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Internal and External Balance In a Centrally Planned Economy

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I. Introduction

This paper presents a model of an open centrally planned economy (CPE). In a framework which allows disequilibrium and (informal) quantity rationing, we seek to represent both the effects of domestic macroeconomic processes on trade flows and the effects on domestic macro variables of foreign sector phenomena. We investigate the adjustment of the system to exogenous shocks and the policy tradeoffs facing the planners.

We start from the closed economy model constructed in Portes (1978b). That paper sought to provide a CPE analogue to IS-LM: a consistent basis for the development of large macroeconometric models, for smaller-scale hypothesis testing and the elaboration of structural equations for households' and planners' behaviour, and for the comparative statics and macro dynamics of CPEs. It adapted the macroeconomic model with quantity rationing of Muellbauer and Portes (1978) to the CPE case, in particular replacing capitalist firms by socialist central planners. Their interaction with households in the process of plan construction and implementation may generate various types of quantity-constrained equilibria. Among these is repressed inflation, but the model treats demand and supply symmetrically. It allows but does not assume various combinations of excess demand or supply in the markets for commodities and labour.

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Here we have four commodities: money, labour, domestically produced output, and a good produced abroad. Both commodities are tradeable at given foreign prices, but these are unrelated to domestic prices, and we can not use conventional import demand and export supply functions. Nor are we concerned with the (accounting) "exchange rate". There are no autonomous capital flows, and those which accommodate balance of trade surpluses or deficits have no direct influence on the domestic economy. With these major differences, we explore in our open CPE a problem familiar from conventional open economy macro: the conflict between internal and external balance. A subsidiary objective is to give a theoretical basis for proper specification of foreign sector equations for CPEs.

Section II gives assumptions, definitions, notation, and a story of the processes which the model represents. Section III formally specifies household behaviour and the technology. Section IV discusses plan construction and Section V the relations in it between internal and external balance. Section VI deals with plan implementation and with the quantity-constrained macroeconomic equilibria in our open CPE. Section VII suggests extensions of the model.

II. Assumptions and Definitions

Many of the assumptions in this paper are explained or justified in more detail in the two papers cited above.

Our period is the calendar year. The process determining current (plan) period outcomes begins in the preceding period, when the planners construct the plan. At that time they have expectations for the capital stock, inventories, and household financial assets at the beginning of the plan period, as well as for the balance of trade

outcome for the period preceding the plan period. Their preferences are defined on aggregate marketed consumption and aggregate government expenditure. They choose a plan subject to their knowledge of household behaviour and the technology, as well as a constraint on the aggregate balance of trade.

The plan is a set of planned values of the main macro variables, on which the planners will base their demands for labour and imports, the wage, and their supplies of exports and of consumption goods for purchase by households. During the current period they discover errors in the expectations and perhaps in their assumptions about household behaviour and technology, and their actual behaviour diverges from the plans as a function of these errors and of some variables (in particular, output) determined endogenously during the period. The interaction of the planners' behaviour with that of households on the markets for consumption goods and labour determines the actual values of the macro variables.

The equilibrium of the current period is quantity-constrained, with familiar phenomena such as multiplier processes. There may be excess demand or supply on either or both domestic markets. If so, the quantity transacted will be the minimum of supply and demand, and the quantity "rations" encountered by agents on the long side of one market will in general affect their effective supply or demand in the other. The plans for the following period depend inter alia on the planners' expectations for the current balance of trade and for the capital stock, inventories, and household assets at the end of the current period, which in turn depend on excess demands and supplies during the period. Thus in the medium and longer run, the planning process and its response to indicators of "disequilibrium" serve as equilibrating mechanisms.

There are four commodities: money, domestically produced output, the imported good, and labour, each homogeneous. The domestically produced good serves all final uses. Capital stock composed of it combines with labour services in a neoclassical production function to generate value added (net output). Value added in turn combines in fixed proportions with the imported good to produce gross output. Thus the import serves only as an intermediate good. This simple specification of the technology has been used very effectively in a recent open economy model by Findlay and Rodriguez (1977). It is well suited to the problems we address here, and it can easily be extended, as we indicate in Section VII.

Exports are demanded and imports are supplied in unlimited amounts at the ruling foreign prices.

Labour services are the only variable input. Households freely supply labour, demand goods and money balances, and have stable preferences represented by a utility function which they maximize. They cannot borrow, and there is no return on holding money balances. As in CPE reality, there are no debt instruments or equities.

The planners control the productive sector, which we may think of as a single state enterprise cum "monobank" (combined central and commercial bank) and budgetary authority. They set the domestic price of gross output and the money wage rate. They demand labour from and supply consumption goods to households, hold inventories, and set aside shares of gross output for export and for government expenditure (used for investment, defence, and non-marketed consumption). We represent their preferences over aggregate marketed consumption and government expenditure by a planners' utility function.

In the standard CPE modelled here, foreign prices and the monetary counterparts of foreign trade flows are completely separated from the domestic economy by the "price equalization subsidy" system. Without going into details (for a brief description of the macro-economic consequences, see Portes, 1978a), we may simply ignore here the effects of foreign exchange transactions on the domestic money supply, all of which is held by households in our model. We are concerned here with the interactions between monetary and real variables as they affect the behaviour of households and planners, and for this purpose the budgetary reflection of foreign exchange transactions need not be considered (Wolf has dealt with this problem in a series of papers, including his contribution to this Conference).

