Structural Change and Economic Dynamics 21 (2010) 165–180

Contents lists available at ScienceDirect

Structural Change and Economic Dynamics

journal homepage: www.elsevier.com/locate/sced

Determinants of TFP growth: A close look at industries driving the EU–US TFP gap☆

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ARTICLE INFO

Article history:
Received July 2009
Received in revised form February 2010
Accepted March 2010
Available online 30 March 2010

JEL classification:
D24
O47
O52

Keywords:
Growth determinants
Total factor productivity
European Union

ABSTRACT

This paper explores the determinants of the EU–US TFP growth gap using EU KLEMS. As found in previous analyses, TFP growth appears to be driven by catching-up phenomena associated with the gradual adoption of new technologies. TFP growth is also significantly driven by developments at the "technological frontier", especially since the mid-1990s. Industries with higher R&D expenditures and higher adoption rates for ICT-intensive technologies appear to exhibit higher TFP growth rates, whilst human capital has mostly a significant effect across countries. Regarding determinants in industries relevant for the different TFP performance of the EU versus the US, ICT-producing industries appear to benefit from R&D in terms of stronger spillovers from TFP gains at the frontier, network utilities are strongly affected by product market regulations, whilst the retail and wholesale trade industry is significantly influenced by consumption dynamics which permit a better exploitation of scale economies.

1. Introduction

Total factor productivity (TFP) is the main driver of growth in most mature economies, and understanding the determinants of TFP growth is essential in devising policies that help to enhance growth prospects. Most existing analyses aimed at analysing the determinants of TFP growth take either an aggregate perspective or make use of the overall available industry sample in panel data analysis. However, there is growing agreement that the bulk of TFP growth could be concentrated in a relatively narrow set of industries. This consideration appears especially relevant for the debate on the gap between the EU and the US in terms of productivity growth.

According to the prevailing view, the EU–US TFP growth gap is structural in nature, with the implication being that in the absence of a substantial policy turnaround, the EU could be condemned to a long period of relatively low TFP growth (e.g., Sapir et al., 2003; van Ark et al., 2003). This pessimistic assessment reflects the fact that the EU's current institutions and policy frameworks underpin its comparative advantage in medium-technology manufacturing industries, where the room for further substantial TFP growth appears limited.[1]

However, even if clearly evident in aggregate growth accounting measures, the EU–US TFP growth gap dif-

☆ This article was written by Kieran Mc Morrow, Werner Röger and Alessandro Turrini, European Commission, Belgium, European Commission and CEPR, Belgium © European Communities, 2010 The views expressed in this article are those of the author(s) and do not necessarily reflect the official position of the European Commission.

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[1] Conversely, some observers consider the EU–US productivity gap as being, at least partly, due to measurement problems and mostly temporary, in light of the lagged effects from the labour, capital and product market reforms progressively introduced in the EU since the early 1990s (e.g., Blanchard, 2004).

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doi:10.1016/j.strueco.2010.03.001

fers strongly across sectors and is actually concentrated in a handful of industries. Whilst the US advantage is highly concentrated in industries producing information and communication technology goods (ICT) and in a number of market services, notably retail trade services and business services, the EU exhibits stronger TFP growth in network utilities, notably telecommunications.

Since TFP determinants are likely to differ substantially across industries, this paper aims at identifying the TFP growth drivers in those industries that are key in explaining the divergent TFP performance of the EU relative to the US.

The analysis makes use of the EU KLEMS[2] database, an industry-level database funded by the European Commission and constructed by a consortium of European academic and government research institutes co-ordinated by the National Institute of Economic and Social Research (NIESR) in the UK and the Groningen Growth and Development Centre (GGDC) in the Netherlands. The database contains high-quality measures of factor inputs and has been conceived with the explicit purpose of carrying out growth analyses. In particular, it makes data available on different types of capital and, skills-differentiated, categories of labour. Compared with previous similar analyses using the EU KLEMS database (Inklaar et al., 2008), our sectoral focus is broader since it does not restrict itself to private services but also includes manufacturing. In addition, there is also an attempt to explore the role of a larger set of potential TFP determinants: human capital, R&D, ICT capital, product and factor market regulations, macroeconomic developments, and industry-level indicators of changes in firm demography.

