DISCUSSION PAPER

Report No. DRD112

Macro-Economic Aspects of the Effectiveness of Foreign Aid: on the Two-Gap Model, Home Goods Disequilibrium and Real Exchange Rate Misalignment

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September 1984

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Macro-Economic Aspects of the Effectiveness of
Foreign Aid: on the Two-Cap Model, Home Goods
Disequilibrium and Real Exchange Rate Misalignment

by

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Abstract

We construct an open economy disequilibrium model to assess the welfare effects of aid in different macroeconomic regimes. Aid is shown to have different effects in different unemployment regimes because it increases the social costs of wage-price rigidities in the classical regime but decreases them in the Keynesian unemployment regime. A link is made with the two-gap model, but we highlight the role of real exchange rate misalignment (failure to clear the NT goods market).
1. Introduction

Aid flows to LDCs have to an increasing degree become a victim of the fiscal and employment problems plaguing most OECD countries. Both bilateral and unilateral aid (as a share of donor GDP) have declined since the sixties (World Bank (1983)).

This has led to renewed concern about the effectiveness of aid. Renewed, since that issue was very much at the forefront of Development Economics in the fifties and sixties. In particular, Chenery and various collaborators in a series of papers developed and applied the "Two-Gap Model", the focus of which is effectiveness of aid (in terms of increased output aid allows) in different macro-economic regimes. 1/ This is also the issue we discuss in this paper.

The two-gap model has been (and still is) applied to more countries than any other model with the possible exception of Polak's version of the basic monetary approach model (Polak (1957)). It nevertheless has not been integrated into modern international economics and has always been under a cloud because the model's dependence on seemingly ad hoc building blocks has prevented its use for explicit welfare statements. Moreover the formulation typically used in applications was in the international-macro tradition of the time by completely ignoring relative prices, thereby turning the focus away from the real exchange rate as the crucial variable influencing the effectiveness of aid. 2/

Findlay (1973, 1984) criticized the two gap literature for its neglect of relative prices. That point is of course well taken if the two gap

1/ An influential application of the Two-Gap framework is Chenery and Bruno (1962); see Bacha (1982) for a recent treatment.
2/ Clearly several contributors to the Two-Gap literature were aware of the important role of the exchange rate. They did not highlight it, presumably because of elasticity-pessimism inspired doubts about the effectiveness of exchange rate changes of practically acceptable size.
approach is used in a medium or long term growth context (as is very often done); it is hard to believe in fixed relative prices as a long run phenomenon. On the other hand short run wage rigidities are at the core of many macroeconomic problems, especially in LDCs. Here we explicitly introduce wage-price rigidities, but in a short-run macroeconomic context, where it is, in our view, a plausible assumption.

In this paper we return to the issue of macroeconomic aspects of effectiveness of aid, highlighting the role of real exchange rate misalignment (a precise definition of which is provided in the context of a disequilibrium model). We demonstrate in a reinterpretation of the two-gap model, that an ex-ante wedge between Saving gap (income minus expenditure and Trade gap (current account) implies ex ante home goods market disequilibrium. The binding Trade gap corresponds to excess supply of home goods and therefore Keynesian Unemployment; a binding Savings gap to excess demand for home goods and therefore to Classical Unemployment.

We then construct a simple open economy disequilibrium model (a similar model is used by Neary (1980) and van Wijnbergen (1984b), to rigorously incorporate the consequences of disequilibrium on private behavior, and trace the welfare effects of aid in the different macroeconomic regimes wage-price rigidities give rise to.

We finally reformulate the expressions for welfare effects in different regimes so obtained, to suggest a second best type interpretation of the differential welfare effects of aid: those effects equal the benefits that would obtain in a market clearing world plus a term measuring the impact of aid on the social cost of the price rigidities/distortions. That extra term is positive in the Trade gap-Keynesian unemployment regime, but negative in the Savings Gap-Classical unemployment regime.
We conclude by suggesting some simple formula's based on our general expressions; these hopefully make the results easier to implement in practice.

2. A Disequilibrium Open Economy Model

Saving gap corresponds to ex-ante income minus expenditure and Trade gap to the ex ante Current Account. 1/ The equality of these two concepts, an equality which is the cornerstone of much of modern open economy macroeconomics (Dornbusch (1980)), fails to hold if the level of NT goods prices is such that the NT goods market does not clear.

