



# Innovation efforts and performances of Brazilian firms<sup>☆</sup>



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## ABSTRACT

We analyze the relationship between innovation and firms' performance in Brazil using a comprehensive database that cross-references innovation information by PINTEC (Technological Innovation Research) of the IBGE (Brazilian Institute of Geography and Statistics) and financial information from Serasa and Gazeta Mercantil. Results from the structural equation modeling suggest that variables associating with investments in innovation, which are connected to the innovative effort of a company, do not explain financial performance significantly.

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## 1. Introduction

Innovation became a key activity that may not only influence the viability of a firm but also trigger social and economic change (Cheng, Chang, & Li, 2013; Kim & Hwang, 2011; Wu, 2011). The ability to innovate is fundamental to sustain competitive advantage (Chen & Huang, 2010; Subramaniam & Youndt, 2005). Innovation is vital to the survival of modern corporations (Ko, To, Zhang, Ngai, & Chan, 2011). Although corporations often perceive innovation as inherently positive for organizations (Liao & Rice, 2010), the relationship between innovation and performance is still an open question (Bowen, Rostami, & Steel, 2010).

Although innovation plays an important role on the capitalist system in the classical view of scholars such as Adam Smith and Karl Marx, Schumpeter (1934) was the first to explicitly research innovation. Economists now consider innovation to be one of the vectors of economic growth (Grupp, 1998) and, since the 1920s, researchers focus attention on the subject. However, empirical studies addressing the relationship

between innovation and business performance became more frequent only after Solow's (1957) seminal article.

From a theoretical perspective, the diversity of research results has engendered other projects in the academic field for a better understanding of the causes and effects of innovation inside organizations. The heterogeneity of variables and the difficulties in understanding their relations and in distinguishing ambiguities have hindered research in this area (Cainelli, Evangelista, & Savona, 2004). From a country-level perspective, using macroeconomic data, several studies seek to explain the economic conditions that make an environment favorable to innovation (Denyer & Neely, 2004; Hinlopen, 2003). Despite garnering significant attention within the discipline of industrial economics, the theory of innovation constitutes a specific field of research, leveraging contributions from a wide range of areas of knowledge, particularly those originating from organizational and economic studies, thus forming a solid, albeit newly constructed, theoretical body. Different researchers using quantitative and qualitative methodologies under multiple approaches have studied the relationship between innovation and business performance. However, no theoretical consensus exists regarding the importance of investment for company innovation (Cainelli et al., 2004; Jiménez-Jiménez & Sanz-Valle, 2011).

In this context, by applying exploratory factor analysis and structural equation modeling, this study proposes constructs that may associate with the innovation phenomenon. We argue that these constructs then impact firm performance. Through a comprehensive database that cross-references innovation information from PINTEC (Technological Innovation Research) of IBGE (Brazilian Institute of Geography and Statistics), and financial information from Serasa and Gazeta Mercantil, this study assesses the potential relationships between innovation and the performance of Brazilian companies. In particular, original variables

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are grouped into three latent factors related to human capital, innovative effort and relational capital. These latent variables are then related to the latent variable of firm performance.

This paper involves a large sample of private as well as public companies, which is rare in Brazilian research projects. Specifically, this study tests whether innovation efforts have a positive influence on firm performance. The results suggest that some observable variables may build a relevant factor associated with innovation. However, the study does not find evidence that the latent factor of innovation influences a firm's financial performance.

## 2. Theoretical background

The influence of scientific advances on society has existed since ancient times, yet the lack of guidance of ancient people for capital accumulation did not allow countries such as Greece and Egypt to use the knowledge developed to accumulate wealth (Lekachman, 1959). In the last three centuries, scholars have come to appreciate the contribution of technological advances, including the application of scientific knowledge in the development of products and processes and, combined with the consolidation of a market-oriented society, allowed the phenomenon of innovation to develop as a field in and of itself (Grupp, 1998). Despite the variety of ways to conceptualize innovation, most definitions are related to the adoption of a new idea or behavior (Jiménez-Jiménez & Sanz-Valle, 2011).

The increasing presence of service sector companies, particularly those focusing on the development of technology in a wide range of fields of knowledge, has been playing an important role in the economy of countries (Cooper, 1984). Grupp (1998) states that innovation is a consequence of the development of science and technology, particularly through the process of Research and Development (R&D). In this regard, innovation within the firm emerges when the outputs of the process are potentially profitable. As a result, innovation crucially depends on R&D investments in fields that are capable of delivering applications to the existing scientific and technological domain. Hu (2003) summarizes innovation as a process of knowledge creation that requires creativity and involves a degree of uncertainty regarding results.

