

## **Trevor Winchester Swan AO**

### **ANU Inaugural Trevor Swan Distinguished Lecture**

by

**Peter L. Swan\***

23 May 2006

New Lecture Theatre, John Curtin School of Medical Research, Bldg 54, Garran Rd,

ANU

4.30pm-6.00pm

ANU has chosen an ideal time to launch this new distinguished lecture series in Trevor's honour as it is the 50<sup>th</sup> anniversary of the publication of Trevor's most famous work on growth theory (Swan, 1956). I congratulate ANU for taking this important initiative.

Trevor was born on 14th of January 1918 to George Henry and Clara Ellison Swan (nee Grant), one of four siblings with a brother, Laurence, and two sisters, Clarice and Hazel. Picture 1, below, is of George and Clara.

Trevor had a strong resemblance to his father. George was a tramways engineer in charge of a depot. George's father, Henry William Swan, was born in England in 1848 and migrated to Australia. He was an "inspector of nuisances" in Sydney, which seems to be like a Health Inspector would be now, and which included keeping the noise down, rowdy kids, flying kites, etc.<sup>1</sup> Trevor died of cancer on January 15th, 1989. A lot of what I recount below has been better said by Noel Butlin and Bob Gregory (1989) in their *Economic Record* appreciation.



---

\*Contact details: Peter L. Swan, School of Banking and Finance, UNSW, tel. 02 9385 5871; email: [peter.swan@unsw.edu.au](mailto:peter.swan@unsw.edu.au). I wish to thank Robert Dixon, Alan Hall and Barbara Spencer for comments.

<sup>1</sup> Family information supplied by Lesley Booth.

Trevor's academic brilliance shone through early, topping his primary school in all subjects, excelling at debating at Canterbury Boy's High, John Howard's high school, and coming dux in 1936. He achieved one of the highest places in the New South Wales Leaving Certificate in that year.

He was gifted in the piano, music, singing until his voice broke and acting, where he appeared in Faust and other reparatory productions in Canberra in the 1950s, as well as being a champion debater. His love of music continued throughout his life. His memory and ability to recall verbatim practically the vast amount of literature he read made him an outstanding conversationalist.

While employed at the Rural Bank (now State Bank of New South Wales) under John Crawford (subsequently Sir John and Vice Chancellor of the Australian National University) he did his economics degree at Sydney University on a part-time basis. He achieved the highest possible accolade of the University Medal in 1940. He was the fifth person in 30 years to obtain the medal and the only part-time student.

In the following year he married the girl who had achieved one of the highest places in the Economics Degree -- Phyllis Mary (Pat) Grill -- clearly an attempt to combine the best available economic expertise. Pat qualified to enter the University of Sydney from Sydney Girls High at the ripe old age of 15 but learned secretarial skills to fill in time for a year as she felt she was too young and was also working in the economics section of a bank and studying part-time. The wedding occurred on the 27th May, 1941. She continued to care devotedly for him until the day he died. Pat passed away just on a year ago on 25<sup>th</sup> March, 2005, at the age of 88. One of their progeny, my sister, Barbara Spencer, and her husband, Jim Brander, are very prominent and highly cited economists who founded the area known as "strategic trade theory". My son, Anthony Swan, has published a number of articles in economics journals and is undertaking his PhD at ANU in the area of growth economics. Unfortunately, the gene for economics has yet to be identified.



Picture 2: Trevor and Pat in the early years

Trevor started his academic career in 1940, the year he graduated with his first-class Honours degree, as an assistant lecturer at Sydney University. He was only 22 years of age at the time. One of his substantial publications of that time was his contribution to understanding the controversy over “loanable funds” versus “liquidity preference” in which Trevor appears to settle the issue (Swan, 1941).

With the Japanese bombing of Pearl Harbour and subsequent advance towards Northern Australia Trevor became part of an exodus of economists from academia and the banks to relatively senior positions in the war-time government. He became an economics advisor to the then Minister for War Organisation of Industry, WOI, John Dedman.<sup>2</sup>

In terms of his theoretical and empirical work, apart from his direct impact on economic policy making, Trevor is well-known for a number of contributions beginning with the second macroeconomic model ever built, the first being Jan Tinbergen (1936) in a 34 equation model of the Dutch economy, and the third, Lawrence Klein (1950), a seven equation model of the U.S. economy, 1921-1941.

---

<sup>2</sup> As a personal aside, when I was studying economic history at ANU John Dedman was a fellow student of advanced age completing his degree that he has commenced in the 1920s. Unusually for an undergraduate, John was awarded an Honorary Doctorate by ANU prior to graduation. He subsequently had a building named after him for his critical role in founding the ANU in his ministerial role in the war-time and post-war Labor governments. It seems that the advice that freshly-minted graduates are given to succeed and honour their Alma Marta was not applicable to John who created the Alma Mata of tens of thousands prior to his graduation.

Tinbergen shared the first Nobel Prize in 1969. Klein received the Nobel Prize for his econometric models in 1980.

Colin Clark (1949), one of Australia's most distinguished economists described Trevor's econometric model of the Australian economy (Swan, 1943, 1989) in the following way:

“In 1943 Mr T. W. Swan, of the Department of Post-War Reconstruction, Canberra, prepared a paper entitled *A Working Model of the Australian Trade Cycle*. He was the first statistician to take literally Lord Keynes's requirement that, before determining functional relationships, all variables should be reduced to ‘wage units,’ i.e., divided by an index of money wage rates. (If we fail to do this, and compare the money values of the variables, spurious correlations will be introduced by general changes in the price level affecting several variables together: if we try to reduce every variable to its real component we obtain a system of equations of unworkable complexity: by using the rate of hourly wages as a general divisor we avoid both difficulties.) Mr Swan's application of this principle produced remarkable results. He expressed consumption, investment and imports as functions of national income, and obtained a system of equations which, with exports, public expenditure, and tariff levels as exogenous variables, made it possible to “explain” movements in national income for a ten year period. (For an analysis over a longer period it would be necessary to take account of inventory changes, and also the effects of past accumulations of capital goods upon current demand.)”

Well before the advent of computers and econometric packages for estimating systems of simultaneous equations and where the only mechanical aid was a slide rule, Trevor (Swan, 1943) describes the method he used to estimate his system of ten equations for the Depression period, 1928-1939:

“The method of evaluating the functional relationships of the system is necessarily empirical. Nevertheless, in view of considerable error margins in many of the available statistics, and the great possibilities of misleading results being produced by multi-collinearity in the time-series, it has been thought wise wherever possible to impose certain *a priori* conditions on the shape of the functional relationships. Subject to these conditions, linear or curvilinear regression lines have been fitted graphically to the data plotted as a scatter diagram.”

While it is not true to assert that coefficients were simply assumed, clearly a certain amount of structure was imposed and this might help to explain why Trevor was reluctant to publish. Robert Dixon now has a simulation version of Trevor's model available on the web that fits the data well.

