



Education, Strategy and business economics

Innovation and productivity: empirical evidence for Brazilian industrial enterprises

Inovação e produtividade: evidências empíricas para empresas industriais brasileiras

Innovación y productividad: evidencias empíricas en empresas industriales en Brasil

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Abstract

The aim of this paper is to carry out an empirical investigation into the relationship between innovation and the productive performance of Brazilian businesses measured by Work Productivity (WP) and Total Factor Productivity (TFP). Data taken from the Research of Innovation (PINTEC, 2003, 2005, 2008) and estimated cross section models and panel data was used. The results suggest that innovation produces an incipient impact on competition in the national industry, reflected in the small magnitude of coefficients associated with the diverse indicators of innovation.

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Keywords: Innovation; Productivity; Panel data analysis

Resumo

Neste artigo, tem-se como objetivo realizar uma investigação empírica acerca da relação entre inovação e desempenho produtivo das empresas industriais brasileiras medido por Produtividade do Trabalho (PT) e Produtividade Total dos Fatores (PTF). Foram utilizados dados provenientes da Pesquisa de Inovação (PINTEC 2003, 2005 e 2008) e estimados modelos *cross section* e de dados em painel. Dada a pequena magnitude dos coeficientes associados aos diversos indicadores de inovação, os resultados sugerem que a inovação produz impacto incipiente na produtividade da indústria nacional.

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Palavras-chave: Inovação; Produtividade; Painel

Resumen

El objetivo en este trabajo es realizar una investigación empírica sobre la relación entre la innovación y el desempeño produtivo de las empresas industriales en Brasil medido por Productividad Laboral (PT) y Productividad Total de Factores (PTF). Se han utilizado datos de la Encuesta de Innovación (Pintec 2003, 2005 y 2008) y se han estimado modelos de corte transversal y datos de panel. Dada la pequeña magnitud de los coeficientes relacionados con los diversos indicadores de innovación, los resultados sugieren que la innovación produce impacto incipiente en la productividad de la industria nacional.

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Palabras clave: Innovación; Productividad; Datos de panel

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Introduction

Several studies have shown the existence of a positive relationship between innovation and productivity. Internationally, many countries are moving to incorporate R&D measures in their national accounting systems and thus directly attribute its impact on growth as well as adding the importance of knowledge for economic development. Furthermore, the theoretical debate has converged to understand that the growth of productivity permeates by the innovative activity of enterprises.

Pioneering studies on productivity growth sources reveal that the capital and labor inputs explain less than half of the variation in productivity. The unexplained part, called “residual” is often considered the effect of the technological change on the productivity. In this sense, these studies seek to find measures for technological change (improvement in capital, quality of work and R&D activities) in order to explain the residual productivity growth (Cassiman et al., 2011; Griliches, 1979, 1998, 2000; Huergo & Jaumandreu, 2004; Ortega-Argilés, Potters, & Vivarelli, 2005; Tsai & Wang, 2004; Wakelin, 2001).

However, there is no consensus regarding the most appropriate way of measuring productivity. In the international literature, most studies use two productivity measures: Work Productivity (WP) and Total Factor Productivity (TFP).

The purpose of this article is to investigate the relationship between innovation and production performance of Brazilian companies, as measured by Work Productivity (WP) and Total Factor Productivity (TFP). The explanatory variables are divided into four groups: business characteristics, technological expertise, industry classification and innovation indicators, measured by new products and processes, organizational change and technology index.

The proposed methodology for this study is based on the estimation of econometric models: Cross-section analysis for the year 2008; and panel data analysis for the years 2003, 2005 and 2008. The data were provided by the Brazilian Institute of Economic Geography (IBGE) from the crossing of Annual Industrial Research (PIA) and Innovation Research (PINTEC) information with foreign trade records from SECEX/MDIC.

Because of the shortage of studies undertaken on the relation of innovation and productivity at firm level in Brazil, this study contributes to the empirical debate on the subject in Brazil in two directions: testing the relationship between innovation and production performance using two productivity measures enshrined in national and international literature (Work Productivity and Total Factor Productivity); and testing various innovation indicators (product innovation, process innovation, organizational innovation and technology index) also widely used in the literature.

To meet this goal, the paper is organized in five sections, including this brief introduction. The second section presents the theoretical and empirical debate on the influence of innovation on business productivity. The third section describes the methodological procedures and the data used. The fourth section reports the results of the empirical study. Finally, the fifth section summarizes the final considerations.

Innovation and productivity

Theoretical debate

Several papers deal with the impact of innovation on business productivity. Recently, the increase of data available at the firm level and the advancement of econometric techniques have contributed to the growth in empirical studies (Cassiman, Golovko, & Martínez-Ros, 2010; Griliches, 1998, 2000; Huergo & Jaumandreu, 2004; Ortega-Argilés et al., 2005; Tsai & Wang, 2004; Wakelin, 2001).

Although there is considerable debate about the productivity measures, there is no consensus on the most appropriate form of measurement. In the international literature, most studies use two measures of productivity: Work Productivity (WP) and Total Factor Productivity (TFP).

WP is commonly calculated as the ratio between the industrial transformation value (ITV) measured by the difference between sales revenue and production costs, and the number of persons employed (PE) in the company (Britto, 2009; Chudnovsky, López, & Pupato, 2006; Mairesse & Mohnen, 2010; Santana, Cavalcanti, & Bezerra, 2011; Van Beveren & Vandebussche, 2009).

$$\text{Work Productivity} = \text{ITV/PE} \quad (1)$$

The main advantage of the work productivity measure is the ease of availability of data and the simplicity of calculation. However, some criticisms are raised about this measure of productivity. First, it creates instability in determining how a more efficient material utilization can result in a total productivity gain for the enterprise. Second, this measure shows much more the productivity improvements resulting from efficiencies in material and component procurement than gains from a more efficient use of manpower and energy. In this regard we note that this gain in added value productivity, due to the purchase of lower-cost materials, results in an apparent gain, if considered the possible problems that can lead to making that decision. Third, the labor productivity is sensitive to production adjustments made by companies in function of the number of employees engaged, because if the company reduce the number of employed persons and maintain the value of industrial transformation, the result will be increased productivity.

Other studies use the TFP as a form of incorporating the productivities of each resource into one expression (Cassiman et al., 2010; Griliches, 2000; Ortega-Argilés et al., 2005; Tsai & Wang, 2004; Wakelin, 2001).

One of the main advantages of using TFP is considering the possibility of substitution in the use of the factors by the production process. Another advantage is that it constitutes the most appropriate instrument to measure technical change by industry and the role of intermediate inputs in production. The TFP allows disaggregating the sources of economic growth, making it possible to identify patterns of past growth and evaluate potential tools to encourage future economic growth (OECD, 2005). However, the disadvantage of using a multifactor measure is the difficulty in measuring the various production inputs used in

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