Leveraging Total Factor Productivity in Developing Countries

Dr. Sahar Mohamed Aboud
Lecturer of Economics
Institute of National Planning
Sahar.aboud@inp.edu.eg

Rama Elsayed Said
PHD. Researcher
Faculty of Economics and Political Sciences
Cairo University
rama_elsayed2015@feps.edu.eg

Scientific Journal for Financial and Commercial Studies and Researches (SJFCSR)
Faculty of Commerce – Damietta University
Vol.2, No.2, Part 1, July 2021

APA Citation:
Aboud, S. M. & **Said**, R.E. (2021). Leveraging Total Factor Productivity in Developing Countries, ***Scientific Journal for Financial and Commercial Studies and Research***, Faculty of Commerce, Damietta University, 2(2)1, pp.275-321.
Website: https://cfdj.journals.ekb.eg/

Abstract

Given the importance of the TFP as one of the sources of economic growth, and in light of the relevance of the GCI index to the determinants of the TFP, using a sample of 46 developing countries, this study aims at testing the hypothesis that the GCI is a good proxy for the TFP in this group of countries. The contribution of this study is three folds: first, it verifies the global competitiveness report (2018) conclusion that the GCI index is considered to be a good proxy for the TFP with a specific focus on developing countries. Second, it reconstructs the GCI in a way that reflects the relative importance of the different pillars, and finally, it highlights some policy areas which require more attention from developing countries to leverage its TFP.

This study concludes that human capital, financial development, and information and communication technology (ICT) development have the highest contribution to variations of TFP in developing countries.

Further, the results of the study show that the way the GCI is constructed in terms of the choice of variables, as well as the weights given to the different pillars, affects the reliability of the GCI as a proxy for the TFP in developing counties.

Keywords:

Economic Growth and Aggregate Productivity- principal components analysis, dynamic panel regression.

I Introduction

Reforms to foster productivity growth is of paramount importance for developing countries if it is to achieve sustainable economic growth. According to the Neo-Schumpeterian growth theory, the process of economic development is affected by the distance between one country and those at the global technology frontier. Thus, the drivers of growth are not uniform across all countries. This theoretical underpinning may justify the different roles played by total factor productivity (TFP) in developing and developed countries as evident in the empirical studies conducted on both groups of countries.

Along the same line, the relative importance of the different determinants of the TFP is expected to differ between the two groups of countries (developing and developed). This hypothesis was verified in Norris & Kyobe (2016). Studying the impact of different kinds of reforms on TFP, average labor productivity as well as sector-level productivity (i.e., agriculture, manufacturing, and services), they concluded that lower-middle-income countries benefit most from reforms related to trade, foreign direct investment (FDI), and removal of agricultural prices control and subsidies, while the emerging economies benefit more from reforms that enhance the efficiency of the banking sector and the capital market as well as improve the business environment.

In light of the above, it is imperative to further investigate the sources of low TFP in developing countries as a first step towards improving the economic performance of this group of countries and putting it on the sustainable growth path. It is essential for developing countries to quickly develop their pathway out of these constraints that hinder their growth.

Trying to identify these constraints countries have been increasingly monitoring its rank in the global competitiveness index (GCI). According to the global competitiveness report (2018), the GCI index is considered to be a good proxy for the TFP. And to support further this conclusion, the World Economic Forum (WEF) conducted an empirical study in 2018, the result of which was that the GCI 4.0 explains over 81% of cross-country variation in income levels and 70% of cross-country variation in long-term growth.

Given the above, this study tries to answer two main questions:

1-What are the factors that have the highest impact on total factor productivity in developing countries?

2-To what extent the global competitiveness index is a good proxy for total factor productivity particularly for developing countries?

The contribution of this study is three folds: **first**, it verifies the global competitiveness report (2018) conclusion that the GCI index is considered to be a good proxy for the TFP with a specific focus on developing countries. **Second**, it reconstructs the GCI in a way that reflects the relative importance of the different pillars, and **finally** it highlights some policy areas which require more attention from developing countries to leverage its TFP.

This study concludes that human capital, financial development, and information and communication technology (ICT) development have the highest contribution to variations of TFP in developing countries.

Further, testing for the hypothesis if the GCI is a good proxy for TFP in the case of developing countries, the results of the study shows that the way the GCI is constructed in terms of the choice of variables, as well as the weights given to the different pillars, affects the reliability of the GCI as a proxy for the TFP.

The rest of this paper is organized as follows: section 2 summarizes the theoretical and empirical literature review on determinants of TFP. Section 3 presents the methodology adopted in this study including the technique used for the empirical investigation of the relative importance of TFP determinants in developing countries. Finally, section 4 presents the results of the empirical finding and section 5 concludes this research with some policy recommendations

II Literature Review

2.1 Theoretical Background

In 1956 Robert Solow in his seminal paper "A Contribution to the Theory of Economic Growth", introduced technical progress - commonly named in the growth literature as Solow's residual - as one of the factors determining long-run economic growth. According to him changes in physical capital, labor, and technical progress (TFP) determine together the rate at which the economy will grow.

Despite being a leading model in modern growth theory, Solow's model had a major shortcoming of treating technical progress as an exogenous variable.

Trying to open the black box of Solow's residual, a new generation of growth models appeared in the mid 80's, known by the Endogenous Growth Models. Pioneered by Romer (1987,1990) and Lucas (1988), the Endogenous Growth Models- starting from the AK models all the way to the different types of the Innovation based Endogenous Growth Model - focused on endogenizing the production of technology by introducing the accumulation of human capital, Investments in the creation of knowledge through R&D, openness of trade and FDI as a channel for technology transfer, and investment in public financed goods. Examples of these kinds of models include Grossman & Helpman (1991), Aghion & Howitt (1992), and Barro and Sala-I-Martin (1992).

Outside the orthodox economic thinking, the New Institutional Economists have focused on the role of institutions in economic growth. It was North (1968) who first coined the role of institutions in economic growth. Departing from the Neoclassical Approach in explaining growth, North developed a theory in which institutions play a key role in explaining events in the American and European economies. According to him the role of technological change in fostering productivity is overestimated (Claude & Shirley, 2014). Building on the works of North and other new institutional economics pioneers like Coase and Williamson, institutional economists have produced a vast amount of literature examining the relationship between economic growth and the different kinds of institutions including legal institutions, political institutions, culture and Property rights (Lee,2016). Under the influence of institutionalist, mainstream economists have increasingly incorporated institutions into the neoclassical models by adding variables that reflect institutions in the standard neoclassical growth model (Claude & Shirley, 2014).

From the sectoral perspective, the structuralist school has focused on the economy's structure and its implication on economic growth. According to them there is a difference between the sectors in their level of productivity, and their innovative capability as well as their linkages with other sectors in the economy and their spillover effect. Hence the higher the share of high productive sectors in the GDP (mainly manufacturing), the higher the level of its TFP.

This theoretical background has guided the empirical literature on the TFP determinants in different countries and regions as will be presented below.

2.2 Empirical Evidence

Empirically there is a massive number of studies on growth and productivity. Generally speaking, we can classify this literature into two groups: The first group of empirical studies focus on establishing the relationship and quantifying the importance of total factor productivity as a determinant of growth, while the second group studied the determinants of total factor productivity[1]. Focusing on the latter group, empirical studies have analyzed determinants of TFP at either the micro (firm), meso (regional) or macro (national) levels.

