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NEW PRODUCT INTRODUCTIONS, SHAREHOLDERS' WEALTH, AND FIRST-MOVER ADVANTAGES

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Abstract

This paper examines the impact of announcements of new product introductions on the stock price of pioneering firms and their rivals to determine whether first-movers gain long-term competitive advantages. An analysis of 108 radically new products indicates that pioneering firms earn statistically significant positive abnormal returns at announcement while their rivals suffer statistically significant negative abnormal returns. These wealth effects indicate that pioneering firms attain sustainable first-mover advantages, in general. The cross-sectional regression analysis of the abnormal returns reveals that the magnitude and/or durability of first-mover advantages are greater in fragmented but high-technology industries.

INTRODUCTION

Numerous theoretical studies in the industrial organization literature advance the notion that the first firm to enter the market for a specific product or service achieves permanent competitive advantages that include technological leadership, preemption of assets, and buyer switching costs (Lieberman and Montgomery, 1988). In a comprehensive literature review, Kerin, Varadarajan, and Peterson (1992) conclude that prior studies often find that first-movers enjoy larger market shares than late-entrants, which may be considered a support to the notion of first-mover advantages.

However, there may be counterbalancing first-mover disadvantages that include free-rider effects, resolution of technological and market uncertainty, shifts in technology or customer needs, and various types of organizational inertia (Lieberman and Montgomery, 1988). In addition, Kerin, Varadarajan, and Peterson (1992) and Lieberman and Montgomery (1988) argue that a closer inspection of prior empirical evidence reveals that it does not provide unequivocal support to the notion of first-mover advantages arising from entry order alone, for a number of reasons.

First, prior studies have a sample selection bias since they analyze the market shares of surviving entrants. Because a large portion of new products fail (Davidson, 1976), this limitation results in a "survivor bias" that raises concerns about the validity of the empirical findings on the order of entry and market share relationship (Glazer, 1985; Mitchell, 1991).

Second, economic profit is the appropriate measure of first-mover advantages. However, because disaggregate accounting data are rarely available publicly, market share is typically used as a surrogate measure. Yet, market share is not a good surrogate. A first-mover may enjoy a larger market share at the expense of a lower profit margin. Also, the timing of market share measurement is a problem because products continually enter and exit the marketplace.

Third, the relation between market entry order and market share is moderated by many firm- and industry-characteristics. For example, resources at the firm's disposal play an instrumental role in maintaining its first-mover advantages (Chandler, 1990). Also, the studies by Robinson (1988) and Robinson and Fornell (1985)

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suggest that first-mover advantages are more powerful in consumer-goods markets than in industrial-goods markets.

Finally, in addition to the above critical assessment of the literature by Kerin, Varadarajan, and Peterson (1992) and Lieberman and Montgomery (1988), market shares do not account for differences in the risk positions of early and late entrants across industries. Early entry may have an expected large payoff but may also entail substantial risks (Aaker and Day, 1986) resulting in a negative risk-adjusted economic return.

This paper has two objectives: first, to test the hypothesis that pioneering new products carries advantages over rival firms by overcoming the above cited methodological problems of prior studies; and second, to identify the product, firm, and industry characteristics that determine the magnitude and sustainability of first-mover advantages.[1] The results are useful in evaluating the merits of pioneer versus follower strategies while considering relevant product, firm, and industry characteristics.

Methodologically, this paper is different from previous research in three ways. First, the sample of this paper does not have a "survivor bias" since the analysis relates to the introduction phase of new products whose success is not yet determined. Second, this paper uses the abnormal stock return at announcements of new product introductions as the appropriate measure of first-mover advantages since it represents a risk-adjusted revision in investors' unbiased assessment of the present value of the firm's future economic profit.[2] Third, this paper tests the sustainability of first-mover advantages depending on the product, firm, and industry characteristics.

This paper is organized as follows. The following section reviews the empirical evidence on new product introductions and discusses the testable implications of first-mover advantages. Section 3 describes the procedure used to obtain the sample announcements and the data necessary to perform the cross-sectional analysis. Section 4 analyzes the wealth impact of the announcements on pioneering firms and their competitors, which determines whether first-movers enjoy competitive advantages. Section 5 presents the results of the cross-sectional analysis of the abnormal returns to pioneering firms and their rivals, which identifies the significant product, firm, and industry characteristics that attenuate or amplify first-mover advantages. Section 6 concludes the paper.

