Modelling Keynes with Kalecki

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INTRODUCTION

The starting point for *neoclassical* interpretations of Keynes’s system is ‘Modelling Keynes with Hicks’. Students are thereby misled into believing that Keynes analysed a general equilibrium exchange economy (summarized by the IS curve, with production merely an ‘exchange with nature’) in which the underlying barter transactions were obscured by a ‘veil of money’ (summarized by the LM curve). However, Keynes himself strongly emphasised that his analysis applied to a monetary production economy, one in which both aspects were well integrated.

By contrast, the starting point for *post-Keynesian* interpretations of Keynes’s system should be ‘Modelling Keynes with Kalecki’. It is true that Keynes’s *quaesitum* can be understood by a close reading of both volumes of his *Treatise on Money* and then the *General Theory*, but his analysis was lengthy and complex, with hardly any mathematics or graphs deployed. Keynes, in fact, criticized the use of mathematical models to understand complex reality: “[I]n ordinary discourse … we can keep ‘at the back of our heads’ the necessary reserves and qualifications and the adjustments which we shall have to make later on, in a way in which we cannot keep complicated partial differentials ‘at the back’ of several pages of algebra which assume they all vanish.” (Keynes, 1936, pp. 297-8) However, modern economics teaching practice demands mathematical models that track rigorous arguments in an erudite manner. Post-Keynesian instructors need a mathematical modelling tool of comparable simplicity to Hicks’s IS-LM framework to help students understand how a capitalist monetary production economy actually works, *sans* pure exchange and the veil of money.
Michał Kalecki was a Polish auto-didactic economist who used engineering-based mathematical tools to explain the modern capitalist monetary production economy. Kalecki’s prior claim, and the depth he added, to the Keynesian approach was first identified by Joan Robinson (Robinson, 1965). A more recent analysis (Chapple, 1991; 1995) delineates the relationship between Kalecki’s theory of modern capitalism and Keynes’s *General Theory*. These studies reinforce our position: the need for a simple mathematics-based model of Keynes’s approach that cannot be hijacked by the mainstream, forming a basis for policy analysis and *praxis* that the heterodox economics community can use as a teaching method utilising equations and spreadsheets.

This chapter sets out first the intellectual foundations of using Kaleckian insights to provide a heterodox version of Keynes’s model of capitalism and then expounds the ‘in principle’ argument for a simple modelling approach that can serve as a teaching aid. Secondly, the equations and identities of our dynamic Keynes-Kalecki (KK) Model are listed, with exogenous growth rates for the supply of labour and its average productivity. This model is capable of tracking the real capital stock through simulated historical time as it physically depreciates and is renewed via real investment outlays.

The KK Model is deployed to demonstrate Kalecki’s vision of the long period being but a succession of short periods. Using this view of *historical time*, we demonstrate the effects of various policy recommendations in a capitalist economy facing a doubling of the growth rate of its labour supply, based on three different institutional settings: (i) the Entrepreneurs’ lower money wage growth and work intensification policies; (ii) the Trade Unionists’ higher money wage growth and job sharing policies; and (iii) Kalecki’s planned market economy based on
maintaining a viable profitability gap to ensure entrepreneurs grow investment at whatever rate is needed to maintain a zero unemployment steady state in the long term.

This chapter goes on to explain how a researcher could make this core macroeconomic model more realistic and worthy of being calibrated against statistical databases. Finally, certain conclusions are drawn concerning reality and its treatment in both neoclassical and post-Keynesian economics. The KK Model’s equations and identities in Appendix A, together with time series plots of various policy outcomes in Appendices B through G, complete the chapter.

THE INTELLECTUAL CAPITAL UNDERLYING THE KEYNES-KALECKI MODEL

The simple thesis that this modelling exercise is built on is that Keynes alone will always be susceptible to being hijacked by neoclassical economists, due to the links that the mainstream inevitably will find among Keynes’s tangled Marshallian roots. However, incorporating the major elements of Kalecki’s approach into Keynes’s system will provide a model impregnable to the ‘bastardisation’ that has happened (and will continue to happen) to Keynes’s General Theory model on its own. The two elements of Kalecki’s thought that need to be incorporated into Keynes’s system are the dynamics of investment and profits and the distribution of income based on class. Perhaps then a more developed version of this KK Model can be applied to macroeconomic policy (with the political business cycle being integral), leaving government with only this option: to provide a thorough-going reform of the process of capital formation. Such a programme could radically transform capitalism into a society that uses markets for the public interest (with profit incentives and risk-taking intact) rather than for the private interests of a very few.
The KK Model is first expounded, then subjected to computer simulation experiments within three institutional settings, having Entrepreneurs, Trade Unionists and Kaleckians in charge of policy formation. This teaching model stands on the shoulders of a set of seminal works that have tackled this project of modelling Keynes with Kalecki over the last 30 years. The stance taken here is that all the previous work has been significant in furthering the model building and unlocking the secrets of how such a KK monetary production economy would operate.

