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Internet usage, electricity consumption and economic growth in Australia: A time series evidence

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ABSTRACT

This study estimates the short- and long-run effects of the Internet usage and economic growth on electricity consumption using annual time series macro data for Australia for the period 1985–2012. ARDL bounds test for cointegration and Granger causality test for causal link are applied. Results from ARDL estimates indicate that the Internet use and economic growth stimulate electricity consumption in Australia. Internet usage and economic growth have no significant short-run relationship with electricity consumption. Multivariate Granger causality test confirms unidirectional causal link running from Internet usage to economic growth and electricity consumption. The findings are robust across different econometric specifications. The findings imply that Australia is yet to achieve electricity efficiency gains from ICT expansion and that it may pursue energy conservation policy without any adverse effect on its economy. Australia needs to promote its existing carbon capture and storage facilities, significantly boost investment in the renewable energy sector, in particular, in solar energy and build nuclear power plants for electricity generation to reduce CO_2 emissions. Also promoting green IT and IT for green might be potential means to curb environmental damage from Internet usage. A coordination between ICT policy, energy policy and growth policy is also recommended.

1. Introduction

Information and communication technologies (ICTs) have a wide array of effects on key global systems (Moyer and Hughes, 2012). The rapid use and expansion of these technologies have proved to contribute towards increasing productivity, boosting economic growth (Shahiduzzaman and Alam, 2014a,b) and reducing energy intensity (Moyer and Hughes, 2012). As such, the study on environmental impacts of ICT has drawn special attention since the early 1990s. Ever since, the studies investigating the energy impacts of ICTs have been profoundly researched in a macro framework. Although the rapid expansion of ICT usage is believed to improve productivity and energy efficiency, there is no consensus as yet on its effect on the environment. Some of the studies support the positive role of ICT in mitigating greenhouse gas emissions while others conclude that ICT use exerts pressure on energy use (Moyer and Hughes, 2012) hence leading to an increase in electricity consumption – one of the key sources of global CO_2 emissions (Hamdi et al., 2014).

Since 1970s, there was a general interest in how to reduce energy consumption and CO_2 emissions in economies through the expansion of ICTs. Schumpeter (1934, cited in Walker, 1985) coined the idea that it was possible to reduce energy

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demand while allowing the economy to grow by the expansion of ICTs that potentially contribute towards energy saving gains. The widespread expansion of ICTs has caused dramatic rise in the demand for electricity in the last two decades. ICT related electricity consumption has increased significantly both in the workplaces and households (IEA, 2009). The combined electricity consumption related to ICT equipments such as communication networks, personal computers and data centers is growing at a rate of nearly 7% per year (i.e., doubling every 10 years). The relative share of these ICT products and services in the global electricity consumption has increased from about 3.9% in 2007 to 4.6% in 2012 (Heddeghem et al., 2014).

A significant percentage of domestic electricity consumption in Europe is linked to the use of ICT products and services (Faucheux and Nicolai, 2011). According to some estimates (Greenpeace International, 2014), ICT industry is responsible for 2% of global CO_2 emissions. Because all ICT products need electricity to operate, rapid expansion of ICT use leads to increasing demand for electricity threatening environmental sustainability through greenhouse gas emissions and Australia is no exception. But if energy efficiency could be achieved leading to energy saving gains, the positive effect of energy efficiency might outweigh the negative effect of increased electricity consumption.

Since the mid-1990s, the Internet usage has been increasing at a rapid speed in Australia (Fig. 1). An overwhelming majority of Australians are using the Internet. In 2011, 87% of the Australians had used the Internet up from 81% in 2009 and 73% in 2007. The vast majority of household connections are now through broadband (96%) while the proportion of Australians accessing the Internet through a mobile device more than doubled between 2009 and 2011 from 15% to 37% (Ewing and Julian, 2012). It is claimed that the Internet has been transforming the Australian economy for the last 10 years (Bowles, 2012; Deloitte Access Economics, 2011) and is anticipated to play even more significant role in the future as it looks forward to becoming a leading digital economy. In 2010, the direct contribution of the Internet to the Australian economy was AUS$ 50 billion or 3.6% of its Gross Domestic Product (GDP). The contribution of the Internet to the economy will further increase and is projected to be around AUS$ 70 billion by 2015 (Deloitte Access Economics, 2011). Not only these numeric figures reflect the Internet's recent role in Australian economy in growth and productivity, two most recent empirical studies (Shahiduzzaman and Alam, 2014a,b) support the persistent positive role of ICT capital in boosting its economic growth and productivity.

Nevertheless, in its bid to be a leading digital economy, Australia has been undergoing the construction of the largest ever broadband rollout project, the National broadband network (NBN) with a view to expanding high speed internet (broadband) to the regional and remote areas of the country. One of the key objectives of the NBN is to narrow the digital divide in the country (Lee, 2011) which is believed to be in the danger of widening (Bowles, 2012). While the NBN rollout is justified and is consistent with Australia's move to be a leading digital economy, the benefits reaped from the massive expansion of the broadband infrastructure is not expected to be without opportunity cost. In other words, the future energy impacts of this expansion cannot be ruled out. Australia is one of the top CO_2 emitters in the world alongside USA, Canada, Germany, the UK, Saudi Arabia and Qatar on a per capita basis (Shafiei and Salim, 2014). The same authors argue that 90% of the power generation in Australia is still sourced from non-renewable fossil fuels such as coal, gas and oil. As a result, there has been a sharp increase in CO_2 emissions. Nevertheless, the rapid expansion of ICT use in the region is likely to have significant energy impacts as ICT products and services cannot be operated without electricity.

Energy is largely sourced from electricity in Australia (Salahuddin and Khan, 2013) and it is one of the major industries of the country. Electricity generation is the single largest contributor to greenhouse gas (GHG) emissions producing 38% of total emissions in Australia and 90% of electricity was generated from the burning of fossil fuels dominated by coals, gas and oil in 2012 (Asafu-Adjaye and Mahadevan, 2013). Coal provided 68% of Australia's electricity needs in 2012. Per capita electricity consumption has been steadily rising in Australia for most of the period during the last four decades (Fig. 2). Although energy

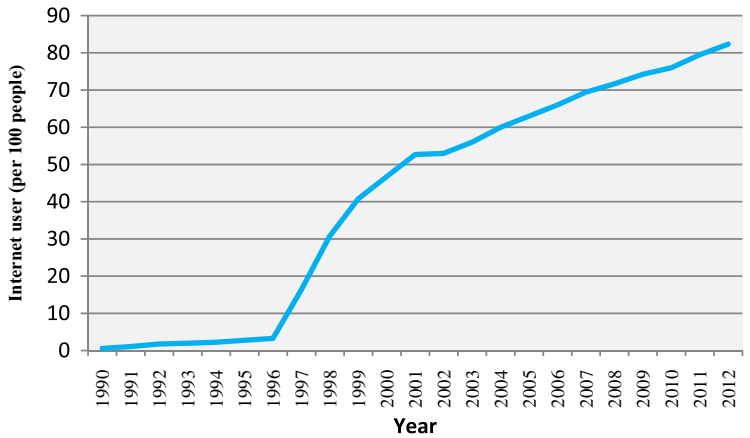

Fig. 1. Trend in the number of Internet users per hundred people (%) in Australia during 1990–2012. *Source:* World Development Indicators Database, The World Bank (2013).