In this review we will focus on empirical studies published starting 1990 onward with a particular focus on developing countries. Further it will largely focus on studies concerned with the determinants of TFP at the macro-economic/ country level, and to a lesser extent reviews studies conducted at the micro and meso levels. The rationale behind this limitation in the scope of the literature review is two folds: first; this study is mainly concerned with the determinants of total factor productivity in developing countries and thus macro studies are more relevant here. Second; the more recent work has the advantage of building up previous literature and developing it further through the use of improved data sets and the advancement of econometric methods (Isaksson,2007)

Empirical studies examining the determinants of TFP are diversified in terms of the countries covered, time period, method of estimation and the variables taken into consideration as determinants of total factor productivity. However, there are a number of determinants that are commonly examined in the literature as possible factors affecting the

[1] Although the importance of total factor productivity in economic growth is well established in the literature on economic growth, studies on the determinants of total factor productivity is inconclusive and the results of the empirical studies have shown a degree of variation on the significance of some determinants of total factor productivity especially with respect to infrastructure and openness to trade and institutions.

TFP, these include the following: technical progress, human capital, infrastructure, the structure of the economy, fiscal policy, monetary policy and financial development, trade policy, and institutions. Table (1) in the annex summarize the potential impact of each variable on TFP.

A quick survey of the literature on the determinants of the TFP in developing countries (Table (2) in the annex provides a summary review for these studies) reveals that the factors outlined above are considered to be determinants of total factor productivity in developing countries, with the exception of some model specifications where some of these factors were insignificant. However, the specificity of developing countries is revealed with respect to the direction of the effect of the different factors on TFP. As we find that the empirical results of some of the studies reviewed did not confirm the theoretical hypothesis regarding the impact of the variables understudy on TFP. For example, in Fadiran & O. Akanbi (2017) human capital and trade openness and financial development had a negative effect on total factor productivity. Similarly, Khan (2006) reached the same results with respect to human capital and trade openness. In Olomola &T. Osinubi (2018), FDI had a negative impact of TFP, also in Alshammari & M. Rakhis (2019) the R&D affected the TFP negatively. Finally, in Raggl (2018), human capital did not have a significant impact on TFP until a certain level of people with secondary and tertiary education is reached.

In all these studies the different effect of those variables on TFP compared to what is postulated in the theory was justified on the grounds of the poor status of each variable in the group of countries under study in a way that resulted in a negative impact on TFP. For example, the high level of imports justifies the negative sign of the trade openness index, like wise lack of skills and weak financial development justify the adverse effect of human capital and financial development on TFP.

III Data

3.1 The Dependent Variable (Total Factor Productivity)

There are a variety of techniques used to estimate the TFP including parametric and non -parametric methods, however, for simplicity and considering the possible bias in the coefficients estimated due to the possible endogeneity of capital and labor, this paper uses the growth accounting technique to estimate the TFP. In this technique GDP growth rates are decomposed into contributions from observable input factors of production and a residual term. Relying on a Cobb–Douglas production function the residual that is not explained by both the capital and labor is used as an estimate of TFP.

$Y_t = A_t K_t^{\propto} (L_t H_t)^{1-\propto}$ Eq (1)

where Y_t is real GDP at time t, A_t is total factor productivity, K_t is the real capital stock, , L_t is total employment, and H_t is an index of human capital measured by the level of education, thus, $(L_t H_t)$represents the labor force after accounting for the level of education.

TFP is given by the following equation:

$Ln\, TFP_t = Ln\, Y_t - (\propto LnK_t + (1-\alpha) Ln(L_t\, H_t))$ Eq (2)

To calculate the capital stock, we used the perpetual inventory method which takes the stock of capital as the accumulation of past investment using the following equation:

$K_t = I_t + (1+\Phi) K_{t-1}$ Eq (3)

Where:

K_t is the capital stock

K_{t-1}: is the initial capital stock

I_t: is the investment

Φ: is the rate of depreciation

The annual TFP growth rates were calculated by differencing the log-transformed TFP levels of year t and t-1

$TFPG = ln\,(TFP_t)$ - $ln\,(TFP_{t-1})$ Eq (4)

Data on real GDP and gross capital formation and employment are obtained from the World Development Indicators data base, while the data on labor and capital shares, as well as the human capital index [2] and the depreciation rate are obtained Penn World Table (PWT) 9.0.

3.2 The Independent Variables

For the independent variables, this paper uses the 12 sub-indices (pillars) of the global competitiveness index (GCI) issued by the World Economic Forum (WEF) to represent the different determinants of the TFP namely: institution, infrastructure, financial system, macroeconomic stability, business dynamism, ICT adoption, innovation capability, human capital (Health & Education), market size, labor market efficiency, goods market efficiency. Table (3) in the annex contains the list of variables included in each sub-index.

Due to the change in the methodology in computing the GCI sub-indices starting 2017, we rescaled the overall score before 2017 to be range from 0- 100 instead of the original score 1-7, to ensure the consistency of the series.

Due to the presence of multicollinearity between the TFP determinants (annex table (4)) this paper uses the GCI as the independent variable instead of using individual pillars.

We conduct the analysis for the period (2007- 2017), for a sample of an unbalanced dataset of 46 Developing & emerging countries selected from a larger sample of countries featured in the GCI and in Penn World Table.[3]

[2] Human capital based on the average years of schooling from Barro and Lee (2013) and an assumed rate for
primary, secondary, and tertiary education from Caselli (2005). ((Feenstra, Inklaar, and Timmer 2015))

[3] Sample includes: Armenia, Bolivia, Bostwana, Brazil, Bulgaria, Cameron, China, Colombia, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, Gabon, Guatemala,

We exclude countries that depend on oil production in its total output (more than third), due to the high share of oil in total output which could result in overestimation of growth, we also exclude countries that don't have a complete data series for both GCI and TFP for the targeted period.

IV Econometric Analysis

4.1 Methodology

To measure the relative importance of the TFP determinants, Relative Weight Analysis (RWA) was used. The RWA is a relative importance measure based on regression coefficient which addresses the problem of multicollinearity among the independent variables through variable transformation to create a new set of variables that are highly correlated to the original variables but are orthogonal to one another. In the RWA, the dependent variable (Y) is regressed on a new set of independent variables to get a new set of standardized regression coefficient, and these regression coefficients are rescaled back to the original variables by combining them with standardized coefficient obtained from regressing the original independent variables on their orthogonal counterparts producing an estimate of relative importance (T. Scott & J.M. Lebreton, 2015). The advantage of this method instead of its alternative "dominance analysis (DA)" is that it produces equivalent results yet it is computationally less demanding[4].

Honduras, India, Indonesia, Iran, Jamaica, Jordon, Kazakhstan, Kenya, Kyrgyzstan, Lao People's DR, Lesotho, Malaysia, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Namibia, Nigeria, Paraguay, Peru, Philippine, Romania, Russia, Serbia, South Africa, Sri Lanka, Thailand, Tunisia, Ukraine, Venezuela.

[4] In the dominance analysis the relative importance is based on the additional contribution of a predictor in all subset models, thus the computations required to run the analysis grows exponentially with the number of predictor variable.