Athanasios (Tom) Asimakopulos, inspired by the work of Joan Robinson to include Kalecki into the Keynesian approach, began this project by underpinning Keynes’s effective demand analysis with both Kalecki’s double-sided investment-profit relationship (Asimakopulos, 1977) and his class-based income distribution theory derived from mark-up pricing practices under monopoly capitalism (Asimakopulos, 1975). The former was a graphical representation without an investment function, while the latter was a tightly constructed mathematical model. The determinants of income shares, “… given the propensities to save, are thus the mark-ups and capitalists’ expenditures in real terms” (Asimakopulos, 1975, p. 330). Harris (1974) developed this idea further with Kalecki’s ‘degree of monopoly’, showing how unemployment and excess capacity are the normal case under capitalism, with prices and profit margins being governed by the monopoly position of firms. Harcourt and Kenyon (1976) were able to link monopoly pricing and the investment decision into a coherent graphical representation in which “… a unique solution could be found for the size of the margin above ‘normal’ prime costs and the level of planned expenditure, given the firm’s expectations about the future level of demand.” (Harcourt, 1982, pp. 122-3).
The late 1970s and into the 1980s saw a concerted attempt by many post-Keynesians to incorporate Kalecki into the Keynesian analysis through the use of the static ‘equilibrium’ concept. They wished to gain the respect of the economics mainstream with models that would provide alternatives that could be understood and appreciated within the dominant neoclassical paradigm. These essentially graphical expositions, with Kaleckian concepts integrated into Keynes’s framework, are evident in Skouras (1979), Lianos (1983-84) and Reynolds (1987, pp. 97-107). Sawyer (1982, p. 150) in his Kaleckian alternative macroeconomic exposition even uses the Hicksian IS-LM equilibrium model to show a decline in investment opportunities and unemployment.

These 1980s modelling attempts flew in the face of Kalecki’s central message that a change in investment in “… no way results in a process leading towards equilibrium.” (Kalecki, 1990, p. 231). Asimakopulos (1989, p. 17) argues that Keynes shared with Kalecki this ‘temporary resting place’ view of employment, given the volatile nature of investment. Thus arises the need to model Keynes explicitly with Kalecki’s approach to the capitalist economy, rather than the other way around, as was attempted in the 1980s. This latter approach failed to be accepted in the mainstream; in fact, the mainstream moved further away, even to the extent of rejecting Keynes in textbook macroeconomics (see Mankiw, 1998). The exposition in this chapter explicitly models Keynes upon a Kaleckian foundation. This part of the intellectual history of the KK model was developed in the 1990s.

Bhaduri (1986, p. ix) stated, in the preface to his textbook on the dynamic model of macroeconomics, that the radical content of Keynesianism in the book came through what was learnt from Kalecki. This ushered in a major shift in the post-Keynesian approach to modelling Keynes: the explicit incorporation of Kaleckian concepts as foundations (rather than ‘add-ons’)
in an alternative paradigm. The Marxian origins of Kalecki’s analysis clearly made this effort an alternative that was not aimed at being evaluated from a neoclassical perspective. Arestis (1992) spent half his book destroying the grand neoclassical synthesis before advancing an alternative dynamic post-Keynesian fully-fledged model that placed Kalecki at the centre, with income distribution and decision-making (private and public) being determined through relative power. In the same year, the foundation of a post-Keynesian approach to economics was presented by Lavoie (1992, p. 422), who stated that “… the economics of Kalecki provides better foundations for a post-Keynesian or post classical research programme than does the economics of Keynes.”

During the same period, the decision-making process in organisations within market capitalism was also questioned, with Davidson (1991) taking his cue from Chapter 12 of Keynes (1936) and developing the fundamentally uncertain (non-ergodic) nature of the future and the very limited insights provided by the past into this future. Courvisanos (1996) shows how Kalecki’s investment analysis provides a strong institutional foundation to the investment instability that arises out of this non-ergodocity. From this emerges the endogenous susceptibility cycle in long-term expectations, which can explain the persistence of business cycle volatility. As a learning process, Kaleckian economics sees the chain of short-term decisions (taken in historical time) making up the long-term trend, a ‘statistical artefact’ which has no independent existence.

Building on this in recent work on long-run Kaleckian models of growth by Lavoie (2002) and Cassetti (2003), Kaleckian economics is now about more than just filling in a lacuna in Keynes’s economics, as suggested by Toporowski (2003, p. 229). In fact, Lavoie (2006, p. 105) argues cogently that heterodox authors draw upon the flexible Kaleckian model of growth as a tool of analysis. With the increased popularity of Kalecki’s economics (see Blecker, 2002),
it is time to provide a more fundamentally Kaleckian exposition of the post-Keynesian model, drawing on research by scholars of Kalecki’s oeuvre. This is the work of the remaining sections of the chapter, enabling Keynes’s economics to be presented in a simple mathematically-based model that is a robust and distinct alternative to the ‘bastard Keynesian’ approaches adopted by the mainstream.