Further pioneering contributions of the model are two simulations of “what if” questions: “What would have happened if the Commonwealth Arbitration Court had not cut the basic wage?” and “What public policy might have preserved Australia

from the Great Depression?" His conditional answer to the second question is exchange depreciation of 52%. The model highlight is a graphical depiction of aggregate supply and demand showing for probably the first time a Keynesian 45 degree cross diagram in which there are adjustment towards equilibrium shown as Picture 2 below.

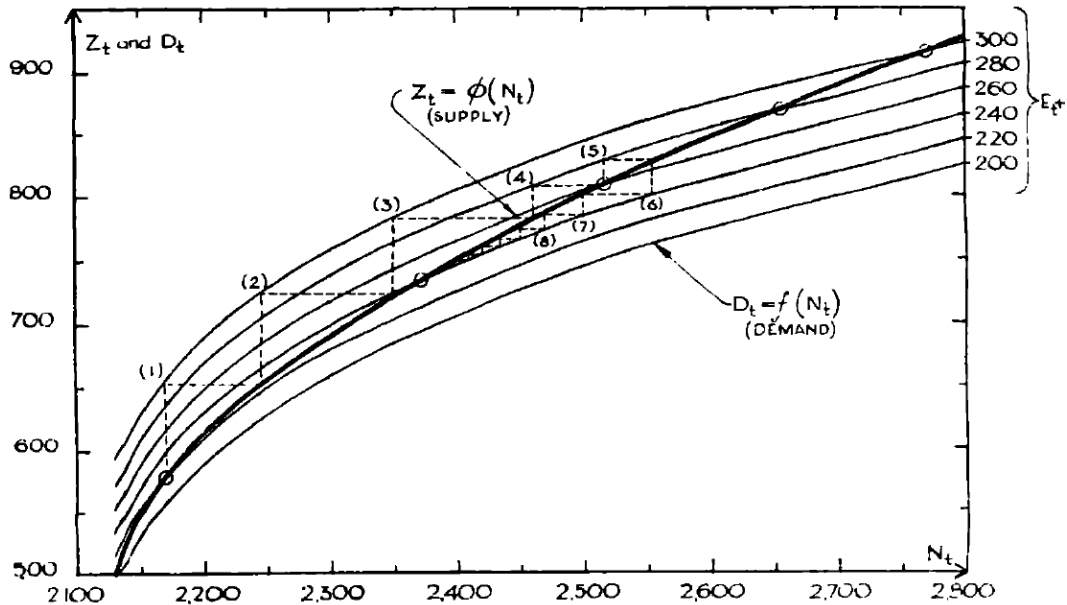


FIGURE I  
The Aggregate Supply and Aggregate Demand Functions  
(Wage Units)

Picture 3: Trevor's Keynesian 45 degree cross diagram from Swan (1989) showing the adjustment towards equilibrium

Trevor was involved with the drafting of the "White Paper on Full Employment" in 1945. Following rapid promotion in the Department of WOI under H.C. "Nugget" Coombs, subsequently Chancellor of the ANU and Governor of the Reserve Bank, Trevor rose to be Chief Economist, Department of Post-War Reconstruction, in the period 1946 - 1950. Coombs thought highly of Trevor—"one of the very best theoretical economists we have ever produced in Australia". "His theoretical grasp of the structure of the economy, his mastery of statistical techniques, his gift of lucid exposition and his incredible capacity for work made him the effective mainspring of the War Commitments Committee" (Rowse, 2002, p. 157). Subsequently, Trevor was to write a less happy letter to Nuggett, his life-long friend, to try to convince Coombs

to change his stance over the preservation of traditional aboriginal ways, even though he knew it would be to no avail.<sup>3</sup>

In 1947 and 1948 Trevor was on secondment to the “Economic Section of the Cabinet Secretariat of His Britannic Majesty’s Government”, to give it its official title, in London reporting on the balance of payments problems of Western Europe. When asked to comment on a document proposing means to limit imports to conserve scarce Sterling reserves and reduce dollar imports by quantitative means, *i.e.*, rationing, he responded:

“Unless the problem is approached with care and system, there would seem to be some danger of the development of an autarkical outlook and an over-concentration on direct and immediate gains from imports-replacement at the expense of indirect and future losses. Indeed, at first sight one might suppose that already the stresses of the last few years (including the war-time developments, aimed at saving shipping space) might have pushed import replacement beyond the point of true economy.” (Swan, 1947, p.6).

It is clear from this statement that Trevor was far from being an interventionist when it came to protection, even though he was living in a highly interventionist era in an economy that was still being run on command and control lines.

With the victory of Robert Gordon Menzies in 1949, the Prime Minister took advantage of Trevor’s gift with words by working closely with Trevor on a number of his major "economic" speeches.

Trevor took up the Foundation Chair in Economics at the Australian National University, in the Research School of Social Sciences in 1950. At the age of 32 he was the youngest appointment to the ANU as a chair.<sup>4</sup> Nonetheless, he continued to be closely involved with Government economic policy, especially budgetary and

---

<sup>3</sup> “I simply cannot agree with your deeply held belief that the ‘Way of the Aborigines’ can be preserved, even if the developers are kept off their lands. To have any hope of preserving it you would have to build a new Wall of China and declare that beyond the wall their would be Australian citizens entirely deprived of education and social welfare, without which they have no means of knowing even what choices there are and can only be regarded as animals in a vast desert. I know I have no hope of convincing you of this.” Trevor in a letter to Coombs, 13 October, 1970. See Rowse, 2002, p. 316.

<sup>4</sup> ANU correspondence at the time paints the following picture: “in 1948 he was being eagerly sort by a leading economist in the European Economic Commission, who described him as ‘exceptionally able and brilliant’. Except for a short stint as a lecturer at the University of Sydney, most of his work to date had been in government departments. Coombs new him well and supported him warmly; but Copeland, who suspected he thought too highly of himself, remarked that he had not yet undertaken a sustained piece of work and thought he would benefit from a few years at a more junior level. Swan had initially applied for an advertised readership in economics. However, as Hancock had shown, the market was not teeming with economists; so despite Copeland’s doubt, he was offered the chair.” (Foster and Varghese, 1996, p. 54).

exchange rate policy, throughout his working life. He withdrew from advising Sir Robert Menzies after a disagreement over the Suez crisis in 1956 but played a decisive role in the 1961 “short, sharp shock” that had such an adverse short-term impact on the Australian economy that Menzies came within one seat and a handful of votes to losing the 1961 election. Subsequently, the Australian economy enjoyed over a decade of low unemployment and low inflation. Typically, his advice was provided behind the scenes, working closely with friends such as Sir Frederick Wheeler, Secretary to the Treasury, and Bill Hayden (subsequently Governor General), while Bill was Treasurer in the Whitlam Government. He advised nearly every Prime Ministers over the period 1949-1985.



Picture 4: Trevor in his office at ANU. The same building and desk that he used at Post-War Reconstruction.

