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A Formal Analysis of the Cambridge Economic Policy Group Model

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Two propositions about management of the British economy advanced by the Cambridge Economic Policy Group (CEPG) have aroused some controversy. One concerns the relationship between fiscal policy and the balance of payments; the other concerns the relative merits of import restricts and devaluation as alternative means of achieving full employment. Both have also caused confusion and misunderstanding because they were not formulated with sufficient precision when originally advanced in newspaper articles (especially Godley and Cripps, 1974) and annual policy reviews (CEPG, 1975, 1976). The policy reviews were based on a fully defined computer model (the current version is described in Fetherston, 1976), but because this was developed for realistic quantitative analysis it is too complicated and too specific to be suitable for a general exposition.

This paper provides a simplified presentation of the main assumptions of the CEPG model and derives from them some precise conclusions about the effects of fiscal and trade policy. Little or no attempt is made to justify the assumptions, the purpose being to clarify what has been asserted rather than to argue in favour of these conclusions against others.

The quantitative model used for policy reviews was always intended to evolve in the light of experience and criticism and in response to the changing focus of interest in specific policy objectives and instruments. The assumptions and conclusions presented here are still provisional.

In order to derive the theorems in an intelligible analytic form, some simplifications to the realistic quantitative model have been adopted. In particular, disaggregation of components of the current balance of payments, output, national income and public accounts, as well as short-run dynamics, have all largely been omitted.

The first section of the paper gives an overall, verbal description of the model to indicate how it relates to different theoretical traditions. The three following sections describe in turn assumptions relating to real demand, external trade and inflation, and derive specific propositions about relationships between targets and instruments. The final section outlines properties of the model as a whole, based on results from the preceding sections.

I. General Description

In its broad structure the CEPG model lies squarely within the postwar tradition of Keynesian model-building. The main targets of policy are employment and output, the current balance of payments and the rate of inflation. The principal instruments are fiscal policy and the exchange rate. The sufficiency of these instruments for achieving the targets is one of the issues to which this paper is addressed.

The causal structure of the model involves demand and output being determined by a multiplier process in response to fiscal policy, exports and import propensities; employment being determined in response to real demand and output; exports and import propensities being determined by world trade and by the relationship between domestic and external price levels measured in common currencies; and the rate of inflation being determined by cost increases, in particular money wages, import prices and tax rates.

The limited independent role ascribed to monetary policy is conceived in terms of credit restrictions and interest rates (although the latter are assumed not to have much influence in practice because of external and internal constraints on their use). The money supply is regarded as entirely endogenous, being fully determined by decisions on fiscal policy, credit restrictions and interest rates and by external flows; it is not itself a policy variable with any independent influence on demand or the price level.

Within this orthodox Keynesian framework—broadly shared, for example, by the Treasury (H.M. Treasury, 1975) and National Institute (Bispham, 1975a) models—CEPG's particular conclusions derive mainly from three sets of assumptions.

Firstly, the consumption function concept is extended to bring private fixed investment as well as consumption into a single "private expenditure function" with private disposable income in aggregate as the main explanatory variable. Formally this is very different from the traditional representation, which emphasises the distinction between consumption, determined by personal income, and investment, determined by an accelerator process. In practice over the cycle the predictions of the two models need not be very different because investment and the share of profits in national income both move procyclically. Given the well-known difficulty of modelling the corporate sector, there is an advantage in aggregation provided the overall relationship is empirically robust. What is ensured, by modelling the expenditure function in the aggregate, is that assumptions about acquisitions of financial assets by the private sector as a whole are plausible in the long run—a matter of great importance for a medium-term model.

The aggregate function implies a relationship between fiscal policy, home demand and the balance of payments that is simpler and more clear-cut than that implied by traditional Keynesian models. While the so-called "New Cambridge" result has gained some qualified support (Budd, 1975; Ball *et al.*, 1975; Corden *et al.*, 1975; Stamler, 1975), it had been strongly denied by others (notably Kahn and Posner, 1974, and Bispham, 1975b).

