THE IMPACT OF NEW PRODUCT INTRODUCTION ON THE FINANCIAL PERFORMANCE IN THE NOTEBOOK INDUSTRY

by

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Abstract

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This thesis investigates the impact of new product introduction rate on the firm financial performance in the notebook industry. Specifically, we divide the changes made in the products, compared to their predecessors, into structural and incremental ones and estimate the impact of each on three indicators: Net Profit margin, Return on Assets and Market Capitalization. We use the data of top 10 notebook manufacturers for 11-year period (2002-2012). The methodology of the research is based on the standard producer theory.

Using the panel data regression models, we show that Net Profit margin and Market Capitalization of the company are positively affected by major innovations and negatively affected by minor ones. The effect on Return on Assets ratio is found to be not statistically significant.

The results of the research can be used by management of the company for making decisions about introducing new product on the market.

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LIST OF ABBREVIATIONS

CAPEX. Capital Expenditures

EBIT. Earnings Before Interest And Taxes

EBITDA. Earnings Before Interest, Taxes, Depreciation And Amortization

EPS. Earnings per Share

NPD. New Product Development

NPI. New Product Introduction

PC. Personal Computer

R&D. Research and Development

ROA. Return on Assets

SG&A. Sales, General and Administrative Expenses

Chapter 1

INTRODUCTION

New product introduction (NPI) is one of the instruments that companies use to secure growth, to raise profitability and to increase or maintain current market share. NPI especially benefits companies that introduce something completely new (pioneering companies) – they earn significant returns and gain a long-term competitive advantages (Zantout and Chaganti, 1996). Obviously, radical innovations are not frequently done. More often companies conduct just some moderate changes in the product. Nevertheless, such product introductions have positive effects on the firm's top-line and bottom-line financial performance and on the firm value both in the short-run and long-run (Pauwels et al., 2003). Moreover, the firm value impact of product introduction increases over time, while promotional incentives tend to decrease company's value in the long-run (Pauwels et al., 2003).

One of the most NPI-oriented industries is personal computer (PC) industry. It is a kind of industry where the producer is the one who creates the demand, not waiting until the consumer understands what he needs. A high rivalry makes it quickly develop and stimulates technological changes. As a consequence, PC industry products have short life-cycles and need to be constantly replaced by newer ones for the company to get competitive advantage. Bayus et al.(2003) shows that NPI in PC industry positively affects company's asset growth and profit rate, but it does go through the decrease in sales, general and administrative expenses (SG&A) intensity rather than the increase in gross operating return.

Still, NPI does not only benefit the company. It also increases its expenses

through huge R&D expenditures. Also, frequent introductions of new electronic products increases electronic waste (e-waste): in the USA alone, consumers throw away 400 million electronic products each year (Plambeck and Wang, 2009). So, social responsibility of the companies leads to the necessity to spend a lot of money on environmental protection. In addition, there exists a high probability of failure or a risk of fast imitation by competitors. According to Gourville (2006) new products fail at the stunning rate of between 40% and 90%, depending on the category. Among main reasons are negligible changes in the product compared to its predecessor, improvements in substitutes, wrong pricing strategy or wrong target audience chosen etc.

So, it is clear that there are both benefits and losses connected with NPIs. According to the producer theory, all firms are profit-maximizers. That is why, it is highly important for a company to make a right decision of whether a new product should be introduced or not. In particular, this research is aimed to answer the following questions: Does high rate of NPI always benefit the PC producer? What is better for financial performance: to introduce slightly changed 'new' products more often or to introduce rather rarely but more innovative products?

When talking about NPIs, PC industry differs a lot from most other industries, so we believe that it should be analyzed separately. This analysis will follow in the steps of Bayus et al. (2003). But Bayus used data for 1974-1994 years when PC industry was in its infancy. Since that time a lot of things have changed. First of all, desktop computers have now a lot of new technical characteristics and are much more compact. A good example of the degree of changes occurred is that floppy discs widely used 10-15 years ago, now completely disappeared. Second, other categories of PC appeared: laptops and netbooks. Third, new substitutes were introduced such as tablets and smartphones. Finally, today's PC industry has

much higher NPI rate. Thus, it is possible that results obtained by Bayus are no longer applicable to this industry.

For our analysis we use panel data (company, year) for top 10 world laptop producers for an 11- year period (2002-2012). We decided to pick out notebooks separately, mainly because today laptops are not just an addition to traditional desk-based PCs, but a self-sustained product. In fact, according to iSuppli Corp., in the 3Q 2008 notebooks shipments for the first time have overtaken desktop PC sales. On the other hand, we do not include, tablet PCs into our research, because they concede strongly by their technical characteristics and operating efficiency to laptops and thus may be considered as a supplement, but not as a substitute to notebooks.

The methodology of the research is based on the standard producer theory and its assumption that all firms are profit maximizers. We divide changes made in the products into major and minor ones. As dependent variables we use the following three indicators of company's financial performance: Net income margin, Return on Assets (ROA) and Market Capitalization (as a proxy to firm value). Independent variables are: the number of major and minor NPIs (both successful and unsuccessful) per year in the company. The main sources of data are Bloomberg database, companies' websites and sites devoted to personal computers.

The remainder of the paper is structured in the following way: Chapter 2 gives a comprehensive review of the existing literature on the effects of NPI on financial performance of the companies; Chapter 3 outlines theoretical and empirical framework of the research; Chapter 4 provides data description; Chapter 5 includes estimation results and discussion; Chapter 6 summarizes all findings.