Nor do we include here taxes or transfer payments. Accounting relationships for the closed economy version of the model are set out in Section II of Portes (1978b). A turnover tax, income tax, direct deductions from enterprise profits, and money transfers to households could easily be incorporated in a more complicated exposition.

We use the following notation:

q = flow of gross output per period

y = value added per period

x = sales of goods per period for domestic use

c = flow of goods purchased by households

g = flow of goods purchased by government

s = stock of inventories

ℓ = flow of labour services sold by households

R = domestic price of gross output

W = money wage rate

M = stock of money

$w = W/R$ = real wage in units of domestic output

$m = M/R$

k = stock of productive fixed capital

e = exports of domestic gross output per period

i = imports of intermediate good per period

P_e = foreign price of one unit of domestic output (in foreign currency)

P_i = foreign price of one unit of imported good (in foreign currency)

$p = P_e/P_i$ = commodity (barter) terms of trade

$B = P_e e - P_i i$ = balance of trade in foreign currency

We consider a single current (plan) period, and flow variables for this period will be written without time subscripts, flows for the previous period with subscript -1. For stock variables, the subscript 0 denotes the value at the beginning of the current period, while the absence of subscript denotes the value at the end of the current period. A superscript e denotes an expected value, a superscript p a planned value. Superscripts d and s denote demand and supply. We use primes for derivatives of a function of a single variable, subscript j for the partial derivative w.r.t. the j^{th} argument listed.

III. Household Behaviour and the Technology

The treatment here of the household sector is virtually identical to that in Muellbauer and Portes (1978), to which the reader is referred for details. Only in comparisons with a market economy having a more complex financial structure and corresponding household portfolio

choice would the different institutional environment begin to matter. CPE households are essentially free in their consumption expenditure and labour supply decisions. They may be more likely than households in a capitalist market economy to encounter quantity constraints in the goods market and less likely in the labour market, but this becomes relevant only when we consider the complete model.

There is one significant difference: We can assume a constant (centrally fixed) domestic price level. The consumer goods price is not used as a macroeconomic equilibrating mechanism by the planners, nor is the free kolkhoz (collective farm) market large enough to affect noticeably the aggregate price level facing households. These price indices have been remarkably stable since the mid-1950s, and we assume households expect this stability to continue. Thus we can write the household budget constraint in real terms:

$$m_o + w\ell = c + m.$$

Intertemporal maximization of a utility function defined on present and future consumption and leisure subject to this constraint gives the demand for goods and supply of labour functions:

$$(1) \qquad c^d = \begin{cases} c^d(w,m_o;\theta) & \text{if } \ell^d \geq \ell^s = \ell \\ \bar{c}^d(w,m_o,\ell;\theta) & \text{if } \ell = \ell^d < \ell^s \end{cases}$$

$$(2) \qquad \ell^s = \begin{cases} \ell^s(w,m_o;\theta) & \text{if } c^s \geq c^d = c \\ \bar{\ell}^s(w,m_o,c;\theta) & \text{if } c = c^s < c^d \end{cases}$$

Here θ denotes a vector of parameters governing the (probabilistic) expectations of the future wage and future quantity constraints. We do not include it as an argument below, but these expectations are always implicit. We take (1) and (2) as aggregate demand and supply schedules.

Equations (1) and (2) explicitly distinguish the unconstrained and constrained demands and supplies. The effective demand or supply expressed on a market, written here simply as c^d or ℓ^s, is that which takes into account any quantity constraint encountered on the other market. The unconstrained demand depends only on initial endowment, current prices (the wage rate), and expectations. The constrained demand, written with a bar, depends in addition on the level of the constraint. Thus if $\ell^d \geq \ell^s$, households are unconstrained on the labour market and express their unconstrained demand $c^d(\cdot)$ on the goods market. But if the labour market is in excess supply, households cannot sell all the labour they would like, so the effective demand for goods is the labour-constrained demand: $c^d = \bar{c}^d(\cdot)$, a function of the labour "ration". Similarly, labour supply will be given by the constrained function $\bar{\ell}^s(\cdot)$ if households face excess demand for goods. Note that we assume labour supply is unaffected by non-marketed consumption.

We assume signs for some of the partial derivatives:

$$(3) \qquad c_1^d > 0,\ c_2^d > 0;\ \bar{c}_1^d > 0,\ \bar{c}_2^d > 0,\ \bar{c}_3^d > 0$$

$$\ell_2^s < 0;\ \bar{\ell}_2^s < 0,\ \bar{\ell}_3^s > 0$$

We make no assumption on the response of labour supply to a change in the wage rate, but we note that a consistency condition relating the constrained and unconstrained labour supply function (see Muellbauer and Portes, 1978, Section 3) implies $\bar{\ell}_1^s + \bar{\ell}_3^s c_1^d = \ell_1^s$, so $\bar{\ell}_1^s < \ell_1^s$. As intuition suggests, the goods-rationed labour supply curve is more likely to be backward-sloping with respect to the wage rate.

