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INTERTEMPORAL DISEQUILIBRIUM IN AN OPEN ECONOMY

Michael J. Moore and J. Peter Neary

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**Intertemporal Disequilibrium in an Open Economy**

1. Introduction

The existing literature on small-open-economy disequilibrium models has made important contributions to our understanding of the causes and likely cures for non-price rationing in open economies. However, insufficient attention has been paid to the intertemporal aspect of behaviour and this has made it difficult to analyse some open-economy issues, notably the determination of the current account. This study attempts to fill that gap in a diagramatically tractable way building on the work of Neary and Stiglitz (1983).

Probably the major analytic insight which existing open-economy disequilibrium models have contributed is a refinement and clarification of the term 'small open economy'. It has come to be realised that this term implies two distinct assumptions: world prices for traded goods must be fixed and it must be possible to purchase and sell unlimited quantities at these prices. The early and highly influential paper by Dixit (1978) made both these assumptions and in addition allowed no role for non-traded goods. As a result, the model exhibits very 'Classical' properties: because agents never face constraints in the goods markets, unemployment is always of the Classical kind, in the sense that it must fall if real wages are cut. Increased government spending is powerless to influence the level of domestic activity in such an underemployed economy.
and leads only to an equal deterioration of the current account.

The possibility of Keynesian unemployment, and so a role for demand management policy, re-emerges if any form of goods market constraint is introduced. This may be in the form of a non-traded good, the price of which is sticky, as in the model of Neary (1980) which attempted to provide micro-foundations for the Salter-Swan model. Alternatively, it may be in the form of an export sales constraint as in Steigum (1980), Cuddington (1980) and Bruno (1982). In both cases the model under consideration is one of a small open economy, but the failure of goods markets to clear introduces elements of the closed-economy Barro-Grossman-Malinvaud model.

However, disequilibrium models of open economies have not kept pace with the recent revival of interest in intertemporal issues by equilibrium theorists. (See, for example, Dornbusch (1983), Obstfeld (1980) and (1982), Razin and Svennson (1983) and Sachs (1982).) One exception is the work of van Wijnbergen (1983) which is closely related to our second model below. Indeed, it has proved surprisingly difficult to extend even closed-economy fixprice models beyond a single time period in a manner which is both rigorous and at the same time readily accessible for policy analysis. Muellbauer and Portes (1978) stressed the importance of this issue but did not present an operational technique for dealing with it. Neary and Stiglitz were the first to construct and give diagrammatic exposition to
an explicitly intertemporal rationing model. They extended the Barro-Grossman model to a many period setting with the innovation of rational constraint expectations. Benassy (1983) covers similar ground but considers future constraints in the goods market only. In addition, future prices and constraints are determined by current variables, in a manner similar to that of Hildenbrand and Hildenbrand (1978).

In the present paper, we make a start at bridging the gap between one-period disequilibrium models and intertemporal equilibrium models of small open economies. The plan of the paper is as follows: Section 2 extends the Dixit framework, which allows for disequilibrium in labour markets only, to two periods. In Section 3, the one-good assumption of Dixit is relaxed and an exogenous export sales constraint is introduced. Section 4 summarises the results and notes directions for future research.
2. A Simple Model

We first construct the simple model of this section's title by developing a 2-period version of Dixit i.e there are no possibilities for goods market constraints. Unlike Dixit, there is no money because as no time periods beyond the second are contemplated, there is no need for end-period stocks to appear in the agents' objective functions.

2.1 The Agents

We consider in turn each of the three agents in the economy: the firm, the household and the government.

(i) The Firm

The treatment of the single aggregate firm is very similar to Neary and Stiglitz particularly with regard to investment and behaviour under conditions of quantity constraints. The reader is referred to that paper, especially the appendix, for a full exposition.

