Internet Incidence on SME's Sales:
A Propensity Score Matching Analysis

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ABSTRACT

The purpose of this paper is to determine how much is the "bonus" or "prize" to the sales per worker of Internet-using firms compared to not Internet-using firms. The author employs matching techniques based on an Argentinean database. The author first presents a binary logit model, in which the dependent variable is a dichotomous variable equal to 1 if the firm adopted Internet and 0 otherwise, to evaluate the factors that influence a firm's probability of adopting Internet. A propensity score matching (PSM) model is then used to assess the impact of using Internet on the sales per worker. The author finds statically significant differences in the sales average between firms that are similar in many dimensions such as location, size, and sales market except for the Internet adoption decision. By probing that Internet access improves SME's sales, the author is validating the Public Sector ICT modernization programs for SME. The contribution of this paper consists of using a well known technique as PSM to analyze a recent field of research which is the contribution of Internet adoption to the firm's sales per worker.

Keywords: *Information and Communication Technologies (ICT), Internet Adoption, Productivity, Propensity Score Matching (PSM), Small and Medium Enterprises (SME)*

1. INTRODUCTION

In the modern economy, in addition to traditional production factors (physical capital, labor), the Information and Communication Technologies (ICT) are one of the new productive emerging factors. ICT contribution to and impact on firm performance is of critical importance together with complementary capitals such as the human capital (human skills), and the organizational capital (workplace organization), and knowledge (Arvanitis, 2005).

Since the emergence of the New Economy approach, many researchers were aware to analyze the relationship between ICT investment and firms' performance. During the last 80, the literature could not find a significant tie between ICT investment and industrial productivity (Roach, 1991; Morrison & Berndt, 1990; Strassmann 1990; Brynjolfsson 1993). This phenomenon known as "the productivity paradox" was established by Solow who argued that "*you can see the computer age everywhere these days, except in the productivity statistics*".

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However, many studies found the existence of a positive relationship between firm productivity and ICT investments (Dvir et al., 1993; Brynjolfsson et al., 1994; Lichtenberg, 1995, Greenan & Mairesse, 2000, Licht & Moch, 1999, Aral, Brynjolfsson and Wu, 2006; Brynjolfsson and Hitt, 1996; 2003; 2000; Dedrick et al 2003).

The hypothesis behind the long term positive effects of ICT investment on firm productivity is that ICT would be part of a wider system of technology and organizational changes that enhances firm productivity. Investment in computers is a necessary but not a sufficient condition to increase productivity. Human skills, capacity and new organizational forms are collateral to the ICT adoption process at firm level. Alderete (2012) explains that awareness and technology skills and knowledge in electronic markets, or what some authors called IT alignment (Cragg et al., 2002), refers to disutility of effort.

Recent research in the contribution of ICT investment on firm performance has produced evidence of its positive contribution to several measures of firm performance. This is probably reflecting improvements in the exploitation of ICT by firms. Identifying and implementing the complementary organizational changes needed for a successful ICT adoption are difficult and costly. These adjustment difficulties lead to variations across firms in the use of ICT, its organizational complements and resulting outcomes. At the same time, the ICT impact on firms' performance is neither automatic nor lineal (Rivas & Stumpo, 2011).

Strategic attention has to be placed so that the new opportunities provided by ICT are not purely limited and accessible only by the larger corporations within national economies, but also to small and medium enterprises (SME) (Kotelnicov, 2007; Ifinedo, 2011). During the last decade, ICT diffusion has been one of the main objectives in the policy agenda of the European Union, with particular emphasis on the adoption of digital technologies among SME (Commission of the European Communities, 2001). Since 2005, the Avanza Plan in Spain has been built to improve the Information and Communication Technologies (ICT) adoption level in Small and Medium Sized Enterprises (SME). This Plan has mobilized more than 3016,6 MM euros to foster ICT adoption in SME, and to extend the use of Internet and new technologies. Besides, ICT firms' leaders such as HP, Intel, Microsoft, Nokia and Vadafone are joining forces through a "Plan of Competitiveness" to help Spanish SME. The objective of the plan is improving SME competitiveness by offering firms the benefits of last technologies, such as cloud computing. This initiative will be supported by the Tourism, Commerce and Industry Ministry of Spain for three years to impact on 3 million SME.

In Latin America, Rivas and Stumpo (2011) summarizes some of the direct programs for ICT implementation at firm level (see Table 1).

PROIMPE- The Program to promote Information Technologies Use in Small and Micro Enterprises from Brazil was built to promote Brazilian SME ICT implementation and at the same time, to build new businesses, train and develop a market to supply ICT solutions. About 17 projects were developed through arrangements between SEBRAE and other institutions as SOFTEX, ASSESPRO and FENAINFO.

However, data about the impact of these direct programs on firms is scarce. In this paper, we determine the causal effect of Internet adoption in a firm's productivity. We suppose that Internet adoption will foster an increase in sales. The ideal framework to identify the Internet incidence on sales would be to build an experiment where the decision to adopt internet were independent of certain characteristics inherent to the firm. Building an experiment based on these programs is not actually feasible. Therefore, a quasi-experimental design is a feasible solution when we cannot control for the allocation of treatments and of other factors.

Once firms recognize the importance of using ICT, SME adopt Internet to increase their outcomes attained from a better productivity. If we could probe that Internet access improves SME's productivity, we would be validating the ICT modernization programs for SME.