LITERATURE REVIEW AND TESTABLE IMPLICATIONS OF FIRST-MOVER ADVANTAGES

Empirical evidence on the stock market reaction to announcements of new product introductions indicates a generally positive response. Chaney and Devinney (1992) report a significant cumulative average abnormal return of 0.6% over a three-day period centered on the product announcement date in a sample of 1481 announcements. Similarly, Woolridge and Snow (1990) document a significant two-day abnormal return of 0.69% in a sample of 241 announcements.

Unfortunately, there is no published study on the intra-industry information transfers resulting from announcements of new product introductions.[3] Yet, it is important to examine the share-price response of rival firms. The above documented gains to pioneering firms cannot be regarded as support to the notion of first-mover advantages unless they are compared to those earned by rival firms.

The determination of the wealth impact of new product introductions on rivals of the pioneering firms is an empirical question since it cannot be predicted a priori. The announcements may convey conflicting signals about the present value of assets in place and the present value of growth opportunities of rival firms. Specifically, a new product may represent a competitive threat to an existing rival product and/or may identify a new profitable opportunity to free-ride.[4] In an informationally efficient capital market, the former signal should generate negative abnormal stock returns whereas the latter signal should generate positive abnormal stock returns to shareholders of rival firms. Therefore, the net wealth effect resulting from announcements of new product introductions on rival firms may be negative, zero, or positive.

If it pays to be a first-mover, it is reasonable to expect pioneers to earn higher abnormal stock returns than later entrants. Therefore, results showing that pioneering firms earn significantly larger abnormal returns than their rivals at the time of announcing a new product introduction support the notion of first-mover advantages. On the other hand, results showing that pioneering firms earn significantly smaller abnormal returns than their rivals support the opposite notion of first-mover disadvantages.

The above comparison of abnormal returns of pioneering firms to those of their competitors can demonstrate the presence of first-mover advantages or disadvantages, irrespective of inter-firm or inter-industry differences.

The conclusion would be useful for determining the merits of pioneer versus follower strategies, in general. However, an equally important (and perhaps more interesting) investigation is to identify significant factors that attenuate or amplify first-mover advantages since one particular strategy (of pioneering or following) may not be necessarily an optimal choice for all firms. For this reason, a cross-sectional regression analysis of the abnormal returns to pioneering firms and their rivals is conducted. A predictor variable that significantly increases the gains to pioneering firms and that increases the losses to rival firms would be an amplifier of first-mover advantages.

Four factors may be significant determinants of the magnitude and durability of first-mover advantages. The first factor is whether the product is a consumer good or an industrial good. The second factor is the pioneering firm's size relative to its competitors. The third factor is the industry concentration, and the fourth factor is the industry's technology level.

The product type may be a significant determinant of first-mover advantages since corporate buyers have a larger purchase volume than individual consumers. Therefore, their investment in information acquisition activities is justified (Lieberman and Montgomery, 1988). In addition, switching costs in industrial-goods markets often dissipate over time as buyers become more knowledgeable about competing products. On the other hand, in consumer-goods markets, buyer-perceived risk may lead to greater reliance on known brands or suppliers (Kerin, Varadarajan, and Peterson, 1992). Therefore, first-mover advantages may be more powerful in consumer-goods markets than industrial-goods markets.

The size of the pioneering firm relative to its rivals may influence the magnitude of firstmover advantages since larger firms have greater resources to commit in support of their new products and they are more able at appropriating (i.e., limiting the spillovers of) a technology they introduce (Ouchi and Bolton, 1988). Therefore, large firms may achieve more sustainable firstmover advantages when they introduce a new product.

Industry concentration may have a bearing on first-mover advantages since according to the Schumpeterian models of innovation, intra-industry technology diffusions are more likely in concentrated markets. To the extent R&D spillovers are good substitutes for own R&D (Spence, 1984), the ability of late-entrants to free-ride on the pioneering firm's investment reduces the magnitude and sustainability of the first-mover's competitive advantages. Therefore, first-mover advantages are inversely related to industry concentration.

