PRODUCTIVITY ANALYSIS

ECONOMICS RESEARCH CENTRE

Issue 20/1
March
2020

SECTORAL PRODUCTIVITY DEVELOPMENTS IN CYPRUS

SUMMARY AND POLICY CONCLUSIONS

An economy's productivity growth is a reflection of the performance of its individual sectors. In this bulletin we aim in assessing the performance of the Cyprus economy both at the aggregate and at the sectoral level. We do so by employing two of the most widely used measures of productivity, Total Factor Productivity (TFP) and labour productivity. These two measures are interrelated in that labour productivity growth can be attributed to movements in TFP growth and in the relative intensity of the use of capital and labour (capital deepening). We consider a total of ten aggregated industries or sectors, defined according to the classification of economic activities – NACE Rev.2, for the period between 1996 and 2018.

A particularly tough period for the Cyprus economy was the period of the European economic crisis. Over the years from 2007 to 2009, a period by the end of which the European economic crisis began to unfold, as well as up to 2014 is the worse in terms of productivity growth (TFP growth) for all sectors of the economy. The banking crisis that peaked in 2013 also affected sectoral performance. It is not until the last period of our sample, the years between 2015 and 2018, that the Cyprus economy showed a remarkable improvement in terms of productivity growth, both at the aggregate and at the sectoral level. This is mainly due to reforms (in the labour market and the public sector) that have taken place since the beginning of the crisis.

Cyprus' main productivity growth drivers are the Information and communication sector, the Financial and insurance sector and the Wholesale and retail trade transport, accommodation and food service sector. Productivity growth in these backbone sectors over the period 1996–2018 exceeded the productivity growth in all other sectors. On the other hand among the worst contributors to the economys' productivity growth are the Industry and the Agriculture, forestry and fishing sectors. These two sectors are relatively small and their TFP growth is on average amongst the lowest relatively to the other sectors.

Policy reforms towards improved legal and institutional environment are crucial to the performance of the backbone sectors. Countries with deeper financial markets, flexibility in their labour markets, more skilled labour, and greater private investment in R&D, are also the countries whose high-tech industries are experiencing higher TFP growth. Further, labour market regulations, like strict employment protection legislation are known to depress productivity in low technology sectors. Labour market flexibility and efficient financial markets can ease the shift of labour and capital from less-to more-productive activities. Overall, policies introducing greater flexibility in the labour market, reforming the public sector to minimize bureaucracy and increase efficiency, as well as policies that support innovation through financial deepening and human capital investment, should be a priority in order to promote and sustain productivity and, consequently, economic growth.

ISSN 1986-1001

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1. Introduction

The aim in this bulletin is to investigate sectoral productivity differences and how these explain the aggregate productivity growth in Cyprus. To do so we describe the patterns of productivity growth across major sectors in the economy by employing two of the most widely used measures of productivity, Total Factor Productivity (TFP) and labour productivity.

TFP is computed using the growth accounting framework (Solow, 1957). Growth accounting provides a useful framework for measuring the part of output growth that is not explained by the contributions of labour and capital. TFP growth reflects advances in general knowledge, changes in the skills and efforts of labour, reductions in inefficiency and the reallocation of resources to more productive uses, among others. High productivity reduces average costs and in the long term reduces product prices, thereby inducing competitiveness. It is therefore crucial to promote policies that boost productivity as it is directly related to a country's welfare. Labour productivity is measured as output per hour of work. TFP growth and labour productivity growth are interrelated since changes in labour productivity over time depend both on TFP changes as well as changes in the relative intensity of the use of capital and labour (the latter is referred to as capital intensity or capital deepening). At the aggregate level, labour productivity is also a significant policy tool as it is directly related to income per capita, a widely used measure of living standards.

To analyze the sectoral and the economy-wide patterns of productivity growth in Cyprus we use data from Eurostat for a total of ten aggregated industries or sectors, defined according to the classification of economic activities – NACE Rev.2, for the period between 1996 and 2018.[1] We evaluate which sectors are relatively more efficient and hence more growth enhancing for the Cyprus economy.

