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GOODWIN'S LECTURES ON THE PHILLIPS MACHINE IN 1963

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Recollection

The Cambridge economics faculty moved to the Sidgwick Avenue site about 1961. For a while some of the lectures remained at Mill Lane, most of the others moving to the lecture block – Mrs Robinson and Sen at Mill Lane, Kahn and Kaldor each in narrow rooms on the second floor of the lecture block. Les *mauvaises langues* said Kaldor chose a small room for its standing-room-only effect, while Kahn on current issues (incomes policy) was for the happy few, the connoisseurs. Meade had replaced Robertson as the 'principles' lecturer, and he lectured twice a week – from the first drafts of his *Principles* – in the largest aula of the lecture block, to an audience surprisingly numerous, given the multiplicities of his blackboard taxonomy of sideways shifts in static schedules.

But Goodwin lectured in the new wing, in the room at the end of the corridor under the Marshall library; and he alone lectured on Saturdays, at ten, so that the audience was select. The room was called the Marshall room then. It is now the Meade room; and, along with much else, library aside, Marshall is all but forgotten in the precincts; even the photograph "Setting out to revise the Principles" seems to have been discreetly withdrawn. Goodwin's lectures were on "[the] national income machine" and delivered in that room, perhaps because of its view of the Selwyn College gardens, or because Phillips' bulky machine always stood there, despite its rollers, its brown wooden frame locked in a heavy glass cabinet whose awkward doors Goodwin would prize open at the start of each lecture. The machine stood at the other end of the room from the door, with a slanting view of the gardens across the room. Off and on since the early 1960s it has been a comforting presence, ever in much the same place, latterly with a clutter of malfunctioning white-boards half-hiding it from view; its big glass doors surprisingly unscathed. Refurbishment aside, it had barely been moved for four decades when Allan McRobie showed it off, in newly working order, at the Faculty's low-key centenary in 2003.

Forty years on, the gardens of Selwyn are finer gardens than they were in 1963, when Goodwin would occasionally break off in mid-lecture to size them up in thought. Six foot two or three to the machine's five, he was a tall man with a handsome profile, a leonine mane, long elegant hands and gracefully pointed fingers: Doré's Quixote. He spoke in a particularly attractive soft middle-Western accent. His gestures – level with the top of the machine's frame – were flowingly expressive, even when, with a fine sweep of a bow, he would stoop down to the lower Perspex tanks to comment on the balance of payments, an interesting reality in those days. (Goodwin's Harvard thesis had started out being on money, the equation of exchange, and monetary policy; and needless to say this Hoosier, who was twenty in the big bank failures of 1933, knew a great deal more about their difficulties than, self-deprecatingly, he let on.)[1] This oblong receptacle – a cistern resembling the vegetable compartment of an ice-box – is, in the hydraulics of the machine, the money stock as modified by the goods and services balance; and the two gushing little conduits issuing into it (domestic spending and exports) encapsulate what has become known as the monetary approach to the balance of payments, or absorption.[2] The water in the Cambridge machine was clear rather than coloured, and the Perspex tank had an unintended leak in those days,[3] so that as the lecture progressed, the widening puddle on the floor would eventually generate disconcertingly interesting readings on the national-income and interest-rate panels near the top of the frame, readings perhaps

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[1] Goodwin's 1941 paper on the supply of bank money in England and Wales applies lovely simple, almost eye-balling, graphical methods to identify the interest elasticity of demand for active balances (Keynes' M1) and to arrive without fuss at a very modern result, that in practice free reserves and the central bank's behaviour make the money supply endogenous. (*Oxford Economic Papers*, 1941, pp 1 – 29) His subsequent paper on Keynesian and other theories of interest provides an analysis of the circumstances under which low interest rates will fail to persuade banks to lend; this is remarkably modern in terms of the difficulties to which 'quantitative easing' attempts to respond, as in terms of the role the term structure plays in monetary transmission. *(Review of Economics and Statistics*, vol 25, 1 (February 1943).