During the 1950's Trevor's made his three most recognised contributions to economics. These were not only to make him famous but also to put Australian economics on the world map. In 1953 he circulated a paper on policy instruments and targets that was not published until 1960 (Swan, 1960). This paper foreshadowed some of the subsequent work of Robert Mundell who received the Nobel Prize in

1999 for modelling monetary and fiscal policies under different exchange rate regimes. The three targets were full employment, price stability and balance of payments equilibrium and the three instruments, domestic demand to be managed via fiscal policy, money wages to be managed by the Arbitration Court and the exchange rate. The last instrument ceased to be relevant after the floating of the dollar by Paul Keating in 1983, a move not prompted at the time by high-minded theory but rather by the practical impossibility of coping with vast speculative flows.

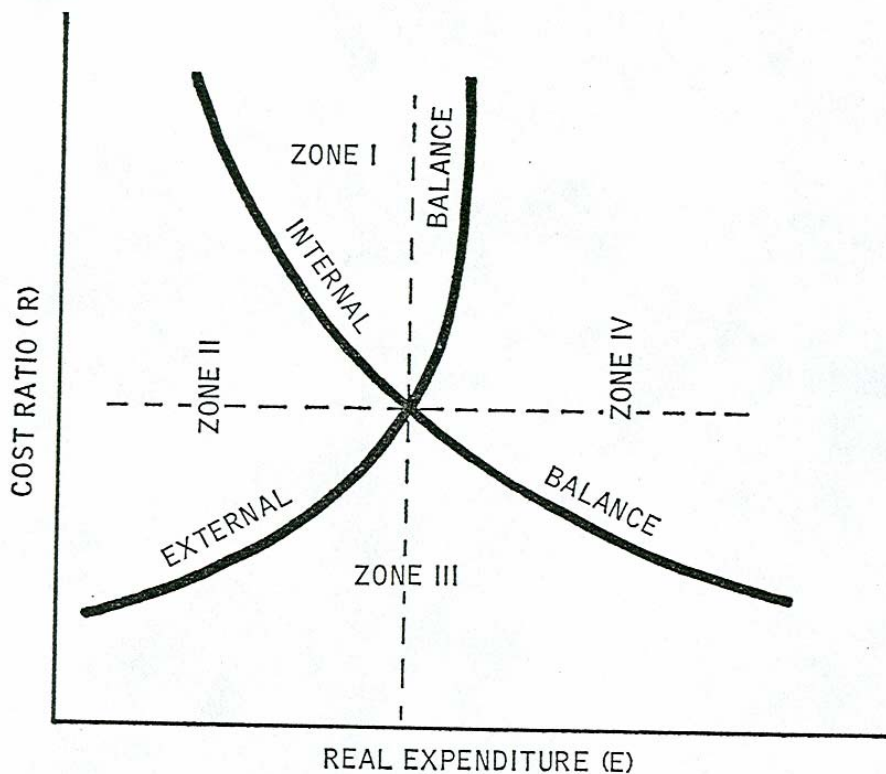
This together with financial deregulation was described by Paul Kelly as “arguably the greatest blow struck against the protectionist, introverted, regulatory apparatus’ established in the early years of Australia’s existence as an independent nation.”

Assuming that Australia cannot affect its terms of trade between the prices of its export and imported goods, the exchange rate together with the level of money wages determined by the Court determines the “real” exchange rate between foreign traded goods, imports and exports, and domestic goods, that is, between traded and non-traded goods. The earlier approach by James Meade (1951) had largely relied on changes in the terms of trade to equilibrate the external economy. Meade was awarded the Nobel Prize in 1977 for his work on international trade.

In May 1955 Trevor presented a related paper to a small group of economists at a meeting in the Commonwealth Bank. A slightly altered version was given as the Giblin Lecture at the August 1955 ANZAAS meeting which was not published until 1963 (Swan, 1963). It solved in diagrammatic terms the problem of simultaneously achieving both internal balance, that is price stability without unemployment, and external balance, balance of payments equilibrium with a stable exchange rate. As in Swan (1960) an important simplification was made by assuming that a small country like Australia cannot affect its terms of trade, making it possible to put imported and exported goods prices on the one axis.



T. W. SWAN  
 DIAGRAM 2



Picture 5: Trevor's model of internal and external balance

In effect, on the horizontal axis is real expenditure on non-traded goods whose prices are determined in the domestic market and on the vertical axis the real exchange rate which is the price of import and export (traded) goods relative to the price of domestic goods as represented by local wage costs. Domestic expenditure policies and domestic wage rates set via the Arbitration Court now help to determine both internal and external balance and the four zones of economic unhappiness described on the diagram. In essence, by constructing a Keynesian economic model relevant for a small trading nation Trevor could now articulate complex economic policies to a large audience in a very simple and understandable way. Two other well-known Australian economists, Wilf Salter (1959) before his untimely death and Max Corden (1960), extended Trevor's diagrammatic approach.

Trevor's role as a practical policy economist leading the public policy debate, unusually from a strong theoretical basis, was reflected in a high public profile. This is illustrated by the following cartoon.

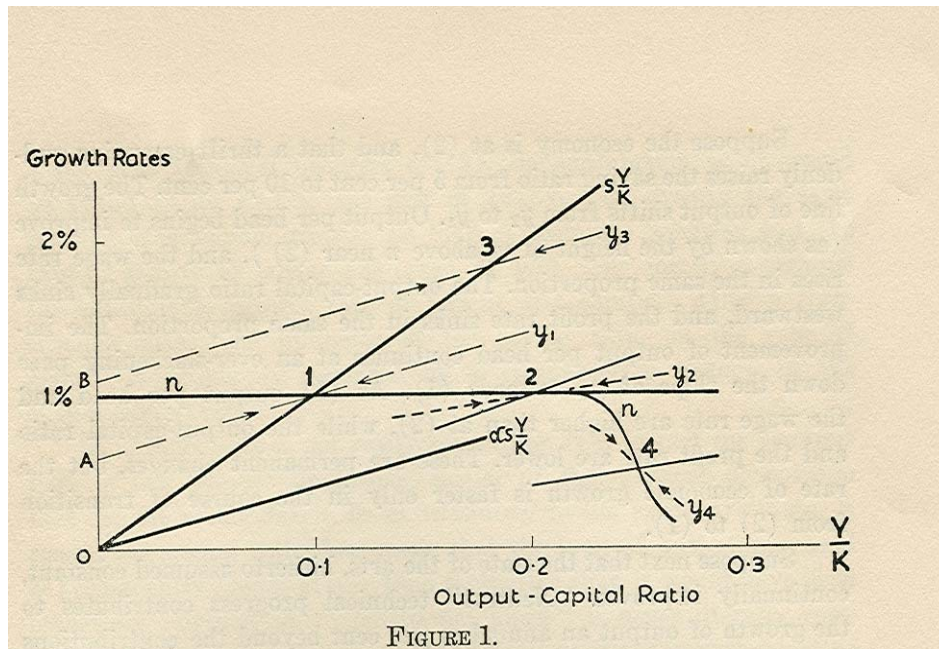


Picture 6: All economists long to be loved, including Trevor. Despite best efforts, not all succeed all the time.

