MS_i is the firm's market share. A firm does not exercise market power if price equals marginal revenue. That is, if

$$\frac{\alpha + (1-\alpha)MS_i}{\varepsilon} = 0 \tag{5}$$

in Equation (4). However, if the left-hand-side expression of Equation (5) is significantly greater than zero, then the firm does exercise market power. Equation (5) is the basis for the test of market power that will be implemented below.

The marginal revenue equation from above together with the first-order conditions from the firm maximization problem are used by Martin to show that

$$PCM_i = \frac{\alpha}{\varepsilon} + \left(\frac{1-\alpha}{\varepsilon}\right) MS_i + \beta_2 KSR_i + \beta_3 ISR_i + \beta_4 NSR_i \tag{6}$$

in the case of constant returns to scale. Since

$$\frac{\alpha}{\varepsilon} = \beta_0$$

and

$$\frac{1-\alpha}{\varepsilon} = \beta_1,$$

then

$$\frac{\alpha + (1-\alpha)MS_i}{\varepsilon} = \beta_0 + \beta_1 MS_i$$

which is estimable. The importance of this is that the marginal revenue equation shows that if this term is greater than zero, marginal revenue will exceed price exposing exerted market power. Thus, a test for market power is the statistical significance of a positive value of the intercept plus the slope coefficient on market share times market share in a regression like Equation (6). That is, if

$$\beta_0 + \beta_1 \overline{MS} > 0 \tag{7}$$

(where $\overline{MS}$ denotes the firm's average market share), then the firm is exercising market power. To allow for estimates of market power both before and after the resolution of an antidumping investigation, Equation (6) is estimated with an intercept dummy taking the value of 1 after the outcome has been determined and 0 otherwise; and also with an explanatory variable defined as the product of this dummy and firm market share. This gives us Equation (1) above.

The computation of a market power statistic (i.e., Equation (7)) both before and after the outcome of an antidumping investigation provides an empirical measure of how the protection-seeking firm's market power has changed as a result of the antidumping investigation. Specifically, the market power statistics are computed as:

$$\beta_0 + \beta_1 \overline{MS}_{\text{before}} \qquad \text{(prior to resolution of the antidumping petition)} \tag{8}$$

$$(\beta_0 + \beta_5) + (\beta_1 + \beta_6)\overline{MS}_{\text{after}} \qquad \text{(after the resolution of the antidumping petition)} \tag{9}$$

where $\overline{MS}_{\text{before}}$ is the firm's average market share prior to the petition resolution and $\overline{MS}_{\text{after}}$ is the firm's average market share after the petition resolution. A t-test is then utilized to ascertain whether or not the change in market power is significant.

2. Empirical Results

Based upon the theoretical considerations discussed above, it is hypothesized that the market power of U.S. plaintiffs in an antidumping investigation will: (1) increase when trade officials accept their petition and levy duties, (2) remain unchanged or fall when the antidumping petition is rejected, and (3) increase when domestic

plaintiffs withdraw a petition. Four case studies of industries which have utilized antidumping law during the 1980s are presented below. The semiconductor industry and the tapered roller bearing industry both serve as an example of an industry having had its antidumping petition accepted. The hydraulic cement industry is presented as a case study of plaintiffs who have had their antidumping petition rejected by U.S. trade officials. The steel industry serves as an example of U.S. plaintiffs who withdrew their petition once a VER had been negotiated among the U.S. firms, the foreign firms, and the U.S. government. For each industry, salient facts of the case are presented and the empirical market power test conducted.[14]

3. Time Series Issues

Given that Equation (1) is estimated using firm-level time series data, it is necessary to test the residuals for autocorrelation and to test the individual time series for stationarity. Although the individual coefficients in Equation (1) have little economic meaning in the context of the market power model to be used, the intercept and slope coefficient on market share are used to construct the market power statistic. OLS was used in estimating Equation (1) for each firm in the case studies below. The exact Durbin–Watson statistic along with its p-value is reported for each regression in footnotes 18, 20, 23, and 27. It was found that positive serial correlation in the residuals did exist for several of the firms. For these firms Equation (1) was estimated using a procedure which corrects for this.