Finally, the industry's technology level may be a determinant of first-mover advantages since imitation through reverse-engineering may be more difficult when the product is a high technological innovation. In addition, firms operating in high-technology industries are usually locked-into specialized assets which become not valuable upon a technological discontinuity, as their past learning is invalidated and their manufacturing systems are made obsolete. Therefore, first-mover advantages may be more significant in high-technology industries.

THE SAMPLE

Announcements of new product introductions are obtained from *the Wall Street Journal Index (WSJI)* by checking every entry under the heading "New Products" in the period 1975 through 1992. For every entry that pertains to a corporate announcement of a new product introduction, the full text in the *Wall Street Journal (WSJ)* is photocopied and read to determine its eligibility for inclusion in the sample. Screening criteria are as follows:

1. The announcement is an initial unanticipated new product introduction and not a plan to develop a new product, or the successful development of a technology, or a product update. The following are examples of announcements that are screened out due to this criterion:

   > Lotus Development Corp. plans to create a future version of its best-selling 1-2-3 spreadsheet to run with Microsoft Corp's next version of Windows... (*WSJ* 05/08/90)
   >
   > International Business Machines Corp. said it developed an experimental computer chip that can store more than one million bits of information... An IBM spokesman said that the chip still is in the experimental stage... (*WSJ* 04/24/84)
   >
   > Eastman Kodak Co., as expected, introduced an improved film for its disk cameras. Kodak said the film has better grain, sharpness and more contrast than the original disk film introduced with the cameras last year... (*WSJ* 09/29/83)

2. The announcement is made by a first-mover and not a follower which is trying to encroach on the leader's market share. Following are examples of announcements that are screened out due to this criterion:

> Kimberly-Clark Corp. said it is adding thin diapers to its Huggies disposable diaper line. The new product will compete with a thin diaper already offered by Procter and Gamble Co. ... (*WSJ* 07/16/86)

> Digital Equipment Corp., bidding to expand its personal-computer business, announced a free service program and introduced a more powerful version of its Rainbow personal computer. Digital a late entrant in the personal computer market with a line of products that weren't widely available until early this year; reiterated that it expects to sell 100,000 personal computers by year's end... Digital said the new Rainbow 100+ personal computer will include a 10-megabyte hard disk and will sell for $5,475. That is about the same price as a comparably equipped International Business Machines Corp. PC-XT, analysts said. Since the IBM product is in short supply, Digital may take business from IBM... Digital said its Rainbow products can be equipped to use many of the software programs developed for the IBM personal computers. (*WSJ* 09/28/83)

   This criterion and the preceding one are very important since they ensure that the firms making the sample announcements are truly first-movers creating totally new markets or exploiting major technological discontinuities that change the basis of competition in existing markets.

3. The announcing firm and at least one of its competitors have the needed data on the database of the Center for Research in Security Prices (CRSP) and on the annual industrial tape of COMPUSTAT.

The final sample consists of 108 announcements of new product introductions made in the period 1975 through 1992 by fifty-seven New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) listed firms. These announcements pertain to forty-three four-digit SIC industries. Following are examples of announcements of new product introductions included in the sample:

> Hewlett-Packard Co. said it introduced a calculator that is the first capable of doing conceptual algebra and calculus... Hewlett-Packard said the machine, known as the HP28C, is designed primarily for engineers, scientists, mathematicians and computer experts. It will allow them to tackle a range of problems not previously solvable on calculators by permitting the entering and storage of complex equations using mathematics symbols... (*WSJ* 01/12/87)

> Eveready Battery Co., aiming to jolt the consumer battery competition, said it developed the first AA 1.5-volt lithium battery for consumer use. Eveready, a unit of Ralston Purina Co., said the new battery will be introduced early next year and is expected to last up to twice the length of common alkaline batteries in many applications... Other major players in the consumer battery market are Duracell Inc., which concentrates in the alkaline segment, Eastman Kodak Co. and closely held Rayovac Corp. ... Kodak, which already markets a nine-volt lithium battery, didn't have any comment... Dr. George Mayer; director of the Mellon Institute's Battery Technology Center at Carnegie-Mellon University, said "increases in the capacity of alkaline batteries are becoming more and more infrequent as the technology matures. Lithium will definitely be the new top of the line." (*WSJ* 09/30/88)

