

## THE SIGNIFICANCE OF COMPANY INNOVATIVENESS FOR STOCK PRICE AND VOLATILITY

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**Abstract:** *The aim of this paper was to determine whether company innovativeness is significant for the price and volatility of stocks. In modern business conditions, innovation is one of the foundations of business success because companies that innovate not only monitor changes in the environment but also generate new revenue, open new markets, and so on, which significantly improves their position in relation to the competition. Exploring the significance of innovation for stock price movements can be important for understanding how the market reacts to innovation, but it can also motivate companies to invest more in innovation processes and the implementation of innovation activities. In the paper, the authors used a quantitative methodology based on a panel regression analysis of data collected from secondary sources for the period from 2005 to 2020. The research included eight of the most innovative companies ranked by the Boston Consulting Group. The results indicate that company innovativeness is statistically significant for average stock price and coefficients of variability. Given the important role that innovativeness plays in a company's business, the results obtained can serve as guidelines for managers in charge of implementing innovation activities in companies, as well as investors and other relevant stakeholders. Recommendations for future research are aimed at expanding the model with additional variables, which could potentially increase the representativeness of the model, and testing existing models on other data sources.*

**Keywords:** *company innovativeness; stock prices; stock volatility*

**JEL classification:** *G110, O310*

## INTRODUCTION

Innovation is considered a key fundamental element and outcome of entrepreneurial activities (Davidsson, 2004). Although there are many definitions and classifications of innovation that differ in scope, what most definitions have in common is the factor of “novelty” or improvement of a product or service, production process or other function and activity of a company.

Thus Hurley & Hult (1998) point out that innovativeness is the cornerstone of a company’s innovation activities. In modern business conditions, innovativeness is one of the fundamental prerequisites for the success of a company, and this is especially emphasized in companies in high-tech industries (Galović, 2016). Following the above, it can be pointed out that the innovativeness of a company is a key factor in the company’s business and also a significant component of the organizational culture of the company which contributes to business success.

According to Santos-Rodrigues, Figueroa Dorrego, & F-Jardon (2012), innovativeness is a condition for a company’s growth, often rewarded by the market, and develops from the company’s willingness to take risks and accept unconventional ideas, institutions and creativity. Based on the above explanation, and in light of the increased number of innovations, the increased number of innovative activities of companies and increased competition, the question arises: “Does the market reward company innovativeness?” The answer to this question is especially important for company managers because they are under constant pressure to create added value for shareholders and owners (Lehmann, 2004).

The problem of the paper arises from the assumption that innovative activities of companies are recognized by investors and that innovativeness of a company is significant for the price and volatility of stocks because innovative companies create new products and new market niches thus creating new revenues and new market opportunities that the competition cannot keep up with, which gives a long-term perspective of their business and reduces investment risk for investors. Therefore, in this paper it is hypothesized that: Hypothesis 1: “Company innovativeness is significant for stock price“ and Hypothesis 2: “Company innovativeness is significant for stock volatility”.

The primary goal of this paper is to prove the significance of innovativeness for the price and volatility of stocks of large global companies. The contribution of the results manifests in a scientific sense in the form of enriching the theory and field of research related to innovation and innovation management, as well as in professional contribution through support and guidance to managers in charge of managing innovation activities in large companies.

The paper is divided into five parts. After the introduction, the second part of the paper presents a theoretical overview of innovativeness, its importance and measurement in companies and the impact on stock price movements. The third part of the paper explains the methodological framework of the research, while the fourth chapter presents the research results and discussion. The paper ends with a conclusion.

## THE THEORETICAL FRAMEWORK OF THE RESEARCH CONCEPT

The field of innovation is theoretically a rich field that includes different perspectives and categorizations of definitions and concepts. In order to provide a theoretical overview of terms relevant to the concept of this research, the paper presents

definitions of innovation and innovativeness, measures of company innovativeness and previous contributions in research on the impact of innovativeness in companies on stock price movements.