The basic point is easily made. Define $Y$ as income in terms of traded goods, $A$ as total expenditure, also in terms of $T$-goods: The value of output of $T$-goods is $Y_T$ ($Y_N$ for NT goods). The Savings gap then equals Income minus Expenditure $Y - A$ and the Trade gap $Y_T - A_T$, the excess of $T$-goods production over $T$-goods consumption. Simple accounting tells us that

$$(\text{Ex ante}) \text{ Savings gap} = Y - A$$

$$= Y_N + Y_T - A_N - A_T$$

$$= (Y_T - A_N) + Y_T - A_T$$

$$= Y_N - A_N + (\text{ex ante}) \text{ Trade gap}$$

This implies that the central point of the two-gap literature, the possibility of a difference between the savings gap and the trade gap is tantamount to positing the possibility of a difference between ex ante demand and supply in the NT goods market, and explains why persistence of such a "gap differential" is possible if for one reason or another the real exchange rate can not be changed sufficiently.

1/ In the absence of interest payments, which are irrelevant for the present analysis. They will therefore be ignored in what follows.
We will demonstrate the differential impact of foreign aid in different goods market regimes using a simple disequilibrium model allowing for NT goods market disequilibrium. The static framework adopted here (a one period model) is a limitation. On the other hand a dynamic extension is straightforward and would not alter the main point. The reader who is not convinced should consult my paper on the Shadow Price of Foreign Exchange (van Wijnbergen (1984c)) where such a dynamic extension is provided.

The model used here is in many ways different from the familiar two-gap model (cf. Chenery and Bruno (1962), or for a more recent treatment Bacha (1982)): there are two production sectors instead of one and no investment or intermediate imports. These can be introduced at little costs in terms of increased complexity, but would not affect the deeper reason for differential impact of aid, which, as we argue below, consists of home goods disequilibrium because of a misaligned real exchange rate.

In view of the short run nature of the analysis we assume in what follows a Ricardo-Viner structure with sector-specific capital and introduce the possibility of labor and goods market disequilibrium by assuming wage-price rigidity. There are two sectors in the economy, producing T goods and NT goods respectively. The production structure is described using a revenue function; a revenue function gives the maximum revenue from efficient production given relative prices and factors use:

\[ R = R(Q, l; L) \]  

(1)

where \( Q \) is the relative price of NT goods in terms of T-goods (the real exchange rate) and \( L \) is labor used. Capital stocks in each sector are fixed and left out of the list of arguments for notational convenience.

The labor demand curve is derived from the requirement that the marginal value product of labor should equal the wage:
\[ R_L = W \] 

or

\[ L = L(W, Q), \quad L_W = R_{LL}^{-1} < 0, \quad L_Q = -R_{LQ}/R_{LL} > 0 \]

The Rybczynsky term \( R_{LQ} \) is always positive in Ricardo-Viner models. \( W \) is the real Traded Product Wage.

Similarly expenditure behavior is described using an expenditure function; the expenditure function gives the minimum expenditure needed to achieve welfare level \( U \), given relative prices:

\[ E = E(Q, l; U) \]

\( E \) is the Hicksian demand function for NT goods. Investment cannot be satisfactorily dealt with in this static framework so we ignore it. A full intertemporal version of this model is used for the discussion of the Shadow Price of Foreign Exchange in van Wijnbergen (1984c).

The budget constraint is

\[ R(Q, l; L(W, Q)) + F = E(Q, l; U) \]

with \( F \) representing aid.

To construct the disequilibrium model consider first labor market equilibrium under excess demand for NT goods. In that situation firms can sell whatever they want and will therefore be on their notional (i.e. unconstrained) demand curve for labor along the labor market equilibrium schedule NN. We furthermore assume a fixed labor supply. This leads to a
labor market equilibrium schedule under excess demand for NT goods (to the left of the Walrasian equilibrium A in figure 3.1):

$$\bar{L} = L(W, Q)$$  \hspace{1cm} (5)

Equation (5) corresponds to LL in figure 1. LL is positively sloped in LL space:

$$\frac{dW}{dQ} \bigg|_{LL} = R_{LQ} > 0$$  \hspace{1cm} (6)

