

## Investigating the Impact of Technology and Network Readiness on National Competitiveness

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### Abstract

*The purpose of this paper is to investigate the relationship between 'growth competitiveness' of a nation and its 'technology', 'network readiness', 'public institutions', and 'macroeconomic environment' dimensions. Employing ordinary least squares a linear model has been estimated using year 2004 data for 104 countries, reported in the Global Competitiveness Report of the World Economic Forum. The paper concludes that the impact on growth competitiveness of technological progress, depicted by the 'technology' and 'network readiness' dimensions, is much higher than the impact of the 'public institutions' and 'macroeconomic environment' dimensions. This result may have policy implications with respect to the efforts that a nation has to put in improving its competitiveness.*

**Keywords:** Growth competitiveness, public institutions, macroeconomic environment.

### Introduction

The following three inter-related processes are usually acknowledged to be important in creating economic growth (McArthur and Sachs (2002):

1. The efficient allocation of resources, based on market competition and a sophisticated division of labor.
2. Capital accumulation, which does not include plant and equipment only, but it also includes human capital.
3. Technological progress, which is achieved, either by actual improvements in technology, called 'technological innovation', or by adopting technology that has been developed elsewhere, called 'technological diffusion'.

Although these three processes, i.e. division of labor, capital accumulation, technological progress, are significant in creating economic growth, it is argued (McArthur and Sachs, 2002) that technological progress is perhaps the most essential of the three. This is because technological progress does not only drive the society to a higher standard of living but it also puts the foundations for a continuous economic growth. However, continuous economic growth is closely related to 'competitiveness'.

According to the European Commission (1999) competitiveness is defined as “the ability to produce goods and services which meet the test of international markets, while at the same time maintaining high and sustainable levels of income”. Similarly, Porter (2004) presents “the most intuitive definition of competitiveness (to be) a country’s share of world markets for its products.” However, although the concept of competitiveness is well accepted by economists to be very important for economic growth, still this concept is rather controversial. Krugman (1994), for example, argues that if it is accepted that competitiveness has any meaning, then this meaning is simply another way of saying ‘productivity’. “Productivity isn’t everything, but in the long run it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.” Furthermore, Porter (1985) advocate that “a nation’s prosperity depends on its competitiveness, which is based on the productivity with which it produces goods and services. Sound macroeconomic policies and stable political and legal institutions are necessary but not sufficient conditions to ensure a prosperous economy.”

According to the discussion above, the European leaders at the Lisbon Summit in March 2000 defined eight distinct dimensions assumed to be critical for improving national competitiveness. These dimensions, constituting the so-called ‘Lisbon Strategy’ for improving competitiveness, are presented in Table 1.

*Table 1.* Lisbon Scores: Comparing the EU to the US

Dimensions for Improving National Competitiveness	US Score	EU Score	EU –US Score
An Information Society for All	5.86	4.61	-1.25
Innovation, Research and Development	6.08	4.41	-1.67
Liberalization	5.11	4.69	-0.42
Completing the single market	5.70	5.13	-0.57
State aid and competition policy	4.52	4.25	-0.27
Network Industries	5.85	5.81	-0.04
Telecommunications	5.60	5.96	0.36
Utilities and transportation	6.10	5.65	-0.45
Efficient and Integrated Financial Services	5.82	5.52	-0.29
Enterprise Environment	5.71	4.74	-0.97
Business start-up environment	5.83	4.52	-1.32
Regulatory environment	5.58	4.96	-0.62
Social Inclusion	5.04	4.81	-0.23
Returning people to the workforce	5.60	5.06	-0.54
Upgrading skills	5.31	4.96	-0.35
Modernizing social protection	4.20	4.40	0.21
Sustainable development	4.96	5.16	0.20
Overall Lisbon Score	5.55	4.97	-0.58

*Source:* Blanke, J. and Lopez-Claros, A. (2004)

In the same table the scores for each dimension are reported for year 2004 (Blanke & Lopez-Claros, 2004). These scores have been obtained by the responses to the World Economic Forum’s ‘Global Competitiveness Report’ Executive Opinion Survey. A country with a perfect

performance in any of the eight dimensions would have a score of 7. From Table 1 it is seen that “based on the comparison with the US benchmark, it would seem that in order to get closer to the Lisbon goal of becoming ‘the most competitive and dynamic knowledge-based economy in the world’, much attention should be focused within the EU on three particular areas: improving the environment for innovation and R&D, developing a stronger information society and creating an enterprise environment that is more conducive for private sector economic activity” (Blanke and Lopez-Claros, 2004).

