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The sense of causality between growth and economic development: an essay on VAR modeling in the case of Tunisia

Mabrouki, Mohamed

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Abstract
The purpose of this article is to study the relationship between the economic growth and the development. While, even if it is recognized that the growth is definitely a condition of the development, it is not always sufficient. In this research, we are interested to demonstrate the extent to which growth promotes the development? Did the development leading to growth? Our empirical investigation attempts to test the relationship between GDP and three components of the development indicator (HDI). Using the techniques of VAR modeling and causality in Granger's sense, in the framework of the Tunisian economy during the period from 1970 to 2015, the results of the estimates show the existence of a reciprocal link between economic growth and development.

Keywords: Economic growth, Development, HDI, VAR, Granger Causality, Tunisia.

Résumé
L'objet de cet article est d'étudier le lien entre la croissance économique et le développement. S'il est admis que la croissance constitue, sans doute, une condition du développement, elle n'est pas toujours suffisante. En effet, dans quelle mesure la croissance favorise-t-elle le développement? Et, est ce que le développement engendre la croissance ? Notre investigation empirique tente de tester la relation liant le PIB et trois composantes de l'indicateur de développement (IDH). En utilisant les techniques de la modélisation VAR et de la causalité au sens de Granger, dans le cadre de l'économie tunisienne durant la période qui s'étale de 1970 à 2015, les résultats des estimations montrent l'existence d'un lien réciproque entre la croissance économique et le développement.

Mots clés : Croissance économique, Développement, IDH, VAR, Causalité, Tunisie.

Introduction

The relationship between the growth and the economic development has been expanding in recent years; particularly since the number of development attempts failed in the countries of the third world even some of these countries have experienced strong and continuous economic growth during the last decade. This is very clear in the report on Economic Development in Africa (UNCTAD) in 2014 which noted that « Despite the relatively dynamic economic growth in Africa over the last decade, several countries on the continent face of enormous challenges of development ... ». Indeed, if growth is definitely a prerequisite for development, it is not always sufficient.

However, the empirical evidence shows that countries with the highest development index (HDI greater than 0.8) are those who have benefited from increased economic growth long. The most rapid improvement of IHD is recorded in emerging countries with exceptional growth, the image of Hong Kong, the Republic of Korea and Singapore. This is explained by the fact that the growth provided resources that used to improving the lifestyle.

Indeed, is it possible to say, that growth is a sufficient condition for economic development in general?

This question was always addressed by the approaches and policies. The economic development of a country is usually associated with, among others; the achievement of sustainable growth is sustained production and thus revenue. However, if income distribution

is very unequal and / or new resources are not properly managed for development, growth cannot be accompanied by social and economic changes and improve overall living conditions beyond simply increasing the standard of living.

So, we are wondering if growth despite being a key that promoting the development. We will try in this research to answer this question. We will show first that growth has improved living standards and second, we will study the interrelationship between development and growth.

The purpose of this paper is to study the meaning of the causality that characterizes the relationship between economic growth and development. To do this, we will organize the rest of this work as follows: a first section will be devoted to the theoretical discussion of the complexity and the ambiguity of the relationship between these two notions. As a result, VAR modeling and Granger causality techniques will be implemented to empirically investigate the nature of the causal relationship that may exist between growth and development within the framework of the Tunisian economy during the period from 1970 to 2015. The last section will be reserved for conclusion and recommendations.

2/ The relationship between growth and development: theoretical elements

For growth and for economic development, we find the existence of different definitions that causes a complexity and ambiguity of the relationship between the two concepts.

The growth supports the development

According to François Perroux (1961), «Growth is defined by a sustainable increase in the size of a business, simple or complex, made of structural changes and possibly system, and accompanied by variable economic progress»[1]. We mean by the term technical progress variables all the means and material conditions that will give individuals to increase their well being. Thus, growth can be seen as a means to promote the implementation of a development process. The winner of a Nobel Prize in Economics, Simon Kuznets, defines the economic growth of a country « ... As rising long period of its ability to offer its people a range constantly expanded economic goods; this increased capacity is based on technical progress and institutional adjustments it requires »[2].

For the author, modern economic growth results in a permanent capacity to provide a growing population an increasing amount of goods and services per inhabitant.

For Joseph Stiglitz (2015), The Nobel Prize in economics and former chief economist of the World Bank, «We have, and we, need growth for those at the bottom have access to a standard of living more comfortable »[3].

So, growth is a quantitative long-term process that should lead to a qualitative improvement that reflects developments in society towards better economic and social conditions. In short, growth must promote development.

The development promoting growth

The development appears according to François Perroux (1961) as an explanation of growth. Development «is all mental and social changes of a population that make it suitable to grow cumulatively and permanently, its real global product»[4]. Thus, the development represents the

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[1] L'économie du XXe siècle, Paris, PUF, 1961, note 1, p. 408.