The firm's decision problem is to maximise the present value of profits in the two periods:

\[ \Pi = \pi + \Pi \]  \hspace{1cm} (2.1)

We adopt the convention throughout of using lowercase letters for the first period, uppercase for the second period and script for variables referring to both periods. In the first period, the firm has to decide its level of employment, e, which determines its output x through the
production function $f(e)$. In addition it must decide what portion of its output to hold over as investment, $i$, to the second period. Using $p$ and $w$ to denote the current price and wage rate respectively, first-period profits are:

$$\Pi = p(x-i) - we \quad (2.2)$$

Similarly, second period profits are:

$$\Pi' = PX - WE \quad (2.3)$$

where $X = F(E, i)$ is output in the next period and $P$ and $W$ are in (present value terms) the subjectively certain point expectations of second period prices. Thus a discount rate is implicit in all future variables; for this model however, it is convenient to suppress it.

Given that labour and capital are technological complements, the behavioural functions of the firm are summarised in (2.4) to (2.7). The signs beneath the variables denote the signs of the partial derivatives.

$$e = e(p, w) \quad (2.4)$$

$$i = i(p, P, W) \quad (2.5)$$

$$E = E(p, P, W) \quad (2.6)$$

These in turn imply a current sales function:
\[ y = y(p,w,p,w) = f[e(p,w)] - i(p,P,W) \quad (2.7) \]

(ii) The Household

We assume there is a single aggregate household which derives utility from consumption in both periods. Labour supply is assumed fixed. The objective of the household is to maximise:

\[ U = U(c,C) \quad (2.8) \]

subject to:

\[ pc + PC = Y \quad (2.9) \]

\( Y \) is lifetime household income, i.e., wealth: its relationship to the firm's production is discussed below. The household budget must be balanced over two periods. The excess of current income over current consumption in period \( t \) is assumed to be saved in the form of foreign bonds which pay an exogenous nominal rate of interest \( r \). Thus (2.9) is derived from:

\[ pc + s = py - t \quad (2.10) \]

and

\[ PC = PY + (1+r)s - T \quad (2.11) \]

where a bar over a variable denotes the expected value of a future variable expressed in future spot prices. Thus:
\[ P = \frac{\bar{P}}{1+r} \]  

(2.12)

where \( t \) and \( \bar{t} \) are defined as current and future lump-sum taxes on households, respectively, and \( s \) is the household's accumulation of foreign assets. The outcome of this decision-making process are the household's demand for goods functions for each period:

\[
\begin{align*}
  c &= c(p, P, \bar{Y}) \\
  c &= c(p, P, \bar{Y})
\end{align*}
\]  

(2.13)

It is assumed that goods in both periods are normal and that present and future goods are gross substitutes.

Next we must relate household wealth to the value of production. Household income in each period equals wage income and profits less taxes. This in turn equals the value of production (net of taxes) less the value of current output carried forward for investment purposes:

\[
Y = \bar{Y} + \text{NET} + WE \bar{Y} - J = p(x - i) + \text{PX} - J
\]  

(2.14)

Note that when the economy is in full Walrasian equilibrium

---

1. Strictly speaking, Neary and Stiglitz (1983) should have subtracted investment from the value of current output in computing household wealth. However, their results are not substantially affected by this omission because of the envelope theorem result given in (2.16).
(i.e. full employment prevails in both periods), (2.14) can be rewritten:

\[ Y = \pi[f(1) - i(p, P, W)] + \mathcal{P}[L, i(p, P, W)] - \mathcal{J} \quad (2.15) \]

The total differential of (2.15) is:

\[ dY = (x - i)dp + XdP \quad (2.16) \]

(2.16) follows from the first order condition, \( \mathcal{P} \pi = p \), which states that the marginal product of capital is equal to (one plus) the real interest rate. Thus, by the envelope theorem, wealth is unaffected by the optimal adjustment of investment when the firm faces no goods-market constraints.

(iii) The Government

The Government can make purchases of the good in both periods. This must be financed by taxation though there is no requirement that the budget must be balanced within each period. A budget surplus leads to the accumulation of foreign bonds and conversely in the case of a deficit. However, the government faces the intertemporal budget constraint:

\[ \mathcal{J} = t + T = pg + PG \quad (2.17) \]

(2.17) can be interpreted as the condition that the present value of government foreign borrowing is zero. We have
explicitly assumed that the household perfectly foresees future taxes. We have also assumed that the market for the foreign bond is perfect so that government and household face the same rate of interest. Thus the manner in which public spending is financed does not alter behaviour. 'The Ricardian equivalence theorem' is much favoured by exponents of the equilibrium theory of the business cycle eg., Barro (1974). It has been contested by Feldstein (1976), Buchanan (1976) and most notably by Tobin (1980). We have decided to incorporate it here so as to follow the thesis of Neary and Stiglitz that disequilibrium models are perfectly consistent with rational expectations.

