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Pathological Knowledge-Based Economies: Towards a Knowledge-Based Economy Perspective on the Current Crisis

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Abstract *The crisis that started on Wall Street in mid-2007 and that has turned into a global financial and economic crisis is also a crisis of knowledge-based economies (KBEs). In fact, it is related to intrinsic features of such economies. The central point argued in this paper is the need for a specific knowledge-based economy perspective on the crisis that takes human nature seriously, i.e. that incorporates psychological factors like Keynes' 'animal spirits'. Such a perspective is a pre-requisite for designing institutions that might be able to reduce the likelihood of the development of severe pathologies of KBEs in future. It also suggests the need for a new kind of welfare economics.*

Keywords: knowledge-based economies; crisis; information and communication technologies; ignorance; risk; human nature

Introduction

At the beginning of the twenty-first century most economies can either be described as knowledge-based economies (KBEs) or as aspiring to develop into such economies. While KBEs can be defined in many different ways, they have to do with information, knowledge, learning, innovation, entrepreneurship, networks, information and communication technologies (ICTs). It is not uncommon to find various combinations of these terms to denote a particular version of a knowledge-based economy (KBE) popular at a particular time and place.

In a stock-take of the impact of the current economic crisis on long-run growth drivers and of the policy responses to the crisis as of early 2009, the OECD admits that

> The current crisis is the first of this severity to hit OECD countries, since they have shifted to knowledge-based service economies where investment in

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> intangible assets is of equal importance as investment in machinery, equipment and buildings.[1]

Many of the stimulus packages currently being implemented by governments in order to counter the crisis put some emphasis on investments in ICTs, e.g. in education, intelligent transport systems, greening the economy, smart buildings, grids, health, the environment, public services etc.[2] What does not seem to be sufficiently acknowledged is that the highly ICT- and knowledge-intensive industries at the centre of the crisis, e.g. primarily Finance, Insurance and Real Estate (FIRE), are an important part of KBEs, and that, for that reason alone, the current crisis is also a crisis of KBEs.

This paper argues for a *knowledge-based economy perspective on the current crisis*. Innovation and intensive use of ICTs are key features of KBEs. They also are key building blocks of the current crisis. This perspective is not meant to minimize the impact of other factors, e.g. the availability of cheap credit and the role of the regulatory regime, but to re-direct discussion about the origins of the crisis to those associated with the intrinsic nature of KBEs. This also requires that a knowledge-based economy perspective on the current crisis 'takes human nature seriously'.

The remainder of the paper is organized as follows. The next section discusses the concept of KBEs, focusing on the 'mainstream' OECD definition and some of its limitations. This is followed by an exploration of other aspects of KBEs which are usually neglected, in particular the implications of 'not knowing'. This opens a window on the inherent potential of KBEs to develop severe pathologies. This is followed by a brief discussion of the impact of the current crisis on the KBE and the important role prescribed to ICTs in overcoming the crisis. Next, a KBE perspective on the current crisis is put forward in more detail in order to highlight why the current crisis is a crisis of KBEs. Moreover, if we want to reduce the likelihood of similarly severe KBE pathologies in future, the knowledge policy discourse needs to be extended to incorporate insights from psychology about human behaviour. This arguably also requires the development of a new kind of welfare economics that puts more emphasis on results from behavioural economics and happiness research. The final section contains some concluding comments. In particular, a suggestion is made for a research agenda that derives a taxonomy of potential pathologies of KBEs.

The Concept of Knowledge-Based Economies

A commonly used definition of KBEs is that provided by the OECD in the mid-1990s, i.e. KBEs are 'economies which are directly based on the production, distribution and use of knowledge and information'.[3] The OECD observes that the emergence of such economies is reflected in trends towards high-tech investment, high-tech industries, highly-skilled labour, and associated productivity gains. It sees its task in promoting science, technology and industry policies that support these developments.[4] Intimately related to the development of KBEs is the emergence of ICTs as 'general purpose technologies' that spread throughout the economy, facilitating productivity gains and further innovations.[5]

