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Social Capital Formation, Internet Usage and Economic Growth in Australia: Evidence from Time Series Data

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ABSTRACT

This study estimates the short- and long-run effects of social capital and internet usage on economic growth using annual time series macro-data for Australia for the period of 1985-2013. Dickey-Fuller generalized least squares unit root and Zivot and Andrew structural break tests are conducted to assess the stationarity of all the series. Hansen-Gregory and autoregressive distributed lag (ARDL) bounds tests confirm a cointegrating relationship among the variables. ARDL estimates indicate a significant long-run positive relationship between economic growth and internet usage. No significant relationship is found between economic growth and social capital in both the short- and the long-run. However, the interaction term of internet usage and social capital has a significant positive association with economic growth both in the short- and long-run. The short-run relationship between economic growth and internet usage is insignificant. A bidirectional causal link exists between internet usage and economic growth and between the interaction variable and economic growth. Unidirectional causality runs from internet usage to the interaction variable. No causal relation is found between social capital and economic growth. The findings are also supported by applications of a different econometric method, namely dynamic ordinary least squares estimation. The positive interaction effect of internet use and social capital on economic growth supports the recently raised view that Australia should take into account social capital formation in its digital divide policy.

Keywords: Autoregressive Distributed Lag, Australia, Economic Growth, Social Capital, Granger Causality, Internet Usage
JEL Classifications: F10, N13, O10, P10

1. INTRODUCTION

Most studies of determinants of economic growth focus on factors such as the stock of physical and/or human capital, technological capacity and innovation, the management skills of the leaders in the business and state sectors, and trade liberalization of domestic and international markets. But less attention is paid to the important role of social factors such as culture, social norms and cohesion in promoting economic growth. This study addresses this issue by examining the effect of the use of the internet on social capital and the consequences of this effect for economic growth. Therefore, the variables of interest in this study are social capital proxied by trust, the use of internet and an interaction term between social capital and internet usage.

The term "social capital" was first coined by L. J. Hanifan (Putnam 2000, p.443) who highlighted the importance of the social structure of the people within the spheres of business and economics. The concept was later popularized by Bourdieu (1980; 1986), Coleman (1988, 1990) and Putnam et al. (1993), Putnam (1995; 2000). Coleman (1990) defines social capital as "... social organization that constitutes social capital, facilitating the achievement of goals that could not be achieved in its absence or could be achieved only at a higher cost." In their seminal work, Making Democracy Work, Putnam et al. (1993) define social capital "as the collective values of all social networks and the inclinations that arise from these networks to do things for each other." Also he views social capital as encompassing features such as trust, social norms and networks that can improve the efficiency of the organization of society by facilitating coordinated actions. Given this point of view, Putnam et al. (1993) use indices of civil society and political participation to measure the stock of social capital. The World Bank adopted a similar definition of social capital. It defines social capital as "the norms and networks that enable collective action. It refers to the institutions, relationships and norms that shape the quality and quantity of a society's social interactions."

However, the nature of the empirical literature on the measurement of social capital is very broad. Studies which have emerged vary substantially in their methods and data collection for measuring social capital. One of the most recent studies (Righi, 2013) claims that three main attributes of social capital which should be measured are generalized trust, the intensity of the associative links, and civic and political participation expressed in various ways. Nevertheless, so far, the indicators used in literature on social capital are often trust and associational activities. A recent meta-analysis study (Westlund and Adam, 2010) covering 65 studies on social capital conclude that trust is the most widely used measure of social capital.

Australia has experienced spectacular growth in internet usage during the last two decades (Figure 1), and this has significantly transformed the Australian economy (Deloitte Access Economics, 2011).

Figure 2 shows the logarithmic trend in real gross domestic product (GDP) per capita of Australia during the period 1985-2012 which shows a steadily rising trend.

Recent literatures suggest that the internet also has the potential to generate social capital in Australia (Notley and Foth, 2008) but no research has been completed to measure that effect. The aim of this article is to address this shortcoming. It assesses the empirical relationship between social capital, internet usage and economic growth in the context of Australia. It is also expected that higher levels of Internet use would lead to denser social networks resulting in increased level of trust and higher levels of trust would also cause a rise in the use of internet. In view of this potential of the internet to generate social capital, an interaction variable is introduced between internet usage and the generation of trust. Thus, our model circumvents the omission bias present in previous growth models. The current study represents the first empirical investigation of this issue in Australian context. The findings of the study have important policy implications for Australia and are probably relevant to other economies.

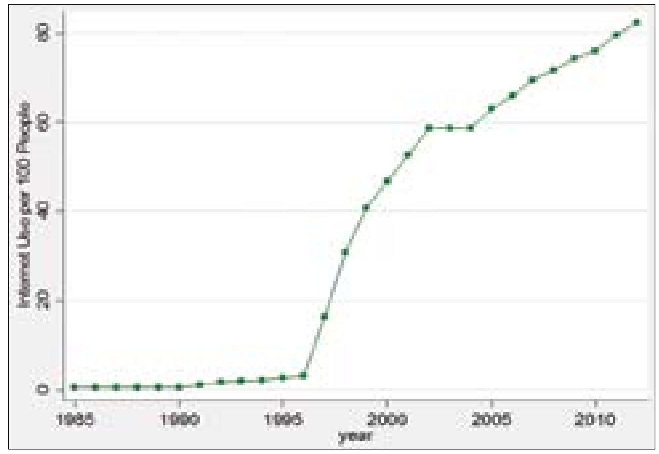
The rest of the paper is structured as follows: Section 2 provides a relevant literature review, and the methodology used in this empirical analysis is presented in Section 3. Section 4 reports the empirical estimated results and the conclusions and policy implications of the research are given and discussed in Section 5.

2. LITERATURE REVIEW

2.1. Social Capital and Economic Growth

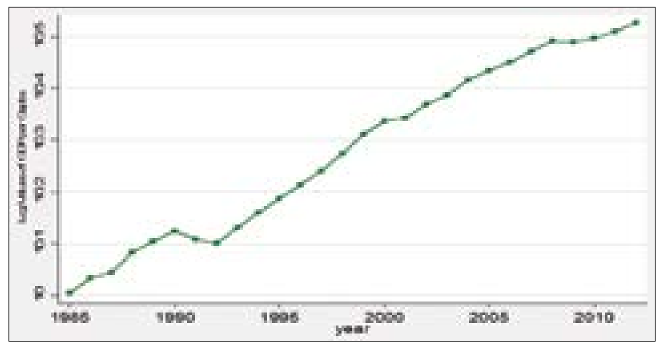
Economists have shown increasing interest in the role of social capital in boosting economic development. Building on the pioneering works of Kormendi and Meguire (1985), Baumol (1986), Grier and Tullock (1989), Barro (1991) and Mankiw et al. (1992), growth empirics have increasingly focused on the roles of institutions and culture in influencing economic performance. Despite criticisms and difficulties in its measurement, social capital

Figure 1: Number of internet users per 100 people (%) in Australia during 1985-2012



Source 1: The World Data Bank, World Development Indicators Database, The World Bank (2013)

Figure 2: Logarithmic trend in per capita real gross domestic product of Australia during the period 1985-2012



Source 2: The World Data Bank, World Development Indicators Database, The World Bank (2013)

has been successfully introduced into the modeling of economic development in the last decade as an important contributor to economic growth. Putnam et al. (1993), in an influential study investigating the relationship between social capital and economic development in Italian regions, found that differences in social capital contribute significantly to regional differences in economic and institutional performance in Italy. They argued that countries/regions with higher stocks of social capital can be expected to experience higher levels of economic growth than countries having lower levels of social capital. This argument was supported by several other studies (Brown and Ashman, 1996; Krishna and Uphoff, 1999; Ostrom, 2000; Uphoff, 2000; Rose, 2000). Also Fukuyama (1995a; 1995b) found social capital to be an important factor in explaining economic success.

