

Does Economic Freedom Enhance the Impact of Technology on Global Productivity?

Koffi N'Da, Rochester Institute of Technology, New York, USA; E-mail: kxnbbu@rit.edu

Ashok Robin, Rochester Institute of Technology, New York, USA; E-mail: arobin@cob.rit.edu

Thomas Tribunella, SUNY at Oswego, New York, USA; E-mail: tribunel@oswego.edu

ABSTRACT

This paper assesses the joint effects of economic freedom and technology on productivity. Using regression analysis we examined a sample of more than 100 countries from 1990 to 2000. The results indicate that countries with greater economic freedom have an increased association between technology and productivity.

INTRODUCTION

Productivity is considered a key indicator of national success. Consequently, much effort has been expended in the economics literature to determine factors influencing it. Our concern is with a subset of this literature pertaining to the effect of technological investments on productivity. This literature generally finds that technology is associated with productivity and economic growth.

But technology cannot be considered in isolation. Other factors may affect or modify the relationship between technology and productivity. In this study, we consider one such factor, economic freedom. The objective of this paper is to assess the joint effects of economic freedom and technology on productivity. The existing literature tends to treat these two factors as separate and our contribution is to consider the joint effects. We argue that technology has a greater effect on productivity when coupled with economic freedom. We test this hypothesis using a sample of more than 100 countries and find supportive evidence.

BACKGROUND AND LITERATURE REVIEW

Technology and Economic Performance

Many studies have investigated the relationship between Information Technology (IT) investment, productivity, and economic growth. Dedrick, Gurbaxani and Kraemer (2003) categorize these studies based on the aggregation level of data: firm-level, industry-level, and country-level. The initial debate in the literature centered on whether IT produced economic growth or productivity. Early tests did not indicate a relationship, but tests using data from the 1990s indicate that IT influences productivity.

While most of the studies were conducted using firm-level data, many studies also used country-level data. These studies are of recent vintage (mid-1990s onward) and use univariate tests associating IT investments with economic growth and productivity. The greatest impact of IT is found in developed countries (Yoo 2003). The link between IT and economic performance is not robust in developing countries (Dewan and Kraemer 2000).

The lack of an IT impact in developing nations is further explored by Indjikian and Siegel (2005). These authors review existing evidence and conclude that IT investments by themselves cannot solve the travails of developing nations. This raises the possibility of moderating factors affecting the link between IT and productivity.

Economic Freedom and Productivity

Economic freedom, as distinguished from civil and political freedoms, refers to the degree in which a market economy exists and provides an environment favor-

ing voluntary exchange, free competition, property rights, and a limited degree of interventionism in the form of government ownership, regulations, and taxes (Gwartney and Lawson 2002). Most but not all studies indicate that economic freedom is positively and significantly correlated to productivity. Focusing specifically on developing countries, there has consistently been empirical evidence that economic freedom is one of the most important factors that affect economic performance. Countries that better protect economic rights tend to grow faster (Goldsmith 1997). According to Wu and Davis (1999), the establishment of free a market is essential to a developing country's economic growth. Other studies have demonstrated that economic freedom combined with other factors such as political freedom, civil freedom, and democracy has a positive effect on the economic performance of developing countries (Nelson and Singh 1998; Vega-Gordillo and Alvarez-Arce 2003).

Contribution of this Study

The notion that IT investments and diffusion need to be supported by complementary investments and environmental conditions (Green, Melnyk and Powers 2002; Lee, Gholami and Tong 2005) is an important one and lies at the heart of our study. At the firm-level such complementary investments may include items such as workforce training. At the national level too, there are many environmental variables affecting the impact of IT. In this paper, we consider economic freedom to be a complementary variable.

Our study is perhaps most closely related to Meso, Datta, and Marika (2005). These authors examined the modifying effects of governance variables on the relationship between economic growth and IT. They found an interaction effect for certain variables. For instance, they found that Voice, Accountability, and Rule of Law interact with IT to further economic growth. However, they also find IT to be negatively related to economic growth contrary to much of the literature. Our study uses different dependent and independent variables and measures in different time periods. More importantly, our focus is on economic freedom and not governance.

DATA AND METHODOLOGY

Productivity

The dependent variable in our study is Gross Domestic Product (GDP) per worker adjusted for purchasing power parity and expressed in US currency. We collected values for this variable for the years 1990 and 2000 from the Global Market Information Database issued by Euromonitor International. The database covers 205 nations from 1977 to 2006.

Technological Capability

Our independent variables are technology and economic freedom. We measure technology through the Indicator of Technological Capabilities for Developed and Developing Countries. The indicator was compiled by Archibugi and Coco (2004). We use this index because it is one of the most widely used and detailed indexes.

