

A CAUTIONARY TALE FOR DIGITAL AGE TRANSITIONING: THE IMPEDING POLARIZATION EFFECTS

Raluca Ioana IORGULESCU¹

John M. POLIMENI²

Abstract

Jobs are susceptible to computerization depending on the tasks involved. The existing literature documents the impact of computerization on labor market outcomes in highly developed countries and it also raises awareness about the future of IT-saturated societies based on the experience of advanced countries.

In 1966, Michael Polanyi observed that “We can know more than we can tell... The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar...” and almost fifty years later David Autor explains how the IT revolution is a cause for an accelerated labor market polarization (a simultaneous increase of jobs requiring high-education and offering a high wage and of jobs requiring low-education and paying a low-wage) as an expression of Polanyi’s paradox.

This paper will present, assuming an intensifying IT revolution globally, an overview of the concepts and the empirical results that warn about the possibility that an IT-bounded Romanian labor market where Polanyi’s paradox and the productivity paradox are at work could increase inequality through digital divide, job polarization and wage polarization.

Keywords: Polanyi’s paradox, productivity paradox, labor market polarization, digital divide, digital age, Romania

JEL Classification: J23, J24, O14, O33

1. Introduction

The knowledge society announces itself as the next stage of country level socio-economic organization and it is critically influenced (for the good or for the bad, the future will decide ...) by the leveling effect of globalization. The most developed countries are already experiencing a structural change, while the rest of the world might follow them sooner or later. It should be mentioned the case of former centrally planned economies which transitioned (and some are still transitioning), after the fall of the Berlin Wall, to open-market systems. These countries (especially if they became or will become members of the European Union) have to undergo, simultaneously, a double structural change (cascade transition).

Each country, because of institutional variety, has its own specificity and increasing computerization could influence it in a different way since certain jobs are at risk more than

¹ Senior Researcher. Institute for Economic Forecasting–NIER, Romanian Academy, Bucharest, Romania, raluca_i@lycos.com.

² Associate Professor. Economics at Albany College of Pharmacy and Health Sciences, USA.

others. Frey and Osborne (2013, 44) examine how the advancement of robotics “is likely to change the nature of work across industries and occupations” and implement a novel methodology to assess the susceptibility to computerization for more than seven hundred occupations in the United States. This study is not singular; the impact of computerization on labor market outcomes in highly developed countries is documented in the literature (Autor, Katz, and Kearney, 2006 and 2008; Goos and Manning, 2007; Autor and Dorn, 2013; Goos, Manning, and Salomons, 2014). The downside of this experience should be a warning signal for societies with a fast pace of IT catching-up or moving in this direction especially since The Global Information Technology Report 2014 finds that “The digital divide between developed and developing countries is widening as emerging nations, despite large investments in ICT, are failing to reap the same big economic and social benefits from technology as their more developed cousins” (Bilbao-Osorio et al., 2014).

McMullin and her collaborators (2007, 308) accurately point out that any person with a lack of technological skills is exposed to be excluded from various aspects of life including employment. Unfortunately, in this way the advancement of the IT revolution breeds a *digital divide* among the citizens of one country (nationally) or among countries (globally) and it seems to be one of the most recent causes for increasing inequality. If in a world of digital economies, Moriset and Malecki (2007, 2009) emphasize the paradox of local ecosystems as ‘double-edged’ geography.

In 1987, Robert Solow, the well-known Nobel laureate in economics, noticed: “You can see the computer age everywhere but in the productivity statistics”; following his remark, the unfulfilled expectations for a spectacular productivity growth after the huge investment in information technology was labeled the *productivity paradox*. Today, around the world, there is an ongoing debate (Liu et al., 2014; Acemoglu et al., 2014; Mithas and Lucas, 2014; Chen and Xie, 2014; De Serres et al., 2014) over the causes and the measurement of this effect for different countries while the research on the link between informatization and economic growth is polarized between “the digital divide” and “the world is flat” (Sun et al., 2014).