The history of the development of the mainstream concept of KBEs as used by the OECD, and that of the related concept of 'information economies', makes fascinating reading. Godin analyses the development of the KBE concept from its earliest appearance in the 1960s to its revival by the OECD in the 1990s and

beyond, and discusses its main protagonists. He hypothesizes that during the 1990s the term was used by policy-makers as an umbrella concept that enabled them to focus on a broad range of science and technology issues and their importance for the economy, as well as enabling the generation of a similarly large set of (mostly traditional) statistics 'under one roof'.[6] The information/KBE concept has been promoted by many others who developed their own specific definitions, resulting in a lack of clarity and consistency between the many definitions within and across disciplines.[7]

This diversity should not be surprising. A moment's reflection suggests that KBEs come in many different forms, even if one sticks to the mainstream OECD definition. For example, employment shifts towards information/knowledge workers are found in all OECD economies, irrespective of whether they are predominantly industrial-based, service-based, or even primary industry-based (like, for example, New Zealand[8]). Moreover, the role of tacit knowledge in knowledge generation and diffusion implies that much knowledge will remain localized, despite the importance of codification based on ICTs.[9] Also, there is a diversity of beliefs and values about core KBE elements even amongst a group of similar countries.[10] In short, KBEs are very diverse, reflecting the characteristics of each economy and society.[11] To speak of 'the KBE' is misplaced and, more importantly, misleading.

However, the mainstream definition of KBEs does point to some common features, like the emphasis on science and technology, innovation, and ICTs. What is also common across economies is the neglect of financial and banking sector innovation from the knowledge policy discourse. I regard Kahin and Foray's 2006 book as a summary of mainstream knowledge policy thinking.[12] There are chapters on new models of innovation and on the emerging cyber-infrastructure, and under the heading 'innovation' the index mentions biomedical research, custom integrated circuits, and grid technologies. Financial innovation does not figure anywhere, despite the fact that, according to the preface, the book examines the economic and social implications of information technology.[13]

From Knowledge-Based Economies to Ignorance Economies and Beyond

In order to get closer to an understanding of the inherent potential of KBEs to develop severe pathologies, it is necessary to delve somewhat deeper into the nature of such economies and, especially, their relationship with the unknown.

Ignorance and Risk Economies

KBEs are intimately related to 'not knowing', i.e. the unknown or ignorance. The creation of knowledge implies that it replaces some unknown, although it would not be correct to say that KBEs reduce the unknown, because, as the saying goes, the more we know the more we find out that we do not know. Moreover, it is also the case that the creation of knowledge often depreciates or destroys existing knowledge, or leads to the neglect of certain forms of knowledge.

Roberts and Armitage approach KBEs from such a perspective.[14] They focus on the concept of ignorance and argue that KBEs are *at the same time and by their very nature* also 'ignorance economies':

> … we want to argue, the knowledge economy is precisely rooted in the production, distribution, and consumption of ignorance and lack of information.

> What we are suggesting, then, is that the knowledge economy is one wherein the production and use of knowledge also imply the creation and exploitation of ignorance, for not only knowledge but also ignorance now play a main role in the formation of advanced global capitalism. The knowledge economy is at the same time an ignorance economy.[15]

Moreover, by facilitating a shift in the balance between codified and tacit knowledge towards the former, Roberts and Armitage argue that ICTs lead to a growth in ignorance.[16] The wider perspective provided by the ignorance economy is useful for extending our understanding of the true nature of KBEs, and, although Roberts and Armitage do not focus on pointing out the potential pathologies ignorance economies might entail, they provide a platform from which to start such investigations.

Kenway *et al.*,[17] in a sense, go a step further in this direction than Roberts and Armitage. They also focus on the nature of knowledge and its relationship with the unknown; however, building on a number of sociological theories of risk, their concept of the 'risk economy' highlights the possibility of unintended consequences and hazardous side effects of techno-scientific innovation in KBEs. These are due to the types of knowledge created and the persons (i.e. their personalities) creating it. In particular, Kenway *et al.* emphasize the fact that in mainstream economics, (calculable) risk has triumphed over (non-calculable or Knightian) uncertainty. An adequate notion of the risk economy, however, has to encompass both. The restricted notion of (calculable) risk creates just an illusion of control. In reality, the type of innovation promoted in advanced KBEs (i.e. frontier technologies) may be high risk, and these risks may be increased by the pressure to release under-researched technologies due to commercial considerations, and due to the type of entrepreneurship KBEs foster:

> Generally then, the ghost of the risk economy raises the possibility that the formula for economic growth in the knowledge economy may also endanger future generations. Risk as a calculus of probability and pretence to know the future actually conceals uncertainty.[18]