Schumpeter (1934) classifies innovations in two types: (i) radical and (ii) incremental. Radical innovations are those originating from the process of creative destruction, a term coined to explain technological or market paradigm breakthroughs, shifting to something completely new and that can be represented by a product or a process (Schumpeter, 1934). In contrast, incremental changes relate to the continuous improvement process that aims to consolidate radical changes and to reinforce the competitive position of companies. Hence radical changes are connected to firms' exploration activities of new knowledge or markets, while incremental changes concern the exploitation of existing knowledge and markets (Adner, 1999). For Damanpour (1991), innovation can be technical or administrative. The former includes new processes, products or services. The latter refers to new procedures, policies and organizational forms (Damanpour, 1991; Jiménez-Jiménez & Sanz-Valle, 2011).

Empirical and theoretical studies from a wide range of areas of knowledge serve as the basis for the development of innovation theories. Several papers on innovation frequently cite the work of Schumpeter, by virtue of his proposed taxonomies for radical and incremental innovation, which are responsible for the maintenance of the capitalist system (Schumpeter, 1934). Thus, Schumpeterian postulates have been guiding the understanding of the innovative process in firms (Malerba, 2005). The central point of Schumpeter's work is the study of changes in several industries due to processes of creative destruction or even of creative accumulation. The theory of innovation has been encountering more support in the neo-Schumpeterian schools of thought, yet the neoclassic doctrine has also resorted to innovation postulates for the refinement of theories, including, for instance, competition, game and decision theories (Grupp, 1998; Nieto, 2003).

Nelson and Winter (1974, 1982) criticize the neoclassical explanation of capitalist growth, since this school of thought does not take into account the innovation process within the firms. These authors fall into the category of evolutionary thinking (Grupp, 1998) with a considerable contribution to the development of Innovation Theory. According to Nelson and Winter (1982), the following aspects characterize the innovative firm: importance of knowledge inside organizations; organizational structure; R&D. To Nelson and Winter (1982), the existing knowledge within a company comprises what each individual and what each area possess, in the context of a team (Dosi & Nelson, 1994). This perspective is compatible with the growing interest in Knowledge Management, now consolidated as a strategic asset for firms, precisely due to the potential to drive innovation (Amit & Schoemaker, 1993). For instance, Olavarrieta and Friedman (2008) highlight the role of knowledge-related resources as antecedents of competitive advantages.

Under another perspective, Solow (1957) discusses the relationship between technological change and business performance. Several other studies seek to analyze the conditions that determine the innovative behavior of companies. For example, Cabagnols and Bas (2002) suggest six guidelines to explain the innovative behavior of firms: characteristics of the demand of the firm (price elasticity, evolution and homogeneity); conditions for appropriation of the benefits of innovation (patents and models to protect innovation, secrecy in innovative activities, innovation in the efficiency of lead times between products and processes); sources of technological knowledge (consumers, suppliers and society); market structure (level of concentration, intensity of technological competition); characteristics of the firm (size, market share, diversification level, nature of abilities) and strategy of the firm (quality, marketing, etc.).

Feeny and Rogers (2003) state that a company's innovation activities do not occur separately from central competences, but in parallel and within the actual routine activities of the firm through inventions, learning, and implementation of new knowledge. Leiponen (2002) argues that the innovation process supplements the company's internal activities and is rooted not only in sources inside the organization, but also in agents outside the company. Therefore, firm innovation capacity reflects investment in several factors, including knowledge of employees, management methods, culture, and internal and external relationship networks (Feeny & Rogers, 2003; Grupp, 1998; Hinlopen, 2003). Besides looking at R&D expenditure and the number of patents, Feeny and Rogers (2003) also include in their innovation construct the brand and design activity variables. Duguet (2006) stresses that other indicators need to be considered in the formation of innovation construct, since focusing exclusively on R&D might not ensure the best understanding of innovation based on econometric techniques.

Analyzing the innovation structure of a given firm, one must recognize the relationship between innovation in processes and innovation in products, a topic discussed by several authors (Cabagnols & Bas, 2002; Duguet & Greenan, 1997; Leiponen, 2002; Vernon, 1966). Some studies assume that innovation in products precedes innovation in processes (Teece, 1986). In contrast, arguments related to the characteristics of the current market (where the life cycle of products is becoming increasingly shorter, forcing companies to constantly innovate their products) suggest that companies must constantly demand shifts in their production structures.

Nevertheless, Cabagnols and Bas (2002) suggest that companies targeting product innovation present better results than process-oriented companies. Process innovations do not happen just to keep abreast of the development of new products; gains in operating efficiency drive innovation, thereby enabling shorter lead times, greater reliability of the process, increased flexibility in production, and reduced costs and operating expenses. Therefore, the strategy of simultaneously developing product and process innovations implies the capacity to acquire knowledge in the market or to develop such knowledge inside the firm (Cabagnols & Bas, 2002).

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