ELSEVIER

Information Economics and Policy 12 (2000) 367–392

INFORMATION ECONOMICS AND POLICY

www.elsevier.nl/locate/econbase

R&D spillovers, information technology and telecommunications, and productivity in ASIA and the OECD

Gary Madden*, Scott J. Savage

Communications Economics Research Program, School of Economics and Finance, Curtin University of Technology, GPO Box U1987, Perth 6845, Australia

Abstract

This paper examines the role research and development (R&D) plays in technology progress for a sample of OECD and Asian economies from 1980 to 1995. An empirical model is estimated which relates total factor productivity to domestic and foreign R&D activity, trade, and information technology and telecommunications (ITT). Model estimates confirm a positive relationship between national productivity and R&D activity exists in the long run. Further, the benefits of R&D can spillover countries through trade, in particular, trade in ITT equipment.

Keywords: Information technology; R&D spillovers; Trade; Telecommunications; Total factor productivity

JEL Classification: O47; O50

1. Introduction

Endogenous growth models emphasise innovation and trade as vehicles for technological spillovers that permit developing countries to catch up to industrialised countries. The creation and accumulation of knowledge can improve sectoral and national productivity through the invention of intermediate goods (or by improving the quality of existing goods), which bring about the more effective use of existing resources (Grossman and Helpman, 1991). The role knowledge

* Corresponding author. Tel.: +61-89-266-4258; fax: +61-89-266-2391.
E-mail address: maddeng@cbs.curtin.edu.au (G. Madden).

0167-6245/00/$ – see front matter
PII: S0167-6245(00)00024-X

plays in technological progress has been the subject of much recent attention in the economic growth literature. Several studies find that the returns from investment in knowledge are positive, and they are greater than returns from investment in equipment, infrastructure and machinery (Griliches, 1988, 1994; Nadiri, 1993; Coe and Helpman, 1995). Further, Coe and Helpman (1995) argue that own knowledge enhances a country's ability to take advantage of innovation and technological advance elsewhere.

Coe and Helpman (1995) extend Grossman and Helpman's (1991) 'product variety' model of innovation to show that national productivity increases with the accumulation of both domestic and foreign knowledge (see also Bayoumi et al., 1996). Employing annual cross-section, time-series data for 21 OECD economies and Israel from 1971 to 1990, Coe and Helpman (1995) demonstrate a significant positive relationship between total factor productivity (TFP) and knowledge, approximated by research and development (R&D) capital stock, exists. Further, the benefits of R&D can also spread to (spillover) other countries through trade when measured by the share of aggregate imports to gross domestic product (GDP). The predicted convergence occurs only when knowledge spills over perfectly between countries. This finding has important implications for national trade liberalisation and economic integration policy. For instance, Feenstra (1996) shows that when knowledge spills over imperfectly between countries, small open economies may experience slower rates of economic growth rates after trade liberalisation and integration.

Application of the above findings to particular national circumstances is somewhat problematic as received empirical evidence usually relate to OECD economies and aggregate imports are nominated as the sole channel for the transmission of R&D spillovers internationally. Coe et al. (1997) extend their sample to 77 developing economies, and estimate an equation that relates TFP to foreign R&D capital, imports of machinery and equipment relative to GDP, and educational attainment.[1] This TFP equation does not include an argument for domestic R&D for developing countries since these data are scarce. Model estimates indicate that a 1% increase in the foreign R&D stocks of industrialised countries (in the 'North') raises output of the developing countries (in the 'South') by 0.06%.[2] However, the assumption of negligible domestic R&D in developing countries is unacceptable for some 'high income' Asian countries contained in

[1] To ensure that trade benefits domestic productivity, trade partners must provide products and information in which the domestic country is in short supply. By trading with an industrial country that has a larger 'stock of knowledge' a developing country stands to gain more in terms of both the products it can import and the direct knowledge it can acquire than it would by trading with another developing country (Coe et al., 1997).

[2] Coe et al. (1997) consider how the interaction of education attainment with foreign R&D affects productivity, and find the secondary school enrolment ratio has no significant effect on the marginal benefit of foreign R&D. Engelbrecht (1997a) finds that human capital has a positive impact on productivity only when it interacts with a productivity catch up variable.