THE FINANCIAL REWARDS OF NEW PRODUCT INTRODUCTIONS IN THE
PERSONAL COMPUTER INDUSTRY

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Abstract

There is little question that new product innovation is a cornerstone to firm success. Particularly in technologically dynamic markets like personal computers, new products are central to long-term financial performance. However, exactly how new product introductions influence firm value is less clear. Based on data from firms in the personal computer industry, we study the effect of new product introductions on three key drivers of firm value: profit rate, profit rate persistence, and firm size as reflected in asset growth. We find that new product introductions influence profit rate and size, but not persistence. Interestingly, the effect of new product introductions on profit rate appears to stem from a reduction in selling and general administrative expenditure, notably advertising, intensity rather than through an increase in gross operating return. Firm profitability in this industry apparently benefits from new product introductions because new products need less marketing support than older products.
1. INTRODUCTION

Academics, practitioners and consultants share the belief that new products are important to the long-term financial success of a firm. For example, based on results from an annual innovation poll by *Fortune* magazine, consultants at Arthur D. Little claim that innovative companies achieve the highest shareholder returns (Jonash and Sommerlatte 1999). Cooper (1998) states that new products are vital to the success and continued prosperity of the corporation. Drucker (1999) maintains that, in the era of “profound transition” that we are entering, only organizations with a systematic policy of innovation are likely to succeed.

These views are consistent with empirical event study research that has found a positive association between new product announcements and stock return. For example, Chaney, Devinney and Winer (1991) find an average daily excess return of 0.25 percent for new product announcements one day before to one day after the announcement. Subsequent event studies looking at the stock market reaction to information associated with new product announcements reinforce this finding of a positive stock market reaction to new products (e.g., Eddy, et al. 1993; Hendricks and Singhal 1997; Koku, Jagpal and Viswanath 1997).

*How* new products influence firm value, however, is less clear. While advantageous in isolating an impact on firm value, event studies are limited in their ability to explain *why* the effect occurs, i.e., event study analysis does not address what mechanisms or underlying drivers are influenced by new products. Further, previous research studies provide few, and often contradictory, insights concerning how new products influence the underlying drivers of firm performance. Consequently, our understanding of the effects of new product introductions on the financial rewards of a firm is very much incomplete.
The argument that new product activity enhances firm value rests on the basic idea that new products provide a degree of temporary market power to a firm that can be used to obtain private (as opposed to public) returns to innovation (e.g., Arrow 1962). In the absence of this effect, firms would have no incentive to undertake the risky investment required for new product development and market introduction. Innovative firms can take advantage of the transitory market power via several mechanisms. First, new products incorporating advanced features and capabilities can lead to higher sales and firm growth. Second, firms may attempt to enhance their profits by targeting segments that yield high margins. Third, new products can allow a firm to lower its costs by targeting its current customers with “new and improved” products instead of having to incur the expenses related to finding new customers for its existing, older products. Fourth, new products may transform the firm’s capabilities and allow profits to persist over a longer period of time.

These mechanisms suggest that the study of effects of innovation (e.g., new product introductions) on firm value requires and provides inter-disciplinary insights. As innovative activity can influence a number of different performance outcomes, research requires the use of a financial valuation model to establish a framework for understanding how these outcome measures affect firm value. Further, innovation is not an isolated activity of the firm. Rather, it is inter-related with the other business functions, in particular, marketing. As such, research about the effect of innovation on financial performance provides insights into the interactions taking place between innovation and marketing activities.

In this study, we empirically examine the effect of new product introductions on three key drivers of firm value: profit rate, profit persistence, and firm size. We further examine the relationship between new product introductions and the components of firm profitability (gross
operating income, SG&A expenditures, and components of SG&A). These analyses allow us to gain insights into how new products influence firm value. The context for our study is the personal computer industry, a technologically dynamic market in which new products have played a critical role in continued industry growth. Our empirical results indicate that new product introductions in this industry influence profit rate and firm size, but not profit rate persistence. We find that the effect of new product introductions on profit rate stems from a reduction in SG&A expenditures, most notably advertising, rather than through an increase in gross operating income.

The remainder of this paper is organized as follows. In the next section, we briefly present a standard valuation model to show the relationship of profit rate, profit rate persistence and firm size to firm value. We then discuss how new product introductions are expected to relate to each of these financial drivers as well as the components of profitability. With this background, we then discuss the industry setting and available data for our empirical study. The econometric model and estimation issues are then presented, and the results from our empirical analyses are discussed. Conclusions are in the final section.

