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ICTs, Business Regulation and Economic Development : A Cross-country Examination

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ABSTRACT

Government regulation of business activity has been recognized as having critical impact on countries economic development. The aim of this research is to empirically explore the role played by information and communication technology (ICT) on the regulatory environment for doing business at the country level. We expect that the greater the access to information, the better the regulatory framework for doing business which can in turn have a positive impact on economic performance. Further, we intend to assess the extent to which ICT measures mediate the effect of business regulation on countries' economic performance as measured by GDP per capita. This undergoing research is based on empirical evidence from two databases of the World Bank namely the Doing Business Database and the World Development Indicators database both of which had their most recent release in September 2008. Preliminary results using data corresponding to the year 2005 support our hypotheses.

INTRODUCTION

Government regulation of business activity has been widely recognized as having critical impact on countries' economies. This realization has led many countries to engage in great efforts to implement regulatory reforms intended to expedite and simplify their existing frameworks of business regulation, in fact as many as two hundred regulatory reforms were introduced in 98 countries between April 2006 and June 2007, which mainly involved reform of entry regulations (Worldbank Doing Business Report 2008). International Development institutions have been

strong advocates of regulatory reform and have developed specific measures to assess and monitor the regulatory business environment at the country level. Among these, the Doing Business Project (www.doingbusiness.org) launched in 2003 by the World Bank developed a database of indicators that is used to compute an “Ease of Doing Business” (*EDB*) index for 175 countries. The Doing Business database is enhanced and updated every year to track and analyze objective measures of business regulations in ten different areas, namely: starting a business, dealing with licenses, employing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business. The EDB index is a synthesized measure of regulation of business activity at the country level based on indicators from all ten areas. Once computed, the index is used to rank countries in ascending level, with an index of one meaning friendlier regulatory environment.

Multiple studies have used the Doing Business Database to scrutinize the linkages between business regulation and other economic variables like economic growth (Brandt, 2004; Djankov, Jalilian, Kirkpatrick and Parker, 2006; McLiesh and Ramalho, 2006; Hasan, Mitra and Ulubasoglu, 2007), size of the informal sector (Loayza, Oviedo and Serven, 2005) and entrepreneurial activity (Klapper, Laeven and Rajan 2006; van Stel, Storey and Thurik, 2007). However, less attention has been paid to what specific factors account for the wide variation observed in business regulation across countries. Particularly, we consider that one of the critical factors affecting a country’s ease of doing business is the availability of information and communication technology (ICT) infrastructure that can support the automation and simplification of regulatory procedures. Countries cannot maintain an adequate level of simplicity in regulation if they lack the technological resources to streamline and expedite their processes. This research is therefore intended to fill in this gap by examining the relationship between ICT measures and Ease of Doing Business. Moreover, we want to explore to what extent ICT measures mediate the effect of business regulation on country’s economic growth.

The next sections describe the sources of data and are followed by the details of the preliminary results obtained using data for the year 2005.

DATA COLLECTION AND EXPLORATION

Our dependent variable of government regulation of business activity is measured by an index obtained from the World Bank’s “Doing Business” database. The most recent database was

recently released in September 2008. This index is called “ease of doing business” (EDB) and is a summary measure of both amount of existing regulatory procedures and their corresponding outcomes including time and cost. The EDB index we use in this paper corresponds to the year 2005 and was computed as the simple average of country percentile ranking of each of the seven topics covered in the doing business report. This computational approach is appropriate when there is no information to determine the relative weights of the index components and it is common in different sectors and industries like education and sports (Doing Business report 2008).

We use number of PCs per 1000 people and number of internet hosts as proxies for Information and Communication Technology (ICT) availability. These ICT data are obtained from the World Development Indicators (WDI) database from the World Bank for the year 2003. We use a lag of approximately two years to account for the time that it takes for technology changes to influence the regulatory framework. Because we are combining a set of indicators for different years from the two different datasets, we have different number of observations for different variables, which affect the total observations considered for the different regression models.

The following table shows the definitions and sources of the data used.

