

**MICHAL KALECKI AS A BEHAVIOURAL ECONOMIST:
IMPLICATIONS FOR MODERN EVOLUTIONARY ECONOMIC
ANALYSIS**

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Visiting Scholar from 1 July 1999 - 31 January 2000 at MERIT,
Maastricht University, PO Box 616,
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Paper presented to the
**POLISH ECONOMIC SOCIETY
KALECKI ANNIVERSARY CONFERENCE
WARSAW, POLAND
27 – 28 SEPTEMBER 1999**

ABSTRACT

A challenge to economic thought is the subject of this paper. As Kaleckians we should all come together and commemorate the centenary of Michal's birth by examining various analyses that derive their theoretical foundations from Kalecki. There is also a challenge, to extend Kalecki's theory into a vastly changed society from the one he was born into. The institutions have vastly altered as the knowledge-based economy is inexorably placing the manufacturing economy into the same position as the agrarian economy. Now the Physiocrats are only an interesting historical link in economic thought. As an economist centrally concentrating on the structures and conventions of the manufacturing economy, Kalecki is in danger of ending up in the same HET archive. This paper is an academic discourse through the vast new evolutionary economics literature surrounding the knowledge-based economy and what Kalecki's insights can contribute. In a way it is a counterfactual trip into a Kaleckian world as if he was born a century later.

The link between the Kalecki we all know, and the implications for evolutionary economics discussed in this paper is the essential 'behavioural' Kalecki. This is the behavioural economics of Kalecki that underlie all the analyses that Kaleckians use all the time. By setting out the dimensions of the knowledge-based 'New' economy, this paper applies Kaleckian behavioural economics to this economy. Then the evolutionary process is set out with continual signposts to Kalecki's insights that can contribute to a better understanding of the New economy. The growing evolutionary economics literature and the outlined generalised process, are having significant theoretical and policy influences. With Kalecki on board, the paper ends with six research agenda areas that deserve the attention of economists well versed in Kalecki's work (as against Kaleckian reductionism). Such research work is important to the development of economic theory and policy, as no theoretical work should be left uninterpreted after a century of change. My own initial behavioural Kaleckian contribution has been the springboard to recent attempts at affiliation with evolutionary economics and the policy implications of such linkages.

Acknowledgement: Thanks to Julio Lopez for his comments on an earlier version of this paper regarding the essence of Kalecki and for his probing questions. Alas, responsibility for this version is mine alone.

Kalecki's innovative theoretical views now seem to constitute the cement that pulls together the various schools of the post-classical research programme. (Lavoie, 1992, p. 422)

Setting the Agenda

On the 17th November 1997, *Business Week* heralded the emergence of “The New Economy” in the USA. The term has since been used in both the mass media and business journals world-wide to signal the widespread use of microelectronics and computer based networks as information and communication technologies (ICT) that have enabled knowledge to become the ‘key’ economic engine. The “...new intangible features of international transactions appear to form the essence of what the ‘new’ economy is all about.” (Soete, 1999, p. 3) Evidence from traditional trade and foreign direct investment flow data show no increase in globalisation, yet, in terms of the internationalisation of information and knowledge the level of intangible transactions that do not show up in balance of payments has grown exceptionally strongly. (Soete, 1999, pp. 6-12). These intangibles stretch across the domains of purely financial to exchange and co-operation of information and knowledge (scientific, business, media). Thurow (1999) calls these developments the third industrial revolution.

Michal Kalecki was born at the beginning of what Thurow (1999) calls the second industrial revolution, with its huge structural changes brought about by electrification and “Fordist” mass production based on oil. Kalecki's economic analysis is clearly based on monopoly power within the manufacturing sector; even his development and socialist economic writings reflect this second industrial revolution. All the authors who have applied Kaleckian analysis in theory and empirical evidence have done it explicitly

within the context of manufacturing and related distribution (tertiary) sectors.¹ This raises the issue as to whether Kalecki's insights into analysing modern capitalism are relevant to "The New Economy".

A minimalist perspective to this issue would be to look at what aspects of Kalecki's manufacturing world are still relevant within "The New Economy". This would not address the central issue of the structurally changed economy and Kalecki's work becomes sidelined. This paper aspires to a broader dimension on this issue, by attempting to place Kalecki's insights into the centre of the innovation-based evolutionary systems analysis that is explicitly studying this 'new' economy. In this way post-Keynesian economics can, through Kalecki, be made applicable to evolutionary economics. Since both schools of thought are part of what Lavoie (1992, p. 5) calls the "post-classical research programme", this approach follows his dictum in the opening quotation.

This paper first specifies the crucial dimensions of "The New Economy". Then, Kalecki is brought in from a behaviouralist perspective to analyse the process of change in capitalism towards this "New Economy". The paper next outlines the evolutionary economic process underlying the endogenous technical change models that have been used extensively to explain this "New" economy. This process is set out with possible links to Kalecki being flagged. Finally, a research agenda for Kaleckian-evolutionary

¹ Lavoie (1992, pp. 94-148) explicitly sets his theory of the firm within this manufacturing context, with its 'cost-determined' pricing and reserves of manufacturing/distribution capacity. Other notable Kaleckian manufacturing-based analyses are Steindl (1952), Asimakopulos (1977), Sylos Labini (1979), and Arestis et al. (1985-86).

analysis is proposed that should make Kalecki's innovative views continue to be relevant into the next century.

Dimensions of The New Economy

Six significant dimensions to the new information-knowledge based economy are set out in this section. Together they provide the stylised facts on the type of capitalist economy that will dominate in the next century. From the epistemological position of realism,² Kalecki's economics will need to deal with these aspects in some form.

Technological Revolution

Structural change to The New Economy is identified and dated in Freeman and Soete (1997, p. 19) as the Fifth Kondratieff wave (1990s - ?). Microelectronics is the ubiquitous and cheap key factor input into this economy, with its emergence at the beginning of the 1990s being related to the proliferation of personal computers, establishment of the world wide web, laying out of the information highways infrastructure, and development of digital networks. This is the organicist ontology dimension (Lavoie, 1992, p. 7), which focuses on the process of technical change. Microelectronic technological revolution is the specific process by which capitalism has evolved from the 'Fordist' mass production manufacturing base to the new information and knowledge base.³ Structural unemployment is a significant by-product of this revolution.

² See Lavoie (1992, p. 7) for the full "presuppositions" in the post-classical research programme.

