Firms' Strategies and the Effects of Antidumping Policy

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Using the antidumping case of the United States SRAM imports from Taiwan, this paper investigates the relationship between firms' strategic interaction and the effects of antidumping policy in an international oligopoly industry, First, based on the theoretical framework of Reitzes (1993), the effects of antidumping policy on firms' profitability under price competition as well as quantity competition are investigated. Second, the event study method is applied to examine the impact of antidumping policy on the rates of return on the firms' common stock. Empirical results show that the firms of importing country can benefit from the protective effect of an antidumping policy. Contrary to general beliefs, however, under some circumstances, the firms of exporting country not only might not be hurt, but can gain from it, depending on the firms' strategies. Empirical evidence also indicates that the strategic behavior between SRAM firms seems to be more consistent with what suggested in a price-competition model.

Keywords： antidumping, strategic trade policy, event study, SRAM
JEL classification: F14, L61

1. Introduction

Since the 1980s, antidumping cases have been increasing considerably around the world. Taiwan has been one of the most affected countries. One of the distinctive features of antidumping cases is that they often occurred in international oligopoly industries, such as steel, chemical and hi-tech industries. Since strategic considerations are important in firms' management in an oligopoly industry, the following interesting questions naturally arise: Is there any relationship between dumping behavior and firms' strategies? Is there any connection between the nature of strategic interaction among competing firms and the effects of antidumping policy? These important issues have attracted quite a few theoretical and empirical investigations.

The dumping problem in the international markets has been examined by economists as early as Viner (1923). Viner argued that dumping is a phenomenon of price discrimination by a firm with some market power. However, the relation between firms' strategies and dumping had not been discussed extensively until the 1980s when the oligopoly theory started to show much progress. The empirical investigations of dumping problem have also emerged enormously since the early 1980s, but most of them focused on the cases in the United States and European countries.[1]

The purpose of this paper is to investigate the effects of antidumping policy, using the antidumping case of SRAM (static random access memory) imports of the United States from Taiwan. Micron Technology, Inc. of the U.S. filed dumping charges in 1997 with its

[1] See, for instance, Either and Fisher (1987), Webb (1992), Reitzes (1993), Prusa (1992), Hartigan , Perry and Kamma (1989), Harper and Huth (1997) and Hughes, Lenway and Rayburn (1997), Chen and Chen (1999).

Department of Commerce (USDOC, hereafter) and International Trade Commission (USITC, hereafter), alleging that Taiwanese firms sold SRAM at less than fair value (LTFV, hereafter) in the market of the United States. This was the first time that Taiwanese firms in the semiconductor industry were charged to have dumped their products in the international market at unfair prices. International production SRAM was highly concentrated. A few large firms in the United States, Japan, South Korea and Taiwan together accounted for dominant shares of world SRAM market. Given its oligopolistic market structure, it seems to be a ideal target for testing the theory of strategic trade policy. Moreover, one of the distinctive features of Taiwanese firms in the semiconductor industry is that firms adopt different operating strategies. Some domestic firms are OEMs, whereas others manufacture and market their products under their own brands. How is the difference in firms' strategies related to the impact of antidumping policy? This is also an important issue we will pursue in this paper.

The rest of the paper is organized as follows. Section 2 provides a brief review of the U.S. antidumping law and the antidumping case of U.S. imports of SRAM from Taiwan. In Section 3, the dynamic oligopoly model of Reitzes's (1993) is used to examine the effects of an antidumping policy on the profitability of firms Section 4 presents our empirical model and the estimation method. The empirical results are discussed in Section 5. Final section provides brief concluding remarks.

2. A brief review of the U.S. antidumping law and the SRAM case

In this section, the implementation procedure of the U.S. antidumping law and the

history of the antidumping case of the U.S. imports from Taiwan are summarized.

In accordance with the current U.S. antidumping law, an antidumping petition is filed with the USDOC. Petitions can be either initiated by interested parties on behalf of the industry, or self-initiated by the USDOC. The USDOC has 20 days to determine whether the petition is acceptable and if so, to institute a preliminary investigation to determine whether the subject imports were sold at LTFV.

