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Investment Performance, Capital-Widening and Economic Policy

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Abstract

Fixed investment as a share of GDP has declined over a long period in many G10 countries. The aim of the paper is to provide a theoretical framework for explaining this. The model emphasises the negative effect on investment of uncertainty about the effects of a policy response to an output gap. When government contracts demand to close an output gap that is the result of an initial decline in fixed investment, it tends to exert a cumulative depressive effect on capacity and growth. Since this involves a dynamic process the mechanisms at work are illustrated through a theoretical simulation approach.

1. Introduction

Fixed investment as a share of GDP has declined over a long period, falling by about three percentage points in the G10 countries since the 1960s.[2] There are many possible explanations for this decline in investment output ratios. On a benign view, fixed capital productivity may have risen in the short run due to greater utilisation, allowing a short-run rise in output with little capital growth.[3] (DTI 1996, Davies 1996).

A less relaxed view would stress increased difficulty in privately appropriating profit, or increased risk, as features inhibiting fixed investment. On this view, the social return to investment may be higher than the private return, implying that economic growth is investment constrained. One of the reasons why investment constraints have not excited more interest is that there is fairly strong evidence that the accelerator relationship works well at the aggregate level. Put differently, if output rises, there is little to worry about with regard to investment.[4] Although there is some evidence that the incremental capital output ratio is declining, the robust accelerator relationship may appear to suggest that growth is not constrained by a lack of capital, except perhaps in the short run. In the long run any constraint is generally argued to arise in respect of demand or profitability. Moreover, since investment is but a relatively small component of demand, its role in growth, as far as the demand side is concerned, is often regarded as passive.[5]

The response to these criticisms from those who regard investment as having a causal role in growth has been to focus on the supply side influence of capital accumulation (Cosh *et al* 1996; Mayes and Young 1993). The story here is familiar. There is a transitory boost to growth from capital deepening, even in the neoclassical model. With plausible parameter values, this can last for several decades. The effect can be stronger with scale economies or learning by doing. The effect can even be permanent under new growth theory, e.g. with external economies of scale. Even without external benefits, more investment can increase growth if there are

non-market impediments to investment such as non-neutral taxation or asymmetric information in the provision of finance; or if technical progress is embodied.

The empirical relevance of this long-run supply-side approach is controversial (de Long and Summers 1992; Clarke 1993; Dowrick 1995; Blomstrom et al 1996; Oulton and Youmg 1996). One highly contested issue is which forms of investment are most likely to be characterised by external benefits, e.g. capital deepening (equipment), infrastructure, or some more general category of 'broad capital'.

2. *Investment and capital shortage*

In this paper we pursue a supply-side approach based not on capital deepening but capital widening. We argue that a divergence between private and social returns which results in a shortfall in plant capacity can have a long-run effect on growth. This postulated growth effect is quite independent of any assumptions with regard to enhanced efficiency of new capital vintages which tends to dominate the supply-side approach to investment-led growth. It is also independent of any externalities such as spillovers of market information from firms who are first to expand.

The argument advanced here is known in the literature as the capacity shortage approach and there are conflicting views as to how important it is (Dreze and Bean 1990, Bean and Gavosto 1990, Rowthorn 1995). In principle, inadequate capital formation may bring about inflationary pressure either directly or by its effects on wage pressure.

In this paper we simulate the performance of a stylised economy in which capital shortage emerges as risk rises as a result of policy intervention. The resultant output gap and associated inflationary pressure is met by deflationary policy. Since the operation of this policy can in turn increase the level of risk, it is possible that there will be a downward spiral in investment and output growth. The argument may be made in three stages.

First, the capacity stance, Z, is defined as the ratio of capacity to expected demand.[6] A loose capacity stance indicates that firms are planning to hold excess capacity as they are optimistic about the future. This encourages them to invest. In contrast, a tight stance indicates that firms are not willing to take the risk of investment; rather they are prepared to forego potential earnings as they are uncertain about the prospects of future demand. These propositions follow from the theoretical premise that the capacity stance depends positively on expected unit profitability and - unless profitability is very high - negatively on the risk of the investment project. (Nickell 1978; Aiginger 1987; Driver and Moreton 1991, 1992).[7] A rise in the expected profitability of investment will convince firms to adopt a loose stance whereas an increase in the perceived risk of investment will generally induce firms to adopt a tight stance.[8]

Since the focus of this paper is on risk and on the cumulative effect of short-run dynamics we will take expected profitability as given and focus on the effect of risk on the capacity stance. We formalise these views in the following equations

$$Z=K/E[Y] \qquad (1)$$

$$Z=Z(\sigma)\ ,\ Z'(\sigma)<0 \qquad (2)$$

where Z, the capacity stance, is defined as the ratio of capital (K) to the expected level of output (Y) and where Z depends negatively on risk (σ).