METHODOLOGY

Much mathematics-based post-Keynesian modelling has employed econometric methods consistent with the neoclassical static equilibrium approach (Downward, 2003). This method is based on making specific assumptions to derive abstract theoretical models, then writing up ‘results’ based on speculation of outcomes from this exercise. There may also be some separate empirical testing, using regression techniques, that aims to provide a post hoc rationalisation of the modelling results already obtained. All the econometric limitations of such an approach – including choosing assumptions, identifying and collecting data and manipulating the data to provide conclusions that show at least some partial regularities – raise serious questions about the suitability of such a methodology. Keynes’s quote, above, regarding partial differentials that are assumed to vanish, should give warning to any post-Keynesian who attempts to model the economy. Recent post-Keynesian criticisms that embrace his warning have emerged. From an open systems and non-ergodic perspective, the econometric approach is seen as a closed system based on an ergodic world view (see Dow, 2001). From a critical realist perspective, such a plurality of partial regularities from an unpredictable system ensures that “… econometric inferences are thus inherently problematic” (Downward, 2003, p. 97).
The mathematical methodology employed in this chapter is distinctly different; it is a variant of the systems dynamics approach. “Systems dynamics is well-suited to post-Keynesian-institutionalist economic model building. It is a dynamic disequilibrium approach to modelling complex systems that portrays human behaviour and micro-level decision making as it actually is, rather than as it might be in an idealized state.” (Radzicki, 2006, p.6). In utilising this approach, partial differentials are always in the picture and do not (in Keynes’s sense) ‘vanish’. Systems dynamics is thus a vital supplement to verbal reasoning, rather than the way standard econometrics has replaced verbal reasoning (see, for example, any issue of The American Economics Review since the early 1980s).

The integrated dynamic model developed by Kalecki is most appropriate for this KK modelling exercise. A systems dynamics model uses computer simulation to identify patterns of behaviour in the model based on certain circumstances. This is seen through changes in the variables (and in such ratios as the profit rate) over a long succession of simulated historical short periods that can be represented as separate columns on a spreadsheet. A simple KK Model is expounded with a very basic set of five behavioural relationships that are supported by the underlying intellectual capital. The rest of the model consists of identities, given parameters and an exogenous natural rate of growth.

The baseline case is the KK Model in a constant 2 per cent per period (2% pp) steady state of full-employment growth. This growth rate is maintained because there is a constant positive gap of 3% pp between the return on capital (8% pp rate of profit) and the cost of capital (5% pp rate of interest) that is exactly sufficient to keep entrepreneurs expecting and realising that particular degree of excess profitability. When we simulated the passage of historical time,
we observed a classic steady state with all time series data plotting as 2% pp exponential growth paths over an indefinite future with full employment and zero price inflation.

With aggregate demand growth being equal to the economy’s natural rate of growth (comprising 1% pp increases in both workforce and labour productivity), we introduced a higher workforce growth rate of 2% pp. We then imagined the Entrepreneurs arguing with the Trade Unionists over the most efficient way to ensure these extra workers find employment, i.e. how best to raise the rate of economic growth to 3% pp, in line with the new higher natural rate of growth. Only after the effects of their four suggested policies (two per side) are demonstrated by KK Model runs can both classes potentially unite behind a fifth, Kaleckian, policy that it is demonstrated will achieve and maintain their agreed societal goal of steady economic growth at 3% pp, with profitability slightly higher at 9% pp and minimal rates of inflation and unemployment.

Three different institutional settings are examined: (A) Entrepreneurs’ Ideal, where (A1) money wage growth is moderated or (A2) work is intensified, leading to higher productivity; (B) Unions’ Ideal, where (B1) money wage growth is raised or (B2) job sharing is practised, leading to lower average productivity; and (C) Kalecki’s Ideal, where (C1) investment planning raises the rate of real investment, resulting in a profit rate that soon rises to four (previously three) percentage points above the economy’s constant interest rate of 5% pp. In each case, the same KK Model is used, with its cumulative causation explained by the positive (investment-profits-investment) and negative (price-excess capacity-price) circular feedback loops that impart the economic dynamics. The patterns that emerge from these five simulation exercises enable comparisons of outcomes, as well as providing a simple teaching system to convey the dynamics
of an economy that, once set up with certain institutional settings, develops path-dependence as simulated historical time passes.

By far the most important aspect of our KK Model is the macroeconomic feedback from investment to profits. In his *Treatise on Money*, Keynes called it the Widow’s Cruse, while Kalecki’s Dictum states that “capitalists earn what they spend, and workers spend what they earn” (Sawyer, 1985, p.73). This mechanism, which neoclassical economists ignore in their fruitless search for ‘the micro foundations of macroeconomics’, is the feedback loop that constitutes ‘the macro foundations of microeconomics’. Specifically, this is the post-Keynesian microeconomics of a monetary production economy that should replace the discredited general equilibrium economy with its ergodicity, its fictional auctioneer, its *tatônnement*, its barter exchange fixation, and its veil of money.

**THE KK MODEL**

Our Keynes-Kalecki macroeconomic model is set out in Appendix A. It has 22 main variables, one ‘equilibrium’ variable and nine others. Only five of its 22 main variables are determined by behavioural equations based on Keynesian and Kaleckian insights. The remaining 17 variables are determined by identities: mathematical statements that are true *ex definitione*. This baseline KK Model is our starting point, and 12 parameters govern its dynamic behaviour.

There is one ‘equilibrium’ variable, the entrepreneurs’ profitability gap $\Delta r = [r - i] \%$ pp. When $\Delta r$ is zero, for instance, this indicates that entrepreneurs are ‘content’ with their real investment $[I^*, \text{ units pa}]$ and production $[Q, \text{ units pa}]$ decisions, even though this generates a
stationary state of zero growth in which new investment simply replaces their depreciated capital.

