DEPARTMENT OF ECONOMICS

Working Paper

DEMAND POLICY IN THE LONG RUN

Peter Skott

Working Paper No. 2000-17
Centre for Dynamic Modelling in Economics

ISSN 1396-2426

UNIVERSITY OF AARHUS • DENMARK

CENTRE FOR DYNAMIC MODELLING IN ECONOMICS

DEPARTMENT OF ECONOMICS - UNIVERSITY OF AARHUS - DK - 8000 AARHUS C - DENMARK

☎ +45 89 42 11 33 - TELEFAX +45 86 13 63 34

WORKING PAPER

DEMAND POLICY IN THE LONG RUN

Peter Skott

Working Paper No. 2000-17

DEPARTMENT OF ECONOMICS

SCHOOL OF ECONOMICS AND MANAGEMENT - UNIVERSITY OF AARHUS - BUILDING 350

8000 AARHUS C - DENMARK ☎ +45 89 42 11 33 - TELEFAX +45 86 13 63 34

Demand policy in the long run

Peter Skott
Department of Economics, University of Aarhus
Email: pskott@econ.au.dk

December 8, 2000

Abstract

This paper analyses the use of aggregate demand policies to ensure full-employment growth in the long run. The results support Victoria Chick's warning in *Macroeconomics after Keynes* against the misapplication of short-run Keynesian policy prescriptions to long-run problems.

JEL Classification: E12

Key words: demand policy, long-run unemployment, warranted growth

To appear in a festschrift for Victoria Chick edited by Philip Arestis, Meghnad Desai and Sheila Dow (Routledge 2001).

1 Introduction

> 'My thesis is that a root cause of the current inflation is a misapplication of a policy prescription of the *General Theory*; a policy designed as a short-run remedy has been turned into a long-run stimulus to growth, without examining its long-run implications.' (Chick 1983, p. 338)

The principle of effective demand is at the centre of Keynes's theory. For all the developments, extensions and, in some cases, outright distortions of Keynes's ideas, most 'Keynesians' still view the level of aggregate demand as a critical and independent determinant of economic activity in the short run. When it comes to the long run, however, positions differ.

New Keynesians - like the traditional neoclassical synthesis - see aggregate demand as an accommodating variable in the long run. Price and wage stickiness may prevent equilibrium in the labour market in the short run but although the adjustment may be slow, market forces will gradually reestablish labour market

equilibrium. This convergence process is mediated by the effects of changes in prices and wages on both aggregate demand and aggregate supply. Ultimately, however, aggregate demand will have to match the level of aggregate supply that is forthcoming when employment is at its equilibrium level.

The Post-Keynesian position on the role of demand in the long run is less clear. Some Post Keynesians view the demand side as a critical influence, not just on the *level* of income and employment but on the long-run rate of *growth*. One can also, however, find Post-Keynesians who take a more negative position on the role of aggregate demand. As indicated by the opening quotation, Victoria Chick is among those who have expressed skepticism concerning the use of traditional Keynesian policy to address long-run problems.

The long-run issues are analysed in the last two chapters of *Macroeconomics after Keynes (MAK)*. Inflation, it is argued, 'is best understood as the culmination of a process which began at the end of the Second World War' (p. 338). At the centre of this process was a misapplication of Keynesian policies: 'The simple message taken from the *General Theory* was that to raise income one must invest. Hence postwar policy has offered direct or indirect encouragement to investment' (p. 338). This, Chick points out, overlooked Keynes's own warning that 'each time we secure to-day's equilibrium by increased investment we are aggravating the difficulty of securing equilibrium tomorrow' (*GT*, p. 105; *MAK*, p. 338). As a result of these increased difficulties, 'the long-term effect of semi-continuous expansionary policy is bound to be inflationary' and 'inflation since the war can be looked upon as the result of attempting to forestall the inevitable consequences of an increasing capital stock' (p. 339).

These claims are based on assumptions of a stable population and a slackening of the rate technical progress from the mid 1960s onwards (pp. 340-2). The role of 'capital inadequacy' is singled out, too. Capital inadequacy, Chick argues, is one of six key assumptions underlying the *General Theory*, possibly the most basic of the six assumptions since it is this assumption which justifies the focus on stimulating investment. If 'the social return from investment is almost bound to be positive, then almost any investment is a Good Thing: not only does it provide employment in the short run, it is also a beneficial addition to productive capacity' (p. 359). Empirically, the assumption of capital inadequacy was reasonable in Keynes's time and it also fitted well at the beginning of the postwar period when there was 'a need for massive capital accumulation for reconstruction' (p.339) . Capital accumulation, however, implies that gradually a state of inadequacy will turn into one of capital saturation, in which 'an increment to the capital stock cannot be expected to yield enough to cover replacement cost, *even* if full-employment demand is sustained throughout' (p. 359). This development, Chick argues, requires a rethinking of traditional policy.

The argument in these chapters is intriguing but perhaps it is also fair to say that the presentation remains a little sketchy and that the details are not fully

spelled out. Certainly when the book appeared in 1983 I found it difficult to follow the argument despite, as I recall, several lively discussions with Victoria Chick about these issues. Rereading the chapter today, I think most of my misgivings may have been ill-founded and that the logical structure of the argument can be captured and clarified using a formal model.