Chapter 2

LITERATURE REVIEW

Many studies on new product introduction effects have been done over the last 30 years. This section will provide a review of the most significant results obtained in this field and relevant to our topic. We will start with the effects of NPI in general and then proceed to the results concerning NPI impact on the PC industry.

A number of studies confirm the importance of new product introduction for the company's growth. Crawford (1980) demonstrates that R&D expenditures and new product marketing strategy should be an important part of corporate strategy. This idea is also supported by Patrick (1997), who claims that NPI helps to maintain growth and thus protects the interest of company's stakeholders. In addition, the theory of the product life-cycle argues that a company has to constantly innovate to keep its product line up-to-date, in order to stay competitive. According to the studies, NPIs ensure growth by influencing the following factors.

First of all, new products were proved to be critical to the competitiveness of the company (Yoon and Lilien, 1985; Chaney et al., 1991; Cooper, 1990; Wheelwright and Clark, 1995). This is especially important for technological industries, where the increased pace of technological changes and increasing consumer demand stimulates competition and hence makes it harder to benefit. In such industries the only way to differentiate the company's products from the rivals' ones is to innovate.

Besides, providing competitive advantages, NPI are also believed to increase profitability of the company. Mansfield (1968) and Mansfield et al. (1971) showed that returns on R&D (above 20%) were much higher than returns on other investments and that R&D expenses were positively related to the profits. Geroski et al.(1993) also showed that there were positive effects of innovation on profitability. But not all researchers stand by this point of view. For example, Schumpeter (1934, 1950) considered the effect of innovative products on profitability and claimed it to be neither positive nor negative. In his opinion, at first, this kind of products generates higher returns because of low competition, but after some time the appearance of imitators increases the competition, leading to the decrease in the returns. Similarly, Nas and Leppalahti (1997) emphasized that NPD was not a cheap process, which negatively affects profitability of the company. They also stated that introducing innovative products led to higher sales and market shares but not to higher profitability ratios.

Third, the impact on firm value has been widely discussed. Aaker and Jacobson (1987) and Jacobson (1987) used market share as a determinant of market value and found the relation to be positive. Other studies used stock market data. Pakes (1985) and Hall (1999) both investigated the correlation between patent behavior and stock prices, and both came to the conclusion that NPI had a positive effect on firm value. Another - one of the most significant studies on this topic - belongs to Chaney et al. (1991). He used a traditional event-study methodology to study the stock market reaction to announcements of new product introductions. The impact was found to be about 0.75% over a 3-day period, but it was found to vary across different industries. Also, it should be taken into account that the stock reaction is not a perfect proxy for firm value, since it does not reveal the

true product's market value, but only an opinion about it and expectations about its success or failure.

Despite the significant benefits from NPI, it also has some disadvantages – it is expensive and, what is more, risky. According to BAH (1968) about half of the resources spent on NPI are spent on products, which are not successful in the market. Similar results are obtained by Hopkins and Bailey (1971) - only half of the companies successfully introduced at least two thirds of their new products. Cooper (1990), in his turn, states that only 60% of new products introduced to the market are successful. Even though the numbers are different, it is clear that risk of failure is quite high, so companies should think twice before introducing a new product. Moreover, even in case of success, there is always a possibility for fast imitation by competitors, which would not give the company enough time to return all investments. That is why, high rivalry is considered to be one of the main reasons for product failure, (Cooper, 1979, Scherer, 1977). Among other reasons short product life-cycles (Yoon and Lilien, 1985), lack of strategic focus and insufficient product marketing (Hoban, 1998) are stated.

In addition, because of high riskiness of NPI, two main dilemmas arise. First, does it really mean that being first to the market really benefit the company? The results are contradictory. On the one hand, Barton and Krause (1985) emphasize that in the highly competitive environment only the development of innovative products will give enough competitive advantages to the company. The first movers achieve greater market shares (Kerin et al.1992) and earn abnormal positive returns (Zantout and Chaganti, 1996). But on the other hand, Cooper (1979) reports that being first to the market does not ensure product success, because all the first-mover advantages are "almost equally balanced by the many pitfalls and disadvantages". In addition, a high market share may be reached at the expense of profit margins or high expected payoff may bear significant risks

(Aaker and Day, 1986). Finally, Robinson (1988) notes that the first-mover advantages are lower for industrial goods compared to consumer goods, which also should be taken into account.

Another controversial issue raised by the researchers is what is more profitable: introducing innovative goods or just modified ones? Kleinschmidt and Cooper (1991) recommend investing in developing new products (especially for mature markets), since they appear to receive a larger market value than reformulated ones. By contrast, Yoon and Lilien (1985) argue that both kinds of products are beneficial, it just depends on the market needs. According to their findings, new original industrial products better suit to diversification than to expansion purposes; they also are subject to lower competition, but require higher expertise and larger R&D investments. Moreover, ceteris paribus, reformulated products should be introduced to the market as soon as possible, while innovative ones are more likely to succeed after some delay in the launch.

Yet, many studies argue that these questions are important only from theoretical point of view, while in practice other factors determine the success of NPIs. Blagoevski-Trazof (2000) emphasizes the importance of having a balanced portfolio of products being at different development stages in order to mitigate the risks. Also, NPI should be built in the global strategy of the company, facilitating the achievement of chosen objectives. BAH (1968) believe that longer experience in NPI is the key to success. Yelkur and Herbig (1996) state that only synergy of R&D, engineering, marketing, market orientation, and qualitative management will provide the high benefits from NPI.