The most significant aspect of our KK Model is that it needs only five behavioural equations to drive this toy economy. The following are the five equations:

1. Unit Price: \( P_t = P_{t-1} + \alpha(v_t - 1) \) dollars per unit, where \( v_t = Q_t / Q^* \), the ratio of production to available capacity. This equation shows that the monetary production economy’s all-purpose consumption/investment commodity has a money price that rises (falls) whenever production exceeds (falls short of) available capacity. This equation is not Kaleckian; it is our answer to the false neoclassical charge that Keynes’s system needs sticky prices or some form of market power to make it work. Our unit price is completely flexible and it is the one that would prevail if perfect competition between numerous small businesses really did exist. The KK Model results undermine the neoclassical claim that Keynesian involuntary unemployment cannot occur if prices are competitively set and highly flexible.

2. Money Wage Rate: \( w_t = w_{t-1}(1 + w_q g_q + w_p g_p) \) dollars per worker pp. This equation shows that the money wage is inflexible downwards, in line with Keynes’s teaching, and will rise with growth in labour productivity and/or price inflation. This formulation is widely accepted by economists, some of whose equations also allow for higher rates of unemployment to depress the level to which money wages otherwise rise. Econometric testing has failed to disconfirm this near-universal labour market hypothesis.

3. Real Consumption: \( C^*_t = W_t / P_t \) units pp, which utilises Kalecki’s classical assumptions that entrepreneurs do all the saving, while wage-earners (including entrepreneur directors and managers to the extent they pay themselves salaries for organisational and decision-making skills) do all the consuming.
4. Real Investment: \( I^* = (1 + \beta x_{rt})dK^* \), units pp, which means that if the profitability gap is zero, entrepreneurs merely replace that fraction (\( d = 6\% \)) of their opening real capital stock (\( K^* \), units) which will depreciate away during the current short period. Over time, this ensures the maintenance of a stationary state, i.e. the no-growth economy is in dynamic ‘equilibrium’ or, as post-Keynesians would have it, is ‘fully adjusted’. However, if \( x_{rt} \% \) pp is above (below) zero, this results in positive (negative) net investment to the extent of the profitability gap times the ‘animal spirits’ reaction coefficient (\( \beta \)), which also is based on the ‘susceptibility’ of investment influencing the entrepreneurs (see Courvisanos, 1997). So, if \( \beta = 11.13 \) and the profitability gap is +3\%, entrepreneurs will lift gross real investment by 33.4\% more than the \( dK^* \), units needed to simply replace their depreciating capital stock. Technical change with incremental innovation is incorporated into the replacement investment.

5. Production: \( Q_r = C^* + I^* \), units pp, which means that production is undertaken in response to (and is equal to) the sum of real consumption and real investment expenditures, in this one-commodity world with no inventory investment. The equation reflects Keynes’s teaching that entrepreneurs always can ‘find the point of aggregate demand’ in the short period and fix their levels of production accordingly.

The five behavioural equations above and ‘equilibrium’ variable constitute the very heart of our KK Model. They are the only targets available for critics of post-Keynesianism to aim at, since all other relationships in the model are ‘bulletproof’ identities. Every other relationship is a definitional identity, which no economist, neoclassical or otherwise, can argue with.

There are 12 parameters in our ‘BaseCase’ KK Model:
\( \alpha = 0.5 \), a price adjustment coefficient on the production/capacity ratio (\( v_l \));
\( \beta = 11.13 \), an investment reaction coefficient on the profitability gap (\( x_{rt} \));
\( w_q = 1.0 \), indicating 100% passthrough of productivity growth into money wages;
\( w_p = 1.0 \), indicating 100% passthrough of price inflation into money wages;
\( i = 5\% \) pp, the interest rate set exogenously, e.g. by a horizontalist Central Bank;
\( d = 6\% \) pp, the depreciation rate for capital goods, which lasts for 16.7 periods;
\( q_0 = 100 \) units per employee pp, the initial average productivity of labour;
\( gq = 1\% \) pp, the growth rate of average labour productivity;
\( N_0 = 3,203 \) potential employees, the initial size of the economy’s workforce;
\( gN = 1\% \) pp, the growth rate of the economy’s workforce;
\( K^*_0 = 800,000 \) units, the entrepreneurs’ initial stock of real capital; and
\( z = 2.498 \) units of capital, needed to produce one unit of the single all-purpose good.

There are also nine other variables which play no part in the system, being merely various ratios and one difference, \( \text{viz.} \) the profit margin \( (rm_t = P_t - wc_t, \) dollars per unit). Nonetheless, they are of some interest, e.g. the Keynesian multiplier \( (k_t = Y_t / I_t) \) is not derived from a consumption function and is not necessarily constant. Also, the mark-up \( (m_t = rm_t / P_t, \) \%) can vary in a quite non-Kaleckian manner because we have assumed neoclassical flexible prices – though only to demonstrate their complete compatibility with involuntary unemployment in Keynes’s \textit{quaesitum}.