If the petition determination is affirmative, the USDOC must notify the USITC to institute a preliminary investigation to determine whether the domestic industry is materially injured, or is threatened with material injury, or the establishment of the industry in the U.S. is materially retarded. The USITC has 45 days to implement its preliminary investigation. If the USITC's preliminary determination is affirmative, the USDOC will continue to proceed its LTFV investigation, and within 160 days of the initial filing of the petition the USDOC must make a preliminary determination whether there is reasonable evidence that the subject imports were sold at LTFV. If the determination is affirmative, the USDOC must estimate the "dumping margin," and require the subject importers to post a cash deposit or bond to cover the estimated dumping duties payable.

After the USDOC's preliminary investigation and before the USITC's final determination, the investigation can be terminated or suspended. Termination occurs only if the petition is withdrawn by the petitioner. Termination usually results from agreements reached by the domestic industry and subject importers. Suspension occurs if subject importers reach an agreement with the USDOC to stop selling at LTFV to the U.S. market, cease exporting to the U.S. market completely, or eliminate the injurious effect of their

actions.

If the antidumping case is neither terminated nor suspended, then the USDOC must institute field study and hold hearing to make a final determination whether subject imports is sold at LTFV and, if so, to estimate “dumping margins” within 75 days of its preliminary determination. Provided that the USDOC’s preliminary and final determinations are affirmative, then the USITC must make its final determination of injury within 45 days of the USDOC’s final determination. If the USITC’s final determination is also affirmative, the USDOC has 7 days within which to instruct customs officers to assess the appropriate antidumping duties (see Table 1). Within 30 days after the publication of the USITC’s final determination, subject importers can appeal to the U.S. Court of International Trade (USCIT, hereafter) for a review to investigate if antidumping determinations are appropriate.

Micron Technology Inc. of the U.S. filed a dumping charge against the SRAM manufacturers in Taiwan and South Korea, in February 1997, alleging that those firms sold their products to the United States at LTFV. The subject imports were high-speed SRAM which were mainly used in personal computers. Major producing countries of SRAM in the 1990s included Japan, United States, South Korea and Taiwan. Japan was the largest producer of SRAM, accounting for more than 40% of world market South Korea had a share of the world market as high as 15%. In 1995 and 1996, Taiwan accounted for 13.1% and 8.9% of the world SRAM production, respectively. Most of the SRAM output in Japan and South Korea was of low-speed while about 80% of Taiwan’s SRAM output was of high-speed. As a result, the manufacturers of SRAM in Taiwan were the main targets in this

antidumping case (see Tables 2 and 3).

The major Taiwanese exporters of SRAM to the United States included Winbond Electronics Corporation, United Microelectronics Corporation (UMC), Taiwan Semiconductor Manufacturing Company (TSMC) and others. The top three exporters accounted for 98%, but they adopted different operating strategies.. Winbond manufactured and sold all of its products under its own brand. Only part of UMC's products were sold under its own brand. The UMC also manufactured OEM products. As for TSMC, all of its products were OEM products.

In its preliminary investigation completed in April 1997, the USITC determined that the SRAM imports from Taiwan and South Korea were detrimental to the American industry. Accordingly, the USDOC decided in February 1998 to impose antidumping duties on the subject Taiwanese and Korean firms, the rates ranging from 7.59% to 113.85%. The USITC completed its final investigation on April 1, 1998 and uphold its original ruling. As a result, the USDOC enforced the antidumping duties on April 18, 1998 (see Table 4)

The TSIA (Taiwan Semiconductor Industry Association), on behalf of the subject Taiwanese SRAM firms appealed to the U.S. Court of International Trade (USCIT) in May 1998. The USCIT returned the dumping charge case to the USITC for re-examination in July 1999 and the USITC kept its original judgment. The TSIA then filed another appeal to the USCIT, and the USCIT sent the case to the USITC for retrial in April 2000. This time, the USITC reversed its original decision thorough a vote of 4:1 on July 12, 2002.