> A natural insecticide derived from an Asian mahogany tree will soon give consumers an alternative to the synthetic bug killers... The product, developed by W.R. Grace & Co. and to be distributed by Ringer Corp., will be introduced early next year. It is intended to challenge such popular synthetic pesticides as diazinon, malathion and carbaryl, all of which are toxic to humans and many animals... As more pests develop resistance to traditional synthetics, and more consumers become concerned about pesticide health risks, many chemical makers are accelerating efforts to produce natural alternatives... Diazinon, an organophosphate, is the most widely used lawn and garden pesticide in America. It is made by Ciba-Geigy Corp. and marketed in the US by Chevron Corp.'s Ortho unit. American Cyanamid Co. makes malathion, another organophosphate... Jow-Lih Su, a commercial development specialist for Grace, said the extract's complicated molecule makes it difficult for insects to develop resistance... Grace researchers found that honey bees and other beneficial insects that interact with plants only as adults aren't affected by the product... Other independent tests indicate that the product isn't toxic to birds or mammals, including humans... (*WSJ* 10/30/91)

Table 1 presents the characteristics of the sample of new product introductions. Panel A provides a chronological distribution of the sample, and Panel B classifies the announcements by their two-digit SIC major group. The new product introductions are relatively evenly distributed over the 1975-1992 period, during which stock market conditions varied substantially. In addition, the sample encompasses a variety of industries; although, 77.8 percent of the announcements pertain to major groups 28, 35, 36, and 38.

TABLE 1
Characteristics Of The Sample Of Corporate Announcements Of New Product Introductions

The sample consists of 108 announcements of new product introductions. These announcements are made in the period 1975 through 1992 by 57 NYSE and AMEX listed firms and pertain to 43 four-digit SIC industries. These announcements are initial unanticipated new product introductions made by first-movers having with their rivals sufficient data on CRSP and COMPUSTAT.

Panel A: Chronological Distribution Of The Sample

Year	Number Of Announcements	Percent Of Sample	Year	Number Of Announcements	Percent Of Sample
1975	3	2.8	1984	4	3.7
1976	4	3.7	1985	6	5.6
1977	7	6.5	1986	5	4.6
1978	1	0.9	1987	5	4.6
1979	5	4.6	1988	11	10.2
1980	8	7.4	1989	5	4.6
1981	5	4.6	1990	5	4.6
1982	4	3.7	1991	12	11.1
1983	11	10.2	1992	7	6.5
			Total	108	100.0

Panel B: Distribution Of The Sample By Major Industry Group

Two-Digit SIC Major Group	Number Of Four-Digit SIC Industries	Number Of Announcements	Percent Of Sample
20. Food and kindred products	3	4	3.7
21. Tobacco products	1	2	1.9
26. Paper and allied products	1	4	3.7
28. Chemicals and allied products	5	19	17.6
29. Petroleum and coal products	1	4	3.7
30. Rubber and miscellaneous plastics products	1	1	0.9
34. Fabricated metal products	4	5	4.6
35. Industrial machinery and equipment	8	23	21.3
36. Electronic and other electric equipment	8	18	16.7
38. Instruments and related products	7	24	22.2
49. Electric, gas, and sanitary services	2	2	1.9
58. Eating and drinking places	1	1	0.9
73. Business services	1	1	0.9
Total	43	108	100.0

Table 2 provides descriptive statistics for the pioneering firms, their rivals, and the sample product markets. In many cases, rivals of the pioneering firms are mentioned in the full text of the announcement in the *Wall Street Journal*. However, the *Market Share Reporter* and *Manufacturing USA* published by Gale Research Inc. are also used to identify all rival firms in the relevant specific product market.[5] Then, they are grouped into equally-weighted portfolios to deal with the problem of cross-correlation and also the problem of a very high noise to signal ratio that would be caused by using disaggregated data.[6] Data on total assets and net sales are year-end figures for the fiscal year before the new product introduction announcement, taken from the annual industrial tape of COMPUSTAT. The percentage of the industry output bought for personal consumption is obtained from *Manufacturing USA* Data on industry concentration are taken from the *Market Share Reporter* and the *Census of Manufactures*. The number of observations for percent of industry output bought for personal consumption and the four-firm concentration ratio is less than 108 because of missing data.