In addition to autocorrelation, it is standard practice to test individual time series for stationarity. In general, a stochastic process which generates a time series is said to be stationary if its mean and variance are constant over time, and the covariance between observations in the series is a function only of how far apart they are in time, not the time at which they occur. A time series violating these properties is called nonstationary. Regressions containing nonstationary time series may produce spurious results. A common way to test for stationarity is to ascertain whether or not the series has a unit root. If a unit root exists then the given time series is nonstationary; if a unit root does not exist then the series is stationary. If the nonstationary time series data to be used in a regression are found to be cointegrated (i.e., following the same underlying trend), then regression results containing these series are meaningful.[15]

While it would be straightforward to perform unit root tests (i.e., Dickey–Fuller or augmented Dickey–Fuller tests) on each firm's time-series variables in Equation (1), doing so may be problematic. Notwithstanding the fact that these variables are

[14] Ideally, a larger sample of industries would provide better evidence concerning the market power results. However, the four industries utilized were the only ones during the 1980s that had enough publicly available data for meaningful empirical results to be obtained.

[15] A time series that has a unit root is known as a random walk (which is nonstationary). Most econometrics textbooks can be referenced for a more detailed discussion of stationarity, tests for unit roots, and cointegration (for example, see Green, 1997). Some commonly used tests for unit roots are the Dickey–Fuller test, the augmented Dickey–Fuller test, and the Engle–Granger test.

all expressed in ratios which are less likely to be nonstationary than are variables expressed in levels, the fact that there is a regime shift (i.e., protection granted or rejected) halfway through the time series may affect the mean and/or variance of these series for reasons unrelated to the underlying stochastic process that generated them. Therefore, unit root tests on these variables may show nonstationarity, not because the underlying stochastic process is nonstationary, but because of regime changes. Following Gujarati (1995), there is a presumption that the disturbances ε_i in Equation (1) are a stationary, white-noise series. This is unlikely, however, if the series in Equation (1) are nonstationary. To test for this an Engle–Granger test was conducted for each firm. One proceeds by estimating Equation (1), obtaining the residuals $\hat{\varepsilon}_i$, and using the Dickey–Fuller unit root test on these residuals. Doing so allows one to find out if the regression residuals are stationary. If the residuals are stationary then the time series data in Equation (1), despite being individually nonstationary due to the regime shift, are cointegrated. Specifically,

$$\Delta\hat{\varepsilon}_i = \beta_i(\hat{\varepsilon}_{i-1}) \tag{10}$$

was fitted for each firm. If the t-statistic for β_1 exceeds the Engle–Granger critical values then ε_i is stationary (i.e., it does not have a unit root), and the variables in Equation (1) are cointegrated. This was indeed the case for the 9 firms examined below and the null hypothesis of a unit root can be rejected.[16]

4. A Study of Petition Acceptance: The Semiconductor Industry

On September 9, 1985, an antidumping petition was filed by Advanced Micro Devices, Intel Corporation, and National Semiconductor Corporation against Japanese firms for allegedly dumping erasable programmable read only memory (EPROM) and dynamic random access memory (DRAM) semiconductor chips on the U.S. market. On July 30, 1986, Commerce suspended its antidumping investigation concerning these products and on July 31, 1986, the President announced that the U.S. and Japan had reached an agreement on semiconductor trade that, among other things, required the suspension of the ongoing antidumping investigation concerning EPROMs and DRAMs from Japan. This agreement called for Japanese producers and exporters to revise their U.S. prices to eliminate sales at LTFV. On August 26, 1986, however, the U.S. plaintiffs filed a request to continue the antidumping investigation. On October 30, 1986, Commerce issued its final determination that these products were being sold at LTFV; and, on December 29, 1986, the ITC issued its final injury determination affirming injury to the U.S. semiconductor industry. The effect of the affirmative determination by the ITC was to cause the terms of the 1986 Agreement (particularly the price floor on Japanese chip imports) to remain in force rather than having the ITC impose dumping duties. A negative determination would have rescinded the price floor contained in the Agreement.