The second distinctive feature of the Policy Group model is that money wage determination is represented as the outcome of periodic negotiated wage settlements composed in part of compensation for past price and tax changes and in part of *ex ante* changes in the disposable real wage. This approach makes it possible to examine the part played by inflation in reconciling *ex ante* real wage targets with actual resource availability. It is broadly consistent with the later views of Keynes (Trevithick, 1975), and contrasts both with the Phillips Curve, whether in its original or "expectations-augmented" form (Friedman, 1975), and with the analysis of bargaining that focuses on attempts to change pay relativities (Phelps Brown, 1962).

The vertical long-run Phillips Curve (Friedman, 1975, p. 22) implies that low unemployment generates accelerating inflation. Under the CEPG assumptions

a lower rate of unemployment (given the balance of payments and terms of trade) would normally be associated with a slower rate of inflation.

The third main respect in which the CEPG model differs from many others is in the special attention paid to factors influencing the distribution of real disposable income between wages and other incomes. Here the assumptions are not particularly novel or controversial. But given the view that money wage bargaining is concerned with real wage targets, income distribution is of particular importance because it directly affects resources available for real wages, and hence the rate of inflation.

II. Real Demand

In this and the following sections, assumptions of the model are presented as simplified equations.

The equations are formulated as medium-term relationships with a steady growth rate, g, and a steady rate of inflation, r. Trend parameters (such as underlying growth of productivity) are omitted, as are short-term dynamic specifications (such as adjustment lags), which have in any case not been the main focus of interest. Equation numbers are prefixed either with D (definitional identity), A (behavioural assumption) or T (derived proposition). A list of symbols is given at the end of the paper. Those with primes denote variables at current prices.

This section specifies the determination of real national income and output, conditional on the tax rate, public expenditure, exports, the propensity to import, the terms of trade and the rate of inflation.

Definitions

The real expenditure–output identity is given by

(D1) $$Q \equiv D + X - M$$

where the variables are measured at constant factor cost. Domestic expenditure is further disaggregated as

$$D \equiv XP + G + S$$

all measured inclusive of a "relative price effect" so that

$$XP' \equiv PD.XP$$
$$G' \equiv PD.G$$
$$S' \equiv PD.S$$

where PD is the ratio of current market prices to constant factor cost. The inclusion of a relative price effect, apart from being a useful simplification, normally tends to improve the measure of resource pre-emption (in terms of employment content) of different components of demand.

The money income–expenditure identity (ignoring net income from abroad) is written as

(D2) $$Y' \equiv D' + X' - M'$$

where Y' is measured inclusive of net indirect taxes. An overall net tax rate, t, which determines the distribution of national income between the public and private sectors, may be defined by

(D3) $$T' \equiv tY'$$
$$YP' \equiv Y' - T' = (1-t)Y'.$$

Ignoring net income and transfers from abroad, the current balance of payments surplus is

(D4) $B' \equiv X' - M'$.

To express the balance of payments in "real" terms in such a way that it can be brought into equivalence with domestic claims on real national income, the money value of the current balance is divided by the domestic price deflator:

(D5) $B \equiv B'/PD$.

Note that since

$$B'/PX = X - M/TT$$

the real current balance as defined above can also be approximately represented as

(T1) $B \approx X - M/TT$

provided (as is usually the case) that $PD \approx PX$.

The real national income is defined as

(D6) $Y \equiv Y'/PD = D + B$.

Writing m for the propensity to import and using (T1), this implies

(T2) $Y \approx Q(1 + m(1 - 1/TT))$.

The familiar proposition expressed in (T2), that the real national income depends on real output and the terms of trade, is thus a consequence of definitions and accounting identities.

Behavioural assumptions

Imports and stockbuilding are determined in volume terms by conventional propensities, which may be written

(A1) $M = mQ$

(A2) $S = \alpha_0 gQ$.

The effects of competitiveness on the propensity to import will be considered in the following section.