2 A Harrodian benchmark

2.1 The standard setup

Consider a closed, one-sector economy with two inputs, labour and capital. Assume, moreover, that the production function has fixed coefficients and that there is no labour hoarding. If Y, K and L denote output and the inputs of capital and labour, respectively, these assumptions imply that

$$Y = \nu L \leq \sigma^{\max} K \tag{1}$$

where the parameters ν and $\sigma^{\max}$ represent labour and capital productivity when the factors are fully utilized. Unlike the level of employment, the capital stock cannot be adjusted instantaneously. The desired rate of utilization of capital therefore will be less than one if firms want the flexibility to respond to short-run fluctuations in demand; the desired output-capital ratio (σ^*) accordingly is less than the 'technical maximum' $\sigma^{\max}$. Given these assumptions, a standard Harrodian investment function relates the change in the rate of accumulation to the difference between the actual output-capital ratio (σ) and the desired ratio[1]

$$\frac{d}{dt}\hat{K} = \lambda\left(\sigma - \sigma^*\right), \lambda > 0 \tag{2}$$

where $\hat{K}$ is the rate of accumulation. It should be noted perhaps that although the introduction of a separate investment function is central to the Harrodian analysis, the qualitative conclusions do not depend on this precise specification. The argument would go through substantially unchanged with a non-accelerationist specification of the form

$$\hat{K} = \mu_0 + \mu(\sigma - \sigma^*), \mu > 0 \tag{2'}$$

This alternative specification has a drawback, however. The sensitivity of investment to changes in utilization is likely to depend critically on the time frame: the short-run sensitivity undoubtedly is quite low (thus ensuring the stability

[1] Gross investment cannot be negative so the specification of the investment function (2) should be seen as an approximation. In a permanent depression with $\sigma < \sigma^*$ the rate of accumulation will converge to some finite lower bound.

of a short-run Keynesian equilibrium) while the long-run effects of a permanent change in utilization are likely to be very substantial. The magnitude of the adjustment parameter μ in (2') thus depends on the time frame of the application while μ_0 should include the lagged effects of past discrepancies between actual and desired utilization rates.[2] The accelerationist version of the investment function in (2) avoids these problems since the differential short- and long-term response is built into the specification.

In addition to investment decisions, firms make price (or output) decisions. I shall assume that output prices are set as a constant markup on unit labour cost. Hence, the share of gross profits in gross income is constant, that is,

$$\Pi = \alpha Y \tag{3}$$

where Π and α denote gross profits and the profit share.

Following Post-Keynesian tradition let us assume that all wage income is spent while firms/capitalists save a fraction s of gross profits.[3] Total saving (S) then is given by

$$S = s\Pi \tag{4}$$

The equilibrium condition for the product market, finally, is given by

$$S = I \tag{5}$$

where

$$I = \frac{dK}{dt} + \delta K \tag{6}$$

is gross investment and δ the rate of depreciation.

Both the capital stock and the rate of accumulation are predetermined in the short run and the equilibrium condition (5) serves to determine the levels of output and employment. Substituting (3) and (4) into (5) and rearranging, we get

$$\sigma = \frac{\hat{K} + \delta}{s\alpha} \tag{7}$$

The rate of accumulation and the capital stock cease to be predetermined once we move beyond the short run and the dynamics of the system can be examined by substituting equation (7) into (2):

$$\frac{d}{dt}\hat{K} = \lambda(\frac{\hat{K} + \delta}{s\alpha} - \sigma^*) \tag{8}$$

[2] The perspective of the present analysis is predominantly long term which would suggest a high value of μ.

[3] The argument would go through substantially unchanged with a single saving rate out of total income.

Equation (8) has a stationary solution given by

$$\hat{K}^* = s\alpha\sigma^* - \delta \tag{9}$$

This stationary solution for the rate of accumulation represents the 'warranted growth rate'. The warranted path is unstable. If, for some reason, the initial value of $\hat{K}$ falls below the stationary solution, the resulting shortage of aggregate demand will cause the output-capital ratio to be low, and a low output-capital ratio - unwanted excess capacity - leads to further reductions in the rate of accumulation.

It is easy, of course, to think of factors that can create a ceiling to the upward instability in the rate of accumulation (the obvious one is the full-utilization ceiling, $\sigma \leq \sigma^{\max}$) but expansionary Keynesian policies may be needed to reverse a downward spiral and bring the economy out of a depression. Thus, the instability of the warranted growth path implies a role for active stabilization. But in this Harrodian setup, policy makers face an additional challenge, aside from stabilization: if the parameters s, α, δ and σ^* are independent of the forces that determine the growth rate of labour force then the warranted rate will (almost certainly) differ from the 'natural growth rate' in the absence of policy intervention.