Now, after examining the general effects from NPI, we will review the existing results concerning the NPI effects on the PC industry companies. Surprisingly, there is not much detailed and thorough research on this topic. Chaney et al.

(1991) noted that for technologically based industries, in particular computers, the impact of new product announcement on stock prices was the highest, which means that NPI has a positive impact on the firm value in this industry. Additionally, Quelch and Hoff (1986) showed that increase in NPI rate was associated with higher returns. Also, the NPI was found to increase the market share of the company (Bayus and Putsis, 1999). Still, new product introduction in the personal computer industry entails a significant amount of risk, because of rapid technological change and tough competition (Yelkur and Herbig, 1996). Over the last 30 years computer industry has been growing and developing relatively faster than other industries did - sales of PCs grew at double-digit rates from the early 1980s to the 2000s (Carlson, 2006). Because of high international competition and short product life-cycles, purely innovative products appear more often in this industry. The most solid research on how NPI affects PC industry was done by Bayus (2003). Using data on 16 companies for 1974-1994 years (141 pooled cross-section time-series observations) he investigated the impact of NPI on three drivers of the firm value: firm size, profit rate and profit rate persistence. The first two were found to be positively affected by NPI, while for the last one there was no effect. Nevertheless, it should be noted that the increase in profit rate was primarily driven by the decrease in Sales General & Administrative expenses and not by increase in gross operating return.

So, as we can see the existing studies do not provide an unambiguous answer about the impact of NPI on financial performance of companies in the computer industry. Moreover, these studies were conducted when the industry was in its infancy and there are no recent studies concerning PC industry and, in particular, laptops, which were introduced not so long ago and which we are going to concentrate on. So, the proposed thesis is aimed to make a contribution into liquidation of this gap.

Chapter 3

METHODOLOGY

As mentioned above, this research is aimed at investigating the impact of a new product introduction rate on financial performance of the company. To do this we will start with a standard producer theory. According to it, the objective of any firm is to produce output Y, using limited resources – capital K and labor L – in the most efficient way. In other words, any firm is profit maximizing. The production function is usually written as:

$$Y = f(K, L) \tag{1}$$

Any product introduction requires significant resources, both capital and human, which could be used for other purposes. That is why, to make the decision about NPI, a firm should consider benefits and losses of two alternatives (opportunity costs):

Alternative 1: to introduce new product. Then, the profit maximizing function will look like:

$$\pi_1^* = \max \pi_1 = p_1 f_1(K, L) - wL_1 - rK_1 \tag{2}$$

Alternative 2: not to introduce a new product. Accordingly, the profit maximizing function in this case will be:

$$\pi_2^* = \max \pi_2 = p_2 f_2(K, L) - wL_2 - rK_2 \tag{3}$$

Since, the firm is profit maximizing, it will choose to launch a new product only if

this alternative will make it better off. So, to make a right decision the firm should solve the following maximization problem:

$$\max(\pi_1^*, \pi_2^*) \tag{4}$$

Solving this problem will answer to questions whether a new product should be introduced and how much input should be used to produce in an optimal way.

Translating this result into real life: since firms are assumed to be profit maximizers, new product introductions should have a positive effect on the company's financial performance. Otherwise, they would not have chosen it.

Still, we ought to remember about the high level of uncertainty, which accompanies each product launch. First, it is hard to predict the demand, since in the laptop industry, quite often the firms are those that create it. Second is the competition – both external and internal. If the product is not innovative enough, there is always risk of fast imitation by competitors. As for the internal competition, introducing new models too often may lead to cannibalization – the firm will not get all the potential profits of the previous product. In addition, introduction will often make each model less valuable to the consumers and they will have no incentive to buy the product knowing that after a short period of time there will be a new one. On the other hand, introducing models too rarely leads to low brand awareness and decrease of the market share. Also, the high failure rate, which exists in the notebook industry, is a strong evidence that it is hard to predict whether the product will succeed and what will be the volume of the profits. This uncertainty, eventually, may lead to a wrong decision about introducing a new product and distortion of financial performance of the company.

Therefore, I am going to test what is actually the effect of the product introduction on firm's financial performance. In particular, based on the previous studies and common viewpoint I will be testing the following hypotheses for the laptop industry:

Hypothesis 1: NPI affects positively the financial performance indicators.

Hypothesis 2: Major changes in the products have greater positive impact on the company's financial performance than minor ones.

As the main independent variable of interest we will be using the number of new product launches (both successful and unsuccessful) per year for each company. We will also control for the level of changes made in the product – whether they are major or minor ones. Since there may appear the endogeneity problem: companies with better financial performance will tend to introduce more models, we will be using lagged number of NPIs per year to eliminate the problem. Moreover, NPIs have a lagged effect on company's financial performance, so taking lagged NPI we will also account for this.

To analyze firm performance I will be using the following indicators as dependent variables: Net income margin, ROA and Market Capitalization (as a proxy for firm value).

Net income margin is one of the most often used measures of profitability and is calculated as the ratio between net income and revenues of the company. It measures the percent of the revenues that is left after all operating and non-

operating costs were deducted. The higher is the profit margin, the better the company controls its costs and the greater income is available for stockholders. By contrast, a low profit margin means high dependence on sales volume, since

even a small decline in the revenues can result in losses for the company. New product introduction, if successful, should increase the revenues of the company, but it may affect the net income margin in both positive and negative way, depending on the degree of cost increase.

