INFRASTRUCTURE AND INSTITUTIONS AS PART OF THE ECONOMIC GROWTH PROCESS: RESULTS FROM A DYNAMIC PANEL APPROACH

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Abstract - This study revisits the ongoing debate on the e ect of infrastructure investment on long-run economic growth. We strongly argue that the productivity of the infrastruc-ture investment depends the institutional frameworks. This paper improves on the methodology by conducting system-GMM estimations for a panel of 221 countries. The results suggest in the countries where there is a better institutional quality there is a positive correlation between infrastructure investment and economic growth. In particular, the study show that there is a positive and robust correlation between infrastructure investment and economic growth in countries with a well established democratic system and "good" regulations.

Keywords - Infrastructure; institutions; economic growth; investment; quality.
JEL classi cation: H54, F20

I. INTRODUCTION

The objective of this study is to assess the degree of the in uence of infrastructure capital investment on economic growth, which is conditioned by the quality of institu-tional setup. In practice has tended to obscure the di erent channels through which institutions a ect economic performance. But in this context, infrastructures have taken as a physical core, and political institutions and governance qualities are con-sidered as a soft component in shaping growth patterns of the economy. The macroe-conomic literature has long been interested in dealing with e ect s of infrastructure on the one hand, and the role of institutions on the other side, to the aggregate out-put and productivity. In the last two decades many authors have studied di erent aspects of the e ects of institutions on economic development (See, e.g., Knack and Keefer, 1995; Acemoglu et al., 2002; Acemoglu et al., 2005; Lee and Kim, 2009). From the days Sanchez-Robles (1998) onwards the relationship between infrastructure and growth has been reported by many authors and reviewers (See, e.g., ; Canning and Pe-droni, 1999; Bougheas et al., 2000; R•oller and Waverman, 2001; Calderon and Serven, 2004; Calderon et al., 2015). However, the e ect of infrastructure and institution on economic growth are seldom studied both together. The modern policy development literature does too little to integrate the core physical infrastructural developments with standard institutional and governance characteristics of countries.

The e ciency of infrastructural development depends on many of the countries on the characteristics of institutional nature as well as regulations as such kind of public investments are typically subject to extensive government controls (Tanzi and Davoodi, 1998). Hence, institutional qualities are the vital detriment of the maxi-mization of economic returns of infrastructural stocks.

This study re-examines the joint e ect of infrastructure, and political institutions qualities cause on economic growth. Further, the study considers both the bidirec-tional causal e ect between both infrastructure and institutions and the economic growth with a sample of annual panel data from 121 countries from the year 1980 to 2015. To the best of our knowledge, the e ect of infrastructure investment has never formally considered in the context of panel data analysis looking at the e ect of in-stitutional frameworks on economic growth. Hence, this study intends to contribute to the exciting litterateur on the long-run economic growth in three important ways.

First, I posit that the stronger political, institutional frameworks stimulate eco-nomic composition and productivity by facilitating e cient infrastructural develop-ments. Second, we develop long years of the new dataset that composes a signi - cant number of sample countries with broader determinants. Third, this study ac-complishes some improvements concerning empirical methodology because I support these new ndings not only by simple cross-section regressions but also by xed-panel specify a dynamic panel data model. The dynamic panel approach includes lagged dependent variables as regresses to control for growth dynamics and employ the Generalised system Method of Moments (sys-GMM).

I nd that ine ectual investment positively and signi cantly correlated with eco-nomic growth in countries with better institutional qualities and vice-versa. In par-ticular, the productivity of infrastructure investment a ected economic growth posi-tively and given considerably better institutional frameworks such as democracy, law and order, control of corruption, bureaucratic qualities and governance

stability. In contrast, infrastructural investments with weak institutional setups like autocracy lower economic growth. Our results are robust with various sample speci cations and dataset.

II. METHODOLOGY AND DATA

2.1. Estimation Methodology

Taking into account, the econometric challenges that literature suggested, ap-plying the General Method of Moments (GMM) estimation can able to correct un-observed country heterogeneity, omitted variable bias, potential endogeneity. The GMM estimation also helps to overcome the reverse-causality that can arise from measurement error, autoregression with autocorrelated errors, simultaneity, and sam-ple selection errors which mostly a ect the growth variables (Arellano and Bover, 1995; Blundell and Bond, 1998). Speci cally, using system-GMM, the growth equa-tion helps to reduce a small sample bias problem of rst-di erenced GMM (Lee and Kim, 2009). Furthermore, we estimate the system-GMM is used to estimate the following equation:

$$Y_{it} \quad _3 \quad _1 Y_{it\ 1} \quad _3 IN\ F\ R_{it} \quad _3 IN\ ST_{it} \quad _3 IN\ ST_{it} \quad IN\ F\ R_{it} \quad _3 Z_{it} \quad (1)$$

where $_2$ is the country-speci c xed e ect, Y_{it} is the log of GDP per capita in country i expressed in constant US dollars at time period t, $IN\ F\ R_{it}$ is the variable relating to physical infrastructure of country i at time period t, $IN\ ST_{it}$ is the variable relating to political and governance institutions of country i at time period t, and the interaction between constitutive terms is given by $\mathbf{p}IN\ ST_{it}\ IN\ F\ R_{it}\mathbf{q}$. We use multiplicative interaction term in our model due to the hypothesis that we want to test is conditional interaction theory. The error term in 1 is made up of two components: $_{i\ it}$ where $_i$ stands for a country-speci c e ect it can be viewed as the collection of factors that are speci c to a country but are not included as regresses and it $_{it}$ represents an idiosyncratic component.