2. A FINANCIAL FRAMEWORK FOR FIRM VALUATION

Financial valuation models are useful for providing insight into how and which “conventional” financial measures explain cash flows over time and hence firm value. One commonly used valuation framework is the “competitive process, constant growth valuation model” (see, e.g., Levonian 1994 for a derivation). This model accounts for linkages between inter-temporal cash flows, firm growth and the sustainability of profits, and highlights the importance of profit rate, profit rate persistence and firm size in influencing firm value.
Three primary assumptions form the basis for this valuation model. First, as is the case in all valuation models, it is hypothesized that firm value is determined by expectations of discounted future cash flows. Second, the firm is modeled to grow at some constant rate $g$ over time. Third, profit rates (e.g., return on equity or ROE) may not be completely sustainable and, instead, may decay over time back to the cost of capital ($ke$) as a result of the competitive process. That is, $(ROE_t - ke) = \phi(ROE_{t-1} - ke)$, where $\phi$ is the persistence of profit rates and, as such, $(1-\phi)$ is the decay rate.$^1$

These three assumptions give rise to the following expression for market value:

$$ MV = \left[ 1 + \frac{\phi(ROE - ke)}{(ke - g)(1 - \phi)(1 + g)} \right] BV $$

This model highlights that market value ($MV$) results from three key drivers, i.e., profit rate in terms of ROE, the size of the firm as measured by its book value ($BV$) and growth ($g$), and profit rate persistence ($\phi$). The larger the firm’s ROE (or, more precisely, the ROE less cost of capital differential), the more market value is enhanced. While profit rate has been the primary focus of business performance studies, this model indicates that other considerations are important as well. In particular, size (as reflected by the level of invested capital and its growth) has an interactive effect on firm value. Size magnifies the benefits (losses) of a positive (negative) ROE less cost of capital differential. Persistence has a similar interactive effect. Higher persistence, which may reflect the presence of isolating mechanisms that restrict imitation, results in long-term gains (losses) for firms with positive (negative) profit rate less cost of capital differentials.

$^1$Under the condition that $\phi=1.00$, this model reduces to the more rudimentary (albeit widely used) constant growth model (e.g., Fruhan 1979; McTaggert, Kontes and Mankins 1994).
We use this valuation model as a framework for assessing the effects of new product introductions on firm value.

3. NEW PRODUCT INTRODUCTIONS AND FIRM FINANCIAL PERFORMANCE

To gain insight into the underlying mechanisms that link new product introductions to changes in firm value, in this section we consider how new product introductions might influence the key financial drivers of firm value (i.e., profit rate, profit persistence, and size).

3.1 Firm Profit Rate

In line with conventional wisdom, we hypothesize that:

\[ H_1: \text{Firm profitability is positively related to its new product activity.} \]

Empirically, the work of Geroski, Machin and Van Reenen (1993) is perhaps most directly related to this hypothesis. In a study of product, process and material innovations introduced by manufacturers in the United Kingdom between 1945-1983, they find a significant (but what they label as “modest”) positive effect of innovation on profit margins. A concern however, which the authors note, is that commercial success is one of the criteria used to select innovations for their study, i.e., their data contain only successful innovations. Since sample bias is present in their study, the reported results may overstate the true effects of new products on profit rate.

Support for this hypothesis might also come from previous research examining the effect of variables such as R&D expenditures and patent activity that are expected to be correlated with new product introductions. But, here we find weak or conflicting evidence. While a number of studies have reported surprisingly large estimated effects of R&D (e.g., Pakes 1985), others question its size and report effects consistent with normal returns (e.g., Lach and Schankerman...
And, even though patent statistics are thought to be closely related to innovation, studies consistently find that patent counts are not associated with financial performance (e.g., Griliches, Hall, and Pakes 1991).

Although the hypothesis of a positive association between profit rates and new product introductions is widely presumed, the lack of any strong and direct empirical support in the published literature raises important questions. For example, it may be that the costs associated with new product introductions outweigh any increase in sales revenues. Consistent with this idea, Bayus and Putsis (1999) find that personal computer firms with longer product lines have higher costs as well as higher market share. Indeed, their results indicate that the cost increases associated with a broader product line and new product introductions dominate any potential demand increases in this industry. Consequently, to understand more fully the relationship of new product introductions and firm profitability, a closer examination of the components of firm profitability is warranted.

While much of the discussion associated with the effect of new product introductions on profit rates focuses on gross operating return (i.e., revenue minus cost of goods sold/assets), other components of profit also might be influenced. New product introductions do not occur in isolation, but rather interact with other activities of the firm, in particular, marketing. As such, the effect of new product introductions on profits will depend on inter-relationships with these other activities whose costs are part of SG&A expenditures.