To test the hypothesis of the GCI as a good proxy for the TFP, panel data techniques (Fixed and random effects[5]) is used to estimate two models, in the first models the TFP growth rate is a function of time lagged GCI as constructed by World Economic Forum (WEF) with country and time effects as follows:

$$TFPG_{c,t} = \beta_0 + \beta_1 \ln GCI_{c,t-1} + \varepsilon_{c,t} \qquad \text{Eq (4)}$$

Where:

$TFPG_{c,t}$: is the annual growth rate of total factor productivity

$GCI_{c,t-1}$: time lagged GCI index

$\varepsilon_{c,t}$: residual

In the second model, we modify the global competitiveness index by assigning different weights to the 12 pillars using principal component analysis to determine these weights, instead of giving them equal weights as per the WEF methodology[6], then we estimate a model in which TFP growth rate is a function of a time-lagged overall modified GCI index (GCIM) with country and time effects as follows:

[5] In a fixed effects model, the unobserved variables are allowed to have any associations whatsoever with the observed variables while "In a random effects model, the unobserved variables are assumed to be uncorrelated with (or, more strongly, statistically independent of) all the observed variables. Hausman test has been used to select between fixed and random models. (Baltagi, H. (2005)

[6] The PCA is a technique used to reduce the dimension of a dataset by synthesizing the information

contained in a number of possibly correlated variables into a smaller or equal number of uncorrelated variables named principal components. Each component is interpreted using the contributions of variables to the component (Pearson, 1901 and Jolliffe, 2002).

$$TFPG_{c,t} = \beta_0 + \beta_1 \ln GCIM_{c,t-1} + \varepsilon_{c,t} \qquad \text{Eq (5)}$$

Where:

$TFPG_{c,t}$: is the annual growth rate of total factor productivity

$GCIM_{c,t-1}$: time lagged GCIM index

$\varepsilon_{c,t}$: residual

Table (5) in annex shows the descriptive of the variables used in the analysis.

4.2 Results:

a) Total factor productivity growth

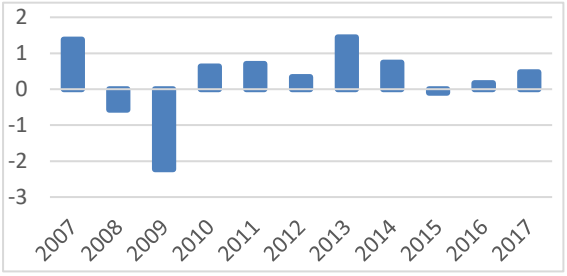
Analyzing the TFP growth rates for our sample of countries during the period (2007-2017) reveals that, although on average the TFP reordered a positive growth rates for developing countries, it is generally low and on a declining trend, with the exception of year 2013 were

the TFP growth rates jumped from the exceptionally low levels achieved in the years of the financial crisis.

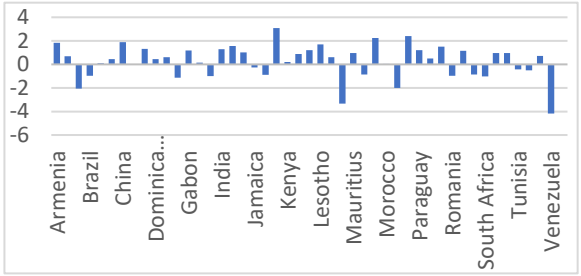
Fig (1a, b)

Average total factor productivity growth during (2007- 2017)

a) By year



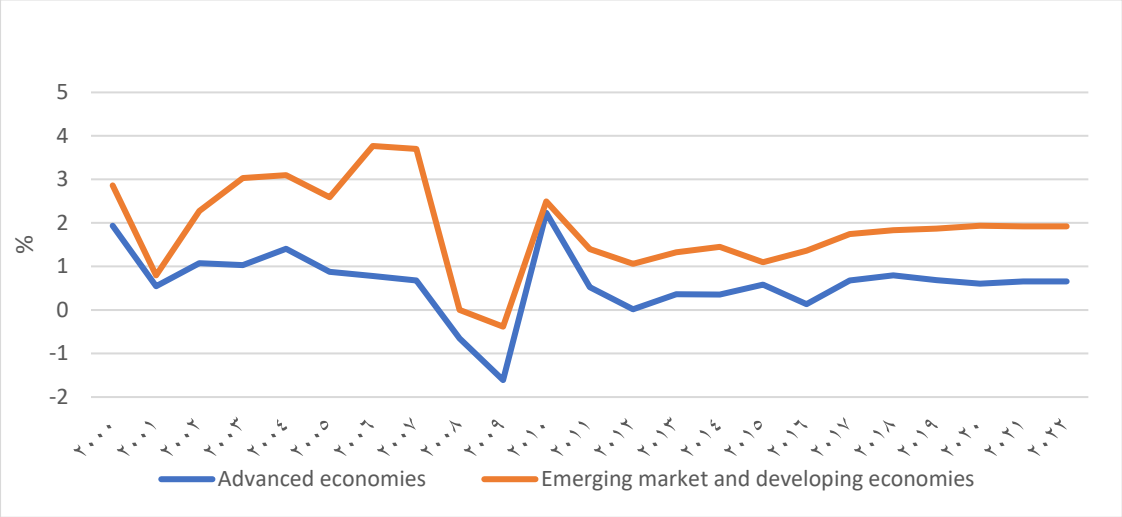
b) by Country



Source: Authors' calculation using WDI data and PWT 9.0

These results are consistent with the IMF estimates for the TFP growth during the same period as shown in figure (2).

Figure (2): Total Factor Productivity growth during the period (2000-2022)



Source: IMF (International Monetary Fund). 2017. World Economic Outlook Update, April 2017: Gaining Momentum? Washington, DC: IMF.

The IMF expects that TFP growth will stay below the pace registered before the global financial crisis, especially for emerging market economies, and it is expected to be even lower after the COVID19.[7]

[7] There are many possible explanations for this productivity slow down, and expected slow recovery in coming years. **One of these justifications is the statistical justification**, the main argument here is related to how the GDP is measured, Since the calculations of total factor productivity is based on GDP data, any measurement error in the GDP is going to be reflected in the productivity growth estimations. (The World

These results also confirm the conclusions of other empirical studies that the physical capital is considered the main source of growth for developing countries, with a minimal contribution of the TFP, and that the poor economic performance of these countries could be attributed to the low and insufficient productivity growth. Examples of these studies include Pipitone (2009), and Abu-Qarn, A., and S. Abu-Bader (2007) for the case of Mediterranean countries and MENA region, Fernandez- Arias and S. Rodriguez (2017) for Latin American countries and Nachega Jea -Claude & Thomson (2006), for the case of Niger

In light of the above, it is of utmost importance that developing countries further analyze what has been driving the low performance of the TFP. In attempt to do so, we present below the results of the RWA.

b) The relative contribution of TFP determinants to the variance of total factor productivity growth: Relative Weight Analysis

The results of the Relative Weight Analysis (table 1), reveals the following:

- **The human capital, financial systems, and information and communication technology (ICT) adoption have the highest relative contribution to the variance of TFP in developing countries** accounting for 22%, 14.5%, and 14% respectively, followed by institutions, labor market efficiency, and business dynamism.

