CPS 85-Finance and Business Statistics I

Total factor productivity and factor contribution to growth: A disaggregated approach by industry

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Introduction

I- Review of the literature

II- Theoretical formulations

1- Production function used

2- Contribution of the inputs to economic growth

III- Application to the Moroccan economy

1- About the methodology used

2- Obtained results

IV- Conclusion and statistical recommendations

The production of goods and services is a complex process that involves a combination of the main inputs (capital and labor) in addition to other elements considered as "manna from heaven". Later, this "manna from heaven" has been named "total factor productivity (TFP)" and has been treated in the economic literature, for a single product (notably GDP), for sectors (such as agriculture or manufacturing) and/or specific goods (such as wheat or cotton).

Indeed, when productivity, respectively TFP, is studied at the national level, it is often based on aggregate data where the results obtained are usually an average of all sectors of the economy under consideration.

➔ A study on TFP at sectoral level is needed to allow us to analyze each sector separately.

The objective of this work is to estimate TFP for the industries according to the National Accounting Classification (NAC) based on the growth accounting framework for the case of Moroccan economy using annual data from 1999 to 2019. Next, we will see the contribution of the inputs, namely capital and labor, in the growth of each of these branches.

- TFP is defined as the share of output growth unexplained by inputs growth. It captures the efficiency with which labor and capital factors are combined to generate output.

- For the case of a single aggregate product, which is GDP, the economic literature is rich with studies related to TFP. However, there is an increasing proliferation of studies on TFP at the disaggregated level that focus on a given sector or a given product, using different estimation approaches. These sectoral studies have focused mainly on manufacturing where the inputs used and outputs obtained are easily quantifiable. (KONG & TONGZON, 2006).

- Similarly, works on disaggregated TFP have focused on some products or branches such as food, textiles, paper, chemicals, metallurgy, machinery and tools and "other sectors". (ENGLANDER & MITTELSTADT, 1988) and (MEYER-ZU-SCHLOCHTERN, 1988).

- This sectoral disaggregation of TFP has also been experienced using the data envelopment analysis (DEA) method, for the case of Singapore, on annual data from 1985 to 2000, instead of using the growth accounting equation adopted in this paper. (KONG & TONGZON, 2006).

- On the other hand, to study the TFP of Turkish agricultural sector between 2000 and 2014, two non-parametric approaches were used which are different from those based on growth accounting (ABUKARI, ÖZTORNACI & VEZIROGLU, 2016). Same thing for the calculation and decomposition of TFP growth of wheat sector (soft and durum) in Tunisia where this product was examined between 1980 and 2012 using the Malmquist index. (CHEBIL, FRIJA & ALYANI, 2015).

- The TFP of the Pakistani manufacturing sector was also estimated using a two-digit nomenclature of the Pakistan Industrial Classification 2007 for the overall period 1970-2006 which was divided into sub-periods of five years in order to compare the results obtained between these sub-periods, and was carried out by adopting an estimation approach other than growth accounting. (KAMAL, 2015).

- From this literature review, it can be seen that different approaches can be implemented to study TFP for certain sectors and/or products.

1- Production function used

$$Y = A * K^{\alpha} * L^{\beta} \quad (1)$$

$$Y = A * K^{\alpha} * L^{1-\alpha} \quad (2)$$

$$\left(\frac{Y}{L}\right) = A * \left(\frac{K}{L}\right)^{\alpha} \quad (3)$$

$$\Delta Log\left(\frac{Y}{L}\right) = c + \alpha * \Delta Log\left(\frac{K}{L}\right) \quad (4)$$

Capital series :

$$\begin{cases} K_{t+1} = (1-\delta) * K_t + I_t \\ K_0 = \dfrac{I_0}{g+\delta} \end{cases} \quad (5)$$

2- Contribution of the inputs to economic growth

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha * \frac{\Delta K}{K} + \beta * \frac{\Delta L}{L}$$

1- About the methodology used

2- Obtained results

Branch or Industry	A	α	R^2	DW
AB (Agriculture, forestry and related services and fishing)	0,12	0,4	0,01	3
C00 (Mining)	0,71	0,95	0,56	2,6
D00 (Manufacturing industries)	0,15	0,54	0,12	1,96
F45 (Construction and public works)	0,36	0,8	0,6	1,13
G00 (Trade)	0,29	0,86	0,34	2,05
H55 (Hotels and restaurants)	0,08	0,83	0,39	1,54
JK (Financial and real estate activities)	0,21	0,95	0,92	1,8
L75 (General public administration)	0,32	0,99	0,7	2,7
MN0 (Education, health and social activities)	0,52	0,92	0,8	0,9
Total Value Added (OULAD EL FAKIR, 2022)	0,01	0,45	0,12	2,45

Industries	Average growth 1999-2019 (in %)			Alpha	Contribution of inputs to the growth of each branch (in %)		
	Y	L	K		L	K	A
AB	3,9	-1,1	4,5	0,4	-0,5	2,7	1,6
C00	3,2	-1,5	4,2	0,95	-1,4	0,2	4,4
D00	2,9	0,1	4,0	0,54	0,0	1,8	1,0
F45	4,5	3,6	4,8	0,8	2,9	1,0	0,6
G00	2,9	2,6	4,0	0,86	2,2	0,6	0,1
H55	3,7	5,1	4,4	0,83	4,2	0,7	-1,3
JK	3,8	7,3	4,5	0,95	6,9	0,2	-3,3
L75	4,5	0,3	4,8	0,99	0,3	0,0	4,2
MN0	4,0	1,8	4,6	0,92	1,6	0,4	2,0
Total Value Added (OULAD EL FAKIR, 2022)	3,8	0,8	5,0	0,4	0,4	2,3	1,1

IV- Conclusion and statistical recommendations