[2] Simon Kuznets, acceptance speech of the Nobel Prize in 1971
[3] Paris Match, Posted on 10/09/2015, Interview Marie-Pierre Gröndahl.

[4] L'économie du XX° siècle, Paris, PUF, 1961, note 1, p. 408.

transformation of economic structures and systems, but also social and cultural and political and institutional and accompanying behind the growth.

Thus, in turn, economic development is a factor for creating favorable conditions for economic growth.

As such, the development refers to Paul Bairoch (1990) « All economic, social, technical, and institutional related to the increase in living standards resulting from technical and organizational changes resulting from the industrial revolution of the 18th century»[5]. This definition reflects a link between development and growth.

Theoretically, the relationship between growth and development is a reciprocal link. However, this link is not mechanical. Growth does not necessarily lead the development and vice versa.

3/ Causality between growth and economic development: an empirical study

While, economic growth is the increase during a given period the production, the development is any process of transformation of economic structures and systems and social and political and cultural rights. Those factors fight against poverty and promote education, health and equity. Thus, the development has a qualitative aspect; it is less quantifiable then economic growth.

Growth is generally measured by the growth rate of gross domestic product (GDP). This presents some problems: this indicator does not take into account all the wealth produced (non-salaried domestic production and the informal sector); does not adequately reflect the level of living; does not reflect the distribution of wealth. Therefore, the United Nations Development Program (UNDP) has developed since 1990 an indicator for Human Development (IDH) The calculation was amended in 2010 to reflect a number of criticisms. This indicator is a composite index made up of the average of three indicators for each rank country on a scale from 0 to 1: index of GDP per inhabitant expressed in purchasing power parities. The index of hope of life at birth and the index of education measured by an indicator combining two thirds of the adult literacy rate and one third school enrollment.

How growth favors the development? And is that development promotes growth?

This leads us to use VAR modeling and Granger causality in order to verify the nature of the relationship between the growth indicator (GDP) and the different components of the development indicator (HDI).

The procedure adopted in this methodology proceeds through the following steps. First, it is necessary to study the stationary of time series using the test strategy of Dickey and Fuller (1979, 1981). Then, if all the series are made stationary, we estimate a VAR(p) model and apply the Granger causality test. The data used is from the World Bank data bank.

Methodology

The approach adopted is to use a four-variable VAR model. Considering the time series of GDP per inhabitant ((GDP_t) US$ constant international PPP of 2011), life expectancy at birth (LEB_t), primary school completion rate ($PSCR_t$) and gross enrollment ratio (GER_t), which are considered all, as endogenous. A model of simultaneous structural equations can be constructed to explain their behaviors considering that each variable depends on its delayed values and the delayed values of the other three variables.

The advantage of the model VAR proposed by Sims (1980) is not to impose restrictions priory. "Beware of theoretical a priori. Let the data speak "(Sims, 1996). We try to test the reciprocal relationship between growth and development by estimating possible relationships

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[5] Bairoch P. [1990], « Développement », in Greffe X. et alii (éd), *Encyclopédie Economique*, Paris, Economica, pp. 133-164.

between gross domestic product (growth indicator) and life expectancy at birth, enrollment rate, and Completion rate of primary education, as development components (HDI).

This modeling is based on the assumption that the evolution of the economy can be well represented by the description of the dynamic behavior of a vector of N variables linearly dependent on the past.

We can build the following VAR model:

$$GDP_t = a_{10} + a_{11}GDP_{t-1} + ... + a_{1P}GDP_{t-P} + a_{21}LEB_{t-1} + ... + a_{2P}LEB_{t-P} + a_{31}GER_{t-1} + ... + a_{3P}GER_{t-P} + a_{41}PSCR_{t-1} + ... + a_{4P}PSCR_{t-P} + u_{1t} \quad (1)$$

$$LEB_t = b_{10} + b_{11}GDP_{t-1} + ... + b_{1P}GDP_{t-P} + b_{21}LEB_{t-1} + ... + b_{2P}LEB_{t-P} + b_{31}GER_{t-1} + ... + b_{3P}GER_{t-P} + b_{41}PSCR_{t-1} + ... + b_{4P}PSCR_{t-P} + u_{2t} \quad (2)$$

$$GER_t = c_{10} + c_{11}GDP_{t-1} + ... + c_{1P}GDP_{t-P} + c_{21}LEB_{t-1} + ... + c_{2P}LEB_{t-P} + c_{31}GER_{t-1} + ... + c_{3P}GER_{t-P} + c_{41}PSCR_{t-1} + ... + c_{4P}PSCR_{t-P} + u_{3t} \quad (3)$$

$$PSCR_t = d_{10} + d_{11}GDP_{t-1} + ... + d_{1P}GDP_{t-P} + d_{21}LEB_{t-1} + ... + d_{2P}LEB_{t-P} + d_{31}GER_{t-1} + ... + d_{3P}GER_{t-P} + d_{41}PSCR_{t-1} + ... + d_{4P}PSCR_{t-P} + u_{4t} \quad (4)$$