3. Theoretical Considerations

The theoretical framework of Rietzes (1993) is employed in this paper. Since Rietze (1993) focused on the overall welfare effects of an antidumping policy without elaborating the impact of the policy on firms' profitability, this section will fill in this gap by providing detailed comparative static results in this respect.

3.1 Basic Assumptions

Consider a three-stage two-period duopoly model. There are two countries, Home and Foreign , having a single firm producing homogeneous products. The game starts with a commitment by the policy makers in the Home country, who chooses the extent to which she will punish dumping in the first period. The policy-maker select the probability (θ) that she will punish dumping. After θ is announced, firms simultaneously choose output (or price) for the first period. If dumping is punished, duties are not imposed until the second period, thus the impact in the first period illustrate the strategic behavior induced by the threat of antidumping enforcement. The duties are imposed prior to the output (or price) choices chosen by the firms simultaneously for the second period, and the duties are set equal to the dumping margin (i.e., the price differential between the home and foreign markets).

Suppose that the Foreign firm and the Home firm compete in the Home markets while the Foreign firm is a monopolist in its local market. Since the two markets are separated and the Home markets are more competitive than the Foreign market, the Foreign firm's export might be lower than its local price. This type of price discrimination is usually treated as dumping in many antidumping statues. Because different assumptions about the

firms' strategic behavior yield vastly different results, quantity competition (Cournot case) and price competition (Bertand case) are considered, respectively, in the following discussion.

3.2 The Cournot case

Suppose that the goods produced by both firms are perfect substitutes. Each firm face a constant marginal cost. In period t, the Home firm's profits are

$$\pi_t = [p_t(h_t + H_t) - c_t]h_t, \quad t = 1, 2$$

where p_t is the inverse demand function of the Home market; h_t and H_t are the Home firm's and Foreign firm's sales in the Home market, respectively; and c_t is the constant average cost as well as marginal cost of Home firm.

The Foreign firm's export profits in periods 1 and 2 are

$$\prod_1 = \left[p_1(h_1 + H_1) - C_1 \right] H_1,$$

$$\prod_2 = \left[p_2(h_2 + H_2) - C_2 - I_2 s_1 \right] H_2,$$

where C is the constant average cost and marginal cost of Foreign firm; H is the Foreign firm's exports to the Home market; I_2 is indicator function: $I_2 = 1$ if dumping in period 1 is punished by the imposition of antidumping duties and $I_2 = 0$ if dumping is not punished; s_1 is the dumping margin which is assumed to be the price differential between Foreign firm's local sales and exports, that is,

$$s_1 = s_1(F_1, h_1, H_1) = \max\{0, P_1(F_1) - p_1(h_1 + H_1)\}.$$

where P_t is the inverse demand function of the Foreign market and F_t is the Foreign

firm's sale in its local market.

The Foreign firm's profits in its local market in period t are

$$\prod_t^* = [P_t(F_t) - C_t]F_t, \quad t = 1, 2$$

Under quantity competition, it can be shown that, when dumping in the first period is subsequently punished in the second period, an increase in the first–period dumping margin reduces the Foreign firm's exports in the second period, which induces the Home firm to expand output in that period. As a result, the Home firm's profits in the second period will be increased while the profits of Foreign firm will be decreased. Hence, the Home country's commitment to an antidumping policy provides incentive for the Home firm to increase output and the Foreign firm to reduce exports and increase local sales in the first period. Because the Home firm produces additional output at marginal cost which it then sells at a price in excess of that cost, the profits of the firm in the first period will also increase. In contrast, the overall profits of Foreign firm will decrease because the decline in export profits, arising from the policy induced expansion in the Home firm's output, cannot be compensated by the consequently increase in profits of its local sales. Moreover, in the circumstances when firms' products are imperfect substitutes, the above-mentioned results still hold. The comparative static results under quantity competition are summarized in Table 5.