Return on assets (ROA) is calculated as ratio of company's earnings to its assets. It measures how effectively the management uses available resources to generate profits. Unlike Return on Equity (ROE) ratio, it does not take into account the capital structure, with which the company finances its activities.

Finally, market capitalization is the total value of company's shares outstanding. It can be used as a proxy for the firm value, since the stock price reflects the market perception of company's activities, expectations about the future performance and thus the price, which market is willing to pay for the company. Clearly, the introduction of a truly innovative product is expected to have a positive impact on the company's market capitalization, since it means that the company is willing and able to take a leading position in its sphere of specialization. By contrast, the market reaction to less radical products is hardly predictable.

In addition to the main independent variable we need some control variables.

Control variables for Net Profit margin.

Table 1 provides a short summary of the variables, which are most commonly used as determinants of profitability of a manufacturing firm.

As we can see, for the net income margin all the researchers have primarily chosen the following factors: 1) lagged dependent variable; 2) leverage; 3) productivity; 4) liquidity; 5) size of the firm; 6) sales growth; 7) competitiveness.

Table 1: The control variables used in the literature for the firm profitability

Author, year	Dependent variable	Independent variables
Stierwald, 2009	Current profit rate (profit level /total assets)	Lagged profit rates, ln (lagged productivity estimate), lagged leverage ratio (total liabilities/total assets), lagged size of the firm
Asimakopoulos et al., 2009	Net profit margin	Size, sales growth, investment, leverage and current assets.
McDonald, 1999	Net profit margin	Lagged profitability, industry concentration
Okwo et al. 2012	Net profit margin	Long-term-debt/equity ratio, inventory turnover ratio, debtors' turnover ratio, creditors' velocity, total assets turnover ratio
Joh, 2003	Ordinary income/ assets, net income/ assets	Size, export/sales, advertisement/ sales, market share, log (assets), lagged equity ratio, ownership concentration
Allen et al., 2011	Net profit margin	Market share, 4-firm concentration ratio, debt/equity, number of employees
Bilal and Amjad, 2013	Net profit margin	Leverage (total liabilities/total assets), growth opportunitites (sales growth/total asset growth), size (ln (sales)), liquidity (current assets/current liabilities), age (difference betweeen observation year and establishement year of the company), earnings volatility
Demir, 2007	Operating profits/ net fixed assets, net profits before taxes/net fixed assets	Lagged dependent variables, capital output ratio, market share, size (ln (net fixed assets), net sales growth

The lagged dependent variable is included, because the previous year financial performance has the impact on the current one. Leverage represents the structure of the company's capital that is the share of debt and equity, and thus has a direct impact on the profitability of the company. The higher is the labor productivity, the more efficient is the production, the smaller amount of resources is used, and hence, the higher margins are brought. The liquidity indicator measures how quickly the firm's assets can be converted into cash. The size of the firm is also expected to affect the profitability measure, although the impact can be both positive and negative, depending on the economies of scale. The sales growth is a percentage increase in sales and is also expected to have a positive impact. Competitiveness, usually measured by using the market share, describes what is the place of the company on the market, its supplies, customers and niche, which also directly affect the net income margin.

Combining all above mentioned, we have chosen the following control variables for the net profit margin:

1. Lagged Profit margin to account for the impact made by previous year performance.

2. Net Debt-to-Equity ratio (DE ratio)as a leverage indicator. The greater is the ratio, the greater is the portion of debt in financing the company's activities. A very high DE ratio may be a negative sign for stockholders, because in case of bakruptcy, they are less protected. On the other hand, too low level of debt means that the company does not use the opportunities, which credit capital gives.

3. Sales per emloyee will be used as a measure of labor productivity and is expected to have a positive impact on the company's performance.

4. We will use Current ratio as a proxy for the level of the firm's liquidity. Current ratio is measured as ratio between current assets and current liabilities. It is a liquidity ratio that reflects the company's ability to pay for its short-term liabilities, and which directly affects the efficiency of available capital resources usage.

5. The number of employees will be used as a proxy for a firm's size. It was already mentioned, that the impact of this variable is hard to predict.

6. Also we will be using the sales growth indicator, since in the laptop industry, where a huge R&D expenditures are present, the volume of sales is the indicator that mostly determines the profit of the company.

7. As for competitiveness, we do not have data for the market share or other possible proxies, that is why, we will not use it in our model.

Control variables for Return on Assets ratio.

There are not many papers devoted to the study of the determinants of the Return on Assets ratio. Table 2 contains the control variables, which were chosen for the manufacturing firms.

Although each author depending on the purposes of his research has chosen a different set of variables, there are factors present in all papers. Those are the factors that affect ROA, regardless of the industry or the variable of interest. We will use them for our research:

1. Leverage. As for the Net profit margin, we will use the Net debt to Equity ratio as an indicator of the company's capital structure.

2. Size – number of employees in the company.

Table 2: The control variables used in the literature for the ROA ratio

Ramachandran and Gavoury, 2011	ROA	Total debt/total asset, expense/income, debt/equity, current ratio
Banchuenvijit, 2012	ROA	Ln (paid compensation per employee), ln (firm age), export factor (dummy), ln (capital intensity=fixed assets/total assets), firm size (ln(assets))
Siminica et al., 2012	ROA	Capital employed ratio, leverage, self-financing ratio, quick ratio, overall solvency, coverage of capital invested
Tayib and Salman, 2011	ROA	Intellectual capital, size, leverage, capital employed
Dogan, 2013	ROA	Firm age, leverage (total liabilities/total assets), liquidity (current assets/current liabilities)

3. Liquidity. We will use Current ratio as a proxy for liquidity and we expect it to have the same effect on ROA as on Net income margin.