Temple and Johnson (1998) showed that increase in trustful interactions leads to increased trust. This can be an important factor in reducing transaction costs (especially market transaction costs) and as a result, increasing economic welfare and productivity, as shown in Tisdell (2009). Consequently, generalized trust could be treated as a productivity-enhancing input in the production function (Crudelia, 2006). Several other studies (Bertrand et al., 2000; Sobel 2002; Miguel, 2003; Tau, 2003; Temple and Johnson, 1998 etc.) also investigated the contributions of social capital to economic growth.

Using two indicators of social capital (trust and civic norms), Knack and Keefer (1997) examined the relationship between social capital and economic performances for a sample of 29 market economies. They found that social capital plays stronger role in countries with higher and more equal incomes, with higher levels of education and more homogeneous population. Knack and Keefer further argued that countries with higher trust also have better institutions. Zak and Knack (2001), relying on a cross section of 41 countries, regressed economic growth on both levels of interpersonal trust and institutional strength. They found that interpersonal trust has a positive significant effect on economic growth holding formal institutions constant. Beugelsdijk et al. (2004) found that the results of Zak and Knack (2001) were robust even when some institutional factors (such as religion and political instability) had been controlled for. Many other studies have found positive relationship between social capital (measured by trust) and economic growth (for example, La Porta et al., 1999; Whiteley, 2000; Dincer and Uslendar, 2007; Algan and Cahuc, 2010; Sangnier, 2010).

Beugelsdijk and Schaik (2005) in a study in 54 European regions presented evidence that variations in social capital explain growth differentials in these regions, especially when they used the extent of associational activity adopted as an indicator of the amount of social capital. They also concluded that it is not the number of network relationships that spur economic growth in the regions but the intensity of the engagements in these relationships. Tabellini (2006) used an instrumental variables approach to assess the impact of interpersonal trust on growth in European regions and found a positive association between them. Dinda (2008) estimated a one-sector growth model using data for 63 countries and found that social capital by developing human capital positively affects the equilibrium growth rate.

Ahlerup et al. (2009) used an empirical cross-country growth regression to examine the effects of interpersonal trust and institutional strength on economic growth and found that interpersonal trust has positive effect on economic growth but the magnitude of this effect diminishes with higher levels of institutional strength. Akcomak and Weel (2009) investigated the empirical association between social capital, innovation and per capita income growth in 102 European regions in the period 1990-2002. They found that social capital contributes to economic growth by fostering innovation but does not directly increase per capita income growth.

Most studies investigating the relationship between trust and economic growth argue that greater trust contributes to economic growth in two ways. First, increased trust between individuals and organizations can improve economic management by the authorities by increasing social cohesion. Second, greater trust may result in heightened empathy. This encourages individuals to behave reliably with other agents. In turn, this results in an increased number of mutually beneficial trades, reduced monetary and transactions costs, greater collective action and improved information flows that eventually spur economic activities and improve economic performance. Thus, most empirical studies have found robust positive relationship between trust and economic growth. However, Roth (2009) found negative relationship between trust and growth while Raiser (2008) found no relationship between these variables.

From the above review, it is evident that although the literature investigating the growth and other macroeconomic effects of trust has been evolving quickly, such study is absent in Australian context. The current study is an attempt to fill in this gap.

2.2. Internet and the Economy

Literature investigating the direct effects of the internet on economic activity is very scarce despite the internet's growing role in every aspect of the economy. In one of the earliest studies on the economic effects of the internet, Frehund and Weinhold (2002) investigated the effect of the internet on the service trade and found a positive significant relationship between them. Choi (2003) studied the effect of the internet on inward foreign direct investment (FDI) using data for a panel of 14 source countries and 53 host countries. The study applied cross country regression on a gravity FDI equation. The findings of this study indicated that a 10% increase in the number of internet users in a host country raised FDI inflows by 2%.

Frehund and Weinhold in another study (2004) argued that the internet has a positive effect on bilateral trade. Running both time series and cross section regressions on a sample of 53 countries, they found that the internet stimulates trade. They also concluded that the internet reduces market-specific fixed costs which contribute towards export growth.

Choi and Yi (2005) investigated the effects of the internet on inflation. They employed pooled ordinary least squares (OLS) and random effects models using data for the period for a panel of 207 countries. Their results showed that a 1% increase in the number of the internet users led to a 0.42% drop in inflation. Noh and Yoo (2008) tested the empirical relationship among the internet adoption, income inequality and economic growth. They used a panel of 60 countries for the period 1995-2002. They found that the internet effect on economic growth is negative for countries with high income inequality. The findings were attributed to the presence of digital divide in these countries as digital divide hampers economic growth effect of the internet.

Choi and Yi (2009) used data for a panel of 207 countries for the period 1991-2000 to examine the impact of the internet on economic growth while controlling for some macro-variables namely the investment ratio, government consumption ratio and inflation. They used a number of panel econometric techniques such as pooled OLS, individual random effects, individual fixed effects, time-fixed effects, individual random and time fixed model and finally panel generalized method of moments (GMM) to control for endogeneity among the explanatory variables. Their findings supported the view that internet has a significant positive role in spurring economic growth. Choi (2010) estimated the effect of the internet on service trade using panel data for 151 countries for the period 1990-2006. Pooled OLS, fixed effects model and panel GMM were employed for estimation of the data, and a significant positive relationship was found between the number of the internet users and total service trade. It was concluded that a 10% increase in the number of the internet users prompted an increase in service trade of between 0.23% and 0.42%.

Lio et al. (2011) investigated the effects of internet adoption on reducing corruption using a panel of 70 countries for the period 1998-2005. They first of all, conducted a Granger causality test to assess the causal direction of the relationship. Having found the causal link, they further applied dynamic panel data models (DPD) to estimate the relationship between variables while addressing the endogeneity problem. The empirical results indicated that the internet played a significant role in reducing corruption.

Goel et al. (2012) used the internet as an indicator of corruption awareness. He found that there is negative relationship of the internet hits about corruption awareness with corruption perception and corruption incidence. Elgin (2013) used a panel data of 152 countries for the period 1999-2007 to investigate the effects of the internet on the size of the shadow economy. The study used cross country regressions and found that the association between the internet usage and the shadow economy strongly interacts with GDP per capita (GDPC). The study further highlighted two opposing effects of the internet usage - the increasing productivity effect reducing the size of the shadow economy and the increasing tax evasion effect increasing the size of the shadow economy. The results were robust across different econometric specifications.

Choi et al. (2014) investigated the determinants of international financial transactions using cross country panel data for bilateral portfolio flows between the USA and 38 other countries for the period 1990-2008. The study estimated the effect of the internet on the cross border portfolio flows into the USA from the other countries in the panel. They employed a gravity model and found that the internet reduces information asymmetry and thus increases cross border portfolio flows. The results were found to be robust across different empirical models. Najarzadeh et al. (2014) used DPD of 108 countries for the period 1995-2010. They employed various econometric techniques such as pooled OLS, fixed effect and 2-step GMM techniques to assess the effects of the internet on labor productivity. Their findings indicated a positive and significant contribution of the internet to stimulate labor productivity in these countries.

Gruber et al. (2014) estimated the returns from broadband infrastructure for the period 2005-2011 and also assessed the cost of broadband roll out under different assumptions of technical performance. Their findings contrasted with the forecasted benefits from the expansion of broadband coverage. However, the study also found that the future benefits to be reaped from a broadband roll out project outweigh the investment involved therein for the highest performance technologies. The study recommended public subsidies to promote building high- speed broadband infrastructure.

Czernich (2014) examined the relationship between broadband internet and unemployment rate using data of various municipalities of Germany. Simple OLS regression indicated a negative relationship between broadband internet and unemployment while such an association between these variables could not be confirmed with the introduction of an instrument variable in the same study.

Lechman and Marszk (2015) examined the relationship between ICT penetration and exchange traded funds (ETF) for Japan, Mexico, South Korea and the United States over the period 2002-2012 using two core indicators of ICT, "number of internet users per 100 people" and "Fixed Broadband internet subscriptions per 100 people." Using logistic growth models to analyses the data, the study found a positive, strong and significant relationship between ICT penetration and ETF.