³ The neo-classical paradigm recognises this new technological revolution and has attempted in recent work to analyse its effects, even if it is in a limited way. See Caselli (1999).

Innovation

The nature and extent of innovation in this new economic climate has been examined extensively by technology-based economic research. Rothwell (1994) summarises the research on this area, calling it the fifth generation innovation process that concentrates on ICT systems integration and networking. ICT has vastly increased the efficient means of innovation through the accumulation and transmission of data that is incorporated into a strongly collaborative network system. Global access of this technological system of innovation centrally clustered around new ICT has led to an increased rate of innovation consequent on the “...dramatically reduce[d] communication and information handling and processing costs” (Soete, 1999, p. 12). This higher innovation rate under ICT, together with reduced investment delivery lags, establishes a requirement for shorter payback periods on investment commitments compared to manufacturing investment where the nature and extent innovation involves a longer time horizon.

Investment cycle

“Volatility is here to stay, but technology and globalisation will spur robust growth”. This subtitle to another *Business Week* (24th August 1998) issue on The New Economy encapsulates the investment cycle dimension. Keynes (1930) recognises that waves of investment expenditure are stimulated by new technology. From a Kaleckian perspective, Courvisanos (1996) maps the investment cycle pattern between endogenous (minor improvements) innovation that is “part and parcel” of investment decision-making (Kalecki, 1954, p. 158) and exogenous (radical) innovation. The latter occur at severe investment cycle troughs that generate structural change, powerful burst in economic growth (boom), and strong susceptibility to cyclical downturn. Any downturns lead to expanded cyclical unemployment. Hollanders et al. (1999) provide empirical evidence to

support this pattern. After the 1973-91 period of weak capitalist investment, the 1991-98 period has been characterised by strong investment in USA, leading to rapid growth divergence from Europe and Japan. The investment has been in mobilising private capital stock in ICT, developing the infrastructure of information highways (process innovation) and the “commodification” of knowledge processes (product innovation).⁴

Knowledge-based economy

Along with the physical based ICT investment outlined above is the intangible investment in the new knowledge and its dissemination needed to take advantage of all the new ICT capital stock. In the USA, investment in intangibles has increasingly outgrown those in physical capital (Abramovitz and David, 1996). The manufacturing sector has become highly dependent on ICT knowledge-base for its economic activity.⁵ This is evident by greater intangibles that are needed as inputs, while more services are incorporated into their final products.⁶ The growing size and importance of the services sector that trades essentially in knowledge is the counterpoise of declining manufacturing (Wyckoff, 1996).

⁴ See Hollanders et al. (1999, pp. 18-25) for empirical details of all three processes. It is interesting to note that Australia has also seen similar strong economic growth (4.6 per cent over the year to December 1998), but only from the mid-1990s (Huh, 1999). The lack of innovation in Australia has not prevented it from quickly adopting all three forms of innovation from the USA, both in the form of consumption and investment spending (Goldsworthy, 1997, pp. 103-7). The lag in Australia’s strong growth rate compared to the USA reflects this adoption time.

⁵ See Caselli (1999, p. 80, fn. 3) on the types of manufacturing equipment arising from ICT systems.

⁶ For example, the wine industry is increasingly using ICT-based knowledge input to produce large and consistent wine output, while its product demand is increasingly dependent on knowledge of wines, adoption in restaurants, product endorsement in entertainment outlets, and wine-based tourism (Ruthven, 1998).

Information Inequality

All major structural changes throw up greater inequalities. Depressed isolated regions and disadvantaged groups *within* advanced nations, and less developed nations all struggle to take advantage of the new economic developments. The New Economy has exposed a large number of information-poor that exist in all these identified sectors of the world.⁷ The internet does not lend itself to organised mass action to prevent the information-rich from conducting their internet money-making (Thurow, 1999). Worse still, the culture and knowledge-base in underdeveloped economies is so far removed from the internet as to make any “catching-up” a ludicrous proposition (Arunachalam, 1999).

Role of the State

The ICT-based globalisation raises serious issues for the role of the State in intervening on its nation’s behalf. Governments need to assess how to reconstruct activist economic policies. The global access of knowledge (at least to the information-rich) has favoured deregulation of the private sector and privatisation of the public sector. The new specifications of the role of the State can be seen from the 1980s financial deregulation that led (due to unsustainable financial volatility) to more prudential-oriented financial regulations on a global co-operative approach. Soete (1999, pp. 18-22) identifies three broad policy perspectives: comprehensive industrial and regional policies with learning-type perspective adjustments; international regimes on laws and rights; co-operative global interventions (especially on the environment and the information-poor problem). Macroeconomic stabilisation of inherent instability and full employment should figure as

⁷ For detailed statistics on information-poor, see UNDP (1999).

part of all three processes noted, rather as some separate box of “fine-tuning” implements.⁸

A ‘Behavioural’ Kalecki Analysis of The New Economy

The task here is to take some essential features from Kalecki’s analytical exegesis and use them to explain aspects of The New Economy’s dimensions. From a post-Keynesian outlook, this type of analysis is generally absent in the literature.⁹ Despite Keynes (1930, Volume 2, p. 86) recognising innovation in the link from cycles to growth, by the time of *The General Theory* (Keynes, 1936) this aspect drops out as Keynes provides a depressing view of the long period.¹⁰ Then, the dominant post-war Keynesian macroeconomic models were developed in a strongly aggregative way with an equilibrium analysis (to solve simultaneous equations), and making technical change exogenous. This approach to cycles and growth ignored the vast work of Wesley Mitchell that had through the 1920s and 1930s identified cumulative innovative change and breakdowns in such processes (Rostow, 1990, pp. 282-88). Following this tradition, innovation-based analysis is lacking in post-Keynesianism.¹¹

⁸ See Courvisanos (1996, pp. 217-32) on how the State can “tame uncertainty” while at the same time restructuring sectors and regions through comprehensive investment planning.

⁹ *The Journal of Post Keynesian Economics* (US publication) prior to Volume 21 (1998-99) has no articles centrally on The New Economy or generally on the *evolution* of innovation and technology. In Volume 21, Khalil (1998-99) and Setterfield (1999) provide some evolutionary glimpses, Thurow (1998) and Appelbaum and Schettkat (1999) examine structural change, and Legge (1999) is a book review of Galbraith (1998). *The Cambridge Journal of Economics* (UK publication) dedicated a whole issue to technology and innovation (Vol. 19 (1), February 1995). All the articles came from the broadly evolutionary economics approach, but there was no attempt in any of them to link their analyses to ‘the tradition founded by Marx, Keynes, Kalecki, Joan Robinson and Kaldor’. Brouwer and Kleinknecht (1999) is a short *CJE* note that *does* make this type of effort. Kaleckian influences were not perceived by this author in any of the articles referred to in this note.