The assumption about private acquisition of financial assets in money terms is given by

(A3) $AFP' = \alpha_1(g + r)\, YP' - \alpha_2 S'$

where AFP' refers to net acqusition of financial assets external to the private sector as a whole. This can be influenced by interest rates or credit rationing, specially hire purchase controls. But such monetary influences have normally had only a minor role in the United Kingdom and are therefore not formally considered here.

The determination of private expenditure (excluding stockbuilding) follows directly from the above assumption:

$$XP' \equiv YP' - AFP' - S' = \{1 - \alpha_1(g + r)\}\, YP' - (1 - \alpha_2)S'.$$

Since the same deflator is used throughout the relationship is the same in real terms:

(T3) $XP = \{1 - \alpha_1(g + r)\}\, YP - (1 - \alpha_2)S$.

Real income, the balance of payments and fiscal policy

From (T1) and (D6),

$$Y = XP + G + S + X - M/TT.$$

Substituting from (A1), (A2), (D3), (T2) and (T3), a conventional multiplier solution for real income can be obtained as

(T4) $Y = (G + X)/\phi$

where

$$\phi = t + \alpha_1(g + r)(1 - t) - \frac{\alpha_0\alpha_2 g - (m/TT)}{1 + m(1 - 1/TT)}.$$

Note that the multiplier is the lower, the higher the rate of inflation because inflation is assumed to raise private net acquisition of financial assets relative to income. The steady-state tax rate necessary to achieve a given target level of real income can be derived from (T4) as

$$t = \frac{\left[\frac{G + X}{Y} - \alpha_1(g + r) + (\alpha_0\alpha_2 g - m/TT)/\{1 + m(1 - 1/TT)\}\right]}{\{(1 - \alpha_1(g + r)\}}$$

and the steady-state public sector financial deficit as a share of national income can be expressed with a little further manipulation as

(T5) $$\frac{DG}{Y} = \frac{\left[\alpha_1(g + r)\left(1 - \frac{G}{Y}\right) - \alpha_0\alpha_2 g/\{1 + m(1 - 1/TT)\} - \frac{B}{Y}\right]}{\{1 - \alpha_1(g + r)\}}.$$

This is a precise formulation of the proposition about the relationship between the public sector deficit and the balance of payments deficit advanced in the January 1974 London and Cambridge Bulletin (Godley and Cripps, 1974). With realistic parameter values the relationship linearizes approximately to

$$\frac{DG}{Y} = 0{\cdot}15g + 0{\cdot}30r - 1{\cdot}05\frac{B}{Y}.$$

The effects of inflation and real growth in the above formulation are regarded by CEPG as relatively uncertain, while the link between the steady-state budget deficit and balance of payments deficit is more clear-cut. The relationship prescribes a fiscal policy rule that is necessary, but not sufficient, for achieving medium-term growth, inflation and balance of payments targets; but it does not directly specify which of these targets will be most affected by changes in fiscal policy.

III. The Balance of Trade

This section specifies the determination of the balance of trade, conditional on the level of real output, the rate of inflation, home and foreign costs, the exchange rate, tariff policy and world demand.

Definitions and assumptions

The current balance of payments has already been defined in money and real terms (ignoring net income and transfers from abroad) as

(D4) $B' \equiv X' - M'$

(D5) $B \equiv B'/PD.$

Assumptions are now required about the determination of export and import volumes and prices. Trade volumes are assumed to be determined by income and relative cost terms (the cost of UK output compared with that of competitors, expressed in common currency units):

(A4) $X=\beta_0 WX^{\beta_1}\{RX.RFC.(1+t_x)\}^{-\beta_2}$

(A1a) $M=\mu Q\{RX.RFC/(1+t_m)\}^{\beta_3}.$

The propensity to import, m, in the previous section is thus given by

$$m=\mu\{RX.RFC/(1+t_m)\}^{\beta_3}.$$

Relative factor cost in "own" currencies is defined as the ratio of home unit cost to the "world" price of competitive products:

(D7) $$RFC\equiv\frac{PD}{1+t_a}\Big/PWC$$

This variable provides an index of costs in the United Kingdom relative to competitor countries.

