



The contribution of Information and Communication Technology investments to Greek economic growth: An analytical growth accounting framework [☆]

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ABSTRACT

Information and Communication Technology (ICT) investments are the driving force behind the resurgence of growth in the developed countries during recent years. They are also the main reason for the increased growth rates of Total Factor Productivity (TFP). In this paper, we examine whether these relationship also hold for Greece. We use a neoclassical growth accounting model to identify the sources of growth and more specifically the role of ICT investments. We find that the contribution of ICT investments has increased during the period 1988–2003, but that this contribution is still lower than in the United States. During 1996–2003, ICT capital services contributed 0.75 to the total growth rate. We also examine the role of ICT investments at the industry level; we find that ICT investments have most benefited the Finance, Insurance, Real Estate and Business Services industries, and the Wholesale and Retail Trade industries. Finally, our results show that growth rates of TFP have also risen, a necessary condition to maintain the high growth rates of productivity in the future.

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1. Introduction

The resurgence of productivity during the late 1990s and the early 2000s is a topic that has attracted many growth economists. The main reason for this recovery of productivity in the United States and in many European countries is the increased shares of Information and Communication Technology (ICT) investments in aggregate fixed capital formation. Prices in ICT assets have declined

more in relative terms than prices in non-ICT assets, leading to substitution of ICT capital for non-ICT capital. However, this result has not always been clear. said that we see computers everywhere but in the productivity statistics, a paradox that until the middle of 1990s, nobody could reasonably explain. Nevertheless, during the second half of 1990s Average Labor Productivity (ALP) grew 2.4% per year in the United States, one percentage point higher than in the first half of 1990s. It seemed that ICT investments were finally boosting productivity rates.

Oliner and Sichel (2000) and Jorgenson and Stiroh (2000) were the first authors who examined this resurgence of US growth. Oliner and Sichel (2000) concluded that ICT capital deepening and industry productivity of computer sector were responsible for two-thirds of the rise

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in ALP during the late 1990s. Jorgenson and Stiroh (2000) used a slightly different methodology¹ and found almost the same results. However, they were more cautious, as they were not sure if the technological improvements would continue at the same pace and if the resulting high productivity rates would persist in the future. Whelan (2002) estimated a higher contribution of ICT capital because he assumed that ICT efficiency remained constant until the retirement of the asset. Kiley (1999) estimated a negative contribution of computers to output growth due to adjustment costs. Recent papers, like Oliner and Sichel (2003) and Jorgenson et al. (2003b), confirmed that these results were still valid. However, Gordon (2000) was more skeptical and only supported the finding that the ICT-producing sector benefited from the TFP growth. In Europe, growth was sluggish during the late 1990s. Schreyer (2000) and Daveri (2000) overtook the lack of official data by using data from a private source. Schreyer (2000) examined four European countries, the United States, Canada, and Japan; he estimated that ICT capital contributed 0.17–0.29% to growth of the largest European countries during 1990–1996. Daveri (2000) expanded the number of countries that Schreyer (2000) examined to 13 European and 5 others. He estimated a much higher contribution of ICT for each country than did Schreyer (2000). Both economists found that large European countries have lagged behind in comparison to the United States. Colechia and Schreyer (2002) showed that during the late 1990s, ICT contributed between about 0.3% and 0.9% per year to economic growth compared with the early 1990s, when ICT contributed only 0.2–0.5%. Van Ark et al. (2002) used a broad dataset and they showed that the gains from ICT capital were higher in the United States than in Europe. Finally, Vajselaar and Albers (2002) showed that the role of ICT capital was most important in Europe in the late 1990s, but these investments did not benefit the overall economy through higher TFP growth.

Economic growth in post-war Greece follows different patterns. Alogoskoufis (1995) divides the Greek post-war economy into two periods. Before 1973 Greece was a leading developing economy with high growth rates and low unemployment and inflation rates; after 1973, we observe the exact opposite picture, with almost zero growth rates and very high inflation and unemployment rates. During the last 15 years, we observe a gradual improvement of the economy, with growth rates steadily higher than the EU average and almost the same inflation rates.

The resurgence of the Greek economy was mainly the result of increased public and private investments, and the recovery of TFP growth. New incentives, such as the new investment law of 2004 and the framework of public–private partnerships, along with the decline of interest rates due to adoption of the euro, boosted private investments. Greek firms invested heavily in new technologies and in new methods of production. In addition, the resources of the second and third Community Support Frameworks, and the preparations for the Athens 2004

Summer Olympic Games, stimulated public investments, especially in network infrastructures.

The other source of the Greek resurgence was the recovery of TFP growth. While TFP growth was negative in the period 1980–1995, it turned positive during the last decade. The structural reforms of the last decade (reforms in labor markets, market liberalization, tax reform, privatizations, investments in human capital, modernization of public administration) created an accommodating macroeconomic environment, which in turn supported entrepreneurship, improved business climate, and enhanced competition. According to IMF (2008), the expansion of the Greek economy was not a temporary incident; growth is expected to remain robust in the mid-term driven by continued strong domestic demand, despite the recent financial turmoil. Some selected papers that examined economic growth in Greece are Dimelis et al. (1996), Bosworth and Kollintzas (2001), Daveri (2001, 2002), and Timmer et al. (2003). Dimelis et al. (1996) presented the stylized facts of Kaldor (1957) and Romer (1989) and considered whether they applied to the Greek economy. Their conclusions were consistent with those of Alogoskoufis (1995), but they found that the critical point was somewhere in 1980 and not in 1973 as Alogoskoufis (1995) suggested. Bosworth and Kollintzas (2001) concluded that the economic growth slowdown in the 1980s could be traced both to a decline in capital investment and to a decline in TFP. Daveri (2001, 2002) was the first to examine the role of ICT adoption in Greece, along with other EU countries. He found that in the late 1990s, the contributions from ICT capital and TFP growth rose in Greece, even though he included Greece in the group of the ‘slow ICT adopters’. Finally, Timmer et al. (2003) extended the work of Van Ark et al. (2002) and included Greece. They found that during the late 1990s, ICT capital contributed 0.5% per year to both GDP and ALP growth, compared with the early 1990s when ICT assets contributed only 0.2% per year.

The most complicated part of a growth accounting framework is the use of capital. Wealth stocks are not suitable for growth accounting; the price of an asset is almost never proportional to its ability to produce goods and services, because the age/efficiency function (used for productive stocks) and age/price function (used for wealth stocks) are different.² Most assets, such as automobiles, industrial machinery, household appliances, and personal computers³ exhibit differences between age/price and age/efficiency profiles. Prices reflect expectations of future services and not current inputs to the production function.

Our first step was to construct “productive capital stocks” using an age/efficiency function and the “Perpetual Inventory Method” (PIM).⁴ However, “productive capital

² See OECD (2001) and Harper (1982) for a full discussion on age/price and age/efficiency profiles.

³ Personal computers and peripherals have a more complex age/efficiency profile because of their rapid obsolescence. Obsolescence is caused by technological change and introduction of new vintages that are not always compatible with older vintages. See Doms et al. (2004), Geske et al. (2003) and Wykoff (2003) for a further discussion on the topic.

⁴ The Bureau of Labor Statistics (BLS), the Australian Bureau of Statistics (ABS) and the OECD also use this method among other researchers. See Harper (1982, 1999), ABS (1997) and OECD (2001).

¹ Jorgenson and Stiroh (2000) used the ‘production possibility frontier’ model, which was first employed by Jorgenson and Griliches (1967). The main difference is that they split output into consumption and investment and so they estimated the services of consumers’ computers.

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