[16] The results of these tests are available from the author upon request.

Table I. Pre- and post petition acceptance market power statistics: The Semiconductor Industry

Firm	Pre-resolution (January 1980–December 1986)	Post-resolution (January 1987–December 1991)	T-test of difference[a]
Advanced Micro Devices	0.2870	0.3579	5.14
Intel Corporation	0.3801	0.5933	55.63
Texas Instruments	0.3490	0.4419	44.95

[a] All t-statistics have p-values of 0.0000 (one-tail). A t-test, conducted on all three semiconductor firms to test the null hypothesis that the difference between the post-resolution and pre-resolution market power statistic is less than or equal to zero against the alternative that this difference is greater than zero, indicates that each firm's market power statistic significantly increased after receiving protection.

Equation (1) is estimated for several of the leading U.S. semiconductor producers: Advanced Micro Devices, Intel Corporation, and Texas Instruments.[17] National Semiconductor Corporation did not have a sufficient number of observations to allow for the implementation of the market power test. Texas Instruments, which was not a plaintiff in this investigation but nevertheless was a supporter of the petition, was substituted for National Semiconductor as Texas Instruments is a leading manufacturer of semiconductors. The data are from 1980.1 through 1991.4 (48 observations). The structural break during this period occurs in 1987.1 as the ITC's final affirmative injury decision was in December 1986. Estimates of Equation (1) for each of these firms allow for computation of the market power statistic before and after the antidumping petition was accepted. These are presented in Table 1 and were obtained for each firm using Equations (8) and (9). Each firm's market power statistic significantly increased after their antidumping petition was accepted.[18]

Are there any other industry-specific changes that may have accounted for the market power results in Table I? There were significant losses in U.S. competitiveness both here and abroad in the early to mid 1980s due in large part to a substantial appreciation of the dollar on world financial markets. In the latter half of the 1980s the dollar depreciated markedly somewhat reversing this trend. Since Japan was

[17] The main line of business for the U.S. plaintiffs in this investigation is Semiconductors and Related Devices as classified under SIC 3674.

[18] All market power statistics reported in Table I are greater than zero at the 1% level of significance. The econometric software *Shazam* computes and reports the exact Durbin–Watson (DW) statistic and probability for the null hypothesis that no autocorrelation in the residuals exists. For Advanced Micro and Texas Instruments these were DW = 1.3073 (p = 0.0005) and DW = 1.4789 (p = 0.0057), respectively, providing evidence of positive serial correlation at greater than the 99% level of confidence. Therefore, Equation (1) for these firms was estimated using a procedure which corrects for this. The data for Intel did not exhibit autocorrelation and OLS was used in estimating Equation (1).

the major target of unfair trade complaints by the U.S. semiconductor industry during the 1980s (see Flamm, 1993) Equation (1) was re-estimated for each of the semiconductor firms controlling for variations in the dollar/yen exchange rate. It is expected that the dollar's rise against the yen in the first half of the 1980s ought to be associated with lower U.S. semiconductor firm profitability and that the dollar's fall against the yen in the second half of the 1980s ought to be associated with higher firm profitability (all else equal). The rationale for including this exchange rate variable in Equation (1) is to see if the significant increase in the market power statistic for these firms could be "explained away" by the relatively strong dollar in the early 1980s and the relatively weak dollar in the latter part of the 1980s. As explained in greater detail in Nieberding (1994), the market power results in Table I still obtained after controlling for the dollar/yen exchange rate; namely, each firm's market power increased significantly after petition acceptance.