Increasing labor market polarization (the simultaneous increase of jobs requiring high-education and offering a high wage and jobs requiring low-education and paying a low-wage) in developed countries undergoing a structural change, caused by the advancement of the IT revolution, is an expression of *Polanyi’s paradox* (Autor, 2014). The discussion about this paradox, also known as ‘the problem of Tacit Knowledge’, started, half century ago, with Michael Polanyi’s remark: “We can know more than we can tell... The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar” (1966) and it blends today, conceptually, with the debate about the prospects for artificial intelligence.

In the case of an IT-intensifying society, socioeconomic polarization and inequality could increase through three channels: human capital digital divide, job polarization and wage polarization. This paper sketches a digital age labor market subjected to Polanyi’s paradox and productivity paradox, it introduces the concepts, gives some information for highly developed countries and cautions with respect to countries subjected to cascade transitions.

The rest of the paper is organized as follows: Section 2 introduces the IT productivity paradox. Section 3 presents more details about the labor market polarization effects of an IT-economy while Section 4 introduces the case of cascade transitions. Section 5 concludes.

2. The IT revolution and the productivity paradox

Autor (2014, 3) reminds us that Keynes, in his essay 'Economic Possibilities for our Grandchildren' (1930), foresaw that in a century's time, "we may be able to perform all the operations of agriculture, mining, and manufacture with a quarter of the human effort to which we have been accustomed" but he was optimistic that, despite the short-term new disease called technological unemployment, in a century a fifteen-hour workweek and a high standard of living would be the norm. Meanwhile, according to Autor's calculations, in the U.S. "The share of information processing equipment and software in private, non-residential investment rose from approximately 8 percent to more than 30 percent between 1950 and 2012, with the largest leap occurring between 1990 and 2000".

The productivity paradox was analysed and popularized in the seminal paper by Brynjolfsson (1993) "The productivity paradox of information technology" for the case of the United States. It showed how over twenty years, between 1970 and 1990, delivered computing-power increased by more than two orders of magnitude while productivity for the same period seemed to have stagnated. Brynjolfsson reviewed a vast literature aimed at explaining the productivity paradox and he concluded that methodological and measurement deficiencies of IT productivity are as much to blame as the mismanagement by developers and users of IT. Actually, four categories of explanations were delimited: measurement of outputs and inputs, lags due to learning and adjustment, redistribution and dissipation of profits and, last but not least, mismanagement of information and technology.

A historical look at the evolution of the digital technology and at the measurement of the associated productivity growth was provided by Paul A. David (2000). It is of interest to mention some of his findings since the dotcom bubble (IT bubble) started roughly in 1997 and burst in 2001. He also warns about the IT revolution and the subsequent labor market impact and measurement difficulties associated with this type of structural change of the economy:

The development and exploitation of digital information, like previous profound historical transformations based upon new "general purpose engines," turns out to entail a complicated technoeconomic regime transition whose success is contingent upon the coordination and completion of many complementary changes in methods of production, work modes, business organization, and supporting institutional infrastructures. Transformations of that sort, however, involve not only the obsolescence of skills, capital assets and business models; typically they are marked also by the accelerated rate of appearance of new goods and products. For a time, then, the latter developments are of a sort that will seriously challenge the ability of inherited statistical indicators to track and measure the performance of the economy which is undergoing significant and unprecedented structural changes. (David 2000, 56)

A decade ago, Warren Bennis, the man who invented the study of corporate leadership, was reported saying that even if over the past 25 years the IT Revolution has increased productivity by almost 70 percent in the United States, instead of technology becoming a time-saver "everybody... is working harder and longer" (Mandel et al., 2005). This is another facet of the productivity paradox emphasized even more by Bob Moulesong, who wrote in 2013 about corporate America; he makes the point that "despite years of cutting corporate bloat, managers are a much bigger share of the workforce than they were 15 years ago".

The fact that globalization and the Internet, despite offering a host of new opportunities, do augment the intensity of competition and entail a lot more work is supported using the results of a McKinsey survey covering more than 7,800 managers from

all over the world. Even more, one quarter of large companies' executives say "their communications – voice mail, e-mail, and meetings – are nearly or completely unmanageable" and "40 percent of executives spend a full day per week on communications that are not valuable" (Moulesong, 2013). Decades ago, Nicholas Georgescu-Roegen warned about the action of the entropy law for societies evolving towards increasing complexity and implicitly bureaucracy. When it comes to corporate 'bureaucracy' "No matter how many layers of management were supposed to be taken out in the great restructuring, there always seem to be more people on the e-mail distribution lists" (Moulesong, 2013).