2.2. Data Description

We estimate the above model for per capita GDP growth rates, institution quality and infrastructure capital investment for 121 countries during the period 1980-2015. The number of observations varies depending on the di erent model we used in the estimation. In the analyses, we used xed telephone subscriptions (per 100 people) as a proxy of infrastructural capital investment mainly for two reasons. First, because of lack of a panel data on another sector of infrastructural investments, we forced to restrict on the telephone service developments. Second, in cases of most countries, the telephone is major issue in the political economy of infrastructure services and highly related to institutions (Esfahani and Ram rez, 2003). For this study, we used the usual data sources for most of our variables. For institution variables, we depend on two major sources. We use Marshall and Jaggers (2002) dataset of Polity IV Project for political institution indicators and the International Country Risk Guide (ICRG) dataset. Besides we procured additional data on infrastructure and institutions from the Cross-National Time-Series Data Archive (CNTS) (Banks, 2011).

III. RESULTS

Table 1 presents results from system-GMM estimations as is now standard, which dealt with the problems of endogenous explanatory variables and time-varying omit-ted variables. In all of our regressions, Iuse the two-step procedure and obtain robust standard errors proposed by the Windmeijer (2005) nite sample correction. As the

Table 1: System-GMM Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log of GDP per capita t-1	0.862***	0.854***	0.848***	0.872***	0.867***	0.825***
	(0.033)	(0.032)	(0.026)	(0.028)	(0.030)	(0.030)
Log of telephone subscription	0.705***	0.780***	0.542***	0.777***	0.754***	0.123
	(0.210)	(0.212)	(0.160)	(0.196)	(0.217)	(0.242)
Polity2	-0.026	-0.023	-0.025			
	(0.034)	(0.031)	(0.025)			
Polity2 x telephone	0.049***	0.054***	0.053***			
	(0.014)	(0.014)	(0.013)			
Corruption				-0.141	-0.211	-0.231
				(0.144)	(0.164)	(0.235)
Corruption x telephone				0.077	0.101*	0.198***
				(0.057)	(0.059)	(0.074)
Log of average years of secondary education	0.571			0.472		
	(0.503)			(0.573)		

Log of average years of tertiary education		0.925	-0.228		0.769	0.688
		(0.716)	(0.698)		(0.851)	(0.853)
Log of trade openness			0.363***			0.347***
			(0.133)			(0.121)
Log of nancial development			0.753***			0.873***
			(0.176)			(0.224)
Log of Population growth rate			0.741***			0.548*
			(0.245)			(0.282)
Constant	9.574***	10.420***	0.158	9.367***	10.333***	2.530
	(2.105)	(2.309)	(2.615)	(1.795)	(2.206)	(2.616)
Observations	693	693	679	651	651	637
Number of Id	99	99	97	93	93	91
period	Yes	Yes	Yes	Yes	Yes	Yes
Hansen Test (stat.)	0.131	0.135	0.740	0.151	0.187	0.892
Test AR(3) (z-stat.)	0.461	0.464	0.759	0.916	0.974	0.234

Notes: This table reports the results of system-GMM regressions in which log real per capita GDP growth ver di erent time periods is regressed. Standard errors in parenthesis are heteroskedasticity robust standard errors. Signi cance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively. number of our sample countries is large enough, Iuse deeper lags as instruments and reject serial correlation in the third order.

The standard speci cation of tests is presented in the lower part of the table. It shows that all regressions reject the null of no rst and second-order autocorrelation and that all models do not reject the null of no third-order autocorrelation [1]. The Hansen tests of the overidentifying show any evidence of poor instrument choice or bad speci cation of the model at the 95% con dence level.

The rst three columns of Table 1 estimate the models that are controlled for di erent determinants of growth. The results con rm that the presence of a positive and statistically signi cant correlation between the infrastructure development and economic growth in the presence a better an institutional democratic setup. In the same manner the last three columns of Table 1 display a positive and statistically signi cant correlation between infrastructure capital investment and economic growth where there is strong control of corruption.

The coe cient of the product term of corruption and telephone subscription, as a proxy for institutions and infrastructure, is signi cant in most speci cations. The only di erence between the results reported in Table ?? and Table 1 is that the product terms are not signi cant in a xed-e ect estimation. Given that the system-GMM is supposed to handle an endogeneity problem the ndings in Table 1 are more reliable and robust results than the xed-e ect estimate.

In summary, the estimates of Table 1 display a constitutive view of political insti-tutions is fundamental determinant for the infrastructure capital investments to be more productive and positively a ect economic growth. This conclusive presumption becomes more applicable when Itake into account possible omitted variables and endo-geneity problems of the models by using dynamic panel estimations than xed-e ect method.

CONCLUSION

The study shows that in countries with a better institutional quality there is a positive correlation between infrastructure investment and economic growth. In par-ticular, we nd that there is a positive and robust correlation between infrastructure investment and economic growth in countries with a well established democratic sys-tem and "good" regulation. We also show that the productivity of the infrastructure investment is no longer positively associated with economic growth in countries where an entirely autocratic regime in power.

There are several possible reasons why institutional qualities do matter for the ef-fect of infrastructure investment on aggregate output or productivity.

First, countries with democratic (binding legislature) institutional frameworks have a positive e ect on economic growth and investment than authoritarian regimes (nonbinding legisla-tures) which is having an adverse e ect on economic growth (Wright, 2008). Second, regulations are a benevolent mechanism for the productivity of public investments as ine ciency is stronger in public owned investments. Dal Bo and Rossi (2007) show that corruption is signi cantly associated with lower e ciency of infrastructure investment.

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