Economic Forum WEF, 2018), **Other explanations for the TFP slowdown** is related to the weak performance of the TFP determinants including weak levels of investment, and thus a slow rate of adoption of new technologies embodied in capital, as well as the weakening of technological innovation or diffusion prior the global financial crisis (Fernald, 2014). In addition to the slowdown of global trade integration and human capital accumulation, and the diminishing effects of structural transformation in the case of emerging market economies. (The World Economic Forum WEF, 2017

This result is consistent with the results of Kim and Loayza (2019) in which education had the highest contribution to the variance of TFP growth estimated at 49% followed by institutions and market efficiency for the case of developing countries during the period (2004-2014)

Table (1) Decomposition of Productivity Variance

Variable	Decomposition of Variance of productivity Level (%)
Human Capital	22
Financial system	14.5
ICT adoption	14
Institutions	9.4
Business dynamism	9
Labor Market efficiency	9
Goods Market efficiency	6
Infrastructure	5.4
innovation	5
Market size	4
Total Variance	100

Source: Authors' calculations

- **The weak contribution of both the infrastructure and innovation in explaining the variance of the TFP in developing countries**. In the case of infrastructure, this can be explained partly by the variation between the developing countries in the level of development of their infrastructure, but it is also highly related to what Hulten (1996) referred to as efficiency of infrastructure, that is the adequacy of managing and maintaining the existing infrastructure. According to Hulten (1996), "Low and middle-income countries that use infrastructure inefficiently pay a growth penalty in the form of a much smaller benefit from infrastructure investments".

As for innovation, the relatively low budget allocated to research and development (R&D) in developing countries, as well as the bottlenecks in institutional framework related to the innovation system might provide a justification for its low contribution.

Further analysis of these results highlights the complementarity between the TFP determinants. Currently the TFP in developing countries is driven by the human capital, however this factor alone is not sufficient to raise their TFP to reach levels that are on par with that of the developed countries, bottlenecks in the other determinants of the TFP especially in relation to innovation, and infrastructure handicap the TFP to moderate levels. According to the evolutionary theory of growth, it takes both efficiency and creativity to drive economic development, and here we expand the concept of efficiency not only to refer to the efficiency in using the factors of production, but also the efficiency in institutions and markets. Thus, joint improvements in all the determinants is required to drive high growth rates in the TFP.

C. Principal Component Analysis

The results of PCA (shown in table (6&7) in the Annex), we find that the first three components explain 75% of the variance of explanatory data. For index construction, we relied only on the first component which explains around 53% of the variance of the explanatory data. Further, by examining the factor loadings we find that the first component has the highest factor loadings for almost all the TFP determinants except for the labor market and macroeconomic stability.

The modified GCI index is a linear combination of the standardized sub-indices as follows:

$$GCIM_{c,t} = 0.89 * \text{z(Business dynamism)} + 0.87 * \text{z(Infrastructure)} + 0.86 * \text{z(innovation)} + 0.85 * \text{z(Goods Market efficiency)} + 0.80 * \text{z(Financial system)} + 0.78 * \text{z(Institutions)} + 0.77 * \text{z(ICT adoption)} + 0.62 * \text{z(Human Capital)} + 0.51 * \text{z(Market size)} + 0.49 * \text{z(Labor Market efficiency)} + 0.28 * \text{z(Macroeconomic stability)}$$

Where z = value- mean/ standard deviation

D. The relationship between GCI, GCIM and total factor productivity growth

The regression results of equations (4) and (5) using unbalanced dataset are shown in tables (2) and (3). In both models based on the Hausman test, the random effect model is rejected, so we focus on the fixed effect results.

Comparing the results of the two models, we find that in the first model, the GCI index is not statistically significant, which does not confirm the WEF conclusion that the GCI with its current methodology is a good proxy for TFP.

Table (2): Model (1): GCI as a proxy of TFP

Dependent variable	TFP growth	
No of observation	501	
No of countries	46	
	Fixed effects	Random effects
	Coefficient (SE)	Coefficient (SE)
C	-51.50362 (0.0046)	-1.090784 (0.7071)
Ln (GCI I, t-1)	0.212298 (0.8859)	1.745822 (0.0202)
R2	0.26	0.014072
Hausman test	Chi- square 10.46	Prob>chi2 = 0.0057

Source: Authors' calculations

In the second model where we reconstructed the GCI index, the new index (GCIM) is statistically significant, showing a positive relationship between the GCIM and the TFP. In this model, an increase of 1% in the lagged GCIM is associated by an increase in the TFP growth rate by 1.44% after controlling for country and time effects. However, given the low R^2 estimated at only 26% the overall explanatory power of the model is weak.

Table (3): Model (2): GCIM as a proxy of TFP

Dependent variable	TFP growth	
No of observation	501	
No of countries	46	
	Fixed effects	Random effects
	Coefficient (SE)	Coefficient (SE)
c	-5.1313 (0.0094)	-3.21137 (0.0121)
Ln (GCIM I, t-1)	1.443727 (0.0061)	0.930518 (0.0047)
R2	0.26	0.015743
Hausman test	Chi- square 5.98	Prob>chi2 = 0.00544

Source: Authors' calculations

This can be explained partially by the methodology of constructing the sub-indices (pillars) of the GCI, as we find that a reconstruction of the GCI index using the principal component analysis had a big effect on the results of the model, accordingly a reconstruction of the sub-indices is expected to improve these results by giving the overall index a higher explanatory power in the variation of the TFP.

Further, the choice of variables under each pillar could have a negative effect on the degree the index proxies the TFP. For example: some pillars are represented only by one or two variables: like the macroeconomic stability and health, in addition to the absence of indicators that reflect quality in some pillars.

Conclusion

Given the importance of the TFP as one of the sources of economic growth, and in light of the relevance of the GCI index to the determinants of the TFP. This study aims at testing for the hypothesis that the GCI is a good proxy for the TFP for a sample of developing countries.

Further, in a quest to explain the weak contribution of the TFP in the growth of developing countries, the study also aims at identifying the factors that the currently driving the TFP in developing countries, and highlighting those that have the least contribution in the variation of the TFP.

The econometric results of this study show that the GCI with its current methodology is not significant, however, after doing a slight modification in the GCI methodology by assigning each pillar a different weight using PCA, the new index (GCIM) has proven to be significant yet not highly reliable given the weak explanatory power of the model.

Other refinements on the methodology of the GCI, might further improve the results of the model. Examples of these refinements include: re-constructing the sub-indices along the line of the overall GCI index, as well as choosing variables that represent both the quantitative and qualitative aspects of the pillars.

As for the relative contribution of the TFP determinants in the variation of the TFP, results of RWA results show that human capital, financial development, and ICT development have the highest contribution to variations of TFP in developing countries, while both innovation and infrastructure weakly contribute to the variation of the TFP.