His remaining major accomplishment was to develop the world's first significant "growth model" which could be, and is, used to analyse the way resources such as labour and capital are combined over time to produce real increases in living standards (Swan, 1956). In excess of a thousand books and articles have built on and utilized either this path-breaking work or work produced independently at about the same time by Robert Solow (1956). I believe that Trevor's article is way in excess of the most highly cited article ever to appear in *The Economic Record*. This has helped to expose much of Australian economics to a world-wide audience. Trevor's model together with the now more famous contribution by Robert Solow is known as the Solow-Swan Growth Model. Robert Solow was awarded the Nobel Prize for Economics in 1987 for his work relating to the economic theory of growth and technical change.

Trevor's diagram below shows how increase in the capital stock due to saving at 10% of income, the heavy  $S \frac{Y}{K}$  line through the origin, eventually results in a steady-state

growth rate of 1%, equal to the growth rate of labour at an output-capital ratio of 0.1. Halving the savings rate to 5% results in the same steady-state growth rate of 1% but at double the output-capital ratio. Hence only technical change can result in a permanently higher growth rate.



Picture 7: Solution to Trevor's Growth Model (Swan, 1956)

However, Trevor's paper is a lot more than the (equal) first neoclassical growth model. It explores the classical Ricardian and Malthusian paths and provides a series of insights into a number of puzzles connected with Joan Robinson's *Accumulation of Capital*, the Wicksell (1934) Effect, and Akerman's problem. Wicksell's work on the treatment of durable goods in his analysis of Akerman's problem is the starting point for my work, and that of others, on the economics of durable goods. See Dixon (2003) for a recent treatment and Rogers (2003) for a survey of some of the empirical literature that has been spawned by the model.

In Appendix 1, I describe the relationship between Joan Robinson and Trevor, some personal anecdotes' about Joan, and Joan's comments on Trevor's two famous papers on growth theory. I have included these for their historical importance. Appendix 2 is a bio of Trevor and a listing of his published and unpublished work that I am aware of.

After writing his growth model paper Trevor was invited to MIT in Cambridge by Robert Solow and Paul Samuelson and then to New Delhi to work on the Indian Five

Year Plan during 1958. While Trevor was at MIT he pointed out that a production function Solow was utilising had the constant elasticity of substitution, CES, property. In this way, the CES function was officially born. Solow and his coauthors publicly thanked Trevor for this insight (see Arrow; Chenery, Minhas, and Solow, 1961).

The well-known trade theorist and development economist, Jagdish Bhagwati, who met with Trevor in New Delhi in 1958, described the difference in approach to “hands-on” advising under difficult circumstances between Trevor and the development economist and Nobel Laureate, Arthur Lewis:

“Swan had come with enthusiasm, eager to put his expert Australian shoulder to the wheel in India's developmental efforts. ... Once Lewis found himself invited to a fundraising luncheon by the Princeton University President for the Iranian Ambassador. Lewis was minding his manners and quietly getting through the lunch when he was suddenly startled to hear the President promising the Ambassador: "We would be happy to send Professor Lewis to Iran to help you with planning your development". As he walked back morose from the luncheon, Lewis ran into the sociologist Marion Levy, a man of some wit, who asked him what the matter was. When Lewis told him, Levy said: ‘Arthur, you should have told the President that Professors can be bought, but not sold.’”

Perhaps Trevor, like Lewis, should have been a more reluctant hands-on development economist. Trevor’s young and brilliant colleague at ANU, Wilf Salter, died tragically of “chicken pox” during his stay on the Indian Sub-continent to provide development advice. Trevor’s health never fully recovered from his time in India. Trevor’s disillusionment with India’s top-down planning process is reflected in his “letter from New Delhi” with which I conclude this tribute. This captures Trevor’s way with words and his affinity with the classics.

In 1987 the Economics Society of Australia made its inaugural Distinguished Fellow Awards to two economists that the Society considered had contributed the most to the development of economics in Australia. One of the two first recipients was Trevor Swan (see *The Economic Record*, December 1987) and the second, Colin Clark. Fittingly, the prize was awarded by the Prime Minister, Bob Hawke.

The awarding Committee summed up Trevor's contribution in the following way:

"The work of Professor Swan is noted for its theoretical brilliance which flowed not only from the ideas but the close relationship between his theoretical work and policy problems." The contribution of this work was recognized by the invitation to deliver the Marshall Lectures at Cambridge. (The only other Australian invited to deliver these prestigious lectures was Professor Copland during the 1930's.)

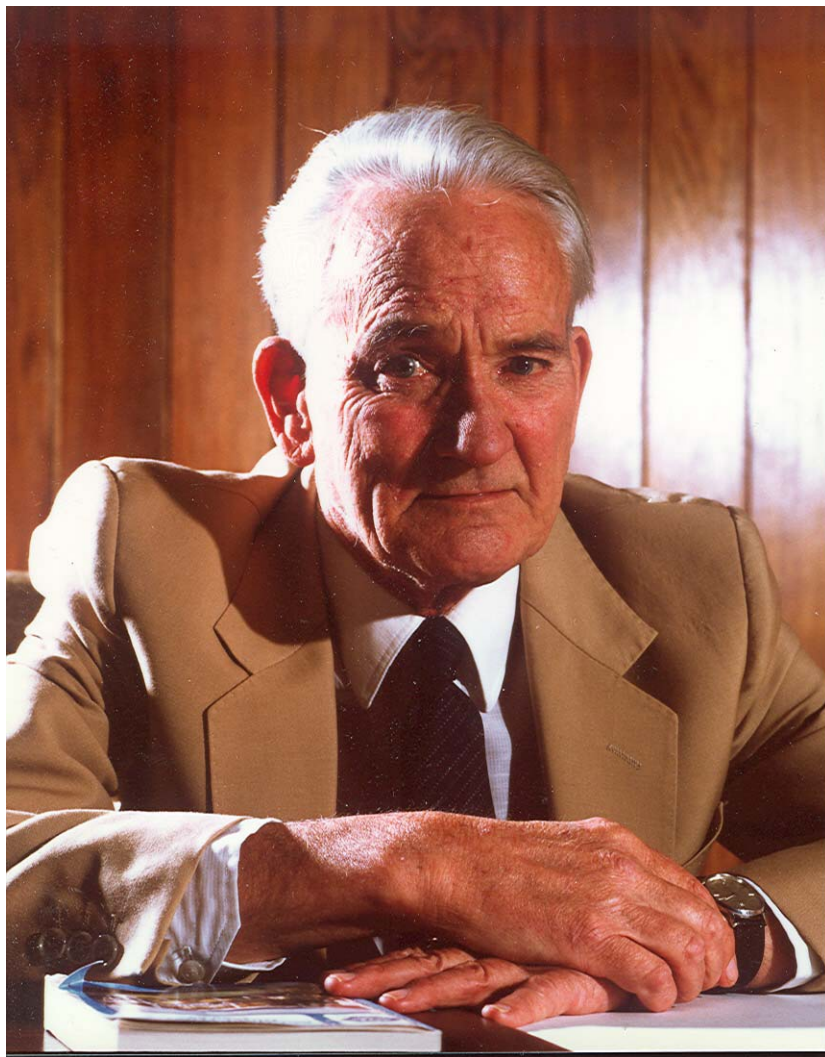


On Australia Day, 1988, the bicentennial year, Trevor was made an Officer of the Order of Australia in recognition of his contribution to both the economics profession and economic policy-making in Australia. The policy advice which he largely provided informally behind the scenes and without pay was publicly recognized when he headed a committee which brought about some major taxation changes introduced by Bill Hayden as Treasurer and when he was appointed to the Board of the Reserve Bank of Australia. Trevor accomplished an enormous simplification of the tax rate structure with fewer bands and the replacement of deductions by allowances that were seen as ‘fairer’ to lower income earners.