2.2 Policy intervention

Assume, for simplicity, that there is no government consumption, that transfers (or taxes) are proportional to wage income, and that the transfer is financed by issuing government debt with a real rate of interest ρ. Algebraically,

$$T = \tau W = \tau(1-\alpha)Y \tag{10}$$

$$\dot{B} = \rho B - T \tag{11}$$

where W, T and B denote total wage income, tax revenue and government debt. The tax rate is given by τ, a negative value of τ representing net transfers from the government to workers. By assumption workers spend what they earn. Interest income on government debt therefore accrues to firms/capitalists and I shall assume that capitalists apply the same saving rate to their combined interest and profit income. Adding together private saving and the government's budget surplus (public saving), the equilibrium condition for the product market now becomes

$$I = s\left(\alpha Y + \rho B\right) + \left(T - \rho B\right) \tag{12}$$

Consider first the long-run equality of natural and warranted rates of growth. Substituting (6) and (10) into (12) and using $\sigma = \sigma^*$, this equalization requires

that

$$g_n = \hat{K}^* = s\left(\alpha\sigma^* + \rho b\right) + \tau(1-\alpha)\sigma^* - \rho b - \delta \tag{13}$$

where $b = B/K$ is the ratio of government debt to the stock of capital and g_n is the natural rate of growth. Solving for the tax rate, we get

$$\tau^* = \frac{g_n + \delta - s\alpha\sigma^*}{(1-\alpha)\sigma^*} + \frac{(1-s)\rho}{(1-\alpha)\sigma^*}b \tag{14}$$

This precise choice of the tax rate ensures the equality between the warranted and the natural growth rates.

Stabilization may dictate deviations from the equilibrium level in (14). With the introduction of a public sector, the short run equilibrium solution for σ, equation (7), is replaced by

$$\sigma = \frac{\hat{K} + \delta + (1-s)\rho b}{s\alpha + (1-\alpha)\tau} \tag{15}$$

This equation reflects the standard short run result in Keynesian models that output is inversely related to the tax rate.[4] Equation (15) in combination with (2) imply that policy makers need to reduce (raise) the value of τ if the initial rate of accumulation is below (above) the warranted rate. The reduction (increase) should be large enough to raise σ above (reduce σ below) σ^*. The investment dynamics then causes accumulation rates - and hence the short-run solution for σ - to be rising, and the tax rate can be returned to its equilibrium level once the actual rate of accumulation has become equal to the natural growth rate. By construction the natural, the actual and the warranted rates now coincide and the economy follows a steady growth path with a constant rate of employment. If this constant rate of employment is below full employment, a temporary tax cut can be used to speed up accumulation and raise employment growth above the natural rate until full employment has been reached.

2.3 Sustainability

Overall, the manipulation of tax rates would appear to provide a solution to both of the problems identified by Harrod. Stabilization, however, involves only *temporary* variations in tax rates while the equalization of the natural and warranted growth rates requires *permanent* intervention. This difference is central to Chick's argument. Thus,

[4] Stability of the short-run equilibrium requires that the parameter τ is chosen such that the denominator (and hence the short-run multiplier) is positive. Since gross output and consumption cannot be negative, the expression in (15) also requires a non-negative numerator; that is, the linear specification of the saving function only applies within a range of values that satisfy this non-negativity constraint.

> 'Keynes's policy prescription was designed for a specific illness - unemployment and excess capital capacity in a world in which there was still considerable gain from further capital accumulation. The prescription, furthermore, was for a limited dose, designed to shock the patient into sustained self-recovery. It was not designed to sustain him over a long period.' (*MAK*, p. 338)

Can tax policies sustain the patient in the long run? The solution for τ^* depends positively on the debt ratio b, and this ratio changes endogenously over time. Sustainability of the policy therefore requires - as a necessary condition - that the movements in b be bounded asymptotically.

Let us assume that perfect stabilization along the full employment growth path is being achieved. Then, substituting (10) and (14) into (11), we get

$$\dot{B} = s\rho B - (g_n + \delta - s\alpha\sigma^*) K \tag{16}$$

and

$$\begin{aligned} \dot{b} &= \frac{\dot{B}}{K} - b\hat{K} \\ &= (s\rho - g_n) b - (g_n + \delta - s\alpha\sigma^*) \end{aligned} \tag{17}$$

This differential equation has a stationary solution at

$$b^* = \frac{g_n + \delta - s\alpha\sigma^*}{s\rho - g_n} \tag{18}$$

The solution will be unstable if $s\rho > g_n$ and stable if the inequality is reversed.

Recall that a stable labour supply was one of the key assumptions listed in *MAK.* If we take this to mean a value of zero for the natural growth rate g_n then the instability condition is met, assuming that the rate of interest is positive. More generally, the smaller the growth rate g_n the more likely it is that the stationary solution becomes unstable and that, consequently, the sustainability condition fails to be satisfied. The misapplication of Keynesian policies, in other words, leads to an unsustainable build-up of public debt and ever-increasing tax rates to cover the interest payments. This development, as argued in *MAK,* is a recipe for stagflation.