Substituting (2.17) into the household budget constraint (2.9) and noting that \( y = x-1 \), we obtain:

\[
p[x-(c+i+g)] + P[X-(C+G)] = 0 \quad (2.18)
\]

The two bracketed terms in (2.18) are the current account surpluses \( b \) and \( B \), in periods 1 and 2, respectively, equal to output less absorption. The equality states that these must be equal and opposite in sign, i.e., that the present value of the stream of surpluses and deficits must be zero.

2.2 Walrasian Equilibrium

We are now ready to illustrate equilibrium assuming the labour market clears in both periods. The conditions for this are given by the labour market equilibrium loci (LMEL) for each period:
LMEL_1: \[ l = e(p,w) \] (2.19)

LMEL_2: \[ L = E(p,P,W) \] (2.20)

Since \( p \) and \( P \) are given to a small open economy, it is convenient to illustrate the general equilibrium in \((w,W)\) space. As figure 1 shows, this takes an especially simple form reflecting the fact that, for given prices, only one wage rate in each period is consistent with full employment. The labels in the four regions denote the different types of incipient disequilibrium: e.g., ESL_1 signifies excess supply of labour in the first period.

Even in Walrasian equilibrium, the first period current account is not, in general, balanced. Since there is no money in the model and the only asset is a foreign bond, it is not meaningful to define a foreign exchange market. Thus, there is no exchange rate to balance the current account. The condition for balance is:

BT_1: \[ x(p,w) = c(p,P,Y) + i(p,P,W) + g \] (2.21)

To locate BT_1 in figure 1, we note that an increase in \( w \) cuts output leaving absorption unchanged thus tending to cause a deficit. An increase in \( W \) cuts investment without affecting output or the other components of demand, thereby causing a surplus. Consumption is not disturbed by wage changes because of our Walrasian assumption of full employment in both periods. Thus \( w \) and \( W \) must move in the
FIGURE 1: WALRA SIAN EQUILIBRIUM
WITH CURRENT ACCOUNT SURPLUS
same direction to secure current account balance. $BT_1$ is upward sloping in $(w,W)$ space with slope:

$$-y_w^*/y_W$$  \hspace{1cm} (2.22)

Above $BT_1$ a surplus prevails and conversely below. Figure 1 is drawn under the assumption that a surplus prevails at the Walrasian equilibrium.

The interesting comparative statics exercise is to examine the effect of a temporary devaluation, i.e., a change in the intertemporal terms of trade. It is diagrammatically convenient to consider an anticipated future devaluation i.e. an increase in $P$: this can also be interpreted as a fall in the world interest rate. From (2.19) it is clear that this has no effect on the current labour market equilibrium. From (2.20) $W$ adjusts upwards more than proportionately to clear the second period labour market. The new equilibrium is along $LMEL^*_2$ in figure 2. In the goods market, only the demand side is affected by a change in $P$, from (2.21), and the effect on the surplus, $b$, is:

$$\frac{\partial b}{\partial P} = -[\{c_P + c_Y(b)\} + \{i_P + i_WdW/dP\}] \hspace{1cm} (2.23)$$

The first bracketed term relates to consumption and implies that households will increase spending unless behaviour is dominated by a sufficiently large initial deficit. The effect on investment is not immediately transparent because
FIGURE 2: EFFECT OF ANTICIPATED DEVALUATION IN WALRA SIAN EQUILIBRIUM
of the need to take account of the changes in future wages which are required to clear the second period labour market. We recall the first order condition:

\[ PF_i = p \quad (2.24) \]

Noting that \( W \) adjusts to keep second-period employment constant in Walrasian equilibrium, the total differential of (2.24) is:

\[ F_i \, dp + PF_{ii} \, di = 0 \quad (2.25) \]

From (2.25) investment unambiguously rises in (2.23) so that overall, demand rises and the surplus is cut as a consequence of an anticipated future devaluation. In figure 2, the current account is initially balanced at the Walrasian Equilibrium. Following the increase in \( P \), the \( BT_1 \) locus shifts upwards to its new position \( BT_1^* \). The important feature which has emerged is that \( BT_1 \) shifts upwards more than \( LMEL_2 \) so that the new Walrasian equilibrium lies in the zone of current account deficits.