Export and import price deflators are assumed to be weighted averages of home and external prices, the relevant external prices being "world" prices of competitive products and of raw materials (both converted to sterling). For simplicity all exports are assumed to be competitive products, while imports comprise a mix of the two categories.

(A5) $$PX=\left\{\frac{PD(1+t_x)}{(1+t_a)}\right\}^{\beta_4}\left(\frac{PWC}{RX}\right)^{(1-\beta_4)}$$

(A6) $$PM=\left[\frac{PD}{(1+t_a)(1+t_m)}\right]^{\beta_5}\left[\frac{PWM^{\beta_6}.PWC^{(1-\beta_6)}}{RX}\right]^{(1-\beta_5)}$$

The "world" terms of trade for raw materials relative to competitive products is defined as

(D8) $WTT\equiv PWM/PWC.$

The terms of trade and the current balance

The above assumptions and definitions lead directly to a useful theorem about export and import price levels and the terms of trade:

(T6) $$PX=\frac{PD}{1+t_a}.\frac{(1+t_x)^{\beta_4}}{(RX.RFC)^{(1-\beta_4)}}$$

$$PM=\frac{PD}{1+t_a}.\frac{WTT^{\beta_6(1-\beta_5)}}{(1+t_m)^{\beta_5}(RX.RFC)^{(1-\beta_5)}}$$

$$TT=(1+t_x)^{\beta_4}(1+t_m)^{\beta_5}(RX.RFC)^{(\beta_4-\beta_5)}.WTT^{-\beta_6(1-\beta_5)}.$$

If the exchange rate is continuously adjusted to compensate for relative inflation, export and import prices will rise at the same rate as domestic prices. The terms of trade will in these circumstances depend only on border taxes, t_x' and t_m, and on the world terms of trade for raw materials.

The solution for the current balance, conditional on a given level of real output, may be written using the approximation (T1) as

(T7) $$B=\beta_0 WX^{\beta_1}\{RX.RFC.(1+t_x)\}^{-\beta_2}$$
$$-\frac{mQ(RX.RFC)^{\beta_3+\beta_5-\beta_4}.WTT^{\beta_6(1-\beta_5)}}{(1+t_x)^{\beta_4}(1+t_m)^{\beta_3+\beta_5}}.$$

This solution has the appropriate property that a proportionate subsidy on exports together with an equal proportionate tariff on imports is equivalent to an effective devaluation of the same magnitude. Note that the equivalence is exact if the current balance is measured in terms of foreign exchange but is only approximate in terms of sterling.

CEPG are not "elasticity pessimists" as regards the medium-term results of a maintained devaluation of relative costs. The long-term elasticity of export values in foreign currency terms with respect to an effective devaluation $(\beta_2-\beta_4)$ is assumed to exceed unity and that of import values $(\beta_3+\beta_5)$ to be approximately unity. But it may take several years for the full response to materialize, and the terms-of-trade elasticity $(\beta_5-\beta_4)$ is assumed to be adverse, especially in the short run.

The balance of payments and real income

The balance of payments may be a constraint on domestic policies in several different senses. This section does not discuss constraints that capital flows in the balance of payments may impose on monetary policy, interest rates, etc. Here it is simply assumed that some minimum target for the current account determines the maximum level of real national income that can be achieved.

For simplicity suppose that the current balance of payments must be zero. The maximum level of real output consistent with this requirement is the solution Q_0 of equation (T7) above when $B=0$:

$$\text{(T8)} \qquad Q_0=\frac{\beta_0 WX^{\beta_1}}{mWTT^{\beta_6(1-\beta_5)}}\cdot\frac{(1+t_m)^{(\beta_3+\beta_5)}}{(1+t_x)^{(\beta_2-\beta_4)}}\cdot(RX\cdot RFC)^{-(\beta_2+\beta_3-\beta_4+\beta_5)}.$$

This level of output may be supposed to be maintained by an appropriate fiscal policy.