3.3 The Bertrand case

If the firms set prices instead of quantities, an antidumping policy will produce rather different effects. With Bertrand behavior and perfectly substitutable products, a given firms have incentive to undercut its rival's price whenever that price exceeds its marginal

cost. If one firm has a cost advantage over another firm, the equilibrium price will be equal to the marginal cost of the high-cost firm and the low-cost serves the whole market. When both firms face the same marginal cost, the equilibrium price will be equal to that marginal cost, but the firms' market shares will be indeterminate.

The more interesting case is when firms produce imperfect substitutes and engage in price competition. It can be shown that in this case an antidumping policy induces the foreign firm to raise its export price and lower its local price in the first period with a view to reducing any future antidumping duties. Since, under typical assumptions, prices are strategic complements, the increase in the foreign export price causes the domestic firm to raise its price in the first period. This reaction by the Home firm will raise the Foreign firm's export profits in the first period. This result contrasts with that obtained in the quantity competition case where an antidumping policy creates a strategic incentive for the Home firm to expand its first-period output and consequently diminish Foreign export profits. The comparative static results under quantity competition are summarized in Table 6.

4. Empirical Model

The event study method is employed in our empirical analysis. This method measure the impact of a specific event on the value of the firm. The basic premise of the method is that capital market is efficient so that security prices will reflect any available information and adjust immediately, Thus, the effects of an event will be reflected in security prices. One of the advantages to adopt this method is that a measure of the event's economic impact can

be estimated using security prices observed over a relatively short period.[2]

Typically, the first step of an event study analysis to estimate the expected return on the firms' stocks prior to the event. The commonly applied empirical model in this respect is market model. [3]Let R_{it} denote the return on the stocks of i firm at time t, R_{mt} denote the return on market portfolio at time t. Suppose that the relationship between R_{it} and R_{mt} can be represented in the following equation:

$$R_i = \alpha_i + \beta_i R_{mt} + \mu_{it}, \quad i = 1 \cdots N$$

where α and β are unknown parameters, μ are stochastic disturbances. In this equation, R_{mt} represents macroeconomic factors affecting the returns on the stocks of all firms, and its parameter β_i can be interpreted as indicating the market sensitivity of the stocks of i firm., whereas α_i indicates the effects of firm-specific factors. [4]

The above equation is estimated with the time series sample data prior to the event, and then used to forecasted the returns during the event period. The differences between actual returns and forecasted returns during the period is interpreted as abnormal returns that can be attributed to the event. The average of abnormal returns over all sample firms is then calculated and its statistical significance is tested so as to determine if there is any evidence that the event has an significant impact.[5]

One of the drawbacks of the previous procedure is that if the effects of the event on different firms have opposite directions so that the abnormal returns have different signs,

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[2] See MacKinlay (1997) for a detailed discussion of this method.
[3] See Armitage (1995), p. 46.
[4] See Fama (1976), pp. 76-77.
[5] See Campbell et al, (1997), Ch. 4.

then the power of this test will be very limited. Because of the considerable differences in the strategies of Taiwanese SRAM firms, it is highly probable that the effects of antidumping on different firms will vary vastly. To get rid of this problem, an alternative procedure is to establish a multivariate regression model as follows[6]：

$$R_{it} = \alpha_i + \beta_i R_{mt} + \sum_{j=1}^{J} \gamma_{ij} D_{jt} + \mu_{it}, \quad i = 1 \cdots N$$

where J denotes the number of events during the whole period, D_{ji} are dummy variables. D_{jt} equals to 1 when J^{th} event appears at time t, and D_{jt} equals to 0 for any other time period. The unknown parameters γ_{jt} indicate the abnormal returns resulting from the emergence of J^{th} event.