It may not be plausible to assume, as we have done so far, that the interest rate remains constant in the face of large movements in the debt ratio b. Portfolio considerations would suggest a positive relation between the debt ratio and the interest rate: in order to persuade capitalists to hold an increasing share of their wealth in government bonds the return on these bonds will have to increase relative to the return on the other asset in the portfolio. The (net) rate of return on real capital, however, is constant along a warranted growth path (it is given

by $\alpha\sigma^* - \delta$) so these considerations suggest a functional relation between the debt ratio and the interest rate,

$$\rho = \varphi(b), \varphi' \geq 0 \tag{19}$$

Substituting (19) into (17) leaves us with a non-linear differential equation. Since φ' is positive, however, this extension merely reinforces the instability conclusion.

3 Factor substitution

3.1 The short run

The Harrodian benchmark model in section 2 lends support to Chick's warning: the application of aggregate demand policy to the long-term equalization of warranted and natural growth rates may run into trouble. The formalization, however, misrepresented her analysis in at least one respect: the analysis in *MAK* assumes diminishing returns to capital and some scope for substitution between capital and labour. The model, by contrast, stipulated a fixed-coefficient production function, and it is commonly believed that the Harrodian analysis becomes irrelevant if factor substitution is possible.

Let us assume that the production function is Cobb-Douglas. This assumption may exaggerate the degree of substitutability, even in the long run.[5] I shall be extremely neoclassical, however, and assume that the Cobb-Douglas specification applies, not just to the long run, but to the short run too. Thus, it is assumed that one can move along the production function in the short run and that the capital stock will always be fully utilized. For present purposes these neoclassical assumptions do little harm and they are very convenient analytically. Equation (1), then, is replaced by

$$Y = K^{\alpha} L^{1-\alpha}, 0 < \alpha < 1 \tag{20}$$

Equation (20) together with a saving function are standard elements of a simple Solow model. The normal closure for this model is to impose a full employment condition. Alternatively, one may add a Keynesian element in the form of a separate investment function but the specification in (2) needs amendment. By assumption the predetermined capital stock is now fully utilized at all times and a low level of aggregate demand will be reflected in low rates of return, rather

[5] Harrod undoubtedly would have thought so. In Harrod (1973, p. 172), he commented that 'the rate of interest and the MARC [the minimum acceptable rate of return] do not often have a big effect on the method chosen'. This led him to conclude that an attempt to derive a rate of interest 'which brought the warranted growth rate into equality with the natural rate ... really makes no sense.'

than in low rates of utilization. The natural extension of the investment function to the case with substitution therefore becomes:

$$\frac{d}{dt}\hat{K} = \lambda(\pi - \pi^*), \lambda > 0 \tag{21}$$

where π is the rate of (gross) profits.

Equation (21) says that the rate of accumulation increases if the rate of profits exceeds the 'required return' π^*. I shall assume that the required return is determined by the cost of finance (ρ), the risk premium (ε) and the rate of depreciation

$$\pi^* = \rho + \varepsilon + \delta \tag{22}$$

where, for simplicity, the cost of finance is given by a unique real rate of interest, ρ.

In the short run both the capital stock and the rate of accumulation are predetermined (cf. equation (21)) and, leaving out the public sector, the equilibrium condition for the product market can be written,

$$s\pi - \delta = \hat{K} \tag{23}$$

The first-order conditions for profit maximization in atomistic markets imply that[6]

$$\frac{w}{p} = (1-\alpha)K^{\alpha}L^{-\alpha} = (1-\alpha)\frac{Y}{L} \tag{24}$$

and

$$\pi = \alpha\frac{Y}{K} = \alpha\sigma \tag{25}$$

Substituting (20) and (25) into (23), we get

$$L = \left(\frac{\hat{K}+\delta}{s\alpha}\right)^{1/(1-\alpha)} K \tag{26}$$

[6] Imperfect competition and a constant markup on marginal (labour) cost leads to a trivial modification. In this case the real wage rate and the rate of profits become

$$\frac{w}{p} = \frac{1-\alpha}{m}\frac{Y}{L}$$

$$\pi = 1 - \frac{1-\alpha}{m}$$

where $m \geq 1$ is the markup factor.

and

$$Y = \frac{\hat{K} + \delta}{s\alpha} K \tag{27}$$

Equations (26)-(27) capture the short-run determination of employment and output by aggregate demand. An increase in the saving propensity s reduces employment while increases in K or $\hat{K}$ (which raise investment) lead to a rise in employment. With arbitrary values of the capital stock and the rate of accumulation there is no reason for the labour market to clear. Unemployment may lead to a decline in the money wage rate but no Keynes effect or other stabilizing influences of changes in the price level have been included.[7] Investment, by assumption, is predetermined, saving is proportional to income, and since output and employment are determined by the equilibrium condition for the product market, they are unaffected by changes in money wages. The system exhibits 'money wage neutrality'.

3.2 From capital inadequacy to saturation

Moving beyond the short run, equation (21) describes the change in the capital stock, and substituting (27) and (25) into (21) we get

$$\frac{d}{dt}\hat{K} = \lambda \left(\frac{\hat{K} + \delta}{s} - \pi^* \right) \tag{28}$$

The stationary solution - the warranted rate of growth - is given by

$$\hat{K}^* = s\pi^* - \delta \tag{29}$$

and it is readily seen that Harrod's two problems - the instability of the warranted growth path and the discrepancy between the warranted and natural growth rates - both reappear in this setup if the required rate of return is taken as exogenously given.