[2] As is well-known the absorption approach was Sidney Alexander's national-accounting explanation (1952) for the apparent failure of the sterling devaluation of 1949 (in reality, a US dollar revaluation) to improve the balance of payments. Alexander was a near contemporary of Goodwin's at Harvard both as an undergraduate and doctoral candidate, and an occasional pupil of Keynes in 1936.

[3] Or perhaps the design was indeed intended to depict the well-known recording errors of the balance of payments, when international banking and other accounting fancies intervene.

too low on the former and maybe, maybe not, too high on the latter. The leak might have been from the crank-handle, reminiscent of that on a sowing machine, which served to modify the income velocity of money by adjusting the capacity of the Perspex tank; or from an inverted funnel within the money-stock tank itself, ingeniously designed – by defeating Bernouilli's principle – to make the rate of depletion of money balances into the income stream to be proportional to the remaining money stock. (The same ingenious curvilinear weir is used at the top of the machine to generate savings from disposable income, and again in determining the relationship between imports and exports and – in those heroic Bretton Woods days of controls on capital movements – the level of international reserves.)

At the start of each lecture Goodwin would set one or other of the levers controlling the functional relationships (tax to national income, imports to reserves, etc.), and then – as the flow got going – he would scamper around stylishly calibrating the others till the flushing and cascading of the liquid flow found its equanimity and the gurgling settled down to a quiet stream. The link between the money-stock tank and the flow of funds in the banking system is in the machine effected by a representation of the acceleration principle, relying rather trickily on another Perspex tank-within-the-tank, a thimble really, bobbing like a porous buoy on the money-stock surface of the larger cistern: if this thimble dips too low, a camshaft turns investment down; if too high there is a boost instead – because of the weight of asset accumulation – in excess of what the monetary authorities may be trying to achieve. In the early 1960s this bobbing thimble seemed the hardest part of the equipment to bring into equilibrium, perhaps because of its realistic representation of investment volatility, or maybe instead because of the leak to the larger tank.

The tracings on the national income and interest-rate panels would be peered at after adjustment to the various levers to try out the equilibrating effect of tweaking, say, the relation between financial-asset acquisition and investment, or the savings propensity. Often enough the pencil-stubs on the markers would give out quite soon after their jagged motion had started tracing out the oscillations. At length, after

further gushing and gurgling, Goodwin – side-stepping the gathering puddle – would stand back, head aslant and cupping his chin in his hand, with something of the appreciative pose of a painter contemplating work in progress, without dissatisfaction at the leak, but rather with a sense of adventure. For the audience in the Marshall room, the scratchy tracings on the panels – whose view needed rather good eyesight once the pencils had given out – provided quite possibly more instruction, not only on the stock-flow dynamics of the macro-economy, but in the intricacies of the subject as a whole, than there may have been in the taxonomy of sideways shifts in static schedules more clearly visible on a distant blackboard in a large aula.

Post-script

In 1963 the Hicks-Hansen IS-LM model had not yet been repudiated by Hicks,[4] but then neither had the diagram penetrated the Cambridge precincts. It was an asteroid in quite another galaxy. A bit of its simple straight-schedule geometry might have sheepishly peered out in Meade's second-year lectures, but the idea that aggregate economic activity might usefully be discussed in terms of a couple of linear equations, without any reference to profits or to inventories, and in a liberal confusion of stocks and flows – such an idea belonged to an altogether alien and uninteresting universe.[5] Keynes might have been pleased with Hicks' review, but only in the way that anyone who has delivered himself of hard work welcomes serious attention.

Had the term been in vogue at the time (it was not, because textbooks were not in common use in the Cambridge in the early 1960s), the concern of macroeconomics would have been taken to be with the character of aggregate economic activity, mainly its ups and downs and its central tendencies. Keynes formulated these ups and downs and tendencies in terms of two aggregate flows, one easily conceived of as uniform (money) and the other requiring some not-implausible homogenization

[4] Hicks, John Richard (1980), 'IS-LM: an explanation', *Journal of Post Keynesian Economics,* Volume II, No. 2, pp 139-154
[5] I remember being told, in as recently as 1975, by an undergraduate who is now a distinguished game-theorist, of his wonder (though it was no surprise to me) at realising that the supervisor of his work at King's College – who was the foremost macro-forecaster of the British economy at the time, and remains so – was innocent of any acquaintance whatever with IS-LM, and had quizzed him with genuine interest about the model, as a sophisticated mandarin of Chi'en Lung's court might have inquired of Lord Macartney of the curious customs of the savages in Europe.