Table 1. Variable Definitions and Sources of Data

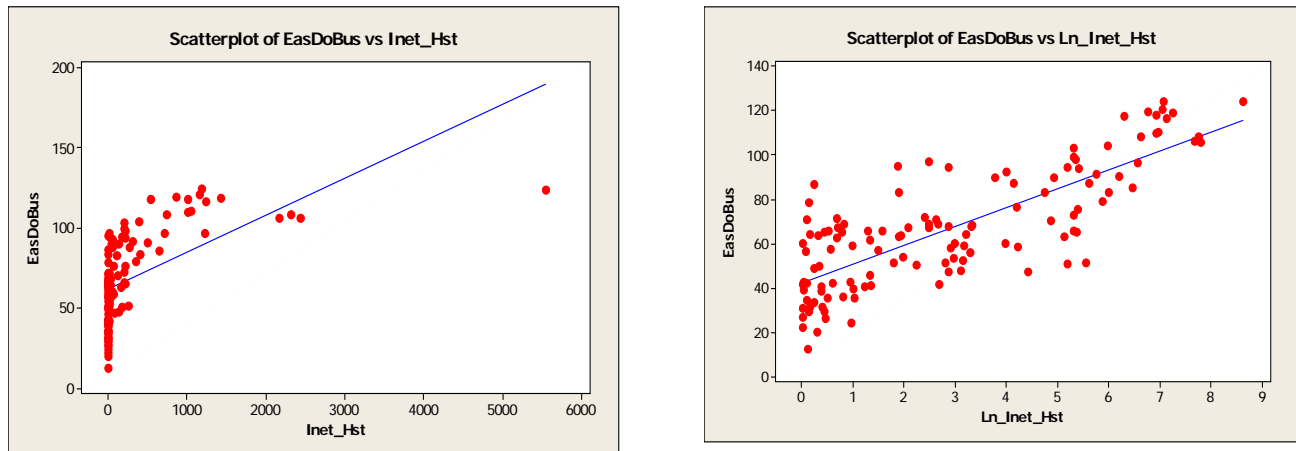
Variable (Indicator)	Definition	Source
Ease of Doing Business Index (EasDoBus)	summary measure of both amount of existing regulatory procedures and their corresponding outcomes including time and cost	Doing Business database from World Bank’s Doing Business Project. (2005)
Personal computers (per 1,000 people) (PCs)	Personal computers are self-contained computers designed to be used by a single individual, per 1,000 people.	International Telecommunication Union, World Telecommunication Development Report and database. (2003)
Secure internet hosts (Inet_Hst)	Secure servers are servers using encryption technology in Internet transactions.	International Telecommunication Union, World Telecommunication Development Report and database. (2003)
Gross National Income (GNI)		World Development Indicators Database (2005)

Table 2. Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
EasDoBus	129	12.76	124.30360	66.67	26.05
Inet_Hst	126	.01	5549.40	249.42	656.93
PCs	116	.00	708.67	129.05	179.48
GNI_pc	128	100.00	43350.00	6720.84	10213.81
Valid N (listwise)	110				

In order to improve linear relationship with our dependent variable “EasDoBus”, logarithmic transformation of independent has been applied to the considered variables. For example the figure below .shows the scatter plots for the number of internet hosts “InetHost”.

Figure 1. Transformation of Variables



MEASURES ON BUSINESS REGULATION

In this section we examine the relationship between our measures of ICT availability (i.e. number of PCs and Internet Hosts) and business regulation. We hypothesize that ICTs are positively related to Business Regulation. A preliminary inspection of the variables shows a linear relationship, which is confirmed by the simple regression model.

The regression model includes the measure of business regulation as dependent variable and the proxies for ICTs availability as independent variables In order to control for the influence of

economic performance on the dependent variable of business regulation, we ran a step-wise regression model and include the natural log of country's economic income per capita in the first step and the technology variables on the second step.

The SPSS results of this model are shown below.

Table 3. Summary of Regression Results – Dependent Variable is Business Regulation

	Adj R ²	Standard Error	Model Siginif..	Variables	Standard. Coefficients	t	Sig.
Step					Beta	B	Std. Error
1	.576	17.538	.000	(Constant)		-3.481	.001
				Ln_GNI_pc	.762	12.212	.000
2	.663	15.642	.000	(Constant)		2.226	.028
				Ln_GNI_pc	.003	.021	.984
				Ln_Inet_Hst	.377	2.784	.006
				Ln_PCs	.461	2.831	.006

The coefficients of the regression model illustrated above confirm our hypothesis that the technology availability measures are indeed significant in determining business regulation. Both Ln_Inet_Hst and Ln_PCs yield significant coefficients at the 1% level ($p : 0.006$). Validation of this model was conducted using a random sample of 70% of observations which yielded consistent results, as illustrated on the following table.