2. It is well known that the effect of a devaluation depends on the initial state of the current account. We abstract from this problem and assume throughout the discussion that such effects can be neglected.
FIGURE 3: EFFECTIVE EQUILIBRIA WITH WALRA SIAN EXPECTATIONS
2.3 Effective Equilibria with Walrasian Expectations

To examine effective equilibria we categorise expectations in the same way as Neary and Stiglitz (1983). Walrasian expectations describe the situation where agents expect all markets to clear in future periods. If rationing in future periods is expected, agents will take account of the expected future constraints: expectations are rational in a deterministic model if agents have perfect foresight about these constraints. The latter case of rational constraint expectations is the subject of the next section. In the present section, we re-examine the results of section 2.2 when there is rationing in the labour market in the current period with Walrasian expectations about the second period.

The current wage $w$ is fixed exogenously so that the labour market does not, in general, clear in the first period. The future wage $W$ continues to be flexible: otherwise Walrasian expectations are irrational. The labour market equilibrium loci (2.19) and (2.20) are unchanged: figure 3 differs from figure 1 only in the specification of the $BT_1$ locus.

To the right of the $LME_1$ in figure 1, $BT_1$ lies in a region of first period excess supply of labour. Thus household income is at less than full employment level and consumption is correspondingly reduced. In moving from notional to effective equilibria, $BT_1$ pivots downwards, as in figure 3, expanding the area of current account surplus. The slope of $BT_1$ ($ESL_1$) is:
FIGURE 4: EFFECT OF ANTICIPATED DEVALUATION ON EFFECTIVE EQUILIBRIA WITH WALRA SIAN EXPECTATIONS.
\[-y_w(1-pc_y)/y_w\] (2.26)

(2.26) is obviously a smaller slope than (2.22) if the marginal propensity to consume \(pc_y\) is less than 1. The remainder of \(BT_1\) which lies to the left of the \(LMEL_1\) in figure 1, lies in the region of current labour shortage. The firm is constrained, output is reduced so the area of current deficit is expanded. In fact, the balance of trade locus in the region of current labour shortage, \(BT_1\), \((EDL_1)\) is independent of the level of the current wage \(w\), and is horizontal as in figure 3.

It can be easily verified that the comparative statics conclusions which applied in the Walrasian case remain unchanged when there is current rationing with Walrasian expectations. Indeed, (2.23) continues to be the relevant expression describing the effect of an anticipated future devaluation on the current surplus. This is illustrated in figure 4. Starting from the position where \(BT_1\) goes through \(Z\), the Walrasian Equilibrium, the effective equilibrium can lie anywhere along \(LMEL_2\), depending on the level of current wages. Labour shortage coincides with current account balance whilst high wage levels lead to unemployment and current account deficit. Following an increase in \(P\), both \(LMEL_2\) and \(BT_1\) shift upwards to new positions at \(LMEL_2^*\) and \(BT_1^*\) respectively. The new equilibrium lies along \(LMEL_2^*\) and implies a current deficit irrespective of the value of \(w\).
FIGURE 5: EFFECTIVE EQUILIBRIA WITH RATIONAL CONSTRAINT EXPECTATIONS
2.4 Effective equilibria with rational constraint expectations

It is now possible to examine the effect of rationing in both periods on figures 1 and 3. Both the current and the future wages \( w \) and \( W \) are exogenously determined. Since there are no goods markets constraints, the labour market equilibrium loci (2.19) and (2.20) continue to remain unchanged. Indeed, \((w,W)\) space is partitioned into four regions corresponding to all four possible combinations of current and future effective disequilibrium in the labour market. In figure 5, \( U_i \) and \( R_i \) indicate unemployment and labour shortage respectively in period \( i \).