4. Labor productivity – sales per employee. The more productive is the labor of the company, the more efficiently are firm's assets used and hence the greater is ROA.

5. Capital productivity will be measured by Return on Capital employed (ROCE) ratio, which is calculated as the ratio of Net profit to the Capital employed (difference between Total assets and Current liabilities).

6. For solvency indicator we will use the Total assets to Net debt ratio. It is used for estimation of the company's ability to pay its short-term and

long-term debt through selling its assets.

Control variables for the Market capitalization.

The variables, which are most often used as determinants of market capitalization (see Table 3), can be divided into six main groups: size, profitability, leverage, growth opportunities, investment opportunities and diversification.

Table 3: The control variables used in the literature for the market capitalization

Chowdhury and Chowdhury, 2010	Share price	Size (share capital), profitability (EPS), public ownership (in percentage), capital structure (long term debt/total assets), dividend payout ratio, asset and operating efficiency (fixed asset turnover), growth rate (sales growth rate), liquidity (current ratio) and business risk (operating leverage)
Allayannis and Weston, 2001	Ln (Tobin's Q)	Size (ln(total assets), access to financial markets ln(total sales), ln(CAPEX)), leverage (long-term debt/shareholder's equity), profitability (ROA), investment growth (CAPEX/sales, R&D, goodwill-advertizing/total assets), industrial diversification, geographic diversification (foreign sales/total sales), industry effect, credit rating
Jin and Jorion, 2006	Q ratio	Size (ln (total assets), profitability (ROA), investment growth (CAPEX/total assets), leverage (long-term debt/common equity), production costs
Tahir and Razali, 2011	Tobin's Q	Size (ln (total assets)), leverage (total liabilities/market value of equity), profitability (net income/total assets), international diversification (dummy variable), majority ownership (percentage of 30 largest shareholders)
Cetorelli and Peristiani, 2010	Tobin's Q	Size (total assets), age (age from time of incorporation), ROA, sales growth
Lookman, 2004	Ln (Tobin's Q)	Growth options (CAPEX/assets, CAPEX/sales), ROA, log (assets), ratings index, leverage (total debt/equity), E&P revenues

For our research we will use the following proxies to them:

1. Size – number of employees in the company for each year. We expect a positive sign, since the size affects the perception of the investors: the larger is the firm, the less likely it is considered to collapse.

2. Profitability – we will use Net income margin, since it is one of the most commonly used indicators of company's profitability. A more profitable firm is expected to have higher stock price than a less profitable one.

3. Leverage (Debt to Equity ratio). There are contradictory views on whether the capital structure has an impact to the company's value. We will use instead the profitability of the employed capital (ROCE) and solvency of the company, which definitely affect the performance of the company and its attractiveness for the investors.

4. Growth opportunities – Sales growth rate

5. Investment opportunities. Goodwill is considered as one of the best proxies for investment opportunities. It measures the value of company's intangible assets, such as: a company's brand recognition, intellectual property and reputation among its customers and employees. The higher is company's brand recognition and the better is its reputation, the higher should be its value. But since in our dataset we have a lot of missing values for goodwill, we will not use this variable. Instead, we will use the firm's research and development (R&D) expenditures as a proxy for investment opportunities, since the higher are R&D expenditures, the greater should be company's intangible assets (e.g. licenses, patents, trademarks etc.) and its brand recognition.

6. Diversification – all companies are geographically and segmentally diversified, so we cannot use dummy variable in this case. We also do not have accurate data for this factor, so it will not be used in the model.

Following the chosen theoretical framework, we will use the following regressions to investigate the impact of NPI rate on the three indicators of companies' financial performance:

1) Profit margin

$$Profit\ margin_{i,t} = \alpha_i + \beta_1 NPI_major_{i,t-1} + \beta_2 NPI_minor_{i,t-1} + \beta_3 Profit\ margin_{i,t-1} + \delta_1 LP_{i,t} + \delta_2 NDE_{i,t} + \delta_3 N_empl_{i,t} + \delta_4 Sales_{i,t} + \delta_5 Current\ ratio_{i,t} + \varepsilon_{i,t} \quad (5)$$

2) Return on Assets

$$ROA_{i,t} = \alpha_i + \beta_1 NPI_major_{i,t-1} + \beta_2 NPI_minor_{i,t-1} + \delta_1 LP_{i,t} + \delta_2 Current\ ratio_{i,t} + \delta_3 NDE_{i,t} + \delta_4 N_empl_{i,t} + \delta_5 ROCE_{i,t} + \delta_6 Solvency_{i,t} + \varepsilon_{i,t} \quad (6)$$

3) Market Capitalization

$$MCap_{i,t} = \alpha_i + \beta_1 NPI_major_{i,t-1} + \beta_2 NPI_minor_{i,t-1} + \delta_1 N_Empl_{i,t} + \delta_2 Sales_{i,t} + \delta_3 Current\ ratio_{i,t} + \delta_4 Profit\ margin_{i,t} + \delta_2 ROCE_{i,t} + \delta_2 Solvency_{i,t} + \delta_2 R\&D_{i,t} + \varepsilon_{i,t} \quad (7)$$

where

NPI_major, t-1, NPI_minor, t-1 – lagged number of major and minor new product introductions per year in a company,

LP – proxy for labor productivity, measured as sales per employee,

Sales – sales growth,

N_Empl – number of employees,

NDE– Net Debt-to-Equity ratio,

ROCE – return on capital employment,

Solvency – Total assets/Net Debt,

MCap – market capitalization of the company.