Figure 1: Productivity (TFP) growth by sector (average annual percent changes, 1996-2018)

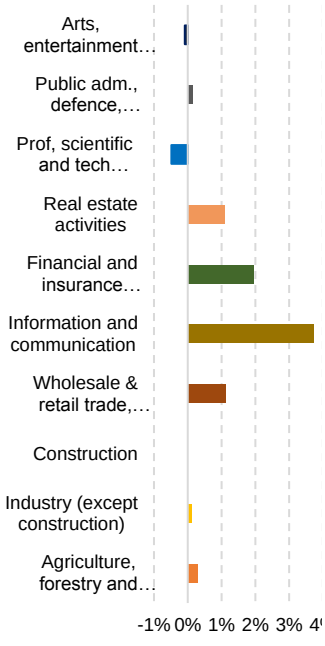
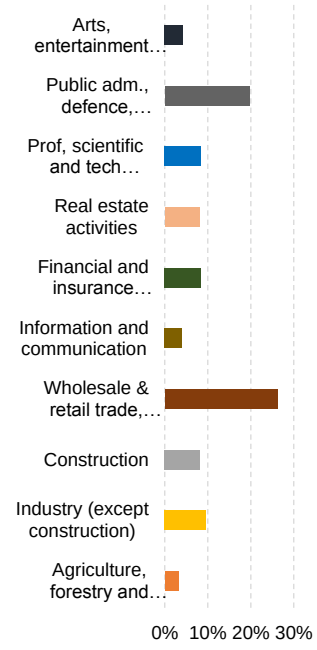


Figure 2: Sector share in total Value Added output (average annual, 1996-2018)



Source: Eurostat and authors calculations

2. Sectoral Productivity growth

TFP growth is defined as the difference between output growth and the growth of an input factor index measuring the change in the contribution of the labour and capital inputs in the production process. We begin the analysis by measuring the average sectoral TFP growth and each sector's share in total value added (Figure 1 and Figure 2, respectively).[2] This will allow us to examine the respective

[1] The ten industries/sectors are: Agriculture, forestry and fishing; Industry (except construction); Construction; Wholesale and retail trade transport, accommodation and food service activities; Information and communication; Financial and insurance activities; Real estate activities; Professional, scientific and technical activities, administrative and support service activities; Public administration, defense, education, human health and social work activities; Arts, entertainment and recreation, other service activities, activities of household and extra-territorial organizations and bodies.

[2] The variables used are the gross value added in current prices and constant prices, the number of employees (total and self-employed), the total hours worked (man hours, for total employees and the self-employed), investment in current and constant prices, and the compensation of employees. All price data are expressed in euros at constant 2015 prices. Output is constructed using the value added in current prices as the value of output, together with the value added in constant prices considered as the quantity of output. The price of output is obtained by dividing current prices with constant prices. Regarding labour, the compensation of employees is used as the value of labour, adjusted to include those who are self-employed, a procedure also followed by the European Central Bank. Having obtained the value of labour and hours worked, the price of labour is calculated and expressed in 2015 prices. Using the data for the price and value of labour, the quantity of labour

contributions of sectoral productivity growth to aggregate productivity growth. What stands out from Figure 1 is the TFP growth in the Information and communication sector: it is the highest relatively to all other sectors, with an average productivity growth rate of 3.7%. But when examining the sector's share in total economy, it is amongst the lowest. This means that the Information and communication sector is too small, relatively to the other sectors, to substantially affect the economy's TFP growth rate. A similar picture is presented for the Financial and insurance sector. Although it is the sector with the second highest TFP growth rate, its contribution to the economy's output is not as substantial. On the contrary, the Wholesale and retail trade transport, accommodation and food service sector is the largest sector in the economy and the third in terms to productivity growth, thus positively contributing to the overall productivity growth.

Table 1: Productivity growth
(average annual percent changes)

Sector	Period			
	1996 - 2009	2010 - 2014	2015 - 2018	1996 - 2018
Total	1.34	-0.43	1.93	1.06
Agriculture, forestry and fishing	-1.27	-0.77	7.15	0.30
Industry	0.43	-3.84	3.99	0.12
Construction	-0.62	-3.13	6.12	0.01
Wholesale&retail trade, transport, accom.,food serv.	1.76	-0.20	0.59	1.13
Information and communication	3.85	2.41	5.01	3.74
Financial and insurance	5.39	-1.88	-5.24	1.96
Real estate activities	-0.14	1.90	4.47	1.10
Prof, scientific and tech activities; adm. &support	0.28	-3.09	0.09	-0.49
Public adm., defence, educ, human health & social work	0.44	-0.98	0.53	0.14
Arts, entertainment and recreation; other activities	-0.43	-2.48	4.08	-0.09

Source: Eurostat and authors calculations

TFP growth is also presented in Table 1 for all sectors in our sample and for three sub-periods, 1996-09, 2010-14, and 2015-18.

