



Exacta

ISSN: 1678-5428

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Universidade Nove de Julho

Brasil

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Innovation and financial performance of Brazilian companies: a statistical study for the  
period of 2009 to 2013  
Exacta, vol. 13, núm. 3, 2015, pp. 427-438  
Universidade Nove de Julho  
São Paulo, Brasil

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# Innovation and financial performance of Brazilian companies: a statistical study for the period of 2009 to 2013

*Inovação e desempenho financeiro de empresas brasileiras: um estudo estatístico no período de 2009 a 2013*

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## Abstract

We look at innovation returns in two groups of companies located in Brazil. One group includes innovative companies, referred to as 3i companies (Innoscence Innovation Index) and listed in the São Paulo Stock Exchange – BOVESPA. The other group is referred to as Not-3i companies and are also listed in São Paulo's BOVESPA. We first made a descriptive analysis and then a regression on performance indicators – net margin, asset profitability, and return on equity and on invested capital – with data from companies classified as 3i and Not-3i in the Economatica Report, limited to the period between 2009 to 2013. Results indicate that significant correlation appears between innovation and returns on invested capital, on equity, and on assets for 3i companies, as hypothetically projected. Net margin, however, is lower for 3i than for Not-3i companies, showing that lower gains in 3i companies may be due to higher costs of internal innovation.

**Key words:** Innovation. Innovation and financial performance. Return on innovation.

## Resumo

Estudamos os retornos da inovação em dois grupos de empresas sediadas no Brasil. Um grupo inclui empresas inovadoras (3is), classificadas no Innoscence Innovation Index e listadas na Bolsa de Valores de São Paulo (BOVESPA). O outro grupo (Não 3is) constituiu-se de organizações também listadas na BOVESPA. Fizemos primeiro uma análise descritiva, e depois uma regressão sobre os indicadores de desempenho – margem líquida, rentabilidade de ativos, retorno sobre patrimônio e sobre capital investido, usando dados do Relatório da Economatica para as empresas 3is e para as Não 3is, no período de 2009 a 2013. Os resultados indicam haver correlação significativa entre a inovação e o retorno sobre o capital investido, sobre os ativos e sobre o patrimônio líquido nas empresas 3is, como hipoteticamente projetado. A margem líquida, contudo, é mais baixa para as 3is do que para as Não 3is, mostrando que a restrição de ganhos nas 3is pode ser devido a outras causas, como o maior custo da inovação interna.

**Palavras-chave:** Inovação. Inovação e desempenho financeiro. Retorno sobre inovação.

## 1 Introduction

The relationship between innovation and business performance has become lately a growing field of research. Considering the concept of innovation synthesized in Barbieri and Álvares (2003) as the result of the implementation of an idea yielding positive economic results, empirical studies of this relationship, as well as the respective research methodologies, have multiplied in academia (SLOW, 1957). In general, they involve several quantitative and qualitative studies targeted at consolidating the truthfulness of results, that is, innovation as a business profitability increaser and a satisfier of consumer needs. Innovation has become, then, a basic factor for increasing the performance of companies (BRITO et al., 2009) and a relevant strategic tool to face economic, organizational, and social dilemmas (SILVEIRA; OLIVEIRA, 2013). In spite of the conceptual logic of that relationship, empirical findings of research by Brito et al. (2009) are still not conclusive. They indicate that, thinking rationally, innovation endeavors tend to affect the growth of companies; however, empirical evidence does not consistently support this relationship. One reason could be the difficulty in measuring innovation as a singular cause of a firm's performance. Though many distinct factors may simultaneously be influencing performance, it is hard to ascertain that a positive performance results solely from innovation. To argue against this, however, expert literature shows a direct and positive relationship between innovation and the performance of firms, as in the study by Cho and Puick (2005) among 488 firms located in the United States.

Correlation between innovation and performance has become in recent years an expanding field of research. Due to a high degree of uncertainty about the real causes or set of variables in-

fluencing performance in the context of competition in innovative environments, the implications of innovation on business have become an attractive field of study. Many empirical studies on this relationship have been drawing attention, in spite of the fact that many of them do not carry the necessary well-articulated scientific arguments. In addition, many recent quantitative and qualitative studies simply attempt to confirm the truth of results. In any case, however, innovation is unquestionably a key factor in the performance of companies.