Second, we represent economic policy by a simple counter-inflationary stance, where the output gap, G, represented by the proportionate gap between demand and

capacity is targeted in a simple manner. When the gap exceeds a certain threshold, T, government injects or withdraws a quantum of demand (ϕ). While obviously a simplification, this policy rule mimics the more sophisticated rules implicit in major economic models such as that of the National Institute (Young 1992). The output gap is defined as above as:

$$G=(aY-K)/K \qquad (3)$$

where aY is the required capacity to produce Y.

The simulated policy response is an increment of a quantum X to demand, where:

$$X=\phi, ifG\geq T \; ; \; X=-\phi, ifG<T \qquad (4)$$

Third, while demand is stochastic even without government policy, the main cause of risk in this paper is the action of government policy. Risk is assumed to result from the effects of a policy action in preceding periods.

It is known that the dispersion of year ahead forecasts across forecasting teams depends on volatility of the forecast variable, forecast error and instability in the distribution of demand between its components. (Driver and Moreton 1992). All of these will be influenced by policy changes and uncertainty is thus likely to rise irrespective of the direction of the policy shift.

$$\sigma=\sigma(\phi_1, \ldots \phi_k) \qquad (5)$$

In order to keep the influence of uncertainty simple and transparent we model an uncertain effect to occur if policy is operative in either of the last two periods.

Before describing the model in more detail, some other assumptions are introduced for convenience but are not essential to the model. Firstly, since this is a supply-side model, demand will simply be represented in the absence of government policy by a stochastic process with given parameters. Any variation in investment behaviour is not shown as impacting on that demand, given the supply side focus. Secondly, the underlying profitability of demand is not assumed to vary over time, though the required rate of return, which affects the capacity stance, is affected by the extent of risk.

3. The simulation model

A simple but serviceable cost-of-adjustment model of investment is analysed in Blanchard and Fischer (1989). Firms are assumed to minimise a target cost (TC), recorded as the sum of a cost penalty for disequilibrium production and an installation cost with a penalty for rapid adjustment.

$$TC=0.5(aY_t-K_t)^2+0.5b(I_t)^2 \qquad (6)$$

where K is capital, Y is output and I is gross investment. The usual depreciation condition applies:

$$K_t=(1-\delta)K_{t-1}+I_t \qquad (7)$$

where δ is the depreciation rate.

Using a discount rate, θ, Blanchard and Fischer show that the solution of this model is of the form:

$$Kt=\lambda K_{t-1}+(a\lambda/(b(1-\delta))) \Sigma((\lambda/(1+\theta))^i E[Y_{t+i}|t] \qquad (8)$$

where λ is a calculable root depending on b,θ,δ and $0<\lambda<0$.

4. The simulation

A base case of the simulation is run using just equation 8. In this base case there is no influence of uncertainty on the investment equation. Neither is any counter-inflationary

policy rule applied. The construction of the expected output summation in equation 8 is based on an estimated annual ARMA model for manufacturing output for the UK over the period 1970 to 1995. Using variable deletion tests, the best representation was found to be:

$$Y_t = 1.558Y_{t-1} - 1.02Y_{t-2} + 0.466Y_{t-3} \qquad (9)$$

The parameters for the base case are set as follows:

a=1; b=2.5; δ=0.06; θ=0.1; N=100

The result is charted in Figure 1 for output and simulated capital.

Capital input tracks output fairly well, though the adjustment cost is severe enough to maintain an output gap for several periods. Furthermore, it appears from the simulation that capital shortage occurs more often than capital surplus. This would appear to be due to the nature of the cyclical movement in output, where it is much more likely that the upswing is of longer duration than the downswing. The effect of this is that capital lags output for a longer period in the upswing thus causing the mean output gap (G) to be positive.

Next, equation 8 is supplemented with the feedback rule from the output gap to policy action (equations 3,4). Specifically, there is a threshold output gap of 5 per cent which if exceeded in either direction results in policy becoming operative. At this stage, there is no further feedback to the desired capacity stance, or to the speed of adjustment, as a result of the policy operation (equations 1,2,5).