¹⁰ See Rostow (1990, pp. 272-82) for an account of changes between the two books on the innovation issue.

¹¹ Bortis (1997) broad attempt at a political economy with institutions and behaviour is a very recent example of ignoring to handle technology and innovation in cycles and growth in any significant endogenous way *within* the processes of capitalism. Yet, then Bortis proposes economic policies related to technical change (pp. 339-41).

Kalecki has some significant endogenous innovation-based analytical features that can provide the basis of a post-Keynesian contribution to understanding the processes in ICT-powered capitalism. The starting point is to examine Kalecki's investment cycle models from a behavioural perspective, a position first developed in Courvisanos (1996, pp. 69-72). Procedural (or bounded) rationality is the behavioural context behind the conventions used in Kalecki's investment models. Specifically these are to do with three conventions; retention rates of profit for investment, desired excess capacity levels and acceptable gearing ratios. Underlying investment spending is the technical uncertainty due to embodied process innovation, and market uncertainty due to product innovation. At the static level of analysis, the conventions provide 'risk premium' to cover these fundamental uncertainty factors embedded within investment decision-making at a certain point in time; or what Steindl (1941) calls "preference for safety" in a world of uncertainty.

At a dynamic analytical level, there is recognition by Kalecki that static rules will not be adequate. In Kalecki (1937) there is a sense of 'degree of uncertainty' that alters subjectively with changing rates of capital accumulation. This means that conventions need to take account of increasing risk with rising investment: higher retained profits and lower desired excess capacity rates, with a growing concern for rising gearing ratios. The cumulative nature of this process over the investment cycle expansion will lead to a point when the increasing risk is untenable as capital accumulation rates peak. This creates the conditions for an investment downturn and reduced innovation. The behavioural element to the cyclical investment process is what Crotty (1992) calls the growth-safety trade-off, and provides an explanation to The New Economy investment cycle dimension where volatility (i.e. cycle variance) increases with greater innovation.

Combining the above cyclical process with the Marxian ‘laws of motion’ within Kalecki’s work provide an organicist macroeconomic view of the economy. Rather than reducing the analysis to mechanistic aggregate demand components, Kalecki saw “extended reproduction” through capital accumulation that embodies technical change with cheaper extension of technological developments (Kalecki, 1939). This process comes up against effective demand failures that reduce investment spending, and with it the innovation process. The New Economy has within its own endogenous development the contradiction of both massive expansion and its unraveling. Derived from this contradictory investment process emerges greater cyclical volatility for the New Economy than the old established manufacturing-based economy. Under these conditions, much of the cyclical unemployment in downturns becomes serious structural unemployment in the next cyclical upturn. Empirical patterns of innovation-based investment cycles support this heightened volatility (Courvisanos, 1996, pp. 200-3). Only increased “regularising” from other components of effective demand (particularly government policies or the external sector) can counteract such increased instability.

A few significant short-term aspects of this greater investment volatility from the New Economy have implications for Kalecki's short-term macroeconomic analysis. The most notable is in relation to private investment being the result of past decisions. This remains intact, but as there is a shorter payback period required of investment in the New Economy with firms needing to discount the future strongly with shorter foresight, then investment cycle behaviour is more pronounced (see Hillinger et al., 1992). Two influences emanate from this behaviour. At the infant stage of the new technology there is tendency for short bursts of profit growth followed by short profit declines leading to more frequent cycle periods in this sector (but in macroeconomic terms not yet

significant). At the growth stage, the success of the new technology creates higher expectations of quick profit returns stimulating private investment strongly into what could be viewed as an unsustainable strong investment expansion.

The impact of wages on investment and demand becomes an open question in the volatile new economy. The Fordist wage-labour nexus is where wages are both a crucial cost and a key determinant of consumption (Boyer, 1988, p. 73). In the New Economy the relatively lower labour direct (prime) costs are spread over large fixed costs as scale economies are quickly appropriated (Freeman and Soete, 1997, p. 181). This means that in the infant stage wage costs are more important than in the growth stage. As the New Economy expands, the labour cost element in investment decision-making becomes much less significant. The high productivity-high earnings link in new technology ensures strong consumption demand (Martin, 1994, p. 344). A neoclassical reduction in wage cost policy could provide some short-term benefit to infant firms, but overall it would tend to have little effect on investment, while dampening consumption and exacerbating any cyclical downturn. From another angle, this seems to support Kalecki's analysis.

Two more Kalecki macro-relations can be briefly raised. Reasonably rigid profit margins under Fordist manufacture tend to become less rigid in the New Economy under innovative and volatile competitive pressures, but over time as large new monopolies become entrenched (e.g. Microsoft) profit margins again become more rigid under investment planning mechanisms. The inelastic investment-interest rate relation does not seem to need revision under the new capitalism, particularly due to the unequal access to funding discussed later on in this section.

The essential novelty (or creative) element in innovation comes from Kalecki's "semi-autonomous" variable "d" in his version II investment function which is subject to long-term changes, in particular technical progress (Kalecki, 1954, p. 98). In his (final) version III investment function (Kalecki, 1968), two innovation effects on investment are identified. **First** is the exogenous effect that relates to the intensity of technological innovation; this is the major creative aspect of innovation which provides the long-term trend over Kalecki's trendless pure investment cycle. Major new technical knowledge, in the form of the microelectronic revolution, Kalecki would describe as a random shock for generating growth (Sawyer, 1985, p. 68). However, this exogenous innovation is clearly "...rooted in the past economic, social and technological developments rather than determined fully by the coefficients of our equations as is the case with the business cycle (Kalecki, 1971, p. 183). The intensity of the technical progress of a society and its path of economic development is governed by the extent of such major exogenous innovation. A ceiling on the rate of growth of capital accumulation is determined by the level of adoption of the major technology within any particular economy. This variable, to Kalecki, is 'semi-autonomous' because the level of adoption is positively related to the size of the economy (Kalecki, 1971, p. 175).