Economic Freedom

Our economic freedom variable is the Economic Freedom of the World (EFW) indicator by **Gwartney and Lawson** (2002). It is measured on a ten point scale with 10 denoting the highest level of economic freedom. EFW contains the following five areas: 1) size of government, 2) legal structure and property rights, 3) sound money, 4) openness of markets, and 5) regulation of credit, labor and business.

The EFW measure is also one of the most widely recognized and detailed indexes of economic freedom. We focus on economic freedom rather than political freedom because we are more interested in the policies that directly effect economic productivity. The index has been stable over time and has been used in several published papers (e.g., Vega-Gordillo and Alvarez-Arce 2003). The index has been compiled since 1970 and is publicly available at www.freetheworld.com.

Regression Models

Throughout the tables as well as in the text, we use the variable names mentioned above. We estimate the following models:

- Model A: $\text{Prod2000} = \beta_0 + \beta_1 \text{Tech2000}$
- Model B: $\text{Prod2000} = \beta_0 + \beta_1 \text{Free2000}$
- Model C: $\text{Prod2000} = \beta_0 + \beta_1 \text{Tech2000} + \beta_2 \text{Free2000}$
- Model D: $\text{Prod2000} = \beta_0 + \beta_1 \text{Tech2000} + \beta_2 \text{Free2000} + \beta_3 \text{Tech2000} * \text{Free}$

Where:

- Prod2000 = GDP per worker in 2000
- Tech2000 = Indicator of Technology Capabilities for Developed and Developing Countries in 2000
- Free2000 = Economic Freedom of the World indicator in 2000
- Free = dummy variable equaling 1 when Free2000 is median or higher

RESULTS

Descriptive Statistics

Table 1 reports descriptive statistics on the three key variables: technology, freedom, and productivity. Tech2000 ranges from 0.028 to 0.867 and has a mean and median of 0.329 and 0.313 respectively. Free2000 ranges from 3.5 to 8.7 and has a mean and median of 6.399 and 6.5 respectively. Prod2000 ranges in value from 183 to 105,064 and has a mean and median of 13,273 and 3,978 respectively.

We also calculate correlations. Consistent with the literature on the effects of technology and freedom on productivity, we note significant correlations between technology and productivity as well as between freedom and productivity.

Regression Analysis and Models of Productivity

Model A is a regression of Prod2000 on Tech2000. Consistent with results reported in the literature, we find high R-squares (0.6416) as well as a significant coefficient

Table 1. Descriptive statistics

	N	Min	Max	Median	Mean	Sigma
Tech2000	162	0.028	0.867	0.313	0.329	0.190
Free2000	23	3.500	8.700	6.500	6.399	1.066
Prod2000	66	183	105,064	3,978	13,273	19,377

Table 2. Regression analysis using data from 2000

Model		(A)	(B)	(C)	(D)
Intercept	coef.	-15898	-74165	-43146	-21675
	t-stat	-6.37	-8.48	-5.50	-1.97
	p-val.	<.0001	<.0001	<.0001	0.0512
Tech2000	coef.	87530		67147	48624
	t-stat	14.45		8.36	4.69
	p-val.	<.0001		<.0001	<.0001
Free2000	coef.		14030	5397	2113
	t-stat		10.44	3.64	1.12
	p-val.		<.0001	.0004	0.2642
Tech*Free	coef.				26254
	t-stat				3.71
	p-val.				0.0077
N		117	117	117	117
Adj. R ²		.6416	.4821	.6762	.6933

for Tech2000. We also find strong results with Model B that uses Free2000 as the independent variable. Comparing the R-squares for models A and B, we note a stronger explanatory role for Tech2000. This is confirmed by model C which uses both Tech2000 and Free2000 as explanatory variables. While both variables have significant coefficients we note that the R-square for model C is only slightly higher than R-square for model A.

A key contribution of our study is an understanding of how freedom modifies the effect of technology. Model D adds the interaction variable indicating how freedom modifies the effect of technology on productivity. This variable has a significantly positive coefficient of 26,254 with a t-statistic of 2.71. This indicates that countries with higher levels of freedom have a greater link between technology and productivity. This is consistent with McNair (1998) who argues that there is synergy between IT and economic freedom.

SUMMARY

Using a sample of more than 100 countries, we assess the joint impact of technology and economic freedom on productivity. We use two samples, one containing 1990 data and the other containing 2000 data. We find consistent results indicating that both technology and economic freedom are influential variables. We also find indications that technology is the more important variable and the impact of economic freedom is primarily through its modifying effect on technology. Thus, countries with greater economic freedom have a greater link between technology and productivity.