The effects of trade policy instruments on the level of output, given a zero balance of payments target, are seen to be the same as their effects on the balance of payments, given a fixed level of output. Their effects on real national income are slightly different because the latter is influenced by terms-of-trade shifts as well as changes in the level of output.

If the rate of inflation can be taken as given, the exchange rate, export subsidies, import tariffs and import quotas can all be considered potentially effective methods in the medium term for increasing the level of output and employment in a balance-of-payments-constrained situation. But as will be shown, these instruments may feed back on the rate of inflation. This means that an assessment of the efficacy of different trade policy instruments depends on assumptions about the determinants of inflation. These are considered in the next section.

IV. Inflation

This section specifies the determination of the rate of inflation, given fiscal policy, the terms of trade and the level of relative costs.

Money wages

Wage bargaining may, in the absence of a policy of money wage control, be conceived as establishing an *ex ante* disposable real wage on the basis of taxes and prices that prevail at the time of settlement. The *ex ante* real wage may con-

veniently be defined as the instantaneous value, in terms of going prices and tax rates, of a wage settlement at the moment it is concluded; this will normally be eroded by subsequent price and tax changes until superseded by a new settlement. Money wages being paid in any period are an average of the *ex ante*, or "target", real wages incorporated in past settlements and the range of previous price levels and tax rates on which these settlements were based. With a steady rate of inflation and a constant average tax rate, money wage determination may thus be represented as

$$(A7) \qquad W' \equiv \frac{WD^*}{1-t_w} \cdot PD \cdot (1-\gamma_0 r)$$

where WD^* denotes the average real disposable value of current money wage agreements at the time of settlement, and γ_0 is the average time elapsed since settlements were negotiated.

The factors determining the target real wage cannot be formulated with any precision. In particular it has not been perceptibly influenced by the level of unemployment.

The *ex post* disposable real wage—what settlements actually turn out to be worth—is given by

$$(D9) \qquad WD = \frac{W'}{PD}(1-t_w).$$

From these two relations the rate of inflation can be derived as

$$(T9) \qquad r = \frac{1}{\gamma_0}\left(1 - \frac{WD}{WD^*}\right).$$

Despite the difficulty of explaining or predicting the target real wage, proposition (T9) has some important implications. One is that a once-for-all reduction in the real wage (owing, for example, to higher taxation or a worsening of the terms of trade) will generate a permanently higher rate of inflation unless it is accommodated by an equal reduction in the real wage target. Another is that inflation will be accelerated by a reduction in the lag, γ_0, whether because of frequent renegotiation of settlements or through incorporation of cost-of-living adjustments. It would also be accelerated if γ_0 is effectively shortened because the real wage target is defined with respect to the anticipated future price level rather than that prevailing at the time of settlement.

This equation alone does not provide a complete specification of the determinants of the rate of inflation because the *ex post* real wage is itself influenced by the effect of inflation on the distribution of income.

The determination of real wages

The total disposable real wage bill, considered *ex post*, is a residual from real national income after deduction of taxes and profits (excluding stock appreciation):

$$(D10) \qquad WD.E \equiv (1-t)Y - YC.$$

This expression can be rearranged to show the average disposable real wage as a share of average output per person employed:

$$(T10) \qquad \frac{WD}{Z} = (1-t)\frac{Y}{Q} - \frac{YC}{Q}.$$

Assume that taxes on profits are passed on in prices (or alternatively that profits are untaxed). Disposable money profits (excluding stock appreciation) can then be written as the difference between the value of final sales (net of sales tax) and total costs of supply:

$$\text{(D11)} \qquad YC' \equiv \frac{PD}{1+t_a}(Q+M-X)+\frac{PX}{1+t_x}\cdot X - CC(Q+M).$$