Kalecki provides a behavioural 'micro-level' investment motivation related to this 'semi-autonomous' variable. The motivation for introducing major technological innovations initially is "...to increase profitability by reducing production costs" (Kalecki and Szeworski, 1991, p.377). Kalecki (1954, pp. 17-18) sees this motivation in relation to innovations' long-term influence on raising the degree of monopoly. Further, he identifies entrepreneurs who invest 'today' in innovations as having "...an advantage over those having invested 'yesterday' because of the technical novelties that have reached them"

(Kalecki, 1971, p.173). This gives what Steindl (1964, p. 430) finally recognises as an active role for innovation, with major technical change (like ICT) creating an asymmetric action that delivers a predominantly stimulating effect, lengthening expansion and shortening contraction phases of investment cycles.¹² How this occurs takes us into the endogenous effects of innovation.

Second is the endogenous effect which relates to the speed (or rate) of technological innovation. With the endogenous effect, go-ahead entrepreneurs are induced to introduce innovations in order to gain market share and increase their profit rate over the constant average profit rate assumed by Kalecki in the pure trendless investment cycle. This innovation can be seen as ‘part and parcel’ of investment decision-making. At the macro-level, the ICT-based ‘New’ economy has a strong Schmookler (1966) demand-pull effect so that aggregate investment expansion works through a swarming of innovatory behaviour in a step-wise process described by Goodwin (1990, p. 86).¹³

The final behavioural element based on Kalecki that can be applied to The New Economy relates to inequality. The class analysis in Kalecki seems initially inappropriate to the new technology world where unions are disappearing as fast as new internet entrepreneurs are appearing, leading to the seeming disempowerment (if not the disappearance) of

¹² Entrepreneurial motivation by Kalecki and Steindl in this paragraph is reflected in an untypical Kaldor lecture on the “volatility of entrepreneurial expectations” (Kaldor, 1954). This points towards the partial unpacking of Kaldor’s concept of the technical progress function conducted by Nelson and Winter (1982) and with strong empirical support from evolutionary economists (see next section).

¹³ Bouwer and Kleinknecht (1999) provide empirical evidence from the R&D intensity in Dutch manufacturing and services firms across two years 1988 and 1992. This research lends support to the Schmookler-induced demand pull effect that creates a Goodwin-type swarming of innovations. Industries that are slow to adapt to the ICT-based technological paradigm will have a weak investment expansion cycle, compared to the strong investment expansion in leading ICT-based industries. This market power related to innovation is in evidence by Geroski et al. (1993) that found that profits in innovating firms make them more resistant to business cycle recessions.

labour. At two deeper levels this is quite inaccurate. Class analysis is theorising in terms of groups, with inherent collective coherent behaviour involved, in contrast to methodological individualism that is an absurd reductionist explanation of complex interdependent socio-economic phenomena. In Kalecki power centres in one group: the entrepreneurs who are "...a controlling group of big shareholders" (Kalecki, 1954, p. 93) that manage the firm. Such power has effects at two levels.

The first level is with the entrepreneurial function itself. Kalecki has a concise entrepreneurship quotation that challenges the (still) dominant orthodox economics position on the efficient capital market. It also questions the orthodox management-based entrepreneurship position on the central role of 'entrepreneurial ability':

Many economists assume, at least in their abstract theories, a state of business democracy where anybody endowed with entrepreneurial ability can obtain capital for starting a business venture. This picture of the activities of the 'pure' entrepreneur is, to put it mildly, unrealistic. The most important prerequisite for becoming an entrepreneur is the *ownership* of capital. (Kalecki, 1971, p. 109, italics in the original)

The entrepreneurial function is significant if it leads to investment in ICT, and this means a need to explain how innovation is financed. The extreme difficulty pioneer ICT-based innovators as a group have to finance new venture creations compares with the financial 'deep pockets' of large corporations for research and development (Legge and Hindle, 1997, p. 507). Thus, the process of innovation in 'The New Economy' is inherently unequal in terms of economic power *within* the capitalist class.

The second level is related to inequality in an 'entrepreneur economy' and its implications for information inequality. The source of inequality stems from the basic Kaleckian proposition that capitalists 'earn what they spend', while workers 'spend what

they earn'. By investment, capitalists determine the extent of their own profits, with the residual in wages going to labour. Since entrepreneurs are the sub-group of capitalists that make the investment decisions, they are the causal element of volatility and innovation in the capitalist system.¹⁴ In this sense, they determine the level and distribution of income.¹⁵ Galbraith (1998) is an admirable book that makes the link between Keynesian demand and Schumpeterian change to look at growing US pay inequality, to which Kalecki's income distribution model would add stronger theoretical generalisations rather than the specifics of the USA in the Galbraith study.

Further, Kalecki's same aphorism can be applied in a behavioural approach to information poverty directly. The ICT-based investment spending and related endogenous innovation feeds back through profit reinvestment into greater knowledge-based economic power. This reinforces the 'creative' power of information. This 'innovation control' power of entrepreneurs to decide on reproduction of technology provides the information-rich with the financial and knowledge-based wherewithal to maintain and extend information inequality. Labour that has limited 'New' knowledge is potentially subject to exploitation in situations like call centres, or to remain in long-term unemployment (Courvisanos, 1998a).

The Evolutionary Economic Process and Technical Change

Beginning with Nelson and Winter (1982), there has been a large explosion of research work in what is broadly termed 'evolutionary economics' (Hodgson, 1997, pp. 10-14). Evolutionary economics has reached a level of intellectual rigour, relevance, and

¹⁴ The remaining capitalists are 'rentiers' who basically spend on capitalist luxury consumption goods.

¹⁵ See Asimakopulos (1975) and Kriesler (1987) for detailed analyses of Kalecki's income distribution models.

prolificacy that it has been recently touted as the possible new economic paradigm (Bryant and Wells, 1998). There are different versions of modern evolutionary economics that are examined in great detail by Hodgson (1993, 1997), Foss (1994) and Nelson (1995). This section briefly outlines the essential elements of the evolutionary process that are generally agreed to by the above reviews of the evolutionary literature, and applies them to technical change within The New Economy. As this exposition unfolds, there will be various ‘bookmarks’ that will signal links to the Kaleckian behavioural analysis from the previous section, providing opportunities for cross-fertilisation between the two research paradigms.