One possibility is that SG&A expenditures will increase because the new product requires additional support (e.g., increased advertising) or development efforts (e.g., increased R&D). Indeed, the marketing literature highlights new product introductions as an action requiring increased advertising. Bly (1993), for example, notes that “introducing many new
products to the market dramatically increases your advertising expenditures. In fact, the new product innovator will spend more than twice as much on advertising and promotion as a business with fewer new products.” Thus, the prevailing view is that it is necessary to invest heavily in advertising during the initial stages of a product introduction and that this front-end commitment tends to dissipate initial stage profits (e.g., Burton and Miller 1976).

While less widely articulated, a competing view about the inter-relationship between new products and SG&A activity also exists. Under this view, new products may be less costly to market than existing products. Thus, it is products that lag behind the technology frontier or that fail to offer an obvious reason for purchase that require more intensive demand-creating marketing activities. Angell (2000), in the context of pharmaceuticals, takes an even more extreme position. She contends that “the less important the drug, the more marketing it takes to sell it. Important new drugs do not need much promotion. Me-too drugs do.” Further, the new product can be targeted to current customers, instead of having to find new customers for the existing products. In this case, more efficient use could be made of advertising and selling resources, e.g., less advertising and personal selling resources may be needed to reach target sales levels for new products.

Only by empirically studying the effect of new product introductions on the components of profit rate can we gain insights into these possible phenomena. To our knowledge, these issues have not been explored in the published literature.

3.2 The Persistence of Firm Profit Rate

Our working hypothesis concerning the persistence of firm profit rate is:

\[ H_2: \text{The persistence of firm profitability is positively related to its new product activity.} \]
Geroski, Machin and Van Reenen (1993) note that there are two schools of thought regarding how an innovation can contribute to a firm’s superior performance. An innovation contributes either by being the “product of the innovation process” that temporarily enhances a firm’s market position, or by the “process of innovation” that allows profit to persist because it transforms the firm’s internal capabilities. Both mechanisms are consistent with this hypothesis. The profitability of an innovating firm may exhibit greater persistence because the firm does not introduce just one new product but continues to introduce new products over time and, as such, reduces imitation by competitors. Further, to the extent that innovation transforms a firm’s capabilities, this creates an asset that competitors may find difficult to imitate.

However, past research has rarely investigated, and thus has yet to produce consistent results regarding, the possible effects of new product introductions on the persistence of firm profit rates. Roberts (1999) investigates the issue, but reports findings that we are cautious to build upon. His study looks at the effect of the relative proportion, which is assumed to be fixed across time, of sales derived from innovative products on the persistence of profits for firms in the pharmaceutical industry. He finds that this innovation measure is positive and significantly related to profit persistence for firms with previous period’s profits below the mean, but is insignificant for firms with previous period’s profits above the mean. These results are somewhat surprising in that they imply that innovative activity lengthens the time period for negative returns, but not for positive returns. Some methodological concerns—firm innovativeness is modeled as time invariant and the role of other potential firm-specific effects are not captured in the model—suggest that the issue be more closely examined.

3.3 Firm Size

Consistent with the widespread viewpoint, we hypothesize that:
\textbf{H}_3: \textit{Firm size, as reflected in asset growth, is positively related to its new product activity.}

This hypothesis is consistent with Sutton’s (1998) theory of endogenous sunk costs (e.g., R&D expenditures and the resulting new product introductions), in that a firm can grow in size as it reinvests its profits into the development of future new products. Further, even though new product introductions may lead to a competitive advantage, this may not directly show up as a higher profit rate for the firm. The firm may plow back its profits into expenditures anticipated to influence longer-term profits or make use of its advantage by increasing market share. In agreement with this, Bayus and Putsis (1999) find that market share is positively related to firm product line length in the personal computer industry. While we strongly expect new product introductions to be positively associated with firm growth, we are unaware of past research documenting this result.