Since the required return π^* depends on the interest rate it is natural to consider the rate of interest as a possible policy instrument. To simplify the analytics I shall focus on a pure case of monetary policy. In terms of the model in subsection 2.2, this pure case arises if the tax rate and the government debt are equal to zero and if it is assumed that capitalists wish to hold a portfolio consisting exclusively of real capital (that is, $\varphi'(0) = \infty$ in equation (19)).

[7] A more elaborate model will contain both stabilizing and destabilizing effects of falling wages and prices and, as argued in *GT* (chapter 19) and *MAK* (chapter 7), the net effects are uncertain.

The steady-state, full-employment requirements follow directly from (29) by setting the accumulation rate equal to the natural rate of growth:

$$\hat{K}^* = s\pi^* - \delta = g_n \tag{30}$$

or

$$\rho = \frac{g_n + \delta}{s} - \varepsilon - \delta \tag{31}$$

The stabilization of the economy at the warranted path associated with this particular value of π^* ensures the equality between the growth rate of employment and the growth rate of the labour supply. But the initial position of the economy may be off this steady state. As pointed out in *MAK,* p. 339, the 'postwar boom began with a need for massive capital accumulation for reconstruction in Europe'. A low capital stock implies that the rate of accumulation and the rate of profits will be high if - as a result of appropriate aggregate demand policy - the economy operates at full employment (cf. (26)-(27)) and, as indicated by (29), the warranted rate of growth associated with a high rate of profits is also high. Putting it differently, at the beginning of the postwar period the output-capital ratio at full employment generated a warranted rate that exceeded the natural rate of growth.

Given these initial conditions, the maintenance of full employment growth requires the manipulation of policy so as to achieve a gradual shift in the warranted path itself as well as the continuous stabilization of the economy vis-a-vis this moving equilibrium. Let us assume, for the time being, that policy-makers accomplish this tricky task and that they successfully manipulate interest rates (and thereby aggregate demand) so as to maintain full employment.[8] The implications of the model for output and the capital stock can now be analysed without any reference to the investment function.[9] From equations (20), (23), (25) and the full employment assumption we get a standard dynamic equation for the evolution of the capital-labour ratio,

$$\dot{k} = s\alpha k^{\alpha} - (g_n + \delta)k \tag{32}$$

[8] I shall use monetary policy as a shorthand for policies 'that have offered direct or indirect encouragement to investment. Tax concessions to retain earnings and capital gains, investment allowances and grants, and accelerated depreciation allowances have been used fairly continuously; monetary policy aimed at lower interest rates and fiscal policy designed to raise demand have been used episodically.' (*MAK*, p. 338)

[9] This was Solow's (1956) justification for leaving out Keynesian complications. In the concluding section he notes that '[a]ll the difficulties and rigidities which go into modern Keynesian income analysis have been shunted aside. It is not my contention that these problems don't exist, nor that they are of no significance in the long run' (p. 91); in fact, '[i]t may take deliberate action to maintain full employment' (p. 93).

where $k = K/L = K/N$ is the capital-labour ratio at full employment. It follows that

$$k \to \left(\frac{s\alpha}{g_n + \delta}\right)^{1/(1-\alpha)} = k^* \tag{33}$$

and that k will be increasing monotonically if the initial capital intensity is below the long-run equilibrium k^*. Having assumed full employment and determined the time paths for the capital-labour ratio, the time path for output can be derived. Thus, the Keynesian elements play no role in the determination of output, employment and the capital stock. Instead, they determine the time path of real rate of interest.

Using (21) and (23) we have

$$\frac{d}{dt}(s\pi - \delta) = \frac{d}{dt}\hat{K} = \lambda(\pi - \pi^*) \tag{34}$$

or, using (32) and (34),

$$\begin{aligned} \pi^* &= \pi - \frac{1}{\lambda}\frac{d}{dt}(s\pi - \delta) \\ &= \alpha k^{-(1-\alpha)} - \frac{1}{\lambda}\frac{d}{dt}\left(s\alpha k^{-(1-\alpha)}\right) \\ &= \left[\alpha k^{-(1-\alpha)}\right]\left[1 + \frac{s(1-\alpha)}{\lambda}\left(s\alpha k^{-(1-\alpha)} - g_n - \delta\right)\right] \end{aligned} \tag{35}$$

By assumption the initial value of the capital-labour ratio is below k^*. Hence, the two terms in square brackets on the right hand side of (35) are both positive and decreasing in k. It follows that the required rate of return, π^*, will also be positive and decreasing in k, and since - from (33) - the capital intensity increases monotonically towards its equilibrium value k^*, the required rate of return will be decreasing over time. Asymptotically,

$$\pi^* \to \alpha k^{*-(1-\alpha)} = \frac{g_n + \delta}{s} > 0 \tag{36}$$

In order to reduce the required return, the real rate of interest also has to decrease. From (37) it follows that

$$\rho = \pi^* - \varepsilon - \delta \to \frac{g_n + \delta}{s} - \varepsilon - \delta \gtreqless 0 \tag{37}$$

A negative real rate of interest does not necessarily imply a negative social return to investment if the risk premium is positive. In the case where $\varepsilon = 0$ and $\rho < 0$, however, the long run equilibrium is characterized by 'dynamic inefficiency' or, in other words, the initial position of capital inadequacy changes into one of capital

saturation in which 'an increment to the capital stock cannot be expected to yield enough to cover replacement cost' (*MAK*, p. 359).