In addition to the macroeconomic variable, the returns might be sensitive to industry-specific factors. Hence, the industry index of stock returns R_{et} is also included as an explanatory variable. It is also possible that the events might also cause the slope parameters to change, another dummy variable D_0 is thus added to test their constancy. The regression equation used in this paper is as follows：

$$R_{it} = \alpha_{i0} + \beta_{i0} R_{mt} + \beta_{i1} R_{mt} D_{0t} + \delta_{i0} R_{et} + \delta_{i1} R_{et} D_{0t} + \sum_{j=1}^{J} \gamma_{ij} D_{jt} + \mu_{it}, \quad i = 1 \cdots N$$

where D_0 is equal to 1 for the period from the emergence of first event to the end of the last event and is equal to 0 for the other period. Another five dummies are included to represent important events during the process of the case: petition filing, USITC's preliminary determination, USDOC's preliminary determination, and USDOC's final

[6] See Binder (1995, 1998) for details.

determination, and USITC's final determination.

Usually the exact time when the event occurs is not clear-cut. Before the formal announcement of an event, this information might have already released to some agents in the market. The regulation codes of government or industry association might also result in time lag for the event to have exerted full impact. To take into account this uncertainty, sometime D_{jt} will cover the period starting a few days prior to the announcement and a few days after that event (see Table 7 for details).

5. Data and Empirical results

The definition of the explained variables and explanatory variables are listed in Table 7. The weighted index of Taiwan Stock Exchange and Standard and Pool's 500 index are used as proxies for rates of returns on market portfolio in Taiwan stock market and the U.S. stock market, respectively. The change rates of Electronics Industry Index of Taiwan Stock Exchange and Philadelphia's Semiconductor Index are used to control for the industry-specific effects in Taiwan and the U.S., respectively. The data on the rates of return on the common stocks of the pertinent firms are collected from the database of the computer center of the Ministry of Education of Taiwan and the New York Stock Exchange, respectively.

Before we provide hypothesis tests on the parameters, several diagnostic testing are implemented to ensure the appropriateness of our empirical model. The Augmented Dickey-Fuller (ADF) tests indicate that the hypothesis that each variable is I (1) process is rejected at the 5% significance level, which implies that all variables are stationery. The likelihood ratio test is employed to test if the error terms of the models follow GARCH

(Generalized Autoregressive Conditional Heterogeneity) process. It is found that the appropriate model for Micron is GARCH (2,1) while the appropriate models for other firms are GARCH(1,1). [7]

The empirical results summarized in Table 8. The results indicate that during the petition filing stage, all the rates of return of importing competing firm or exporting firms show positive abnormal return, which implies that exporting firm as well as petitioners can gain from the antidumping policy at the first stage when the antidumping duties are not yet imposed. These results are contrary to the prediction of the quantity-competition model, but are consistent with what suggested in the price-competition model.

At the second stage, the impacts on the firms are rather different. In general, the affirmative determinations of injury or dumping tend to have a positive effect on TSMC and negative effects on Winbond and UMC, while the impact on Micron is mixed. Because the coefficients of $D_1,\ldots,D_4$, represent the effects of the new information on the firms, in order to evaluate the total impact of the antidumping policy, it might be more informative to cumulate these effects. The cumulated effects are summarized in Table 9.

The results in Table 9 indicate that the antidumping case has exerted similar effects on Micron and TSMC. The cumulated effects at the second stage and the total effects of the case were positive. Since TSMC manufactured OEM products, it seemed that it also benefited from the protective effect of the antidumping policy. The cumulated effects at the second stage on Winbond and UMC were negative, and total effect on Winbond was positive, but not statistically significant whereas the total effect on UMC was negative, but

[7] See Bollerslev et al. (1992) for detailed discussion of GARCH models.

also not statistically significant. These results were also consistent with the prediction of the price-competition model.

6. Concluding remarks

Using the antidumping case of the United States SRAM imports from Taiwan, this paper investigates the relationship between firms' strategic interaction and the effects of antidumping policy in an international oligopoly industry, First, based on the theoretical framework of Reitzes (1993), the effects of antidumping policy on firms' profitability under price competition as well as quantity competition are investigated. Second, the capital market event study method is applied to examine the impact of antidumping policy on the rates of return on the firms' common stock.