\textbf{4. THE PERSONAL COMPUTER INDUSTRY}

The empirical setting for our study is the personal computer industry. A personal computer can be defined as a general-purpose, single-user machine that is microprocessor based and can be programmed in a high-level language. The historical reviews by Langlois (1992) and Steffens (1994) suggest that the personal computer industry is a rich and dynamic setting in which to study how new product introductions influence firm value. Many, but not all, firms were active in introducing new products, and products based on old and new technology were in the market contemporaneously throughout this period. Frequent new product introductions, ease of firm entry and exit, and the inability by any single firm to establish a long-term competitive advantage are prominent features of this industry.
As shown in Figure 1, the personal computer industry has witnessed rapid growth since its inception in 1974. Personal computer unit sales grew from under 500,000 units in 1980 to over 18 million units in 1994. Both hardware and software technology has improved substantially over this period. For example, Table 1 shows that the microprocessors\(^2\) used in the first generation personal computers (e.g., Intel’s 8080 and Zilog’s Z80) have been continuously superceded by later technology generations (e.g., Intel’s 80286, 80386, 80486, Pentium). Each new microprocessor is associated with increased processing speed, enabling the development and use of more sophisticated operating systems, graphics, and application packages. Not surprisingly, the proliferation of advanced technology has encouraged frequent new product introductions in this industry (see Figure 1).

[insert Figure 1 and Table 1 about here]

5. DATA

One of the main barriers to research on this topic is the availability of appropriate, objective data on new product introductions and matching information on financial performance at the firm level. Fortunately, suitable data for the personal computer industry can be obtained by merging information from two sources. Details on product introductions by personal computer manufacturers come from International Data Corporation’s (IDC) Processor Installation Census. Financial data, including information on assets, income, sales, cost of goods

\(^2\)As discussed in Steffens (1994), the most parsimonious way to describe the technology generations of personal computers is to compare their microprocessors or CPUs (central processing unit). The CPU is the brain of the computer since it contains the arithmetic and logic component, as well as the core memory and control unit for the computer. Thus, CPU design determines the computer’s overall power and performance.
sold, and selling, general and administrative (SG&A) expenses, are obtained from Standard and
Poor’s COMPUSTAT annual data files.

The IDC *Processor Installation Census* database provides a listing of all new personal
computer products introduced between 1974 and 1994. IDC is the oldest among the various
firms that tracks the American computer industry and is widely respected as having a very
accurate picture of activity in this industry. The IDC data include details about the manufacturer
name, brand name, CPU, and introduction date for each personal computer product introduced.\(^3\)

Following prior research with these data (e.g., Bayus and Putsis 1999), we consider a new
product to be any new, unique brand-CPU combination since manufacturers generally incur
significant expenses associated with the production and launch of each brand model (e.g., Apple
Computer’s Lisa and Macintosh are each considered to be a new product although they use the
same Motorola 68000 CPU).\(^4\)

The COMPUSTAT database provides financial data for publicly traded firms on the New
York, American, and NASDAQ stock exchanges. We make use of both the Industrial and
Industrial Research Files to capture not only firms that survived through the end of the data
period, but also those that did not survive. Merging the IDC data with COMPUSTAT data

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\(^3\)This level of detail is only available through 1994 since IDC changed its data collection procedure to a more
aggregate format in 1995. Also, products with CPUs that could not be identified due to proprietary technology are
excluded from our analysis.

\(^4\)As part of our empirical analysis to be discussed in the next section, we also considered other “new product”
definitions (see Table 1). These included new product technologies (the first introduction of a personal computer
based on a new microprocessor generation, e.g., 8-bit, 16-bit, 32-bit, 64-bit) and new product models (the first
introduction of a product based on a unique CPU, e.g., Intel’s 80286, 80386DX, etc.). Since the variables based on
these various definitions are highly correlated, our estimation results are very similar for all of these measures.
restricts the personal computer firms that can be studied. For instance, our sample includes only publicly traded companies. Further, we only include firms for which their primary business is the manufacture of personal computers. Thus, for example, IBM is not considered in our analysis as the financial data reported by COMPUSTAT aggregate across its substantial non-PC businesses. Our matching process yields a panel of sixteen firms who were in the PC market for all or some of the period 1974 to 1994, generating a total of 141 pooled cross-section time-series observations.

Since our analysis is restricted to publicly traded firms and only those that do not have substantial activity in markets other than personal computers, our sample of firms (and thus our results) may not be representative of the population of all companies in the personal computer industry. Nonetheless, firms included in our analysis are important in their own right, e.g., the sixteen firms in our sample account for almost one third of personal computer industry sales in every year during our data period. Further, our sample includes both large firms (e.g., Apple, Compaq, Dell, Gateway) as well as smaller firms, early market entrants (three firms in 1977, one in 1978) as well as later entrants (two in 1987, one in 1988), and survivors as well as non-survivors (seven of the sixteen firms in the sample disappeared from the market by the end of the data period). Altogether, there are 1,070 new product introductions represented in the data, with a per-firm range of two to 136 new products. Finally, we note that the pattern of sales and new product introductions for these sixteen firms parallels the industry patterns in Figure 1.
6. EMPIRICAL ANALYSIS

To empirically estimate the effect of new product introductions on the business performance of firm \( i \) in year \( t \) (\( Perf_{it} \)), we begin with a base model of the form:\(^5\)

\[
Perf_{it} = \alpha_i + \beta_1 Intro_{it} + \beta_2 Intro_{it-1} + \phi Perf_{it-1} + \epsilon_{it}
\]  \hspace{1cm} (2)

We make use of two measures of performance, i.e., return on assets (ROA) and asset growth, as dependent measures.\(^6\) We examine the potential effects of new product introductions on profit persistence by including the interaction of \( Intro_{it} \) with \( Perf_{it-1} \) in the ROA model.