The technology is represented by the two equations

(4) $q = \min (y, \alpha i)$

(5) $y = y (\ell, k_o)$

Value added is generated by the production function (5), with the usual neoclassical properties, in particular:

(6) $y_1 > 0,\ y_2 > 0,\ y_{11} < 0,\ y_{22} < 0,\ y_{12} > 0$

Units are chosen so that we can write the fixed proportions production function for gross output in the form (4). The imported intermediate good is used up in the process of production. Since p is the value at foreign prices of a unit of domestic output in units of the import, positive net output at foreign prices requires $pq-i > 0$. From (4), we have $p\alpha i - i > 0$, or $1/\alpha p < 1$ ($1/\alpha p$ is the amount of domestic output which must be exported to pay for the imports used in producing one unit of domestic output).

IV. Plan Construction

We suppose that in constructing the plan, the planners maximize a utility function U(c,g) subject to several constraints: an aggregate balance equation (output equals end-use); equations relating sales of consumption goods and labour services to household demand and supply; the technology of (4) and (5); an inventory holding function, relating desired inventories to output; and a balance of trade target. They choose a vector of planned macro variables, $(q^p, c^p, g^p, \ell^p, w^p, e^p, i^p)$, conditional on their expectations $(m_o^e, k_o^e, s_o^e, B_{-1}^e, P_i^e, P_e^e)$.

The utility function is of course to be understood as merely a formal representation of the implicit preferences governing the planners' tradeoffs (we do not distinguish between "the planners" and their "political masters"). It does embody the usual assumptions of consistency and stability in these preferences, at least in a neighbourhood of the chosen point. If the utility function were explicitly intertemporal, we could in a first step derive a mixed direct-indirect utility function with the additional argument of end-period inventories, whose role as an asset would be derived from the future part of the original intertemporal utility function. Our alternative here of assuming an inventory holding function is convenient and undoubtedly very close to the rule of thumb which the planners actually use. For simplicity, we suppose that the planners desire end-period inventories proportional to gross output during the period: (6) $s = \beta q$.

The aggregate balance equation for goods does not require that the planners seek supply-demand balance in individual markets, specifically the consumption goods market. Thus we might consider two types of plan: "balanced" and "unbalanced". In the former, the planners do seek zero excess demand on the consumption goods market, and they correspondingly assume that labour supply will be given by the unconstrained function $\ell^s(\cdot)$. In the latter, they assume that given m_o, their choice of the wage rate and consumption goods supply will be such that the consumption goods market will be in excess demand, so labour supply will be given by the constrained function $\bar{\ell}^s(\cdot)$.

The unbalanced plan and motivations for it are discussed in Portes (1978b). Here we suppose initially that the plan is "balanced" ex ante. Our discussion below of internal and external balance will however allow disequilibria of all kinds, and there may of course be excess demand or supply for consumption goods or labour ex post, in plan implementation (e.g., if the planners' expectations are overly optimistic).

There is no justification for consciously planning excess supply on the labour market (given that the planners attach utility to output but not to household leisure), nor excess demand. Thus the planners can assume that household demand for goods will be given by the unconstrained function $c^d(\cdot)$.

The assumption that plan construction is constrained by a balance of trade target $\bar{B}$ expressed in foreign currency is evidently central to the model. There are various alternatives. For example, one might make B an argument of the planners' utility function. But socialist central planners are unlikely to pursue neomercantilist objectives, and it is indeed generally agreed that "foreign trade is conducted to obtain essential imports, with exports viewed as a necessary evil, to pay for the imports (Holzman, 1968, p. 284)." One might instead turn to an explicit intertemporal maximisation, where the time path chosen might entail borrowing from or lending abroad, taking into account the need to repay or the future returns. But this would be complicated and probably unrealistic.

Much of the literature on CPE foreign trade suggests that a given short-run balance of trade target may be a reasonable approximation for a simple model (see the Holzman essay cited above, to which the model here is clearly related). Perhaps a more difficult question

is how this target is determined. We assume here that it is a function of past balance of trade deficits and surpluses (or, if one prefers, cumulated debt or net reserves), the sequence of which is denoted by B_L, with special emphasis on the most recent past, i.e., the expected balance B^e_{-1} for the period preceding the plan period. The first step towards greater realism would be to treat intra-CMEA and convertible currency trade separately. Both the nature of the balance of trade constraint and the assumptions on foreign demand and supply conditions might differ between the two.

The specification here, with imports linearly related to output and a given balance of trade target, apparently determines exports as a function of q, $\bar{B}$, and foreign prices. But q also depends on y, which is a function of ℓ; and labour supply depends on the real wage, which in turn depends on output available for consumption, which varies with exports. So the model is not quite so simple after all.