3. The emerging labor market in the digital age: polarization effects

Workers skilled in using new information and communications technologies (ICT) are more efficient and in developed countries automation already replaced many unskilled manual jobs. Job polarization due to computerization is explained mainly based on two hypotheses: skill-biased technological change or the increased demand for more educated workers (SBTC) and routine-biased technological change or the preference for replacing labor in routine tasks (RBTC).

Technology-related wage inequality increased abruptly in the US and UK starting in the 1980s and after a few years it spread across the OECD. In the last quarter of a century, developed countries increasingly encountered polarized labour markets (they lost many jobs from to the central part of the wage distribution while were created jobs at the lower and higher ends of it). Goos et al. (2014) show that between 1993 and 2010 job polarization across advanced economies in Western Europe became pervasive and their model explains it based on RBTC and offshoring (their results show RBTC to be the most important cause).

Given the extensive research on impact of ICT on labor market polarization in the United States, it is imperative to recall the 2009 warning given by Susan Crawford, President Obama's special assistant for technology and innovation at the time: "we are creating two Americas where the wealthy have access.... while others are left on a bike path, unable to join in the social and economic benefits that the internet brings" (Crow 2014, 2).

In the aftermath of the Great Recession shock, the McKinsey Global Institute discussion paper 'Help wanted: The future of work in advanced economies' (Manyika et al., 2012) highlighted the long-term issues affecting jobs and employment in advanced economies and warned that "labor market institutions and policies have not kept up with the changes in business practices and technology that are defining what kinds of jobs will be created and where they will be located. As a result, simply restoring robust aggregate demand may not be enough to bring back pre-recession employment levels and will not prepare the workforce for the new jobs of the next two decades."

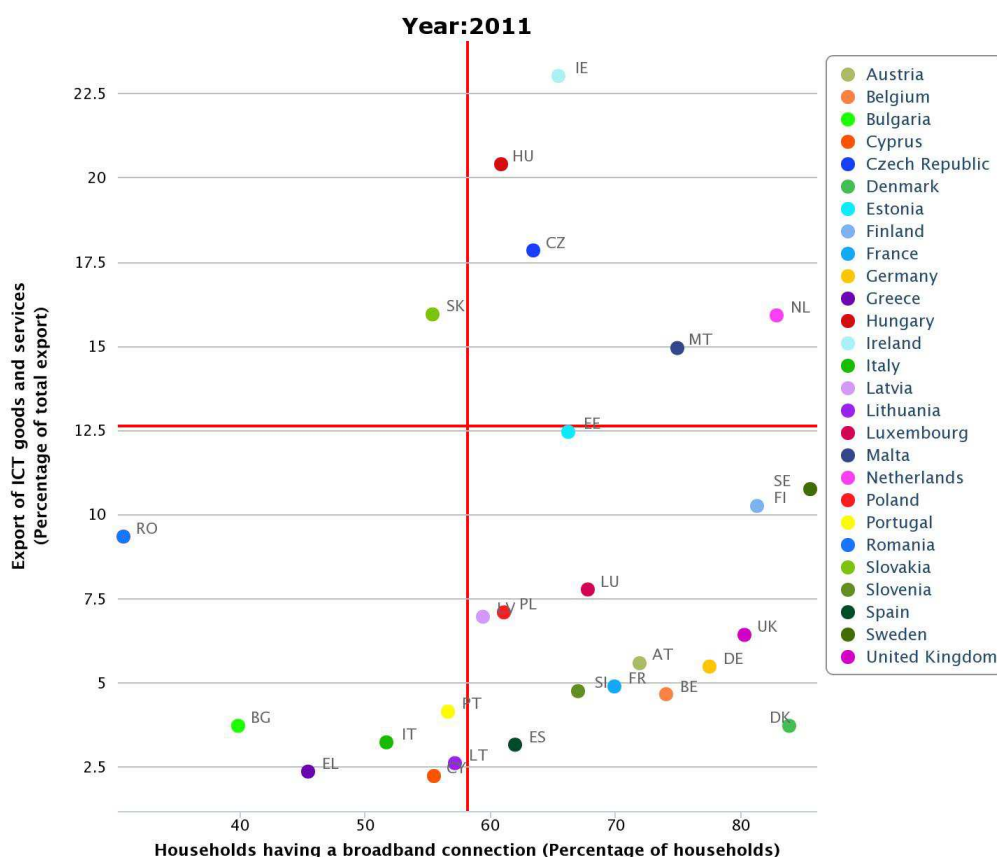
Recently, a poll of the most important U.S. mainstream academic economists was conducted by the Chicago Initiative on Global Markets on the impact of technology on employment and earnings. The poll results suggest that many of the leading economists in the U.S. have "accepted—at least tentatively—the proposition that a decade of technological advancement has made the median worker no better off and possibly worse off" (Autor, 2014).