Research evidences raise the question of whether innovation is a necessary but neutral inducer (since, depending on how it is used, it can be positive or not), or if innovation has become a necessary inducing tool for firms' performance. This study seeks to analyze the influence of innovation on the performance of firms by demonstrating, in a comparative sample of 3i and Not-3i companies its positive influence on their financial performance, in a selected time period.

Methodologically, we searched for information on performance indicators during the period of 2009 to 2013 and did a trend analysis on selected indicators: net margin, asset profitability, equity profitability, and return on invested capital. Additionally, we did a regression analysis using a dummy variable, attributing value "1" to innovative firms and "0" to non-innovative firms. As a result, we were able to infer influence of innovation on the performance of firms with statistical positive betas.

## 2 Literature review

The concept of innovation has been studied from distinct perspectives in recent years. It seems that the majority of researchers agree on the economic nature of innovation; that is, improving

something in design, basic operating functions, process, or applicability must demonstrate market acceptance, by capturing value in the market. However, its definition holds another internal ingredient, that is, value generation. In economic terms, internal ingredient refers to cost-effectiveness, and market acceptance refers to financial returns. Stressing one path or another depends on the momentum and the economic operating context of the firm, where innovation is essential to reach and maintain competitive advantage.

Most expert literature in innovation deals with the object or the format of innovation with an internal look at the ingredients of innovation. Bessant and Tidd (2007), for instance, look at the object of innovation when classifying innovation in product, process, position, or paradigm. Henderson and Clark (2005), on the other hand, leading the current trend of conceptualizing innovation as the process of creating improvement (incremental, radical, modular, and architectural), emphasize the format of innovation.

Innovation concepts in the Oslo Manual (1997) stress market value capture. Firms innovate when they develop and implement improvements on existing products and processes or create new ones. Of course, creation of or improvements in products/processes by a company are intended to capture market value. Barbieri and Álvares (2003) are more explicit, understanding innovation as the result of the implementation of an idea with positive economic results.

An innovative firm, according to Tidd, Bessant, and Pavitt (1997), involves more than a social structure. It involves several integrated components that work together to create and reinforce the adequate environment to generate innovation. For the authors, innovative firms retain ten features that are crucial to achieve higher performance: shared vision and leadership; adequate infrastructure; key individuals; effective working

groups; permanent individual development; ample communication; higher involvement with innovation; client focus; creative environments; and organizational learning. An innovative firm, as per the Oslo Manual (1997), is characterized as an organization that has developed innovative strategies and implanted products and processes, management models, marketing and business models, or even a combination of these.

## 2.1 Competitive advantage

Innovation is always connected to competitive advantage in companies. However, competitive advantage results from several factors, some of them deriving from internal elements or internal arrangements (BARNEY, 1991) and some of them resulting from adaptability to market forces (PORTER, 1989). Recent theories on organizational ambidexterity (BIRKINSHAW; GIBSON, 2004) and technological resilience (REINMOELLER; BARDWIJCK, 2005) broach once again the same concepts seen in Barney (1996) and Porter (1989). Ambidexterity theory, in fact, represents better the same concepts brought by Porter related to external or market forces and the value chain. While market forces require counteractions, ambidextrous organizations require adaptability; and while value chains require an internal combination of primary and secondary activities, ambidextrous organizations need growing internal alignment of processes and structure.

On the other hand, Barney (1996) advocates that companies with valuable, rare, inimitable, and irreplaceable resources may obtain competitive advantage. Resilience theory amplifies this concept pointing out that the expanding technological domain and the development of innovation capabilities, for instance, would allow companies to maintain competitive advantage unaltered when facing pressures from competitive environ-

ments or external scenarios, affecting their competitive abilities.

One of the first to note the relationship between innovation and competitive advantage, however, was Schumpeter (1985), who noticed that innovations keep the capitalist system “alive”. Schumpeter points out that innovation nurtures the creation of new technological, managerial, and market paradigms responsible for changes in the competitiveness of companies. In the same stream, Hurley and Hunt (1998) postulated that companies holding abilities to innovate also develop competitive advantage leading to higher levels of market share and financial performance. Evolving from the pure concept of strategy, Porter (1999), seconded by Besanko et al. (2000), recognizes that companies can reach competitive advantage through innovation, that is, by means of applying new technologies and new ways of doing things.