The rationale is simple: an increase in Q given W does not affect labor demand in the T sector but increases it in the NT sector. To get back to equilibrium an increase in W is called for. This increase in W is less than proportional to the increase in Q since, contrary to Q, W affects labor demand in both sectors. Formally this implies that

$$0 < \frac{Q}{W} \frac{dW}{dQ} = \frac{Q}{W} R_{LQ} < 1$$

Consider next the NT goods market schedule under excess supply of labor:

$$R_Q (Q, 1; L(W, Q)) = E_Q (Q, 1; U)$$  \hspace{1cm} (7)

or

$$\frac{dW}{dQ} \bigg|_{NN} = R_{QL} - \frac{(R_{QQ} - E_{QQ}) R_{LL}}{R_{QL}} > R_{QL} > 0$$

or the NN schedule (to the North of A) is also positive and steeper than LL. 1/

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1/ Because of concavity of $E$ in prices and $R$ in factor use, and convexity of $R$ in prices ($E_{QQ}, R_{LL} < 0, R_{QQ} > 0$).
The goods market equilibrium schedule under excess demand for labor and the labor market schedule under excess supply of goods collapse into one schedule (LN in figure 1) in models without inventories, since a regime between the two schedules would be characterized by double rationing of firms, which is incompatible with rational firm behaviors. Firms cannot have excess demand for labor if they cannot even sell the output of the currently employed labor force. \(^2\) The LN schedule is negatively sloped but need not concern us since it plays no role in the analysis that follows.

3. Welfare Effects of Aid

3.1 Consider now the effects of foreign aid. We first look at the impact of aid on the market clearing values of the real exchange rate and the real wage.

The effect of an increase in foreign aid on the schedules discussed in section 2 is straightforward; \(T\) does not affect labor markets directly (i.e. for given \(W\) and \(Q\)), therefore the LL schedule does not shift.

Goods markets of course are affected by an increase in aid, since aid comes in the form of traded goods (or assets easily convertible in such goods) but will partially be spent on NT goods:

\[
\frac{dQ}{dF} \bigg|_{NN} = \frac{C_N}{R QQ - E QQ - R LQ^2/R LQ} > 0 \quad (8)
\]

\(C_N\) is the marginal expenditure propensity on NT goods (\(C_N = E_{QU}/E_{U}\)). This represents an outward shift. Aid causes the Walrasian equilibrium to shift out from A to B in figure 1, with a higher real exchange rate and a higher real traded product wage.

\(^2\) See van Wijnbergen (1984b) for a qualification which we will ignore since it involves implausible rationing schemes on labor markets.
This point may be worth stressing: substantial amounts of aid will put upwards pressure on the real exchange rate and will in that way counteract the export promotion schemes often recommended by the aid donors. This is especially important in the plausible case of substantial but temporary aid. The problems that may arise are familiar from the literature on the Dutch Disease in countries enjoying temporary oil revenues (cf. van Wijnbergen (1984a,b)).

One result from that literature also applies to aid recipients. In countries without good access to international capital markets (this applies therefore to most major aid recipients!) temporary aid will lead to a temporary increase in expenditure and therefore to a temporary real appreciation. This draws resources into the NT sector and therefore leads to a temporary decline in Traded goods sector output. If that sector is characterized by infant industry type Learning by Doing externalities, production subsidies \( l \) to \( T \)-goods producers should be increased during the time the temporary real appreciation lasts (van Wijnbergen (1984a)).

3.2 To assess differential effects of aid in different macro regimes we need to spell out the mechanics of the economy in the different disequilibrium macro-regimes.

In the \( K \)-region, the real exchange rate is too high for commodity market clearing, leading to demand determined output:

\[
X_N = E_Q (Q, l; U) \tag{9a}
\]

Furthermore, the budget constraint is:

\[
Q X_N + R_T + F = E(Q, l, U) \tag{9b}
\]

\( l \) There is no case for temporary tariff protection, since that would also lead to unnecessary distortions on the consumption side.
However a more unified treatment across regimes is possible if we use
the Neary-Roberts (1982) concept of virtual prices, i.e. the price at which
rations are willingly consumed or, where relevant, produced. That leads to a
reformulation of (9a, b):

\[ R_Q(Q, l; W, Q) = E_Q(Q, l; U) \]  \hspace{1cm} (10a)

\[ R(Q, l; W, Q) + (Q - \bar{Q}) R_Q + F = E(Q, l; U) \]  \hspace{1cm} (10b)

\( \bar{Q} \) is the "virtual" exchange rate, the \( \bar{Q} \) at which producers would willingly
supply the quantity \( \bar{X}_N = E_Q(Q, l, U) \). The virtual rate only enters on the
producers side since consumers are not rationed in the goods market in the K-
region.