4. Signaling cascade transitions

If attention is turned to countries that aim to emulate the digital age model of development, it is of interest to focus on the European Union due to its unique mix of

countries in different stages of development (transitional, less advanced and advanced) striving for convergence as a functional entity. The Digital Economy and Society Index (DESI) “is a composite index developed by the European Commission (DG Connect) to assess the development of EU countries towards a digital economy and society. It aggregates a set of relevant indicators structured around 5 dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services”; DESI scores range from 0 (worst performance) to 1 (best performance). Based on DESI, European Union countries are organized in clusters with the 2015 low-performance cluster including Bulgaria, Cyprus, Greece, Croatia, Hungary, Italy, Poland, Romania, Slovenia and Slovakia. Of these ten Member States, seven are former transitional countries (except for Cyprus, Greece and Italy) and they joined the EU in three waves: Hungary, Poland, Slovenia and Slovakia in 2004, Romania and Bulgaria in 2007 and Croatia in 2008.

FIGURE 1 ICT EXPORTS VERSUS HOUSEHOLDS WITH BROADBAND CONNECTION FOR EU COUNTRIES (% , 2011)



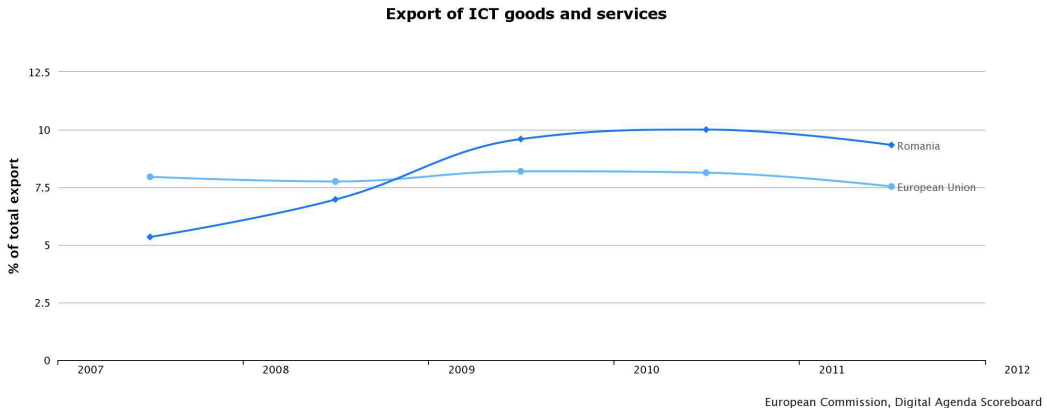
European Commission, Digital Agenda Scoreboard

Source: European Commission, Digital Agenda Scoreboard

The case of Romania is one of interest since the country is emerging as a preferred IT offshoring location for companies including Oracle, Microsoft, IBM, and Vodafone, despite its overall severe digital gap (Figure 1).

Between 2007 and 2010, the share of Romanian ICT services in total exports was above the EU average (Figure 2).