Up to 2009, TFP of the total economy grew at an average annual rate of 1.4%. During this period most sectors exhibit negative or close to zero productivity growth. Exceptions are the Financial and insurance and Information and communication sectors. These two are the most productive sectors, reaching on average, 5.4% and 3.9% productivity growth, respectively. Over the years from 2010 to 2014, a period during which the European economic crisis peaked (between 2010 and 2012), is the worse in terms of productivity for all sectors and the total economy. In fact, with the exception of the Information and communication and the Real estate sectors, productivity growth for all sectors is either negative or close to zero. During the last period in our sample, the years between 2015 and 2018, Cyprus performance showed a remarkable improvement in terms of productivity growth, both at the aggregate and the sectoral level. This is mainly due to reforms (in the labour market and the public sector) that have taken place since the beginning of the crisis. More precisely from 2015 to 2018 productivity in Cyprus grew at an annual rate of 1.9% per year. All sectors, except the Financial and insurance sector more than recouped relatively to their previous bad performances.

3. Labour productivity growth

Labour productivity growth can be attributed to movements in TFP growth and in the relative intensity of the use of capital and labour. If the capital stock per labour hour increases, this is an indication of economic expansion. Table 2 and Figure 3 present the labour productivity growth and its breakdown to TFP growth and capital deepening growth, for the total economy as well as for each sector. On average, over the 1996-2018 period, the highest labour productivity growth among the sectors took place in the Information and telecommunication sector with 5.5% growth. 68% of this growth rate is attributed to TFP growth (3.7% of the total 5.5%). The Financial and insurance sector follows with an average labour productivity equal to 2%.

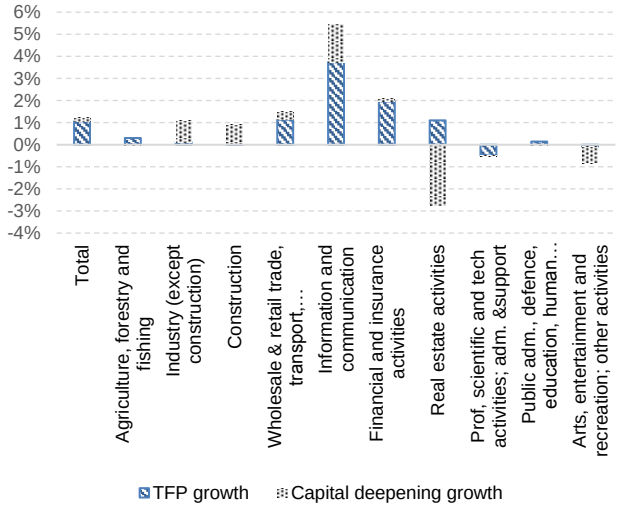
is then obtained. The capital stock is calculated using the perpetual inventory method with a constant depreciation rate of 7%. Finally, TFP growth is constructed as output growth minus a weighted sum of the growth of all inputs, where the weights are based on two-period average factor shares.

Table 2: Labour productivity growth decomposition
(average annual percent changes, 1996–2018)

Sector	Labour productivity	Contributions	
		TFP	Capital deepening
Total	1.25	1.06	0.19
Agriculture, forestry and fishing	0.27	0.3	-0.04
Industry	1.07	0.12	0.96
Construction	0.91	0.01	0.91
Wholesale&retail trade, transport,accom.,food serv.	1.52	1.13	0.39
Information and communication	5.45	3.74	1.71
Financial and insurance	2.09	1.96	0.13
Real estate activities	-1.65	1.1	-2.75
Prof, scientific and tech activities; adm. &support	-0.51	-0.49	-0.03
Public adm., defence, educ, human health & social work	0.11	0.14	-0.03
Arts, entertainment and recreation; other activities	-0.83	-0.09	-0.75

Source: Eurostat and authors calculations.

Figure 3: Labour productivity growth
(average annual percent changes, 1996–2018)



Source: Eurostat and authors calculations.

Figure 4, offers a more detailed look at most of the sectors. Figure 4, Panel A, presents the sector with the highest labour productivity growth; the Information and telecommunication sector. It is clear that the fluctuation of labour productivity through the years between 1995 and 2018, is attributed almost entirely to efficiency changes with capital deepening being relatively constant throughout the period.

Exactly the opposite is observed in the Real estate sector. Table 2 shows that the Real estate's labour productivity growth fell on average by 1.65% over the years between 1996 and 2018. This is attributed to a drop in capital deepening by 2.8% that overcame the increase in TFP growth (1.1%), over the same period. Figure 4, Panel B, shows that up to 2014 the sector's labour productivity growth follows roughly the changes in capital deepening. According to the data, both output and capital growth are relatively stable during over the entire period, while labour growth is considerably more variable. Thus, the fluctuating labour growth is the main source of the fluctuating labour productivity growth.