Determining the effect of NPI on each of the chosen indicators is of high importance for managers and stockholders, since this knowledge will help to make a decision concerning the necessity of the NPI.

Chapter 4

DATA DESCRIPTION

For our analysis we will use panel data (company, year) for top 10 world laptop producers for a 11-year period (2002-2012). Such time period is quite reasonable because laptop industry truly started developing only about 10 – 15 years ago. Since our sample includes only leading companies, it may seem as non-representative. But, the companies chosen together possess a significant market share (about 90%, see Table 4) and thus will correctly reflect the main market tendencies. All the financial and non-financial data, used in the analysis, were collected from Bloomberg database, companies' websites and websites devoted to personal computers.

For the purposes of our analysis, we define the major introduction as an introduction of new series of notebooks. Consequently, the minor introduction is an introduction of a new model within already existing series.

The companies that have been chosen are: Acer, Apple, ASUS, Dell, Fujitsu, HP, Lenovo, Samsung, Sony and Toshiba. Their countries of origin primarily belong to Asian region: seven of ten companies are headquartered in Taiwan, South Korea, Japan, China and only three are founded in USA. All the entities are large multinational companies, which sell their products all over the world. Although the companies' positions in the market have been changing over time, all these companies were included in the top-10 list of the laptop producers over the last years (see Table 4).

Table 4: Market share of top-10 laptop producers for the Q1 of 2008 and 2010

Company	Country	Q12010 Market Share, %	Rank	Q12008 Market Share, %	Rank
Acer	Taiwan	19.4	1	14.6	3
Apple	USA	3.6	9	4.6	7
ASUS	Taiwan	8.9	5	4.3	8
Dell	USA	11.6	3	15.1	2
Fujitsu	Japan	1.9	10	5.2	6
HP	USA	19.3	2	20.8	1
Lenovo	China	8.3	6	7.5	5
Samsung	South Korea	4.3	7	N/A	N/A
Sony	Japan	3.7	8	4.2	9
Toshiba	Japan	9.3	4	9.3	4
Total		90.3		85.6 (w/o Samsung)	

All the companies have different policies on frequency of new product introductions. About half of the companies - Apple, Dell, Fujitsu and Lenovo - prefer to make more rare but major introductions, the rest – Acer, ASUS, HP, Samsung, Sony and Toshiba introduce on average more than 120 models per year, which only slightly differ from the existing ones.

This fact is also illustrated by the Figures 1 and 2, where 1 stands for Acer, 2- Apple, 3 – Asus, 4- Dell, 5 – Fujitsu, 6 – HP, 7 – Lenovo, 8 – Samsung, 9 – Sony, 10 – Toshiba.