Our empirical results indicate that the firms of importing country can benefit from the protective effect of an antidumping policy. This result supports the argument of strategic trade theory advanced by Brander and Spencer (1984). Contrary to general beliefs, however, under some circumstances, the firms of exporting country not only might not be hurt by the antidumping policy, but also can gain from it. It depends crucially on the firms' strategies. In particular, an OEM exporting firm seems to gain protective effect of an antidumping policy of the importing countries. Besides, our empirical evidence indicates that the strategic behavior between SRAM firms seems to be more consistent with what suggested in a price-competition model.

References

Chen, Kun-Ming and Tsai-Chia Chen (1999), "Antidumping and Stock Prices: The Case of Taiwan's Iron and Steel Industry," *Papers and Proceedings of Taiwan Economic Association*, 71-101.

Shen-Fu Chen (1997), "A Study on the antidumping case of SRAM," *Semi-conductor Industry Information Sharing service*,

Armitage, S. (1995), "Event Study Methods and Evidence on Their Performance," *Journal of Economic Surveys*, 8, 25-52.

Binder, J. (1985), "On the use of the multivariate regression model in event studies," *Journal of Accounting Research*, 23: 370-383.

Binder, J. (1998), "The Event Study Methodology since 1969," *Review of Quantitative Finance and Accounting*, 11, 111-137.

Bollerslev, T., R.Y. Chou, and K. F. Kroner (1992), "ARCH Modeling in Finance," *Journal of Econometrics*, 52, 5-59.

Bollerslev, T., and Jeffrey M. Wooldridge (1992), "Quasi-Maximum Likelihood Estimation and Inference in Dynamic Modles with Time Varying Covariances," *Econometric Review*, 11, 143-172.

Brander, J. A. and B. J. Spencer (1984), "Tariff Protection and Imperfect Competition," in H. Kierzkowski, (ed.), *Monopolistic Competition and International Trade,* 194-206, Oxford: Clarendon Press.

Campbell, J. Y., A. W. Lo, and A. C. MacKinlay (1997), *The Econometrics of Financial Markets*, New Jersey: Princeton University Press.

Ethier, W. J. and R. D. Fischer (1987), "The New Protectionism," *Journal of International Economic Integration*, 2, 1-11.

Fama, E. F. (1976), *Foundations of Finance*, N.Y.: Basic Books.

Harper, R. K. and W. L. Huth (1997), "Japanese Equity Market Response to U.S. Administered Decisions," *Managerial and Decision Economics*, 18, 11-26.

Hartigan, J. C., P. R. Perry, and S. Kamma (1989), "The Injury Determination Category and the Value of Relief from Dumping," *Review of Economics and Statistics*, 71, 183-186.

Hughes, J. S., S. Lenway, and J. Rayburn (1997), "Stock Price Effects of U.S. Trade Policy Responses to Japanese Trading Practices in Semi-conductors," *Canadian Journal of Economics*, 30, 922-942.

MacKinlay, A. Craig (1997),, “Event Studies in Economics and Finance,” *Journal of Economic Literature*, 35, 13-39.

Prusa, T. J. (1992), “Why are so Many Antidumping Petition Withdrawn?,” *Journal of International Economics* , 33, 1-20.

Reitzes, J. D. (1993), “Antidumping Policy,” *International Economic Review*, 34, 745-763.

Staiger, Robert W., and Frank A. Wolak (1994), “Measuring Industry-Specific Protection: Antidumping in the United States,” *Brookings Papers on Economic Activity: Microeconomics*, 51:103.

Viner, J. (1966), *Dumping: A Problem in International Trade,* N.Y.: Augustus M. Kelley.

Webb, M. (1992), “The Ambiguous Consequences of Anti-dumping Laws,” Economic Inquiry, 30, 437-448.

