UNDERSTANDING BROADBAND DEMAND: AN EMPIRICAL ESTIMATION ON SMES

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Abstract: Internet broadband diffusion since the beginning has up-fronted discussion among policy makers, researchers and academicians about its economic impact and technological capacity of institutions and countries. Nowadays it is undisputable that broadband contributes to the economy but it is questionable how to measure the impact on the economy. The importance of SMEs for the economies and their contribution to growth increased the interest of studying in detail patterns, trends and factors contributing to their productivity and growth. Internet application on SMEs contributes to growth, productivity and internalization of companies.The recent coronavirus disease (Covid19) pandemic is yet another evidence about the importance and ongoing increase on demand for boradband. It is not disputable that broadband increased the IT intensive sector and employability of IT experts. These shifts should be treated as signaling to policy and curricula changes in order to address the mismatch from graduates and labor market needs.Studying the time span (short-term vs. long-term) impact of broadband on the economy is a challenge that remains for future research. Firms specific factors that contribute to increasing productivity result as determinants of firms having internet broadband. The hypothesis being tested is that productivity SME indicators' variables are positively correlated with the probability to have a fast internet broadband. Being competitive means having the right information on time. The underlined hypothesis is based on the fact that the web and internet can not be considered as a medium only but also as a new economy The empirical evidence provided is on estimates from a sample of 360 SME from The *Business Environment* and *Enterprise* Performance *Survey.*A logit model is estimated and results that productivity SME indicators' are positively correlated with the probability to have a fast internet broadband. Companies that introduce a new product have 21.5% higher probability to have a high speed broadband than enterprises that do not introduce a new product, holding other covariates constant.The empirical evidence suggest that having a quality certification, and introducing a new product increase the probability to have a internet broadband; also sales have positive impact on the probability to have a internet broadband. Future research may undertake comparison of broadband diffusion controlling for country specific factors and controlling for size of firms. Another challenge that remains on empirical grounds is to quantify the effects of broadband on growth. Last but most important it will remain a challenge to measure how IT knowledge had impact on the success and failure to different sectors during coronavirus disease (Covid19) pandemic.
Keywords: estimate, SME, broadband demand

1. INTRODUCTION

The hypothesis being tested is that productivity SME indicators' variables are positively correlated with the probability to have a fast internet broadband. Being competitive means having the right information on time. The underlined hypothesis is based on the fact that the web and internet can not be considered as a medium only but also as a new economy.The recent developments with pandemic of Covid19 is just another prove that internet and IT sector has become a necessity for the most of the bussnies etnities to remain in the sector and overcome the undergoing difficulties. Also human capital was challenged to develop knowledge in order to overcome online working difficulties. The hypothesis is tested on a sample of 360 SME. The data are extracted from **The *Business Environment* and *Enterprise* Performance *Survey*** dataset.

Broadband connection substituted dial-up internet connection for household and business. The revenues to internet providers are enormous creating a new value for the economy and a new area of interest among researchers; the business entity and policy makers. The investment to internet broadband resulted with large revenues to the providers but still it is unknown if this the maximization point. Broadband adoption is a costly investment therefore we want to further investigate how SMEs demand for broadband may be determined.There is a general agreement that economic gains from internet broadband may not be measured using traditional economic reasoning. The paper is organized in three sections after introduction: the first second reviews the literature, the second part provides the empirical evidence and in the last part concluding remarks are provided.

2. LITERATURE REVIEW

Internet as a new service in the market was followed by a range of new products and also induced more innovation allowing consumers more variety. Broadband offered more quality service for customers compared to dial up connections and because of quality advantages it diffused rapidly.

Greenstein and McDevitt (2009) conclude that the economic impact of broadband in the US GDP is miss measured. Also they acknowledge that broadband generates addition revenue of 40%-50% of the US GDP and 31-47% of the newly revenue is consumer surplus. Faulhaber (2002) note that American consumers have adopted broadband as fast as other new technologies. Wallsten (2006) provide empirical evidence that regulations that reduce entry costs and support investments are supportive to broadband growth but empirical evidence does not fully explain the differences in broadband diffusion among countries.

The diffusion of broadband among countries switched the labor market requirement to IT experts and business etnities switched to IT intensive sectors. Mathews and Healy (2007) note that internet provide possibility to SMEs to be engaged and informed in international competition. Lumeti (2000) suggest that internet may increase the number of customers of SMEs.

Lehr et al (2006) provide empirical evidence that broadband access increases economic growth and productivity and that the economic impact is measureable. They do find evidence on positive relationship between access to broadband and employability, rental rates and also on establishment growth. Although the results do not test possible causality still it is evident that broadband matters for the economy.