THE KK DYNAMIC MODEL: THREE INSTITUTIONAL SETTINGS WITH FIVE POLICIES

From a teaching perspective, the chapter outlines five simple experiments conducted within three different ideal institutional settings over an ‘era’ (here defined as 100 simulated short periods).
As experimentalists, we want to observe what happens as this model capitalist monetary production economy develops through historical time. Each experiment represents a different policy applied within one of the institutional settings. In turn, Entrepreneurs, Trade Unionists and Kaleckians run the KK Model to check out the efficacy of their favoured policies for lifting the economy out of its 2% pp steady state and onto a new 3% pp steady-state growth path. This is assumed to have been necessitated by an increase in the rate of workforce growth from the ‘BaseCase’ of \( gN = 1\% \) pp to the ‘PerturbedCase’ of \( gN = 2\% \) pp, with average labour productivity growth remaining unchanged at \( gq = 1\% \) pp. Appendix B shows that, after an era of simulated historical time, the 2% pp (3% pp) natural rate of growth economy maintains (rises to) an unemployment rate of zero (62.3%). Clearly something has to change, otherwise there will be 14,171 unemployed and starving citizens at the turn of the new era, with only 8,577 workforce members still in employment.

Setting A is called the *Entrepreneurs’ Ideal*, based on their notion that if only (A1) money wage growth can be moderated, or else (A2) work intensity can be increased, everything will be fine. Policy A1 was achieved by decreasing the Productivity-Wage Passthrough from \( w_q = 1.0 \) to 0.9, and Policy A2 achieved by raising the speed/duration of work so that Labour Productivity Growth increased from \( gq = 1\% \) pp to 1.1% pp. Unfortunately, Appendix C shows that the impact of Policy A1 will result in even less employment (6,379 workers), a higher unemployment rate (72%) and an excess capacity rate of 25.6%. This is accompanied by a severe deflation of unit wage cost (\( wc_t \) falls from $10 to $3.78) and profit margin (\( rm_t \) down from $2.50 to $1.39), hence also price (\( P_t \) decreases from $12.50 to $5.17) over the era. Appendix D illustrates the only slightly less damaging effects of Policy A2. There still is less employment after 100 periods (\( L_{100} = 7,777 \) workers and \( u_{100} = 65.8\% \)) but at least these figures are better
than under the Entrepreneurs’ alternative Policy A1. Also, the excess capacity rate of zero ensures no changes in initial wage cost, profit margin or price. Under all policies except the Kaleckian, the economy’s initial 8% profit rate on capital stock remains constant for 100 periods (which also is true of both the BaseCase and PerturbedCase).

Setting B is called the Trade Unionists’ Ideal, based on (B1) raising money wage rate growth to stimulate aggregate demand, or else (B2) job sharing, which reduces average labour productivity to ‘spread the pain’ of absorbing the extra workforce entrants. The first was achieved by increasing the Productivity-Wage Passthrough from \( w_q = 1.0 \) to 1.1, and the second by lowering the duration of work so that Labour Productivity Growth decreased from \( g_q = 1\% \) pp to 0.9% pp. By the turn of the era, Appendix E shows that Policy B1 delivers the best employment (13,784 workers) and unemployment (39.4%) outcomes of all four policies under institutional settings A and B. However, the associated negative excess capacity rate (\( x_{100} = -60.7\% \)) precludes its implementation: realistically, physical production cannot exceed capacity by this percentage, even in wartime.\(^4\) Severe price and wage cost inflation outpaced profit margin increases and, at the constant 8% profit rate, there simply was no incentive for entrepreneurs to invest in expanding their production capacity. Appendix F shows that Policy B2 maintains wage and price stability with zero excess capacity but delivers only 9,461 jobs by the turn of the era, at which time the unemployment rate has climbed to 58.4%.

Setting C is called Kalecki’s Ideal, based on harnessing the profit-investment-profit feedback loop to lift the constant profitability gap from its BaseCase value of 3% to 4% by (C1) a raft of Keynesian-Kaleckian planning policies designed to raise the growth rate of real investment from 2% to 3% pp, while simultaneously restricting the growth of money wages to minimise inflationary pressures. The profitability gap is the major explanator of investment
behaviour (Courvisanos and Richardson, 2006), so Kaleckian policies were focussed on raising
the $\beta$-coefficient which multiplies $x_r$. Specifically, it was encouraged by non-coercive
investment planning measures to rise from $\beta = 11.13$ to 12.55, partly as the result of an *incomes
policy deal* with the trade unions. This moderated the passthrough of labour productivity growth
into money wage rises from $w_q = 1.0$ to 0.8 and helped lift the ‘animal spirits’ of entrepreneurs.
Despite being a deeper cut than the $w_q = 0.9$ of Policy A1, this did not disadvantage the working
class because the KK Model shows (a) the real wage increasing from 80 to 290.9 units under C1
*versus* 197.6 units under A1 and (b) employment rising from 3,203 to 22,508 wage earners under C1
*versus* 6,379 wage earners under A1. Our final Appendix G displays excellent Policy C1
outcomes over 100 periods: as noted above, there was employment of 22,508 workers, but also
an unemployment rate just over 1% and an excess capacity rate of a little under 1%, together
with price and wage cost rising more slowly than profit margin, so that the inflation rate never
tops $gp_t = 0.4\%$ pp.