Picture 8: Trevor Winchester Swan AO receiving his award from the Governor General in the Bicentennial Year 1988

He was appointed for a five year term to the Board of the Reserve Bank by the Treasurer, Bill Hayden and Whitlam Government in 1975 and a subsequent five year term in 1980 by the Treasurer, John Howard, and the Fraser Government. His contributions were recognized by both sides of politics. Mr Gough Whitlam, in a speech he gave as Prime Minister, referred to Trevor "as the doyen of Australian economists." Those who knew him personally would be impressed by his ready friendship and kindness, his eloquence and debating skills, his excellent memory and verbatim recall of apt quotations.



Picture 9: Trevor on the Board of the Reserve Bank of Australia

Let me conclude with Trevor's letter from New Delhi with his commentary on India's five year plan. In typical fashion he uses poetry and literary allusions to reinforce his point. In this case to question the fate of the very enterprise he is intimately involved with.

## LETTER FROM NEW DELHI

Suddenly it is summer and the jackal howl  
deep in the jungle which is suburban scrub.

In the cool nights too they used to howl  
(pleasuring in the dome of Ferozshah,  
playing jackal to his Ozymandias)  
to keep themselves warm . Soon  
with the rains their cadence will fall  
outjackalled by the tawny nullah courses  
that scurry for the Jumna's holy gorging  
alms and ashes, rinds and shucks,  
water for the taps of Delhi.

Now in the summer do the jackals howl  
wantonly, dreaming of a five-year plan?

If I were a jackal I'd howl to show  
my jackalness. Here a lifted voice,  
is answered in brick and plaster by a thousand tongues  
none human but the wallah's  
whose cherry-ripe betels his lips. If I  
were a jackal mortality would be my friend  
and only the vultures my enemy. I could live  
on the killings of my friend  
and howl without shame.

Trevor Swan

## References

- Arrow; K. J., H. B. Chenery, B. S. Minhas, and R. M. Solow, 1961, "Capital-Labor Substitution and Economic Efficiency," *Review of Economics and Statistics* 43, 225-250.
- Clark, C. 1949, 'A system of equations explaining the United States trade cycle 1921 to 1941', *Econometrica*, 17(2), pp. 93-124.
- Corden, W. M., 1960, "The Geometric Representation of Policies to Attain Internal and External Balance," *Review of Economic Studies* 28, 1-22.
- Corden, W. M., 1968, "Australian Economic Policy Discussion in the Post-War Period: A Survey," *American Economic Review* 58, 88-138.
- Dixon, R., 2003, "Trevor Swan on Equilibrium Growth with Technical Progress", *Economic Record* 79, 487-490.
- Dixon, Robert "Simulation with EViews: Swan's Model", Department of Economics at The University of Melbourne  
<http://www.economics.unimelb.edu.au/simulation/eviewsswan.pdf>
- Foster, S. G. and Margaret M. Varghese, 1996, *The Making of the Australian National University*, Allen and Unwin, Sydney.

- Gregory, R. G. and N. G. Butlin, 1979, "Trevor Winchester Swan, 1918-1989," *Economic Record* 75, 369-376.
- Klein, Lawrence, 1950, *Economic Fluctuations in the United States 1921-1941*, John Wiley and Sons, New York.
- Meade, J. E., 1951, *The Balance of Payments*.
- Osborn, Edward, 1958, "The Wicksell Effect," *Review of Economic Studies* 25, 163-171.
- Pitchford, John D., 2002, "Trevor Swan's 1956 Economic Growth 'Seminar' and Notes on Growth," *Economic Record* 78, 381-387.
- Rogers, Mark, 2003, "A Survey of Economic Growth," *Economic Record* 79, 112-135.
- Rouse, Tim, 2002, *Nugget Coombs: A Reforming Life*, Cambridge University Press, Cambridge UK.
- Salter, W. E.G., 1959, "Internal and External Balance: The Role of Price and Expenditure Effects," *Economic Record* 35, 226-38.
- Swan, T. W., 1941, "Some Notes on the Interest Controversy," *Economic Record*, 153-165.
- Swan, T. W., 1943, "A working model of the Australian trade cycle", Department of Post-war Reconstruction, Canberra, unpublished.
- Swan, T. W., 1945, published 1989, "The principle of effective demand — a 'real life' Model", *Economic Record* 65(191), 378-98.
- Swan, T. W., 1947 "Replacement of Imports by Home Production," Economic Section of the UK Cabinet Secretariat, 8<sup>th</sup> October 1947, 9 pp. T230/28 010421
- Swan, T. W., 1956, "Economic Growth and Capital Accumulation", *Economic Record* 32, 334-361.
- Reprinted in Peter Newman (ed.) *Readings in Mathematical Economics*, Volume 2, Capital and Growth, 172-199, Baltimore: John Hopkins Press, 1968. Reprinted in *Macroeconomic Theory: Selected Readings*. Harold R. Williams and John D. Huffnagle, eds. Englewood Cliffs, NJ, Prentice-Hall, 1969, 477-86.
- Swan, T. W., 1960, "Economic Control in a Dependent Economy", *Economic Record* 36, 51-66. First presented at a seminar at ANU, 30 June 1953.
- Swan, T. W., 1963, "Longer Run Problems of the Balance of Payments", in H.W. Arndt and W.M. Corden (eds.), *The Australian Economy*, Sydney: Cheshire. Originally mimeographed and circulated in May 1955. Reprinted in R.E. Caves and H.G. Johnson (eds.), *Readings in International Trade* (selected by a Committee of the American Economic Association).
- Swan, T. W., 1964, "Of Golden Ages and Production Functions", in K. Berrill (ed.) *Economic Development with Special reference to South East Asia*. London. Macmillan, 1964, 3-16.
- Swan, T. W., 2002, "Economic Growth", *Economic Record* 78, 375-380. Written in 1956.



Swan, T. W., 1964, "Of Golden Ages and Production Functions", in K. Berrill (ed.,) *Economic Development with Special reference to South East Asia*. London. Macmillan, 3-16.

Tinbergen, Jan, 1936, "An Economic Policy for 1936" in L Klaasen *et al* (eds), 1959, *Jan Tinbergen: Selected Papers*, 37-84 and in G. Dhaene and A. Barten, 1989, "Where it All Began: The 1936 Tinbergen Model Revisited", *Economic Modelling*, 203-219.

Wicksell, Knut, 1934, *Lectures on Political Economy*, Vol. I, Appendix 2, "Real Capital and Interest," Routledge and Sons, London.

