ICT and Future Productivity: Evidence and Theory of a GPT*

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Abstract

Information and Communication technology (ICT) is able to explain accelerations in productivity in sectors that are ICT users. We employ Structural VARs to investigate the effects of ICT supply shocks on Total Factor Productivity (TFP) and other macroeconomic variables. In response to this sector-specific supply shock relative prices of ICT goods and services immediately fall, ICT investment rises on impact, and TFP displays a significant delayed and persistent increase. In line with theories of ICT as a general-purpose technology, we analyze a two-sector general equilibrium model in order to rationalize previous results and estimate key parameters via impulse-response matching. We conclude that ICT accumulation is able to enhance productivity through a positive spillover effect which takes into account the overall level of diffusion of ICT capital in the economy.

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1 Introduction

Although there is large consensus on the importance of productivity as a driver of economic performances, less agreement is on the underlying sources that enhance its growth. For several years, most of the business-cycle literature purposely decided to avoid such a question by proxying movements in productivity as random shocks.[1] However, the robust empirical evidence of the slowdown in productivity right before the great recession is summoning the literature to take a step back and devote more attention on the drivers of medium-term productivity growth.[2]

Along Comin and Gertler (2006), some theoretical contributions rationalize endogenous productivity dynamics by adapting features of endogenous growth models into DSGE models. Following Romer (1990), most of those papers augment final-good production functions with an expanding composite of intermediate goods produced by the R&D sector in order to allow for an endogenous rate of adoption of new technologies.[3] Consistent with those previous models, other papers attempt to provide empirical evidence of a slowdown in the productivity of the R&D sector. Specifically, they show that although research effort is keeping rising, the rate of new ideas and discoveries is slowing down.[4]

Motivated by this wave of research, this paper follows a different path and argue that Information and Communication Technology (ICT) plays an important role in driving medium-term productivity in sectors that are ICT users. Our contribution is twofold. First, we provide a robust empirical evidence to show that current rises in

[1] Kydland and Prescott (1982) and Long Jr and Plosser (1983) are among the first papers which consider productivity shocks on general equilibrium models.

[2] See Cette et al. (2016) and Byrne et al. (2016) among others.

[3] Bianchi et al. (2014), Anzoategui et al. (2016), and Moran and Queralto (2017) use similar techniques to endogenize growth. In particular, Bianchi et al. (2014) augment a DSGE model using a quality ladders model in the vein of Grossman and Helpman (1991). Moreover, Anzoategui et al. (2016) and Moran and Queralto (2017), similarly to Comin and Gertler (2006), use a model of expanding variety in the vein of Romer (1990).

[4] Jones (2009) and Bloom et al. (2017) are two important contributions that highlight those facts.

ICT-investment explains significant and persistent increases in future Total Factor Productivity (hereafter TFP). Second, we analyze a standard theoretical framework in order to both motivate and explain our empirical results.

Regarding the empirical section, the idea is to identify supply (technological) shocks which are only specific to the ICT sector in a Structural VAR context.[5] In order to have a reliable identification procedure our multivariate system needs to embody three key variables: TFP, ICT investment (hereafter ICTI), and relative prices (hereafter RP). Importantly, ICTI is defined as the total expenditure in equipment and computer software meant to be used in production for more than an year. Thus, an increase in ICTI has to be though as an ICT capital deepening. Moreover RP is simply the ration between prices in the ICT sector over prices in the overall economy. As pointed out by

In other words, In order to identify a ICT supply shock, we expect it to be orthogonal to current TFP because the ICT sector accounts for a negligible part in the whole economy. In addition, ICT supply shocks should enhance the usage of this ICT goods and services

we seek a shock which are ordered respectively first and second, we look for a shock which does not affect TFP on impact but that maximize the impact effect on ICT investment.

We employ Structural VARs to investigate the effects of ICT supply shocks on Total Factor Productivity (TFP) and other macroeconomic variables. In response to this sector-specific supply shock relative prices of ICT goods and services immediately fall, ICT investment rises on impact, and TFP displays a delayed significant and persistent increase. In line with theories of ICT as a general-purpose technology, we analyze a two-sector general equilibrium model in order to rigorously rationalize previous results and estimate key parameters via impulse-response matching. We

[5]An interesting paper which is somehow related to our empirical part is Jafari Samimi and Roshan (2012). The authors identify ICT shocks as a potential driver of the Iranian business cycle using a completely different identification strategy and obtaining qualitatively different results.

conclude that ICT accumulation is able to enhance productivity through a positive spillover effect which takes into account the overall level of diffusion of ICT capital in the economy.

2 Empirics

3 Model

4 Conclusion

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