Further the results highlight the complementarity between the TFP determinants. Currently the TFP in developing countries is driven mainly by the human capital, however this factor alone is not sufficient to raise their TFP to reach levels that are on par with that of the developed countries, bottlenecks in the other determinants of the TFP, especially in relation to innovation and infrastructure, handicap the TFP to moderate levels

The policy implication of these results is two folds: first, looking at the GCI index as a proxy for the TFP should be done with caution taking into consideration its limitation in methodology. Second, the developing countries need to adopt a comprehensive and integrated approach in its reform efforts. This approach requires building two kinds of linkages:
First: Linkages between the determinants: for example, efforts to increasingly adopt ICT, should be highly integrated into any institutional reform, and at the same time, the institutional reform should be done in a way to facilitate the ICT adoption in business practices. Another example is related to innovation. Institutional reform should tackle problems related to the innovation system, provide incentives to the private sector to engage in R&D activities. Further, efforts to build human capital should promote the skills necessary for technology adoption and innovation.
Second: Linkages with sectoral dimension: for example, improving access to finance although being an important goal in itself, however, how credit is distributed between high and low productivity sectors is vital for leveraging the TFP. The same applies to the ICT adoption, and the extent to which ICT is adopted in business practices not just for household use. Further, as much as the general infrastructure is needed, specialized infrastructure is of paramount importance to attract investments in certain fields.

Finally, this study has some limitations that should be taken in consideration when interpreting the its results. On one side the time frame utilized is bounded with the number of years in which the GCI index was issued. On another side this study focuses only on developing countries, thus to further validate the results of the study there is a need to expand the sample of countries to include developed and emerging economies.

Annex

Table (1): TFP determinants and its potential impact

The Determinants	Potential impact on TFP
Technical progress	All growth theories have stressed on technical progress as the main source of economic growth. Since not all countries have the capabilities to produce knowledge, they acquire the knowledge either through trade by importing the goods that embodies this knowledge especially imports from machinery and equipment, or through FDI[8]. However, the real impact of technology transfer on the TFP will remain contingent to absorptive capacity of the recipient country which is at the end highly related to local R&D capacities and human capital.
Human Capital	Human Capital affect productivity through two channels: ▪ Its direct impact on labor productivity ▪ Its effect on the ability of the country to generate and absorb technology
Infrastructure	The effect of infrastructure comes mainly through enhancing the productivity of the private capital. The existence of suitable infrastructure (transport, energy, water and sanitation and telecommunication) is essential to support all economic activities, however, this role is affected by the way the infrastructure is financed and the efficiency of managing the infrastructure.

[8] Acquiring knowledge through technology transfer is especially relevant to developing countries given their limited capability to produce advanced technology

The Structure of the Economy	Since different sectors have different levels of productivity, the structure of the economy between the different sectors (agriculture, industry and services) is considered to be one of the determinants of TFP. The higher the share of high productive sectors in the GDP (mainly manufacturing), the higher the level of its TFP.
Fiscal Policy	The fiscal policy can have a positive or negative effect on productivity depending on the structure of the government spending and whether the taxes levied are distortionary or non-distortionary and the way the budget deficit is financed. Generally, taxes on labor and capital incomes affect the incentive structure to investment in human capital and physical capital. Further volatility in the tax rate increases investment risks which will consequently induces capital flight and reduces domestic investment. On the expenditure side, while public expenditure on infrastructure and education and health has a positive impact on productive investment, consumption expenditure and the inefficiency in government expenditure at large are expected to impact productivity negatively. Finally, the way the government deficit is financed can have a negative impact on inflation, and the level of external debt and can crowed out private investments.
Monetary Policy and Financial Development	▪ The impact of the monetary policy on TFP is indirect and it is transmitted through the effect of interest rate on the incentives to invest, including the productivity enhancing investments. ▪ The impact of financial development on productivity is mainly realized through the ability of the financial system to provide

	finance to entrepreneurs and innovative firms, as well as the extent it allows investors to diversify the risks of innovative activities which are characterized by high levels of uncertainty
Trade Policy	The link between trade and productivity stems from two channels: ▪ Technology transfer embodied in capital ▪ The impact of trade liberalization on competition. Being subject to higher level of competition could induce the firms to use their inputs more efficiently, as well as enhance the market dynamics. Further trade liberalization gives higher access to higher quality/ more diversified intermediate inputs, opens the door for more product specialization and expand export opportunities.
Institutions	The relevance of institutions to productivity stems from their influence on the incentives in the society. For example, laws related to property rights have an impact on the individuals' decisions to invest in physical or human capital or adopt more efficient technologies. Further the efficiency in economic institutions affect the allocation of the resources to their most efficient uses.

Source: Authors' compilation from: (Isaksson, 2007), (Acemoglu D., S. Johnson & J. Robinson, 2004), (Akinlo, 2005).

Table (2): Determinants of TFP in Developing Countries in Empirical Literature

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
Alshammari N., & M.. Rakhis (2019)	The effect of Human Capita on TFP	Marco and Micro	Macro: (8 countries from the MENA region) Micro: (3 countries from the MENA region)	Macro: 1990-2015 Micro :2013	▪ Macro: human Development index, trade openness, GDP annual growth rate, total labor force ▪ Micro: Infrastructure proxied by the experience of power outage, innovation proxied by the number of new methods for inputs, production or sales, R&D expenditure, Capital, Average level of education, highest level of education	Both the macro and micro analysis confirmed the positive contribution of human capital on total factor productivity and firm's sales. As for other control variables: Macro analysis: both the trade openness and investment had a positive effect on productivity while the labor force had a negative effect on productivity. Micro analysis: infrastructure and R&D and innovation had a negative effect on firms sales

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
Maryam K. & Zainb (2018)	Effect of technology diffusion on TFP growth and convergence	Macro	91 developing countries	1960-2015	▪ 2 variables representing technology diffusion: FDI and Trade openness as % of GDP, Consumer price index (CPI), Real exchange rate, index for human capital, TFP gap with frontier country, interaction terms of FDI and trade openness with the gap	Both FDI and trade openness had a positive impact on the TFP growth and contribute positively in the convergence process, however, FDI had a dominant effect compared to trade openness ▪ As for other control variables both the human development index and the real exchange rate had a positive effect on TFP growth, while the CPI had a negative effect.
Olomola, P. & T. Osinubi (2018)	Macro	Effect of different determinants of TFP	Mexico, Indonesia Turkey and Nigeria (MINT countries)	1980-2014	▪ FDI, inflation, human capital, corruption, government stability, law and order	▪ Human capital and corruption were key drivers of TFP in MINT countries in both the long run and short run ▪ In the long run, human capital and government stability had positive effect on TFP, while FDI and Corruption had a negative effect

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
						▪ In the short run, inflation had a negative effect on TFP while human capital and corruption has a positive effect
Seleem, N. & Ch. Zaki(2018)	Micro and Macro	Determinants of TFP at the micro and macro levels	MENA countries	-	Micro: share of government ownership, foreign ownership, age, formal ownership, age, formal registration, gender of owner or manager, share of imported inputs, owns a certification for foreign firm, legal status. ▪ Macro: institutions proxied by the time to enforce contracts, fiscal policy proxied by tax burden, monetary policy proxied by lending rate, trade restrictiveness proxied by	▪ At the micro level: government ownership, foreign capital, female managers, owing a foreign certification and formal registration all had a positive relationship with TFP. ▪ At the macrolevel: longer time to enforce contract and high tax burden, and high lending rate all had a negative impact on TFP while higher tariff level had a positive impact on TFP.