As a result of these five simulations, two crucial observations can be made. The first is
that both Entrepreneurs and Trade Unionists got it wrong because they ignored the influence of
animal spirits and expected profitability on real investment, hence realised profit rate and
profitability gap impacting subsequently by revision of expectations. Secondly, *Kalecki’s Ideal*
shows that by creative investment planning and adopting an incomes policy (thus harnessing the
power of the gap between expected profitability and actual cost of capital), the four nightmare
outcomes of the other two Ideals can be banished. The profitability gap and its $\beta$-coefficient
(reflecting animal spirits and susceptibility) is the significant solver of the macroeconomic
problem and leads to understanding better the microeconomics of the economy as well.
Courvisanos and Richardson (2006) provide the theoretical and computer simulation experiments
to support this proposition, now partly incorporated into Institutional Setting C for teaching purposes. The positive investment-profits-investment feedback loop engendering cumulative causation and path-dependence that stems from this Kaleckian rule of a constant and sufficiently wide profitability gap. Together with an incomes policy to dampen the endogenous growth of money wages, this Kaleckian policy approach can achieve and maintain the desired full-employment steady state growth trajectory throughout any stretch of simulated historical time.

POSSIBLE FURTHER DEVELOPMENTS OF THE KK MODEL

Our simple teaching model could be expanded into a realistic representation of a contemporary capitalist economy by incorporating standard treatments from the extant literature of imports, exports, international capital flows, taxation and government spending, etc. and adding a Central Bank policy reaction function to alter the interest rate in response to changes in the inflation rate from time to time. This enhanced model also could be changed from an open economy macro engine into a similarly dynamic and realistic full-blown microeconomic system by disaggregating the labour and capital stocks, plus the flows of production, consumption, profits, etc., and computing vectors of money wage rates, labour productivities, profit margins, and prices. If this were to be achieved, one would be able to trace how the positive feedback mechanism of Kalecki’s Dictum ‘rules the roost’ in terms of the ‘macrofoundations of microeconomics’.

With investment determining profits (hence also the average profit rate, around which all single-industry profit rates cluster) the microeconomic analyst then would have a model worthy of estimation against statistical datasets. There has been a long-standing puzzle in capital theory.
Do profits ultimately stem from compensating ‘thrifty’ capitalists for voluntarily practicing ‘frugality’ (Smith), ‘abstinence’ (Senior) or ‘waiting’ (Marshall), or for suffering ‘lacking’ (Robertson)? From ‘the’ marginal productivity of ‘capital’? the ‘natural rate of interest’? the duration of the ‘period of production’? or the ‘surplus value’ extracted from labour? From natural growth/maturation processes? or from rewarding entrepreneurial risk-bearing? Kalecki’s Dictum (aka Keynes’s Widow’s Cruse) assures us that the answer to this puzzle is ‘From none of the above’! We believe that further development of the KK Model presented here will stimulate empirical research to confirm that it is investment outlays which create the profits those same investors reap.

Entrepreneurs and neoclassical economists are always quick to bemoan the economic losses caused by labor strikes. No such angst, however, accompanies the periodic ‘capital strikes’ that characterize the downswing and trough phases of every business cycle. Lack of investment causes far larger economic losses than the occasional withdrawals of labor that do occur, even in the best regulated mixed economies. During these recessions and depressions, capitalists and neoclassical economists point to profits - in the form of low profit rates, low aggregate profits and low profit share – as the causal factor in the downturn of investment and production. But correlation is not causation. Kalecki and Keynes discovered the true cause: lack of investment by capitalists causes lack of profits for capitalists. The persistent refusal of entrepreneurs and neoclassical economists to recognize this fact means that measures ranging from Keynes’s comprehensive socialization of investment to Teutonic and Scandinavian indicative planning guidelines will have to be adopted if capitalist economies are ever to shrug off their incubus of inherent instability and begin to enjoy the prosperity and civility that accompany smooth steady-state economic growth.
In a previous Kaleckian computer simulation experiment conducted by the authors (Courvisanos and Richardson, 2006), the instability of the economy was demonstrated in a far more complex model. The systems dynamics complexity in that particular model created business cycles with amplitudes that were *endogenously* confined within a ‘corridor of viability’. The model allowed the system to cycle widely, but always within a corridor that ensured the capitalist economy did not fly off into chaos. This was a demonstration of how dynamic complex systems models can produce unstable time paths with embodied technical progress, but with the endogenous fluctuations moderated by emergent limits to investment, borrowing and excess capacity.⁵

As part of our programme to create a realistic representation of a typical contemporary mixed economy, we plan to combine our basic teaching KK Model with the complexity elements of this other model. We then will be able to produce endogenous dynamic behaviour that can cause fully-adjusted stationary and steady states to emerge, as well as traverses to converging, diverging and cyclical growth paths. The level of complexity will make such a version more appropriate for upper level undergraduate teaching and for Masters degree coursework.⁶

CONCLUSIONS: REALITY AND POST-KEYNESIAN ECONOMICS

Towards the end of the 20th century, Eichner and Kregel (1975) noted that neoclassical models do not attempt to explain reality; they are designed to show optimal outcomes that would emerge from models built on general equilibrium axioms. This allows neoclassical economists to claim ‘objective scientific rigor’ in arguing for normative policy changes to real economies, e.g. in the *Entrepreneurs’ Ideal* setting that maintains a steady 8% pp profit rate at the expense of the rest
of the community. At the cost of some abstraction, a one-commodity world with monetary production (the KK Model presented in this chapter) can show what outcomes emerge from policies applied in different idealized settings. The work in this chapter reverses the causality in economic theorizing from the neoclassical methodology described by Eichner and Kregel.