From the above discussion, it is evident that all the empirical studies on the economic effects of the internet dealt with only panel data. Hence, to the best of our knowledge, studies involving time series data are almost absent. The current study is believed to be a good contribution in internet-growth time series literature.

2.3. Internet and Social Capital in Australian Context

Recent data confirm that the residents of rural and remote areas in Australia are socially disadvantaged compared to their urban counterparts (ABS, 2013). It has been argued that increased social inclusion through greater social interaction at the community level could play a vital role to narrow digital divide between regions (Broadbent and Papadopoulos, 2013). Charleson (2013) suggested that enhancing empowerment and social capital by greater use of the internet network for those already burdened with disadvantage and marginalization is a potential means to narrow the current digital divide in Australia.

Internet use increasingly enhances the opportunities for social support and it has the potential to generate social capital.

The internet can help to build citizen trust through online civic engagement (Warren et al., 2014). The ability to do so however, depends on the nature of the social obligations, connections, and networks available to individuals'. Internet usage generates social capital by developing networks of relationships between different people and different communities (Lippert and Spagnolo, 2011). The internet has emerged as the key facilitator of social networks in modern times.

In Australia, successful digital divide policy must include a social capital framework in its agenda to ensure the digital inclusion of the disadvantaged people in rural and regional areas and elsewhere (Notley and Foth, 2008). Internet users have reported increasing positive impacts of their internet use in areas such as hobbies and interests, shopping, work, employment and health care information (Doong and Ho, 2012). There has been significant increase in the use of various social network sites which affect our social, political and economic lives (Ferreira-Lopez et al., 2012). It was suggested (Shim, 2013) that online social network services supported by rural ICT policy should take into account social capital.

A few earlier studies addressed the potential of internet to generate social capital in Australia but only to a limited extent. Such studies (Meredyth et al. 2004; Hopkins, 2005; Fernback 2005; Foth and Podkalicka, 2007) have concluded that ICT use can have a positive impact on an individual's social inclusion and on a community's collective social capital. However, most of these studies were descriptive and are dated in their policy relevance. Selwyn and Facer (2007) argued that ICT lies at the heart of most of the activities that are seen to constitute "social inclusion" - from playing an active role in one's neighborhood and community to maintaining one's personal finances.

Simpson (2005) emphasized the interplay between physical infrastructure, soft technologies and social capital for successful implementation, widespread uptake, greater social inclusion and the sustainability of ICT initiatives. DiMaggio and Hargittai (2001) argued that internet builds social capital by enhancing the effectiveness of community-level voluntary associations. Servon (2002) perceived technology as a tool of inclusion or exclusion. She notes that technology includes certain classes of people while excluding others. The observation of Servon is important in relation to the digital divide between residents of rural and remote areas of Australia and their urban counterparts. There is evidence that the former because of age, educational achievement and so on are relatively lacking in skills to utilize the internet compared to the latter. One associated problem is that it is easier and less costly to enhance the internet skills of those residing in urban areas than in rural and remote areas. Therefore, even with high speed internet access the former may be disadvantaged in accumulating social capital and locked out of networking with those who are relatively skilled in using internet.

These findings lead to consideration of what is known as "network society thesis" (Barney, 2004; Castells, 2000). The central idea of 'network society thesis' is that contemporary social, political and economic practices, institutions and relationships are organized through and around network structures. The "network society thesis" is a useful tool for understanding new forms of internet use because it connects with and then extends the concept of the information society. The arrival of the internet technology resulted in a significant expansion of network communication (Wellman, 2001; Castells, 2001).

There are both positive and negative effects of a network society (Barney, 2004). However, the internet in a developed society like Australia shapes the necessary infrastructure of everyday life (Deloitte Access Economics, 2011). It is within the "network society thesis" framework that social inclusion and social capital offer policy frameworks through which the current digital divide could be bridged by addressing the online needs of specific disadvantaged groups and ensuring that all citizens with online opportunities are able to participate in the formation of social, cultural and economic capital.

There are at least three reasons to suspect that web-mediated social participation can work as an effective strategy to protect the relational sphere of individuals' lives from the pressure of time (Antoci et al., 2012). First, it is less exposed to the deterioration of the social environment that physically surrounds individuals. Second, it is less time-consuming than face-to-face interaction and thus saves time for social participation. Third, online interactions contribute to the accumulation of internet social capital. A salient feature of this capital is that it allows asynchronous social interactions; one can benefit from another's participation through the act of communicating a message or posting a photo even when the person who did this is offline. Internet social capital also benefits internet non-users by the information spill-over.

However, the social capital effect of internet may not always be positive. In fact, it may also crowd out social participation when it is massively used for entertainment rather than for social networking. It may even lead to so called "cyber balkanization" by stimulating the separation of communication into sepa7rate groups with specific interests leading to group separation and community fragmentation (Van Alstyne and Brinjolfsson, 1996; Gentzkow and Shapiro, 2011; Bauernschuster et al., 2014).

In summary, the above review reveals that there is a significant gap in the literature about the association between internet use and social capital in the Australian context although there are plenty of studies that investigate the effects of other factors on social capital. No recent study has been completed to investigate the link between internet usage and social capital even though digital divide is best understood by considering the socioeconomic context and being related to the issue of social capital (Charleson, 2012). There are some earlier studies that used old data and have very little policy relevance to current situation. Since social capital generated through online-networking was recognized as a priority in digital divide policy in Australia (Notley and Foth, 2008) and that online trust generated and intensified by online networking has the potential to lead to the accumulation of generalized trust, an in-depth investigation in the area is called for.

2.4. A Review on the Measurement of Social Capital

Despite its historical roots and considerable contemporary use of the term "social capital," there has been increasing debate about the development of tools for measuring social capital empirically. The appropriate measurement of social capital is one of the major challenges in social capital research today. There has not been a consensus yet about the appropriate indicators for measurement of social capital (Fukuyama, 2001; Antoci et al., 2012). In literature, it has been measured in a number of innovative ways but obtaining a single measure for social capital is still elusive.

Three reasons (Antoci et al., 2012) have been identified for this failure: first, the most comprehensive definitions of social capital are multidimensional incorporating different levels and units of analysis. Such a range of definitions allow the concept of social capital to be applied in a multitude of guises and to analyze and explain various phenomena, a situation described by Mohan and Mohan (2002, p.199) as "operational opportunism" and by Stone (2001, p.5) as "empirical mayhem." Second, any attempt to measure the properties of inherently complex concepts such as community networks and organization is correspondingly problematic third, because of the paucity of long-standing surveys designed to measure "social capital" contemporary researchers have resorted to compiling indexes from a range of approximate items such as measures of trust in government, voting participation trends, membership of civic organizations, hours spent in volunteering and so on.

It is believed that there is a gulf between theoretical understandings of social capital and the way, social capital has been measured in most of the empirical work to date. It is this gulf which leads to empirical confusion about the meaning, measurement and outcomes of social capital. Paxton (1999 p.90) identified the same problem noting that previous studies provide little rationale for how measures of social capital relate to theoretical definition. This has resulted in the use of questionable indicators of social capital.

The empirical literature on social capital is now very broad and studies differ in their degree of depth, methods and data collection. One of the most recent studies (Righi, 2013) argues that the three main attributes of social capital requiring measurement are generalized trust, the intensity of the associative links, civic and political participation expressed in various ways. From the above review, it is evident that social capital is a complex multidimensional concept. Therefore, it is a challenge to satisfactorily represent it by a single measure or figure.