Let us put it together. A balanced plan requires aggregate balance between output and end-use; consumption goods supply equal to household demand; planners' demand for labour equal to household supply; end-period inventories satisfying (6); and achieving the balance of trade target. This may be expressed as the following planners' problem:

$$\max U(c,g) \quad \text{s.t.}$$

$$q = c + g + e + s - s^e_o \tag{7}$$

$$q = \min (y, \alpha i) \tag{8}$$

$$y = y(\ell, k^e_o) \tag{9}$$

(10) $c = c^d(w, m_o^e)$

(11) $\ell = \ell^s(w, m_o^e)$

(12) $s = \beta q$

(13) $\bar{B} = B(B_L, B_{-1}^e)$ [$B(\cdot)$ is a decreasing function of each argument]

(14) $e = (\bar{B} + P_i^e i)/P_e^e = \bar{B}/P_e^e + i/p^e$

Equations (7)-(14) define in (c,g) space a feasible region whose boundary we denote by $F(c,g) = 0$. To ensure that part of this feasible region is in the non-negative quadrant, we must impose restrictions on $\bar{B}$ and s_o^e. The planners cannot require an excessive target: if $\ell^s(\underline{w}, m_o^e) = 0$ for some $\underline{w}$, and $y(0, k_o) = 0$, then we must assume $\bar{B} \leq P_e^e [s_o^e - c^d(\underline{w}, m_o^e)]$. Subject to this restriction, the planners' problem will look something like Figure 1.

Figure 1

Supposing that imports are always kept in correct proportion to domestic value added (the maximisation will in fact guarantee this), substitution reduces equations (7)-(13) to the following condition:

(14) $[1 - \beta - (1/\alpha p^e)] \cdot y[\ell^s(w)] = c^d(w) + g + \bar{B}/P_e^e - s_o^e$

(here m_o^e and k_o^e have been suppressed for simplicity). This implicitly defines $F(\cdot)$, and differentiation yields the slope of this boundary curve:

(15) $-(dg/dc)_{F=0} = 1 - [1 - \beta - (1/\alpha p^e)]\ y_1\ \ell_1^s/c_1^d$

Maximisation of $U(\cdot)$ over the feasible region requires that this slope equals that of the relevant indifference curve, so we have the

equilibrium condition - $(dg/dc)_{F=0} = U_1/U_2$, or

$$(16) \qquad U_1 c_1^d + U_2\{[1 - \beta - (1/\alpha p^e)]\, y_1\, \ell_1^s - c_1^d\} = 0$$

Assuming $1 - \beta - (1/\alpha p) > 0$ (net output allowing for inventory accumulation is positive), we find $U_1/U_2 \lesseqgtr 1$ according as $\ell_1^s \gtreqless 0$. If a higher wage will have a positive effect on labour supply and hence on output, then the implicit price of an extra unit of g at the margin must exceed one unit of c, because reducing c will reduce output; thus $\ell_1^s > 0$ implies $U_2 > U_1$.

Note from (14) how $\bar{B}$ plays the role of a prior claim on gross output: $\bar{B}$ deflated by P_e^e gives the volume of domestic output which would have to be exported to earn the foreign exchange target if there were no imports (hence no production) at all.

Equations (7)-(13) and (16) determine a plan $(q^p, c^p, g^p, \ell^p, s^p, y^p, e^p, i^p)$, where $q^p = q^p(m_o^e, k_o^e, s_o^e, B_{-1}^e, P_i^e, P_e^e)$, etc. How these plans vary with expectations is a useful comparative statics exercise, especially since it may also indicate how the planners would respond in plan implementation if their expectations were not realised. In addition to the assumptions on signs in (3) and (6), we assume $1 - \beta - (1/\alpha p) > 0$, $U(\cdot)$ quasi-concave, and neither c nor g inferior. TLen total differentiation of (7)-(13) and (16) with some tedious but straightforward manipulation gives the following results.

$$(17) \qquad \partial w^p/\partial m_o^e < 0\ , \qquad \partial w^p/\partial B_{-1}^e > 0\ ,$$

$$\partial w^p/\partial k_o^e > 0 \quad (\text{if } \ell_1^s \geq 0)\ , \qquad \partial w^p/\partial P_i^e < 0\ ,$$

$$\partial w^p/\partial s_o^e > 0\ , \qquad \partial w^p/\partial P_e^e > 0\ .$$

Results for output depend on the sign of ℓ_1^s: $dq^p = y_1 d\ell^p + y_2 dk_o^e$, where $d\ell^p = \ell_1^s dw^p + \ell_2^s dm_o^e$. Effects on imports and exports follow immediately.

Although such exercises are informative, they do not cast much light on the relationship between internal and external balance. To this we now turn.

V. Internal and External Balance

Starting with a balanced plan, we can easily explore tradeoffs between the balance of trade target and one or another domestic variable. Thus holding government expenditure constant and maintaining aggregate balance in the sense of equation (14), we have the relation

$$(18) \qquad (dw^p/d\bar{B})_{dg=0} = -1/[P_e(U_1/U_2)c_1^d] = (dc/dg)_{F=0}/P_e c_1^d$$

and with consumption constant, the obvious

$$(19) \qquad (dg/d\bar{B})_{dc=0} = -1/P_e \ .$$

Of much more interest, however, is how the planners might manipulate policy instruments in seeking internal and external equilibrium and how these two objectives are themselves related. Here we do not have the exchange rate as a policy instrument - there is no direct effect of foreign on domestic prices, and hence none on domestic demands and supplies of goods. Instead, the policy instruments are direct controls over w, e, and g.