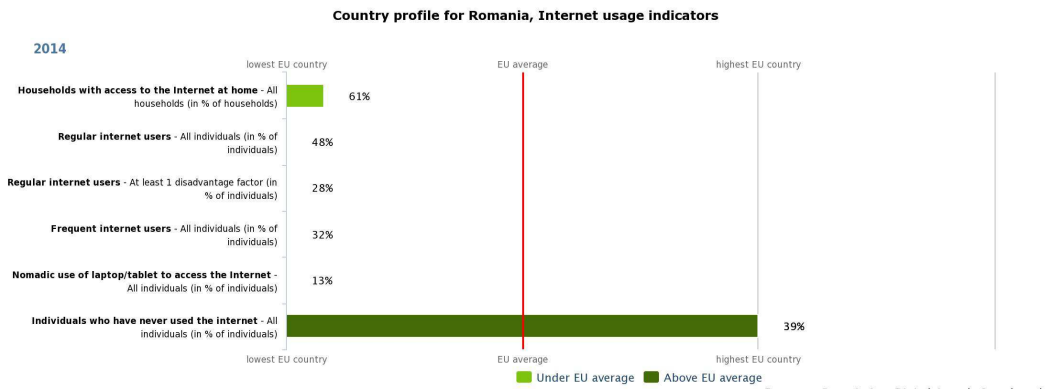
FIGURE 2 ICT EXPORTS FOR ROMANIA VERSUS EU AVERAGE (2007-2011)



Source: European Commission, Digital Agenda Scoreboard, Romania

Romania has the lowest percentage of regular Internet users in the EU; it is not a surprise since 39% of its total population has never used the Internet (while the average for EU is 18%).

FIGURE 3 INTERNET USAGE INDICATORS FOR ROMANIA VERSUS EU AVERAGE (2014)