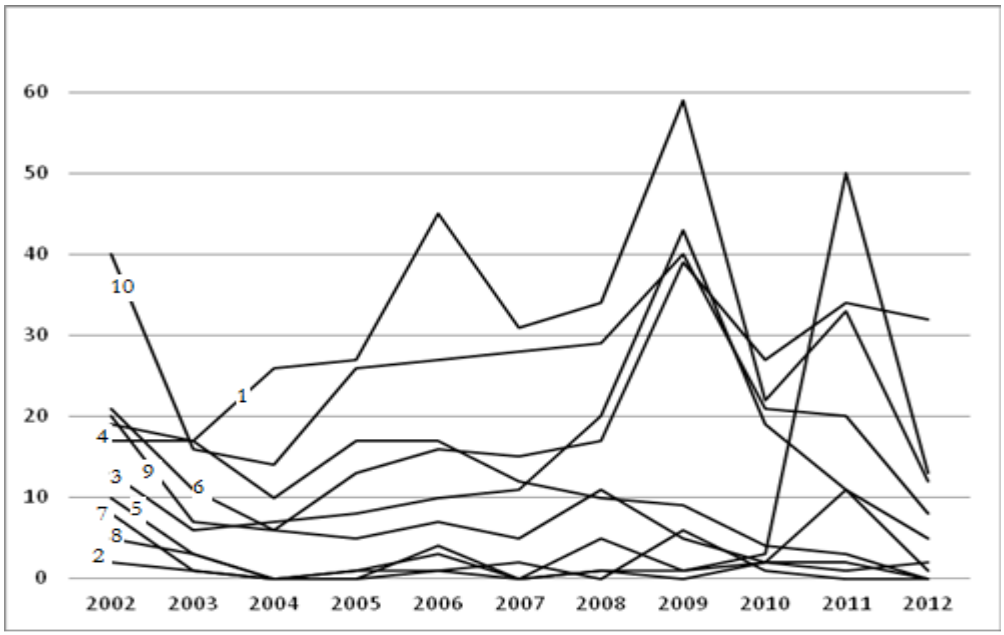

Figure 1: Number of major NPIs per year for each company, 2002-2012

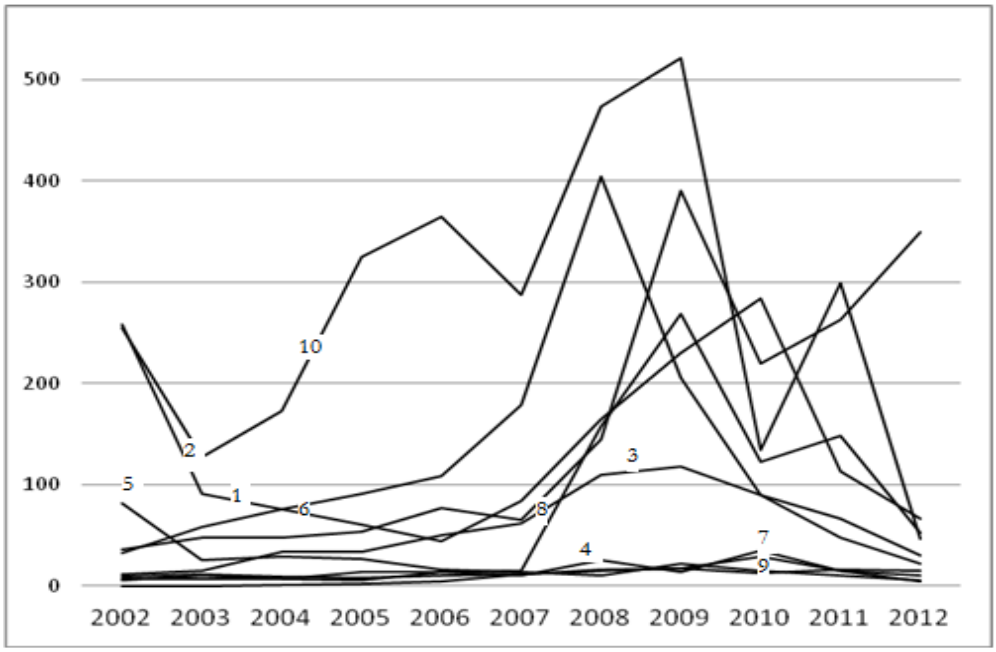

Figure 2: Number of minor NPIs per year for each company, 2002-2012

Although the number of new product introductions changed over time for all the companies, we still can see the general tendency of the companies to primarily introduce products with either structural or incremental changes.

We also provide the descriptive statistics for major, minor and total new product introductions per year.

Table 5: Descriptive statistics for NPI rate per year for each company for 2002-2012 years.

Variable	Obs	Mean	Std. Dev.	Min	Max
NPI_total	110	98.67	121.26	5	561
NPI_major	110	11.92	12.88	0	59
NPI_minor	110	86.75	113.03	0	521

As we can see, on average companies make about 12 major NPIs and about 87 minor ones. The standard deviation is high, which means that some companies introduce significantly greater number of new models, than others. Such great variation makes us expect that the heteroskedasticity will be present in the model, so we will have to account for it.

The descriptive statistics for the variables of interest is presented in table 6:

Table 6: The decriptive statistics for the financial indicators, 2002-2012

Variable	Obs	Mean	Std. Dev.	Min	Max
Profit margin	110	0.54	2.30	-1.63	20.52
ROA	110	0.68	2.16	-3.2	9.82
Mcap	110	48445.27	77951.97	1731.68	626550.4

So, on average the leading companies have 0.54 profit margin, which means that about half of the revenues is left to the shareholders after subtraction of all

costs. The return on assets is equal to 0.68, so on average $0.68 of profits is generated per each $1 of assets. Still, the high standard deviation for all three variables and large range show that companies significantly differ in their profitability and firm value. We are going to check whether the new product introdiction rate contributes to this difference.

While performing the analysis, the disadvantages of the data should be taken into account. First, we have rather small sample, because the notebook industry started developing not so long ago and almost the whole market belongs to ten biggest companies. In addition, we do not have proxies for all necessary factors that affect our financial performance indicators. Also, the separation of the new product introduction on the minor (new model) and major (new series of models) is not perfect: the extent to hich new series or models differ from previous ones is different for different companies. Because of the absence of appropriate ranking of models by "newness" we cannot account for this difference.

Chapter 5

EMPIRICAL ANALYSIS AND DISCUSSION

As was mentioned above, we have a balanced panel for 10 companies for 11 years (2002-2012). To analyze panel data we can use one of three techniques: fixed effects, random effects or simple OLS. To choose between fixed effects and pooled OLS we have used standard F-test and for all regressions it showed that we should use fixed effects. To decide between fixed or random effects we have run a Hausman test. The null hypothesis of this test is that the preferred model is the random effects model versus the alternative hypothesis, which states that the fixed effects model should be used. It basically tests whether the unique errors (u_i) are correlated with the regressors, the null hypothesis is they are not. To choose between random effects and pooled OLS we have run the Breusch-Pagan test, will null hypothesis that random effects model should be chosen. The summary table with the results of the tests results is presented below:

Table 7: Results of the Hausman and Breusch-Pagan tests

Dependent variable	Profit margin	ROA	Market Capitalization
Hausman test	chi2(7) = 12.88 Prob>chi2 = 0.0751	chi2(7) = 38.22 Prob>chi2 = 0.0000	chi2(8) = 5.40 Prob>chi2 = 0.7136
Breusch-Pagan test	chibar2(01)=0.00 Prob>chibar2 = 1.0000	-	chibar2(01)=0.00 Prob>chibar2 = 1.0000
Result	Pooled OLS	Fixed effects	Pooled OLS

So, according to the results of the tests we should run pooled OLS regressions for profit margin and market capitalization and fixed effects regression for return on assets ratio.