Equation (2), in addition to including variables reflecting the effects of current and lagged new product introductions (\( Intro_{it}, Intro_{it-1} \)), allows for unobserved, time-invariant firm-specific effects via the intercept \( \alpha_i \).\(^7\) Dynamic firm effects are modeled by including lagged performance \( Perf_{it-1} \) in the model. Since we include both current-term and lagged new product introductions in the model, this specification allows for serial correlation (current-effects) as well as a state-dependent (persisting) dynamic relationship. As such, this model allows for a wide range of possible effects and influences.

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\(^5\)Although not shown, the model also includes dummy variables to allow for annual industry-wide effects.

\(^6\)We use ROA and asset growth (as opposed to, in particular, ROE and equity growth) in that we wish to focus on operating returns, which depend on the total resources (i.e., assets) that the firm has deployed.

\(^7\)This is only necessary when ROA is the dependent measure. For the asset growth relationship, parameter estimates from the model allowing for fixed effects and those from the model constraining \( \alpha_i \) to be the same across firms are in very close correspondence. As a Hausman specification test cannot reject the null hypothesis of no firm-specific differences in growth rates, we make use of the more efficient estimator constraining the intercept for asset growth to be constant across firms.
Because of the firm-specific fixed effects $\alpha_i$ in (2), empirical estimation requires taking first differences of the data, which removes the firm-specific intercept. This, in turn, necessitates the use of instrumental variable estimation, since differencing induces correlation of $Perf_{it-1}$ with the error term of the differenced model. Following Anderson and Hsiao (1981), we use lagged values of firm performance at time period $t-2$ as instruments.

6.1 Profit Rate

Model 2.1 in Table 2 presents the results of estimating Equation (2) with ROA as the dependent measure. We find positive effects for new product introductions. The estimated effects for current and lagged new product introductions are 0.85 and 1.14, respectively, and each is significant at the 1% level. We also tested for longer-term effects, but found no evidence of an effect lasting beyond one year. For example, the estimated effect of new product introductions lagged two years was 0.16 with a t-statistic of 0.73. As a sensitivity check, we also explored the role of new product introductions on an ROA measure based on net income as opposed to operating income. Our conclusions are the same in that we find a highly significant association between the net income based ROA measure and both current and lagged new product introductions.

[insert Table 2 about here]

\[ A \] possibility is that new product introductions are not exogenous, but rather are influenced by current-term firm profitability. Further, both new product introductions and firm profit may be jointly influenced by a contemporaneous shock. These two possibilities would generate biased coefficient estimates in our analysis. To assess these cases, we constructed an instrumental variable estimate for the change in new product introductions (based on values of the series lagged two periods) and undertook a Hausman specification test. We obtain a test statistic of 0.19, compared to a $\chi^2(1)$ 5% critical value of 3.84. Thus, we cannot reject the null hypothesis that product introductions are not influenced by current-term profits.
6.2 Profit Rate Persistence

Profits in this market appear to display little, if any, persistence. The estimated autoregressive coefficient in Model 2.1 (0.06) is both small in magnitude and statistically insignificant. This estimated effect is below what we, and others, observe for ROA persistence across the spectrum of publicly traded firms (i.e., around 0.6). However, this finding is consistent with the personal computer industry being very dynamic with ease of competitor entry and exit. Another possible reason for a lack of profit persistence may stem from the role of product introductions. In particular, the persistence parameter may not be a constant. Rather, it may vary depending on new product introductions. To allow for this possibility, we expand Equation (2) to allow the autoregressive coefficient to vary systematically depending on firm product introductions, i.e., \( \phi = \phi_0 + \phi_1 \text{Intro}_{it} \). Model 2.2 in Table 2 presents the estimation results with this interaction term. We see no evidence that persistence does in fact depend on new product introductions. The estimated effects for persistence (0.25) and the interaction term (-0.46) are individually, and jointly, statistically insignificant.