I argue that this applies as much to innovation in FIRE industries as it does to techno-scientific innovation.[19]

Bullshit Economies

Being ignorant about an issue often does not prevent people from talking about it. Such talk can be described as 'bullshit', and in KBEs where uncertainty has mostly been banned from the perceptions of policy-makers and the public in favour of risk, there seems a lot of it around. The moral philosopher Harry Frankfurt is one of the few observers of contemporary Western society who dares to seriously write about this phenomenon:[20]

> … the production of bullshit is stimulated whenever a person's obligations or opportunities to speak about some topic exceed his knowledge of the facts that are relevant to that topic … to speak extensively about matters of which they are to some degree ignorant.

Frankfurt tries to develop a theoretical understanding of bullshit, distinguishing it from related phenomena, like lies:

> Someone who lies and someone who tells the truth are playing on opposite sides, so to speak, in the same game. Each responds to the facts as he understands them … The bullshiter … does not reject the authority of the truth, as the liar does, and oppose himself to it. He pays no attention to it at all. By virtue of this, bullshit is a greater enemy of the truth than lies are.[21]

Economies where bullshit is the basis for much of the decision-making in key industries can be described as 'bullshit economies'. They are ignorance or risk economies gone wrong where decision-makers are trying to cope with the 'unspeakable complexity of the knowledge economy'[22] by relying on subjective views unencumbered by experience and objective facts. They constitute extreme examples of pathological KBEs. Prime cases are asset bubbles and stock market manias. The economic problems created by such pathologies then undermine the knowledge creation and diffusion processes in the rest of the economy, for example by resulting in a reduction in private and public spending on R&D, education etc.

The Impact of the Current Crisis on Knowledge-Based Economies and ICT Investment as Salvation

In its stock-take of the current crisis, the OECD notes that the crisis has already begun to affect key drivers of long-term growth, for example innovation and entrepreneurship. There is slower growth or even decline in firms' R&D spending (in line with reduced cash flows). Also banks, markets and investors have become more risk averse, i.e. there has been a reduction in internal and external sources to finance R&D. Moreover, business R&D is being re-directed towards short-term, low-risk innovations.[23] All this is 'affecting the stock of knowledge as highly trained researchers and innovators lose their jobs … Small, innovative firms are particularly hard hit …'.[24] Human capital is being depreciated if not lost.

While the crisis is seen as potentially magnifying the competitive advantage of research-intensive firms who seize the opportunity to reinforce market leadership through increased R&D spending, reduced support by the financial system for, especially, new entrants, is a major concern. For example, the drying up of venture capital investment started in the US at the beginning of 2008 and has accelerated since then.[25] Moreover, the declines in international trade, foreign direct investment and access to international financing are endangering the global supply chains that underpin innovation. These supply chains are critical sources of new knowledge and learning.[26]

But all is not lost! 'Investments in a networked recovery can preserve ICTs as a key engine of growth',[27] and 'looking ahead, the OECD Innovation Strategy will contribute to maximizing the benefits of innovation'.[28] One is tempted to ask, has anything changed in terms of the broad vision for growth in KBEs? Apparently not. The OECD also observes that

> Many of the existing stimulus packages put some emphasis on deploying ICT infrastructure and a 'networked recovery'—i.e. the notion that ICT infrastructure and its use are a tool to revive the economy through new innovative services and offer solutions to pressing social problems.[29]

Presumably, that is also what before the crisis many expected financial innovation and the intensive use of ICTs in banking to accomplish.

Similarly undeterred, the Work Foundation[30] has recently launched the second phase of its research programme on the future of Britain's knowledge economy:

> … this major programme brings together major players from the public and private sector (including the UK's creative industries), the NHS and government to develop a definite plan showing how Britain can recover from recession and re-construct a knowledge economy by 2020 … The programme plans to carry out five sector-based studies: on energy and the environment (low-carbon); health-care and the health science base; creative and cultural services; high-tech manufacturing (manu-services); and high-tech services.[31]

The director of the Work Foundation is quoted as saying that 'the strength and durability of the recovery depends critically on how much of the UK's knowledge and scientific base will survive the recession'.[32] In short, it is acknowledged that Britain's KBE has been affected by the current crisis, but it does not seem to have been recognized that it is also intimately related to it. Switching attention away from FIRE industries and to the development of other sectors of the KBE without learning from past mistakes does not seem to be a recipe for future success. Key features of KBEs got us into the mess, but now they are also seen as the best hope for getting us out of it. It seems unlikely that the Work Foundation can develop an appropriate new vision for Britain's KBE if it does not acknowledge and learn from its current intrinsic pathology.