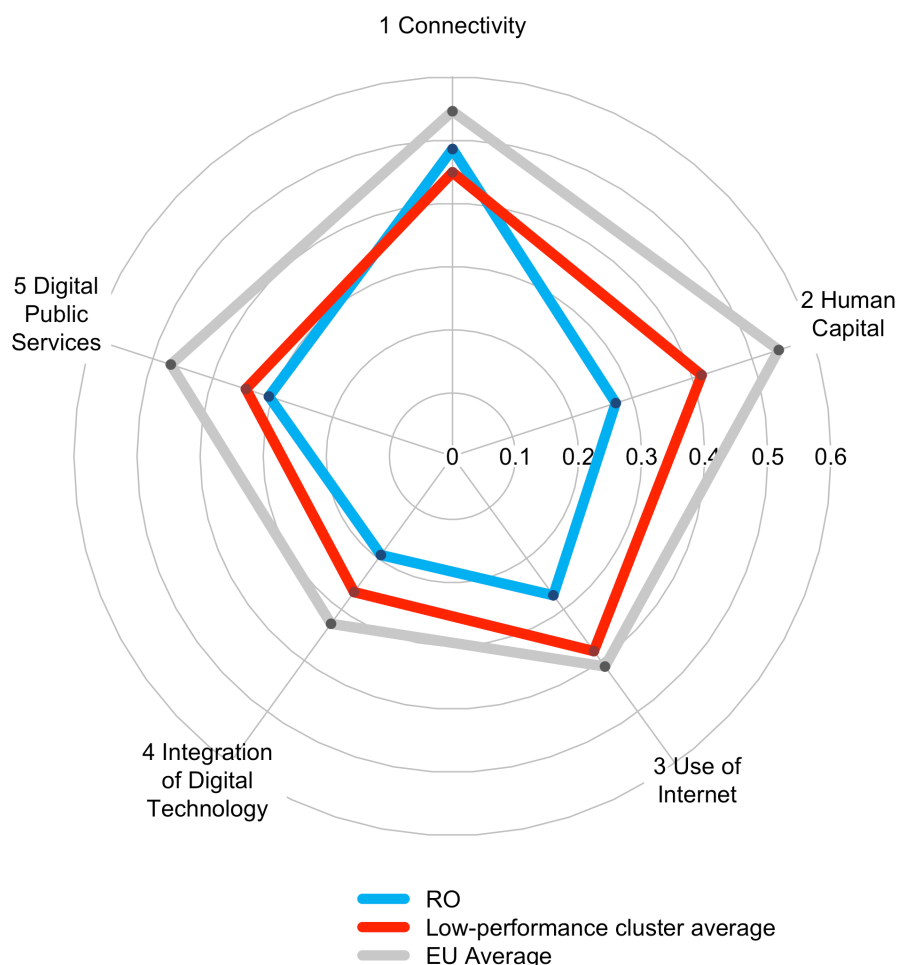


Source: European Commission, Digital Agenda Scoreboard, Romania

According to the EU Digital Agenda country profile (Figure 3), Romania has an overall DESI score of 0.31 ranking 28 out of the 28 EU Member States. Relative to 2013, Romania improved 5% in terms of Connectivity, as more people subscribe to fast broadband networks (59% in comparison to 54%— Romania ranks second for this indicator). Regarding

the development of a Romanian digital economy, there are some barriers: low levels of digital skills (only 20% of population with basic digital skills and the lowest share of ICT specialists - 1.3%- in the workforce of all EU countries) and trust (only 7.7% of internet users use online banking and only 17% shop online - the lowest of all EU countries).

FIGURE 4 THE FIVE DIMENSIONS OF DESI FOR ROMANIA, LOW-PERFORMANCE CLUSTER AND EU28 AVERAGES (2014)



Source: European Commission, Digital Agenda Scoreboard, Romania

Even from these few data, it is easy to infer that the process of converting Romanian society to become part of the EU digital society would encompass a multitude of drastic changes on various aspects such as economic, societal, culture, education, health care and last but not least institutions. A rigorous analysis of these impacts is beyond the purpose of this paper but the warning signal can be raised: the subsequent shocks might be very hard (if not impossible...) to absorb since the impending polarization and increasing inequality will be superimposed on a society already very poor according

to EU standards; in 2013, more than 40% of the population was at risk of poverty or social exclusion.

5. Conclusion

Digital society seems to be the dream world of the future... but this dream might turn to be a nightmare for countries striving to achieve it blindly emulating developed economies. This is especially true for ex-centrally planned economies in Central and Eastern Europe which would be subjected to a cascade transition with no time to build safety nets.

This paper has examined the labor market polarization and increasing inequality effects (Polanyi paradox, productivity paradox, digital divide, job and wage polarization) associated with the evolution of developed countries towards a digital stage. It presents the case of cascade transitions to draw attention to the difficulties to be faced by the newer Member States striving to achieve the digital society goal set by the European Union. Further work will offer a more detailed picture of these impacts and the policy options to mitigate them.

Acknowledgement

This paper presents some results of the study “*The interconnection between econometric modeling of poverty and flow-fund modeling*” part of the 2015 research program of the Institute for Economic Forecasting-NIER, Romanian Academy.

REFERENCES

- Acemoglu, D., Dorn, D., Hanson, G. H., and Price, B. 2014. “Return of the Solow paradox? IT, productivity, and employment in US manufacturing”. *NBER Working Paper* 19837. Available at <http://www.nber.org/papers/w19837> (Accessed 3/24/2015).
- Autor, D. 2014. “Polanyi's Paradox and the Shape of Employment Growth”. *NBER Working Paper* 20485. Available at <http://www.nber.org/papers/w20485> (Accessed 3/24/2015).
- Autor, D.H., Katz, L. F., and Kearney, M. S. 2006. “The Polarization of the U.S. Labor Market”. *American Economic Review Papers and Proceedings*, 96(2): 189-194.
- Autor, D.H., Katz, L. F., and Kearney, M. S. 2008. “Trends in U.S. Wage Inequality: Revising the Revisionists”. *Review of Economics and Statistics* 90(2): 300-323.
- Autor, David H., and Dorn, D. 2013. “The Growth of Low Skill Service Jobs and the Polarization of the US Labor Market”. *American Economic Review* 103(5): 1553-1597.
- Bilbao-Osorio, B., Dutta, S., and Lanvin, B. (Eds.). 2014. *The Global Information Technology Report 2014 - Rewards and Risks of Big Data*. World Economic Forum and INSEAD, SRO-Kundig, Geneva.
- Brynjolfsson, E. 1993. “The productivity paradox of information technology”. *Communications of the ACM* 36(12): 66-77.
- Chen, S., and Xie, Z. 2014. “Is China's e-governance sustainable? Testing Solow IT productivity paradox in China's context”. *Technological Forecasting and Social Change* 96: 51-61.
- Chicago Initiative on Global Market. 2014. IGM Forum poll date February 25, 2014, available at http://www.igmchicago.org/igm-economic-experts-panel/poll-results?SurveyID=SV_eKbRnXZWx3jSRBb (Accessed 3/24/2015)
- Crow, D. 2014. “Digital divide exacerbates US inequality”. *Financial Times*, October 28.