We shall examine the relation between the wage and exports given government expenditure. We could alternatively hold w fixed and let e and g vary, but it will become apparent that this would be much more difficult to do without specific functional forms for $\ell^s(\cdot)$, $\bar{\ell}^s(\cdot)$, and $y(\cdot)$. Moreover, if there is in practice any order of priority between investment and defense expenditure on

the one hand (regarding non-marketed consumption as relatively inflexible in the short- and medium-run) and the wage or consumption supply on the other, it would generally be agreed that the latter adjusts to the former (the empirical evidence is mixed - see Green and H ggins, 1977, Portes and Winter, 1978, and Portes, 1978c).

We might be tempted to start with a simple "assignment rule": e for the balance of trade and w for the consumption goods market. But the story is rather more complicated. To tell it diagrammatically, we construct two curves in (w,e) space. The BB curve is the locus of combinations of w and e which yield a balance of trade equal to the target $\bar{B}$, given the relations between imports and output and between output and the wage through labour supply. The CC curve is the locus of combinations of w and e which yield equilibrium on the consumption goods market, given that exports divert goods from consumption supply while the wage affects both output and consumption demand.

Thus BB is defined by the relation

$$B(w, e) = B(B_L, B_{-1}) = \bar{B} ,$$

which we get from

$$P_e e - P_i i = \bar{B}, \text{ so}$$

$$e = \bar{B}/P_e + q/\alpha p, \text{ and we have}$$

$$\text{BB:} \quad e = \bar{B}/P_e + (1/\alpha p)y[\ell^s(w)] \tag{20}$$

Similarly, CC is defined by the relation

$$c^s(w,e) = c^d(w) ,$$

which we get from the aggregate balance equation (7):

$$q = c + g + e + s - s_o$$

$$(1 - \beta)\, q - g - e + s_o = c$$

$$(1-\beta)y[\ell^s(w)] - g - e + s_o = c^d(w) \quad , \quad \text{so we have}$$

$$\text{(21)} \qquad \text{CC:} \quad e = (1 - \beta)y[\ell^s(w)] - c^d(w) - g + s_o$$

The picture these two curves give will be something like Figure 2, as we explain below.

Figure 2

Above the CC curve, exports are too high for consumption goods market equilibrium, given w and g, so $c^d > c^s$; below it, $c^d < c^s$. Above the BB curve, exports exceed the amount needed to meet the balance of trade target, given output and the associated imports, so $B > \bar{B}$; below it, $B < \bar{B}$.

Thus we see that equation (20) is not quite correct. Where BB lies above CC, as it does to the right of E in Fig. 2, we have $c^d > c^s = c$ for any point on BB, and consequently $\ell^s = \bar{\ell}^s(w, m_o, c)$. Thus we have

$$\text{(22)} \qquad \text{BB:} \begin{cases} e = \bar{B}/P_e + (1/\alpha p)y[\ell^s(w)] & \text{for } c = c^d \leq c^s \\ e = \bar{B}/P_e + (1/\alpha p)y[\bar{\ell}^s(w,c)] & \text{for } c^d > c^s = c \end{cases}$$

Note that (22) means that to the right of E, the vertical distance between BB and CC will <u>underestimate</u> the extent of disequilibrium on the consumption goods market associated with satisfying the balance of trade target. The constraint on households in the goods market reduces their labour supply, hence output and imports, hence

the required amount of exports, so BB is lower than it would be if households could purchase what they desire.

The slopes of the two curves are as follows:

$$(23)\qquad (de/dw)_{BB} = \begin{cases} y_1 \ell_1^s/\alpha p & \text{for } c^d \leq c^s \\ y_1 \bar{\ell}_1^s/\alpha p & \text{for } c^d > c^s \end{cases}$$

$$(de/dw)_{CC} = (1 - \beta)y_1 \ell_1^s - c_1^d$$

On reasonable assumptions, both will be decreasing throughout, i.e. the curves will be concave downwards, as shown. Note that $\bar{\ell}_1^s \leq \ell_1^s$ means that the slope of BB is also reduced by excess demand for consumption goods.

The concave shape of course assumes that both curves begin with positive slopes. For BB, this is ensured if $\ell_1^s > 0$ for sufficiently low w, which is reasonable; BB then peaks where $\ell_1^s = 0$ or $\bar{\ell}_1^s = 0$ (as the case may be), which we can assume does occur at sufficiently high w. For CC, the shape shown means that given g, net output available for export (in excess of consumption demand) first rises with w and ℓ, then falls as both diminishing returns to labour and (eventually) a backward-bending labour supply set in (more than offsetting any fall in c_1^d). If s_o is not so large as to cover both g and $c^d(\underline{w})$ at $\underline{w}$ sufficiently low that labour supply and output go to zero, then CC must start from the horizontal axis at some positive wage.

Where BB starts depends on $\bar{B}/P_e$, and given g, we may have no intersection of BB and CC, as shown in Figures 3-5.

Figure 3

Figure 4

Figure 5

In Figures 3 and 4, BB is above CC throughout. Given g, the balance of trade target cannot be satisfied without excess demand in the consumption goods market; alternatively, g must be reduced to allow simultaneous attainment of internal and external balance. Note that this could occur for $\bar{B} \gtrless 0$. In Figure 5, the target $\bar{B}$ is so "slack" that it can be satisfied for any permissible w without pushing consumption below household demand (this could occur only for $\bar{B} < 0$). In such a case, the planners would doubtless raise g or $\bar{B}$ or both.