### **Innovation and innovativeness**

The economic theory presents many definitions of innovation and innovation activities of enterprises. One of the pioneers of research related to innovation and a source of modern innovation theories is certainly Schumpeter (1934) who, according to Lazzarotti, Dalfovo, & Hoffmann (2011), defined innovation as the introduction of new products or services, the development of a new production process, the opening and establishment of new markets, the development of new sources of supply of raw materials or semi-finished products and the establishment of new industrial organizations.

The European Commission defines innovation in a similar way. In the document Green Paper on Innovation, innovation is defined as the improvement and expansion of a range of products, services and related markets. Furthermore, they define innovation as the establishment of new methods of production, procurement and distribution, as well as the introduction of changes in management and organization, working conditions and workforce skills (European Commission, 1996).

Drucker (1992) states that innovation begins with a systematic analysis and study of good opportunities and successful innovators are people who go among their customers and study them to understand their needs and expectations. Also, Drucker (1992) believes that innovation, in order to be successful, should be simple, have a clear direction and purpose (to avoid confusion) and should begin modestly, because the innovation process is complex, and it takes some time for a company to adapt to changes.

According to Eurostat (2021), innovative companies are businesses that introduce new products or services and processes to the market that have been significantly improved, and the result of technological development is the basis for innovation.

Given the different approaches to defining innovation, there are also different divisions and types of innovation. The Organization for Economic Co-operation and Development - OECD (2021) defines four categories of innovation. The first category is product innovation, the second category refers to process innovation, the third is marketing innovation and the fourth is organizational innovation. Product or service innovation includes the introduction of new or significant improvements to existing products or services (these are most often technical specifications, materials, components and software in the product), as well as improvement of user experience and certain functional features. Process innovation refers to the introduction of completely new or improved ways of production and distribution (these can be significant changes in processes, equipment and software). Marketing innovation refers to significant changes in product design or packaging, product pricing or promotion, while organizational innovation is most often related to new organizational approaches in business practice, organization and relationships with external stakeholders (OECD, 2021).

There are typically two types of innovation in the context of the source of innovation: routine and revolutionary (Bilas & Franc, 2018). Continuous market changes and the never-ending struggle to achieve competitiveness are the drivers of constant

reflection on the process of innovation in companies. This is especially true for large companies that have implemented activities and costs related to research and development in their business strategies. As a result, the innovation process becomes a part of a company's business routine. Due to their size, large companies can better take advantage of economies of scale, are more willing to take a risk, which is an integral part of the innovation process, and are financially more stable and stronger (Bilas & Franc, 2018).

The degree of "novelty" in a product, process or production defines innovation as radical or incremental. Radical innovation refers to a completely new product, production process or business model, while incremental innovation includes improving existing products, processes or business models within a company (OECD & Eurostat, 2018).

Innovation as a kind of change is the result of a company's innovativeness. Cressell & Hansen (2008) define innovativeness as the tendency to adopt or create new products, processes or business systems. Hurley & Hult (1998) define innovativeness as the concept of openness to new ideas, that is, as the orientation of an organization towards innovation. The concept of innovativeness is often associated with the concept of creativity. Levitt (2002) defines creativity as thinking about new ideas and innovativeness as the process of implementing those ideas. According to Jacobs & Snijders (2008), the element of "novelty" in innovation is realized with added value, and it is creativity and innovativeness that contribute to the development of a company's competitive advantage and added value.

### **The importance of innovativeness in companies**

Constant changes, such as increased global competitiveness, shorter product life cycles, faster changes in customer requirements and increased technological capability, highlight the significance of innovation for business operations (Baković & Ledić - Purić, 2011). These business characteristics can sometimes be opportunities and sources of advancement for companies, but they can also be challenges that can jeopardize their business. In times of fierce competition, investment in research, development and implementation of innovation processes become a prerequisite for a successful business (Posavec, Šporčić, Antonić, & Beljan, 2011).