The Construction sector in Figure 4, Panel C, exhibits a similar picture to that of the Real estate sector. Capital intensity growth in the Construction sector is positive with a roughly stable growth rate of 4% annually. This means that the negative changes in labour productivity growth are possibly due to investment on low productive capital.[3]

Both the Real estate and the Construction sectors received large amounts of credit starting in the mid-2005. This resulted to an overvaluation of house prices from 2007-2014. The property bubble was at its full in the period 2006-2008 and burst when the global economic crisis emerged.[4] Furthermore, it is noticeable that, in both sectors there is a jump in labour productivity growth that took place in 2013, the year of the banking crisis.[5] At 2015 prices came back to their long term equilibrium levels close to the values observed in 2006.[6]

In continuation of our earlier discussion for the negative TFP growth rates in the Financial & insurance sector during the years between 2015 and 2018, Figure 4, Panel D, offers the whole picture. It is clear that both TFP and labour productivity growth fell during this period while capital deepening was fluctuating around zero. Inspection of the data shows that the negative labour productivity growth is due to a contraction of the sector's output growth that

[3] Clerides argues that the financial system provided credit in abundance but possibly too much of it was financing unproductive physical structures (Cyprus Economic Policy Review, 2014).

[4] For an overview of the property bubble and the banking crisis, see Clerides (Cyprus Economic Policy Review, 2014).

[5] According to the data in 2013, in the Real estate sector, both output and capita growth fell by 3%, while labour growth fell by a remarkable 23%. This resulted in an increase in labour productivity growth by 20%. In the construction sector case, both output and labour growth fell, but the drop in labour growth was greater than that of output; 37% and 22%, respectively. Hence the increase in the labour productivity growth by 15%.

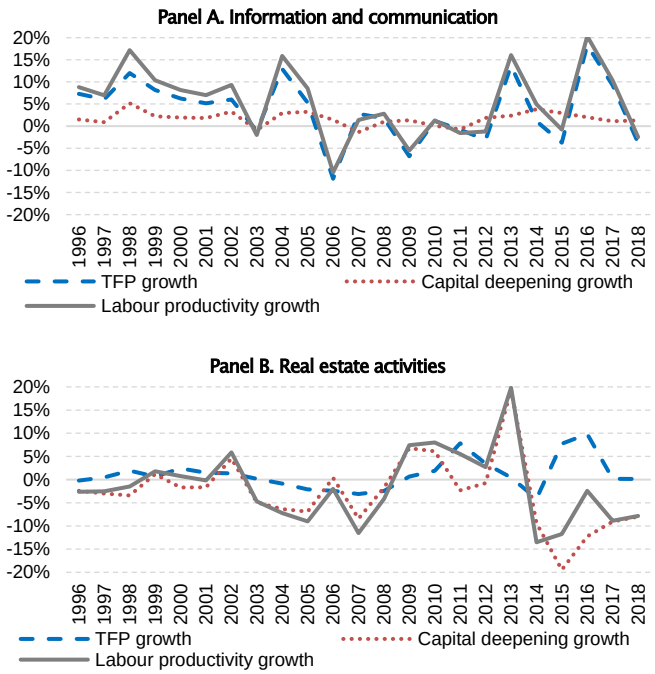
[6] See Mithillou Papageorghiou and Polemidiotis (Central Bank of Cyprus working paper, 2018).