Considering equilibria (intersections of the two curves), we can rule out any point to the left of the peak of CC. In Figure 6, the planners would be foolish to stop at E' - they could raise the wage and get to E with the balance of trade target and home market equilibrium still satisfied, but with higher consumption for the same g.

Figure 6

At any intersection to the right of the peak of CC, if $\ell_1^s > 0$, then CC is falling while BB is still rising. If $\ell_1^s < 0$, then $(1 - \beta) > > (1/\alpha p)$ implies

$$(1 - \beta)y_1\ell_1^s - c_1^d < (1/\alpha p)y_1\ell_1^s ,$$

so that CC is still steeper than BB, and CC must cut BB from above.

Thus we consider the situation shown in Figure 7. In region I, there is excess demand for consumption goods and the balance of trade is below target; in region II, excess demand but overfulfilment of the trade balance target; in region III, excess supply of consumption goods and overfulfilment of the trade balance target; and in region IV, excess supply with the balance of trade below target.

Figure 7

It will be clear that for given g, the policy mix needed to attain E is not unambiguously determined by the region in which the system's initial position lies. The obvious policy rule, to reduce (raise) the wage when there is excess demand for (supply of) consumption goods while raising (reducing) exports when the balance of trade is below (above) target, will ultimately converge on E along a counterclockwise path; but it will in general involve "overshooting" first one, then the other objective. Thus the diagram shows that no simple assignment rule is correct, and indeed it suggests that neither policy has a clear comparative advantage for one or the other target.

A third policy, changing government expenditure, can be represented by shifting the CC curve vertically: down for $dg > 0$, up for $dg < 0$. Starting at an equilibrium like E, an increase in g will mean that internal and external balance can now be simultaneously achieved only by reducing both the wage rate and exports (the original E becomes a point on the boundary between regions I and II).

Parameter changes can also be represented easily with this apparatus::

(i) $d\bar{B} > 0$ shifts BB upwards, reducing equilibrium w and raising equilibrium e. The original equilibrium is now a point on the I-IV boundary. If the planners raise e to get back to BB but do not simultaneously reduce w sufficiently there will be excess demand for consumption goods (region I). The conflict between internal and external balance is evident.

(ii) $dP_i > 0$ or $dP_e < 0$ (either implying $dp < 0$) or any combination giving a deterioration of the terms of trade will also shift BB upwards, with the same consequences as $d\bar{B} > 0$. An improvement

in the terms of trade will make the initial equilibrium a point on the II-III boundary. Note that if the planners adjust w and e so as to maintain equilibrium with constant g, we shall observe $\partial e/\partial P_e < 0$, but the elasticity will in general exceed minus one (algebraically): the improvement in the terms of trade allows an increase in the wage, consumption, and output, hence requiring some increase in imports, so exports cannot fall as much as their price has risen if the trade balance target is to continue to be fulfilled. Nor will the elasticity of demand for imports be zero, as some analyses suggest (on all this, see Holzman, 1968). If the price of imports rises, w, c, ℓ, and q will in general have to fall for internal and external balance to be maintained, so i will be reduced as well.

(iii) Uniform world inflation, i.e. an equiproportionate rise in P_e and P_i, keeping p constant, will have different effects according as $\bar{B} \gtrless 0$. For $\bar{B} > 0$, a targeted trade surplus, BB shifts down, so equilibrium w rises and e falls; the real value of the target denominated in foreign currency has fallen. But for $\bar{B} < 0$, with no policy change the money value of the deficit would rise and exceed the target, so to fulfill it (and maintain equilibrium on the home market) w must fall and e rise - BB shifts upwards. We might of course conjecture that the planners would in these circumstances adjust the target $\bar{B}$.

(iv) $ds_o > 0$ has formally the same effects as $dg < 0$: CC shifts upwards.

(v) $dm_o > 0$ implies a fall in labour supply, so both BB and CC shift downwards. Equilibrium e falls (with output), but a bit of algebra is needed to demonstrate that equilibrium w

falls too, which is not evident from the diagram. With unchanged policies, the system goes into region II, with $c^d > c^s$ and $B > \bar{B}$.

(vi) $dk_o > 0$ shifts $y(\cdot)$ upwards, so both BB and CC shift upwards. Equilibrium e rises, and again it can be shown algebraically that equilibrium w also rises.

Thus the BB-CC curve apparatus depicts clearly both the relationships between policy variables and the effects of policies and parameter changes on the economy. It summarises both internal mechanisms of adjustment to external shocks and the responses of foreign trade variables to domestic events.

VI. Plan Implementation and Quantity-Constrained Equilibria

Although there can be no rigid separation between plan construction and implementation for a CPE, the model and tools we have developed so far are ostensibly concerned only with plan construction. But these plans are the basis for the planners' actions during the plan period. These actions determine some observed variables directly, others through interaction with the household sector and exogenous events.

Here we sketch briefly our approach to modelling what happens during the plan period. A detailed exposition for the closed economy case is given in Portes (1978b), and foreign trade raises no fundamentally new problems.