## Appendix 1: Trevor and Joan Robinson

The relationship between Joan Robinson and Trevor is an interesting one. I believe they must have met, probably for the first time, when Trevor was invited to present the Marshall Lecture in Cambridge in 1963. I recall they had a very emotional reunion in my office at Monash University when Joan visited Monash in the late 1960s. I have attached Joan's comments on both of Trevor's important growth articles below. I got to know Joan quite well when I spent a term in the Economics Department at Cambridge in 1968. When I mentioned to her at morning tea that my work on the Australian car industry showed that Australia should remove the massive level of protection she was so angry that she simply walked straight out of the room. The next day, seeing me yet again in the tea room, she walked up to me in a friendly fashion and apologised for her inexcusable behaviour of the previous day. At least she did not attempt to hide her highly protectionist sentiments. Later when a colleague and his wife who were visiting from Monash were walking with me in the streets of Cambridge my friend pointed to a lady in the street dressed in bright, almost Asian peasant, clothing and walking with an elderly gentleman. What is that peasant woman doing here in the streets of Cambridge, he asked? I said well that lady is Joan Robinson and the gentleman beside her is Lord Kahn. At that moment Joan waved to me and called out, "Peter" and I got to introduce my Australian friends to two very famous economists, one of whom an English lord no less. Joan had been exceedingly impressed by events in China under the Communists, and I think, also North Korea, and I believe that this had influenced her choice of clothing.

Attached are two letters that Joan wrote to Trevor in response to his two major articles on growth theory. Firstly, her comments on Swan (1956):

15<sup>th</sup> January 1957

Dear Professor Swan,

I was much interested in your article in *Economic Record*. As far as I understand the substantive part I agree with it, but your scarecrow does not keep me off the field, because the postulate that the price of a meccano set in terms of commodities remains constant when the wage in terms of commodities alters begs all the questions.

Compare points 1 and 2 in Figure 1. The higher  $\frac{K}{Y}$  at 2 may be composed of

(a) more meccano per man and (b) higher commodity price per unit of

meccano, in any proportions depending on the technical conditions. At one extreme, real wages remain constant, and the whole effect is more meccano sets per man. The output of consumption goods is less (at a given population) because capitalists are consuming less, and output per head is higher. The labour released is engaged in producing more meccano sets (but during the transition the stock of meccano sets was raised, so that the higher output per annum is the same percentage of the stock). At the other extreme, meccano sets per man cannot be varied, everything is the same in technical terms, but the rise in real wages has raised the price of a meccano set in terms of product.<sup>(1)</sup>

In this general case, the rise of  $\frac{K}{Y}$  is made up of a bit of each. This I take to be the real meaning of Wicksell and it cannot be disposed of by calling it “financial.”

I add a few points re J.R. 346. I intend the “widow’s cruse as causative, not mere national-income accounting. Owners of property are not confined by their incomes, but expenditure by capitalists raises profit margins (the excess of sales value over wages cost) and so generates profits. “they get what they spend”.

346. I have retreated from my J.R. units, but I was rather annoyed at Champernowne saying that I proposed them as the measure of capital. My whole point is that a stock of capital can only be described by 4 measures (1) J.R. units (2) value (3) productive capacity (4) employment offered.

347. The discontinuities are not of any importance except as an expository device. In the “continuous” case there are always two techniques (two quantities of mecaano) that yield the same rate of profit. In equilibrium the m.p. of £1 spent on labour is equal to that of £1 of interest (the rate of interest being the rate of profit obtaining). A little more labour with less capital produces the same product as a little less with more. When some product is produced with  $\gamma$  technique (less meccano sets) and some with  $\beta$  with constant wage rate. A little more

---

(1) In this case, if the price of meccano remains constant, because the fall in interest offsets the rise in wages, you cannot get into equilibrium, but as I argue in my note on Harrod, there must be some level of real wages at which this ceases to be true, so that in general there always is a point 2 even when technical conditions are perfectly rigid.

If I have understood your article, you are saying the same thing as I am in this note on Harrod. I agree that he has a let out with his d, but he didn’t see the point of it himself.

will cause the wage rate to rise (make it as little as you please – per man year). Then  $\beta$  and  $\gamma$  are equally profitable.

My discontinuities are only intended to put this phenomenon under a magnifying glass.

351. Yes. This is my point. The m.p theory work for micro problems. At a given level of real wages, for each entrepreneur m.p. of labour is equal to the wage and m.p. of capital is the rate of profit. But as soon as the wage rate changes the whole thing comes unstuck. The chain-index method works all right for a very special problem – my chapter 14. But my objective was to deal with technical progress, and I don't see that it helps there.

352. et seq. This is a point which gave me infinite trouble. I think the point is that the argument only work for comparisons (see p.1 above) while Wicksell tries to use it for a process through time.

When the reproduction cost of capital rises, all existing capital goods are revalued. But they have to be replaced at the new cost. I don't think it is possible to work out the process through time except in some such terms as my Chapter 14. After doing it you can translate it into a chain index, but it doesn't add anything. The “Chapernowne” units are a fifth wheel on the coach.

360. Wicksell effect goes into reverse. I think this is a misleading way of putting it. The rise of wages and fall of rate of profit are both present in every cause, and whether they just balance, or go one way or the other, has no particular significance. My article (as opposed to the book – I hope!) gave a wrong emphasis here.

361. When you consider a balanced stock of capital being continuously reproduced the distinction between working and fixed capital has no significance. The Classical view of investment as a process of feeding consumption goods to workers who produce machines seems to me to be the essence of the matter.

361 note. I do not see any connection between the perverse, or Ruth Cohen case, and the “reverse Wickesll effect”. I am sorry if give a wrong impression.

Finally - the search for a “technical unit” of capital is foredoomed to frustration. When you cannot get an answer, change the question.

Yours Sincerely  
Joan Robinson

Joan's comments on Trevor's 1960 Gamagori paper, eventually published as Swan (1964):

Professor T.W.Swan,  
Australian National University  
Canberra.

62 Grange Road,  
CAMBRIDGE.  
8<sup>th</sup> August, 1960.

Dear Professor Swan,

I have just seen your Gamagori paper and I am glad to find that our views are now much closer together. There are still some points to discuss.

- (1) When you say that  $S$  governs  $I$ , I take it you mean that the authorities arrange that investment is sufficient to maintain full employment without inflationary pressure, leaving  $s$  to look after itself. But if they choose a "better" golden age they have to operate upon  $s$ , presumably by taxation, after they have reached it (as well as in struggling towards it).
- (2) I don't agree that you can have a stationary state with any stock of capital. Given thriftiness and the production function, there is one quantity of mecano, and one value of capital, per head that is compatible with equilibrium. The stationary state has all the characteristics of a golden age. For instance your proposition that the "best" golden age is that in which  $\gamma = S$  is equivalent to the well-known proposition that the "best" stationary state is that with the zero rate of profit.
- (3) The length of service life of capital goods depends on the rate of technical progress (assumed neutral in my sense). In a golden age with a constant rate of profit, the real wage rate of rising at the same rate as output per head. Each machine lives<sup>\*</sup> until the rise in the real-wage rate has reduced its quasi-rent<sup>\*\*</sup> to zero. You will find that in this case also the optimum length of life is attained when the ratio of saving to income is equal to the ratio of profit to income.