We caution readers about the suggestive nature of these results. Because we rely on cross-sectional associations, we cannot make strong statements about causality. Further, we may be detecting spurious correlations by not properly specifying all relevant variables. In particular, our research design could be subject to the problem of correlated omitted variables. Nevertheless, our results are reasonable and consistent with expectations. Thus our study is a valuable complement to the large literature on IT effectiveness.

REFERENCES

- Archibugi, D. and Coco, A. "A New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo)," *World Development* (32:4), 2004, pp. 629-654.
- Dedrick, J., Gurbaxani, V., and Kraemer, K.L. "Information Technology and Economic Performance: A Critical Review of the Empirical Evidence," *ACM Computing Surveys* (35:1), March 2003, pp. 1-28.
- Dewan, S. and Kraemer, K.L. "Information Technology and Productivity: Preliminary Evidence from Country-Level Data," *Management Science* (46:4), April 2000, pp. 548-562.
- Goldsmith, A.A. "Economic Rights and Government in Developing Countries: Cross-National Evidence on Growth and Development," *Studies in Contemporary International Development* (32:2), Summer 1997, pp. 29-44.
- Green, S., Melnyk, A., and Powers, D. "Is Economic Freedom Necessary for Technology Diffusion," *Applied Economics Letters* (9), 2002, pp. 907-910.
- Gwartney, J.D. *Economic Freedom of the World*, www.freetheworld.com.
- Indjikian, R. and Siegel, D.S. "The Impact of Investment in IT on Economic Performance: Implications for Developing Countries," *World Development* (33:5), 2005, pp. 681-700.
- Lee, S.T., Gholami, R., and Tong, T.Y. "Time Series Analysis in the Assessment of ICT Impact at the Aggregate Level – Lessons and Implications for the New Economy," *Information and Management* (42), 2005, pp. 1009-1022.
- Meso, P., Datta, P., and Marika, V. "Moderating ICTs' Influences on Socio-Economic Development with Good Governance: A Study of the Developing Countries," *Journal of the American Society for Information Science and Technology*, 2004.
- Nelson, M.A., and Singh, R.D. "Democracy, Economic Freedom, Fiscal Policy, and Growth in LLDs: A Fresh Look," *Economic Development and Cultural Change*, 1998, pp. 677-696.
- Vega-Gordillo, M. and Alvarez-Arce, J.L. "Economic Growth and Freedom: A Causality Study," *Cato Journal* (23:2), Fall 2003, pp. 199-215.
- Wu, W. and Davis, O.A. "The Two Freedoms, Economic Growth and Development: An Empirical Study," *Public Choice*, (100:1-2), July 1999, pp. 39-64.
- Yoo, S.H. "Does Information Technology Contribute to Economic Growth in Developing Countries? A Cross-Country Analysis," *Applied Economics Letters* (10), 2003, pp. 679-682.

0 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/proceeding-paper/does-economic-freedom-enhance-impact/33241

Related Content

Information Visualization Based on Visual Transmission and Multimedia Data Fusion

Lei Jiang (2023). *International Journal of Information Technologies and Systems Approach* (pp. 1-14).

www.irma-international.org/article/information-visualization-based-on-visual-transmission-and-multimedia-data-fusion/320229

Integrated Design of Building Environment Based on Image Segmentation and Retrieval Technology

Zhou Liand Hanan Aljuaid (2024). *International Journal of Information Technologies and Systems Approach* (pp. 1-14).

www.irma-international.org/article/integrated-design-of-building-environment-based-on-image-segmentation-and-retrieval-technology/340774

Legalistic Entrepreneurship in the Digital World

Fahri Özsungur (2021). *Handbook of Research on Multidisciplinary Approaches to Entrepreneurship, Innovation, and ICTs* (pp. 156-172).

www.irma-international.org/chapter/legalistic-entrepreneurship-in-the-digital-world/260556

Cuckoo Search for Optimization and Computational Intelligence

Xin-She Yang and Suash Deb (2015). *Encyclopedia of Information Science and Technology, Third Edition* (pp. 133-142).

www.irma-international.org/chapter/cuckoo-search-for-optimization-and-computational-intelligence/112323

An Optimal Policy with Three-Parameter Weibull Distribution Deterioration, Quadratic Demand, and Salvage Value Under Partial Backlogging

Trailokyanath Singh, Hadibandhu Pattanayak, Ameeya Kumar Nayak and Nirakar Niranjana Sethy (2018). *International Journal of Rough Sets and Data Analysis* (pp. 79-98).

www.irma-international.org/article/an-optimal-policy-with-three-parameter-weibull-distribution-deterioration-quadratic-demand-and-salvage-value-under-partial-backlogging/190892