5. A Study of Petition Acceptance: The Tapered Roller Bearings Industry

During the 1980s a lot of activity was occurring on the trade front in the U.S. semiconductor industry (see Flamm, 1993). The repeated threats of trade sanctions and the signing of the 1986 Semiconductor Trade Agreement may be seen as confounding events unique to this industry which helped generate the above market power results. This section presents a second case study of an industry which succeeded in having antidumping duties levied against "dumped" imports. This investigation concerned "tapered roller bearings and parts thereof, and certain housings incorporating tapered roller bearings" from Hungary, Italy, Japan, the People's Republic of China, Romania, and Yugoslavia. The domestic plaintiff was the Timken Company. The antidumping petition was filed on August 25, 1986. On September 23, 1987, the ITC issued an affirmative final injury determination and on October 6, 1987, the DOC issued the antidumping duty order.

The Timken Company is the world's largest producer of tapered roller bearings for the auto, truck, machinery, construction, and railroad industries.[19] There were ten domestic producers of tapered roller bearings during the course of the investigation (1983–87) but the Timken Company historically has dominated the U.S. industry accounting for well over half of U.S. industry sales. Equation (1) was estimated for the Timken Company using data from January 1982 through December 1992 (44 observations). The structural break during this period occurs in September 1987 as the ITC's final affirmative injury determination was rendered then. Using Equations (8) and (9), estimates of Timken's market power statistic before and after the antidumping duty petition was accepted are presented in

[19] The Timken Company invented the modern tapered roller bearing and patented it in 1898.

Table II. Pre- and post petition acceptance market power statistic: The Timken Company

Firm	Pre-resolution (January 1982–December 1987)	Post-resolution (January 1988–December 1992)	T-test of difference[a]
The Timken Company	0.3677	0.4302	6.95

[a] This t-statistic has a p-value of 0.0000 (one-tail). A t-test, conducted to test the null hypothesis that the difference between the post-resolution and pre-resolution market power statistic is less than or equal to zero against the alternative that this difference is greater than zero, indicates that Timken's market power statistic significantly increased after receiving protection.

Table II. Timken's market power increased significantly as a result of having it petition accepted and duties levied.[20]

6. A Study of Petition Rejection: The Hydraulic Cement Industry

On October 30, 1986, an antidumping petition was filed by the American Cement Trade Alliance alleging that the hydraulic industry in the U.S. is threatened with material injury by reasons of LTFV imports of portland hydraulic cement and cement clinker.[21] In December 1986 the ITC issued a preliminary determination in which they found no reasonable indication that a U.S. industry was materially injured or threatened with material injury due to the defendants' dumped imports. In order to implement the market power test, several of the largest U.S. cement producers were researched. Only two firms, however, had enough publicly available data for the analysis to be carried out. These two firms are LaFarge Corporation and Southdown Incorporated.[22] In 1994, LaFarge was the second-largest cement producer in North America with 15 cement plants. It is majority-owned by France's LaFarge Coppee, SA. It is also a significant supplier of concrete-based construction materials. Southdown is the nation's third-largest cement and ready-mix concrete producer. The data are from January 1983 through December 1992 (40 observations). The structural break during this period occurs in January 1987. Estimates of the market power statistics before and after the petition was rejected are presented in Table III.

[20] The market power statistics reported in Table II are greater than zero at the 1% level of significance. Since there is no evidence of autocorrelation in the residuals for Timken (DW = 1.9114, p = 0.1786), OLS was used in estimating Equation (1).

[21] The defendants in the investigation were Columbia, France, Greece, Japan, Mexico, The Republic of Korea, Spain, and Venezuela. Portland hydraulic cement consists mainly of compounds of calcium and silica which, when mixed with water, sand, and stone, chemically react to form concrete. Cement clinker is an intermediate material formed in the process and used to produce portland hydraulic cement. Of the four major categories of hydraulic cement, portland hydraulic cement accounts for approximately 95% of domestic production.

[22] The main line of business for these two firms is Hydraulic Cement as classified under SIC 3241.