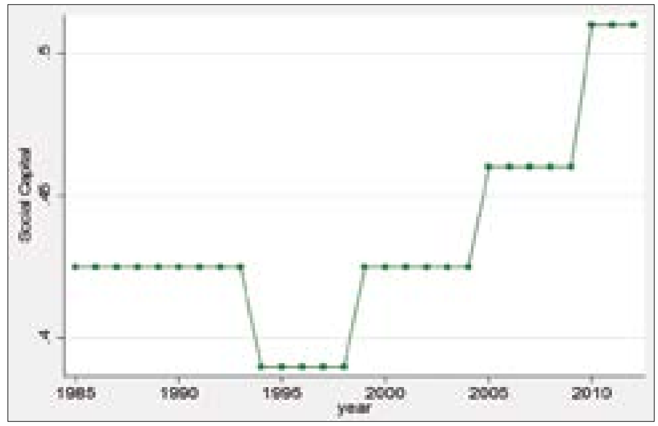
3. DATA AND METHODOLOGY

3.1. Data

We obtained annual time series data on real GDPC and internet users per 100 people for the period of 1986-2012 for Australia from the World Data Bank (previously, World Development Indicators Database, The World Bank, 2013). Since trust is recognized as the most prominent dimension of social capital (Fukuyama, 1995a; 1995b; Knack and Keefer, 1997; Glaeser et al., 2008; Zak and Knack, 2001; Ng et al., 2014), the current study uses trust as the indicator for social capital. Data on trust for Australia was gathered from the World Values Survey (WVS, 2014) conducted in multiple waves from 1981 to 2014. Trust is measured as the percentage share of people who answer that "most people can be trusted" to the WVS survey question *"Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?"* Trust data on Australia were missing for the period from 1985 to 1993 and from 2000 to 2004. The missing values for the periods of 1985-1993 and 2000-2004 were replaced by the average values of two consecutive waves (periods of 1981-1984 and 1994-1998 and periods of 1994-1998 and 2005-2009 respectively) as values of trust are assumed to remain stable for a reasonable period of time and are not expected to change dramatically in terms of numeric values. However, the values of trust for Australia demonstrate a rising trend over the last two decades as depicted in Figure 3.

A few missing values were also observed in the internet users per 100 people series which were replaced by 3 years moving average values. The variable real GDPC is measured at constant

Figure 3: Trend in social capital (measured by generalized trust) values in Australia during 1985-2012



Source: World Values Survey

2005 US$. Another variable combining interaction between internet and trust is constructed to examine their interaction effect on economic growth. All variables are expressed in natural log.

3.2. Methodology

3.2.1. The model

Romer's (1986; 1990) endogenous growth model explains that knowledge spillover positively affects balanced growth. Barro's (1998) endogenous growth model also highlights the role of knowledge and innovation in promoting economic growth. The internet is hypothesized to play a significant role in disseminating knowledge (Choi and Yi, 2009) and presumably this stimulates economic growth. Trust, the most widely used indicator in social capital studies (Westlund and Adam, 2010) to date, is assumed to be generated from within the society and is endogenous to the growth model (Barro, 1991; Akcomak and Weel, 2009; Roseta-Palma et al., 2010). Therefore, the interaction term of trust and internet usage (N*SC) is also assumed to be endogenous. Thus, we estimate an econometric model where per capita real GDP is assumed to be a function of internet usage (NET), social capital (as proxied by trust) and an interaction term of social capital and internet use (N*SC). The functional form of the model is as follows:

$$GDPPC = F(A, NET, SC, N*SC) \quad (1)$$

$$C_t = A.(NET_t)^{\beta 1}(SC_t)^{\beta 2}(N*SC_t)^{\beta 3} \quad (2)$$

Log-linearizing both sides of the equation, we obtain:

$$\ln C_t = \beta_0 + \beta_1 \ln NET_t + \beta_2 \ln SC_t + \beta_3 \ln N*SC + \varepsilon_t \quad (3)$$

The subscript *t* represent the time period.

3.3. Estimation Procedures

3.3.1. Unit root tests

Since macroeconomic time series data are mostly non-stationary, it is imperative that we conduct unit root tests of these series. Dickey-Fuller generalized least squares (DF-GLS) unit root test is conducted since it is superior to most of the conventional unit root tests such as ADF (Dickey and Fuller, 1979), PP (Phillips and Peron, 1988), and KPSS (Kwiatkowski et al., 1992) tests. But this test fails to consider structural break in the series, if any. Therefore, this study employs Zivot and Andrew (1992) structural break test.

3.3.2. Autoregressive distributed lag (ARDL) bounds testing approach

In order to estimate the short and the long-run relationship between variables, we employ ARDL model bounds testing approach developed by Pesaran (1997), (Pesaran et al., 2001). The ARDL technique has several advantages over other conventional cointegration techniques; first of all, this method can be applied to a small sample size study (Pesaran et al., 2001) and therefore conducting bounds testing is justified for the present study. Secondly, it can be applied even in case of mixed order of integration of variables (both for I[0] and I[1] variables). Thirdly, it simultaneously estimates the short-run dynamics and the long-run equilibrium with a dynamic unrestricted error correction model through a simple linear transformation of variables. Fourth, it estimates the short- and the long-run components simultaneously potentially removing the problems associated with omitted variables and autocorrelation. In addition, the technique generally provides unbiased estimates of the long-run model and valid t-statistic even when the model suffers from the problem of endogeneity (Harris and Sollis, 2003). The empirical formulation of ARDL equation for our study is specified as follows:

$$\Delta \ln GDPC_t = \beta_0 + \beta_1 T + \beta_2 D + \beta_3 \ln GDPC_{t\text{-}1} + \beta_4 \ln SC_{t\text{-}1} + \beta_5 \ln NET_{t\text{-}1} + \beta_6 \ln NET*SC_{t\text{-}1} + \sum_{i=1}^{p} \beta_7 \Delta \ln GDPC_{t\text{-}j} + \sum_{j=1}^{q} \beta_8 \Delta \ln SC_{t\text{-}k} + \sum_{k=0}^{r} \beta_9 \Delta \ln NET_{t\text{-}l} + \sum \beta_7 \Delta \ln NET*SC_{t\text{-}m} + \varepsilon_t \quad (4)$$

$$\Delta \ln SC_t = \beta_0 + \beta_1 T + \beta_2 D + \beta_3 \ln SC_{t\text{-}1} + \beta_4 \ln GDPC_{t\text{-}1} + \beta_5 \ln NET_{t\text{-}1} + \beta_6 \ln NET*SC_{t\text{-}1} + \sum_{i=0}^{p} \beta_7 \Delta \ln SC_{t\text{-}j} + \sum_{j=0}^{q} \beta_8 \Delta \ln NET_{t\text{-}k} + \sum_{k=0}^{r} \beta_9 \Delta \ln GDPC_{t\text{-}l} + \sum_{l=0}^{s} \beta_{10} \Delta \ln NET*SC_{t\text{-}m} + \varepsilon_t \quad (5)$$

$$\Delta NET_t = \beta_0 + \beta_1 T + \beta_2 D + \beta_3 \ln NET_{t\text{-}1} + \beta_4 \ln GDPC_{t\text{-}1} + \beta_5 \ln SC_{t\text{-}1} + \beta_6 \ln NET*SC_{t\text{-}1} \sum_{i=0}^{p} \beta_7 \Delta \ln NET_{t\text{-}j} + \sum_{j=0}^{q} \beta_8 \Delta \ln GDPC_{t\text{-}k} + \sum_{k=0}^{r} \beta_9 \Delta \ln SC_{t\text{-}l} + \sum_{l=0}^{s} \beta_{10} \Delta \ln NET*SC_{t\text{-}m} + \varepsilon_t \quad (6)$$

$$\Delta NET*SC_t = \beta_0 + \beta_1 T + \beta_2 D + \beta_3 \ln NET_{t\text{-}1} + \beta_4 \ln GDPC_{t\text{-}1} + \beta_5 \ln SC_{t\text{-}1} + \beta_6 \ln NET*SC_{t\text{-}1} \sum_{i=0}^{p} \beta_7 \Delta \ln NET_{t\text{-}j} + \sum_{j=0}^{q} \beta_8 \Delta \ln GDPC_{t\text{-}k} + \sum_{k=0}^{r} \beta_9 \Delta \ln SC_{t\text{-}l} + \sum_{l=0}^{s} \beta_{10} \Delta \ln NET*SC_{t\text{-}m} + \varepsilon_t \quad (7)$$

Where, ln GDPC, ln SC, ln NET and ln N*SC indicate log values of real GDPC, social capital (trust), Internet users per 100 people and the interaction variable, respectively. Δ is the difference operator. T and D denote time trend and dummy variable, respectively. The dummy variable is included in the equation to capture the structural break arising from the series. ε_t is the disturbance term.