6.3 Asset Growth

As we discussed previously, a firm’s market value increases not just with increases in its profitability, but also (as long as it has a positive profitability to cost of capital spread) with increases in size. That is, for firms with a positive spread, larger firms have greater market value than smaller firms. As such, another way that new product introductions can affect firm value is through an impact on size. Here, too, we see positive effects of new product introductions. As reported in Model 2.3, the estimated effects for both current (0.63) and lagged new product introductions (1.21) are positive and statistically significant. The fact that asset growth exhibits positive persistence (0.22) suggests that the effects of product introduction on growth will persist.
a bit beyond one year. However, the relatively small coefficient indicates that the effect will decay fairly rapidly beyond this point. As a sensitivity check, we also explored the relationship between new product introductions and another size measure, sales growth. This analysis provided results consistent with those observed in Model 2.3. We find that both current and lagged new product introductions are positively associated with sales growth, with the lagged effect being of greater magnitude.

6.4 The Effect of New Product Introductions on the Components of ROA

The results reported in Table 2 show that new product introductions influence business performance through two of the three drivers of business performance we considered. That is, new product introductions influence profit rate and size, but do not influence profit rate persistence. Having found that new product introductions influence profit rate, we now turn our attention to isolating the source(s) of this association. We do so by splitting operating income, the numerator in the ROA measure, into separate components and assessing which components are or are not influenced by new product introductions. We first separate operating income into two fundamental elements, operating income gross of SG&A (“gross operating income,” simply sales less cost of good sold) and SG&A expenses. We then further decompose SG&A into some of its primary components, in particular, separate out advertising expenditures.

Two different kinds of analyses are used to expand our understanding of the phenomenon. One form of analysis, models reported in Table 3, considers the effects of new product introductions on operating income component intensities (operating income component/assets). The second form of analysis, models reported in Table 4, estimates the effects of new product introductions on growth rates of the operating income components.
Combining the two analyses provides an enhanced picture of how the introduction of new products influences profit rate.

[insert Tables 3 and 4 about here]

**Gross Operating Income.** Interestingly, we see no evidence from the estimation of Model 3.1 in Table 3 that new product introductions have a positive effect on gross operating return, i.e. gross operating income/assets. Both current and lagged new product introductions are estimated to have small (-0.04 and -0.14, respectively) and statistically insignificant effects on gross operating return. Model 4.1 in Table 4 shows that new product introductions exhibit some positive (albeit statistically insignificant) association with growth in gross operating income. However, while new product introductions may influence the numerator in the gross operating return measure, they also influence asset growth, and, as such, the denominator in the measure; see Model 2.3 in Table 2. The net result is that there is no significant impact of new product introductions on gross operating return.

**SG&A.** Combined with the results for gross operating return, Models 3.2 and 4.2 in Tables 3 and 4, respectively, show that the positive effect of new product introductions on profit rate arises through an impact on SG&A. We find that in the wake of a new product introduction firms are i) making modest cutbacks in SG&A growth and ii) increasing in size. The end result is that SG&A intensity is reduced, which in turn leads to increased return on assets.

Model 3.2 shows that current and lagged new product introductions are associated with decreases in SG&A intensity (-0.85 and –1.29, respectively). While its role is oftentimes overlooked or excluded from analysis, SG&A plays an important part in firm profitability, as the median SG&A intensity for our data is 0.4, compared to median gross operating return of 0.5. Model 4.2 shows that some of this decrease in SG&A intensity appears to come from firms
cutting back on SG&A growth in the wake of product introduction; SG&A expenditure growth is negatively related to both current and lagged new product introductions. These apparent cutbacks in SG&A growth have an accentuated effect on SG&A intensity as product introductions also generate an increase in asset growth (Model 2.3).

We can gain some insight into the underlying sources of the SG&A association with new product introductions by separately analyzing some of the components of SG&A. In particular, we separate SG&A into R&D expenditures, advertising expenditures, and SG&A expenditures gross of R&D and advertising. Analysis of the advertising measure, which includes the cost of both media advertising and promotional expenditures, while not inclusive of all marketing expenditures, can be expected to provide fundamental insights into the interactions taking place between new product introductions and marketing activities.

**Gross SG&A Expenditures.** We see from Model 3.3 in Table 3 a strong negative relationship between gross SG&A expenditures and both current (-1.29) and lagged new product introductions (-0.66). The reason for this negative relationship is that not only is a firm’s asset base growing with new product introductions, but firms are also decreasing the growth in their gross SG&A expenditures, as is shown by Model 4.3 in Table 4. This decrease is most dramatic at the time of the introduction (-1.89), but continues into the subsequent year as well (-0.73).