At the behavioural level, technical change and innovation is surrounded by technical and market uncertainty creating imperfect information. This is the starting point for all evolutionary processes, as it is with ‘Kaleckian behaviouralism’. Evolutionary writers, particularly in the area of industrial organisation, examine human agency within the firm that creates chance and spontaneity. This allows complexity-type analysis to be used to come up with various outcomes that are not predetermined by the assumptions of the model. These outcomes have much to do with learning processes through feedback and interaction of agents. This leads to knowledge accumulation, path-dependence and increasing rates of diffusion of innovation. Kalecki was well aware of these issues as they relate to investment, both in terms of the lags he allowed in the investment process, but even more in the analysis of the traverse within socialist investment planning models.¹⁶

¹⁶ Formally the ‘traverse’ is “the dynamic (out of equilibrium) adjustment path in historical time” (Kriesler, 1989, pp. 1-2).

To handle uncertainty at an operational level, evolutionists acknowledge the role of bounded (or procedural) rationality needed by agents to derive rules-of-thumb, conventions and guideposts that allow non-optimal decisions to be made. Only through operation of these rules will knowledge be extended in the inductive way that permeates the innovation culture. This knowledge then allows the feedback and interaction in behaviour that leads to learning. Essential at this operational level is the need to be flexible with the operational rules, so that learning can infuse the actions in the next iterative period of decision-making. The various static and dynamic rules in Kalecki and his socialist modeling work on perspective planning provides a strong juxtaposition to the learning processes encompassed in the evolutionary operations.

Economic change occurs via technology, both at the broad technological revolution level and also at the level of incremental innovation. This change happens as a result of the operational aspects outlined above. Change comes in a form that is cumulative, irreversible and reflective of historical time and the socio-economic forces that drive society. The cumulative process is not optimal. As a result of the learning process the technological system is one that mutates, selects and adopts certain forms of knowledge and capital stock for the production process. This is the *evolution* of the system, in the sense that economic development unfolds over time in an iterative way to reveal a changing economy. The muddled process of change is one that at times can be gradual change (especially when there is only incremental innovation occurring at relatively low levels) and other times extremely rapid and revolutionary (when there is a major technological revolution occurring with many experimentations and failures).

Kalecki can also be linked to evolutionary change by his concept of the 'semi-autonomous' variable that alters the investment function, as well as incremental innovation that is part of the investment decision. Economic growth is not a stable process for Kalecki, recognising changes over historical time can be both positive and negative. The one aspect that Kalecki can contribute to the evolution process is the clear chain of short-term decisions that make up the long-run. This is in effect a learning and mutation process, but with recognition for the role of decision-making within the short-term horizon. Demand plays a crucial determinant in such short-term decisions. There is a tendency for evolutionary writers to concentrate on the long-run processes, without explaining the short-term decisions that effectively provide the 'learning' environment for what occurs in the evolutionary process.

Three evolutionary economic papers are mentioned here for they attempt significant linkage with Post-Keynesian analysis by looking at the short-term implications of evolutionary processes. Freeman and Perez (1988) is a seminal theoretical exposition which outlines the structural crisis involved in the transition to the New Economy and shows how this increases the instability of investment behaviour along the lines examined in this paper. In the process of structural crisis, a deep recession (of the type experienced in the early 1990s) as defined by Freeman and Perez forms a basic part of change to the new dominant techno-economic paradigm. This strikes an accord with Kalecki's process of economic growth through cyclical instability and its impact on cyclical/structural unemployment.

The other two papers are more recent empirical-based macroeconomic modeling experiments that use Post-Keynesian analytical elements. Toivanen et al. (1996)

identifies the uncertainty and macroeconomic volatility that emerges out of investment in new technology. In the process of this change, diffusion rates of technology are linked to high growth economies with real interest rate effects not hampering this process and inflation actually speeding up this diffusion. Not surprisingly, Toivanen et al. views the presence of macroeconomic volatility as slowing diffusion. Verspagen (1999) adopts a short-run input-output model and shows that investment demand increases with higher technological progress, but "...this is not enough to compensate for the more efficient use of other factors (labour, intermediate demand)." (p. 12) The analysis also shows that a service economy scenario yields stronger growth than an "environment-friendly through electronics" scenario. In strategic policy terms, "...above average competitiveness is a powerful way of creating economic growth...[and] being specialised in the 'right' sectors is seen to pay off in terms of higher growth...[although] it is not easy to determine which sectors are the right ones." (pp. 13, 15)

Finally, the evolutionary writers recognise systemic failures that result from these above processes. Smith (1998, pp. 41-4) identifies these failures as related to (i) infrastructural provision and investment; (ii) transitional adjustments; (iii) lock-in technology; (iv) institutional (or regulatory) weaknesses. The type and extent of specific failures under these headings is very long, extending from unsustainable natural environments to outmoded regulatory practices, to long-term unemployment, to breakdown of public health systems, etc.. These failures are the rationale for public policy actions. Here too Kalecki's voice can be barely heard in the wildernesses behind optimal neo-liberalism. It was Kalecki's concerns with the structural impacts of capitalism across all such systemic failures that made Kalecki a life-long supporter of public policy planning towards a more

stable and equitable society, which would in turn deliver more efficient long-term economic outcomes.

A Kaleckian-Evolutionary Research Agenda

Any teacher of introductory macroeconomics will attest to the view that it was with “...institutionalism as a midwife that Keynesian macroeconomics was born.” (Hodgson, 1997, p. 30).¹⁷ Yet, in the process of developing macroeconomics to what Joan Robinson calls “bastard Keynesianism”, there has been a strong reductionist programme such that “trade fluctuations...[were merely aggregates] of the economizing units of traditional theoretical economics” (Vining, 1949, p. 79). Macro-econometrics has reduced broad institutional aggregate behaviour to individually smaller and smaller elements in an economic model, with more optimal microeconomic imperatives in each (‘the microeconomic foundations of macroeconomics’). Kaleckian macroeconomics has tended to follow the reductionist path in concert with general macroeconomic modeling.