To examine the cointegrating relationship, Wald Test or the F-test for the joint significance of the coefficients of the lagged variables is applied with the null hypothesis, H_0: $\beta_3 = \beta_4 = \beta_5$ indicating no cointegration against the alternative hypothesis of the existence of cointegration between variables. F statistics are computed to compare the upper and lower bounds critical values provided by Pesaran et al. (2001). To check for the robustness of the cointegrating relationship between the variables, we employed the Gregory and Hansen (1996) residual-based test of cointegration, which allows for a one time change in the cointegrating parameters. The Gregory and Hansen test offers the testing of four models – level, trend, intercept or shifts in the intercept, and slope. We opted for the intercept and slope model that allows rotation in the long-run equilibrium relationship simultaneously with shift.

After the cointegrating relationship is confirmed, long-run and short-run coefficients are estimated with the application of ARDL. The short-run estimation also involves an error correction term which reflects the speed of convergence of short-run disequilibrium with the long-run equilibrium.

3.3.3. The vector error correction model (VECM) Granger causality test

According to Granger (1969), once the variables are integrated of the same order, the VECM Granger causality test is appropriate to estimate their causal link. Knowledge about the exact direction of causal link helps a discussion with better policy implications of the findings (Shahbaz et al., 2013). The potential causality pattern for our study is represented by the following VAR specification in a multivariate framework;

$$\Delta \ln GDPC_t = \beta_{0i} + \sum_{i=1}^{p} \Delta \ln GDPC_t = \beta_{0i} + \sum_{i=0}^{p} \beta_{2i} NET_{t\text{-}i} + \sum_{i=0}^{p} \beta_{3i} \Delta \ln N*SC_{t\text{-}i} + \varepsilon_t \quad (8)$$

3.3.4. Diagnostic tests

A number of diagnostic tests such as LM test for serial correlation, Ramsey RESET test for model specification, normality test for heteroscedasticity and model stability graphical plot tests such as CUSUM and CUSUMS are conducted.

3.3.5. Dynamic ordinary least squares (DOLS)

Finally, we apply the DOLS method (Stock and Watson, 1993) and estimate the long-run coefficients between the variables in order to check for the robustness of the findings from the ARDL estimates. The application of this method for robustness check is appropriate in that this estimator is robust even when the sample size is small and does eliminate the simultaneity problem. Moreover, the obtained co-integrating vectors from DOLS estimators are asymptotically efficient.

4. ESTIMATION RESULTS

Table 1 reports summary statistics. The standard deviations in all the series are quite low implying that the data are evenly dispersed around the mean. Hence it was convenient for us to proceed with the datasets for further estimation.

The DF-GLS unit root test results are reported in Table 2 which shows all the series in our study are first difference stationary, i.e., I(1). Table 3 reports Zivot-Andrew structural break test which also suggest that all the series in the current study are stationary even in the presence of structural break.

Next, we proceed with the estimation of short-run and the long-run relationship among the variables. Since ARDL is sensitive to lag order, for calculating the F statistic, first of all, we need to identify the appropriate lag order. To do this, we choose Akaike Information Criterion as it provides better results than other lag length criteria (Lutkepohl, 2006). The reported ARDL results in Table 4 suggests that the calculated F statistic of 4.516 is higher than the upper bound critical value generated by Pesaran et al. (2001) at the 10% level of significance. Therefore, there is cointegrating relationship between per capita economic growth and the predicted variables - the internet users per 100 people, social capital and the interaction variable of social capital and internet use. But this test does not consider the presence of structural breaks in the series as detected by Zivot and Andrew structural break test. Although ARDL bounds test supports cointegration relationship, Hansen Gregory cointegration test that accounts for structural break is also employed which (as reported in Table 5) confirms the cointegrating relationship among the variables even in the presence of structural break in the series.

Table 1: Summary statistics

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
LGPDC	28	10.280	0.170	10.005	10.526
NET	28	0.441	0.041	0.400	0.481
SC	28	34.355	32.095	0.530	82.349

Table 2: DF-GLS unit-root test

Log levels (Z_t)		Log 1st difference (Z_t)		I (d)
Variable	DF-GLS stat	Variable	DF-GLS statistic	
LGPDC	−0.563	ΔLGDPC	−3.655[a]	I (1)
NET	−0.565	ΔNET	−1.599[c]	I (1)
SC	−1.415	ΔSC	−4.898[a]	I (1)

[a,b,c]Indicate 1%, 5%, and 10% significance level respectively. DF-GLS: Dickey-Fuller generalized least squares

Table 3: Zivot–Andrews structural break unit root test results

Variable	Z and A test for level			Z and A test for 1st difference		
	T-statistic	TB	Outcome	T-statistic	TB	Outcome
LGDPC	−2.795	2008	Unit root	−6.039[a]	1993	Stationary
LNET	−3.531	2002	Unit root	−4.292[b]	1998	Stationary
LSC	−3.921	1998	Unit root	−5.601[a]	1995	Stationary

[a,b,c]Indicate 1%, 5%, and 10% significance level respectively

Results presented in Table 6 indicate that the rapid increase of the internet usage is significantly associated with economic growth in Australia in the long-run. This implies that the NBN roll out for expansion of internet infrastructure likely to contribute to economic growth. Table 6 further shows that there is no significant relationship between economic growth and social capital in Australia. However, the long-run interaction effect of internet usage and social capital on economic growth is positive and significant.

Table 7 reports the short-run effects of the independent variables on economic growth. The findings indicate that there is no significant short-run effects of the internet usage on economic growth. The short-run effect of social capital on economic growth is also negative and significant. The interaction effect of social capital and internet usage on economic growth is positive and significant. The coefficient of the error correction term ECT_{t-1} of −0.20 is significant and has the expected sign. It also implies a reasonable speed of convergence (the short-run deviations being corrected at the speed of 20% towards the long-run equilibrium each year).

Table 8 demonstrates results from the diagnostic tests carried out from the ARDL lag estimates. The LM test confirms no serial correlation while Ramsey's RESET test suggests that the model (equation 1) has the correct functional form. The normality test reveals that the disturbance terms are normally distributed and are homoscedastic as supported by the heteroscedasticity test. The stability of parameters over time is reflected through the graphical plots of CUSUM and CUSUM of Squares (Figures 4 and 5 respectively).

Granger causality results are reported in Table 9. The findings demonstrate the presence of a bidirectional causal relationship between internet usage and GDP and between the interaction variable (N*SC) and GDP. Also unidirectional causality running from internet usage to the interaction variable is found.