(employment or, more generally, a composite of all non-produced inputs constituting the costs of economic activity). The money flow had two resting places, M1 for active balances and M2 for idle, just as in Phillips' machine Perspex tanks. 'Bonds' referred to generalized securities and 'interest' to the multiplicity of yields on those securities.[6] The loanable funds view was a curiosity remembered out of deference to Robertson (who was such a nice person, still around in the Michaelmas term, and then suddenly dead in the spring of 1963). Instead, Sraffa's pregnant aside on the level of the money rates of interest as an independent external influence on the rate of profits seemed wholly natural, these rates (very properly in the plural) quite possibly originating in the foibles of the banking system.[7]

Micro-foundations were not considered particularly revealing as regards aggregate behaviour (although as they generated distinctly interesting mental exercises, or at least Farrell made them so); whereas individual behaviour was clearly conditioned by the constraints of aggregate activity, or what might have been termed macro-foundations. The view that Keynes could have been so very silly as to suppose that ordinary individuals led a hand-to-mouth existence – so that changes in current individual income translated *pari passu* into changes in current individual spending – would never have crossed anyone's mind. Instead it was clear that the consumption function was constructed concave for its requirement of aggregate stability and, through the plausible narrative of 'factors' (in chapters 8 and 9 of the *General Theory*) from aggregate accounting constraints, as Clower subsequently clarified using the money and composite-cost framework which, animal spirits aside, appears to be Keynes' only concession to Marx.[8] Individual decision-making, as orderly or disorderly as blood-cells, and in themselves as microscopically analysable, generated money or cost-unit expenditure and income flows driven by aggregate functions

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[6] Keynes had unguardedly used the term 'bond' for a generalized security whereas, in American usage, the term designated a fixed-interest security, or 'stock' in English.

[7] Sraffa, Piero, *The Production of Commodities by means of Commodities*, Cambridge University Press, 1960, p. 33. After nearly fifty years of increased financial activity and term-structure puzzles Sraffa's footnote still seems remarkably pertinent.

[8] Clower, Robert (1967), "A Reconsideration of the Microfoundations of Monetary Theory", *Western Economic Journal*, 6, 1, pp 1 – 8.

which, being envelopes of individual responses, could be expected to be reasonably well behaved.[9]

With its depiction of economic activity as endogenous, in conception the Phillips machine, belongs to a vanished golden age of innocence; before the 'synthesis', its abetting of micro-foundations for aggregate activity, and its distillation of the result into the small five-component log-linear macro-models that are said to guide today's central banks;[10] models whose determinants of output are pre-set by the manufacturer and which, for all their stock-free simplicity, are not always susceptible of analytical solution, at least not beyond much more than a single period. Bretton Woods is gone and with it its reassuring regulatory approach; and unleashed instead is active finance, in the form of complex and restless interest- and exchange-rate variation, and therefore much heavier flows in and out of speculative inventories. It would be lively now to watch the environs of the M2 tank.

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[9] This had been suggested by Mrs Robinson and was later more rigorously shown by W. Hildenbrandt (1970), "On Economies with Many Agents", *Journal of Economic Theory*, 2,161-188

[10] The five components are: i) the loss function of output gaps and inflation developments to be minimized; ii) the long real interest in the aggregate demand equation generating the output gap; iii) the output gap in the aggregate supply equation generating the inflation surprise; iv) the policy reaction function translating Taylor-wise the loss-function minimization of the output gap and the inflation surprise into a short nominal interest rate; v) and one or more Fisher arbitrage conditions translating that nominal rate and the inflation surprise into a long real rate,