Whether or not the risk premium is positive, a negative real rate of interest implies positive rates of inflation ($\hat{p}$) if the nominal rate of interest is bounded above some lower limit, $i \geq i_0 > 0$. Thus, at the long run equilibrium:

$$\hat{p} = i - \rho \geq i_0 + \varepsilon + \delta - \frac{g_n + \delta}{s} = \hat{p}^{\min} \tag{38}$$

Equation (38) defines a lower limit on the asymptotic rate of inflation. In the classical case with $s = 1$[10] the expression for the lower limit on the asymptotic rate of inflation reduces to

$$\hat{p} \geq i_0 + \varepsilon - g_n \tag{39}$$

By assumption population is roughly stable (one of the six 'key assumptions') and 'the general picture is one in which technical change has slackened' (*MAK*, p. 340). Given these assumptions, 'the vision of growth as normal, which marked the 1960s, should be abandoned' (*MAK*, p. 358-9) and if the natural rate of growth is low or negligible, $g_n \approx 0$, the lower limit on inflation is unambiguously positive. Inflation, in other words, can

> 'be looked upon as the result of attempting to forestall the inevitable consequences of an increasing capital stock. It is both the concomitant of the fiscal and monetary policies designed to promote growth - indeed to maintain the viability of corporate enterprise as we know it - and a useful instrument in its own right, for it drives down the real rate of interest and reduces the burden of corporate and public debt' (*MAK*, p. 339)

The expression for the required return suggests a possible solution: reduce the saving rate. This adjustment happens automatically in models with full employment and infinitely-lived representative agents who engage in Ramsey-type optimization but the relevance of these models for most purposes seems

[10] The saving rate out of profits is likely to be below one. Since the profit share is constant, however, the saving function (4) can be obtained as a reduced-form equation from a specification that allows for saving out of wages. Thus, if

$$S = s_w W + s_p \Pi$$

it follows, using $\Pi/Y = \alpha$, that

$$S = \left(s_w \frac{1-\alpha}{\alpha} + s_p \right) \Pi = s\Pi; s \gtreqless 1$$

questionable.[11] The saving rate could be reduced, instead, through fiscal policy but as indicated in section 2.3, this path may run into problems of its own, as tax reductions and persistent public deficits develop their own trouble-some dynamics.

4 Selectivity

The limitations of Keynesian aggregate demand policies presents a challenge, both theoretically and at the level of practical policy. For Chick 'greater selectivity and planning of investment' (p. 351) is an important part of the answer. Thus, one of the main conclusions of *MAK* is that (p. 360)

> 'the bland assumption implicit in usual macroeconomic theory and policy advice, that one investment is as good as any other, is an anachronism and a costly one. Is it not time to ask the question posed in the previous chapter: could we gain more employment for a lower inflation-cost by attending to the careful *direction* of policy-encouraged investment rather than by giving a stimulus, indiscriminately, to investment as a whole?'

A one-sector model of the kind we have used so far is unable to address this question. A simple extension of the model, however, may illustrate the potential importance of selectivity. Retain the homogeneity of output but assume that there are two techniques of production and that total output is given by

$$Y = Y^1 + Y^2 = K_1^{\alpha} L_1^{1-\alpha} + B K_2^{\alpha} L_2^{1-\alpha} \tag{40}$$

From the point of view of individual producers, both techniques exhibit constant returns to scale. The parameter B, however, is determined by the total amount of capital that is employed using the second technique,

$$B = \bar{K}_2^{\gamma}, 1 - \alpha > \gamma > 0 \tag{41}$$

Thus, the second technique includes a positive externality and yields increasing returns to scale at the aggregate level (but diminishing returns to capital; the knife-edge case of $\gamma = 1 - \alpha$ would give endogenous growth while $\gamma > 1 - \alpha$ would lead to rapidly increasing growth rates).

It is readily seen that if K_1 and K_2 are predetermined and wages are equalized across sectors then the returns to capital will be different unless $B = K_2 = 1$. If the initial capital stock using technique two falls below this threshold, technique one will be the most profitable. In the absence a spontaneous coordination

[11] This is not to say that stock market booms and declining saving rates have had no influence on developments in the 1980s and 1990s.

of investment decisions, it will therefore be optimal for individual firms to concentrate all investment in technique one. Policy intervention, however, may shift investment to technique two, and as soon as the capital stock using this technique has reached the threshold, the concentration of all investment in technique two becomes self-reinforcing. This policy-induced shift raises output in the long run and more importantly, from the present perspective, it may solve the long-run inflationary problem by raising the rate of growth.