Kaleckian behaviouralism in the form outlined above could be the foundation link to the evolutionary process needed to regain the organistic perspective of Keynesian macroeconomics, while also making it applicable to institutions of the new ICT-based economic environment represented by Thurow’s third industrial revolution. Evolutionary economists have made tentative steps to incorporate post-Keynesian elements into their models (e.g. Verspagen, 1999), and to empirically show the role of Keynesian demand in the technological innovation story (e.g. Brouwer and Kleinknecht, 1999). However, as

¹⁷ In the sense that students appreciate that macroeconomic theory is understandable because it relates to actual problems like unemployment within the real world institutions of banks, government budgets, exchange rate regimes, firm’s capital accumulation, household’s saving. Whereas microeconomics relies almost completely on an abstract model of ‘*what if*’ optimal behaviour in firms that are non-specific to any real world institutions.

noted earlier, there does not seem to be any explicit attempts by post-Keynesians to relate their work to evolutionary economics.¹⁸

Seven areas are set out below in the Kaleckian-evolutionary research agenda that can regain the organistic perspective, while adding a “New Economy” institutionalism:

1. Analysis of the endogenous/exogenous innovation dichotomy and the institutional links between them. This could use the short-term causal chain in Kalecki to appreciate how endogenous innovation reacts with investment to affect cycles-cum-growth patterns. Feedbacks from structural change to short-term effects need to be also investigated. Steindl (1952) began this evolutionary project¹⁹, but has been rarely elaborated since then.²⁰
2. Traverse issues on the cumulative path of investment and innovation are difficult to tease out, yet they provide crucial theoretical links on how the economy moves over time both in regions where diffusion of technology is high and regions where it is low. Kaleckians can build on much theory and empirics in evolutionary research by adding the short-term behavioural perspective on firm/industry decision-making. Kaldor’s cumulative causation principle can be used to link with evolutionary concepts of lock-in and path-dependence. In this way analysis of regional development and policies can be made effective, beginning with Kaldor (1970).
3. Keynesian macroeconomic models have a strong application to real economies, where the “...macro-evolutionary models apply some rather strong assumptions on the macroeconomic structure, which make it hard to implement such models empirically.” (Verspagen, 1999, p. 1) The demand-side approach from Kaleckian macroeconomic models can be linked to the supply-side technological change factors in evolutionary models thereby removing the reductionist element in macro-modeling and gaining better ‘strategic competitive’ implications. This should lead to better policy analysis, even at the cost of less predictive ability (but not necessarily any less predictive power).
4. Effective demand analysis is the Kaleckian ‘competitive edge’ over other economic models. Research is required to maintain this edge by extending the analysis from Fordist manufacturing-based economy to ICT service-based economy. Earlier in this paper some tentative thoughts on the impact of this structural change on Kalecki’s effective demand story were set out in relation to wage changes, profit margins, investment lags, interest rates and private investment volatility. Much needs to be done to support or reject these ‘thoughts’. Such conclusions could then be applied to questions of incomes policies, taxation of profits, interest rate policy and (most

¹⁸ I would be interested in being advised of any such attempts that I may have missed.

¹⁹ This has been recognised by the current researchers in evolutionary economists, e.g. Silverberg and Verspagen (1997, p. 137).

²⁰ See Courvisanos (1996) for a recent effort along this trajectory.

crucially) ways to gain and maintain full employment in the face of intensified private investment volatility (see also seventh point below on the State's role).

5. Rules and conventions set in terms of Kaleckian models have had difficulty in explaining when these rules change, the direction of change and the extent of change. When are customs replaced and by what? Kaleckians need a stronger behavioural base of the type outlined in this paper to answer such questions. It is only through contributions from innovation-based evolutionary analysis that there can be some effective resolution of these questions of micro-level behavioural changes (e.g. Bianchi, 1990).
6. "Kalecki's theory of income distribution is one of the most debated parts of his legacy. Various aspects of this theory have been discussed, criticized, and empirically tested in dozens of articles and many books." (Osiaty|ski, 1991, p. 479) This theory has been an effective counter to neoclassical factor distribution and with it providing an appreciation of monopoly capitalism within the specific confines of manufacturing industry under the second industrial revolution.²¹ Now the task is broader, to take the two elements of Kalecki's inequality related to "The New Economy" on financing innovation and capitalist information-rich reproduction into an understanding of information poverty. The project would be the 'New' version of labour income 'poverty'. This is the most speculative of the agenda issues, with little to go on. Even the evolutionary writers have not examined the inequality issues of 'The New Economy', except in relation to regional sectors with limited spillover effects (e.g. CaniNls, 1999).
7. Role of the State in "The New Economy", as indicated in this paper has to be different to the manufacturing-based public policy actions in a micro-macro dichotomy. No such dichotomy can exist in the "New" policy framework. Policy must be articulated in an iterative (or perspective) planning approach that coincides with the nature of the innovation process. An instrumental analysis to policy along the lines of Lowe (1976) is required, where the starting point is where you want to end up. A long-term strategy is set through a grass roots mechanism with short-term specific perspective plans that are monitored and reviewed regularly, as suggested by Kalecki (Nuti, 1986). As the current global economy has policy-makers floundering on the way forward to re-regulation, there is 'room to move' for a new political economy to replace the one so succinctly described by Kalecki (1943).²²

Epilogue

My task in this paper has ended. There has been an attempt to show how Kalecki can remain relevant in a global economy that has changed so significantly since he was born a century ago. The New Economy is no longer centrally based on manufacturing and all the

²¹ See especially Baran and Sweezy (1966, pp. 53-6).

²² Three recent papers by the author have attempted to tackle this crucial policy issue: Courvisanos (1998a) on innovation policy; (1998b) on sustainable environmental planning; (1999) on regional policy.

institutional elements that have led to much debate over Kalecki's work: degrees of monopoly, capacity utilisations, pricing with constant costs, demand management, trade union wage struggle, etc.. The field of play has shifted and the rules of the game have changed, Kalecki needs to be able to play on the new field with new rules or his analysis is no longer useful. The essence of the argument is that if Kalecki's fundamental behavioural perspectives are revived in an organic whole and linked with recent evolutionary economics research, then basic Kaleckian insights will inform modern economic analysis as it has done for Keynesian economics from the 1940s onwards.

The path outlined is not an easy one, but a better one. Two questions that arise from this sort of research agenda give some idea of the difficult terrain that needs to be overcome. Nelson (1995, p. 84), in his survey of evolutionary economics has difficulty with the notion of a better explanation: in terms of what? Prediction, understanding or "just feels right", these are all proposed. Nelson ends up supporting the last one, which is quite unsatisfactory. This leads on the second question raised by Soete in the paper that began this discussion. Soete (1999, p. 10) asks how "...to appreciate the meaningfulness of some evolution when the laws of the underlying dynamics remain even sketchier." Under such conditions, what feels "right" is highly problematic. Nevertheless, the task is in front of us should we wish to accept the challenge.