Table 1 The investigation schedule of antidumping in the United States

Schedule	Investigations
0 day	* file antidumping petition
20 days	* DOC determines whether to institute an investigate or not
45 days	* USITC completes preliminary investigation of industry injury
46 days	* DOC distributes questionnaires
76 days	* The deadline for DOC to collect the questionnaires
160 days	* DOC completes preliminary investigation and announces dumping margins
170 days	* DOC implements investigation in person
190 days	* DOC announces the results of investigation in person
200 days	* Hearing to be held by DOC
235 days	* DOC announces its determination of final investigation of dumping and dumping margins
280 days	* USITC announces its determination of final investigation of industry injury
287 days	* DOC announces antidumping order and the antidumping duties are put in effect

Notes: See Staiger and Walok (1994), pp. 53-58, for details.

Table 2 Market shares of major producing countries of SRAM

Year	Japan	U.S.	South Korea	Taiwan
1993	60.1 %	22.7 %	11.4 %	5.0 %
1994	55.0 %	23.6 %	13.5 %	7.3 %
1995	43.0 %	29.4 %	13.8 %	13.1 %
1996	48.8 %	26.2 %	15.5 %	8.9 %

Source: Shen-Fu Chen (1997), "A Study on the antidumping case of SRAM," *Semi-conductor Industry Information Sharing service*, 2 。

Table 3 Exports and domestic sales ratios of Taiwan's SRAM

year	High-speed SRAM		Low-speed SRAM	
	Domestic sales	Exports	Domestic sales	Exports
1993	70.5 %	29.5 %	39.7 %	60.3 %
1994	72.2 %	27.8 %	56.6 %	43.4 %
1995	70.9 %	29.1 %	41.7 %	58.3 %
1996	76.9 %	23.1 %	41.1 %	58.9 %

Source: same as Table 2.

Table 4 Dumping margins in the U.S. v. Taiwan and South Korea SRAM case

Subject firm	Preliminary determination (a)	Final determination (b)	Change in dumping margins (b)-(a)
Winbond Electronics	94.10 %	102.88%	+ 8.78%
UMC	63.36	93.87	+30.51
Other Taiwanese firms	41.30	41.98	+ 0.68
Non-responding Taiwanese firms	113.85	113.85	0
Samsung	1.59	0	- 1.59
Hyundai	3.38	5.08	+ 1.70
LG	55.36	55.36	0
Other Korean firms	3.38	5.08	+ 1.70
ICSI	10.96	7.59	- 3.37
Anwin	59.06	50.58	- 8.48

Notes：Other Taiwanese firms include OEM products of Taiwan Semiconductor Manufacturing Co., and United Microelectronics Corp., and Mosel-Vitelic, Etron Technology, Utron Technology, et al.

Table 5 The effects of antidumping policy under the assumption of quantity competition

	Home firms' profits	Foreign firms' profits		
		Exports	Domestic sales	Total
Antidumping threat	+	—	0	—
Antidumping punishment	+	—	?	—
Total effect	+	—	?	—

Note: Under quantity competition, the qualitative results in the case of differentiated products are the same as the case of homogeneous products.

Table 6 The effects of antidumping policy under the assumptions of price competition and differentiated products

	Home firms' profits	Foreign firms' profits		
		Exports	Domestic sales	Total
Antidumping threat	+	+	—	?
Antidumping punishment	+	—	?	—
Total effect	+	?	?	?

Note: Under price competition, the qualitative results in the case of homogeneous products are rather different from the case of differentiated products. In the former case, the results depend on the cost differences of the firms.