TABLE 2
Descriptive Statistics For The Pioneering Firms, Their Rivals, And The Sample Product Markets

The sample consists of 108 announcements of new product introductions. Rival firms are identified using the full text of the announcement in the *Wall Street Journal*, the *Market Share Reporter* and *Manufacturing USA*, and they are grouped into equally-weighted portfolios. Data on total assets and net sales are year-end figures for the fiscal year before the new product introduction announcement, taken from the annual industrial tape of COMPUSTAT The percentage of the industry output bought for personal consumption is obtained from *Manufacturing USA.* Data on industry concentration are taken from the *Market Share Reporter* and the *Census of Manufactures.* The numbers of observations for the percent of industry output bought for personal consumption and the four-firm concentration ratio are less than 108 because of missing data.

Variable	Number Of Observations	Mean	Standard Deviation	Minimum	Maximum
Pioneering firms:					
Total assets ($ millions)	108	13,884	24,312	29.9	166,508
Net sales ($ millions)	108	12,261	15,469	44.4	70,336
Rival firms grouped into portfolios:					
Average total assets ($ millions)	108	9,735	11,404	137.0	73,037
Average net sales ($ millions)	108	9,668	10,821	163.0	60,334
Four-digit SIC industries:					
% of output for personal consumption	104	23.7	28.4	0.0	95.0
Four-firm ratio of concentration (%)	99	46.9	20.4	11.0	92.0

As Table 2 indicates, the pioneering firms and rival portfolios vary significantly in size. Total assets of the pioneers vary between $29.9 million and about $166.5 billion, with an average of about $14 billion. The averages of total assets of rival firms in the equally-weighted portfolios vary between $137 million and $73 billion, with an average of about $9.7 billion. Using net sales as another firm size measure, it is also clear that the sample includes large as well as small firms.

The sample includes some products which are clearly industrial goods, others which are clearly consumer goods, and others which can be considered as both. The percentage of industry output bought for personal consumption in the sample product markets ranges between zero percent (industrial good) and 95 percent (consumer good). Finally, the sample new products are introduced into markets with various degrees of concentration. The four-firm concentration ratio varies between 11 percent and 92 percent, with an average of 46.9 percent.

AVERAGE STOCK-PRICE RESPONSE OF PIONEERING FIRMS AND THEIR RIVALS

Estimation Procedure

Assuming daily common stock returns are distributed multivariate normal, abnormal returns to shareholders are estimated using the following market model:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \gamma_j D_{jt} + \varepsilon_{jt}$$

where R_{jt} is the continuously compounded return on firm (or portfolio) j over day t, R_{mt} is the return on the equally-weighted CRSP index over day t, D_{jt} is a binary variable which takes a value of *1* if t is in the pre-specified event period and *0* otherwise, and e_{jt} is an error term that is assumed to have a zero mean and to be normally distributed independent of R_{mt} and D_{jt}. While the coefficient β_j extracts market wide movements from the return series, γ_j isolates the component of the daily return of the security (or portfolio) that is due to the new product introduction itself.

The estimation of the abnormal return parameter γ_j is performed for five different event periods around the day of the announcement of the new product introduction in the *Wall Street Journal* (day 0). The estimation period starts on day -330 and ends on day +30. The five event periods extend, respectively, from day -30 through day -2, from day - 10 through day -2, from day - 1 through day 0, from day 1 through day 10, and from day 1 through day 30. Consequently, the total event-period abnormal return for a firm (or portfolio) j is estimated as $AR_j = W\gamma_j$, where W is the number of days in the event period. When estimating Y_j over the period -1 through 0, for example, daily observations over the periods -30 through -2 and 1 through 30 are deleted from the return series in order to make estimates of β_j with different event periods over the same period -330 through -31. Finally, assuming that new product introductions represent independent events, the following Z-statistic is used to test the hypothesis that the average total event-period abnormal return equals zero:

$$Z = (1/\ J^{1/2}) \sum_{j=1}^{J} (\gamma_j / \sigma_{\gamma j})$$

where J is the number of new product introductions in the sample and $\sigma_{\gamma j}$ is the Ordinary-Least-Squares (*OLS*) estimate of the standard error of γ_j.

Average Wealth Effects

Table 3 presents the average abnormal returns (*AAR*) to pioneering firms and their rivals with the corresponding Z-statistics. In general, the results indicate that announcements of new product introductions are associated with positive abnormal returns to pioneering firms and negative abnormal returns to their rivals. None of the abnormal returns over the periods surrounding the announcement date is statistically significant at conventional levels.