REFERENCES

- Abramovitz, M. and David, P.A. (1996) "Technological Change and the Rise of Intangible Investments: The US Economy's Growth-Path in the Twentieth Century", in OECD (ed.), *Employment and Growth in the Knowledge-based Economy*, Paris: OECD.
- Appelbaum, E. and Schettkat, R. (1999) "Are Prices Unimportant? The Changing Structure of the Industrialized Economies", *Journal of Post Keynesian Economics*, Volume 21 (3), Spring, pp. 387-98.
- Arestis, P., Driver, C. and Rooney, J. (1985-86), "The Real Segment of a UK post Keynesian Model", *Journal of Post Keynesian Economics*, Volume 8 (2), Winter, pp. 163-81.
- Arunachalam, S. (1999), "How the Internet is Failing the Developing World", *The Slab*, based on a talk to the Ninth International Conference of the International Federation of Science Editors, Egypt, June 1998; Australian Broadcasting Corporation, Sydney: <http://www.abc.net.au/science/slab/infopoverty/story.htm>
- Asimakopulos, A. (1975), "A Kaleckian Theory of Income Distribution", *Canadian Journal of Economics*, Volume 8 (3), pp. 313-33.
- Asimakopulos, A. (1977), "Profits and Investment: A Kaleckian Approach", in G.C. Harcourt (ed.), *The Microeconomic Foundations of Macroeconomics*, Boulder Col.: Westview Press, pp. 328-42.
- Baran, P. and Sweezy, P. (1966), *Monopoly Capital*, New York: Monthly Review Press.
- Bianchi, M. (1990), "The Unsatisfactoriness of Satisficing: from Bounded Rationality to Innovative Rationality", *Review of Political Economy*, Volume 2 (2), pp. 149-67.
- Bortis, H. (1997), *Institutions, Behaviour and Economic Theory: A Contribution to Classical-Keynesian Political Economy*, Cambridge: Cambridge University Press.
- Boyer, R. (1988), "Technical Change and the Theory of 'R&D' ", in Dosi et al. (1988), pp. 67-94.
- Brouwer, E. and Kleinknecht, A. (1999), "Keynes-plus? Effective Demand and Changes in Firm-level R&D: An Empirical Note", *Cambridge Journal of Economics*, Volume 23 (3), May, pp. 385-91.
- Bryant, K. and Wells, A. (eds.) (1998) *A New Economic Paradigm? Innovation-based Evolutionary Systems*, Discussions in Science and Innovation 4, Department of Industry, Science and Resources, Canberra: Commonwealth of Australia.
- CaniNls, M. (1999) *Regional Growth Differentials: The Impact of Locally Bounded Knowledge Spillovers*, Ph.D. dissertation No. 99-42, Maastricht: Faculty of Economics and Business Administration, Maastricht University.
- Caselli, F. (1999) "Technological Revolutions", *The American Economic Review*, Volume 89 (1), March, pp. 78-102.
- Courvisanos, J. (1996) *Investment Cycles in Capitalist Economies: A Behavioural Kaleckian Contribution*, Cheltenham: Edward Elgar.

- Courvisanos, J. (1998a) "Investment in Innovation: An 'Instrumental Analysis' based on the Tasmanian and New Brunswick Information Technology Strategies", School of Economics Discussion Paper 98-03, Hobart: University of Tasmania.
- Courvisanos, J. (1998b) "Investment Planning Towards an Innovative and Sustainable Environment", School of Economics Discussion Paper 98-04, Hobart: University of Tasmania.
- Courvisanos, J. (1999) "Regional Economic Decay and Regeneration Under Structural Change", in I. Falk (ed.), *The Dead Centre: Regional Australia in Crisis*, forthcoming.
- Crotty, J.R. (1992) "Neoclassical and Keynesian Approaches to the Theory of Investment", *Journal of Post Keynesian Economics*, Volume 14 (4), Summer, pp. 483-96.
- Dodgson, M. and Rothwell, R. (eds.) (1994) *The Handbook of Industrial Innovation*, Cheltenham: Edward Elgar.
- Dosi, G., Freeman, C., Nelson, R., Silverberg, G. and Soete, L. (eds.) (1988) *Technical Change and Economic Theory*, London: Pinter.
- Foss, N.J. (1994) "Realism and Evolutionary Economics", *Journal of social and Evolutionary Systems*, Volume 17 (1), pp. 21-40.
- Freeman, C. and Perez, C. (1988) "Structural Crises of Adjustment, Business Cycles and Investment Behaviour", in Dosi et al. (1988), pp. 38-66.
- Freeman, C. and Soete, L. (1997) *The Economics of Industrial Innovation*, Third Edition, London: Pinter.
- Galbraith, James. K. (1998) *Created Unequal: The Crisis in American Pay*, New York: Free Press.
- Geroski, P., Machin, S. and Van Reenen, J. (1993) "The Profitability of Innovating Firms", *Rand Journal of Economics*, Volume 24 (2), Summer, pp. 198-211.
- Goldsworthy, A. (Chairman) (1997) *The Global Information Economy: The Way Ahead*, Information Industries Taskforce Report, Canberra: Department of Industry, Science and Tourism.
- Goodwin, R.M. (1990) *Chaotic Economic Dynamics*, Oxford: Clarendon Press.
- Hillinger, C., Reiter, M. and Weser, T. (1992) "Micro Foundations of the Second-Order Accelerator and of Cyclical Behaviour", in C. Hillinger (ed.) (1992), *Cyclical Growth in Market and Planned Economies*, Oxford: Clarendon Press, pp. 167-80.
- Hodgson, G.M. (1993) *Economics and Evolution: Bringing Life Back into Economics*, Cambridge: Polity Press.
- Hodgson, G.M. (1997) "Economics and Evolution and the Evolution of Economics", in Reijnders (ed.) (1997), pp. 9-40.
- Hollanders, H., Soete, L. and ter Weel, B. (1999) "Trends in Growth Convergence and Divergence and Changes in Technological Access and Capabilities", MERIT Research Memorandum 99-019, Maastricht: Maastricht University.