Table 7 Definition of Variables and Data Sources

Variable	Definition	Sources of Data
R_i	Rates of return on the common stock of i^{th} firm.	1. Taiwan: Ministry of Education, Computer Center, database of AEMOS. 2. U.S.: New York Stock Exchange.
R_m	Rates of return on the stocks of electronics industry. The weighted index of Taiwan Stock Exchange and Standard and Pool's 500 index are used as proxies for Taiwan capital market and the U.S. capital market, respectively.	1. Taiwan: Ministry of Education, Computer Center, database of AEMOS. 2. U.S.: New York Stock Exchange.
R_e	Rates of return on the market portfolio. The Electronics Industry Index of Taiwan Stock Exchange and Philadelphia's Semiconductor Index are used as proxies for Taiwan and the U.S., respectively.	1. Taiwan: Ministry of Education, Computer Center, database of AEMOS. 2. . U.S.: New York Stock Exchange.
D_0	Dummy variable for the entire period of the case; its value is one for the period 3 (or 5) days before the petition filing and 3 (or 5) days after the imposition of antidumping duty, 0 otherwise..	
D_1	Petition dummy variable; its value is one for the period 3 (or 5) days before the petition filing and 3 (or 5) days after the filing, 0 otherwise..	
D_2	USITC's preliminary injury determination dummy variable; its value is one for the period 3 (or 5) days before the determination, 0 otherwise.	
D_3	USDOC's preliminary dumping determination dummy variable; its value is one for the period 3 (or 5) days before the determination, 0 otherwise.	
D_4	USDOC's final dumping determination dummy variable; its value is one for the period 3 (or 5) days before the determination, 0 otherwise.	
D_5	USITC's final injury determination dummy variable; its value is one for the period 3 (or 5) days before the determination, 0 otherwise.	

Table 8 Regression results of the U.S. v. Taiwan and South Korea SRAM antidumping case

Explained variable： R_i

Explanatory variables	Winbond	UMC	TSMC	Micron
Constant	-0.156	-0.112	-0.004	-0.143
	(-2.97)**	(-2.37)*	(-0.07)	(-1.36)
R_m	-0.003	0.144	0.150	-0.295
	(-0.04)	(1.75)	(1.09)	(-1.13)
$R_m * D_0$	0.012	-0.031	-0.490	0.094
	(0.08)	(-0.24)	(-2.92)**	(0.30)
Re	0.906	1.034	0.765	1.375
	(14.73)**	(20.70)**	(5.95)**	(12.92)**
$Re* D_0$	0.007	0.036	0.429	-0.301
	(0.07)	(0.48)	(3.08)**	(-2.145)*
D_1	3.170	0.740	0.877	2.721
	(2.21)*	(1.44)	(1.82)	(3.39)**
D_2	-1.547	-0.823	1.847	1.843
	(-1.07)	(-0.56)	(1.50)	(1.77)
D_3	-2.402	-0.246	0.600	-2.662
	(-5.36)**	(-0.28)	(2.10)**	(-1.09)
D_4	1.669	-1.324	0.436	-0.672
	(1.94)	(-0.91)	(0.91)	(-0.69)
D_5	-0.326	-0.829	-0.070	2.494
	(-0.77)	(-2.13)*	(-0.29)	(1.20)*
Variance equation				
Constant	0.285	0.111	0.050	3.126
	(3.67)**	(1.76)	(0.99)	(7.67)**
$ARCH(1)$	0.513	0.161	0.079	0.190
	(5.32)**	(3.24)**	(2.14)*	(5.98)**
$GARCH(1)$	0.513	0.799	0.898	0.795
	(8.19)**	(12.55)**	(16.05)**	(10.34)**
$GARCH(2)$				-0.330
				(-8.94)**
Sample size	620	620	475	551
Window period	3	3	5	3
R^2	0.603	0.745	0.759	0.474

Notes： The t statistics of the estimates are in parentheses where * and ** denote statistically significant at 5% and 1%, respectively. The heteroskedasticity consistent covariances of Bollerslev and Wooldridge (1992) are used.

Table 9 Cumulated effects of the U.S. v. Taiwan and South Korea SRAM antidumping case

Period	Winbond	UMC	TSMC	Micron
First stage: petition filing	3.170	0.740	0.877	2.721
	(4.88)*	(2.07)	(3.30)	(11.48)**
Second stage: Investigations	-2.606	-3.222	2.813	1.003
	(-2.12)	(-1.99)	(4.12)*	(0.08)
Total Effects	0.564	-2.482	3.690	3.724
	(0.06)	(1.12)	(6.30)*	(1.05)

Notes: The F-values of the estimates are in the parentheses where * and ** denote the estimates are statistically significant at 5% and 1% significance level, respectively.