Results from the DOLS are reported in Table 10. Although the coefficients vary, the DOLS estimation produces similar results to

Table 4: Results from ARDL bounds cointegration test

Dependent variable	AIC Lag	F-statistic	Probability	Outcome
F_{LGDPC} (LGDPC|NET, SC, NET*SC)	1	3.787[b]	0.045	Cointegration
F_{NET} (NET|LGDPC, SC, NET*SC)	1	4.222[b]	0.034	Cointegration
F_{SC} (SC|LGDPC, NET, NET*SC)	1	1.679	0.238	No cointegration
F_{NET*SC} (NET*SC|LGDPC, NET, SC)	1	2.156	0.156	No cointegration

Pesaran critical value at 5% = 2.56, 3.49; at 10% = 3.29, 4.37, [a,b,c]Indicate 1%, 5%, and 10% significance level respectively. AIC: Akaike Information Criterion. ARDL: Autoregressive distributed lag

Table 5: Gregory-Hansen test for cointegration with regime shifts, model: Change in regime and trend

Test	Statistic	Breakpoint	Date	1%	5%	10%
ADF	−7.13	14	1998	−6.89	−6.32	−6.16
Zt	−7.16	14	1998	−6.89	−6.32	−6.16
Za	−36.79	14	1998	−90.84	−78.87	−72.75

Table 6: Estimated long run coefficients using the ARDL (1,0,0,0) selected based on AIC

Regressor	Coefficient	Standard error	T-ratio [probability]
NET	−0.005	0.004	−1.310 [0.204]
SC	−1.677[a]	0.531	−3.156 [0.005]
NSC	0.022[b]	0.009	2.447 [0.023]
C	10.955[a]	0.267	40.892 [0.000]

[a,b,c]Indicate 1%, 5%, and 10% significance level respectively. AIC: Akaike Information Criterion. ARDL: Autoregressive distributed lag

Table 7: Error correction representation for the selected ARDL (1,0,0,0) selected based on AIC

Regressor	Coefficient	Standard error	T-ratio [probability]
ΔNET	−0.001	0.868	−1.301 [0.207]
ΔSC	−0.346[a]	0.109	−3.180 [0.004]
ΔNSC	0.004[b]	0.002	1.991 [0.059]
ΔC	2.265[a]	0.837	2.706 [0.013]
ecm(−1)	−0.206[a]	0.079	−2.589 [0.017]

[a,b,c]Indicate 1%, 5%, and 10% significance level respectively. AIC: Akaike Information Criterion. ARDL: Autoregressive distributed lag

Table 8: Diagnostic test

Test statistics	LM version
R^2 0.99	
Serial correlation	χ^2 (1)=0.102 [0.749]
Functional form	χ^2 (1)=0.476 [0.490]
Adjusted R^2 0.99	
Normality	χ^2 (2)=0.970 [0.616]
Heteroscedasticity	χ^2 (1)=3.949 [0.047]

those for the ARDL model indicating that our findings are robust for different methods of estimation.

5. CONCLUSIONS, DISCUSSION, POLICY IMPLICATIONS AND LIMITATIONS

This study examined the empirical relationship among the internet usage, social capital (as proxied by trust), an interaction variable consisting of internet usage and social capital, and economic growth using Australian annual time series data for the period of 1985-2012. Because of the long sample period, DF-GLS unit root and Zivot and Andrew structural break unit root tests were conducted. All the series were found to be stationary at first difference even in the presence of structural breaks.

Table 9: VEC Granger causality/block exogeneity Wald tests

Excluded	Chi-square	df	Probability
Dependent variable: D (LGDPC)			
D (NET)	1.286481	2	0.5256
D (SC)	0.051478	2	0.0746
D (N*SC)	0.469060	2	0.7909
All	3.390583	6	0.7585
Dependent variable: D (NET)			
D (LGDPC)	1.771198	2	0.4125
D (SC)	86.70732	2	0.0000
D (N*SC)	71.58612	2	0.0000
All	88.84968	6	0.0000
Dependent variable: D (SC)			
D (LGDPC)	1.551362	2	0.0604
D (NET)	0.024475	2	0.9878
D (N*SC)	0.021194	2	0.9895
All	1.801866	6	0.9370
Dependent variable: D (N*SC)			
D (LGDPC)	0.019317	2	0.9904
D (NET)	9.996816	2	0.0067
D (SC)	7.060434	2	0.0293
All	11.25363	6	0.0808

Table 10: Results from dynamic OLS

LGDPC	Coefficient	Robust standard error	*P* value
SC	−0.633	0.212	0.003
NET	0.0008	0.001	0.036
NET*SC	0.008	0.003	0.024
Constant	10.40831	0.106	0.000
R^2=0.99			

OLS: Ordinary least squares

Hansen Gregory and ARDL cointegration tests confirm a cointegrating relationship among the variables. The findings from the ARDL estimates suggest that there is a significant long-run positive relationship between internet usage and economic growth. But the long-run relationship between social capital and economic growth is found to be inconclusive. The interaction effect of internet usage and social capital on economic growth is positive and significant. There is bidirectional causal link between internet usage and GDP and between interaction variable and GDP. Unidirectional causality running from internet usage to the interaction variable is also observed. Results from DOLS estimation are consistent with and lend support to the findings from ARDL estimates. The baseline model used in the study satisfied all the conventional diagnostic tests.

Figure 4: Plot of cumulative sum of recursive residuals

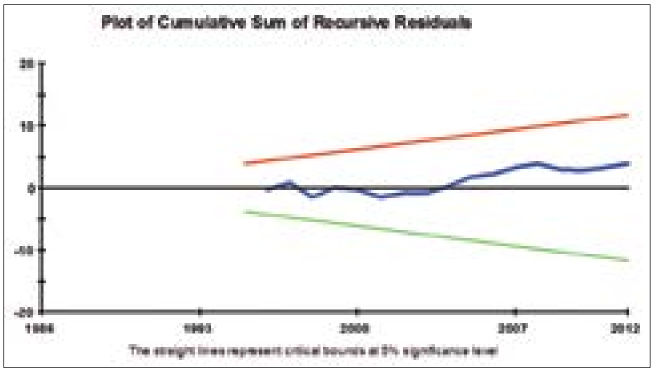
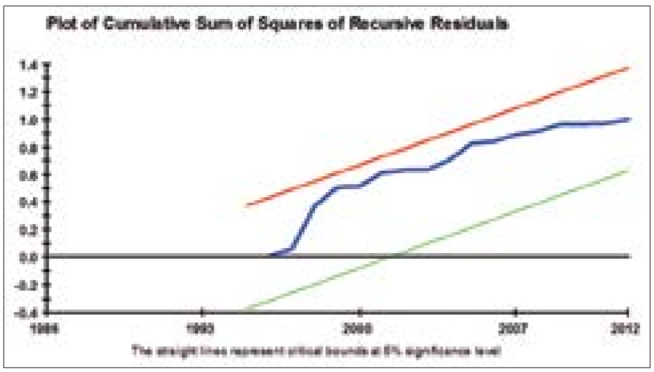


Figure 5: Plot of cumulative sum of squares of recursive residuals



The findings have important policy implications for Australia. Australia has been pursuing various policies to promote internet access and use since early 1990s. Most of the recent literature recognizes the presence of digital divide in Australia (Bowles, 2012; Charlson, 2013; Atkinson, 2008), especially in regional and rural Australia. One of the key objectives of the currently ongoing roll out of the NBN is to narrow the digital divide by expanding the high speed broadband network across the regional and remote parts of Australia. It is argued that social capital generated through the internet has the potential to reduce digital divide in Australia (Tanya and Marcus, 2008). Therefore, the finding of a positive significant relationship between internet usage and economic growth imply that the roll out of the broadband could accelerate the economic growth in Australia. Also, the positive interaction effect of internet and social capital on economic growth is encouraging in that it lends support to the policy makers for inclusion of social capital issue in the digital divide policy. It should, however, not be forgotten that greater use of internet can increase the social isolation of the disadvantaged unless special efforts are made to improve their ability and skills in using the internet. This remains a major challenge in rural and remote areas and can be overlooked when aggregate data are modeled.

Despite the novelty of the study, it suffers from a number of limitations. One major weakness is the measurement of social capital by one single indicator from WVS. It is now well documented in literature that social capital is a multi-dimensional concept. Therefore, future research needs to expand their measure of social capital beyond the WVS trust indicator. Another weakness of the study is that several observations on trust were missing which were replaced by average values of consecutive waves of surveys by WVS. Nevertheless, this study is based on the premise that internet generates social capital through creation and enhancement of online trust (Warren et al., 2014). But internet use may even have negative effect on trust among people by reducing the number of offline interactions (Zhong, 2014; Bauernschuster et al., 2014). Absence of face to face interactions might result in the loss of transmission of much non-verbal information (Bauernschuster et al., 2014).

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REFERENCES

Ahlerup, P., Olsson, O., Yanagizawa, D. (2009), Social capital vs. Institutions in the growth process. European Journal of Political Economy 25, 1-14.