I recently sent you another piece which I am working on. I should much value your comments.

Yours Sincerely,  
(Sgd.) JOAN ROBINSON.

---

\* Assuming that physical life is not shorter than profitable life.

\*\* Gross profit less profit on working capital.

## **Appendix 2 Bio: Trevor Winchester Swan 1918-1989**

- Born: Sydney, January 14, 1918, to George and Clara (nee Grant) Swan  
1941: June 25, Married Phillis Mary (Pat) Grill  
1930-1935: Canterbury High School  
1935: Dux  
1936-1939: University of Sydney (part-time)  
1940: January, Awarded B.Ec with First Class Honours and the University Medal  
1936-1939: Bank Officer Rural Bank of New South Wales  
1940: Assistant Lecturer, University of Sydney  
1942-1945: Economist, Department of War Organisation of Industry Secretary, War Commitments Committee Chairman, Food Priorities Committee Joint Secretary, Joint Administrative Planning Sub-Committee (Defence Committee)  
1946-1949: Chief Economist, Department of Post-War Reconstruction Seconded to Cabinet Office, United Kingdom, 1947-48 Seconded to Council of Economic Advisors, U.S.A., 1948-49  
1949-50: Chief Economist, Prime Minister's Department Accompanied R.G. Menzies to London and Washington, June-July 1950  
1950: June, appointed to foundation Chair in Economics, Australian National University in the Research school of Social Sciences  
Member: Prime Minister's Committee of Economic Advice, 1955 and 1956  
1958: Visiting Professor, Massachusetts Institute of Technology (MIT)  
1958: Leader, MIT Mission to India  
1962-63: Irving Fisher Professor, Yale University, presented the Fisher Lecture  
1963: Marshall Lecturer, Cambridge University, presented the Marshall Lecture  
1967: British Council Visiting Professor, Southampton University  
1967: Presented Giblin Lecture, ANZAAS, Sydney  
1975: Chairman, Australia Government Committee on Tax Options  
1975: August, appointed to the Board of the Reserve Bank of Australia  
1980: Reappointed for a second five-year term  
1983: December, retired from the Australian National University  
1985: August, retired from the Board of the Reserve Bank  
1987: Received inaugural Distinguished Fellow Award from the Economic Society of Australia  
1988: Australia Day of the bicentennial year, became an Officer of the Order of Australia in recognition of his contribution to both the the economics profession and economic policy making in Australia  
1989: January 15, died leaving his widow, four children and four grandchildren.  
2006: Six grandchildren and two great grandchildren with a third due any day.

### **Published Works**

“Australian War Finance and Banking Policy”, *The Economic Record*, 16, (June, 1940).

“Some Notes on the Interest Controversy”, *The Economic Record*, 17, (December, 1941), 153-165

“Price Flexibility and Employment”, *The Economic Record*, 21, (December, 1945), 236-253.

“Price Flexibility and Employment, Rejoinder”, *The Economic Record*, 22, (December, 1946), 282-284.

“Progress Report on the Trade Cycle”, *The Economic Record*, 26, No.51, (December 1950) 186-200

“Measures for International Economic Stability”, A Report by a Group of Experts Appointed by the Secretary-General of the United Nations, New York, 1951, vii+48pp. (Part Author)

“Australia after the Import Cuts”, *The Banker* (April 1952), 205-210.

*The Economic Development of Malaya*. Report of a mission organised by the International Bank for Reconstruction and Development (part author); Baltimore: Johns Hopkins Press, 1955.

Occam's Razor summary of "The Effects of Inflation on Profits" which was published at p. 56 in A R Hall *Australian Company Finance : Sources and Uses of Funds of Public Companies, 1946-1955*, Canberra, ANU 1956. Trevor's authorship is stated at p. 46.

“Economic Growth and Capital Accumulation”, *The Economic Record*, 32, No. 63, (1956), 334-361.

Reprinted in Peter Newman (ed.) *Readings in Mathematical Economics*, Volume 2, Capital and Growth, 172-199, Baltimore: John Hopkins Press, 1968. Reprinted in *Macroeconomic Theory: Selected Readings*. Harold R. Williams and John D. Huffnagle, eds. Englewood Cliffs, NJ: Prentice-Hall, 1969: 477-86.

“Economic Control in a Dependent Economy”, *The Economic Record*, 36 (March 1960), 51-66. First presented at a seminar, 30 June 1953.

“Circular Causation”, *The Economic Record*, (December 1962), 421-26

“Wilfred Edward Graham Salter: 1929-1963”, *The Economic Record*, 39, No. 88 (December 1963), 486-87.

“Of Golden Ages and Production Functions”, in K. Berrill (ed.) *Economic Development with Special reference to South East Asia*. London. Macmillan, 1964, 3-16.

“International Monetary Issues and the Developing Countries”, in *Report of a Group of United Nations Experts*, 1965 (part-author).

“Longer Run Problems of the Balance of Payments”, in H.W. Arndt and W.M. Corden (eds.), *The Australian Economy*, Sydney: Cheshire, 1963. Originally mimeographed and circulated in May 1955. Reprinted in R.E. Caves and H.G. Johnson (eds.), *Readings in International Trade* (selected by a Committee of the American Economic Association).

“Horace Plessay Brown: 1916-71” *The Economic Record*, (March 1971), 115-118.

“Overseas Investment in Australia; Treasury Economic Paper No. 1”, *The Economic Record*, 48. No. 122, (1972)

“Perceptions in Kalediscope, a Review of a book by H.W. Arndt”, *The Australian Economic Review*, 4<sup>th</sup> Qtr 1986. 45-47

“The Principle of Effective Demand – A ‘Real Life Model’”, *The Economic Record* 65(1), (December, 1989), 378-398. Written in 1944 and 1945.

“Economic Growth”, *The Economic Record* 78 No. 243 December 2002, 375-380. Written in 1956.

### **Newspapers, Letters and Comments**

“Exchange Rates and Inflation: A Note”, 14 October 1971 (with A.R. Hall), pp.2.

“Mr Snedden and the Economists”, submitted to *The Canberra Times*, 2 December 1971.

Learn to the Age, September 10, 1974.

“Looking for Economic Realism”, *The Canberra Times*, 11 September 1974.

“Something Nasty in the Woolshed or Cold Comfort”, *The Age*, 14 May 1975.

“Some Questions for the Melbourne Economists” original letter that appeared in *A.F.R.*, 17 July 1978

“North-South Issues and CHOGM”, *The Canberra Times*, 1 October 1981.

“Faith, Hope and the Budget”, *Australian Financial Review*, August 26, 1988.

“Politicians, economists: the Hostages of fortunes”, *Australian Financial Review*, August 22, 1988.

### **Secondary Literature**

“Distinguished Fellow: Professor Trevor Swan”, *The Economic Record*, 1987

Butlin, N. G. and R. G. Gregory, “Trevor Winchester Swan 1918-1989”, *The Economic Record*, December, 369-377.

Arndt, H. W., Non-Traded Goods and the Balance of Payments: Another Historical Note, Mimeo, ANU.