Towards a Knowledge-Based Economy Perspective on the Current Crisis That Takes Human Nature Seriously

The acknowledgement that the current economic crisis is due to pathological KBEs is a prerequisite for being able to recognize potential dangers of future KBE pathologies developing and implementing policies that reduce the likelihood of their occurrence. It requires *a knowledge-based economy perspective on the current crisis*.

Without attempting an exhaustive analysis of all the specific KBE-related factors that have contributed to the current crisis, I wish to highlight two major ones, both of which are associated with the role of ICTs in KBEs. First, without the infrastructure provided by ICTs, financial innovations could not have occurred to the same extent and their implications would have been more limited. Increased ICT intensity was the key infrastructure that enabled the development of the financial and real estate bubbles. Combined with 'rocket scientists' on Wall Street ready to create ever more obscure financial instruments, and failings of human nature, like greed, corruption and incompetence, a major KBE pathology developed which resulted in the biggest recession since the Great Depression 80 years ago.[33]

Secondly, the role of ICTs in the revival of productivity growth in the US economy during the mid-1990s, i.e. the New Economy,[34] might have contributed to a sense of (initially justified) optimism that encouraged house price growth, but then the *perception* of productivity growth became divorced from reality. This hypothesis that fundamentals of productivity growth have contributed more to the growth in US house prices during the years before 2007 than previously thought has recently been put forward by James Kahn, an economist associated with the Federal Reserve Bank of New York.[35] It also suggests that the current crisis is just the latest example

in a succession of major crises directly linked to the nature of KBEs, the earlier ones being the collapse of the New Economy, followed by the end of the telecom bubble.

The kind of futures we can expect for KBEs will importantly depend on whether analysts and policy-makers will recognize the potential pathologies inherent in the nature of such economies. In particular, KBE policies need to take human nature seriously. Policies for KBEs need to be based on insights about *how people actually behave, not on how they ought to behave if they were rational beings*. This might appear odd in economies based on (scientific) knowledge. However, the spectre of the ignorance and risk economy tells us that this should not be perceived as strange or out of place. Some analysts of KBEs have, of course, recognized this and have argued that 'wisdom-based' knowledge policy-making has largely been lost and that it is in urgent need of revival.[36] The discussion of ignorance, risk and bullshit economies highlights the urgency of bringing wisdom back into KBEs. By definition, such policy-making has to take human nature seriously.

While knowledge created in the 'hard sciences' can be assumed to contain a high degree of rationality, the people who create such knowledge are not necessarily very rational in much of the decision-making affecting their research, or their lives in general. The link between knowledge creation, innovation, subjectivity and self-delusion is more obvious in the 'soft sciences' dealing with how people behave, including in finance (despite it employing some 'hard' science tools). How else could one explain that many of the innovations in finance, e.g. those relating to securitization and derivatives, initially regarded as great achievements could turn so quickly into 'financial weapons of mass destruction'?[37] The role of psychological factors on Wall Street and on the part of the public in creating, or at least co-enabling, the crisis has to be taken very seriously. For example, Gladwell has suggested that the roots of the crisis on Wall Street lay in the 'psychology of overconfidence', and Ariely has pointed to the role of psychology and irrational behaviour in the subprime mortgage crisis and its aftermath.[38]

If anything, this should lead mainstream economists to reassess their models that employ rational expectations and minimize, if not completely exclude, a role for Keynes' 'animal spirits'. The latter include the role of confidence (or lack thereof) in investment behaviour, and the impact of considerations of fairness, trust, corruption, antisocial behaviour, money illusion etc. Failure by economists to foresee the current crisis is leading to a long overdue revival of these ideas.[39] They have long been recognized in economic psychology, behavioural economics, and happiness research, but they need to be incorporated into macroeconomic theory and the knowledge economy discourse if we want to understand 'how the economy really works'.[40]

'Taking human nature seriously' also requires a new welfare economics that takes insights from behavioural and happiness research into account. Elsewhere I have put forward the argument that a closer alignment between the knowledge policy and happiness policy discourses should be of high priority.[41] I also raised the question whether it is a coincidence that average subjective well-being seems to have been stagnant in developed countries since about the same time that researchers have noted the development of KBEs. Is there a link between the rise of knowledge workers, the increased pace of innovation and the associated 'creative destruction', information overload and the rise of work-related stress and mental illness in society?[42] Despite the close links between knowledge and economic outcomes at the centre of the mainstream knowledge policy discourse, it is important to remember that

economic outcomes are just an intermediate goal, and not the final goal of economic activity.