The price of domestic expenditure is set as a mark-up on unit historic costs:

$$\text{(A8)} \qquad PD=(1+t_a)(1+e)HC$$

where historic costs lag current costs by γ_1:

$$\text{(A9)} \qquad HC=(1-\gamma_1 r)CC.$$

The share of real profits in output can be derived from these assumptions, together with (A1) and (T6), as

$$\text{(T11)} \qquad (1+t_a)\frac{YC}{Q}=(1+m)\left\{1-\frac{1}{(1+e)(1-\gamma_1 r)}\right\} + \frac{X}{Q}\cdot\left[\frac{1}{\{(1+t_x)(RX.RFC)\}^{(1-\beta_4)}}-1\right]$$

The first result above, (T10), shows, definitionally, how real wages are affected by taxation, the terms of trade and the share of disposable real profits in output. The second result, (T11), describes the factors influencing the share of profits (excluding stock appreciation).

If there is no inflation and no differential profit margin on exports, the formula (T11) reduces to

$$\frac{YC^*}{Q}=\frac{1+m}{1+t_a}\cdot\frac{e}{1+e}.$$

As shown in the appendix, (T11) may be rewritten to show real profits excluding stock appreciation in terms of this "normal" share of profits together with stock appreciation and differential profits on exports:

$$\text{(T11)} \qquad \frac{YC}{Q}=\frac{YC^*}{Q}-\frac{1}{(1-\gamma_1 r)}\cdot\frac{SA}{Q}+\frac{YCX}{Q}$$

where

$$\frac{SA}{Q}=\frac{\gamma_1 r(1+m)}{(1+t_a)(1+e)}$$

and

$$YCX=\frac{X}{(1+t_a)}\left\{\frac{PX(1+t_a)}{PD(1+t_x)}-1\right\}.$$

Real profits inclusive of stock appreciation will hardly vary at all as a share of real output when the rate of inflation changes (whether on account of wage or import costs), although they will vary in response to effective devaluation because this changes the export profit margin.

A change in the steady-state rate of inflation will, however, affect the share of profits excluding stock appreciation, and hence the share of real wages. The size of the effect on real wages is nearly equal in absolute magnitude to the change in stock appreciation.

Adjustments to inflation

The three relationships derived in this section, (T9), (T10) and (T11), jointly determine the rate of inflation conditional on the *ex ante* wage target, output per employee, fiscal policy, the cost competitiveness of exports and the terms of trade.

Given values of policy instruments and exogenous variables, the process of inflation provides two direct mechanisms for reconciling the *ex ante* real wage with available real income. These are the interval between wage settlements and the lag in passing cost increases through into prices.

In addition, policy instruments themselves may vary in response to inflationary pressure. In Section II above it was shown in (T5) that the budget deficit has to be higher, given other targets and instruments, the faster the rate of inflation. This implies that if other targets are unchanged inflation will be cushioned to some extent by lower tax rates. If the balance of payments target can be relaxed, inflation can be moderated still further by tax reductions.

A further policy response that has been used to cushion inflation is to "defend" the exchange rate and allow export competitiveness to deteriorate, thereby reducing the share of profits in income as implied by (T11) and increasing the share of wages. This obviously has effects on other targets which are discussed in the next section.

In circumstances where inflation is controlled by restriction of money wage increases, the analysis of this section may be used instead to derive the *ex ante* level of real wages that must be imposed in wage bargaining in order that the inflation target should be achieved. The scale of reduction in the real wage target, as compared with what otherwise might have occurred, gives some indication of the severity of the wage control policy and of the scale of wage explosion that might ensue.

V. The Interaction of Fiscal Policy, Trade Policy and Inflation

In a Keynesian model there is a presumption that the two main instruments —fiscal policy and the exchange rate—may prove incapable of ensuring satisfactory outcomes for all three principal targets—employment, the balance of payments and inflation—unless there is a Phillips Curve relationship such that low inflation is in the long run the unique counterpart of reasonably full employment. Recent experience of several years of fast inflation combined with high unemployment (following a long period of low unemployment and slow inflation) has confirmed that the Phillips Curve relationship is at best weak. This has made it all the more obvious that for practical purposes the two conventional policy instruments—fiscal policy and the exchange rate—are insufficient.