The innovativeness of a company is certainly conditioned by certain characteristics of the company that support the process of innovation. Specific features in innovative companies can be divided into two groups of skills - strategic and organizational (European Commission, 1996). Strategic skills include the ability to identify and anticipate changes in market trends, as well as the willingness to adapt to them and orientation to the future of business, while organizational skills focus on internal cooperation between organizational departments and external cooperation with research institutions, consumers and suppliers (European Commission, 1996).

An innovation process is a resource-intensive project. The process involves numerous organizational units of a company and requires time and sufficient funds. Innovation is not a single event but rather a process that can and must be managed (Tidd, Bessant, & Pavitt, 2009).

Apple is an example that shows how innovativeness can help a business grow into a large and global company. Understanding the needs of their customers and be-

ing able to quickly adapt to customer requirements can help a company come up with innovative solutions (Hausman, 2005).

Cost reduction, increased productivity and increased market share are some of the indicators of a company's innovative activities (Galović, 2016). Since innovativeness is associated with good business results, it is clear how important it is in companies.

### **Measuring company innovativeness**

Company innovativeness is not easy to measure and there are different ways to do it. Nybakk (2012) describes a model which consists of three parts: product innovativeness, process innovativeness and business system innovativeness, and is implemented in the form of a questionnaire.

Mapping a company's capacity for innovation is an important area of business management, and in response to previous patent-based indicators that explained only a portion of the invention in innovation, a need arose during the 1980s to better understand the innovation process and the importance of using research and development as an indicator of innovation (Bilas & Franc, 2018). Over time, a new tool for measuring innovation in companies has developed - innovation surveys, which have become a widely used research method. The Organization for Economic Co-operation and Development - OECD, the European Commission and Eurostat have made a major contribution to the standardization of research based on innovation surveys at the international level by drafting the Oslo Manual, which contains guidelines for conducting innovation research, research and development and collection and interpretation of data (Bilas & Franc, 2018). Oslo Manual (OECD & Eurostat, 2018), in the context of contemporary economic, social and environmental challenges, provides a systematic approach to the definition of innovation, concepts for measuring innovation in the business sector, as well as the non-profit and public sector, measuring capabilities and external influencing factors of business innovation and the goals and results of the innovation process. From the aspect of measuring the innovation activity of a company, eight main types of activities and expenditures important for strengthening a company's innovation capacity have been defined: research and development (R&D) activities; engineering, design and other creative work; marketing activities; intellectual property; employee training; software and database development; acquisition or lease of tangible assets; and innovation management activities (OECD & Eurostat, 2018).

For this paper, as a measure of innovativeness, we used the Boston Consulting Group – BCG (2020) ranking of the world's most innovative companies, based on a sample of 2,500 senior management respondents. The results are based on the number of votes of CEOs from around the world, the number of votes of CEOs from a particular industry, the diversity index (votes between different industries) and the total shareholder return over the past three years.

### **A review of previous research related to the impact of innovativeness on stock price movements**

The impact of innovativeness on stock movements has been proven in publications, but the significance of this impact has not been clearly demonstrated. According to Sood & Tellis (2009), innovation is one of the most important forces in fostering

the growth of new products, maintaining existing ones, creating new markets, transforming industries and promoting the global competitiveness of nations. They claim that it is the research of the relationship between innovation and return on investment in stocks that can be crucial for understanding the way the market reacts to innovation, but also for motivating companies to invest in innovation. They also believe that an above-average return on investment (relative to the market or some of the market indices) in the stocks of innovative companies is one of the best ways to assess the rewards for companies that invest in innovation. Cillo, Griffith & Rubera (2018) researched the correlation between innovativeness and stock selection by investors. They pointed out that, on the one hand, large investors increase the purchase of stocks of innovative companies, which affects the value of these stocks. On the other hand, some large investors have not achieved the expected results based on innovativeness in previous operations, and if a company's innovativeness increases, they are inclined to sell the company's stocks.