Akcomak, I., Weel, B. (2009), Social capital, innovation and growth: Evidence from Europe. European Economic Review, 53, 544-567.

Algan, Y., Cahuc, P. (2010), Inherited trust and growth. American Economic Review, 100(5), 2060-2092.

Antoci, A., Sabatini, F., Sodini, M. (2012), See you on Facebook, 'A framework for analyzing the role of computer-mediated interaction in the evolution of social capital. The Journal of Socio-Economics, 41, 541-547.

Atkinson, J., Black, R., Curtis, A. (2008), Exploring the digital divide in an Australian regional city: A case study of Albury. Australian Geographer, 39, 479-93.

Australian Bureau of Statistics, (ABS). (2013), A Review of Regional Development Australia Committee 2010-11 Regional Plans: Issues Identified by Regions, Cat No 1318.0. Canberra: Australian Bureau of Statistics (ABS).

Barney, D. (2004), The Network Society. Cambridge: Polity Press.

Barro, R.J. (1991), Economic growth in a cross section of countries. Quarterly Journal of Economics, 106, 407-443.

Barro, R.J. (1998), Determinants of Economic Growth: A Cross-Country Empirical Study. 1st ed. Cambridge: The MIT Press.

Bauernschuster, S., Falck, O., Woessmann, L. (2014), Surfing alone? The internet and social capital: Evidence from an unforeseeable technological mistake. Journal of Public Economics, 117, 73-89.

Baumol, W. (1986), Productivity growth, convergence and welfare: What the long run data show. American Economic Review, 76, 1072-1085.

Bertrand, M., Luttmer, E.F.P., Mullainathan, S. (2000), Network effects and welfare cultures. Quarterly Journal of Economics, 65, 1019-1055.

Beugelsdijk, S., De Groof, H.L.F., Schaik, T. (2004), Trust and economic growth: A robustness test, Oxford Economic Papers 56, 118-134.

Beugelsdijk, S., Schaik, T., (2005), Social capital and growth in European regions: an empirical test. European Journal of Political Economy, 21, 301-324.

Bourdieu, P. (1980), The production of belief: contribution to an economy of symbolic goods, Media. Culture and Society, 2, 261-293.

Bourdieu, P. (1986), The forms of capital. In: Richardson, J.G., editor. Handbook of Theory and Research for the Sociology of Education. Westport, CT: Greenwood Press. p242-258.

Bowles, M. (2012), Digital Economy and Regional Futures: ICT Future Foresight. Melbourne, Australia: Innovation and Business Skills

Australia.
Brown, L.D., Darcy, A. (1996), Participation, social capital, and intersectoral problem solving: African and Asian cases. World Development, 24(6), 1477-1495.
Castells, M. (2000), The Rise of the Network Society. 2nd ed. Oxford, UK: Blackwell Publishers.
Charlson, D. (2013), Bridging the digital divide: Enhancing empowerment and social capital. Journal of Social Inclusion, 3(2), 6-19.
Choi, C. (2003), Does Internet stimulate foreign direct investment? Journal of Policy Modeling, 25, 319-326.
Choi, C., Yi, M.H. (2005), The effect of the internet on inflation: Panel data evidence. Journal of Policy Modeling, 27, 885-889.
Choi, C., Yi, M.H. (2009), The effect of the internet on economic growth: Evidence from cross-country panel data. Economics Letters, 105, 39-41.
Choi, C. (2010), The effect of the internet on service trade. Economics Letters, 109, 102-104.
Choi, C., Rhee, D., Oh, Y. (2014), Information and capital flows revisited: The internet as a determinant of transactions in financial assets. Economic Modelling, 40, 191-198.
Coleman, J.S. (1988), Social capital in the creation of human capital. American Economic Journal of Sociology, 94, S95-S120.
Coleman, J.S. (1990), Foundations of Social Theory. Cambridge, MA: Harvard University Press.
Czernich, N. (2014), Does broadband internet reduce the unemployment rate? Evidence for Germany. Information Economics and Policy, 29, 32-45.
Deloitte Access Economics. (2011), Connecting The Continent. Business Outlook, Canberra: December, 2011.
Dickey, D.A., Fuller, W.A. (1979), Distribution of the estimators for autoregressive time series with a unit root. Journal of American Statistical Association, 74, 427-431.
DiMaggio, P., Hargittai, E. (2001), Digital Divide to Digital Inequality: Studying Internet Use as Penetration Increases, Working Paper # 15, Princeton: Center for Arts and Cultural Policy Studies, Princeton University.
Dincer, O., Uslendar, E. (2007), Trust and Growth, Working Paper, 2007.73, Fondazione Eni Enrico Mattei, July, 2007.
Dinda, S., (2008), Social capital in the creation of human capital and economic growth: A productive consumption approach. Journal of Socio Economics, 37, 2020-2033.
Doong, S., Ho, S. (2012), The impact of ICT development on the global digital divide. Electronic Commerce Research Applications, 11, 518-533.
Elgin, C. (2013), Internet usage and the shadow economy: Evidence from panel data. Economic Systems, 37, 111-121.
Fernback, J. (2005), Information technology, networks and community voices: social inclusion for urban regeneration. Information Communication & Society, 8, 482-502.
Foth, M., Podkalicka, A. (2007), Communication policies for urban village connections: Beyond access? In: Papandrea, F., Armstrong, M., editors. Proceedings Communications Policy & Research Forum (CPRF), Sydney. p356-369.
Frehund, C., Weinhold, D. (2002), The Internet and international trade in services. American Economic Review, 92(1), 236-240.
Fukuyama, F. (1995a), Trust: The Social Virtues and the Creation of Prosperity. New York: The Free Press.
Fukuyama, F. (1995b), Social capital and the global economy. Foreign Affairs, 74, 89-103.
Fukuyama, F. (2001), Social capital, civic society and development. Third World Quarterly, 22(1), 7-20.
Gentzkow, M., Shapiro, J.M. (2011), Ideological segregation online and off line. Quarterly Journal of Economics, 126, 1799-1839.
Gleaser, E., Liabson, D.I., Scheinkman, J.A., Soutter, C.L. (2000), Measuring trust. Quarterly Journal of Economics, 115, 811-846.
Goel, R., Nelson, K., Naretta, M.A. (2012), The internet as an indicator of corruption awareness. European Journal of Political Economy, 28, 64-75.
Granger, C.W.J. (1969), Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37, 424-438.
Gregory, A.W., Hansen, B.E. (1996), Residual-based tests for cointegration in models with regime shifts. Journal of Econometrics, 70, 99-126.
Grier, K.B., Tullock, G. (1989), An empirical analysis of cross-national economic growth, 1951-1980. Journal of Monetary Economics, 24, 259-276.
Gruber, H., Hatonen, J., Koutroumpis, P. (2014), Broadband access in the EU: An assessment of future economic benefits. Telecommunications Policy, 18, 1046-1058.
Harris, R., Sollis, R. (2003), Applied Time Series Modeling and Forecasting. West Sussex: Wiley.
Hopkins, L. (2005), Making a community network sustainable: The future of the wired high rise. TheInformation Society, 25(5), 379-384.
Knack, S., Keefer, P., (1997), Does social capital have an economic payoff? A cross country investigation. Quarterly Journal of Economics, 112(4), 1251-1288.
Kormendi, R.C., Meguire, P.G. (1985), Macroeconomic determinants of growth: Cross country evidence. Journal of Monetary Economics, 16, 141-163.
Krishna, A., Uphoff, N. (1999), Mapping and measuring social capital: A conceptual and empirical study of collective action for conserving and developing watersheds in Rajasthan, India. Social Capital Initiative Series Working Paper No. 13. Washington, DC: World Bank.
Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., Shin, Y. (1992), Testing the null hypothesis of stationarity against the alternative of a unit root. Journal of Econometrics, 54, 159-178.
La Porta, R., Lopez-de Silanes, F., Shleifer, A., Vishny, R. (1999), The quality of government. Journal of law. Economics and Organization, 15, 222-279.
Lechman, E., Marszk. A. (2015), ICT technologies and financial innovations: The case of exchange traded funds in Brazil, Japan, Mexico, South Korea and the United States, Technological Forecasting and Social Change. Available from: http://www.dx.doi.org/10.1016.jtechfore. 2015.01.006.
Lippert, S., Spagnolo, G. (2011), Networks of relations and word-of-mouth communications. Games and Economic Behavior, 72, 202-217.
Lio, M., Liu, M., Ou, Y. (2011), Can the internet reduce corruption? A cross country study based on dynamic panel data models. Government Information Quarterly, 28, 47-53.
Lutkepohl, H. (2006), Structural vector autoregressive analysis for cointegrated variables. Advances in Statistical Analysis, 90, 75-88.
Mankiw, N.G., Romer, D., Weil, D. (1992), A contribution to the empirics of economic growth. Quarterly Journal of Economics, 107, 407-431.
Meredyth, D., Ewing, S., Thomas, J. (2004), Neighbourhood renewal and government by community. International Journal of Cultural Policy, 10, 85-101.
Mohan, G., Mohan, J. (2002), Placing social capital. Progress in Human Geography, 26, 191-210.
Najarzadeh, R., Rahimzadeh, F., Reed, M. (2014), Does the Internet increase labor productivity? Evidence from a cross-country dynamic panel. Journal of Policy Modeling, 36, 986-993.
Miguel, E. (2003), Comment on social capital and growth. Journal of Monetary Economics, 50, 195-198.
Ng, A., Ibrahim, M.H., Mirakhor, A. (2014), Does trust contribute to stock market development? Economic Modelling, Doi:10.1016/j.econmod.2014.10.056.
Noh, Y.H., Yoo, K. (2008), Internet, inequality and growth. Journal of Policy Modeling, 30(6), 1005-1016.