**R&D.** One reason that the effect of new product introductions is more substantial for gross SG&A than for SG&A is that firms are not cutting back on R&D expenditure growth in the wake of a new production introduction. And, indeed, they appear to be actually increasing the growth in R&D expenditures.

We see from Model 3.4 in Table 3 that while current R&D intensity is unrelated to new product introductions—the estimated effect is 0.04 and statistically insignificant—R&D intensity
is negatively associated with lagged introductions—the estimated effect is -0.32 and highly significant. Model 4.4 in Table 4 suggests that firms are increasing contemporaneous R&D expenditure growth with new product introductions. At the same time however, the effect of this increase on R&D intensity is counterbalanced by the positive contemporaneous effect on asset growth. These offsetting influences explain the absence of a contemporaneous association between R&D intensity and new product introductions. Model 4.4 also suggests that R&D expenditure growth is unrelated to lagged new product introductions. This absence of a lagged effect, combined with the positive lagged effect of new product introductions on asset growth, accounts for the significant negative association between R&D intensity and lagged new product introductions.

Advertising. Counter to the convention wisdom that new product introductions require an increase in advertising, we find both the current and lagged effects of new product introductions on advertising intensity to be negative. Model 3.5 in Table 3 shows that both current and lagged new product introductions have statistically significant negative effects on advertising intensity, -0.09 and -0.10, respectively. Indeed, Model 4.5 in Table 4 shows that new product introductions have a negative contemporaneous association with advertising expenditure growth. Firms are scaling back advertising expenditures in the wake of a new product introduction. Since asset growth is positively correlated with both contemporaneous and lagged new product introductions, this induces not only a negative contemporaneous effect, but also a negative lagged effect of new product introductions on advertising intensity.
7. DISCUSSION

Our results indicate that new product introductions in the personal computer industry influence two of the three core drivers of firm value, profit rate and firm size (as reflected in asset growth), but not profit rate persistence. As such, our analyses support Hypotheses 1 and 3, but not Hypothesis 2.

The lack of an effect of new product introductions on profit persistence is not so surprising in the context of the industry we study. Sustaining above normal profits from any source would be difficult to achieve in an industry, like the personal computer industry, in which frequent technological advances and disruptive new product introductions by competitors are the norm. Since introducing new products enhances asset growth, as long as the firm has a positive profit rate to cost of capital spread, market value will also increase. We find that profits from new products are reinvested into building up the firm’s asset base. Market value is additionally enhanced as new product introductions increase profit rates for a two-year period. Particularly in industries with low rates of profitability, activities that enhance return are of fundamental importance in influencing firm value.

Our empirical findings, showing that the introduction of new products enhances firm profitability by increasing firm size and profit rates, are important because of the lack of solid evidence elsewhere in the literature. At the same time, these results are not all that surprising. What is surprising, however, is what our results say about the manner by which new product introductions increase firm profit rates. Our analysis shows that new product introduction activity enhances profitability through reduced SG&A expenditure intensity, and not through gross operating return.
New products introduced into the personal computer market increase sales, but also come at an increased cost. These effects appear to “cancel out” so that operating profit margin remains about the same. However, our results show that new products in this industry have lower selling expenses than the older, more established products. The decrease in SG&A intensity induced by new product introductions indicates, for example, that firms do not have to spend as much on advertising and other marketing activities to sell new products as opposed to older products. Rather than incurring the additional expenses associated with selling its older products to new customers, the firm has lower SG&A expenses by selling new products to its current customers.

Some characteristics of the personal computer industry help to explain why this phenomenon is present in this industry. In particular, this industry combines rapid technological development with the existence of buyers that know what is available (Langlois 1992). Technologically advanced, or at least technologically competitive, new products thus have a ready demand from knowledgeable and discriminating customers. Since customers are able to tell the difference between new and older products, older products with out-of-date technology are more difficult to sell. Moore (1995), McKenna (1997), and others contend that in these kinds of technology-based industries characterized by rapid growth, technological advancement, and buyers empowered by choice and access to information, the appropriate marketing strategy is to supply, and not court, the customers. Demand creation is not needed, i.e., it is assumed that the product is indeed demanded, so the firm should “just ship” products. Instead, it is products that lag behind the technology frontier, or that fail to have an obvious reason for being, that require more demand-creating marketing activities.
8. CONCLUSION

The personal computer industry has been one of the most innovative sectors of the economy and one of the most competitive. Quality-adjusted prices have fallen at a rate of 25% per year. Imitators, with low prices, have few barriers to entry. In such a market environment, it is natural to question how firms are able to realize tangible financial rewards from their new product activities. We find that firms in the personal computer industry achieve financial rewards from their new product introductions because this activity allows them to increase in size and increase their profit rate through lowered SG&A intensity.