Pioneering firms realize, on average, a total abnormal return of 1.15 percent over the -1 through 0 period. This abnormal return is statistically significant at the 1 percent level (i.e., the null hypothesis of no announcement effect is rejected). This result is not due to a few outlier observations since more than 69 percent of the sample abnormal returns are positive.

The two-day abnormal return of 1.15 is larger than the abnormal returns of 0.6 percent and 0.69 percent reported in the studies of Chaney and Devinney (1992) and Woolridge and Snow (1990), respectively. Although the difference may be statistically insignificant, it is as expected. The sample of this paper includes only truly new products introduced by pioneering firms. In contrast, the samples of Chaney and Devinney (1992) and Woolridge and Snow (1990) include product updates and announcements by followers, whose wealth effects are likely to be smaller. In fact, Chaney and Devinney (1992) report that original new product announcements result in greater abnormal stock returns than product update announcements.

Rivals of the pioneering firms suffer a negative total abnormal return of 0.454 percent over the period day -1 through day 0. This average abnormal portfolio return is statistically significant at the 5 percent level and more than 57 percent of the sample abnormal portfolio returns are negative.

TABLE 3
Percentage Average Abnormal Stock Returns (*AAR*) To Pioneering Firms And Their Rivals

The sample consists of 108 announcements. Abnormal returns are computed based on *0LS*-estimates of the event parameter *Yj* in the market model:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \gamma_j D_{jt} + \varepsilon_{jt} \qquad j = 1, ..., J$$

where R_{jt} and R_{mt} are respectively the continuously compounded rates of return to firm (or portfolio) *j* and the equally-weighted CRSP index over day *t*, and D_{jt} is a binary variable which takes a value of *1* if t is in the pre-specified event period and 0 otherwise. The estimation period is day -330 through day 30 relative to the *WSJ* announcement date. The sample average abnormal return:

$$AAR = (W / J) \sum_{j=1}^{J} \gamma_j$$

where *W* is the number of days in the event period and *J* is the sample size. Rival firms are grouped into equally-weighted portfolios. Assuming that new product introductions represent independent events:

$$Z = (1 / J^{1/2}) \sum_{j=1}^{J} (\gamma_j / \sigma_{\gamma j})$$

where $\sigma_{g\,j}$ is the *OLS*-estimate of the standard error of γ_j , is the test statistic for the hypothesis of zero abnormal return. Z-statistics are shown in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively, in a two-tailed test.

	Pioneering Firms		Rival Portfolios	
Event Period	**AAR (%)**	**% Positive**	**AAR (%)**	**% Positive**
[-30,-2]	-0.516 (-0.76)	53.7	-1.189 (-1.33)	50.0
[-10,-2]	0.286 (0.61)	50.9	-0.104 (-0.26)	45.4
[-1 , 0]	1.150 (4.66)***	69.4	-0.454 (-2.13)**	42.6
[1 , 10]	0.393 (0.78)	53.7	-0.320 (-0.69)	46.3
[1 , 30]	0.181 (0.22)	50.0	-1.072 (-1.26)	52.8

Given that pioneering firms gain while their rivals lose at announcements of new product introductions, the results clearly constitute support to the notion that the first firm to introduce a radically new product attains significant competitive advantages, other things held constant.[7] The following section attempts to determine whether certain product, firm, and industry characteristics amplify these first-mover advantages.

CROSS-SECTIONAL ANALYSIS OF THE ABNORMAL RETURNS TO PIONEERS AND THEIR RIVALS

Parameter Estimation

Abnormal returns of different securities are heteroscedastic and may be cross-correlated if contemporaneous or pertain to similar industries. The fact that the sample announcements take place at different points in time, coupled with constructing rival portfolios, eliminate the problem of cross-correlation. However, the problem of heteroscedasticity remains. Therefore, *OLS* estimates of the parameters in the cross-sectional regressions would not be minimum variance estimators, which may cause misleading tests of significance of regression parameters (Sefcik and Thompson, 1986). For this reason, this paper uses Weighted-Least-Squares (*WLS*) regressions which should lead to more powerful tests of coefficients than the *OLS*. The weights that this paper applies are equal to the inverse of the variances of the abnormal returns.

