



# Intangible capital and growth in the ‘new economy’: Implications of a multi-sector endogenous growth model



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## ABSTRACT

The high-technology, knowledge-based ‘new economy’ has contributed greatly to economic growth in recent years. The ‘new economy’ is underpinned by intangible capital and specialised business services. However, despite prevalent empirical evidence, theoretical appreciations of this structural change are sparse. This paper addresses the lacuna by examining the impact of intangible capital on economic growth. It extends the Uzawa–Lucas framework by incorporating a specific production sector for intangible capital and endogenises the human capital effort devoted to intangible capital production. The model provides a novel approach to the analysis of the ‘new economy’ and the impact of business services on growth. The model reveals that expansion of the intangible capital sector may enhance growth by drawing human capital from the other sectors. This possibility is especially relevant for countries where physical capital is relatively scarce. This has significant policy implications for developed as well as emerging economies.

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## 1. Introduction

Modern economies have seen major improvements in living standards and output due to the growth of technology. Rapid technological changes set in motion following the Industrial Revolution have continued into the recent explosion in technological innovation. These technological advancements have been spearheaded by the evolution of the IT-driven ‘new economy’. There has been considerable interest in explaining and gauging the growth impact of the ‘new economy’. The ‘new economy’ generally refers to high-technology, knowledge-based industries, especially those that are closely associated with the production and usage of information technology. Industries that produce

IT hardware and software clearly fall within this category. Services like finance, insurance and management consultancy, and knowledge-intensive sectors like biotechnology, that use information technology extensively are also regarded as a part of the ‘new economy’. Intangible capital is composed of assets that are not associated with the physical stock of fixed assets but help in generating profits. This includes human capital, innovation capabilities and organisational capital (Baddeley, 2003). The ‘new economy’ is characterised by its substantial use of intangible assets (Nakamura, 1999; Bond and Cummins, 2000). Therefore, any analysis of the production process after the advent of the ‘new economy’ needs to focus on both tangible and intangible capital.

Drawing upon advances in measurement strategies for intangible capital, there is now a large body of empirical work capturing the investment and growth aspects of intangible capital in the context of the emergence of the ‘new economy’. These exist in the form of cross-country analysis (Ferreira and Hamilton, 2010), as well as

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research for specific economies and sectors including the US (Corrado et al., 2005, 2009), Japan (Fukao et al., 2009), Europe (Piekkola, 2011), Australia (Barnes, 2010), and India (De and Dutta, 2007). Policy interest in the matter is also strong. The OECD has initiated a project to focus on intangible assets as a source of growth (OECD, 2010). A World Bank study for 115 countries over the years 1995, 2000 and 2005, concludes that the shares of produced, natural and intangible capital are of 32%, 7% and 18%, respectively, in production across the sample and also for developing countries. But for OECD countries intangible capital is the only statistically significant factor with a share of around 50% (Ferreira and Hamilton, 2010). The focus on 'new economy' industries has crucial policy implications for developed as well as emerging economies. For instance, between the financial years 2000–2001 and 2005–2006, services, including emerging areas like finance, insurance, telecommunications and IT, had an approximate share of 52 per cent of India's GDP. More remarkably services contributed to 65% of GDP growth (Ministry of Finance, 2006). Stylised business cycle and structural change aspects of the Indian economy also show the increasing impact of services (Ghate et al., 2013). There is evidence that intangible capital plays a crucial role in the productive process of the IT industry in India and also influences stock market valuations of Indian IT companies (De and Dutta, 2007; De, 2009). Therefore, it is evident that intangible capital plays a crucial role in fostering growth in developed as well as emerging economies though its intensity and usage across sectors may vary. Hence, understanding the dynamics of the high-technology services sector is critical for framing policy initiatives directed at sustaining and accelerating economic growth.

However, despite this empirical validation of the existence and growth implications of intangible capital, there are very few theoretical attempts to explore this structural change in the light of its impact on the growth process. This research is motivated by the need to address this lacuna and develop an adequate theoretical appreciation of the role of the 'new economy' in enhancing economic growth. Most of the existing research examines the role of IT in the productivity of conventional sectors or its direct effect on economic growth (Jorgenson and Stiroh, 2000). Little has been done to identify the mechanisms underlying the process. In particular, to the best of the author's knowledge, the existence of a separate production sector for intangible capital has not been conceptualised in an endogenous growth model.

This paper endeavours to bridge this gap by placing the 'new economy' phenomenon and intangible capital accumulation within an endogenous growth framework. In doing so, the role of certain business services, like management consultancies and advertising agencies, contributing to intangible asset creation as suggested in the existing literature, is placed in a distinct theoretical setting. In that respect the approach adopted in this paper is novel. The framework developed herein extends the Uzawa–Lucas model by incorporating a distinct intangible capital production sector and including intangible capital as a separate input for the production of final goods. To capture the altered production structure, the model

not only adds an additional input and an additional production sector, but also endogenises the human capital effort devoted to intangible capital accumulation. Furthermore, resulting dynamics exhibit significant variations from the Uzawa–Lucas model. At the same time, the model provides a theoretical explanation for the rapid growth accompanying the advent of the 'new economy'. It indicates that besides human capital, intangible capital may be contributing to the growth process. Therefore, the twin forces of human capital and intangible capital overcome the diminishing returns to physical capital. The model shows that expansion of the intangible capital sector may enhance growth, although not permanently, by drawing human investment from the other sectors. This possibility is especially relevant for countries where physical capital is relatively scarce.

The paper is organised into five sections. Following this introductory part, Section 2 provides the basis of the theoretical approach and develops it. Section 3 analyses the model in terms of its equilibrium and stability characteristics. Section 4 examines the dynamics of the model and Section 5 concludes.

## 2. Modelling the impact of intangible capital on growth

This section analyses the 'new economy' process of production and growth with intangible capital as a distinct production input. A theoretical model is developed to motivate the analysis and characterise the possible effects of intangible capital as a distinct input. The importance of intangible capital in the 'new economy' arises from the widespread evidence that organisations do not adopt IT and other knowledge-based production techniques in a structural vacuum. Rather, 'new economy' production techniques are incorporated with significant organisational, structural and human resource adjustments (Bresnahan et al., 2002; Brynjolfsson et al., 2002; Brynjolfsson and Hitt, 2003; Cummins, 2005). These changes result in a situation where the organisation makes substantial expenditures in creating organisational architectures, knowledge management techniques, process methodologies and human resource practices. These organisational innovations can be regarded as investments in creating intangible assets. The nature of this asset as a form of capital is clarified by the notion that any expenditure that leads to the generation of future revenue capabilities should be classified as a capital expense (Nakamura, 1999; Corrado et al., 2005).

Intangible capital refers to means of production and value addition, which do not have physical existence but nevertheless contribute to output and productivity. Such assets are broadly classified into information technology assets, innovation assets and economic capabilities (Corrado et al., 2005). The main feature of intangible capital that differentiates it from physical capital is its non-physical nature. It is analogous to the distinction between software and hardware. In fact, computer software is an intangible asset while hardware is physical capital. Intangible capital is also distinct from human capital; the knowledge, skills, capabilities and other invisible

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