As is the case with all research, due caution should be exercised in generalizing our findings beyond the specific industry, time period, and data sample used in this study. These limitations, however, suggest various directions for future research. In particular, future studies might attempt to generalize our results to other industry settings, including dynamic as well as more stable product technologies and products in the maturity and decline stages of their industry life cycle. In addition, recent signs of a slowdown in the personal computer industry raise the question of whether firms will continue to be able to rely on new products to lower their selling and advertising expenditures (e.g., McWilliams 2000; Hannon 2001). Thus, continuing to increase our understanding of how and why firms benefit from new product activity is an important area for future research.
REFERENCES


Burton, Philip W and J Robert Miller (1976), *Advertising Fundamentals*, Columbus, Ohio: Grid Inc.


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<tr>
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<th>First Generation (4-bit)</th>
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<th>Third Generation (16-bit)</th>
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*This information was assembled with the assistance of Nancy Pressel from Intel Corporation.*
### Table 2
The Effect of Product Introductions on Drivers of Business Performance

(t-statistic in parentheses)

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<td>(3.33)</td>
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<td>1.21</td>
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<td>(-0.84)</td>
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N<sup>*</sup> 109 109 109

Each model also includes annual dummy variables not reported here.

**Definitions**

Return on Assets: Operating Income<sub>t</sub>/Assets<sub>t</sub>

Asset Growth: log(Assets<sub>t</sub>)-log(Assets<sub>t-1</sub>)

New Product Introductions: Number of Brand Models Introduced<sub>t</sub>/Assets<sub>t</sub>

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* The number of observations available for analysis is less than the total number of observations in the data sample because of the use of first differences and the presence of a lagged explanatory factor, i.e., we “lose” 2 years of data for each firm in our sample.
Table 3

The Effect of New Product Introductions on ROA Components

(t-statistic in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>Model 3.1</th>
<th>Model 3.2</th>
<th>Model 3.3</th>
<th>Model 3.4</th>
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<td>(-4.37)</td>
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<td></td>
<td></td>
</tr>
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<td>Introductions&lt;sub&gt;t&lt;/sub&gt;</td>
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Each model also includes annual dummy variables not reported here.

Definitions

Gross Operating Return: \((\text{Sales}_t - \text{Cost of Good Sold}_t)/\text{Assets}_t\)

SG&A Intensity: Selling, General, and Administrative Expenditures<sub>t</sub>/\text{Assets}_t

Gross SG&A Intensity: \((\text{Selling, General, and Administrative Expenditures}_t - \text{Research and Development Expenditures}_t - \text{Advertising Expenditures}_t)/\text{Assets}_t\)

R&D Intensity: Research and Development Expenditures<sub>t</sub>/\text{Assets}_t

Advertising Intensity: Advertising Expenditures<sub>t</sub>/\text{Assets}_t
### Table 4

The Effect of New Product Introductions on Income Growth Components

(t-statistic in parentheses)

<table>
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<th></th>
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<th>Model 4.4</th>
<th>Model 4.5</th>
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<td>106</td>
<td>98</td>
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</table>

Each model also includes annual dummy variables not reported here.

**Definitions**

Gross Operating Income Growth: \( \log(\text{Sales}_t - \text{Cost of Good Sold}_t) \)  
- \( \log(\text{Sales}_{t-1} - \text{Cost of Good Sold}_{t-1}) \)

SG&A Growth: \( \log(\text{Selling, General, and Administrative Expenditures}_t) \)  
- \( \log(\text{Selling, General, and Administrative Expense}_{t-1}) \)

Gross SG&A Growth: \( \log(\text{Gross SG&A Expenditures}_t) \)  
- \( \log(\text{Gross SG&A Expenditures}_{t-1}) \)

R&D Expenditure Growth: \( \log(\text{Research and Development Expenditures}_t) \)  
- \( \log(\text{Research and Development Expenditures}_{t-1}) \)

Advertising Expenditure Growth: \( \log(\text{Advertising Expenditures}_t) \)  
- \( \log(\text{Advertising Expenditures}_{t-1}) \)

<sup>*</sup>The number of observations in the gross operating income equation differs from the gross operating return equation because of the presence of negative gross operating income, which generates missing data once logarithms are taken.
Figure 1

The U.S. Personal Computer Industry, 1974-1994

Source: IDC Processor Installation Census