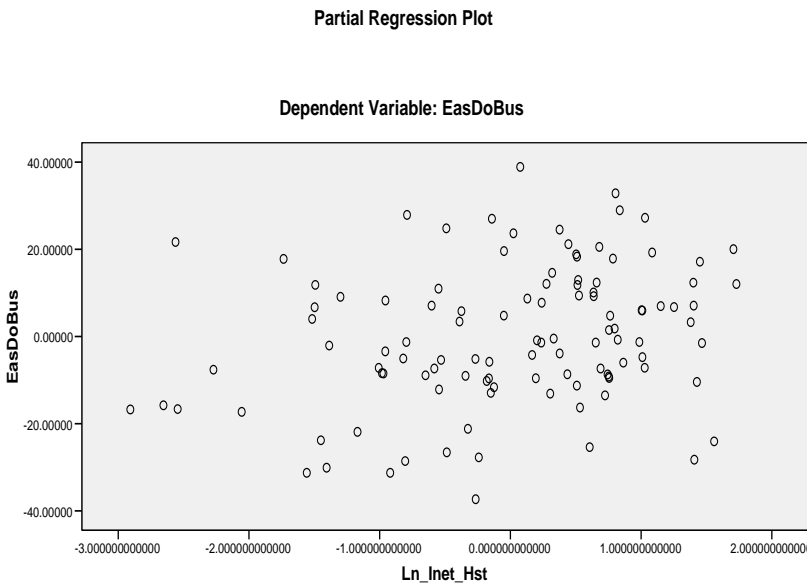
Table 4. Validation of model for Business Regulation using random sample of 70% of cases.

	Adj R ²	Standard Error	Model Siginif..	Variables	Standardized Coefficients	T	Sig.
Step					Beta	B	Std. Error
1	.568	17.526	.000	(Constant)		-3.070	.003
				Ln_GNI_pc	.757	10.426	.000
2	.661	15.520	.000	(Constant)		1.769	.081

				Ln_GNI_pc	.044	.275	.784
				Ln_Inet_Hst	.379	2.516	.014
				Ln_PC's	.423	2.405	.018

Notice that the coefficients for the technology variables remain statistically significant at the 5% level when using only 70% of cases. A plot of residuals show no significant departures from regression assumptions.

Figure 2. Residuals Plot – For Business Regulation regression model

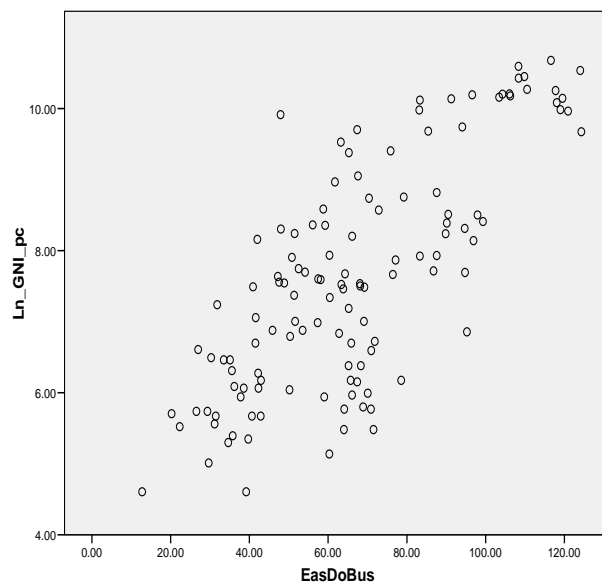


EXAMINING THE INFLUENCE OF REGULATION ON ECONOMIC INCOME

We now move on to explore the relationship between our index of business regulation EasDoBus and per capita income. We test whether ICT measures mediate the relationship between business regulation and per-capita income (our proxy for economic development). In order to examine this mediation effect, three regression equations were utilized as suggested by Baron and Kenny (1986). First, we examine the relationship between the measures of ICT availability (i.e. the potential mediator) and business regulation (i.e. the independent variable). This relationship was

statistically significant as illustrated on the regression results shown on the previous section. Next, economic income (i.e. the dependent variable) was regressed on business regulation. The regression equation for this model was also statistically significant as required by Baron and Kenny (this corresponds to step 1 of the regression model described on table 3 below). Finally, economic income was regressed on ICT availability and business regulation. When controlling for ICT availability, the effect of business regulation on economic income disappeared, thus supporting the mediation effect.