In recent years, innovation has been coupled with sustainability of competitiveness (TAKAHASHI, 2007). In other words, innovation became critical to guarantee a sustainable advantage for competitiveness. Results of research by Tomé et al. (2013), for instance, lead to conclusions on sustainability of competitive advantage when distinct areas of the business other than research and development (R&D), such as marketing, production, finance, and human resources enter the stage for innovation.

## 2.2 Innovation and performance

As time and knowledge evolved starting from Schumpeter’s (1985) first ideas on functionality of innovation for business and companies themselves, as stated earlier, distinct approaches were adopted in the literature to point out or prove the influence of innovation on business. The first ideas were on ability of innovation of self-renewal – old technologies would be replaced by new ones. Then came the influence of innovation on business

competitiveness, replacing the understanding that strategies were sufficient to compete, by creating ambidexterity and resilience in organizations. And in a third stage, we see innovation becoming fundamental for sustaining the competitive advantage of businesses.

In spite of being intuitive, looking at the influence of innovation on business performance, more specifically financial, is even more recent. In the 90’s decade, Neely et al. (1995) recognized innovation as key to business performance. Peteraf (2003) expands this concept and sees innovation as a resource. Since performance results from the excellence of resources management, so it is for innovation. That is, the better innovation is managed, the greater its positive influence on business performance. Under this perspective, Hu (2003) conceives innovation in terms of its functionality for business profitability; that is, innovation endeavors make sense when results translate into profit and benefits for society. The empirical research results of Faems et al. (2010) on product innovation confirm Hu’s (2003) approach on the function of innovation for business; that is, innovation keeps competitive advantage sustainable and, at the same time, exerts a positive influence on the financial performance of the business.

More than firms’ performance, Cho and Puick (2005) found through their research a relationship between innovation and companies’ growth. The relationship between innovation and industrial growth is also widely recognized among economists (BESSANT; TIDD, 2007), which suggests that endeavors in innovation in research and development (R&D) would positively affect the growth of businesses (BRITO et al., 2009). This study also showed a positive correlation between innovation and net revenue.

So important did investments in R&D become that Silveira and Oliveira (2013) consider it as synonymous with innovation. The authors

studied firms that received money from FINEP, the largest technology development financing agency in Brasil, to examine the implications of investments in innovation on the performance of firms. Results of the research indicate that without exception, all innovative firms maintain R&D departments.

Investments in R&D and its business significance for the growth of companies has been identified and analyzed by Hall (1987) in a sample of public manufacturing companies in the United States, showing that companies with R&D grew bigger than companies without R&D programs or departments.

Profitability deriving from innovation, however, is not evident in any industrial sector. For instance, in a study of companies from the Brazilian chemical sector, two hypotheses were tested: (1) the greater the investment in innovation, the greater will expected business profitability be; and (2) the greater the investment in innovation, the greater will net revenue be. Statistical analysis, however, did not allow the authors to demonstrate correlation between investment in innovation and greater profits. Also, data from Amaral and Lima (2011) show no correlation between innovation and profitability. In another study, Silveira and Oliveira (2013) looked at possible correlations between sales, net margin, and patents. Considering the dependence relationship between net margin and profit, results show that investments in innovation are inconclusive with respect to profitability.

Finally, returns on innovation, in spite of being rationally acceptable, seem not to be immediate, or short run. On the same premises, Cruz (2010) proves through his research that, in fact, there are returns from R&D endeavors and direct investments, but only in the medium and long run. One can imagine, however, that it's hard to separate contributions from corporate strategies not

related to innovation from returns coming from investments originating solely in innovation.

## 2.3 Hypothesis

The relationship between innovation and financial performance is a growing research field in academia. According to Slow (1957), in recent years empirical studies examining this relationship have increased in number, as well as the respective methodology. Most of the quantitative and qualitative studies carried out on financial performance evaluation over this period targeted mainly the trustworthiness of results. Knowing that innovation is considered a fundamental factor for firms' financial performance, this study intends to shed some light on the process of the influence of innovation on financial performance in the context of Brazilian companies. The resulting hypothesis is: "Innovation positively influences the financial performance of firms".