Table III. Pre- and post petition rejection market power statistic: The Hydraulic Cement Industry

Firm	Pre-resolution (January 1983–December 1986)	Post-resolution (January 1987–December 1992)	T-test of difference[a]
LaFarge	0.5987	0.5312	−5.75
Southdown	0.4308	0.4176	−2.20

[a] The t-statistic for LaFarge has a p-value of 0.0000 (one-tail). The t-statistic for Southdown has a p-value of 0.0171 (one-tail). A t-test, conducted on both cement firms to test the null hypothesis that the difference between the post-resolution and pre-resolution market power statistic is greater than or equal to zero against the alternative that this difference is less than zero, indicates that each firm's market power statistic significantly decreased after their antidumping petition was rejected.

The market power for both firms decreased significantly after having their antidumping petition rejected.[23] Perhaps a petition rejection sends a signal that aggressive foreign competition will be tolerated in this industry by U.S. trade officials.

7. A Study of Petition Withdrawal: The Steel Industry

In the last 20 years or so the steel industry has been very active in protection-seeking activities.[24] On December 6, 1977, President Carter approved implementation by the Treasury Department of a Trigger Price Mechanism (TPM) to monitor import prices of steel mill products. Effective January 1, 1978, the first Trigger Price Mechanism (TPM) was enacted. In essence, the TPM established a price floor for imported steel based on Japanese production costs plus a markup for transportation costs and profit. Not satisfied with the 1978 TPM, U.S. Steel Corporation filed both antidumping and countervailing duty petitions in April 1980 against steel producers in numerous EC countries. The Carter administration rescinded the TPM on March 1980 in response to these filings by U.S. Steel. On October 8, 1980, following the withdrawal of the antidumping complaints, the TPM was reinstated with 12% higher trigger prices.

This second TPM proved to be unsatisfactory to the steel industry. In January 1982 seven domestic steel firms filed numerous antidumping and countervailing duty complaints against steel firms located mostly in Europe, but also in Asia and

[23] All market power statistics reported in Table III are greater than zero at the 1% level of significance. Since there is no evidence of autocorrelation in the residuals for LaFarge (DW = 1.7086, p = 0.07) or Southdown (DW = 1.7228, p = 0.0728) at the 95% level of confidence, OLS was used in estimating Equation (1) for both firms. If an autocorrelation-correction procedure were used, the market power results in Table III still obtain.

[24] This overview of the protection-seeking activities of the steel industry is based upon information provided in Lenway and Schuler (1991), de Melo and Tarr (1992), and various ITC documents.

South America. The petitions against firms from EC countries were withdrawn after a VER was negotiated limiting them to 5.5% of the U.S. market. This VER took effect on November 1, 1982, and was to run until December 31, 1985. U.S. steel producers continued to pursue unfair trade actions against non-EC exporters. By November 1985, 15 VERs had been negotiated covering 80% of U.S. steel imports, and were to last for a five-year period.

On July 25, 1989 President Bush announced a Steel Trade Liberalization Program under which the existing VERs were extended until March 31, 1992. On March 30, 1992, most foreign companies' limitations of steel exports to the U.S. expired. In June 1992 twelve major U.S. steel producers (later joined by the United Steelworkers union) responded by filing antidumping petitions against 20 countries (and countervailing duty petitions against 13 countries). Subsequent to these filings, Commerce issued a final affirmative LTFV determination against 19 of the countries with estimated dumping margins as high as 109%. The ITC, however, found that only half of the cases in which sales were at LTFV were injurious to the domestic steel injury.