Figure 3. Scatterplot of Economic Income Vs Business Regulation



The following table illustrates the results of the different regression models used to test the mediating role of ICT on the relationship between regulation and economic development.

Table 3. Regression Results – Dependent Variable is Economic Income per capita

	Adj R ²	Standard Error	Model Siginf..	Variables	Standard. Coefficient s	T	Sig.
Step					Beta	B	Std. Error
1	.578	1.045	.000	(Constant)		16.296	.000
				EasDoBus	.762	12.212	.000
2	.862	.613	.000	(Constant)		23.068	.000

				EasDoBus	.001	.021	.984
				Ln_PCes	.661	7.619	.000
				Ln_Inet_Hst	.288	3.383	.001

The tables above show the results for the two steps regression model which give evidence of a significant influence of the ease of doing business index (our proxy for regulation) on per capita income (our proxy for economic development). On the second regression model (2), we introduce the technology variables simultaneously with the business regulation measure. As the results illustrate, introducing the ICT measures to the model causes the significance of the coefficient of business regulation to lose its significance, which supports the mediation effect.

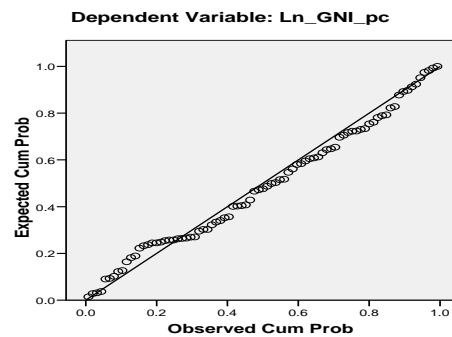
To validate this model, we used a random sample of 70% of the cases. As illustrated on table 4 below, the results are consistent with those of table 3, showing that the coefficients the two proxies for ICTs availability are significant whereas the EasDoBus that proves significant in model 1 loses significant in the second model.

Table 4. Validation Results (70% of cases)– Dependent Variable is Economic Income per capita

Adj R ²		Standard Error	Model Signif..	Variables	Standard. Coefficients	T	Sig.
Step					Beta	B	Std. Error
1	.568	1.066	.000	(Constant)		14.518	.000
				EasDoBus	.757	10.426	.000
2	.833	.662	.000	(Constant)		18.678	.000
				EasDoBus	.022	.275	.784
				Ln_PCes	.629	5.919	.000
				Ln_Inet_Hst	.291	2.782	.007

Checking regression assumptions, we observe no significant deviations.

Normal P-P Plot of Regression Standardized Residual



CONCLUSIONS

This preliminary exploration has set the stage for a more in depth study of the relationship between measures of ICTs, business regulation and economic performance. Our aim is to start building empirical evidence that can inform the ongoing debate on the role of ICTs and its impact on economic development. Our results support the view that ICTs do play a significant role on business regulation and economic performance, as measured by national per capita income.

Our examination of ICT measures (internet hosts and number of PCs) and the index of business regulation made available by the World Bank's Doing Business project confirmed that ICTs are in fact positively associated (positively) with a better regulatory climate and also with greater economic income at the country level. Even though the R-square values obtained were not very high (around 60%), meaning there was significant variance not explained by our models, the coefficients for ICT measures were robust when using a random sample of cases to validate the results. The coefficients for ICT measures remained statistically significant at the 5% level.

The exploration of the mediating role of ICTs showed that, ICTs do in fact appear to mediate the relationship between business regulation and per capita income. When considering ICTs and business regulation simultaneously, the effects of regulation on economic income are no longer significant, hence supporting the mediating effect of ICTs.

Further work is required to enrich the theoretical framework surrounding these relationships as well as validating and replicating the results with recently released data. For example the literature on General Purpose Technologies (GPTs), Technological change and innovation can

inform some of our results. Lipsey(2005) highlighted the importance of the interaction between GPTs and facilitating structures for their economic impact. Such structures include, among other factors, the institutional environment (e.g. regulations) in which such technologies operate.

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