Since the moment innovation became a key managerial tool to set competitive strategies for firms, there is an intuitive logic backing up this hypothesis. This logic comes from the premise that innovation, exerting a direct influence on financial performance of companies, originates revenues resulting from innovative products or services easier accepted by the market. Finally, one could rationalize that innovation, viewed as competitive strategy, supports premium price strategies for products and/or services, increasing the net margin of profits.

## 3 Method

We evaluated the influence of innovation on performance of firms first through a descriptive analysis of the selected performance indicators (net margin; asset profitability; return on equity; and return on invested capital) of companies clas-



sified as 3i, compared to companies not classified as 3i. Following this, we did a regression analysis, using a dummy variable, applying the value “1” to 3i companies and “0” to the others. The regression analysis aimed to verify whether 3i-classified companies would be affected in performance differently from those not classified as 3i. The regression function used was:

Where:

$y$  – performance indicator;

$\alpha$  – constant representing the crossing point of the straight line with vertical axis;

$\beta$  – constant representing the slope (angular coefficient) of the straight line;

$x$  – independent explanatory variable representing the explanatory factor in the equation; This number originates in the dummy variable used (“1” = 3i company; “0” = Not-3i);

$\varepsilon$  – variable, including all residual factors plus any possible measuring mistakes. In the hypothesis, this variable allows us to verify whether the 3i companies are affected positively by the performance indicator, that is, if they have a beta greater than 1.

### 3.1 Variables

Companies seek profit maximization and increased economic value. Therefore, financial performance became an acceptable base for research on companies’ performance. Many authors discuss distinct approaches to evaluate performance (SILVEIRA; OLIVEIRA, 2013), hence, it is important to determine indicators and measures to be used while evaluating overall performance of organizations. Without a measurable indicator and its respective measuring unit, there is no means of determining the efficiency/effectiveness of processes, products, and services. Indicators and measures, however, must be aligned with or-

ganizational strategies and show essential information on performance (SLACK et al., 2006).

Among all performance parameters, profitability is the most exploited dimension for measuring the performance of an organization. This parameter involves measures of indicators such as return on assets (ROA), return on investments (ROI), return on net equity (ROE) and net sales profit (ROS), or simply net margin (ASSAF NETO; LIMA, 2009). Another parameter embraces the idea of growth, basically using the set of indicators, measured in distinct time periods. A third one involves market value of brands (COMBS et al., 2005). On how to deal with performance, Bulgacov and Paulin (2009) alert to the fact that a company’s performance must be evaluated considering more than one area, since performance itself is a multidimensional concept.

Regarding the role of innovation, Bogota’s Manual (JARAMILLO et al., 2001) presents indicators of innovation measurement that are closer to the reality of emerging economies. The Manual handles indicators in three distinct dimensions: impact indicators; innovation/technology diffusion indicators; and costs and investments in innovation. Impact indicators refer to the resulting influence on the financial accounting numbers of a company, such as sales growth and market expansion due to technological efforts of a company (SILVEIRA; OLIVEIRA, 2013). Diffusion indicators refer to how much an innovation or new technology was accepted by the market, resulting in better market resilience for the company or market expansion. Costs and investments indicators, on the other hand, are self-explanatory, signifying how much a company has invested in technology/innovation development in a specific period.

To measure performance as a result of innovation in a company, one can use research and development (R&D) indicators, as suggested by the Oslo Manual (1997); patents granted to a

company that are effectively in use (GEISLER, 1999), or qualification of human resources, all appointed as traditional indicators of innovation (MARINS; ZAWISLACK, 2010). However, when used in isolation, traditional indicators do not assure an ample vision of how much innovation activities affect organizational performance. For these cases, traditional indicators are inadequate because one cannot attribute the success of innovation solely to one indicator or another (MEIRELES et al., 2010).

Therefore, for this study, we collected information that could show performance in a more representative way. We first classified a set of 1,851 companies listed in São Paulo Stock Exchange (BOVESPA), using a digital tool for analyzing stocks and investment funds called Economática (Economatica, 2014), which operates in the market since 1986 and is widely used by investor from the USA, Brazil, Argentina, Chile, Colombia, Peru, and Mexico. This managerial tool uses advanced analysis modules that use financial performance data from sources of higher trustworthiness. For our study, we selected the list of four indicators mentioned earlier: ROS, ROI, ROE, and ROA. We selected data from the last, consolidated financial balance sheet after taxes for the years of 2009, 2010, 2011, 2012, and 2013.