The need for such a new welfare economics is also becoming more obvious in the context of the debate about the ecological sustainability of KBEs. In its stock-take of the current crisis, the OECD argues that the crisis should be used to strengthen efforts to achieve low-carbon economic growth,[43] and the OECD is developing 'green ICT strategies'[44] and its Council has adopted a 'Declaration on Green Growth'.[45] However, the OECD acknowledges that incentives to develop a greener economy have weakened during the crisis,[46] and critics point out that the pursuit of knowledge for economic growth sits uncomfortably with the goal of sustainable KBEs.[47] Evidence is also accumulating that 'natural capital', i.e. the value of renewable and non-renewable natural resources, is associated with high levels of subjective well-being in developed countries, providing a link between sustainability and psychological factors, and pointing to the need for a new kind of welfare economics.[48]

Concluding Comments

Innovation in key knowledge-intensive services sectors, combined with the widespread and intensive use of ICTs throughout the economy, have resulted in the greatest pathology KBEs have experienced so far. KBEs in developed countries need to be rebalanced, i.e. re-specialize by downsizing and restructuring the financial sector and by growing non-financial sectors.[49] The extent to which this has to happen will vary from economy to economy, but, amongst large economies, the greatest restructuring is probably necessary in the US and the UK.[50]

However, despite the fact that ICTs provided the key infrastructure for the current crisis, even critics seem to agree with the view of the OECD that more intensive use of ICTs across all activities and more innovation will help us overcome the crisis. Wade, for example, thinks ICTs have the potential for big expansion in environmental activities and lifetime education services.[51] ICTs will continue to develop and transform KBEs through innovation, like the imminent arrival of the 'Internet of things',[52] the production of knowledge on the part of ICT users (the 'co-invention of ICT applications'),[53] the enabling of alternative modes of production,[54] and many others. Whether such economies will still be called KBEs in future is a moot question. The interplay between the complexities of knowledge, ignorance and technology at the heart of modern economies will remain, even if new buzzwords are invented to label newly emerging features.

KBEs attempt to flourish by pushing out the boundaries of knowledge and by extending the commercial applications of knowledge. Human nature, which finds calculable risk much easier to cope with than Knightian uncertainty, and which is often driven by its 'animal spirits', ensures that the spectre of unintended consequences and hazardous side effects will remain an integral part of this process. In short, KBEs, by their very nature, are prone to exhibit pathologies. This calls for an extended research agenda that explores these issues.

Both growth economists and historians tell us that institutions that underlie the production, preservation and distribution of knowledge are central to growth in KBEs.[55] Also, Foray makes such institutions a centrepiece of his version of a new economic sub-discipline, i.e. an 'economics of knowledge'.[56] It is clear that these 'knowledge institutions' have changed over time and that they are almost surely not yet optimal. I do not have a crystal ball to forecast how knowledge institutions

will change in the future. However, it seems reasonable to assume that the current crisis will affect them. Moreover, returning to the central argument of this paper, a specific KBE perspective on the current crisis that takes human nature seriously should help in designing institutions that minimize potential pathologies of KBEs.

One approach that should prove helpful in this endeavour would be the development of a taxonomy of potential pathologies of KBEs. A starting point might be the development of a taxonomy of KBEs, i.e. providing a classification recognizing the diversity of such economies. This would then help in exploring the various ways that major pathologies might arise in different types of KBEs. Such research should be accompanied by a reassessment of conventional welfare economics and the development of a new kind of welfare economics that takes account of insights from research on subjective well-being and human behaviour in general.