The status of the balance of trade locus \( BT_1 \) needs to be examined separately in each of the zones of figure 5. North-West of the Walrasian equilibrium is the zone of current and expected future unemployment. Thus household wealth and consequently consumption are even lower than the case illustrated in figures 3 and 4. The area of current account surplus is expanded yet again and \( BT_1 \) pivots downwards further. The slope of \( BT_1 \) in the \( U_1U_2 \) region can be derived using the properties of the multi-period profit function of Neary and Stiglitz (1983):

\[
-\frac{y_w(1-pc_y)}{y_w-pc_y(E_w W/P)} \tag{2.27}
\]

(2.27) is less than (2.26) because \( E_w \) is negative. In figure 6, iso-current account loci with slope (2.27) have been drawn in the \( U_1U_2 \) region.
FIGURE 6: RATIONAL CONSTRAINT EXPECTATIONS
AND ISO-CURRENT ACCOUNT LOCI

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North-East of the Walrasian equilibrium in figures 5 and 6 is the region of current labour shortage and expected future unemployment. Because of the labour shortage in the current period, neither output nor wealth are affected by changes in the current wage \( w \). Thus \( BT_1 \) is horizontal in \( R_1U_2 \) and horizontal iso-current account loci have been added to figure 6. South-West of \( Z \) in figure 5, current unemployment coincides with expected labour shortage. Investment is constrained by the shortage of labour in the second period and is not affected by changes in \( W \), the future wage rate. For the same reason, wealth and thus consumption are also independent of \( W \): therefore the iso-current account loci in the \( U_1R_2 \) region have been drawn as vertical lines in figure 6. The final region is one of labour shortage in both periods and is located south-east of \( Z \). The current account is independent of \( w \) because output is determined by the labour supply as in \( R_1U_2 \); it is independent of \( W \) because investment and thus wealth are constrained by the expected future labour shortage as in \( U_1R_2 \). Therefore the current account throughout the region \( R_1R_2 \) in figure 6 is at the same level as that prevailing at the Walrasian Equilibrium. In figure 6, an increase in \( P \) causes the contour map to shift to the North-East, leading to a reduction in the current account surplus. As in the previous sections, the first period labour market is unaffected and the \( LME_2 \) is shifted upwards. However, a new feature is that expectations about the future labour market are affected.
Starting from Walrasian equilibrium, for example, a rise in \( P \) induces an expected labour shortage. More intuitively, if unemployment is initially expected, an anticipated future devaluation makes it less likely to occur.
3. A 2-Good Model with Export Determined Rationing

3.1 Notional Equilibrium

As it stands the one good model presented in Section 2 is limited: unemployment is always of the classical variety as in Dixit (1978). We reinterpret the model in a two good framework where the consumer now chooses between a domestically produced exportable and a non-competing importable good. The following table conveniently summarises our notation:

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<tr>
<th>Quantities</th>
<th>Prices</th>
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<tr>
<td>Production</td>
<td>Consumption</td>
</tr>
<tr>
<td>Exportable</td>
<td>$x, X$</td>
</tr>
<tr>
<td>Importable</td>
<td>$-</td>
</tr>
<tr>
<td>Total</td>
<td>$x, X$</td>
</tr>
</tbody>
</table>

We make current goods and future goods homothetically separable: this allows the construction of consistent per-period price indices: $p(1,q)$ and $P(D, DQ)$ are, in fact, unit utility expenditure functions (See Razin and Svensson (1983)). If we further assume homogeneous separability, this enables us to suppress $D$ and the intertemporal structure of the present model becomes directly comparable with that of section 2.

$$P(D, DQ) = DP(1, Q) = p(1,Q) \quad (3.1)$$
FIGURE 7: ISO EXPORT LOCI IN 2-GOOD MODEL
The expressions for total consumption in the table, c and C represent nominal values eg.,

$$c = c^X + q_c^m = p(1, q)z \quad (3.2)$$

where $z(p(1, q), P(1, Q), \ldots)$ is the real current demand for goods schedule in period 1. Homogeneous separability implies that real current consumption and real future consumption are net substitutes. It is also assumed that the components of current consumption are individually net substitutes for future consumption.