Conventional policy

Before considering the use of import restrictions the implications of the model described above for the conduct of macroeconomic policy by means of fiscal policy and the exchange rate will be brought out by holding constant each one of the three targets in turn, and considering the trade-off between the other two.

First consider the case where real output is held constant. If the balance of payments is required to improve, there must be an effective devaluation (T7) and a higher average tax rate (T5). Both these are strongly inflationary (T10 and T11).

Now consider the case where the balance of payments is held constant. If real output is to be increased there must be an effective devaluation (T8), but this time the average tax rate may be reduced (T5). It is not clear, comparing the full steady-state outcomes, whether inflation will ultimately be faster or slower. The result depends on the size of the inflation-increasing effects of terms of trade deterioration (T10) and higher export profit margins (T11) against the inflation-reducing effects of the lower tax rate (T10). CEPG's detailed quantitative model shows a slight reduction in the ultimate steady-state rate of inflation.

In the short term, however, an increase in output, for a given balance of payments target, becomes strongly inflationary ((T8), (T10) and (T11)) because the volume response to devaluation is slow. The adjustment process needed to take advantage of the long-term steady-state result therefore requires either an intervening period of accelerated inflation or temporary relaxation of the balance of payments target.

The third case, where inflation is held constant while the other targets vary, can be inferred from the first two. In the first case, with constant real output, improvement of the balance of payments was highly inflationary. In the second case, with a constant balance of payments, an increase in output reduced inflation only slightly if at all. It follows that, if inflation is to be held constant, output must be varied widely for small variations in the balance of payments.

The above results, which are expressed in terms of long-run steady states, imply that a major reduction in inflation could be achieved only through tax reductions or defence of the exchange rate and only to the extent that the balance of payments deteriorates.

If on the other hand money wage control is used to provide the additional instrument necessary for simultaneous achievement of all three targets, the reduction in inflation will require a relatively large reduction in the *ex ante* real value of wage settlements and a smaller reduction in the actual real wage.

Import restrictions

The implications of adopting protection as an alternative to devaluation can be considered by assuming that an equal increase in output is to be achieved (for a given balance of payments) by fiscal policy combined either with devaluation of the exchange rate (RX), or with a tariff on imports (t_m), or with a direct reduction in the normal propensity to import (μ).

In the long run, ignoring transitional problems, the terms of trade will be worsened by devaluation and improved by a tariff (T6). In the quota case we assume controls are arranged so as to leave the terms of trade unchanged. Also, the first equation of (T6) shows that export profit margins will rise as a result of devaluation (but are unaffected by tariffs or quotas).

Fiscal policy, in particular the overall tax rate (inclusive of tariffs), will by (T5) be almost, although not exactly, the same under each policy because by assumption output and the balance of payments are identical. If the overall tax rate was exactly the same (and ignoring for the moment any difference in stock appreciation), equations (T10) and (T11) show that disposable real wages would be highest if tariffs are used (because of the terms of trade gain), lower with quotas, and lowest with devaluation (both because of the terms of trade loss and because of the rise in export profits margins). These differences in real wages will

be reflected in the rate of inflation (T9), which will be highest with devaluation and lowest with tariffs.

The differences in real wages and inflation will be reduced, as compared with the above, by differences in the tax rate (T5) (lowest with devaluation) and stock appreciation (T11) (highest with devaluation). But these offsets are only partial since they are induced by the very inflationary pressure they help to accommodate.

The quantitative significance of these comparisons depends mainly on the size of the differences in the terms of trade and export profit margins. In CEPG's quantitative model the terms-of-trade loss resulting from devaluation is small in the long run, although the terms-of-trade gain from tariffs is substantial. The increase in export profit margins resulting from devaluation is also large. The long-run effects on inflation and real wages are significantly different under each of the three types of policy.