Taking into account the preceding discussion, the main purpose of this paper is to estimate the impact of some of the dimensions stated above on national competitiveness. Specifically, the dimensions under investigation are ‘technology’, ‘network readiness’, ‘public institutions’, and ‘macroeconomic environment’. Moreover, it will be tested if the impact of technological progress, which is depicted by the ‘technology’ and ‘network readiness’ dimensions, is higher than the impact of the other two dimensions under investigation.

In the second section, the theoretical model to be estimated is presented and all the data used are described. According to the estimation methodology employed, the statistical estimates of the model and discussion of the meaning of these estimates is presented in section 3. Finally, section 4 presents the conclusions of the study.

### Methodology and Data

The model used in the investigation refers to the estimation of the following function:

$$GC_i = f(T_i, PI_i, ME_i) \quad (1)$$

where:

GC<sub>i</sub> = Growth Competitiveness  
 T<sub>i</sub> = Technology  
 PI<sub>i</sub> = Public Institutions  
 ME<sub>i</sub> = Macroeconomic Environment

The rationale of function (1) supports the view that the nation’s competitiveness (GC) depends on the following three ‘pillars’ (Blanke et al., 2004):

- The technology (T) used in the development process. One of the main lessons of neoclassical growth theory is that technological progress accelerates economic growth (Solow, 1956).
- The state of the country’s public institutions (PI). Although wealth in a nation is generally produced by private business, it is argued that the quality of public institutions affects the efficiency of the operation of the private business (Acemoglu et al., 2002).
- The quality of the macroeconomic environment (ME). It is well accepted that macroeconomic stability is an engine for long-run economic growth (Lipsev et al., 1993).

The data used in the analysis are cross-section, refer to year 2004, cover 104 countries and are taken from Lopez-Claros (2004). The Growth Competitiveness Index and its component indexes,

i.e. the Technology Index, the Public Institutions Index, and the Macroeconomic Environment Index, have been calculated on the basis of both “hard data” and “survey data”. Although details on how these indexes have been obtained may be found in McArthur and Sachs (2002) and in Blanke et al. (2004) it is noted here that the “technology index” has been calculated considering data on innovation, technology transfer and information and communication technology, the “public institutions index” has been calculated considering data on contracts and law, and corruption, and the “macroeconomic environment index” has been calculated considering data on macroeconomic stability. However, the data used in estimation do not refer to the actual scores of the indexes but refer to the corresponding rankings of the 104 nations involved. This is because the use of the actual scores could lead to misleading results due to the weighted average nature of the Growth Competitiveness Index. Moreover, the use of the Growth Competitiveness Index (or ranking) as a dependent variable is due to the fact that “the overall Growth Competitiveness Index (GCI) aims to measure the capacity of the national economy to achieve sustained economic growth over the medium term, controlling for the current level of economic development” (McArthur and Sachs, 2002). This is also seen by the high correlation between the Growth Competitiveness Index and the average growth rate in Gross Domestic Product (GDP) per capita (McArthur and Sachs, 2002).

## Results

Table 2 reports the results for the Growth Competitiveness equation (1). The estimated coefficients, in the estimated equation (1) with ordinary least squares (OLS), have the expected positive signs and all are statistically significant. In terms of importance, it is seen that technology has the larger coefficient, then public institutions, and finally macroeconomic environment.