In plan implementation, we suppose the planners directly control g, w, ℓ^d, c^s, i, and e. Actual values of ℓ, c, q, and s are determined in the complete model, where q is endogenous in the short run. Households

control ℓ^s and c^d; observed $c = \min(c^d, c^s)$ and $\ell = \min(\ell^d, \ell^s)$. Output depends on ℓ, but ℓ^s may depend on c, which in turn (if $c = c^s$) may depend on q, because we argue that actual c^s depends on the planned consumption goods supply, actual output, and actually observed initial inventories and household real balances:

$$(24) \qquad c^s = c^s(q;\ c^p, m_o, s_o)$$

Thus there may be a tâtonnement on quantities to determine actual output, consumption, and employment.

Imports will simply be proportional to output: actual $i = q/\alpha$. The supply of goods for export, on the other hand, we may suppose is adjusted to short-run exigencies in the manner of consumption goods supply:

$$(25) \qquad e = e(q, P_e, P_i;\ e^p, m_o, s_o)$$

It is reasonable to assume that the short-run effects on e will be similar to those suggested by the analysis of the previous section:

$$\partial e/\partial q > 0, \quad \partial e/\partial P_e < 0, \quad \partial e/\partial P_i > 0, \quad \partial e/\partial m_o < 0, \quad \partial e/\partial s_o > 0.$$

There will be four possible constraint regimes, corresponding to the various combinations of excess supply and demand in the goods and labour markets. The actual quantity-constrained equilibrium attained during the period may leave excess demand or supply in either market. It is however a key assumption that the planners' demand for labour be unaffected by excess supply in the consumption goods market: if $c^s > c^d$, they are willing to accumulate the resulting extra inventories without adjusting output or any other variable during the current period. On the other hand, the short-run

adjustments of c^s and e indicated in (24) and (25) imply that actual inventories act as a buffer in this respect as well.

But imbalances appearing during the period will affect the initial conditions for the construction of next period's plan. Thus if inventories are depleted, $s^e < \beta q$ will require correspondingly more planned inventory accumulation for next period; $c^d > c^s$ will affect household real balances, hence m^e; the actual balance of trade will depend on actual i, e, P_i, and P_e, and the planners' expectation of the outcome for this period B^e will affect next period's plan. All these equilibrating mechanisms operating through planners' behaviour are embodied in the model of Section IV.

VII. Extensions

The BB and CC curves facilitate the analysis of the macroeconomics of an open CPE and its adjustment mechanisms with the simple model of Section IV. It seems likely that this apparatus and the conclusions drawn from it would be fairly robust to some obvious relaxations of the simplifying assumptions we have made.

The given balance of trade target is fundamental to the model. Yet we might imagine that the planners would be inclined to vary the target itself according to how much "pressure" they perceive on the economy - e.g., to be willing to seek additional foreign credits if the terms of trade deteriorate, if they decide to undertake a major investment drive, or if household consumption aspirations are manifested in a threatening way. We might then wish to incorporate some external limit on such borrowing.

Foreign borrowing itself suggests introducing other current account transactions besides merchandise trade, in particular, interest payments.

We might wish to represent foreign demand and supply conditions with quantity constraints on exports and imports, or at least with non-horizontal demand and supply schedules.

We could easily relax the assumption of a fixed-coefficients technology, with little effect on our results. For example, we could allow substitution between the imported input and domestic value added in a linearly homogeneous production function

$$(4a) \quad q = \phi(y,i) = yf(i/y) \ ,$$

with i/y depending on foreign sector conditions:

$$(4b) \quad i/y = h(\bar{B},P_i,P_e) \ , \quad h_1 < 0, \quad h_2 < 0, \quad h_3 > 0 \ .$$

Then if we write $f[h(\cdot)] = H(\cdot)$, equation (15) becomes

$$(15a) \quad -(dg/dc)_{F=0} = 1 - [(1-\beta)H(\cdot) - (1/p^e)h(\cdot)]y_1\ell_1^s/c_1^d \ .$$

This together with another step towards realism, allowing imports of consumer goods, would introduce B_{-1}, P_i, P_e, and m_o into the short-run import demand function. But these are directions for future research, as is the study of dynamic paths of the system modelled here.