The paper adopts a "neo-Schumpeterian" growth approach (e.g., Aghion and Howitt, 2006) to analyse TFP determinants: TFP growth depends on the rate of innovation and on the rate at which "state-of-the-art" technologies are adopted/diffused throughout the wider economy. Countries that are close to the technology frontier mainly grow via the introduction of new technologies, whilst the "follower" grouping of countries derive the largest share of their TFP growth from the adoption of better, but already existing, technologies which are available "at the frontier".

The empirical implementation is akin to that in, e.g., Nicoletti and Scarpetta (2003), Griffith et al. (2004), Inklaar et al. (2008). A reduced-form innovation-imitation model is estimated on a panel of 9 EU countries and the US and for 28 manufacturing and services industries over the 1980–2004 period. TFP growth is assumed to depend on two basic explanatory variables. First, a measure of the technology gap with the frontier economy, capturing imitation and later adoption of state-of-the-art technologies. This is a key explanatory factor tested in most existing analogous analyses. Second, TFP growth is regressed on a measure of TFP growth "at the frontier", the rationale being that countries may share in the innovations carried out in the frontier economy either because of independent innovations taking place or because of knowledge spillovers.

On top of these basic explanatory factors, a series of other variables are utilised to represent the framework conditions affecting the production of human capital, R&D, the adoption of ICT technology, and market regulations. They are used either to directly explain TFP growth or to measure the extent to which they indirectly influence the role of TFP growth at the frontier or of the technology gap term in driving TFP growth.

As found in previous analyses, TFP growth appears to be driven by catching-up phenomena associated with the gradual adoption of new-vintage technologies. In addition, our analysis shows that TFP growth is also significantly driven by developments taking place at the "technological frontier", and that these "frontier" effects are becoming stronger since the mid-1990s compared with the catching-up drivers of TFP. When country, sector and year fixed effects are kept in the empirical specification, human capital variables have no significant explanatory power on TFP growth. A role for human capital is restored by eliminating country effects from the specification and computing TFP growth without distinguishing the labour inputs of different skill groups. This result, broadly consistent with Inklaar et al. (2008), suggests that the contribution of human capital improvements to TFP growth is mostly related to (unmeasured) improvements in the quality of labour inputs, and manifests itself across countries. R&D and the adoption of ICT capital appear to play a significant direct role in TFP growth provided that industry effects are not included. This suggests that individual industries with higher R&D expenditures and higher adoption rates for ICT-intensive technologies exhibit higher TFP growth rates, whilst an "across the board" increase in R&D and ICT does not significantly affect TFP growth. Regarding industry-specific determinants, ICT-producing industries appear to benefit from R&D in terms of stronger spillovers from TFP gains at the frontier; network utilities are strongly affected by improvements associated with reduced product market regulations; whilst the retail industry is significantly influenced by consumption dynamics which permit a better exploitation of scale economies.

The remainder of the paper is organised as follows. Section 2 describes the data and provides a descriptive analysis of TFP growth patterns in the EU and the US. Section 3 presents the conceptual background and an overview of existing empirical work on TFP determinants at the industry level. Section 4 presents the results from the econometric analysis. Section 5 summarises the results and discusses policy implications.

2. Data and stylised facts

The following analysis uses the EU KLEMS database, released in 2007 and constructed by a consortium of EU academic and government research institutes (see O'Mahony and Timmer, 2009). The purpose of EU KLEMS is to analyse growth at the industry-level in advanced economies over recent decades. The value added of EU KLEMS is the improved quality and availability of information on the various inputs used in production. Gross output is decomposed into the contributions of intermediate inputs (i.e. energy, materials and services) as well as

[2] *K* for capital, *L* for labour, *E* for energy, *M* for materials, *S* for services.