The results of this modifications are shown in Figure 2. The contrast with Figure 1 is not marked, as there are only a limited number of periods where policy is operative, mostly aimed at correcting excess demand, giving the asymmetry in the cycle noted earlier.

Equation 8 was further amended to incorporate an influence of uncertainty arising from the operation of policy, on investment. There are two modes in which investment can be affected. First, the desired capital output ratio (Z) may be lowered by replacing parameter a with ua where u<1. This corresponds directly to equations (1,2). Second, the speed of adjustment parameter b (and therefore λ) may be altered without affecting the firm's desired long-run capacity stance. In this case only the dynamics of Z are directly affected by uncertainty, though hysteresis may be present due to the effect of possible capital shortage. In this paper we focus on the second and weaker of the two influences because we suspect that it will be more widely accepted that such an influence exists. The result of a fifty percent increase in b, triggered by the operation of policy is shown in Figure 3. The desired and actual capital for the standard b of 2.5 from Figure 2 are shown along with the modified path under the feedback rule which increases b in response to the operation of policy. It can be seen that actual capital with the uncertainty effect tracks lower than without the amendment. Furthermore, the effect is cumulative in that the lower capital input is more likely to raise output gaps beyond the threshold, triggering deflationary policy. Put differently, the output gap and policy reaction feed off each other to reinforce slower growth. The cumulative effect is seen in Figure 3 where the disparity between the two capital stocks is up to ten percent points towards the end of the simulation period. It is doubtful whether an econometric analysis of the ex-post capital and output data could uncover the subtle nature of the simulated relationship. Certainly the series will be cointegrated, given the way in which the

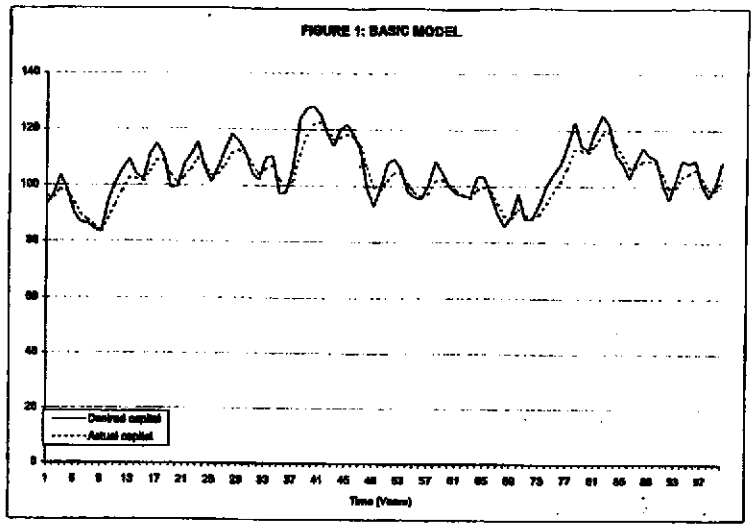
FIGURE 1: BASIC MODEL
Desired capital
Actual capital
Time (Years)