There is no change in the conditions of production which were described in connection with the model of section 2. The notional equilibrium can still be shown by means of figure 1. However, we now have an additional equilibrium condition: the market for the domestic good must clear in each period. Thus figure 1 is reconstructed in figure 7 without the BT locus (which is unchanged) but incorporating the goods market equilibrium locus for period 1, GMEL_1. The slope of GMEL_1 is given by (2.22) which is also the slope of BT_1. However unlike BT_1, GMEL_1 must go through Z, the Walrasian equilibrium. In fact, even in the notional case, goods market equilibrium is secured by quantity adjustment. Since the firm faces a perfectly elastic demand schedule for its exports, the volume of exports can be viewed as a residual which rises or falls, as required, to clear the goods market. GMEL and GMEL are parallel to GMEL_1 and are iso-export lines.
representing lower and higher levels of exports respectively.

3.2 Effective Equilibria

If there is a first-period boom or slump in world demand which is (correctly) believed to be temporary, so that first-period world prices do not change, the market for the domestically produced good does not clear. If there is a slump, the firm faces an export sales constraint at therasian equilibrium and the notional GMEL can be understood to have shifted to the south-east to, say, GMEL in figure 7. If there is a boom so that the firm must serve the needs of the export market before the domestic market, GMEL is the relevant locus. In both cases, the exogenous determination of exports has the effect of rationing domestic agents who must recalculate their decision functions in all markets. 

Throughout the discussion which follows, we will depart from Neary and Stiglitz (1983), who consider goods market constraints on the firm as sales constraints net of investment. Like Van Wijnbergen (1983), we will consider investment as a sale by the firm to itself so that, in the present model, an export sales constraint is a constraint on the output of the firm. There is a definite loss of generality in this simplification: for example, the firm cannot be simultaneously rationed in both the labour and goods markets in the same period: i.e. an underconsumption regime is ruled out. However the model is more conceptually
transparent and computationally tractable.

In figures 8(a) and 8(b), effective loci have been drawn on the assumption that the firm rationally expects all markets to clear in the second period. Figure 8(b) corresponds to an export slump as represented by GMEL in figure 7. That segment of GMEL which is to the right of A in figure 7, lies in conditions of current unemployment: household income is reduced, thus restricting domestic consumer demand so GMEL pivots to the right with slope:

$$-Y_w(1-c_Y^x)/y_w$$ (3.3)

This is shown in figure 8(b) where B lies to the left of the effective GMEL. (3.3) is similar to (2.26), the difference arising from the disaggregated nature of the present model. That part of LMEL that lies below A in figure 7 lies in conditions of excess demand for goods but it remains independent of W because the household's labour supply is fixed. Finally GMEL to the left of A and LMEL that lies above A collapse into a single locus which is independent of w. In figure 8(b) (w,W) space is divided into three disequilibrium regions which are labelled K, C and R using the notation which has been popularised by Malinvaud. It should be noted that the three effective loci do not intersect at the Walrasian equilibrium but at A in figure 7 which corresponds to the same current wage but a lower future wage. Figure 8(a) is constructed in a similar way except that the three effective loci intersect above LMEL at the point
FIGURE 8 (a): EXPORT SALES CONSTRAINT IN 2-GOOD MODEL

FIGURE 8 (b): EXPORT BOOM IN 2-GOOD MODEL
corresponding to C in figure 7.

Unlike most such diagrams which have appeared in the fix-price literature, figures 8(a) and 8(b) are not spaces of possible temporary equilibria. Only certain points are meaningful equilibria because of the assumption that all markets clear in the second period. It is obvious, in fact, that the equilibrium must lie along the LME{sub}L{sub}2. In figure 8(a), this is the locus HI so that the region of Keynesian Unemployment cannot arise when there is an export sales boom. If w is flexible it is reasonable to suppose that it will adjust to the Walrasian equilibrium level Z, thus clearing both present and future labour markets but leaving households in conditions of excess demand for goods.