Notes and References

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2. *Ibid*, pp. 27–8.
3. OECD, 'Special theme: the knowledge-based economy', in OECD, *Science, Technology and Industry Outlook 1996*, OECD, Paris, 1996, pp. 229–56.
4. *Ibid*.
5. See, for example, Elhanan Helpman (ed.), *General Purpose Technologies and Economic Growth*, MIT Press, Cambridge, MA, 1998.
6. B. Godin, 'The knowledge-based economy: conceptual framework or buzzword?', *Journal of Technology Transfer*, 31, 1, 2006, pp. 17–30. Godin has also written a similar history of the concept of the information economy (see B. Godin, 'The information economy: the history of a concept through its measurement, 1949–2005', *History and Technology*, 24, 3, 2008, pp. 255–87). He argues that the 'information economy' was invented to explain structural changes in modern economies, whereas the 'knowledge economy' concept, although originally developed for similar reasons, owes its later revival and development into a buzzword to politics. In the context of the current paper the distinction between the two concepts does not matter.
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8. For the New Zealand case, see my papers: Hans-Jürgen Engelbrecht, 'Towards a knowledge economy? Changes in New Zealand's information work force 1976–1996', *Prometheus*, 18, 3, 2000, pp. 265–82; and Hans-Jürgen Engelbrecht and Anne Mahon, 'Information workforce in New Zealand, 1991–2001', *New Zealand Population Review*, 29, 2, 2003, pp. 19–33.
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10. See my paper: Hans-Jürgen Engelbrecht, 'The (un)happiness of knowledge and the knowledge of (un)happiness: happiness research and policies for knowledge-based economies', *Prometheus*, 25, 3, 2007, pp. 243–66.
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13. *Ibid*, p. ix.
14. J. Roberts and J. Armitage, 'The ignorance economy', *Prometheus*, 26, 4, 2008, pp. 335–54.
15. *Ibid*, pp. 345–6.

16. *Ibid*, p. 347.
17. J. Kenway, E. Bullen, J. Fahey with S. Robb, *Haunting the Knowledge Economy*, Routledge, London and New York, 2006. I focus on just one of their four 'alternative economies'. In addition to the risk economy, they discuss the so-called gift, libidinal and survival economies. In their view these alternative exchange systems are not normally acknowledged as this would highlight the shortcomings of the dominant KBE discourse. However, as Geoffrey Hodgson has pointed out, every socio-economic system must rely on at least one structurally dissimilar subsystem to function, i.e. there must always be a plurality of modes of production. He calls this the 'impurity principle' (see G. Hodgson, *Economics & Utopia: Why the Learning Economy is Not the End of History*, Routledge, London and New York, 1999).
18. Kenway *et al.*, *op. cit.*, p. 52.
19. Of course, this is not a new observation. Van Loon, for example, discusses the risk economy and explicitly mentions the collapse of the US hedge fund Long Term Capital Management in 1998 that almost took down the financial system. See J. van Loon, 'Risk and knowledge', in D. Rooney, G. Hearn and A. Ninan (eds), *Handbook on the Knowledge Economy*, Edward Elgar, Cheltenham, UK and Northampton, MA, 2005, pp. 54–66. Also see the popular book by N. N. Taleb, *The Black Swan: The Impact of the Highly Improbable*, Allen Lane, Penguin Books, New York, 2007. Taleb focuses on the failure of standard but highly inappropriate statistical methods to account for uncertainty. There have been many who saw the increasing potential for the current crisis in the years preceding it.
20. H. G. Frankfurt, *On Bullshit*, Princeton University Press, Princeton, NJ and Oxford, 2005. The quotation is from p. 63.
21. *Ibid*, pp. 60–1.
22. This phrase was used by Brian Kahin in his discussion of major problems associated with knowledge policy. See B. Kahin, 'Prospects for knowledge policy', in Kahin and Foray (eds), *op. cit.*, pp. 1–8.
23. OECD, 2009a, *op. cit.*, pp. 5–6.
24. *Ibid*, p. 6.
25. *Ibid*, pp. 6–7.
26. *Ibid*, p. 8.
27. *Ibid*, p. 13.
28. *Ibid*, p. 15.
29. *Ibid*, p. 27.
30. See http://www.theworkfoundation.com/default.aspx.
31. N. Memon, 'Knowledge economy programme-second phase launched', news article, *The Work Foundation*, 14 July 2009. Available at: http://www.theworkfoundation.com/pressmedia/news/newsarticle.aspx?oItemId=158.
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34. See, for example, K. J. Stiroh, 'Growth and innovation in the New Economy', in D. C. Jones (ed.), *New Economy Handbook*, Elsevier/Academic Press, San Diego and London, 2003, pp. 723–51; K. J. Stiroh, 'Information technology and the US productivity revival: what do the industry data say?', *American Economic Review*, 92, 5, 2002, pp. 1559–76.
35. J. A. Kahn, 'Productivity swings and housing prices', *Current Issues in Economics and Finance*, 15, 3, 2009, 8 pp. Available at: www.newyorkfed.org/research/current_issues. Interestingly, the fact that people's perception of productivity growth became divorced from reality will have been at least partly due to the work of other economists associated with the Federal Reserve