In their research, Chaney, Devinney & Winer (1991) observed one part of an innovation project (presentation of a new product) and found a return on investment of 0.25 percent. Sood & Tellis (2009) tried to complement such partial practices, believing that the focus on individual events of an innovation project is precisely what causes market innovations to be underestimated. They calculated that observing the entire innovation project, as opposed to a single event, yields thirteen times higher return on investment. They classified innovation activities into three categories: initiation (events related to partnerships, financing and the expansion of new innovation projects), development (prototypes, patents and announcements) and product commercialization (launch of a new product and product quality award), stating that development activity brings the highest return on investment when viewed independently.

Innovation can also result in a negative return on investment in the stock market, for example, if an innovative product fails to meet expectations or encourages imitators, i.e., competition, and thus lowers expected sales prices, and it is possible that the cost of promoting an innovative product is higher than expected or that the overall cost of the investment is too high (Crawford, 1977).

Rubera & Kirca (2012) concluded in their research that the stock market is willing to reward innovativeness even before product commercialization. They noticed that managers recognize investing in innovativeness as a tool for increasing revenue, but also warn that managers can reduce investment based on innovativeness when it comes to high-tech companies that frequently present innovative solutions (Rubera & Kirca, 2012).

A great deal of research has shown that a company's success in innovation activities is a key factor in long-term sales results, as well as stock market success (Pauwels, Silva-Risso, Srinivasan, & Hanssens, 2004; Drucker, 1973).

Srinivasan, Pauwels, Silva-Risso & Hanssens (2009) concluded that the introduction of a new product has a positive effect on the return on investment in stocks and that this effect is up to seven times greater for a product that is new to the market than for products that are only new to the company that represents them. They also concluded that presenting new products has a greater impact if the product is perceived to be of high quality.



## **METHODOLOGICAL FRAMEWORK OF RESEARCH ON THE IMPACT OF COMPANY INNOVATIVENESS ON STOCK PRICE AND VOLATILITY**

The methodological framework of the paper is based on panel regression analyses of secondary source data.

Different models can be used in the statistical analysis of panel data, which are classified as static (models with a fixed effect and models with a random effect) and dynamic (Jakšić, Erjavec, & Čeh Časni, 2020). Kennedy (2008) according to Jakšić, Erjavec & Čeh Časni (2020) says that the decision to choose a static model can be made based on whether the effects are considered random or fixed (if they apply to the whole population, they can be considered random, and if they refer only to the effects in the model, then they can be considered fixed). In dynamic linear panel models, the present values of the dependent variable are assumed to be dependent on its previous values (Jakšić, Erjavec, & Čeh Časni, 2020).

BCG's ranking of the world's most innovative companies was used for company innovativeness. To obtain the longest possible observation period and to avoid the impact of methodological changes in BCG research that occurred in individual years, only companies that were among the fifty most innovative companies in the world in all of the years in which BCG conducted its research were observed. The data for stock price and volatility, were obtained and calculated from the websites Macrotrends.net and Finance.Yahoo.com. To avoid potential situational and seasonal fluctuations in stock price movements, the average stock price in individual years was used, while stock volatility was observed based on the calculation of coefficients of variability for each stock in a given year.

Based on the information above, the authors used a model with a random effect, believing that the effects apply to the entire population because they were selected based on data availability for all of the observed years in the model. Current values should not depend on previous ones because BCG conducts an annual ranking of the world's most innovative companies.

## **RESULTS AND DISCUSSION OF THE RESEARCH OF THE IMPACT OF COMPANY INNOVATIVENESS ON STOCK PRICE AND VOLATILITY**

Before the panel regression analyses on the observed variables, it is necessary to show their movement in the period covered by the research, as shown in the three tables below.

Table 1 shows the ranking of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research.