Equation (1) was estimated for several of the leading U.S. steel producers that were active in filing antidumping petitions during the 1980s: Armco Incorporated, Bethlehem Steel Corporation, and LTV Corporation.[25] Armco is a major U.S. integrated steel producer manufacturing stainless steel and steel products, and processed carbon steel sheet and strip. Bethlehem is the second largest domestic integrated steel producer. LTV, the third largest U.S. steel company, is a fully integrated steel producer and one of the largest suppliers of hot and cold rolled steel sheet for the automotive and consumer durable markets. The company recently regained its financial viability as it had been operating under Chapter 11 of the U.S. Bankruptcy Code since 1986. These three firms are the only steel companies with enough available historical data to allow for the implementation of the market power test.[26] The data are from January 1978 through December 1989 (48 observations). The structural break during this period occurs in January 1983. This is so because it was in November 1982 that the VER with EC steel producers, the majority of the defendants in the unfair trade complaints, was negotiated. Estimates of the market power statistic before and after the antidumping petition was withdrawn are presented in Table IV.[27]

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[25] The main line of business for the plaintiffs in this investigation is Blast Furnaces and Steel Mills as classified under SIC 3312.

[26] The most active protection-seeking steel firm during the 1980s was U.S. Steel, the nation's largest integrated steelmaker. In 1986 it changed its name from U.S. Steel to USX Corporation to reflect its move into the energy business due to the 1982 acquisition of Marathon Oil Company. During 1982–1989, however, financial information was reported only for USX as a whole with no data specific to U.S. Steel.

[27] All market power statistics reported in Table IV are greater than zero at the 1% level of significance. Since there is no evidence of autocorrelation in the residuals for Armco (DW = 1.8179, p = 0.089) or Bethlehem (DW = 1.832, p = 0.1003) at the 95% level of confidence, OLS was used in estimating Equation (1) for both firms. There was some evidence of positive serial correlation in the

Table IV. Pre- and post petition withdrawal market power statistic: The Steel Industry

Firm	Pre-resolution (January 1978–December 1982)	Post-resolution (January 1983–December 1989)	T-test of difference[a]
Armco Steel	0.0647	0.0634	−0.06
Bethlehem Steel	0.4472	0.8494	19.97
LTV Corporation	0.1463	0.1026	−3.48

[a] The t-statistic for Armco has a p-value of 0.4769 (one-tail). The t-statistic for Bethlehem has a p-value of 0.0000 (one-tail). The t-statistic for LTV has a p-value of 0.0008 (one-tail). A t-test, conducted for all three firms to test the null hypothesis that the difference between the post-resolution and pre-resolution market power statistic is less than or equal to zero against the alternative that this difference is greater than zero, indicates that only Bethlehem's market power statistic significantly increased after the petition was withdrawn.

Two of the steel companies experienced a decrease in market power subsequent to the petition withdrawal (although only LTV's is statistically significant). The fall in LTV's market power most likely is explained by its financial troubles (largely unrelated to imports) which led it into bankruptcy in 1986. Only Bethlehem Steel experienced a significant increase in market power after petition withdrawal.

The information in Table IV provides at best mixed evidence in support of Prusa's (1990, 1992) contention that U.S. firms withdraw antidumping petitions only after achieving some sort of collusive arrangement with the foreign defendants. Why might this be? The likely reason is that the industry selected for the case study of petition withdrawal is not a good choice primarily because it may be in decline for reasons other than the "dumping" of foreign steel. In fact, Prusa and Hansen (1993) provide strong evidence for this occurrence. They find that industries using either the unfair trade laws or the escape clause to secure protection often are declining industries, and restraining foreign trade does not reverse this decline. The U.S. steel industry in the last two decades most likely fits into this category. Since declining industries are the ones most likely to seek administrative protection, they also are the ones most likely to exhibit injury and obtain protection (even though the injury may not be causally related to imports). So, even if firms are able to negotiate a favorable price/quantity revision with the defendants (either under the auspices of the U.S. government or privately), this may not translate into increased market power for firms in an industry declining for reasons unrelated to import penetration.

V. Conclusion

It was not until the Trade Agreement Act of 1979 that U.S. protection-seekers began to rely heavily on the antidumping statute. This paper has presented a

residuals for LTV (DW = 1.6036, p = 0.0193) and Equation (1) was estimated using a procedure to correct for this.

theoretical discussion and an empirical test of the anticompetitive nature of this law. An industrial organization framework is used to investigate the market power consequences (based upon the Lerner index) of U.S. firms seeking protection under this law. This is accomplished by employing a firm-level empirical test of market power.

