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Entrepreneurship culture, total factor productivity growth and technical progress: Patterns of convergence towards the technological frontier

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ABSTRACT

A firm's set of knowledge processes may be affected by the entrepreneurial culture of the country in which it is located. Total factor productivity, mainly associated with technical progress, accounts for most differences over time and across countries. In the present work we examine the determinants of total factor productivity growth in 26 OECD countries between 1965 and 2010, breaking them down into changes in technical efficiency and shifts in technology over time. Using the US as the technology frontier, different patterns of productivity growth emerge between world technology leaders and countries with low initial levels of productivity. Whereas changes in efficiency seem to be the main result of the evolution in the stock of knowledge in technologically dependent economies, suggesting that less advanced economies can benefit from their relative backwardness, domestic research effort appears to be a relevant factor for technology leaders.

1. Introduction

This work is based on the pioneering work by Robert M. Solow and by authors who went deeper into his economic growth model [45] and technical change in the aggregate production function model [46] and on the growth model proposed by Jones [28]. Over the past couple of decades there has been increased interest in and analysis of the institutional foundations for economic growth. According to Solow, the key factor for growth is technical progress which, as a consequence of the stock of ideas and knowledge in society, counteracts decreasing yields from capital and determines real wages and per capita income; when nominal and real wages, as an important part of income, are established by institutions [44]. Based on the Solow [45] model, researchers have sought to expand the list of economic factors that may contribute to economic growth. A more recent, and as yet developing field, is the role of entrepreneurship. Jones [28] argues that 80% of US growth in the post-war period is due to the transition dynamics associated with increases in educational attainment or the increase in world R&D intensity. They seem to rise smoothly, generating an approximate stable growth path.

In any society, the dominant beliefs and basic values or culture [10,22], institutionalise forms of behaviour, ideas of technical and social progress, educational levels and normative frameworks which are either conducive to, or hinder, the stock of ideas and knowledge and technical and social progress; these behaviours and normative frameworks transfer to a society's aggregate production function, forming part of its total factor productivity, through different types of entrepreneurs or entrepreneurship [40,41], and their rootedness (or institutionalisation) in society [2,3,47].

Thus although the entrepreneurship literature and Jones and Solow's studies of economic growth use very different research procedures and methodology, there is necessarily a permeable frontier between them; and furthermore, institutional conditions

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that guide behaviour and establish normative frameworks are essential for producing one set of outcomes or another in the accumulation of ideas, innovation and growth in the countries examined (see Appendix A), as the technical progress function establishes (i. e. expressions (12) and (13) in the formulation). The independent term β_1 ($\beta_{1i} = \beta_1 + u_i$) in the technical progress function (13) reflects the dimension of culture and entrepreneurship in each country.

Some of the conclusions of this present study, apparently quite separate from the entrepreneurship literature, are nevertheless useful for institutional policies on entrepreneurs. One of these conclusions is that the domestic research effort in countries close to the technological frontier (represented by the United States) has positive, significant consequences for those countries, whereas for less advanced countries, greater benefit can come from importing goods which incorporate technical advances and foreign direct investment. A country's culture and entrepreneurs play an important role in both cases, because entrepreneurs discover opportunities [43] and also create them.

At a macroeconomic level, this article addresses the important question of the factors that determine living standards all over the world, that is, what determines per capita incomes and growth rates of economies over the long run?

From the outset the economic growth literature has shown theoretically and empirically, the predominance of the classical Solow's residual over factor accumulation (i.e. physical and human capital) in the explanation of growth. As a result, total factor productivity (TFP), which is mainly determined by technical progress, appears as the principal component in the description of countries' economic performances over time, and also seems to account for the bulk of the differences in income levels and growth rates.[3] In addition, the empirical literature suggests that technological diffusion matters, and therefore, countries with low initial levels of productivity can benefit from ideas created abroad. This idea is linked to the growing research interest in how organizational knowledge is generated, transferred and implemented [37]. We think that this knowledge is not simply the sum of all the stages and processes in each firm, the country where the company is located may also have an impact. Moreover, regarding organizational culture, Hofstede et al. [25] highlight that there is a significant difference between national culture and organizational culture, nevertheless, firms are embedded in societies defined by certain national culture values [10]. For this reason we think that the institutional context of a firm has become important once more.

Thus, the purpose of this paper is to provide evidence of patterns of total factor productivity growth (explicitly including TFP catch-up). With that aim we endogenize and estimate total factor productivity in the framework of an economic growth model. Subsequently, we decompose total factor productivity growth into catch-up and technical change to distinguish diffusion of technology and innovation respectively.

We apply our convergence model to a sample of OECD countries over the period 1965–2010. Each country is compared to the United States, which is considered to be the technology frontier.[4] We find differential behaviour in countries closer to the frontier with respect to countries with less developed technological knowledge.

The paper is organized as follows. First, in Section 1 we outline the growth model proposed by Jones, 'in which long-run growth is driven by the discovery of new ideas throughout the world' ([28], p. 221), which we use to compute total factor productivity. Then we briefly describe the background of the technical progress function evaluated here that incorporates catch-up with the technology frontier, assumed to be the United States, for our sample of industrialized countries. In Section 3 we proceed to the empirical verification of the technology frontier convergence model. Finally, in Section 4 we critically examine some of the assumptions and implications of the model, focusing on the role of human capital and stocks of ideas.

2. The growth model and entrepreneurship

There is a long-standing tradition of belief in the value of entrepreneurship as a factor in economic growth. Smith [42] recognized the role of profit-seeking entrepreneurs in expanding markets through the ever-increasing division of labour. Holcombe [26], following Kirzner [29], believes that entrepreneurship, once included in the standard neo-classical growth model fleshes out the process by which the factors of production interact to create economic growth.

From this point, the theory of economic growth distinguishing production growth is explained by an increase in the primary resources of capital and labour employed in production and the growth of total factor productivity. The theory of economic growth includes institutional, market and company internal factors that explain the differences in welfare between countries at any given moment in time [6,31,39,45]. The initial hypothesis in the economic theory of entrepreneurship is that the economy is endowed with certain factors. Entrepreneurship contributes to production through a combination of productive factors (capital and labour), and therefore more entrepreneurial resource allocation implies higher levels of production and well-being. Lazear [30] states that entrepreneurs are the single most important players in a modern economy and Henderson [24] claims that entrepreneurs create economic growth in their communities by forming new firms. To capture that role economic growth models have expanded to incorporate various measures of entrepreneurship.

Incorporating entrepreneurship into a model of economic growth makes it apparent that the engine of economic growth is entrepreneurship, not technological advance or investment in human capital per se and that doing so fills in the institutional details to help make the growth process more understandable [26].

Following Jones [28], the aggregate production function can be represented as

$$Y_t = A_t^{\sigma} K_t^{\alpha} H_{Yt}^{1-\alpha}, \quad (1)$$

where A_t is the total stock of knowledge available to this economy, K_t is the aggregate capital stock, and H_{Yt} is the total

[3] See for example; Hall and Jones [20] or Easterly and Levine [14].

[4] In this respect we have followed Fare et al. [16] who noted that: United States is the only country determining the frontier in the constant returns to scale version of technology.

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