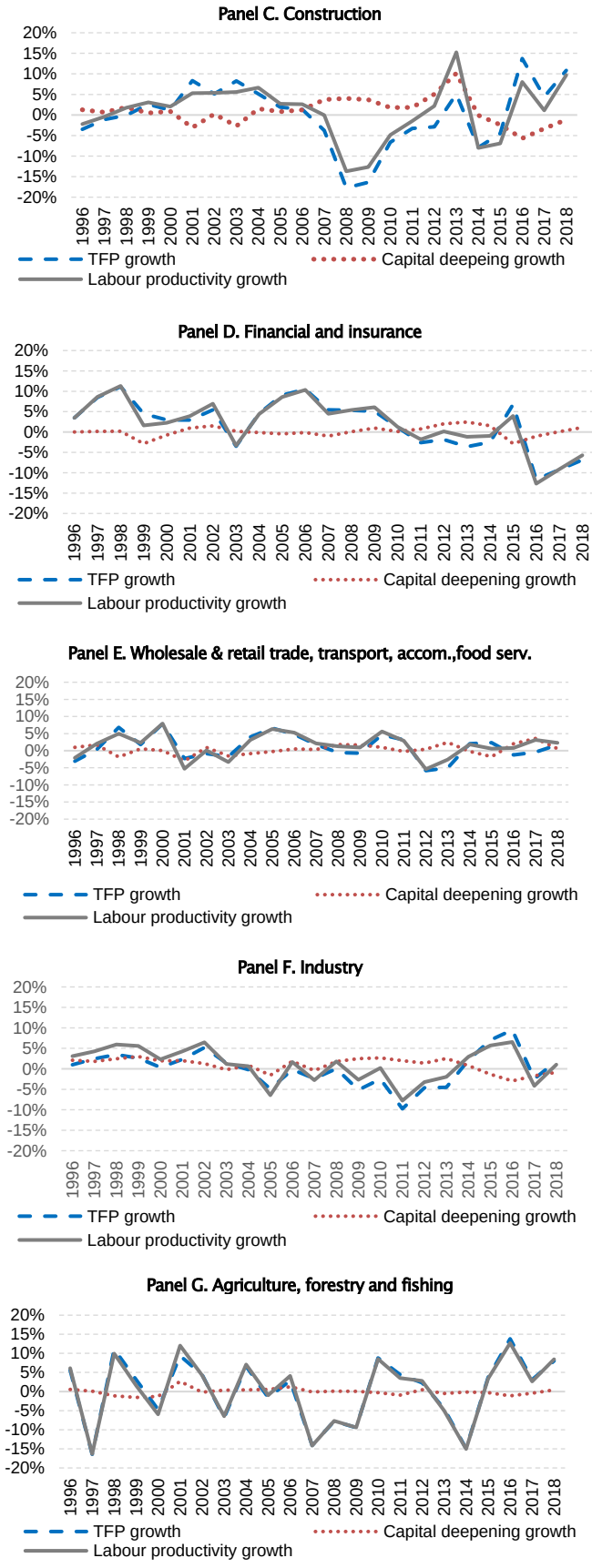
begins in the peak of the banking crisis in 2013 and continues until the end of the period together with a positive labour growth throughout the period. This is mainly due to the consolidation of the banking sector and the resulting loan deleveraging together with employment increase in the sector.[7]

Panel E plots the breakdown of labour productivity growth for the Wholesale and retail trade transport, accommodation and food service sector. Relatively to the other sectors of the economy, it is one of the most stable sectors over time, with a stable capital deepening close to zero over the entire period. Thus the labour productivity in this sector follows almost entirely the movement of its TFP growth.

Finally, Panels F and G plot two of the sectors that are commonly referred to in the literature. The Industry and the Agriculture, forestry and fishing sectors respectively. In Cyprus, these two sectors are relatively small and their TFP growth, is on average amongst the lowest relatively to the other sectors (see also Figure 1).

Figure 4: Labour productivity growth





Source: Eurostat and authors calculations.

[7] According to the Central Bank of Cyprus' working paper by Mithillou Papageorghiou and Polemidiotis (2018), the employment creation in the financial sector is mainly in asset management, foreign exchange, binary options, etc. That is, it did not take place in the banking and insurance parts of the sector.

4. Conclusion and Policy Implications

Cyprus productivity growth over the period 1996–2018 seems to be driven by a strong performance in the Information and telecommunication sector, the Financial & insurance sector and the Wholesale and retail trade transport, accommodation and food service sector. Productivity growth in these backbone sectors exceeded the productivity growth in all other sectors. A high productivity sector can also affect the productivity of other inter–linked sectors in the economy. For example, transport or telecommunications affect the costs of production and are thus critical to the competitiveness of other sectors.

A large body of literature highlights the important role of a strong financial sector on a country's industrial and macroeconomic performance. Firms in industries that rely more on external financing show higher productivity growth in countries where financial markets are more efficient. This is a lesson learned the hard way in Cyprus.

Policy reforms towards improved regulation (legal and institutional environment) are crucial to the performance of the backbone sectors. Countries with strong backbone service industries, deeper financial markets, more skilled labour, more flexible labour markets and greater private investment in R&D, are also the countries whose high–tech industries are experiencing higher TFP growth.

Policy makers can play a major role in sustaining the growth momentum in the above backbone service sectors. Policies that support innovation through financial deepening and human capital investment should be a priority for sustaining productivity growth. Labour market regulations like strict employment protection legislation are known to depress productivity in low technology sectors. Labour market flexibility and developed financial markets can ease the shift of labour and capital from less–to more–productive activities. Policies introducing greater flexibility in the labour market, reforming the public sector to minimize bureaucracy and increase efficiency are measures promoting productivity and, consequently, economic growth.

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