The classification analysis is intended to separate innovative companies from non-innovative companies according to parameters and indicators embedded in the Economática module of innovation factors/elements and other indicators from Exame Magazine. Innovative companies selected should meet all requisites of innovation that classify companies as innovative according to Economática. Additionally, a company should be listed in the stock exchange with shares negotiated in BOVESPA. Financial and share market value performance of each company create an innovation ranking. We used the same criteria as Exame

Magazine (2014), that is, only companies listed in this ranking and recognized as having received awards as innovative companies by the main business magazines in Brazil were considered triple “i” companies. We selected 3i companies appearing every year in the list for the period considered in this study.

ALL	Marcopolo
Ambev	Metalfrio
Banrisul	Natura
Celulose Irani	Parque Eólico Cenaeel (Grupo EDP Energia)
Concepa (Triunfo)	Petrobras
CSN	Souza Cruz
Duratex	Springer Carrier
Ecosul (Ecorodovias)	Tecnisa
Eletronorte (Eletróbrás)	Telebrás
Embraer	Telefônica
Even	TOTVS
Gerdau	Usiminas
Grendene	Vale
Grupo Randon	WEG
Karsten	Whirlpool
Lojas Renner	

**Frame 1: Companies holding the 3i index**

Source: Exame, 2014.

To identify non-innovative companies we did the opposite. We looked at 1,851 shares of companies listed in BOVESPA and extracted all repeated companies, since share data are similar to each other, regardless of the type of share. This process filtered companies, leaving a total of 1,005. Then we excluded all companies with no data. They could restrict regression analysis for the intended period (2009 through 2013). In addition, we eliminated all companies with negative data. This cleaning process reduced the sample to a small number of companies, ranging in number from 153 to 184, depending on the indicator analyzed. Table 1 shows indicators with the respective number of companies.



**Table 1: Amount of companies per performance indicator**

Performance indicator	Number of companies
Return on invested capital (ROI)	153
Return on equity (ROE)	172
Return on assets (ROA)	184
Net margin (ROS)	167

Based on Table 1 data, we tried to establish a correlation between 3i and Not-3i companies. Correlation analysis relies on two variable, “X” and “Y”, and characterizes the association between both. Once the correlation is determined, it is possible to characterize the relationship, as force and direction (Cooper and Schindler, 2001), coming from the results of innovation on a company’s performance.

## 4 Results and discussion

To establish the correlation between innovation and performance indicators among selected companies (3i and Not-3i companies), we first did a macro descriptive analysis and introduced, as explained in the Method section, a dummy variable to differentiate between both in the matrix. We express returns using percentages for the performance of 3i and Not-3i companies. Thus, the descriptive analysis, shown in Table 2, represents the percentages of average financial performance of the indicators, in terms of returns, in each of the two groups of companies. One can see that performance indicators of 3i companies present average returns in the range of 1.7% to 4.7% higher than Not-3i companies, except for Net Margin (ROS).

In Table 2, returns on equity (ROE) present numerically the higher percentage among all indicators. This higher percentage may come from the accumulation of patent value in a company’s equity. Despite the differences in number, ROI,

ROE, and ROA are all positive and higher for 3i companies than for Not-3i companies, proving in some way that market acceptance of 3i companies’ products is better than that for Not-3i companies. However, the same Table (2) of statistical results shows that return on investments (capital investment) presents the highest difference, that is, the highest range of difference on returns (difference of 4.7%) between 3i and Not-3i companies. On the other hand, ROS, expressing net margin, is the only financial performance indicator with higher returns for Not-3i companies. It shows an inverted difference on performance for the five-year period evaluated. We may guess that, at the very least, Not-3i companies practice a very different price policy compared to 3i companies, focusing on gains in production cost, and much less on the appeal of innovation.

**Table 2: Comparative analysis of performance indicators between 3i and Not-3i companies**

	Average ROI %	Average ROE %	Average ROA %	Average ROS %
3i companies	15,42	23,6	9,36	13,06
Not-3i companies	10,7	21,47	7,59	14,2

ROI = return on investment; ROE = return on equity; ROA = return on assets; ROS = return on sales (net margin).