Using technique one, the steady-state rate of accumulation is equal to the rate of growth of the labour supply in efficiency units, $\hat{K}^* = g_n$. Technique two, on the other hand, implies that the steady growth rate will be given by

$$\hat{K}^* = \frac{1-\alpha}{1-\alpha-\gamma} g_n > g_n \tag{42}$$

and the minimum inflation rate now becomes

$$\hat{p} = i_0 + \varepsilon - \frac{1-\alpha}{1-\alpha-\gamma} g_n \tag{43}$$

Comparing (39) and (43) it follows that the long-run inflation constraint has been relaxed. The same goes for the sustainability constraint on taxes and subsidies in section 2.3 which requires that $si < \hat{K}^*$. This conclusion supports Chick's emphasis on selectivity and planning as a way to overcome the problems. The model, however, is exceedingly simple and one should not underestimate the practical problems and pitfalls involved in political intervention to 'pick winners'. Nor should one forget - as pointed out in *MAK* - that the ideological and political obstacles to active intervention can be formidable.

5 Conclusions

It is striking that the analysis of long-term policy in *MAK* makes little reference to labour market issues. This absence stands in sharp contrast to the dominance of the *NAIRU* concept in most discussions of medium- and long-run behaviour.

Post-Keynesians have criticized *NAIRU*-theory and its influence on Western governments and central banks (e.g. Arestis and Sawyer (1998), Davidson (1998), Galbraith (1997)). There are good reasons to be critical. The empirical evidence in favour of the theory is weak and at a theoretical level it is easy to set up models with multiple equilibria, rather than a unique *NAIRU*. Perhaps the most direct route is the one chosen by Akerlof et al (1996) and Shafir et al (1997) who point out that most people suffer from some form of 'money illusion'. Hysteresis models, whether based on duration and insider-outsider considerations or on my own favourite, aspirational hysteresis, is another possibility (e.g. Blanchard and Summers (1987), Skott (1999)). It should also be noted that even very

mainstream models with policy games between unions and central banks can give rise to a traditional long-run trade-off between inflation and unemployment (e.g. Cubitt (1992), Skott (1997), Cukierman and Lippi (1999)). The introduction of externalities and increasing returns opens yet further possibilities (Krugman (1987), for instance, considers a simple case in which aggregate demand policy has permanent effects on real income).

Chick does not raise any of these issues concerning the existence and determination of the *NAIRU.* Implicitly, in fact, the analysis in *MAK* presumes a well-defined and unique level of full employment and, in Keynesian terms, a *NAIRU* is a position of full employment (whatever unemployment may exist at a *NAIRU*-equilibrium will be voluntary in Keynes's sense). Thus, in this particular respect *MAK* shares a key presumption of *NAIRU*-theory. But there are crucial differences between *MAK* and *NAIRU*-theory.

NAIRU-theory, which focusses exclusively on the labour market, suggests that any level or time-path of fully anticipated inflation will be consistent with long-run equilibrium at the *NAIRU.* Putting it differently, from a labour-market perspective the rate of inflation is indeterminate when the economy is at the *NAIRU* (at full employment). The analysis in *MAK* demonstrates that this standard indeterminacy presumption may be wrong when aggregate-demand issues are included in the analysis: the mere existence of a well-defined full employment position (a well-defined *NAIRU*) does not ensure that the level of aggregate demand will be consistent with full employment (with the *NAIRU*). Building directly on the *General Theory*, Chick shows that the maintenance of sufficient aggregate demand to keep the economy at full employment (at the *NAIRU)* may constrain the feasible time-paths of inflation. More specifically - and contrary to the standard presumption - high inflation may be necessary in the long run in order to keep the economy at full employment.

At an empirical level the analysis in *MAK* made sense of the increasing inflation rates, negative real rates of interest, falling profitability and rising unemployment in the 1970s. Inflation has since come down again, real interest rates increased in the early 1980s and have remained positive, profitability has recovered and unemployment - although still very high in most of continental Europe - has also come down, most notably in US, UK and some of the smaller European countries. Although these developments, which took place after the publication of *MAK,* may appear to contradict the analysis, they may in fact be explicable within the framework of *MAK.* Relief has come from several sources. US saving rates, in particular, fell dramatically in the 1980s and the rate of technical progress also appears to have recovered slightly in recent years. Both of these changes help alleviate the inflationary constraint. Neither of them may be permanent, however, and it is too early to dismiss Chick's concerns over the limitations of aggregate-demand policy.

References

[1] Akerlof, G.A., Dickens, W.T and Perry, G.L. (1996) 'The Macroeconomics of Low Inflation'. *Brookings Papers on Economic Activity*, pp. 1-59.

[2] Arestis, P. and Sawyer, M. (1998) 'Keynesian Policies for the New Millennium'. *Economic Journal*, 108, 181-195.

[3] Blanchard, O. and Summers, L. (1987) 'Hysteresis in Unemployment'. *European Economic Review*, 31, pp. 288-295.

[4] Chick, V. (1983) *Macroeconomics after Keynes*. Oxford: Philip Alan.