These equations define a VAR model given that such model in general expresses the current values of the endogenous variables only as a function of a constant and the delayed values of the endogenous variables. The number of delayed values determines the order of the VAR model and the terminology implies that this model is an extension of the autoregressive time series of order p (AR (P)) which can be explained by formulating the vector by equation next:

$$Y_t = \delta + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} ...... + \theta p Y_{t-p} + V_t$$

The estimation of such model assumes the stationary of the different variables. This means that the random vector Y_t has a constant expectancy ($E(Y_t) = m$) through time and the covariance matrices between Y_t and Y_{t+h} depends only on h and not on time (h = 0.1, ...) Which means that for h = 0, cov (Y_t) does not change in time.

It should be noted that in practice, these assumptions mean that the time series do not have trends or seasonal patterns and neither the variances that change over time. To realize these hypotheses or these conditions some transformations on the data are necessary.

First, it is necessary to study the stationary of time series using the test strategy of Dickey and Fuller (1979, 1981).

Study of stationarity

We adopt the sequential strategy of testing the existence of unit roots. We start by applying the augmented Dickey Fuller test on the general model with constant and trend. The following table shows the results of this study:

Table 1:

Variable	Stationarity
Log PIB	Stationary in level, at the threshold of 5%, with a constant
Log TSC	Stationary in first difference, at the threshold of 5%, without constant or trend
Log EVN	Stationary in level, at the threshold of 5%, with a constant
Log TAEP	Stationary in level, at the threshold of 5%, with a constant

The choice of the number of delays

The number of delays is chosen which minimizes the values of the two AIC and SIC information criteria. The model variables are: **Log PIB**, **Log EVN, Log TAEP** et D(**Log TSC**). The following table shows the values of the two criteria for the different delays. We adopt a VAR (1) model.

Table 2:

Delays	AIC	SC
0	-10.45757	-10.28868
1	-19.24274*	-18.39830*
2	-19.12222	-17.60223
3	-18.89041	-16.69486
4	-18.86754	-15.99644
5	-18.92666	-15.38001

Interpretation and discussion of results
Growth promotes development

The VAR model estimation results, consistent with the predictions of development theories, show a positive relationship between the GDP growth rate and the completion rate of primary school with a coefficient of 0.126186 (Table 4), statistically significant at the 5% threshold. In addition, Granger's test shows a causal effect ranging from economic growth towards the completion of the primary education cycle (Table 5). Evidence shows that economic growth has a positive effect on development.

Development promotes growth

Our study shows a causal relationship in Granger's sense (prob = 0.0102 (Table 5)) between life expectancy at birth and completion rate of primary school. The latter influences positively and significantly GDP (prob = 0.0109, (Table 5)). Consequently, two components of the development indicator favor economic growth.

Confirming the predictions of economic theory, our results show a two-way causality between growth and development. Indeed, education plays an essential role in economic development and primary education is a very important step in education. It gives young childhood the basic elements necessary for its evolution and its present and future fulfillment. The founding works of Mincer (1958), Schultz (1963) and Becker (1964) emphasized the importance of qualification and human capital in explaining the income of individuals. More recently, Lucas (1988) and Romer (1990) and several others have shown the importance of human capital as a driver of economic growth. While, several authors such as Lindert (1994) have emphasized the opposite direction of causality rising incomes promote educational progress. As a result, most countries have seen the reduction or elimination of school fees in primary schools. The State must be the primary responsible for the construction of schools' infrastructure and the recruitment of teachers. It is the idea witch is defended by the most diverse currents, that education must be free and accessible to all people. Economic theory shows that the fight against poverty, the reduction of inequality, the increase of productivity and the prosperity of the national economy require the implementation of an efficient system of education.

It should be emphasized that our results reflect Tunisia's particular attention to the health and education sector and to improving the well-being of the population. Note that the HDI is a synthetic indicator that combines several factors of economic aspect (GDP per inhabitant expressed in purchasing power parities) and social aspects such as health and education. In Tunisia, this indicator has shown remarkable and steady growth as shown in the following table:

Table 3: Development of the HDI in Tunisia

Year	1960	1970	1980	1990	2000	2005	2010	2015
IDH	0.43	0.45	0.45	0.54	0.63	0.67	0.70	0.72

Since independence, Tunisia has made an important step in the education and health sector by generalizing and making it free. Indeed, public policy in Tunisia has allocated a large share of

the state's financing resources to the effort to improve infrastructure, education and health. According to the 2010 Human Development Report, Tunisia was ranked among the top 10 countries in terms of non-monetary HDI and GDP between 1970 and 2010.