We also have checked if there is heteroscedasticity in our regressions and found that it is present in all the models, so we used the robust option to get rid of it. Since the dataset is rather small, there is no reason to expect serial correlation. As for endogeneity, we eliminated it by using lagged independent variables. The obtained results are presented in the Table 8.

Now let us interpret the results.

Effect on Profit margin.

According to the regression results, major NPIs have statistically significant positive effect on the profit margin of the company: introducing one new series on average leads to increase in the profit margin by 0.023. The effect is not very large, since high R&D expenditures needed to launch more innovative products reduce the margins significantly.

By contrast, minor NPIs have statistically sighnificant negative impact on the company's net income margin. Introduction of one new model with incremental changes on average leads to a decrease in the profit margin by 0.002. This does not mean that company does not get profits from the new product, it just means that the profit per 1$ of sales decreses.

We should also remember that not all NPIs are successful, which also contributes to such result. So, to get more precise result, the NPIs should be divided into successful and unsuccessful ones and then the effects of each group should be studied separately.

Table 8: Regression results

Variables	Profit margin	ROA	Market Cap
Major NPIs, t-1	0.0232***	0.00267	689.6*
	(0.00866)	(0.00344)	(395.3)
Minor NPIs, t-1	-0.00237**	-0.000756	-99.99**
	(0.00117)	(0.000692)	(45.42)
Profit margin, t-1	0.461***		
	(0.0489)		
Profit margin			-45.85
			(4.317)
Sales per empl.	0.0118	-0.0451	
	(0.0462)	(0.0489)	
Net debt/Equity	0.109	0.0504	
	(0.0876)	(0.0591)	
Number of employees	-0.000000519	0.000000861	0.0495
	(0.000000449)	(0.000000546)	(0.0476)
Sales growth	0.105		28.047
	(0.110)		(24.418)
Current ratio	0.0504	0.0444	27.805**
	(0.0535)	(0.0683)	(11.305)
ROCE		0.541***	-2.083
		(0.0150)	(1.457)
Solvency		-0.00340	2.708
		(0.00201)	(55.00)
R&D			14.81***
			(2.925)
Constant	-0.0279	0.100	-25.391
	(0.123)	(0.168)	(15.519)
Observations	100	100	100
R-squared	0.878	0.958	0.178
# of companies	10	10	10

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Effect on the Return on Assets ratio.

According to the regression results, the effect of both major and minor NPIs is not statistically significant. So, the effectiveness of usage of firm's assets does not depend of the degree of changes (incremental or structural) the company makes in its products.

Effect on Market Capitalization.

The impact of major NPIs on the market capitalization of the company is statistically significant and positive, which is consistent with our expectations. Introduction of new series on average increases the market capitalization by $689.6 million. This can be explained by the fact that performing major innovation means introducing something more or less radically new to the market, which attracts the consumers and increases their awareness about the company. Besides, if the company is able to produce something new, it means that it has enough resources to do it and a good management, which increases the value of the company for the investors.

By contrast, minor new product introductions have statistically significant negative impact on the market capitalization, against our expectations. Introduction of one model leads to decrease in the firm value by almost $100 million. One possible reason is the negligibility of the changes in the product compared to its predecessor, so that consumers prefer to wait for the next model. Second, as was shown, minor NPIs have negative impact on the profit margin. They may also distort other indicators of financial health and stability of the company, which investors pay attention to. Lack of innovativeness may

also be considered as lack of both financial and intellectual resources to produce something new.

The summary of the results is presented in the following table:

Table 9: Summary of the results

Hypothesis	Result
H1: NPI affect positively the performance indicators.	
- major NPIs positively affect profit margin	Do not reject
- major NPIs positively affect ROA	Not significant
- major NPIs positively affect market capitalization	Do not reject
- minor NPIs positively affect profit margin	Reject
- minor NPIs positively affect ROA	Not significant
- minor NPIs positively affect market capitalization	Reject
H2: Major changes in the products have greater positive impact on the company's financial performance than minor ones.	Do not reject

We also should not forget about the imperfections of used dataset. Not large enough number of observations or possibly wrong proxies can decrease the reliability of the obtained results.

Chapter 6

CONCLUSIONS

This paper was aimed to investigate the impact of the frequency and innovativeness of new product introductions on the financial performance of the notebook producers. In particular, we discussed the effect of major and minor new product introduction on the on firm value and profitability. Using data for top-10 laptop producers (more than 90% of the market) for 11-year period (2002-2012), we have obtained the following results.

The analysis has shown that major new product introductions have a positive impact on the profit margin and market capitalization, while minor innovatios are found to have negative impact on these two indicators. Also, according to the results both incremental and structural innovations do not have statistically significant effect on the return on assets ratio.

Still, this does not mean, that only major innovations should be made. In case of failure, the losses from major NPI will be much higher than from minor one. When making the decision about NPI, also the following factors should be taken into account: macroeconomic conditions, target audience, available resources, competitor's behavior, etc. This research just provides the management of the company with the knowledge about what on average the effects of NPI on the firm's financial performance are.

This research was not aimed to give full and profound picture about the interaction between new product launches and company's financial performance and should be considered as a first step in learning what the

effects of NPI truly are. There are several ways to improve this study in the future. First, take data for longer period of time. Second, use data or find good proxies to such factors as market share, competitiveness, industry concentration etc. Third, study the successful and unsuccessful NPIs separately and, if possible, use more accurate separation of NPIs into major and minor ones. Finally, investigate the effect of new product introduction on other indicators of company's financial performance.

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