Cross-Sectional Results

Table 4 provides the results of the cross-sectional analysis of the total two-day abnormal returns to pioneering firms and to rival portfolios at announcement. The regression sample consists of 99 announcements because of missing data on industry concentration. The specification of both models includes a total of four exogenous variables. The first variable (*PERCONSUMPj*) is the percentage of the industry output bought for personal consumption. This variable is a continuous measure of whether the new product is a consumer good or an industrial good. The second variable (*RELSIZEj*) is the ratio of total assets of the pioneering firm to the average of total assets of the firms in the rival portfolio. This variable measures the size of the pioneering firm relative to the average size of its competitors. The third variable (*INDCONCENj*) is the four-firm ratio of industry concentration. The higher the value taken by this variable, the more concentrated the product market is. Finally, the fourth variable (*INDTECHj*) is a binary variable that takes a value of one if the new product pertains to a high-technology industry and zero otherwise. The classification into high- versus low-technology industries is based on the classification in *Business Week's* annual R&D Scoreboard.

The measures of goodness of fit, shown in Table 4, indicate that both models fit the data well. The coefficient of determination of the pioneers' model is 9.62 percent and the *F*-statistic is significant at the 5 percent level. Similarly, the coefficient of determination of the rivals' model is 36.41 percent and the *F*-statistic is significant at the 1 percent level. These results indicate that some of the exogenous variables are significant determinants of the abnormal returns to pioneering firms and their rival portfolios. Specifically, the results of the *t*-tests indicate that *INDCONCENj* and *INDTECHj* have coefficients that are statistically different from zero at the 5 percent level or lower. Multicollinearity, which makes the standard errors of the regression coefficients large, is not the reason *PERCONSUMPj* and *RELSIZEj* do not have statistically significant coefficients. An examination of the variance inflation factors indicate that they are all close to unity in both models.

The coefficient of *PERCONSUMPj* is statistically insignificant at conventional levels in both models. This result does not lend support to the hypothesis that first-mover advantages may be more prevalent in consumer-goods markets than in industrial-goods markets. The industry characteristics in the models are clearly more important determinants of the magnitude of first-mover advantages.

The coefficient of *RELSIZEj* is statistically insignificant at conventional levels. This result is inconsistent with the prediction that large firms are more able at appropriating a technology they introduce. Having greater resources is clearly not sufficient for furthering a firm's technological leadership or enhancing its image with consumers, which would imply sustained first-mover advantages.

The coefficient of *INDCONCENj* is positive and statistically significant at the 1 percent level in the rivals' model. It is negative but statistically not significant in the pioneers' model. These findings are consistent with the prediction that intra-industry technology diffusions are more likely in concentrated markets. In addition, the coefficient of *INDTECHj* is positive and statistically significant at the 5 percent level in the pioneers' model, and it is negative and statistically significant at the 1 percent level in the rivals' model. These results suggest that proprietary learning can generate substantial barriers to entry in high-technology industries. Therefore, as

expected, pioneering firms gain more and their rivals lose more when the new products pertain to fragmented but high-technology industries, which means that first-mover advantages are more significant in such industries.

TABLE 4
Cross-Sectional Regression Analysis Of The Two-Day Event Period Abnormal Returns To Pioneering Firms And Their Rivals

The regression sample consists of 99 announcements because of missing data on industry concentration. The regression model is the following:

$$AR_j = \phi_0 + \phi_1 (PERCONSUMPj) + \phi_2 (RELSIZEj) + \phi_3 (INDCONCENj) + \phi_4 (INDTECHj) + \varepsilon_j \qquad j = 1,\ldots\ldots, J.$$

AR_j is the two-day event period abnormal return to the pioneering firm or the equally-weighted rival portfolio. *PERCONSUMPj* is the percentage of the industry output bought for personal consumption. *RELSIZEj* is the ratio of total assets of the pioneering firm to the average of total assets of the firms in the rival portfolio. *INDCONCENj* is the four-firm ratio of industry concentration. *INDTECHj* is a binary variable that takes a value of one if the new product pertains to a high-technology industry and zero otherwise. The classification into high- versus low-technology industries is based on the classification in *Business Week's* annual R&D Scoreboard. The coefficients of the models are weighted-least-squares estimates with the inverse of the variances of the abnormal returns used as weights. Asymptotic t-statistics are shown in parentheses, ***, **, and * denote significance at the 1, 5, and 10% levels, respectively, in a two-tailed test.