Comparative analysis, however, is just a macro view of the picture. To evaluate influence of innovation on financial performance of companies, we need to establish also the correlation, if there is any, between financial performance indicators and innovation for the two groups of companies. So, we did a correlation analysis between innovation and the selected financial performance indicators for each year in the five-year period. Table 3 shows that the highest correlation between innovation and financial performance indicators is the return on capital investments. This correlation confirms ROI as having the highest average differ-

ence for the returns that were analyzed, as shown above in Table 2, in spite of ROE having been the highest. Numbers in Table 3 also show a negative correlation for Net Margin (ROS) coming from innovation efforts of both groups of companies. Again, the negative correlation confirms the inverted behavior of ROS, with respect to the 3i and Not-3i companies.

Finally, as indicated in the method, we determine the influence of innovation on the financial performance of companies through regression analysis, based on the regression function ( We calculated the influence comparing the 3i group of companies with the Not-3i group, in each year of the selected period, for each performance indicator. Table 4 shows the results.

Return on investments (ROI) coming from innovation endeavors shows positive  $p$ -values ( $p < 0.05$ ) for the majority of the years of the studied period, except for the year 2009. Beta results for this financial performance indicator are positive for all years evaluated, demonstrating a positive relationship between innovation and ROI, in spite of the low values of R squared ( $R^2$ ).

Returns on Equity, Returns on Assets, and Net Margin couldn't establish a strong relationship with innovation, based on  $p$ -values of each performance indicator, since  $p$ , for all of them, is greater than the standard value of .05. In other words, regression analysis may still be a poor statistical model to explain the relationship between innovation and financial performance of these indicators.

**Table 3: Correlation between innovation and performance indicators**

Performance indicators	Correlation with innovation				
	2013	2012	2011	2010	2009
ROI	0,2272	0,2397	0,2397	0,2063	0,0735
ROE	0,1203	0,0737	0,0335	-0,0080	-0,0027
ROA	0,0823	0,0755	0,0628	0,0292	0,0709
ROS	-0,0163	-0,0482	-0,0281	-0,0075	-0,0562

ROI = return on investment; ROE = return on equity; ROA = return on assets; ROS = return on sales (net margin).

**Table 4: Regression analysis of innovation and performance indicators in the 5-year period**

ROI – Return on investment (invested capital)						
Year	2013	2012	2011	2010	2009	Average
R-Square	0,0395	0,0516	0,0574	0,0425	0,0054	0,0422
Beta	4,3471	5,1337	6,1177	5,391	2,6406	4,726
P-Values						
Intersection (alfa)	6E-27	2E-26	3E-26	5E-33	4E-21	2E-31
Innovation (x)	0,0141	0,0049	0,0029	0,0108	0,3683	0,0112
ROE – Return on Equity						
R-Square	0,0145	0,0054	0,0011	6E-05	8E-06	0,0422
Beta	6,2463	3,9052	2,8167	-1,865	-0,446	2,1315
P-Values						
Intersection (alfa)	9E-22	1E-25	4E-15	9E-06	8E-09	8E-14
Innovation (x)	0,1161	0,3369	0,663	0,9167	0,9715	0,7777
ROA – Return on Asset						
R-Square	0,0068	0,0057	0,0039	0,0009	0,005	0,0042
Beta	1,9728	1,6454	1,8448	1,4267	1,9385	1,9385
P-Values						
Intersection (alfa)	2E-20	1E-26	3E-20	3E-12	9E-24	2E-22
Innovation (x)	0,2668	0,3087	0,3973	0,694	0,3388	0,3811
ROS – Return on Net Margin (Return on Sales)						
R-Square	0,0003	0,0023	0,0008	6E-05	0,0032	0,0012
Beta	-0,5934	-1,895	-0,958	-0,264	-1,991	-1,14
P-Values						
Intersection (alfa)	8E-26	3E-27	7E-33	2E-35	2E-32	2E-34
Innovation (x)	0,8344	0,5358	0,7181	0,923	0,4708	0,6572

