Journal of Applied Economics. Vol XVII, No. 1 (May 2014), 1-30

SEMI-ENDOGENOUS VERSUS FULLY ENDOGENOUS GROWTH THEORY: A SECTORAL APPROACH

Sara Barcenilla-Visús, Carmen López-Pueyo, and Jaime Sanaú-Villarroya*
Universidad de Zaragoza

Submitted April 2012; accepted July 2013

This paper analyses the validity of second generation endogenous growth theories for six developed countries and ten manufacturing sectors over the period 1979-2001, applying modern tests and estimation procedures for the treatment of panel data. The basic autonomous innovation-driven model is extended to include international technology transfer and different measures of absorptive capacity. The estimates give great support to semi-endogenous growth theory. Furthermore, Schumpeterian or fully-endogenous growth theory has some support in the high impact of distance to the frontier variable which represents autonomous technology transfer.

JEL classification codes: C33, F14, F43, O32, O47
Key words: endogenous growth, total factor productivity, technical change, panel data

I. Introduction

The 1990s saw much development of theoretical models of economic growth. Most of them had one feature in common: the existence of productive inputs such as technology and human capital which, under the assumption of non-decreasing returns to scale, ensured long-term economic growth. The first generation endogenous growth models — Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992) — ensured that the sustained increase of these inputs

* Sara Barcenilla (corresponding autor): Departamento de Estructura Económica, Facultad de Economía y Empresa, Gran Vía 2, Zaragoza 50005, Spain; email sbarceni@unizar.es. Carmen López-Pueyo: email clopez@unizar.es. Jaime Sanaú-Villarroya: email jsanau@unizar.es. This research has been supported by the European Social Fund, the Government of Aragón and the University of Zaragoza (projects 269-102, 269-122 and 269-165). We would like to thank to Luciano Gutiérrez, Ana Angulo, Maria Isabel Ayuda and Monia Ben Kaabia for econometric help and to the anonymous referees for the helpful comments and suggestions.

should accelerate TFP and per capita output growth. This is the so-called "strong scale effect": the long-run rate of TFP growth and, hence, the long-run growth rate of per capita output were increasing functions of the growth of the knowledge stock which was, in turn, an increasing function of the scale of the economy, quantified by the level of population.

Two pieces of empirical evidence questioned the validity of the prevailing theoretical framework. Firstly, in two influential papers, Jones (1995a, 1995b) has shown a new empirical paradox by pointing out that, historically, TFP growth in developed economies and, particularly, in the United States, has remained constant, or even decreased, despite the continued increase in R&D expenditure and in the number of scientists and engineers. Secondly, and more recently, several empirical studies (see, for example, Stiroh and Botsch 2007) have shown that U.S. productivity underwent continuous acceleration at the start of the present century, even though investment in information and communication technology (ICT) had clearly been reduced.

What might be termed "Jones's paradox" led to the development of new theoretical approaches that introduced certain changes to the basic assumptions of the first generation endogenous growth models. Firstly, semi-endogenous growth theory, initially proposed by Jones himself (1995b), Kortum (1997) and Segerstrom (1998), presupposes the existence of decreasing returns to scale in the production of knowledge. Consequently, if a permanent acceleration in productivity is to be observed, a continued increase in population growth rate is required. The scale effect thus takes its weak form: TFP growth (and per capita output growth) is proportional to the growth rate of population, not to its level.

The development of semi-endogenous growth theory runs parallel with another research trend in the Schumpeterian framework, known as fully-endogenous growth theory, which appeared initially in the works of Aghion and Howitt (1998, chap.12), Dinopoulos and Thompson (1998) and Peretto (1998). They maintain the assumption of constant returns to scale in the knowledge-creation function, admitting, however, the existence of a sectoral differentiation process — horizontal and vertical — associated with economic growth which causes the effectiveness of the "R&D input" to be diluted among a larger number of sectors. Product differentiation prevents population size from having a scale effect on long-run growth, which was a characteristic of the first generation models. In addition, in the long run, constant returns to scale in the knowledge-creation function ensure that TFP growth depends on economic factors and economic policy measures. This establishes a crucial difference with respect to the semi-endogenous growth model, whose parameter restrictions eliminate policy impact on the long run growth rate.