**Table 1.** The ranking of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research

	Apple	Alphabet/ Google	Amazon	Microsoft	Samsung	IBM	HP	Toyota
2005	1	11	17	4	11	7	21	14
2006	1	2	21	5	12	10	42	4
2007	1	2	20	5	16	9	32	3
2008	1	2	11	5	26	12	15	3
2009	1	2	11	4	16	6	7	3
2010	1	2	6	3	11	4	16	5
2012	1	2	9	4	3	6	15	11
2013	1	3	7	4	2	6	16	5
2014	1	2	6	4	3	5	11	8
2015	1	2	9	4	5	13	23	6
2016	1	2	5	4	7	10	13	8
2018	1	2	4	3	5	8	15	17
2019	3	1	2	4	5	7	44	37
2020	1	2	3	4	5	8	15	41

**Source:** Boston Consulting Group – BCG (2020)

According to Table 1 it can be seen that eight companies were among the fifty most innovative companies in the world from 2005 to 2020, across all years studied by BCG. Also, the dominance of Apple and Alphabet / Google in the first two places is clearly visible, as Apple was not in first place for only one year, and Alphabet / Google was not in second place only three times during the observed period. Furthermore, it can be seen that Microsoft has a relatively stable ranking, ranging from third to fifth place over the entire observed period, while HP and Toyota fluctuate the most in rankings.

Table 2 shows average stock price of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research.

**Table 2.** Average stock price of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research (expressed in US Dollars except the stock price of Samsung which is expressed in South Korean Won)

	Apple	Alphabet/ Google	Amazon	Microsoft	Samsung*	IBM	HP	Toyota
2005	1.67	277.76	39.90	25.87	10448.33	83.79	24.31	81.52
2006	2.53	411.19	35.91	26.29	12930.00	83.11	34.51	110.62
2007	4.58	538.75	67.23	30.45	11491.67	105.80	46.11	121.08
2008	5.07	464.85	69.88	26.65	11704.17	110.04	43.34	90.41
2009	5.24	439.69	87.28	22.98	12460.83	109.27	40.40	76.05



2010	9.28	535.62	139.14	27.06	15808.33	131.86	46.19	75.07
2012	20.57	642.82	220.30	29.82	25070.00	196.59	20.40	79.82
2013	16.88	884.24	298.03	32.49	29123.33	194.15	22.74	117.79
2014	23.07	713.97	332.55	42.45	26153.33	182.30	33.88	116.21
2015	30.01	619.98	478.14	46.71	25956.67	155.35	28.83	130.03
2016	26.15	763.21	699.52	55.26	28301.67	150.51	13.16	111.03
2018	47.26	1122.04	1641.73	101.03	47795.00	143.86	23.09	127.66
2019	52.06	1191.22	1789.19	130.38	45995.83	136.99	19.88	128.52
2020	95.35	1478.99	2680.86	193.02	55070.83	124.39	18.84	131.84

**Source:** Macrotrends (2020) and Yahoo Finance (2020)

\* average stock prices for Samsung were not available on Macrotrends.net, so they were obtained from another source, Finance.Yahoo.com, and were calculated as the arithmetic mean of monthly prices

According to Table 2 it can be seen that the average stock price of all observed companies increased from 2005 to 2020, with the difference being in the dynamics of growth.

Table 3 shows coefficients of variability of average stock price of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research.

**Table 3.** Coefficients of variability of average stock price of the world's most innovative companies by year for companies that have been among the top fifty most innovative since the start of BCG's company innovativeness research

	Apple	Alphabet/ Google	Amazon	Microsoft	Samsung*	IBM	HP	Toyota
2005	7%	39%	7%	46%	41%	61%	82%	76%
2006	10%	57%	6%	47%	51%	61%	116%	103%
2007	19%	75%	11%	54%	45%	78%	155%	113%
2008	21%	65%	11%	47%	46%	81%	146%	85%
2009	22%	61%	14%	41%	49%	80%	136%	71%
2010	38%	74%	23%	48%	62%	97%	156%	70%
2012	85%	89%	36%	53%	98%	144%	69%	75%
2013	70%	123%	49%	58%	114%	142%	77%	110%
2014	95%	99%	54%	75%	102%	134%	114%	109%
2015	124%	86%	78%	83%	101%	114%	97%	122%
2016	108%	106%	114%	98%	111%	110%	44%	104%
2018	195%	156%	268%	179%	187%	106%	78%	119%
2019	215%	165%	292%	231%	180%	101%	67%	120%
2020	393%	205%	437%	342%	215%	91%	63%	123%

**Source:** calculated and created by the authors according to data from Macrotrends and Yahoo Finance (2020)

According to Table 3 it can be seen that the coefficients of variability for all observed companies differ between 2005 and 2020.