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
					tariff rates and geography proxied by spatial agglomeration	
Fadiran D. & O. A. Akanbi (2017)	Role of institutions compared to other determinants	Macro	26 Sub-Saharan African countries (SSA)	1990-2011	▪ Macroeconomic Stability: proxied by price level ▪ Fiscal Discipline: proxied by level of government spending ▪ Trade openness: proxied by share of trade in GDP ▪ Human capital: proxied by human capital index ▪ Infrastructure: proxied by infrastructure index. ▪ Financial development: proxied by ration of M2 in GDP ▪ R&D: Proxied by Number of journals published	▪ Institutions played an important role in determining TFP in SSA. ▪ Negative role played by trade. ▪ Negative role played by human capital and financial development in some of the model specifications

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
					▪ Institutions: proxied by policy index and property rights index	
Qutb, R.(2017)	Effect of Human Capital on TFP	Macro	Egypt	1980-2014	▪ Human capital proxied by education attainment of workforce classified into three categories: illiterate, intermediate education and high education	▪ Both high and intermediate education had a positive impact on TFP growth, while illiteracy was insignificant with a negative sign.
Kim J. & J. Park (2017)	▪ Role of TFP in middle income countries econo	Macro	Middle income countries	1975-2014	▪ Human capital proxied by education attainment relative to US ▪ Life expectancy relative to US ▪ Initial population ▪ Openness to trade ▪ Real exchange rate ▪ Income transition dummies	Human capital and real exchange rate and R&D account for a significant part of TFP Insignificant relation between TFP and life expectancy, population, and trade openness

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
	mic growth Identify major factors contributing to TFP growth				▪ Catch up effect measured by initial income per capital relative to US ▪ R&D stock per worker	
Hussein, A.A. (2016)	Effect of trade policy, institutions, geography on TFP in sub-Saharan Africa	Macro	52 countries: 16 low income out of which 10 are sub-Saharan 27 middle income, out of which 3 are sub-Saharan	Average (2000-2003)	▪ Institutional quality : Simple average of six indicators as follows: Voice and accountability, political stability, government effectiveness, regulatory quality, rule of the law and control of corruption ▪ 2 variables for trade policy: restrictiveness of non tariff barriers and restrictiveness of tariff barriers	Core TFP determinants (institutions, trade policy and geography) explain a significant variation in total factor productivity across countries, with positive effect of good institutions and latitude, and negative effect of restrictive trade policies, and land lock countries. Weak domestic credit to private sector had a negative effect of TFP, as well as poor human capital

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
			9 high income countries		▪ 2 variables for geography: latitude and landlock countries 2 control variables: Human capital measured by schooling years and domestic credit to the private sector	
Naz A. et al.(2015)	Effect of trade openness	Macro	A sample of high-, middle- and low-income countries	1942-2003	Export+ Imports /GDP	Positive relationship between trade openness and total factor productivity for all countries in the sample, however the impact is larger for middle income countries compared to high and low income countries .
Raggl, A. K.. (2015)	Effect of human capital and openness on TFP	Macro	Middle east and North Africa	1980-2009	Human capital opens measured by globalization index and GDP per capita	Human capital didn't have a significant impact on TFP until a certain level of people with secondary and tertiary education is reached. Although the level of development measured by GDP per capita is not significant on its own, the speed at which countries catch up is affected by its level of human capital

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
						Although the level of globalization is not significant on its own, The level of globalization had an impact on TFP as soon as a relatively low level of knowledge is reached.
Chaffai M. & P. Plane (2011)	Effect of trade and financial openness on Total Factor Productivity	Meso-manufacturing sector	Tunisia	1983-2002 Subdivided into two periods (1983-1989) & (1990-2002)	Foreign Direct investment, Real effective exchange rate, net exports, structural change, effective rate of protection, domestic demand	During the first period, only the domestic demand and net exports had a positive effect on TFP, while in the second period all trade and financial openness variables were found to have a positive effect on TFP.
Adrian, C. (2011)	Effect of financial development on TFP	Macro	Philippines	1981-2008	▪ Ration of liquid liabilities (M3) to GDP	Positive relation between financial development and TFP

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
Ayuso et al. (2011)	Effect of infrastructure on Total Factor productivity and its components (Technical change and technical efficiency)	Micro	Mexico	1970-2003	Infrastructure index composed of: Telecommunication, Transport (roads, ports and airports) and Household equipment (water, electricity and sewerage)	Infrastructure had a positive effect on private productive factors and the technical change components but not technical efficiency component
Khan S. U. (2006)	Role of Macroeconomic Variables	Macro	Pakistan	1960-2003	▪ Openness to trade ▪ FDI. ▪ Human Capital proxied by education expenditure. ▪ Financial development proxied by private credit and the share of M2 in GDP	▪ Macroeconomic stability, investment, FDI, and financial sector development, employment and government consumption all had a positive association with TFP. ▪ Negative relationship between Trade openness, human capital and TFP

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
					▪ , Fiscal discipline proxied by budget deficit, ▪ investment, ▪ employment, ▪ government consumption ▪ population ▪ Macroeconomic stability proxied by Inflation	
Akinlo A. E. (2005)	Effect of Macroeconomic factors	Macro	34 Sub-Saharan African Countries	1980-2002	▪ Wide array of variables that reflect the macroeconomic environment stability, fiscal policy, monetary policy, capital flows and stock, knowledge investment policy, trade	From the list of variables taken into consideration and which was significant, the following variables had a negative effect on TFP: External debt, inflation, agriculture value added as % of GDP, lending rate, local price deviation from ppp. On the other had human capital, export to GDP ratio, credit to private sector as a % of GDP, Liquid Liabilities as % of GDP contributed positively to TFP.

Paper	Focus	Level of Analysis	Countries	Time frame	Variables	Results
El Haddad, M. (1993)	Effect of Trade Liberalization	Micro	Morocco	1985-1989	▪ Foreign Share in Ownership at the firm level and industry level ▪ Public Share in ownership ▪ Age of the firm ▪ Product diversification ▪ Geographic Dispersion ▪ Import Penetration ▪ Export share in total sales	Strong positive correlation between Trade openness and firm level Total factor productivity

Source: Authors' compilation

Table (3): GCI Variables in the Sub-Indices

Pillars	Variables in each pillar
Institution	▪ Organized crime ▪ Homicide rate ▪ Terrorism incidence ▪ Reliability of police services ▪ Social capital ▪ Budget transparency ▪ Judicial independence ▪ Efficiency of legal framework in challenging regulations ▪ Freedom of the press ▪ Burden of government regulation ▪ Efficiency of legal framework in settling disputes ▪ E-Participation Index ▪ Incidence of corruption ▪ Property rights ▪ Intellectual property protection ▪ Quality of land administration ▪ Strength of auditing and reporting standards ▪ Conflict of interest regulation ▪ Shareholder governance ▪ Government ensuring policy stability ▪ Government's responsiveness to change ▪ Legal framework's adaptability to digital business models ▪ Government long-term vision ▪ Energy efficiency regulation ▪ Renewable energy regulation ▪ Environment-related treaties in force
Infrastructure	▪ Road connectivity

	▪ Quality of road infrastructure ▪ Railroad density ▪ Efficiency of train services ▪ Airport connectivity ▪ Efficiency of air transport services ▪ Liner shipping connectivity ▪ Efficiency of seaport services ▪ Electricity access ▪ Electricity supply quality ▪ Exposure to unsafe drinking water ▪ Reliability of water supply
Financial system	▪ Domestic credit to private sector ▪ Financing of SMEs ▪ Venture capital availability ▪ Market capitalization ▪ Insurance premium ▪ Soundness of banks ▪ Non-performing loans ▪ Credit gap ▪ Banks' regulatory capital ratio
Macroeconomic stability	▪ Inflation ▪ Debt dynamics
Business dynamism	▪ Cost of starting a business ▪ Time to start a business ▪ Insolvency recovery rate ▪ Insolvency regulatory framework ▪ Attitudes toward entrepreneurial risk ▪ Willingness to delegate authority ▪ Growth of innovative companies