However, it is figure 8(b) which is most interesting. Equilibrium must lie on the locus EFG so that first-period full employment can never be attained even if present and future wages are perfectly flexible i.e. the full measure of price flexibility which is present in the notional case of figure 7. The disequilibrium represented in figure 8(b) arises not from domestic wage stickiness but from the price-taking behaviour of a small open economy which is faced with an export sales constraint. In the Keynesian region between E and F, employment is constant at a level below full employment. This is because aggregate demand is independent of w since profits are instantaneously distributed from (2.10). To the right of F, in the classical region, employment falls monotonically even further below this level. In fact, full employment can only be
attained if $W$ falls, boosting investment demand and thus relaxing the hold of the export sales constraint on current output. But $W$ does not fall because it adjusts to clear the second-period labour market.

If the economy starts in a position of Walrasian equilibrium at $Z$, it is difficult to argue convincingly as to how the current wage would respond to the imposition of the export sales constraint. If $w$ adjusted to $F$, the goods market would clear but it seems incredible that wages could rise in conditions of excess of supply of labour, unless the notional labour equilibrium were unstable. It seems likely that the wage rate would remain sufficiently low to maintain the economy in Keynesian unemployment unless wage adjustment were determined by completely exogenous factors.

3.3 Iso-Current Account Loci

Not surprisingly, the introduction of goods market rationing changes the position of the iso-current account loci. Since the level of exports is exogenously determined, these coincide with iso-import contours. In the $K$ region, imports can only change if wealth changes, given $p$ and $P$. However, since current output is independent of $w$ within this region, so also is wealth and iso-current account lines are horizontal in figures 8(a) and 8(b). If $W$ increases, investment falls reducing aggregate demand and thus output, wealth and imports: the higher $W$, the larger the current account surplus. In both the $C$ and $R$ regions, the consumer is rationed in the market for the domestic good. Since current exportables and importables are net substitutes,
this is most likely to lead to forced consumption of current importables. In R, the firm is experiencing a labour shortage so that output, wealth and thus imports are again independent of w. A rise in W also increases the surplus but for a different reason: it cuts investment, relaxes the goods market constraint and reduces the forced consumption of imports. In the classical region, imports respond to changes in W in exactly the same way as under repressed inflation. However, the impact of w is more complex: it has two effects. Firstly, a rise in the current wage cuts output, wealth and imports directly. On the other hand, a fall in output tightens the goods market constraint and forces increased consumption of imports. The net effect is given in (3.4):

$$\frac{\partial c^m}{\partial w} = x_w (c^m_x + c^m_y)$$ (3.4)

3. As Neary and Roberts (1980) point out, net substitution is not sufficient for this result. The shortage of domestic goods means that their virtual price has risen cutting real income. This could lead to a cut in the demand for importables if the income elasticity were sufficiently high, even if the two current goods were net substitutes. However, in this case, continuity demands that we rule out this possibility if the iso-current account loci are to be readily interpreted.
where \( c^m_x \) is the rate of change of imports with respect to increased availability of domestic goods. However from Neary and Roberts (1980) and Geary and Morishima (1973), (3.4) is zero if current exports are weakly separable from all other goods, which is assumed. Thus the iso-current account loci in C are independent of \( w \) as in the other regions. Figure 9 is constructed from figure 8(b) with the iso-current contours drawn as horizontal dotted lines.

3.4 Comparative statics: Changes in the Discount rate

The LMEL(EDG) is independent of future variables and is not affected by changes in the intertemporal terms of trade. Along the GMEL(ESL), investment and the household's demand for current exportables increase if future goods become more expensive. Since current output depends on first-period variables only, it follows that the GMEL(ESL) is shifted upwards. For similar reasons, the 'joint locus' is also shifted upwards thereby contracting the region of Keynesian unemployment. This is shown in figure 9 where the original loci of figure 8(b) are represented by scored lines and the new loci by heavy lines.