It has already been pointed out that in the short term devaluation is highly inflationary unless the balance of payments target can be relaxed. By contrast, protection, whether by tariffs or quotas, presents no transitional problems at all (in the CEPG model). This is because neither the terms of trade nor the distribution of income at any stage move in a manner that is adverse to the disposable real wage.

APPENDIX. STOCK APPRECIATION AND THE SHARE OF PROFITS

First define real profits attributable to the difference between margins on exports and on home sales as

$$YCX \equiv \frac{X}{PD} \cdot \left\{ \frac{PX}{(1+t_x)} - \frac{PD}{(1+t_a)} \right\}.$$

The share of profits excluding stock appreciation may then be written, from (T11), as

$$\begin{aligned} \frac{YC}{Q} &= \frac{(1+m)}{(1+t_a)} \left\{ 1 - \frac{1}{(1+e)(1-\gamma_1 r)} \right\} + \frac{YCX}{Q} \\ &= \frac{(1+m)}{(1+t_a)} \cdot \frac{e}{1+e} - \frac{(1+m)}{(1+t_a)} \cdot \frac{\gamma_1 r}{(1+e)(1-\gamma_1 r)} + \frac{YCX}{Q}. \end{aligned}$$

The average lag between historic cost and current cost must be equal to the stock–turnover ratio, i.e.

$$S = \gamma_1 (Q+M).$$

If stocks are valued at historic cost, stock appreciation in money terms is

$$\begin{aligned} SA' &= \gamma_1 r . (Q+M) . HC \\ &= \frac{\gamma_1 r . (1+m)}{(1+t_a)(1+e)} \cdot Q . PD \end{aligned}$$

and stock appreciation in real terms, dividing by the domestic expenditure deflator, is given by

$$\frac{SA}{Q} = \frac{\gamma_1 r . (1+m)}{(1+t_a)(1+e)}.$$

Now, defining normal profits including stock appreciation as

$$\frac{YC^*}{Q} \equiv \frac{(1+m)}{(1+t_a)} \cdot \frac{e}{1+e}$$

the actual share of profits excluding stock appreciation may be written as

$$\frac{YC}{Q} = \frac{YC^*}{Q} - \frac{1}{(1-\gamma_1 r)} \cdot \frac{SA}{Q} + \frac{YCX}{Q}.$$

LIST OF SYMBOLS

Note: ′ denotes value at current prices; prefix *P* denotes price deflator

Q:	real output
D:	domestic expenditure
X:	exports
M:	imports
XP:	private expenditure (consumption plus fixed investment)
G:	public sector expenditure
S:	stockbuilding
Y:	real national income
T:	net public sector revenue (direct and indirect taxes, etc. *less* subsidies and debt interest)
t:	overall net tax rate (same coverage as T, includes t_x, t_m, t_a and t_w among others)
YP:	private disposable income
B:	current balance of payments
TT:	UK terms of trade (ratio of export to import prices)
m:	propensity to import
g:	real growth rate
r:	rate of inflation
AFP:	private net acquisition of financial assets
DG:	public sector financial deficit
WX:	volume of world trade in "competitive" products
RX:	exchange rate (foreign currency units per £)
RFC:	factor cost of sales by UK producers relative to competitors in own currencies
t_x:	net indirect tax rate on exports
t_m:	net indirect tax rate on imports
t_a:	net indirect tax rate on domestic expenditure
PWC:	world price of "competitive" products in foreign currency units
PWM:	world price of raw materials in foreign currency units
WTT:	world terms of trade for raw materials
W':	money wage
WD^*:	disposable real wage target
t_w:	net direct tax rate on wages
WD:	actual disposable real wage
E:	employment
YC:	disposable real profits
Z:	output per employee
CC:	current cost per unit of final sales
e:	domestic profit mark-up on historic cost
HC:	unit historic cost of final sales
SA:	stock appreciation
YCX:	differential real profits on exports

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