David, P. A. 2000. "Understanding digital technology's evolution and the path of measured productivity growth: present and future in the mirror of the past". In Erik Brynjolfsson, Brian Kahin eds. *Understanding the digital economy: data, tools, and research*. Cambridge, MA: MIT, pp. 49-96.

De Serres, A., Yashiro, N., and Boulhol, H. 2014. "An international perspective on the New Zealand productivity paradox". *New Zealand Productivity Commission Working Paper 2014*, 1.

European Commission. DG CONNECT. Digital Agenda Scoreboard. Available at <http://ec.europa.eu/digital-agenda/en/digital-agenda-scoreboard> (Accessed 5/5/2015).

Frey, C., Osborne, M. 2013. *The future of employment: how susceptible are jobs to computerization?*, unpublished manuscript, University of Oxford: Oxford Martin School.

Goos, Maarten, Alan Manning, and Anna Salomons. 2014. "Explaining Job Polarization: Routine-Biased Technological Change and Offshoring". *American Economic Review* 104(8): 2509–2526.

Goos, Maarten, and Alan Manning. 2007. "Lousy and Lovely Jobs: The Rising Polarization of Work in Britain". *Review of Economics and Statistics* 89(1): 118–133.

Keynes, J. M. 1933. "The economic possibilities for our grandchildren". In *Essays in persuasion*. New York: Macmillan, pp. 358-373. (Original work published 1930)

Liu, T. K., Chen, J. R., Huang, C. J., and Yang, C. H. 2014. "Revisiting the productivity paradox: A semiparametric smooth coefficient approach based on evidence from Taiwan". *Technological Forecasting and Social Change* 81: 300-308.

Malecki, E. J., and Moriset, B. 2007. "The paradox of a "double-edged" geography: local ecosystems of the digital economy". In *The Digital Economy: Business Organization, Production Processes and Regional Developments*. New York, NY: Routledge, pp. 174-198.

Mandel, M., Hamm, S., Matlack, C., Farrell, C., and Palmer, A. T. 2005. "The real reasons you're working so hard". *Business Week* 3953(October 3): 60-67.

Manyika, J., Lund, S., Auguste, B., and Ramaswami, S. 2012. Help wanted: The future of work in advanced economies (discussion paper). Washington, DC: McKinsey Global Institute.

McMullin, J.A., Duerden Comeau, T., and Jovic, E. 2007. "Generational affinities and discourses of differences: a case study of highly skilled information technology workers". *The British Journal of Sociology* 58(2): 297-316.

Mithas, S., and Lucas, H. C. (2014). "Information Technology and Firm Value: Productivity Paradox, Profitability Paradox, and New Frontiers". In Heikki Topi and Allen Tucker eds. *Computing Handbook volume 2: Information Systems and Information Technology Third edition*, Boca Raton: CRC Press, pp. 72-1.

Moriset, B., and Malecki, E. J. 2009. "Organization versus space: The paradoxical geographies of the digital economy". *Geography Compass* 3(1): 256-274.

Moulesong, B. 2013. "Productivity paradox". *The Times of Northwest Indiana*, June 30. Available at http://www.nwitimes.com/business/jobs-and-employment/productivity-paradox/article_7b55c8c0-a259-5820-8ac5-5b49199753aa.html (Accessed 5/5/2015).

Polanyi, Michael. 1966. *The Tacit Dimension*. New York: Doubleday.

Solow, R. 1987. "We'd better watch out". *New York Times Book Review*, July 12, page 36.

Sun, C., Jiao, H., and Ren, Y. 2014. "Regional Informatization and Economic Growth in Japan: An Empirical Study Based on Spatial Econometric Analysis". *Sustainability* 6(10): 7121-7141.