Internet technology and infrastructure in SME is studied theoretically and empirically in Zhu and Kramer(2005), Soto-Acosta et al (2013), Thong (1999), Chang and Hughes (2012).Accordingly internet broadband adoption and innovation are not solely linked to large corporations contrarily they are of interest for both large corporations and SME because of the expected potential benefit on productivity. Kim and Mauborgne (1997) suggest that the speed of growth of companies may be addressed to innovation.

3. BROADBAND DETERMINANTS: EMPIRICAL EVIDENCE

Data on 360 SMEs are extracted from **The *Business Environment* and *Enterprise* Performance *Survey*** dataset in order to provide evidence on broadband determinants. The survey is a firm level survey and the sample is stratified randomly. The question for the dependent variable is whether the company has a high speed broadband or not by allowing to answer YES or NO. Considering the dichotomous nature of the dependent variable the model the estimation is using maxmimul likelihood estimation techniques and the dependent variable is defined as:

$Y=1$; if the enterprise has high speed internet broadband

$Y=0$; if the enterprise has not high speed internet broadband.

The model is estimated in order to test whether having a internet broadband is a function of quality of certification, innovation and sales. The underlying model is:

Broadband= f (quality certification, innovation, sales)

Therefore the underlying model is of probabilistic nature and estimated with maximum likelihood estimation technique. The sample size used is relatively large and according to the Pearson goodness of fit test the model is well specified. The results of the estimates suggest that the independent variables result significant. Hosmer-Lemeshow's test suggests that we may not reject the hypothesis that the distribution fits the data. Crostabulation of observed and predicted outcomes, where one predicts a positive outcome if the probability is 0.5 or more and a negative outcome otherwise suggests that we predict correctly approximately 67.75% of cases. The estimate of the logit model are presented in the table below:

Table 1: Logit estimation

	Coefficient	Stan. Error	Z	P>|z|	95% confidence intervals	95% confidence intervals
Quality certificate	1.008***	.109	9.23	.000	.793	1.222
Innovation	.910***	.073	12.46	.000	.767	1.053
Sales	.018***	.005	.026	.001	.007	.030
Cons	-.457***	.083	-5.44	.000	-.621	-.292

Source: authors' estimation

Note: level by significance *** for 1%; ** for 5% and * for 10% statistical significance

The hypothesis that the effect of all independent variable are simultaneously equal zero is also tested and the results suggest that the hypothesis is rejected at 1% level of significance (LRχ^2=285.41, df=3, p <.01). Additionally the correlation matrix suggests that there are no violation of multicolinearity assumption since the value of correlation coefficients in correlation matrix is relatively small.

Then, the marginal effects areestimated and are presented in the table below:

Table 2: Marginal effects of the logit

Internet	dy/dx	Stan. Error	Z	P>|z|	95% confidence intervals	95% confidence intervals	X
Quality certificate	.217***	.020	10.79	.000	.177	.256	.173
Innovation	.215***	.016	12.83	.000	.182	.248	.529
Sales	.004***	.001	3.26	.001	.001	.007	11.447

Source: authors' estimation with details in appendix
Note: level by significance *** for 1%; ** for 5% and * for 10% statistical significance

According to the estimates it may be concluded that the variables included in the model are significant at conventional levels of significance. Companies that introduce a new product have 21.5% higher probability to have a high speed broadband than enterprises that do not introduce a new product, holding other covariates constant. Enterprises that posses a quality certification have 21.7% higher probability to have a high speed broadband than enterprises that do not possess a quality certification innovate, holding other covariates constant. Another significant determinant that increases the probability to have an internet broadband is sales of the company. The empirical evidence is in favor of the hypothesis we are testing. Nevertheless the results should be taken with caution and they respond to a sample drawn from developing country. Before concluding further research and estimation will provide evidence if the same holds for developed countries.

4. CONCLUDING REMARKS

Broadband and technology in the last century have created a new era on the economy. The demand for products and services changed towards technology intensive industry. Internal and technological factors influence the adoption of broadband among SME. This paper aims to look at some internal factors of SMEs as possible determinats of broadband adoption.

The importance of SMEs for the economies and their contribution to growth increased the interest of studying in detail patterns, trends and factors contributing to their productivity and growth. Internet application on SMEs contributes to growth, productivity and internalization of companies.

According to the estimates it may be proposed twofold use of the results: first there is evidence that enterprises with higher sales, that do innovate and have quality certificate are more prone to use fast internet broadband and second internet provider companies should seek as potential consumers enterprises with larger sales. It may be suggested that having a quality certification, and introducing a new product increase the probability to have a internet broadband; also sales have positive impact on the probability to have a internet broadband.

Future research may undertake comparison of broadband diffusion controlling for country specific factors and controlling for size of firms. Another challenge that remains on empirical grounds is to quantify the effects of broadband on growth. Last but most important it will remain a challenge to measure how IT knowledge had impact on the success and failure to different sectors during coronavirus disease (Covid19) pandemic.

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