*Table 2.* Regression results for the Growth Competitiveness equation (1)

Independent variables	Coefficient	Standard Error	t-ratio	Significance
(Constant)	-2.682	0.603	-4.451	0.000
Technology	0.413	0.020	20.882	0.000
Public Institutions	0.347	0.021	16.439	0.000
Macroeconomic Environment	0.291	0.019	14.975	0.000
R Square	0.991			
F-statistic	3619.628			
(Significance)	(0.000)			
Observations	104			

However, because the results in Table 2 may be biased towards the weights of the three components that constitute growth competitiveness, we included ‘network readiness’ among the independent variables in equation (1). This new variable covers data referring to “the degree of preparedness of a nation or community to participate in and benefit from Information and Communication Technologies (ICT) developments” (Duta et al., 2005). The results of various versions (cases) of the ‘revised’ with the new variable equation (1) are reported in Table 3, where for comparison purposes Case 0 presents the results of Table 1.

Table 3. Regression results for the Growth Competitiveness revised equation (1)

Independent variables	Case 0	Case 1	Case 2	Case 3	Case 4	Case 5
(Constant)	-2.682 (0.000)	-2.648 (0.000)	0.376 (0.778)	-1.316 (0.165)	-1.393 (0.188)	-1.080 (0.325)
Technology	0.413 (0.000)	0.400 (0.000)	0.386 (0.000)	0.364 (0.000)	0.426 (0.000)	
Network Readiness		0.028 (0.467)	0.606 (0.000)	0.280 (0.000)	0.271 (0.000)	0.414 (0.000)
Public Institutions	0.347 (0.000)	0.340 (0.000)		0.381 (0.000)		0.365 (0.000)
Macroeconomic Environment	0.291 (0.000)	0.282 (0.000)			0.329 (0.000)	0.242 (0.000)
Adjusted R Square	0.991	0.991	0.952	0.976	0.971	0.968
F-statistic	3619.628 (0.000)	2702.151 (0.000)	1014.924 (0.000)	1425.945 (0.000)	1147.277 (0.000)	1056.379 (0.000)
Observations	104	104	104		104	104

Notes: Exact significant levels in parentheses.

From the figures reported in Table 3, it may be concluded that:

- The introduction of the 'network readiness' variable in the growth competitiveness equation produced non-significant results, according to Case 1, possibly due to multicollinearity of the independent variables. Thus, other versions of the equation were used in estimation.
- According to Case 2, the estimated coefficient of the 'network readiness' variable is much greater than the estimated coefficient of the 'technology' variable. However, this result may be misleading because the 'network readiness' coefficient may have absorbed the impact of the 'public institutions' and 'macroeconomic environment' variables in determining growth competitiveness.
- Augmenting equation of Case 2 with the 'public institutions' variable (Case 3) or the 'macroeconomic environment' variable (Case 4), it is seen that in both cases the 'network readiness' estimated coefficient is much smaller than the 'technology' estimated coefficient.
- Substituting the 'technology' variable (Case 0) with the 'network readiness' variable (Case 5), the two cases gave similar results.
- In all cases where both the 'public institutions' and the 'macroeconomic environment' variables are present in the equation (Cases 0, 1, 5), the 'macroeconomic environment' estimated coefficient is much smaller than the 'public institutions' estimated coefficient.
- In all cases the adjusted  $R^2$  is very high and significant according to the F-statistic. The highest adjusted  $R^2$  among the cases with all estimated coefficients being significant is that of Case 0.

### Concluding Remarks

The purpose of this paper was to investigate the relationship between ‘growth competitiveness’ and the dimensions for improving national competitiveness of ‘technology’, ‘network readiness’, ‘public institutions’, and ‘macroeconomic environment’.

The major argument in this paper, i.e. that the four dimensions under investigation positively affect national competitiveness, has been proved, considering the estimated four estimated positive coefficients respectively. Furthermore, considering the actual levels of the estimated coefficients, from Cases 0 and 5, i.e., Technology (0.413), Network Readiness (0.414), Public Institutions (0.347 or 0.365), Macroeconomic Environment (0.291 or 0.242), it is seen that the impact of technological progress, which is depicted by the ‘technology’ and ‘network readiness’ dimensions, is much higher than the impact of the ‘public institutions’ and ‘macroeconomic environment’ dimensions. This means that the efforts of nations in order to improve competitiveness should be directed towards technological progress.

Finally, it must be emphasized here that although I tried in this paper to measure the impact of some competitiveness dimensions on national growth, the usual biases in estimating equations employing weighted average indexes may have distorted the results. Therefore, further research is needed in this field in the light of independent hard data and specific country experiences.

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