Notley, T., Foth, M. (2008), Extending Australia's digital divide policy: An examination of the value of social inclusion and social capital policy frameworks. Australian Social Policy 7, Australian Government Department of Family, Housing, Community Service and Indigenous Affairs.

Ostrom, E. (2000), Collective action and the evolution of social norms. Journal of Economic Perspectives, 14, 137-158.

Paxton, P.. (1999), Is social capital declining in the United States? A multiple indicator assessment. American Journal of Sociology, 105, 88-127.

Pesaran, H. (1997), The role of econometric theory in modeling the long run. Economic Journal, 107, 178-191.

Pesaran, H., Shin, Y., Smith, R.J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Economics, 16, 289-326.

Phillips, P., Perron, P. (1988), Testing for a unit root in time series regression. Biometrika, 75(2), 335.

Putnam, R. (2000), Bowling Alone: The Collapse and Revival of American Community. New York: Simon and Schuster.

Putnam, R. (1995), Bowling alone: America's declining social capital. Journal of Democracy, 6, 65-78.

Putnam, R., Leonardi, R., Nanetti, R.Y. (1993), Making Democracy Work. Princeton, NJ: Princeton University Press.

Raiser, M. (2008), Social capital and economic performance in transition economics. In: Castiglion, D., Deth, J.W., Wolleb, G., editors. The Handbook of Social Capital. Oxford: Oxford University Press. p491-519.

Righi, A. (2013), Measuring social capital: Official statistics initiatives in Italy. Procedia-Social and Behavioral Sciences, 72, 4-22.

Romer, P.M. (1986), Increasing returns and long-run growth. Journal of Political Economy, 94, 1002-1037.

Romer, P.M. (1990), Endogenous technological change. Journal of Political Economy, 98, 71-102.

Roseta-Palma, C., Ferreira-Lopez, A., Sequeira, T.N. (2010), Externalities in an endogenous growth model with social and natural capital. Ecological Economics, 69, 603-612.

Rose, R. (2000), How much do social capital add to individual health? A survey study of Russians. Social Science and Medicine, 51(9), 1421-1435.

Roth, F. (2009), Does too much trust hamper economic growth? Kyklos, 62, 103-128.

Routledge, B.R., Amsberg, J. (2003), Social capital and growth. Journal of Monetary Economics, 50, 167-193.

Sangnier, M. (2010), Does trust favor macroeconomic volatility? Paper Presented at the 59th Congress of the French Economic Association, Paris, France.

Selwyn, N., Facer, K. (2007), Beyond the Digital Divide: Rethinking Digital Inclusion for the 21st Century. Bristol: Future Lab.

Servon, L.J. (2002), Bridging the Digital Divide: Technology, Community and Public Policy. Malden, MA: Blackwell.

Shim, K., Lee, S., LaRose, R. (2013), What Happens after the Rural Broadband Gap is Closed? The Case of Korean Information Network Village. Paper Presented at the NCA 96th Annual Convention, Hilton San Francisco. Available from: http://www.citation.allacademic.com/meta/p423392_index.html. [Last downloaded on 2014 Jan 05].

Simpson, L. (2005), Communication informatics and sustainability, why social capital matters? The Journal of Communication Informatics, 1(2), 102-119.

Shahbaz, M., Hye, Q.M.A., Tiwary, A.K. (2013), The effects of financial development, economic growth, coal consumption and trade openness in South Africa. Energy Policy, 61, 1452-1459.

Sobel, J. (2002), Can we trust social capital? Journal of Economic Literature, 40, 139-154.

Stock, J., Watson, M.W. (1993), A simple estimator of cointegrating vectors in higher order integrated systems. Econometrica, 61, 783-820.

Stone, W. (2001), Measuring social capital: Towards a theoretically informed measurement framework for researching social capital in family and community life. Research Paper No.24, Australian Institute of Family Studies. Commonwealth of Australia, Melbourne.

Tabellini, G. (2008), The scope of cooperation: Norms and incentives. Quarterly Journal of Economics, 123(3), 905-950.

Tau, L.M. (2003), Investing social capital to stimulate economic growth and trade in Africa. Paper Presented at the Biennial Conference of the Economic Society of South Africa.

Temple, J., Johnson, P.A. (1998), Social capability and economic growth. Quarterly Journal of Economics, 113, 965-990.

Tisdell, C.A. (2009), Trust and its implications for economic activity, welfare and globalization. In: Aurifeille, J.M., Medlin, C.J., Tisdell, C.A., editors. Trust, Globalisation and Market Extension. New York: Nova Science Publishers. p23-37.

Uphoff, N. (2000a), Understanding social capital: Learning from the analysis and experience of participation. In: Dasgupta, P., Serageldin, I., editors. Social Capital: A Multifaceted Perspective. Washington, DC: World Bank. p215-249.

Van Alstyne, M., Brynjolfsson, E. (1996), Could the internet balkanize science? Science, 274, 1479-1480.

Warren, A.M., Sulaiman, A., Jaafar, N.I. (2014), Social media effects on fostering online civic engagement and building citizen trust and trust in institutions. Government Information Quarterly, 31, 291-301.

Wellman, B. (2001), Physical place and cyber place: The rise of personalized networking. International Journal of Urban and Regional Research, 25, 227-252.

Whiteley, P.F. (2000), Economic growth and social capital. Political Studies, 48, 443-466.

World Bank. (2013), World Development Indicators. Washington DC, USA: The World Bank. Available from: http://www.data.worldbank.org/data-catalog/world-development-indicators/World Bank-2012; 2013. [Last accessed on 2014 Apr 20].

World Values Survey, (WVS). (2014), The World Values Survey, 1981-2014. The World Values Survey Association. Available from: http://www.worldvaluessurvey.org.

Zak, P.J., Knack, S. (2001), Trust and growth. Economic Journal, 111, 295-321.

Zhong, Z. (2014), Civic engagement among educated Chinese youth: The role of SNS (Social Networking Services) bonding and bridging social capital. Computers and Education, 75, 263-273.

Zivot, E., Andrews, D. (1992), Further evidence of great crash, the oil price shock and unit root hypothesis. Journal of Business and Economic Statistics, 10, 251-270.