In its health policy, Tunisia has paid particular attention to improving the health of the population. This has led to an increase in the standard of living. Indeed, life expectancy at birth has seen a remarkable evolution: In 2014 it is 77,588 years for women and 71,9 years for men, as against 43,007 years and 41,06 years respectively in 1960. At the same time, the mortality rate fell from 22.24 ‰ in 1960 to 6.2 ‰ in 2014.
In terms of its education policy, Tunisia has made a huge step in generalizing it and making it free for all children of school age: the enrollment rate rose from 103.5% in 1971 to 113% in 2014. In addition, school retention has improved: the completion rate of primary school has risen from 56.95% in 1971 to 99.72% in 2014. Tunisia has therefore taken up the challenge of illiteracy. Indeed, the adult education program aimed at eradicating illiteracy among young people: the adult literacy rate has evolved from 48.19% in 1984 to 86.87% in 2015.
Another work by Karmi and Chkir (2014) on the case of the Tunisian economy for the period from 1980 to 2011 showed a positive link between economic growth and the three main pillars of the economy. (Social, economic and environmental).

Table 4: VAR(1)

	PIB	EVN	TAEP	TSC
PIB	0.894601	-0.003916	0.126186	0.015887
	(0.04736)	(0.00298)	(0.05179)	(0.01288)
	[18.8888]	[-1.31453]	[2.43664]	[1.23346]
EVN	-0.033140	0.960877	0.002583	-0.052773
	(0.32039)	(0.02015)	(0.35032)	(0.08713)
	[-0.10344]	[47.6753]	[0.00737]	[-0.60570]
TAEP	0.279825	0.003442	0.335622	-0.045297
	(0.14247)	(0.00896)	(0.15578)	(0.03874)
	[1.96415]	[0.38407]	[2.15450]	[-1.16917]
TSC	-1.659348	-0.038110	-0.680792	0.429965
	(0.53007)	(0.03335)	(0.57960)	(0.14415)
	[-3.13041]	[-1.14290]	[-1.17459]	[2.98274]
C	1.455828	0.249204	-0.041857	0.050218
	(0.57526)	(0.03619)	(0.62901)	(0.15644)
	[2.53072]	[6.88639]	[-0.06654]	[0.32101]
R^2	**0.994748**			

Table 5: Causality in the sense of Granger

Hypothesis:	Obs	F-Statistic	Prob.
LOG(EVN) does not Granger Cause LOG(PIB	45	0.02749	0.8691
LOG(PIB) does not Granger Cause LOG(EVN)		1.80882	0.1859
LOG(TAEP) does not Granger Cause LOG(PIB)	45	7.09309	0.0109
LOG(PIB) does not Granger Cause LOG(TAEP)		13.0384	0.0008
D(LOG(TSC)) does not Granger Cause LOG(PIB)	44	14.6582	0.0004
LOG(PIB) does not Granger Cause D(LOG(TSC))		0.11837	0.7326
LOG(TAEP) does not Granger Cause LOG(EVN)	45	0.09277	0.7622
LOG(EVN) does not Granger Cause LOG(TAEP)		7.23615	0.0102
D(LOG(TSC)) does not Granger Cause LOG(EVN)	44	1.67208	0.2032
LOG(EVN) does not Granger Cause D(LOG(TSC))		0.02484	0.8755
D(LOG(TSC)) does not Granger Cause LOG(TAEP)	44	0.00361	0.9524
LOG(TAEP) does not Granger Cause D(LOG(TSC))		0.01029	0.9197

Conclusion

During this research, we have tried to study the relationship between development and economic growth using VAR modeling and causality in the Granger sense. The study showed a correlation between the main pillars of development and economic growth in Tunisia during the period 1970 to 2015. Confirmed to economic theory, growth favors development and development promotes growth.

Although, growth resources in a country are an essential element of development, certain conditions that focus on public policies in education, health, housing, environment and culture, as well as democracy and social equity play an important role in the development process.

For Tunisia, certain measures are essential to promote sustainable development: to introduce sustainable consumption and production, to strengthen social equity and national solidarity, to sustainably manage natural resources, to promote the quality of life of citizens, to promote transport Sustainable, rationalize energy consumption and promote new and renewable energies, promote the knowledge society and adapt governance to better promote sustainable development...

Our study provides empirical evidence that growth promotes development and aims towards development. However, since this work does not take into account many essential development-related data, it is therefore essential to take into account literacy rates, the poverty index, the "gender" indicator of human development, and the indicator of women's participation in the economic and political life...

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