Bank of New York who even increased their projections of (mostly ICT-related) productivity growth for the 2004–14 period (see D. W. Jorgenson, M. S. Ho and K. J. Stiroh, 'Will the US productivity resurgence continue?', *Current Issues in Economics and Finance,* 10, 13, 2004, 7 pp.).

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38. See Malcolm Gladwell, 'Cocksure', *The New Yorker*, 27 July 2009. Available at: http://www.newyorker.com/reporting/2009/07/27/090727fa_fact_gladwell; Dan Ariely, *Predictably Irrational: The Hidden Forces that Shape Our Decisions*, revised and expanded edition, HarperCollins Publishers, London, 2009.
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40. *Ibid.* For a brief introduction to the controversy about the state of macroeconomics, see 'Briefing: the state of economics - the other-worldly philosophers', *The Economist*, 18 July 2009, pp. 58–60.
41. Engelbrecht, 2007, *op. cit.*
42. See *Ibid.* For a light-hearted defence of blue-collar 'non-office cubicle' work see Matthew Crawford, 'The case for working with your hands', *The New York Times*, 24 May 2009. Available at: http://www.nytimes.com/2009/05/24/magazine/24labor-t.html.
43. OECD, 2009a, *op. cit.*
44. OECD, *Towards Green ICT Strategies: Assessing Policies and Programmes on ICT and the Environment*, DSTI/ICCP/IE(2008)3/Final, May 2009b.
45. OECD, *Declaration on Green Growth*, C/MIN(2009)5/ADD1/Final, Paris, 25 June 2009c.
46. OECD, 2009a, *op. cit.*
47. B. Lin, 'A sustainability perspective on the knowledge economy: a critique of Austrian and mainstream views', *Ecological Economics*, 60, 2006, pp. 324–32, argues that to achieve sustainable KBEs that use resources efficiently requires a more equitable distribution of wealth, an issue neglected by both the mainstream literature on KBEs and the Austrian analysis of the knowledge problem.
48. See Hans-Jürgen Engelbrecht, 'Natural capital, subjective well-being, and the new welfare economics of sustainability: some evidence from cross-country regressions', *Ecological Economics*, forthcoming.
49. R. Wade, 'Steering out of the crisis', *Economic & Political Weekly*, XLIV, 13, 28 March 2009, pp. 39–46.
50. For example, *The Economist* reports that in the US, the financial industry's share in total corporate profits peaked at an incredible 41% in 2008. It also cites research that estimates that up to half of the wage gap between financial and non-financial workers between the mid-1990s and 2006 was due to rent-seeking instead of 'genuine wealth-creation'. See 'Surviving the slump: a special report on business in America', *The Economist*, 30 May 2009, p. 15.
51. Wade, *op. cit.*, p. 44.
52. International Telecommunication Union, *ITU Internet Reports 2005: The Internet of Things*, ITU, Geneva, 2005.
53. D. Foray, 'Optimizing the use of knowledge', in Kahin and Foray (eds), *op. cit.*, pp. 9–15.
54. See, for example, Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, Yale University Press, New Haven, CT and London.

55. See C. I. Jones and P. M. Romer, 'The new Kaldor facts: ideas, institutions, population, and human capital', National Bureau of Economic Research, Working Paper 15094, 2009, 30 pp.; I. F. McNeely with L. Wolverton, *Reinventing Knowledge: From Alexandria to the Internet,* W. W. Norton, New York and London, 2008.
56. Dominique Foray, *The Economics of Knowledge*, MIT Press, Cambridge, MA and London, 2004.