Blaug, Mark (ed.), *Who's Who in Economics*, Third Edition, Edward Elgar, Cheltenham, “Trevor Winchester Swan”, 1999, 1083-1084. Prepared by Peter Swan.

Pitchford, John D., “Trevor Swan’s 1956 Economic Growth ‘Seminar’ and Notes on Growth”, *The Economic Record* 78, No. 243, December 2002, 381-387.

### **Unpublished Papers**

“England Since 1918”, Economic History Essay, University of Sydney, 1937, pp.13.

“Forced Savings”, University of Sydney, Economics 2 Essay, 1937, pp.20.

“The Theory of the Totalitarian State in the Twentieth Century”, essay written while at the University of Sydney circ. 1939, pp.4.

“Economics as a Science”, lecture notes prepared for courses at University of Sydney, 1940-1942, pp.33.

“Addendum to the Interest Controversy”, Mimeo, 1941



“A Working Model of the Australian Trade Cycle, 1928-1939”, mimeo, 1943, pp.14.  
 “The Principle of Effective Demand”, mimeo, 1944, pp.34.  
 “The Role of Wages in the Australian Economy”, 1945, pp.7, plus tables.  
 “Wage Policy with Full Employment”, mimeo, circ.1945, pp.8.  
 “Fiscal Policy and Economic Planning”, mimeo, 1948 (unavailable).  
 “Hicks on Budgetary Reform”, mimeo 1948, pp.8  
 “Replacement of Imports by Home Production,” Economic Section of the UK Cabinet Secretariat, 8<sup>th</sup> October 1947, 9 pp. T230/28 010421  
 “The Balance of Payment Problem of Western Europe”, mimeo, November 1, 1948, Economic Section of the UK Cabinet Secretariat, 49 pp. T230/28 010421  
 “The Theory of Suppressed Inflation”, mimeo, (early) 1948, pp.29, plus appendix , pp.9.  
 “United Kingdom National Income, Output and Employment”, Appendices A, B and C, mimeo, 1948.  
 “Review of Economic Policy: The Situation in 1949”, mimeo, 1949, pp.10.  
 “Notes on Recession in U.S.A”, mimeo of August, 1949.  
 “Notes on the Dollar Problem”, circ. 1949, pp.11.  
 “Supplementary Notes on the Dollar Problem”, circ. 1949, pp.2.  
 “Further Notes on the Dollar Problem”, 24 July 1949, pp.2.  
 “The London Financial Conference”, 24 July 1949, pp.4.  
 “The General Dollar Shortage”, 15 June, 1949, pp.14 (author not stated).  
 “Sterling Devaluation”, 24 March 1949, pp.23.  
 “Rough Notes for Speech on Address- In-Reply, The Economic Situation at the End of 1949”, draft of speech in the House by R.G. Menzies, pp.17. See Hansard 14 March, 1950.  
 “The Anatomy of Inflation”, mimeo, 3 April, 1950, pp.39 plus statistical appendix.  
 “Economic Policy Issues”, April 1950, pp.14.  
 “Forecasting Effective Demand”, mimeo, pp.4, circ. 1950.  
 “Problems of Development and Inflation”, mimeo, 1 June, 1950, pp.8.  
 “Rough Notes on Devaluation and Commodity Prices”, notes prepared for Mr J.G. Crawford, in relation to War Service Land Settlement Scheme, circ. 1950-51, pp.4.  
 “Economic Development in Australia”, prepared for \$100 million International Bank for Reconstruction and Development Loan, mimeo, August 1950 (pp.39, plus appendix).  
 “What are the Major Objectives of the Government’s Economic Policy?”, undated circ. 1950, pp.21.  
 “Stability in an Expanding World Economy”, pp.11, 1951, notes for United Nations Report.

“The Australian Post-War Inflation”, rough notes circ. 1951, pp.14.

“Notes on Economic Policy, 1951-52”, mimeo, November 1951, pp.6

“Turning Point in Australian Finance”, 14 March 1952, pp.5.

“Simple Arithmetic”, mimeo, 23 May, 1952 (rough notes).

“The Social Accounts of the New Guinea Market Economy for 1949-50 and 1950-51”, mimeo.

“Simple Algebra: External Balance, Internal Balance and Price Stability”, mimeo, November 1952, pp.9.

“Full Employment and the Balance of Payments”, pp.6 undated.

“Social Control” notes for a seminar, mimeo, pp.16, 16 June 1953.

“A Calculus of Social Choice”, rough notes for a seminar on “Social Control”, 23 June, 1953, pp.10.

“Why Economists’ Don’t Know”, notes for Public Lecture, 14 September 1955, pp.5.

“The Problem of Wages Policy for 1955-56, notes for symposium on wages policy. Section G, ANZAAS, 22 August 1955, pp.2.

“Notes on Some Inter-Relationships of Economic Policies (Employment, Balance of Payments, Spending and Costs), undated, 1955, a version of “Longer-Run Problems of the Balance of Payments”, pp.9.

“Appendix: A Note on Capital”, pp.10, circ. 1955.

“Notes on Economic Growth”, mimeo, 23<sup>rd</sup> July, 1956, pp.8. published in *The Economic Record*, 2002.

“The Budget and the Prospects for 1956-57”, mimeo, 1956, pp.5.

“Economic Control in a Dependent Economy”, Notes for a seminar on “Social Control”, 30 June 1953, pp.18. Published, *The Economic Record*, March 1960.

“Relative Prices and the Balance of Payments”, pp.8, 1961

“Current Economic Prospects and Policy Issues, January 1973” typeset, pp.8.

“Tariffs and the Terms of Trade”, pp.6, undated.

“A Proposal: Excess Pay-Roll Tax on Excess Pay Roll Disallowance”, mimeo, 16 August 1974, pp.4.

“Economic Policy; Then and Now”, interview by Alan Reid, Federal File, May 4, 1975, pp.8.

The Hon. E.G. Whitlam, Prime Minister, 25 July 1975, mimeo, pp.29.

“Notes on Income Tax Options”, 1975-76”, Report of a working party chaired by T.W.Swan with member Mr. Castles, Mr. Cole, Mr. Bridgen and Dr. McCawley, made to the Hon. E.G. Whitlam, Prime Minister, 25 July 1975, mimeo, pp.29.

“Notes on T.W.Swan, Population Growth and Economic Development, Presidential Address, Section G, ANZAAS, Dunedin, 1957” made by H.W. Arndt, mimeo, pp.2.

“New Patterns of Money and Finance”, notes on the Australian Economy, 1979/80, mimeo, pp.6.

“A Personal Note to the Treasurer” 28 June, 1985, advocating the replacement of the income tax by a universal sales tax. One page.

“The Australian Economy at the Cross Roads”, summary of a talk given to the Tasmanian branch of the Economic Society, pp.2.

“Notes on Tariffs and the Terms of Trade”, handwritten, undated, pp.5.

“Economic Control in a Dependent Economy: A Dynamic System”, typeset, pp.6 (undated).

“Relative Prices and the Balance of Payments”, mimeo, undated, pp.7.