	▪ Companies embracing disruptive ideas
ICT adoption	▪ Mobile-cellular telephone subscriptions ▪ Mobile-broadband subscriptions ▪ Fixed-broadband Internet subscriptions ▪ Fiber Internet subscriptions ▪ Internet users % of adult population
Innovation Capability	▪ Diversity of workforce ▪ State of cluster development ▪ International co-inventions ▪ Multi-stakeholder collaboration ▪ Scientific publications ▪ Patent applications ▪ R&D expenditures ▪ Research institutions prominence 0–100 (best) ▪ Buyer sophistication ▪ Trademark applications
Human Capital (Health & Education)	▪ Healthy life expectancy ▪ Mean years of schooling ▪ Extent of staff training ▪ Quality of vocational training ▪ Skillset of graduates ▪ Digital skills among population ▪ Ease of finding skilled employees ▪ School life expectancy ▪ Critical thinking in teaching

	▪ Pupil-to-teacher ratio in primary education
Product market efficiency	▪ Distortive effect of taxes and subsidies on competition ▪ Extent of market dominance ▪ Competition in services ▪ Prevalence of non-tariff barriers ▪ Trade tariffs ▪ Complexity of tariffs ▪ Border clearance efficiency
Labour market	▪ Redundancy costs ▪ Hiring and firing practices ▪ Cooperation in labour-employer relations ▪ Flexibility of wage determination ▪ Active labour market policies ▪ Workers' rights ▪ Ease of hiring foreign labour ▪ Internal labour mobility ▪ Reliance on professional management ▪ Pay and productivity ▪ Ratio of wage and salaried female workers to male workers ▪ Labour tax rate
Market Size	▪ Gross domestic product ▪ Imports of goods and services

Source: World Economic Forum

Table (4) Correlation t Matrix

	tfpg	tfp	ins	infra	macro	HC	fin	ict	buss	innov	goods	lab	size
tfpg	1.00												
tfp	.29	1.00											
ins	-.01	.09	1.00										
infra	.04	.01	.71	1.00									
macro	.10	.08	.24	.24	1.00								
HC	.03	-.11	.29	.62	.06	1.00							
fin	-.01	-.06	.64	.60	.12	.29	1.00						
ict	.01	.05	.49	.73	.16	.62	.56	1.00					
buss	.07	.02	.63	.71	.16	.50	.76	.60	1.00				
innov	.07	.00	.65	.69	.18	.51	.64	.56	.83	1.00			
goods	.13	.06	.77	.64	.16	.36	.74	.54	.78	.69	1.00		
lab	.16	.14	.41	.34	.30	.13	.43	.36	.29	.35	.50	1.00	
size	.05	-.07	.12	.42	.24	.48	.26	.39	.54	.56	.23	-.04	1.00

Table (5): Descriptive statistics of the variables used in the analysis for our sample of countries.

Variable	Obs	Mean	Std. Dev.	Min	Max
Productivity growth	506	0.271249	3.386241	-16.8967	12.544
Institutions	506	35.93024	15.66657	0	75.8
Infrastructure	506	37.83735	16.24233	1.6	78.6
Macroeconomic stability	506	57.33043	18.49822	0	100
Human Capital	506	52.96383	15.42522	0	79.1
Financial system	506	45.51008	16.70473	4.7	95.1
ICT adoption	506	30.87589	12.46758	1.1	70.2
Business dynamism	506	37.36324	15.89121	0	83.6
innovation	506	28.39763	11.89972	0	73.2
Goods Market efficiency	506	44.55553	14.51585	0.1	92.4
Labor Market efficiency	506	42.19723	15.66114	0.3	75.5
Market size	506	49.21008	19.8852	9	100
GCI	506	43.21996	13.44654	6.6	81.7

Source: Authors' Calculations

Table. (6) Variance captured by components

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.846	53.150	53.150	5.846	53.150	53.150	4.268	38.800	38.800
2	1.423	12.936	66.086	1.423	12.936	66.086	2.882	26.200	64.999
3	1.048	9.529	75.614	1.048	9.529	75.614	1.168	10.615	75.614
4	.776	7.057	82.671						
5	.558	5.076	87.747						
6	.400	3.635	91.382						
7	.290	2.636	94.018						
8	.219	1.989	96.007						
9	.187	1.697	97.704						
10	.161	1.468	99.172						
11	.091	.828	100.000						

Source: Authors' Calculations

Table (7) Loadings of variables on components

	Component		
	1	2	3
Business dynamism	.899	.101	-.114
Infrastructure	.869	.090	.010
innovation	.868	.120	-.035
Goods Market efficiency	.847	-.303	-.160
Financial system	.800	-.246	-.191
Institutions	.782	-.356	-.084
ICT adoption	.774	.158	-.016
Human Capital	.620	.520	-.036
Market size	.511	.671	.277
Labor Market efficiency	.491	-.586	.241
Macroeconomic stability	.278	-.147	.910

Source: Authors' Calculations

References

- Akinlo, A. (2005). Impact of Macroeconomic Factors on Total Factor Productivity in Sub-Saharan African Countries. Research Paper No 2005/39, World Institute for Development Economic Research.
- Abu-Qarn, A., and S.Abu-Badr. (2007). Sources of Growth Revisited: Evidence from Selected Mena Countries. World development, 35(5), 752-71
- Aghion, P., and P.Howitt. (1992). A Model of Growth Through Creative Destruction". Econometrica, 60(2), 323-351. doi:10.3386/w3223
- Acemoglu, D., S. Johnson & Robinson. (2004). Institutions as the Fundamental Cause of Long Run Growth". Working Paper No.10481, NBER
- Alshammari N. and M. Al Rakhis (2019). The Determinants of Total Factor Productivity Across MENA Region. International Journal of Innovation, Creativity and Change. www.ijicc.net Volume 8, Issue 4.
- Adrian, C. R. (2011). Linking Financial Development and Total Factor Productivity in Philippines. Working Paper No.66042, MPR
- Ayuso et al. (2011). The Effect of Infrastructure on Total Factor Productivity and its Determinants: A Study on Mexico. Estudios Economicos, 26(1),97-122
- Baltagi,H.,(2005). Econometric Analysis of Panel Data. John Wiley and Sons.