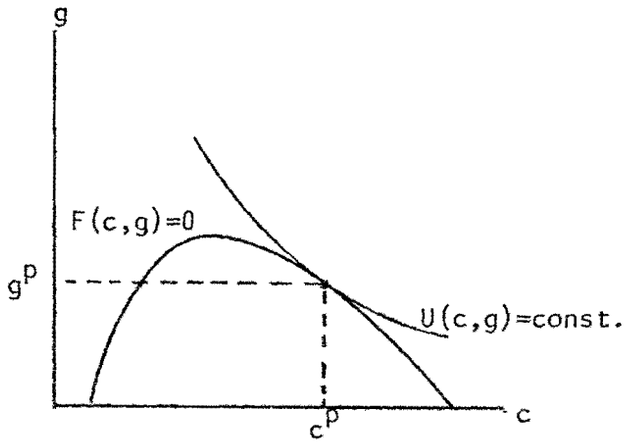


FIGURE 1

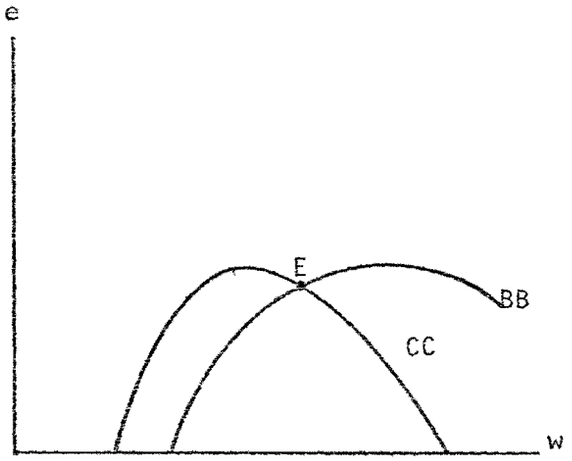


FIGURE 2

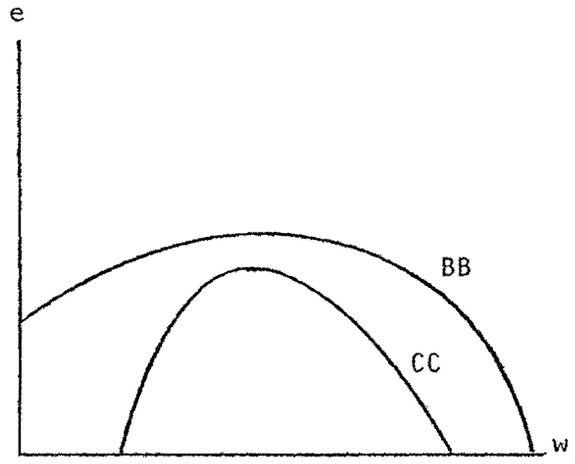


FIGURE 3

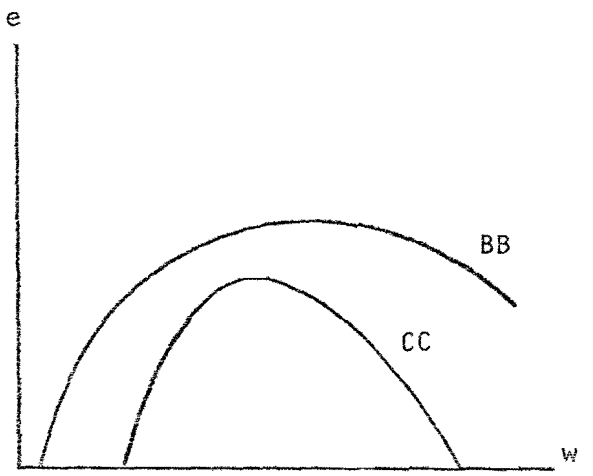
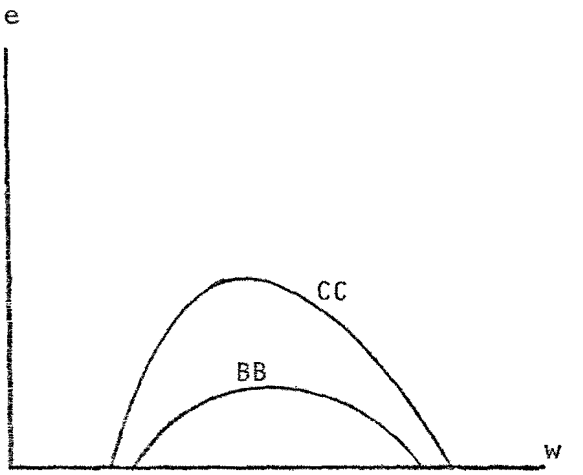


FIGURE 4



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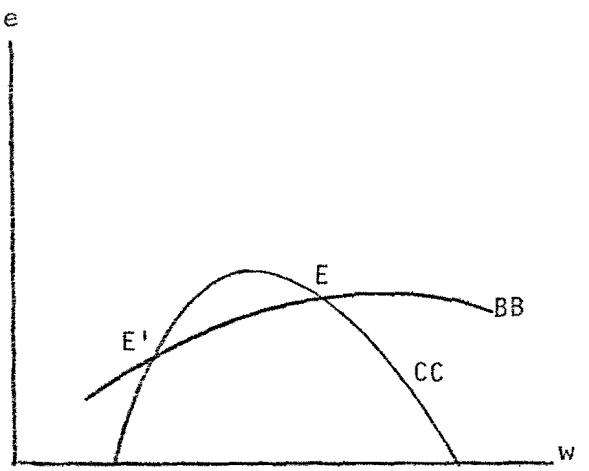

FIGURE 6

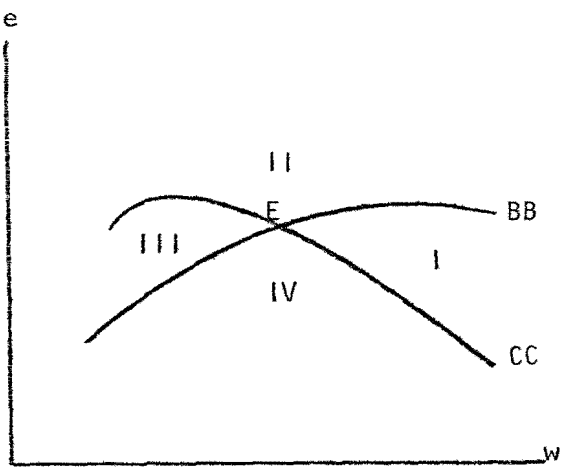

FIGURE 7

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