Chapter 13
Technology Access and Research Prolificacy:
An Econometric Analysis

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ABSTRACT

Modern information and communication technologies enable research collaborations that were not conceivable a mere decade ago. Moreover, the diffusion of extant technologies (such as broadband, and cellular communication devices) more fully in both developing and developed nations has afforded more people access to key communications technologies, creating ever increasing networks and communities of researchers and collaborators. The current study seeks to more fully explicate the relationship between technology access, diffusion and research output. The study shall consider the impact of telecommunications tele-density, Broadband penetration, Computer access and ICT investment on research output and patent submissions. Both static and dynamic estimations are conducted, employing the Arellano & Bover systems estimator method. The findings suggest that telecommunications tele-density and ICT investment are key determinants of academic research output. They are however not significant determinants of patent submissions. These findings are robust for both static and dynamic estimations.

INTRODUCTION

Economic growth research represents amongst the most parsimonious inquiries for econometrics, given the interest in these and proximate matters. Theorists have considered the impacts of a number of key macroeconomic indicators on economic growth. Studies into these relations are as old as the discipline of economics itself. Increasingly research has considered the impact of ICT on economic activity. It is widely acknowledged that technology is a key driver of economic growth. The literature is replete with examples evidencing this set of relations. The relationship between telecommunications infrastructure and economic growth has been considered quite significantly in the extant literature, first by Jipp (1964), who posited the so called "Jipp curve" to define the underlying relationship. Therein, Jipp posited that

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tele-density increases the greater the level of GDP. Much of the recent research into ICT and economic growth contends that information and communications technologies reduce the cost of transacting and as such improve the output of individual firms, therein improving aggregate production (Roller & Waverman, 2001, Madden & Savage 1998, 2000). What of the impact of such technologies on other sources of growth, there is a genuine dearth of research dealing with these matters? The impact of communications technologies on the diffusion of information and pertinently 'basic research' is of unquestionable importance and let little is known about this set of relations.

It may be self evident to many that innovations, or more simply put 'ideas' are pertinent to economic growth. Ideas are said to improve the technology of production (Jones, 2002). New ideas enable the factors of production to produce increased or better quality outputs. Utility is increased as more is produced or what is produced is better than before. These qualities are clearly growth enabling. Romer (1990) posits a worthwhile analogy. He asserts that ancient man used iron oxide based pigments to paint and decorate the walls of the caves they inhabited. Modern man then used these same pigments to 'paint' onto magnetised tape essential for the recording of video footage. The methods associated with the 'massification' of production developed by the Ford Motor Company revolutionised the manufacturing sector in the United States and abroad. The ideas developed by Ford were adopted by competitor firms improving the efficiency of automotive production across the sector.

The literature is replete with examples of innovations and technological advancements deriving from other disciplines and discourses. Nobel laureates Black and Scholes developed a formula for the valuation of options, their 'idea', a contemporary explication to value the uncertainty associated with options contracts was so useful that it is the approach adopted and taught within most business schools around the world and generally accepted by Wall St. The formula itself was based on another 'idea'; it was based on a heat diffusion formula developed in the engineering discourse years earlier.

The transitive quality of ideas, in particular basic research and its set or relations with economic growth is well espoused by Romer (1986). Romer (1986) formalised the conditions, by which ideas lead to growth. Romer asserts that the essence of ideas is that they are non-rivalrous, and by virtue of being non-rivalrous that the 'good' offers increasing returns to scale. Grossman and Helpman (1990) purport accurately that knowledge is a public good (or perhaps more accurately stated a near public good, to the extent that it is unrestricted) in that several parties may benefit from it simultaneously at no extra costs. The work of Romer (1986) is pertinent, Romer has asserted that so called 'knowledge spillovers' may cause investment in knowledge sectors to exhibit non decreasing returns to scale. This enables the innovation process to be sustainable in the long run (Grossman & Helpman, 1990).

Grossman and Helpman (1990) assert that when investment takes place in an economic environment with increasing returns to scale the marginal product of capital need not decline over time to the level of discount rate. Grossman and Helpman (1990) consider the role of Research and development asserting that it is a process essential to the knowledge generation process and consistent with Romer (1986).

As such ideas are profoundly different to other goods and services. Indeed the use of the manufacturing line by Ford did not preclude the use of a similar technique by competitor entities, nor did the application of six sigma methodology by GE preclude the use of similar managerial logic within other enterprises. While certain ideas can be made excludable, via patent and copyright legislation, this paper focuses on basic scientific research. This category of research is readily disseminated, with access relatively unrestricted. Basic research proffered in academic journals and periodicals provides other scholars and practitioners access to new ideas.