Our KK Model assumes three normative institutional settings in which five different policies are applied in an effort to shift the 2% pp steady-state economy onto a new 3% pp steady-state growth path. This chapter compared the results of over 100 short periods that cumulate over Kaleckian historical time into a long-term trend and it was found that only Kalecki’s Ideal would raise the profit rate to a steady 9% pp while achieving full employment and price stability. Only the availability of modern computers and software permits such an exercise to be carried out.

The power of this KK Model resides in its Kaleckian roots that anchor and feed Keynes’s general theorizing about the dynamics of capitalist economies, now finally free of the fear of being hijacked by the mainstream. The model stands in stark contrast to the various interpretations of Keynes that have been proposed by the neoclassicals: Hicks’ IS-LM equilibrium, Samuelson’s synthesis, Friedman’s liquidity preference, Lucas and Sargent’s rational expectations, Mankiw’s sticky markets, and so it goes on. Furthermore, the KK Model is simple to understand because it is made up of only five behavioural equations, all steeped in the post-Keynesian tradition. All the remaining 26 relationships are unexceptional definitional identities.

The results from our five experiments make strong intuitive sense to post-Keynesians, but the model generating them is sufficiently complex to show the level of interaction and cumulative causation that emerges. Under Kalecki’s Ideal, there are the priceless benefits of a
continuously fully-employed economy with no excess capacity and effectively zero inflation, despite a doubling of the workforce growth rate. In all three institutional settings, technical change with incremental innovation is incorporated, so this element cannot be seen as differentiating the outcomes. Courvisanos (2005) shows how such innovation can be much more sustainable in a planned market economy than in the neoclassical ‘free markets’ version.

At the first level of abstraction, the results of these experiments are intuitively satisfactory as regards trend activity over an era of 100 short periods. Closer approaches to reality through opening the economy, modelling taxation and government expenditure, adding more sectors, and incorporating cyclical behaviour can tell us more at the sacrifice of simplicity, but with the need for enhanced computer power and design ingenuity. Research points to the need to conquer these horizons while continuing to provide simple teaching tools that can be useful for communicating the policy alternatives available in a real-world economy.

REFERENCES


APPENDIX A – KK MODEL EQUATIONS/IDENTITIES, WITH BASECASE INITIAL
VALUES (PERIOD t = 0) SHOWN

Main Variables

Expenditure \[ Y_t = C_t + I_t \] \$4,003,441 pp

Employment \[ L_t = \frac{Q_t}{q_t} \] 3,203 workers pp

Employment Growth \[ gL_t = \frac{(L_t - L_{t-1})}{L_{t-1}} \] 1.0% pp

Unit Price \[ P_t = P_{t-1} + \alpha (v_t - 1) \] $12.50 per unit

Price Level \[ p_t = \frac{100P_t}{P_0} \] 100.00

Inflation Rate \[ gp_t = \frac{(P_t - P_{t-1})}{P_{t-1}} \] 0.0% pp

Money Wage Rate \[ w_t = w_{t-1}(1 + w_gq_t + w_pgp_t) \] $1,000 per worker pp

Wage Bill \[ W_t = w_tL_t \] $3,202,746 pp

Real Consumption \[ C^*_t = \frac{W_t}{P_t} \] 256,219 units pp

Consumption \[ C_t = P_tC^*_t \] $3,202,746 pp

Real Capital Stock \[ K^*_t = (1 - d)K^*_{t-1} + I^*_t \] 800,000 units

Capital Stock \[ K_t = P_tK^*_t \] $10,000,023

Real Investment \[ I^*_t = (1 + \beta x_r)dK^*_t \] 64,056 units pp

Investment \[ I_t = P_tI^*_t \] $800,696 pp

Saving \[ S_t = Y_t - C_t \] $800,696 pp

Production \[ Q_t = C^*_t + I^*_t \] 320,275 units pp
Capacity \[ Q^*_t = K^*_t / z \] 320,256 units pp

Profits \[ R_t = Y_t - W_t \] $800,696 pp

Profit Rate \[ r_t = R_t / K_t \] 8.0% pp

Unemployment Rate \[ u_t = (N_t - L_t) / N_t \] 0.0%

Production/Capacity Ratio \[ v_t = Q_t / Q^*_t \] 1.0

Excess Capacity Rate \[ x_t = 1 - v_t \] 0.0%

**Profitability Gap**

Profit Rate > Cost of Capital? \[ x_{r_t} = [r_{t-1} - i_t] > 0? \] 3.0% pp

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Price Adjustment Coefficient (\alpha)</td>
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<td>Inflation-Wage Passthrough (w_p)</td>
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<td>Interest Rate (i)</td>
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<tr>
<td>Depreciation Rate (d)</td>
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<tr>
<td>Initial Labour Productivity (q_0)</td>
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</tr>
<tr>
<td>Labour Productivity Growth (gq)</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Initial Workforce \[ N_0 = 3,203 \] 3,203 workers