	Weighted-Least-Squares Estimates For				
Model For	ϕ_0	ϕ_1	ϕ_2	ϕ_3	ϕ_4
Pioneering Firms	0.809 (1.40)	-0.007 (-0.84)	-0.013 (-0.41)	-0.012 (-1.01)	1.093 (2.17)**
	R^2= 9.62%	Adjusted-R^2 = 5.77%		F = 2.50**	N = 99
Rival Portfolios	-0.205 (-1.83)*	0.001 (0.35)	-0.011 (-0.80)	0.006 (3.68)***	-0.693 (-7.05)***
	R^2= 36.41%	Adjusted-R^2 =33.70%		F = 13.45***	N = 99

CONCLUSION

This paper uses capital market data to test the hypothesis that pioneering carries advantages. In an efficient capital market, a change in the firm's competitive position that is induced by a new product introduction translates into abnormal stock returns to firms competing in the same industry as the pioneering firm. In particular, the announcement of a new product introduction that is expected to enhance the competitive advantage of the pioneering firm, will cause the market to revise downward the market values of the pioneering firm's competitors, unless there are also late-mover advantages. In that case, the market would revise upward their market values. The event-study method of this paper measures the average share-price impact of new product introductions, as an unbiased estimate of first-mover advantages.

In a sample of 108 announcements of new product introductions from the period 1975 through 1992, this paper finds that pioneering firms realize a statistically significant two-day abnormal return of 1.15 percent, whereas their rivals suffer a statistically significant two-day abnormal return of -0.454 percent. These results lend support to the notion of first-mover advantages, and they indicate that market pioneering is usually profitable. The cross-sectional analysis exploits information on product, firm, and industry-specific characteristics to shed light on the determinants of the sustainability of first-mover advantages. The findings indicate that first-mover advantages are more prevalent in fragmented but high-technology industries.

ENDNOTES

1. In contrast to this paper; Robinson, Fornell, and Sullivan (1992) examine whether certain firm characteristics impact management's decision to pioneer or follow.

2. See Fama (1970) and Muth (1961) for the hypothesis of efficient capital markets and rational expectations.

3. Previous intra-industry research examines the announcement of dividend omissions (Boim, 1977), nuclear accidents (Hill and Schneeweis, 1983), mergers (Eckbo, 1983), product recalls (Jarrell and Peltzman, 1985), sales (Olsen and Dietrich, 1985), earnings (Han and Wild, 1990), bank failures (Gay, Timme, and Yung, 1991), bankruptcies (Lang and Stulz, 1992), corporate security offerings (Szewczyk, 1992), stock repurchases (Hertzel, 1991), going-private transactions (Slovin, Sushka, and Bendeck, 1991), and prime rate changes (Nabar; Park, and Saunders, 1993).

4. On December 7, 1983, International Business Machines Corp. announced a new automatic teller machine that dispenses both coins and paper money, causing the stock price of Diebold Inc., its principal competitor in this market, to drop. On the other hand, when RJR Nabisco Inc. unveiled its new smokeless cigarette on September 14, 1987, prices of other tobacco stocks rose.

5. Previous research on intra-industry information transfers define rivals as all firms with the same major four-digit SIC industry of the announcing firm. However; this method of market delineation has its shortcomings. It excludes many relevant competitors classified by CRSP or COMPUSTAT into other four-digit SIC industries and includes many irrelevant firms with the same major four-digit SIC industry but serving different markets. For example, in the medical X-ray films market, Eastman Kodak Co. and DuPont Co. are the leading competitors; although, their major four-digit SIC industry codes are 3861 and 2820, respectively. Alternatively, Eli Lilly & Co. and Johnson & Johnson have the same major four-digit SIC industry code 2834, but they are not competitors in the market for pace-maker-cardioverter-defibrillators.

6. Equal weights are assigned to the rival firms in each portfolio since one cannot predict in a reliable manner what will be the market shares of these rivals in the newly created market.

7. Unfortunately, given that not all rivals of the pioneering firms have data on the CRSP tape, the scope of this study cannot be enlarged to include checking whether the new products reallocate wealth among competitors only or also create wealth for the whole industry.

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