## 5 Conclusions

When we look at the facts only descriptively, attributing to innovation the generic cause of returns, meaning financial performance of innovative companies can originate in their own capacity to innovate and bring products to market, it seems to be a true hypothesis. However, descriptive statistical analysis shows an incongruence regarding ROS (Net Margin) behavior: an inverted influence in two cases on returns to the expected financial performance of 3i and Not-3i companies. First, in the year 2009, ROS is higher in average returns for Not-3i companies than for 3i companies. In fact, ROS is shown to be positive for Not-3i companies, implying a more cost-effective production policy in this type of company. On the other hand, this rationale may be reinforced by the negative correlation of ROS, indicating that innovation plays a negative influence. In fact, most innovation in 3i companies, done internally, increases the general cost of production (innovation plus production), narrowing even more the margins of returns from each product. Since Not-3i companies do not have innovation development costs, their net margin on sales (ROS) would be greater than for 3i companies.

Second, in spite of the high correlation of ROI in all years that were evaluated (Table 3), except for year 2009, where ROI holds the lowest correlation, it may mean that profitability of invested capital in innovation in 3i companies in this year was mainly influenced by the major world economic crisis, decreasing net returns. Market price of 3i companies and Not-3i companies may be similar, but in times of crisis, if innovation cannot decrease costs, net margin of profitability may suffer higher losses than expected. This finding confirms those of Amaral and Lima (2011) and of Silveira and Oliveira (2013), who assert there are no major profitability margins in companies

coming exclusively from innovation. Of course, we understand this finding contextually, not as a general rule. The unusual correlated behavior of ROS ( $p$ -values greater than .05 and negative beta) fits in with the inverted evidence of the behavior of the net margin indicator between 3i and Not-3i companies.

When we delve deeper into this scenario, trying to establish a correlation between innovation and each financial performance, we can confirm generically the same behavior, as a macro guideline. Returns on investment show a positive correlation with innovation, in spite of weak  $R$  squared, and net margins show negative correlation, implying that some positive correlation could be established if we inverted the data, replacing this indicator of 3i companies for the value of Not-3i companies. Descriptively we also see that ROE and ROI present higher average values in the 3i companies than in the Not-3i companies. Generically, therefore, these results agree with research results of Santos et al. (2010), where innovation holds a positive influence on the financial performance of Brazilian companies.

Regarding the correlation between innovation and financial performance indicators of 3i and Not-3i companies, we conclude that a significant correlation appears only between innovation and Return on Investment (ROI) in the five-year period evaluated. For this financial indicator, not only did  $p$  prove to be significant due to it being lower than .05, but Beta was also positive for all evaluated years (except for the year of 2009, whose untypical behavior is explained above), confirming a real correlation between innovation and ROI. In spite of ROE and ROA holding a  $p$ -value higher than the standard, indicating no significant correlation, Beta for both indicators in all five years is positive. This raises doubts on the validity of the statistical model for demonstrating the real implication on financial performance from solely these

indicators, allowing us to guess that there could be, in some way, an influence of these financial performance indicators on 3i companies' performance. The unusual ROS correlation behavior ( $p$ -values higher than .05 and negative Beta) is in line with the inverted evidence of the net margin indicator for 3i and Not-3i companies. These results agree with the findings and evidences found in Brito et al. (2009), Amaral and Lima (2011), and Silveira and Oliveira (2013), for whom no association could be proven between innovation and specific financial performance indicators.

In spite of the coherence and widened vision that this research results casts on business strategy practices, on the role of innovation in companies, and on an expected logical positive influence of innovation on financial performance of companies – except for ROI –, results of this research may be somewhat inconclusive regarding the positive influence of innovation. New research must be carried out to better understand, contextually, specific behavior of financial performance indicators.

Despite the recent 3i index history from Economática, the increasing number of companies included in the study, from both groups, supports the solidness of this research. This fact not only allows for better comprehension, but also amplifies the understandings of specificities of the influence of innovation on the financial performance of companies.

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Recebido em 20 out. 2015 / aprovado em 29 out. 2015

**Para referenciar este texto**

RODRIGUES, L. C. et al. Innovation and financial performance of Brazilian companies: a statistical study for the period of 2009 to 2013. *Exacta – EP*, São Paulo, v. 13, n. 3, p. 427-438, 2015.