Workforce Growth \[ gN = 0.01 \] 1.0% pp

Initial Real Capital Stock \[ K^* = 800,000 \] 800,000 units

Capital-Capacity Ratio \[ z = 2.498 \] 2.498

**Other Variables**

Propensity to Save \[ s_i = S_i / Y_i \] 20.0%

Propensity to Consume \[ c_i = C_i / Y_i \] 80.0%

Keynesian Multiplier \[ k_i = Y_i / I_i \] 5.0

Profit Share \[ rs_i = R_i / Y_i \] 20.0%

Wage Share \[ ws_i = W_i / Y_i \] 80.0%

Wage Cost \[ wc_i = w_i / q_i \] $10.00 per unit

Profit Margin \[ rm_i = P_i - wc_i \] $2.50 per unit

Mark-up \[ m_i = rm_i / P_i \] 20.0%

Real Wage Rate \[ wr_i = w_i / p_i \] 80 units per worker pp
APPENDIX B – KK MODEL (BASECASE & PERTURBEDCASE WITH 2% pp WORKFORCE GROWTH) GRAPHS

BaseCase gN = 1% pa - Workforce and Employment Growth Coincide

BaseCase gN = 1% pa - Rates of Unemployment and Excess Capacity are Zero
Perturbed Case gN = 2% pa - Workforce Growth Exceeds Employment Growth
APPENDIX C – KK MODEL (SETTING A, POLICY A1) GRAPHS

Case A1 - Workforce Growth Far Exceeds Employment Growth

Case A1 - How Unemployment and Excess Capacity Rates Build Up
Case A1 - How Price, Wage Cost and Profit Margin Fall

![Graph showing the fall of price, wage cost, and profit margin over years.](image-url)
Case A2 - No Effect on Price or Its Components

$0.00
$2.00
$4.00
$6.00
$8.00
$10.00
$12.00
$14.00

1 10 20 30 40 50 60 70 80 90

Years

P
wc
rm
Case B1 - Workforce Growth Exceeds Employment Growth by Reduced Margin

Case B1 - Unemployment Rate Rising Despite Production Exceeding Capacity
Case B1 - Price and Wage Cost are Rising Faster than Profit Margin
APPENDIX F – KK MODEL (SETTING B, POLICY B2) GRAPHS

Case B2 - Workforce Growth Exceeds Employment Growth by Reduced Margin

Case B2 - Unemployment Rate Rises but Excess Capacity is Zero
APPENDIX G – KK MODEL (SETTING C, POLICY C1) GRAPHS

Case C1 - Rough Equality between Workforce Growth and Employment Growth

Case C1 - Initial Profit Rate Rise creates Negative Unemployment and Excess Capacity, which then Stabilize
Case C1 - Price and Wage Cost are Rising Slower than Profit Margin
1 Colin Richardson, Imperial College, London, England and University of Abertay, Dundee, Scotland. E-mail: clrich@doc.ic.ac.uk. Jerry Courvisanos, School of Business, University of Ballarat, PO Box 663, Ballarat, Victoria, Australia 3353. E-mail: j.courvisanos@ballarat.edu.au. The authors wish to thank an anonymous referee for helpful suggestions, but remain responsible for the entire content of this chapter.

2 We are indebted to Sardoni (1995, p. 202 fn. 23) for reminding us of this excellent quote.

3 Professor Geoffrey Harcourt suggests that Kalecki’s Dictum would be better phrased as “wage-earners spend what they earn while profit-receivers receive what they spend.” (Dalziel and Lavoie, 2003, p. 340 fn.4). Although neoclassicals are content to believe one surprising truth about capitalist economies (that banks create money out of thin air), they cannot bring themselves to accept another: that it is entrepreneurs’ own combined investment outlays that create the aggregate of profits they all partake of.

4 The model as presented is not a complete systems dynamics model, in that phenomena like unrealistically large negative unemployment and excess capacity rates can occur. This was done to maximise transparency and minimise arbitrary choices of, for instance, floors and ceilings that restrict the free variation of the teaching model’s variables. While it may prove necessary in a research model for estimation against statistical datasets, incorporating such limits in this teaching model would make it difficult for students to discriminate between outcomes that are purely equation-driven and those that are (fully or partly) exogenously-constrained.

5 This theoretical result suggests that the estimated parameter-set of a more complex research model (in which free variation is permitted) could be such as to *endogenously* ‘enforce’ variation within realistic limits on such variables as the unemployment and excess capacity rates.

6 The KK Model is built utilising an Excel spreadsheet, whose advantage is that every student understands the basic concepts involved in replicating equations across the columns that represent short periods. The principal disadvantages are that these equations are hidden behind their numerical outcomes, auditing a spreadsheet is difficult, and only discrete time simulations can be modelled with relative ease. In expanding their teaching model, consideration should be given to migrating the system to Open Source modelling software such as Scilab (www.scilab.org), which is a Matlab-like mathematical programming language.