Based on the presented data, panel regression analyses were made. Table 4 shows results of panel regression analysis for rank of company innovativeness and average stock price.

**Table 4.** Results of panel regression analysis for rank of company innovativeness and average stock price

Regression model parameters	Rank of innovativeness
	z-value
Average stock price	-2.565*
R2	0.056
Adjusted R2	0.048

**Source:** authors' calculations

Note: \*  $p < 0.05$

Table 4 demonstrates that rank of company innovativeness is statistically significant for average stock price, which indicates for companies from the sample that the higher the rank of company innovativeness, the lower their share price. Although the significance of company innovativeness for stock price is proven, hypothesis H1, which assumed the significance of company innovativeness for stock price, cannot be accepted, as a positive correlation between variables was assumed. However, this result is in line with the literature, because Crawford (1977) states that innovation can also lead to negative returns on investment in the stock market, while Cillo, Griffith & Rubera (2018) state that some large investors who have not achieved satisfactory returns in the past based on company innovativeness, sell company's stocks, when company's innovativeness increases.

Table 5 shows results of panel regression analysis for rank of company innovativeness and coefficients of variability.

**Table 5.** Results of panel regression analysis for rank of company innovativeness and coefficients of variability

Regression model parameters	Rank of innovativeness
	z-value
Coefficient of variability	-2.353*
R2	0.048
Adjusted R2	0.039

**Source:** authors' calculations

Note: \*  $p < 0.05$

Table 5 demonstrates that rank of company innovativeness is statistically significant for coefficients of variability, which indicates for companies in the sample that the higher the rank of company innovativeness, the lower their stock volatility.

Hypothesis H2, which assumed the significance of company innovativeness for stock volatility, can be accepted. This result is in line with the assumes that company innovativeness gives a long-term perspective for their business and reduces investment risk for investors.

However, the coefficients of determination of both models are low, which in certain cases may indicate that the model needs to be extended with additional variables or that the data do not explain the majority of the deviation of the variance of the dependent variable relative to the movement of the independent variable (Minitab, 2014). Both situations should be explored further in future research, in which the model could be extended with additional variables to potentially increase its representativeness, and additional data sources could be found to research the observed relationships. Nonetheless, in situations of low values of the coefficient of determination and statistically significant independent variables, important conclusions can still be drawn about how changes in the value of the independent variable affect changes in the value of the dependent variable (Minitab, 2013).

## CONCLUSION

Innovation is a key driver of business and a source of competitive advantage for companies. Regardless of the type and “degree of novelty” they provide, they are a response of companies to new consumer and competition demands, as well as to social and economic changes. The development of innovation within a company based on research and development activities is certainly not a result of chance, but it is a systematically managed process. The ability to innovate, theoretically defined as the innovativeness of a company, represents the strength and willingness of the company to take risks, adopt new knowledge and experience and introduce changes in the form of new products, services, processes and functions. The goal of the paper was to study the significance of company innovativeness for stock price and volatility, and it was accomplished. According to the results of the research, the rank of company innovativeness, is statistically significant for average stock price and coefficients of variability. The scientific contribution of the research manifests in the unique selection of variables of research models and the method of their measurement. Given the important role that innovativeness plays in a company’s business, the results obtained can serve as guidelines for managers in charge of implementing innovation activities in companies, as well as investors and other relevant stakeholders. Low coefficients of model determination are limitations of the research, but they are also motivation for future research. Some of the recommendations related to the implementation of future research include extending the model with additional variables to potentially increase its representativeness and testing existing models on other data sources.

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