- Barro, R. J., and Xavier Sala-I-Martin. (1992). Public Finance in Models of Economic Growth. The Review of Economic Studies, 59 (4): 645-661, https://doi.org/10.2307/2297991
- Chaffai , M.& P. Plane (2011). Total Factor Productivity of Tunisia's Manufacturing Sectors: Measurements, Determinants and Convergence Towards OECD, halshs-00562642
- Claude M. and M. M. Shirley (2014). The future of new institutional economics: from early intuitions to a new paradigm?. Journal of Institutional Economics, 10, 541-565, doi:10.1017/S174413741400006X
- Chen, E.(2002). Total Factor Productivity Debate: Determinants of Economic Growth in East Asia. Asian Economic Literature, l11(1), 18-38 <http://doi.org//10.1111/1467-8411.00002>
- Dabla-Norris, E. & G. Ho and A. Kyobe,(2016).Structural Reforms and Productivity Growth in Emerging Markets and Developing Economies. Working Paper No. WP/16/15, International Monetary Fund
- Fadiran,D., O. A. Akanbi (2017).Institutions and Other Determinants of Total Factor Productivity in Sub-Saharan Africa. Working Paper no 714, ERSA.
- Feenstra, Robert C., Robert Inklaar, and Marcel P. Timmer. 2015. "The next Generation of the Penn World Table." American Economic Review 105 (10): 3150–82. https://doi.org/10.1257/aer.20130954.
- Fernandez- Arias & Sergio Rodriguez-Apolinan (2016). The Productivity Gap in Latin America. Working paper No.IDB-WP-692, Interamerican Development Bank

- Grossman, G. M., and E. Helpman (1991). "Quality Ladders in the Theory of Growth". The Review of Economic Studies ,58 (1).
- Hulten C. R. (1996). Infrastructure Capital and Economic Growth, how well you use it may be more important than how much have. working paper No 5847, NBER
- Hussien, A. A. (2016). Understanding the Total Factor Productivity in Sub-Saharan Africa. Working Paper, No 02/16, The Horn Economic and Social Policy Institute.
- Haddad, M. (1993). How Trade Liberalization Affected Productivity in Morocco. WPS1096, World Bank
- International Monetary Fund. 2017. World Economic Outlook Update, April 2017: Gaining Momentum? Washington, DC: IMF. Available at http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017.
- Isaksson, A. (2007). Determinants of Total Factor Productivity: A Literature Review. Research and Statistics Branch, UNIDO
- International Monetary Fund (2015). Fiscal Policy and Long Term Growth. IMF Policy Paper, < https://www.imf.org/external/np/pp/eng/2015/042015.pdf>
- Jolliffe, I.T., (2002). Principle Component Analysis. Springer Series in Statistics.
- Kim, J. & J. park (2017). The Role of Total Factor Productivity Growth in Middle Income Countries. Working Paper, No 527, Asian Development Bank.

- Kim, Y. E.; Loayza, N. V. (2019). Productivity Growth: Patterns and Determinants across the World. Policy Research Working Paper, No. WPS 8852. Washington, D.C.: World Bank Group.
- Khan, S. U. (2006). Macro Determinants of Total Factor Productivity in Pakistan. SBP Research Buliten,2(2),383-401
- Lee, C. (2016). A Review of the Recent Literature on Institutional Economics Analysis of the Long- Run Performance of Nations. Working Paper No.2016-1, ISEAS.
- Lucas, R.E. (1988). On the Mechanics of Economic Development. Journal of Monetary Economics, 22, 3-42.
- Naz, A. et al. (2015). Total Factor Productivity and Trade: A Panel Data Analysis. Forman Journal of Economic Studies, 11,103-128
- Norris, E. & A. Kyobe (2016). Structural Reforms and Productivity Growth in Emerging Market and Developing Economies. Working Paper No. WP/16/15, International Monetary Fund.
- North, D.C. (1990), Institutions, Institutional Change and Economic Performance. New York: Cambridge University Press.
- Nachega, Jean-Claude & Thomson, F. (2006), Economic Growth and Total Factor Productivity in Niger. Working Paper No. WP/06/208, International Monetary Fund.
- Olomola, P. & T. Osinubi.(2018). Determinants of Total Factor Productivity in Mexico, Indonesia, Nigeria and Turkey (1980-2014). Emerging Economy Studies, 4 (2), 192-217.

- Pipitone,V. (2009). The Role of Total Factor Productivity in the Mediterranean Countries. International Journal of Euro-Mediterranean Studies, 2, 27-51.
- Qutb, R. (2017). How Education does at all Levels Influence Total Factor Productivity Growth. International Research Journal of Finance and Economics, 159, 59-75
- Raggl, A. K. (2015). Determinants of Total Factor Productivity in Middle East and North Africa, Middle East. Econ. Fin, 11(2), 119–143
- Romer, P. (1986). Increasing Returns and Long Run Growth. Journal of Political Economy, Vol. 94, 1002-37.
- Romer, P. (1990). Endogenous Technological Change. Journal of Political Economy, 96, S71-S102.
- Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics, 70 (1), 65–94
- Sleem, N. and Ch. Zaki (2018). On Modelling the Determinants of TFP in the MENA Region: At Macro- Micro Form Level Evidence, Working Paper No. 6, EMNES.
- Tondidandel Scott and James M. Leberton.(2015). RWAweb, Comprehensive, web-based an user friendly tool for relative weight analysis. J. Bus Psychol, 30:207–216 DOI 10.1007/s10869-014-9351-z
- The World Economic Forum WEF, 2018. The Global Competitiveness Report 2017–2018 “, World Economic Forum, Geneva.

دفع الإنتاجية الكلية للعوامل في الدول النامية

إعداد

د. سحر محمد عبود
مدرس الاقتصاد
معهد التخطيط القومي
Sahar.aboud@inp.edu.eg

أ. راما السيد سعيد
باحث دكتوراه
كلية الاقتصاد والعلوم السياسية – جامعة القاهرة
rama_elsayed2015@feps.edu.eg

الملخص العربي:
مع التسليم بأهمية الإنتاجية الكلية للعوامل كأحد مصادر النمو الاقتصادي، وفي ضوء الارتباط بين مؤشر التنافسية الكلية بمحددات هذه الإنتاجية، استخدمت الدراسة عينة من ٤٦ دولة من الدول النامية بهدف اختبار الي اي مدي يعتبر مؤشر التنافسية الكلية للعوامل وكيل جيد (Proxy) جيد للإنتاجية الكلية للعوامل في دول العينة.
تتمثل مساهمة الدراسة في ثلاث جوانب: أولاً، تتحقق الدراسة من استنتاج تقرير التنافسية العالمية (٢٠١٨) بأن مؤشر التنافسية العالمية (Global Competitiveness index) يعتبر وكيل جيد لـ للإنتاجية الكلية للعوامل مع التركيز على الدول النامية. ثانيًا، تحاول الدراسة إعادة بناء مكونات مؤشر التنافسية العالمية بطريقة تعكس الأهمية النسبية للركائز المختلفة، وأخيراً، تسلط الدراسة الضوء على بعض مجالات السياسات التي تتطلب مزيدًا من الاهتمام من البلدان النامية لدفع الإنتاجية الكلية لعوامل الإنتاج بها.
توصلت الدراسة الي أن رأس المال البشري، والتنمية المالية، وتطوير تكنولوجيا المعلومات والاتصالات (ICT) لها الدور الأكبر في تفسير التباين في الإنتاجية الكلية للعوامل ما بين الدول النامية.
علاوة على ذلك، تظهر نتائج الدراسة أن الطريقة التي يتم بها تكوين مؤشر التنافسية العالمية من حيث اختيار المتغيرات وكذلك الأوزان المعطاة للركائز المختلفة، تؤثر على درجة الاعتمادية على المؤشر كوكيل للإنتاجية الكلية للعوامل في الدول النامية.

الكلمات الدالة:
النمو الاقتصادي – الإنتاجية الكلية- تحليل المكونات الرئيسية- انحدار البانل الديناميكي