The market power consequences are examined for each of the three possible resolutions of an antidumping investigation: petition accepted (and duties levied), petition rejected, or petition withdrawn. For each outcome an industry case study is presented and the market power test conducted. The results contained herein support the notion that U.S. firms receiving protection under the antidumping statute enhance their domestic market power, while petition denial diminished market power. The evidence is less clear for plaintiffs that withdrew their antidumping petition prior to the final resolution of the investigation.

Appendix A. Descriptive Statistics of Firm-Level Variables

1. The Semiconductor Industry

Advanced Micro Devices: January 1980–December 1991; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.2920	−0.2970	0.0249	0.1278
MS	0.0860	0.0318	0.0553	0.0135
KSR	6.5800	1.5700	4.1794	1.4862
ISR	0.0280	0.0050	0.0148	0.0062
NSR	0.2982	−0.0880	0.0584	0.0901

Intel: January 1980–December 1991; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.2790	−0.3400	0.1282	0.1263
MS	0.2410	0.0903	0.1441	0.0462
KSR	5.900	1.6600	3.6085	0.8965
ISR	0.0370	0.0050	0.0203	0.0087
NSR	0.4776	−0.0160	0.0741	0.1217

Texas Instruments: January 1980–December 1991; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.1000	−0.3360	0.0284	0.0753
MS	0.6770	0.3240	0.4340	0.0784
KSR	5.0100	1.4600	3.3535	1.0216
ISR	0.0123	0.0020	0.0070	0.0030
NSR	0.1930	0.0000	0.0203	0.0446

2. The Tapered Roller Bearings Industry

The Timken Company: January 1982–December 1992; N = 44

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.1180	−0.4680	−0.0003	0.0969
MS	0.9320	0.2050	0.5719	0.3163
KSR	7.950	3.230	5.7682	0.8758
ISR	0.0270	0.0010	0.0144	0.0067
NSR	0.2350	−0.0130	0.0137	0.0367

3. The Steel Industry

Armco: January 1978–December 1989; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.1900	−0.5160	0.0012	0.1306
MS	0.2120	0.0440	0.1144	0.0402
KSR	15.230	2.5000	5.6858	3.0237
ISR	0.0450	0.0078	0.0262	0.0123
NSR	0.2030	−0.0120	0.0095	0.0311

Bethlehem: January 1978–December 1989; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.2080	−1.0270	−0.0114	0.1641
MS	0.2080	0.1210	0.1546	0.0249
KSR	12.200	4.0900	8.0467	2.5723
ISR	0.0350	0.0077	0.0173	0.0070
NSR	0.1630	0.0000	0.0124	0.0338

LTV: January 1978–December 1989; N = 48

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.0814	−1.2010	−0.0533	0.2172
MS	0.2700	0.1180	0.1827	0.0407
KSR	5.0400	1.3400	2.9133	0.9628
ISR	0.0500	0.0000	0.0211	0.0145
NSR	0.4490	−0.3530	0.0122	0.0847

4. The Hydraulic Cement Industry

LaFarge: January 1983–December 1992; N = 40

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.1970	−0.4270	0.0176	0.1388
MS	0.3800	0.1230	0.2315	0.0699
KSR	8.560	2.8200	4.7370	1.5302
ISR	0.0900	0.0140	0.0345	0.0161
NSR	0.3610	0.0000	0.0392	0.0698

Southdown: January 1983–December 1992; N = 40

Variable	Maximum	Minimum	Mean	St. deviation
PCM	0.5390	−0.5580	0.0512	0.1730
MS	0.4660	0.1620	0.2485	0.0683
KSR	11.020	3.8400	7.1570	1.7116
ISR	0.1140	0.0280	0.0717	0.0202
NSR	0.7380	0.0000	0.4825	0.1443

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