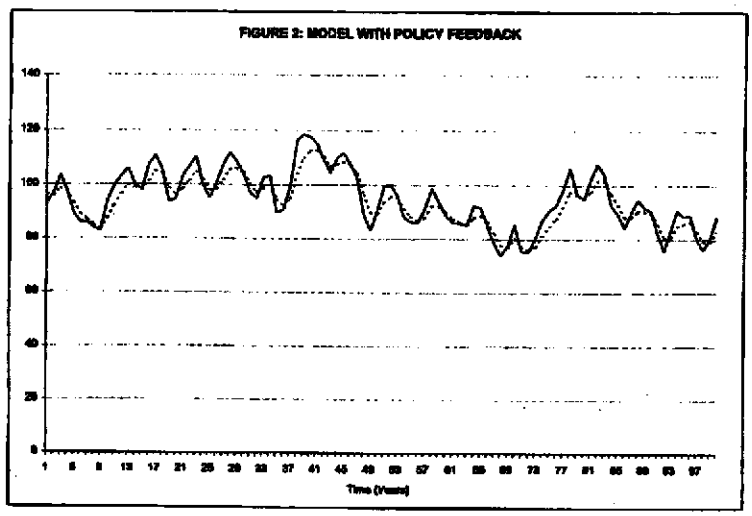
FIGURE 2: MODEL WITH POLICY FEEDBACK

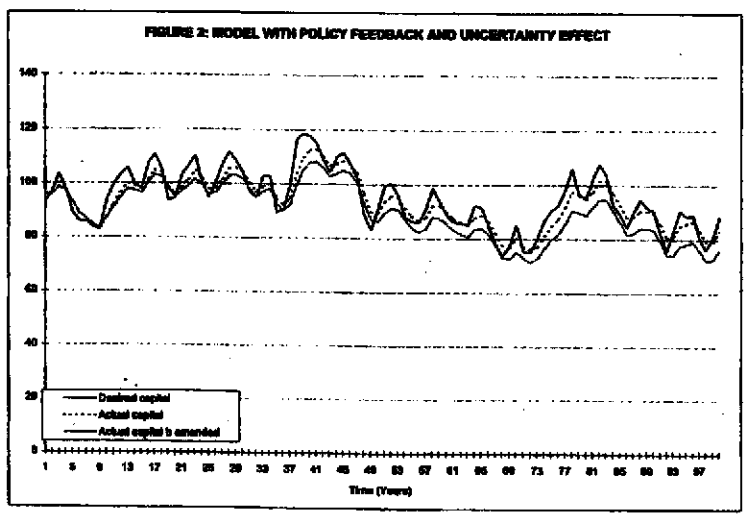
FIGURE 3: MODEL WITH POLICY FEEDBACK AND UNCERTAINTY EFFECT
Desired capital
Actual capital
Actual capital is amended
Time (Years)

capital stock has been constructed. But the real interest lies in the systematic downward bias to both series.

5. Concluding comments

The model used above is intended to be illustrative rather than descriptive. A number of important macroeconomic links have been omitted so that the basic point can emerge more clearly. In particular there is no price flexibility in the model to ameliorate the downward slide in investment. In a closed economy we could expect a drop in real wages to compensate for the capacity pressure, allowing expansionary policy to re-emerge. The model is therefore intended to indicate tendential movement only. The simulation illustrates how, under plausible parameter values, the effects of cautious capacity commitment and policy feedback can combine to exert a cumulative depressive effect on capacity and growth.

Endnotes

1. Imperial College, Management School. We would like to thank two referees for helpful comments on an earlier draft.

2. For a consideration of the investment performance of Europe and the UK, see Ford and Poret (1991); Mayes and Young (1993), Kitson and Michie (1996), Bond and Jenkinson (1966), and Cuthbertson and Gasparo (1995).

3. The long-run position is, however, more complex; in full general equilibrium the direction of change in capital inputs would depend on substitution and demand elasticities. In the *Bank of England Quarterly Bulletin*, February 1996, the long-run fall in investment is attributed to slower technical progress, connected with the end of post-war reconstruction in Europe and Japan (p.54).

4. There may of course be a savings problem such as is alleged to have exerted a drag on domestic investment in the US. That is however bridgeable by inflows of capital, as long as the corresponding current account deficit is manageable. An alternative view is that savings responds to investment in a Keynesian manner.

5. Investment demand is of course highly volatile but this is regarded by many as a second-order problem.

6. Driver (1996) constructs such an index of the capacity stance for the UK based on the CBI Industrial Trends Survey.

7. It might appear that the argument being adopted is that firms are being myopic in that they are not anticipating the long-run benefits of the policies pursued. This is not so; we do not argue that firms are myopic. However, since the timing and magnitude of long-run gains are uncertain, it would be irrational for firms to precommit to irreversible investment using only the expected values of future profit opportunities. While it is rational for the individual firm to delay investment where possible, this caution will postpone and weaken any recovery. Options theory provides an alternative way of analysing this issue (Dixit and Pindyck 1994).

8. Driver (1996) shows that the reason why firms have adopted a more cautious approach to capital investment is because of inadequate expected return. This is a hybrid variable capturing both expected profitability and required profitability.

Thus, firms have been restrained from investing either because expected profitability has been lower or because increased risk has forced them to raise the required or 'hurdle' rate of return. However, actual profitability has systematically improved in the 1980s. There has been an upward trend in actual profitability. Thus, the pretax rate of return for UK Industrial and Commercial companies increased from 4.1 per cent in 1980 to 8.3 per cent in 1993. It is doubtful whether firms continued throughout the 1980s to expect a decline in profitability when actual data were showing a systematic improvement. It therefore logically follows that the reason for the inadequate return lies in a rise in required profitability rather than a fall in expected profitability.

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