The effect of an increase in \( P \) on the iso-current loci of figure 9 is also easy to deduce: it is sufficient to restrict attention to imports. In all regions, consumption of the importable is boosted directly as current goods become relatively cheaper. This is reinforced in the C and R regions by the fact that investment rises tightening the shortage of the domestic good and increasing the forced consumption of the importable. In the K region, output is
FIGURE 9: ISO CURRENT ACCOUNT LOCI AND EFFECT OF FISCAL POLICY IN 2-GOOD MODEL
demand-determined and is increased by a multiplier effect through the domestic goods market: thus wealth and imports also increase in this way. So, an increase in $P$ deteriorates the current account in all regions and causes the entire set of iso-current loci in figure 9 to shift upwards.

3.5 Comparative Statics: Fiscal Policy

Since future taxes are perfectly foreseen, in accordance with the discussion on the Ricardian equivalence theorem in Section 2, all increases in government spending, whether temporary or permanent, are balanced budget increases. The interesting case is where changes in government spending mean changes in government purchases of the domestic good. An increase in current government purchases of the importable does not relax any of domestic constraints directly. Of course, it leads to an actual or foreseen extra tax burden which cuts wealth, thereby expanding the region of keynesian unemployment in figure 9. It also leads to a deterioration of the current account in all regions.

An increase in current government purchases of the domestic good leaves the LMEL(EDG) in figure 9 unchanged since the demand for labour along the locus is supply-determined. Along the GMEL(ESL), aggregate demand is increased directly but private consumption of the domestic good is depressed by the anticipation of tax increases. The direct effect dominates so long as the marginal propensity to consume current exportables is less than unity: this is
assured by our assumption that all goods are normal. Thus GMEL(ESL) is shifted upwards. The 'joint locus' shifts upwards for the same reason and the region of keynesian unemployment contracts as shown in figure 9.

The unusual prediction of this model relates to the impact of fiscal policy on the current account. In the K region, an increase in current government spending on the domestic good does not change wealth. This is because though output is increased by the amount of the increase in government spending, the present value of expected taxes is also increased by the same amount. Thus, from (2.14) wealth is unchanged and imports do not rise. Since exports are exogenous, the fiscal exercise that we have described has no effect on the current account. In the other constraint regimes, the same result holds. In both the C and R regions, output is not affected by changes in government spending. However, an increase in government purchases of the domestic good tightens the shortage of that good and tends to increase forced consumption of importables. At the same time, the anticipation of higher taxes cuts wealth which in turn depresses the demand for imports. The net effect on imports is governed by the sign of the bracketed term in (3.4). It has already been pointed out that this expression is zero under certain assumptions with regard to separability. Thus the effect of changes in government spending on the domestic good is to leave the iso-current account contours in figure 9 unchanged.
4. Conclusion

This paper has examined two disequilibrium models of a small open economy which make explicit the links between periods implied by capital accumulation and current account imbalances. In section 2, it was shown that unemployment can still only be of the classical variety if the simple rationing model of an open economy is reinterpreted intertemporally. By contrast, the model of Section 3 demonstrated that an export sales constraint alone can give rise to Keynesian unemployment even if domestic wages are perfectly flexible. An unusual feature of the model is that agents have perfect foresight, the equivalent of rational expectations in a deterministic model. While perfect foresight does not eliminate the possibility of Keynesian unemployment, it reduces the effectiveness of demand management policy: for example, the government expenditure multiplier on output in conditions of Keynesian unemployment is only unity. Nevertheless fiscal policy emerges as potentially more effective in a small open economy than has been believed heretofore. Because of the 'Ricardian equivalence theorem', the policy can have no effect on the current account in certain circumstances.

The model has a number of obvious limitations. There are no domestic financial assets; and no provision has been made for an intermediate good in production, though Van Wijnbergen (1983) substantially remedies the latter. An obvious extension of the model is to study the effect of changes in the terms of trade. Recently, there has been a
revival of interest in the impact of changes in the terms of trade on the current account. (See Obstfeld (1982) and Razin and Svennson (1983).) This has focussed on a critique of Laursen and Metzler (1950) and Harberger (1950) who argued that a deterioration in the terms of trade causes a deterioration in the current account. A notable feature of the recent debate has been the failure to appreciate that Laursen, Metzler and Harberger were writing in an explicitly Keynesian context. This will be the subject of a later paper.
References


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