[5] Cubitt, R.P. (1992) 'Monetary Policy Games and Private Sector Precommitment'. *Oxford Economic Papers*, 44, pp. 513-530.

[6] Cukierman, A. and Lippi, F. (1999) 'Central Bank Independence, Centralization of Wage Bargaining, Inflation and Unemployment: Theory and Some Evidence'. *European Economic Review*, 43, pp. 1395-1434.

[7] Davidson, P. (1998) 'Post Keynesian Employment Analysis and the Macroeconomics of OECD Unemployment'. *Economic Journal*, 108, 817-831.

[8] Galbraith, J.K. (1997) 'Time to Ditch the NAIRU'. *Journal of Economic Perspectives*, 11, pp.93-108.

[9] Harrod, R.F. (1973) *Economic Dynamics*. London and Basingstoke: Macmillan.

[10] Keynes, J.M. (1936) *The General Theory of Employment, Interest and Money*. London and Basingstoke: Macmillan.

[11] Krugman, P. (1987) 'The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs. Thatcher'. *Journal of Development Economics*, 27, pp. 41-55.

[12] Shafir, E., Diamond, P. and Tversky, A. (1997) 'Money Illusion'. *Quarterly Journal of Economics*, 92, pp. 341-374.

[13] Skott, P. (1997) 'Stagflationary Consequences of Prudent Monetary Policy in a Unionized Economy'. *Oxford Economic Papers*, 49, pp. 609-622.

[14] Skott, P. (1999) 'Wage Formation and the (Non-) Existence of the NAIRU'. *Economic Issues*, 4, pp. 77-92.

[15] Solow, R.M. (1956) 'A Contribution to the Theory of Economic Growth'. *Quarterly Journal of Economics*, 70, pp. 64-94.

Working Paper

2000-4 Licun Xue: A Notion of Consistent Rationalizability - Between Weak and Pearce's Extensive Form Rationalizability.

2000-5 Ebbe Yndgaard: Labour, An Equivocal Concept for Economic Analyses.

2000-6 Graham Elliott and Michael Jansson: Testing for Unit Roots with Stationary Covariates.

2000-7 Nikolaj Malchow-Møller and Bo Jellesmark Thorsen: A Dynamic Agricultural Household Model with Uncertain Income and Irreversible and Indivisible Investments under Credit Constraints.

2000-8 Niels Haldrup, Antonio Montanés and Andreu Sanso: Measurement Errors and Outliers in Seasonal Unit Root Testing.

2000-9 Erik Harsaae: En kritisk vurdering af den generelle ligevægtsmodel.

2000-10 Rasmus Højbjerg Jacobsen: Why the ECB Should be Ultra-Liberal.

2000-11 Michael Rosholm and Michael Svarer: Structurally Dependent Competing Risks.

2000-12 Efforsyni Diamantoudi and Licun Xue: Farsighted Stability in Hedonic Games.

2000-13 Licun Xue: Stable Agreements in Infinitely Repeated Games.

2000-14 Bo Sandemann Rasmussen: Government Debt and Capital Accumulation in the Blanchard-Cass-Yaari OLG Model.

2000-15 Nikolaj Malchow-Møller and Bo Jellesmark Thorsen: Investment under Uncertainty - the Case of Repeated Investment Options.

2000-16 Boriss Siliverstovs: The Bi-parameter Smooth Transition AutoRegressive model.

2000-17 Peter Skott: Demand Policy in the Long Run.

CENTRE FOR DYNAMIC MODELLING IN ECONOMICS

DEPARTMENT OF ECONOMICS - UNIVERSITY OF AARHUS - DK - 8000 AARHUS C - DENMARK
☎ +45 89 42 11 33 - TELEFAX +45 86 13 63 34

Working papers, issued by the Centre for Dynamic Modelling in Economics:

1999-11 Martin Paldam: The Big Pattern of Corruption. Economics, Culture and the Seesaw Dynamics.

1999-21 Martin Paldam: Corruption and Religion. Adding to the Economic Model?

2000-1 Niels Haldrup and Peter Lildholdt: On the Robustness of Unit Root Tests in the Presence of Double Unit Roots.

2000-2 Niels Haldrup and Peter Lildholdt: Local Power Functions of Tests for Double Unit Roots.

2000-3 Jamsheed Shorish: Quasi-Static Macroeconomic Systems.

2000-4 Licun Xue: A Notion of Consistent Rationalizability - Between Weak and Pearce's Extensive Form Rationalizability.

2000-6 Graham Elliott and Michael Jansson: Testing for Unit Roots with Stationary Covariates.

2000-8 Niels Haldrup, Antonio Montanés and Andreu Sanso: Measurement Errors and Outliers in Seasonal Unit Root Testing.

2000-12 Effrosyni Diamantoudi and Licun Xue: Farsighted Stability in Hedonic Games.

2000-13 Licun Xue: Stable Agreements in Infinitely Repeated Games.

2000-16 Boriss Siliverstovs: The Bi-parameter Smooth Transition AutoRegressive model.

2000-17 Peter Skott: Demand Policy in the Long Run.