- Huh, H-S. (1999) "Australian Indicators", in *Quarterly Bulletin of Economic Trends*, Issue No.1, Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne, pp. 15-19.
- Kaldor, N. (1954) "The Relation of Economic Growth and Cyclical Fluctuations", *Economic Journal*, Volume LXIV (253), March, pp. 53-71.
- Kaldor, N. (1970) "The Case for Regional Policies", *Scottish Journal of Political Economy*, Volume XVII (3), November. Reprinted in Kaldor (1978), *Further Essays on Economic Theory*, London: Duckworth, pp. 139-54.
- Kalecki, M. (1937) "The Principle of Increasing Risk", *Economica* (New Series), Volume 4 (16), November, pp. 440-6.
- Kalecki, M. (1939) *Essays in the Theory of Economic Fluctuations*, London: Allen & Unwin.
- Kalecki, M. (1943) "Political Aspects of Full Employment", *Political Quarterly*, Volume 14 (4), pp. 322-31. Abbreviated version in Kalecki (1971), pp. 138-45.
- Kalecki, M. (1954) *Theory of Economic Dynamics*, London: Allen & Unwin.
- Kalecki, M. (1968) "Trend and Business Cycle Reconsidered", *Economic Journal*, Volume 78 (2), pp. 263-76. Reprinted with minor changes in Kalecki (1971), pp. 165-83.
- Kalecki, M. (1971) *Selected Essays on the Dynamics of the Capitalist Economy, 1933-1970*, Cambridge: Cambridge University Press.
- Kalecki, M. and Szeworski, A. (1991) "Economic Problems of Production Automation in Capitalist Countries", in Osiaty|ski (1991), pp. 374-85. Original Polish version in *Ekonomista*, Volume 3, 1957, pp. 105-15.
- Keynes, J.M. (1930) *A Treatise on Money*, London: Macmillan.
- Keynes, J.M. (1936) *The General Theory of Employment, Interest and Money*, London: Macmillan.
- Khalil, E.L. (1998-99) "The Janus Hypothesis", *Journal of Post Keynesian Economics*, Volume 21 (2), Winter, pp. 315-42.
- Kriesler, P. (1987) *Kalecki's Microanalysis: The Development of Kalecki's Analysis of Pricing and Distribution*, Cambridge: Cambridge University Press.
- Kriesler, P. (1989) "From Disequilibrium to the Traverse in Economic Theory", School of Economics Discussion Paper 89-13, Sydney: University of New South Wales.
- Lavoie, M. (1992) *Foundations of Post-Keynesian Economic Analysis*, Aldershot: Edward Elgar.
- Legge, J.M. (1999) "Created Unequal: The Crisis in American Pay: A Review", *Journal of Post Keynesian Economics*, Volume 21 (4), Summer, pp. 561-70.
- Legge, J.M., and Hindle, K. (1997) *Entrepreneurship: How Innovators Create the Future*, South Melbourne: Macmillan.
- Lowe, A. (1976) *The Path of Economic Growth*, Cambridge: Cambridge University Press.

- Martin, R. (1994) "Innovation and Industrial Relations", in Dodgson and Rothwell (1994), pp. 337-47.
- Nelson, R. R. (1995) "Recent Evolutionary Theorizing about Economic Change", *Journal of Economic Literature*, Volume XXXIII (1), March, pp. 48-90.
- Nelson, R.R. and Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*, Cambridge, Mass.: Harvard University Press.
- Nuti, D.M. (1986) "Michal Kalecki's Contribution to the Theory and Practice of Socialist Planning", *Cambridge Journal of Economics*, Volume 10, pp. 333-53.
- Osiatyński, J. (ed.) (1991) *Collected Works of Michal Kalecki, Volume II: Capitalism: Economic Dynamics*, Oxford: Clarendon Press.
- Reijnders, J. (ed.) (1997) *Economics and Evolution*, Cheltenham: Edward Elgar.
- Rostow, W.W. (1990) *Theories of Economic Growth from David Hume to the Present: With a Perspective on the Next Century*, New York: Oxford University Press.
- Rothwell, R. (1994) "Industrial Innovation: Success, Strategy Trends", in Dodgson and Rothwell (1994), pp. 33-53.
- Ruthven, P. (1998) "Implications for Business Strategy and Investment Opportunities", in Mercer-Melbourne Institute, *Quarterly Bulletin of Economic Trends: Special Supplement Issue on the Asian Crisis*, Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne, October.
- Sawyer, M.C. (1985) *The Economics of Michal Kalecki*, London: Macmillan.
- Setterfield, M. (1999) "Expectations, Path Dependence and Effective Demand: A Macroeconomic Model along Keynesian Lines", *Journal of Post Keynesian Economics*, Volume 21 (3), Spring, pp. 479-501.
- Schmookler, J. (1966) *Invention and Economic Growth*, Cambridge, Mass.: Harvard University Press.
- Silverberg, G. and Verspagen, B. (1997) "Economic Growth: An Evolutionary Perspective", in Reijnders (1997), pp. 137-70.
- Smith, K. (1998) "Innovation as a Systemic Phenomenon: Rethinking the Role of Policy", in Bryant and Wells (1998), pp. 17-51.
- Soete, L. (1999) "The New Economy: A European Perspective", paper presented to the European Socio-Economic Research Conference, Brussels, 28-30 April.
- Steindl, J. (1941) "On Risk", *Oxford Economic Papers*, Volume 5, June, pp. 43-53.
- Steindl, J. (1952) *Maturity and Stagnation in American Capitalism*, Oxford: Basil Blackwell.
- Steindl, J. (1964) "On Maturity in Capitalist Economies", in *Problems of Economic Dynamics and Planning: Essays in Honour of Michal Kalecki*, Warsaw: PWN – Polish Scientific Publishers, pp. 423-32.
- Sylos Labini, P. (1979) "Prices and Income Distribution in Manufacturing Industry", *Journal of Post Keynesian Economics*, Volume 2 (1), Fall, pp. 3-25.

- Thurow, L.C. (1998) "Wage dispersion: Who Done It?", *Journal of Post Keynesian Economics*, Volume 21 (1), Fall, pp. 25-37.
- Thurow, L.C. (1999) *Building Wealth: The New Rules for Individuals, Companies and Nations in a Knowledge-Based Economy*, New York: Harpercollins.
- Toivanen, O., Stoneman, P and Diederer, P. (1996), "Uncertainty, Macroeconomic Volatility and Investment in New Technology", Warwick Business School Research Bureau, University of Warwick, U.K., 29th October (mimeo).
- UNDP [United Nations Development Program] (1999), *Human Development Report 1999*, New York: United Nations.
- Verspagen, B. (1999) "Evolutionary Macroeconomics: What Schumpeter(ians) can learn from Kaldor(ians)", ECIS Discussion Paper, Eindhoven: Eindhoven University of Technology.
- Vining, R. (1949) "Methodological Issues in Quantitative Economics", *Review of Economics and Statistics*, Volume 31, May, pp. 77-86.
- Wyckoff, A. (1996) "The Growing Strength of Services", *The OECD Observer*, Number 200, June.