We talk of real exchange rate misalignment whenever \( \bar{Q} = Q \) i.e.
whenever the real exchange rate fails to clear the NT goods market, giving
rise to either Keynesian unemployment \( Q > \bar{Q} \) or overvaluation) or Classical
unemployment \( Q < \bar{Q} \) or undervaluation \( 1/\).

Furthermore the budget constraint holds at actual, not virtual
prices; therefore a correction term \( (Q - \bar{Q}) \bar{Q} \) is needed in the budget
constraint since is evaluated at the virtual and not the actual rate, while
the budget constraint holds at actual prices.

Clearly the "virtual" real exchange rate \( \bar{Q} \) is below the actual one
in the K-region since output is demand determined. Therefore the actual real
exchange rate is overvalued, it exceeds the virtual exchange rate \( \bar{Q} \). In the
Keynesian overvaluation regime there is excess demand for T-goods since their
actual price \( 1/Q \) is below the market clearing "virtual" price \( 1/\bar{Q} \). The

\( 1/ \bar{Q} > Q \) is also compatible with repressed inflation. We confine ourselves
to unemployment regimes however.
counterpart of that is excess supply (and therefore demand determined output) of Non Traded goods.

Accordingly aid has higher welfare effects in this regime than it has in Walrasian equilibrium. Formally this can be seen by differentiating (10a) and (10b) to get:

\[
\frac{dU}{dF} \bigg|_K = E_U^{-1} + \left( \frac{E_U^{-1} C_N}{1 - C_N (Q - \bar{Q}_K)} \right) (Q - \bar{Q}_K)
\]

\[
= E_U^{-1} + \phi (Q - \bar{Q}_K) > E_U^{-1}
\]  \hspace{1cm} (11)

The latter inequality holds since \( C_N Q < 1 \) (it is the budget share spent on NT goods on the margin). So the welfare effect of a unit of aid \((dU/dF)\) equals the marginal utility of income \(E_U^{-1}\) plus a term proportional to the misalignment of the exchange rate \((Q - \bar{Q})\), which is positive in the \(K\)-regime, or in Chenery terminology, the regime where the Trade Gap is binding. In full equilibrium the welfare effect of aid just equals the marginal utility of income \(E_U^{-1}\).

Another way of looking at it is to note that in the \(K\)-region aid pushes the virtual rate \(\bar{Q}\) closer to the actual rate \(Q\):

\[
\frac{d\bar{Q}}{dF} \bigg|_K = \frac{C_N}{(1 - C_N (Q - \bar{Q})) R_{QQ} + R_{QL} L_Q} > 0
\]  \hspace{1cm} (12)

and therefore reduces the distortionary costs associated with the misaligned, overvalued exchange rate and the associated Keynesian unemployment.

Consider now the other regime, where unemployment is classical. Here NT output is supply determined because the real exchange rate is too low given the real product wage \(W\). This implies that the savings gap is binding (cf. section 2).
Since NT output is supply determined in this regime, consumers are rationed:

\[ R_Q = E_Q (\bar{Q}_C, 1, U) < E_Q (Q, 1, U) \]  \hfill (13a)

with the virtual exchange rate \( \bar{Q} \) therefore above the actual exchange rate \( Q \).

The budget constraint now becomes:

\[ R + F = E(\bar{Q}_C, 1; U) + (Q - \bar{Q}_C) E_Q \]  \hfill (13b)

with a correction term \( (Q - \bar{Q}_C) E_Q \) since the budget constraint holds at actual, not at virtual prices.

Simple differentiation once again shows that in this macro-economic regime the effectiveness of aid deviates from the Walrasian term \( E_U^{-1} \):

\[
\frac{dU}{d\bar{F}} \bigg|_C = E_U^{-1} + \frac{E_U^{-1} C_N}{(1 - C_N (Q - Q_C))} (Q - \bar{Q}_C) < E_U^{-1} \]  \hfill (14)

The inequality obtains because in this regime consumers are rationed, so that \( \bar{Q} > Q \), the actual exchange rate \( Q \) is "too low" (i.e. below \( \bar{Q}_C \)) to clear the market. \( \bar{Q}_C \) is determined by equation (13a). Since

\[ E_Q (\bar{Q}_C, 1, U) < E_Q (Q, 1, U) \Rightarrow \bar{Q}_C > Q \]

Once again, the intuition is simple: in the classical or savings gap regime, there is excess demand for NT goods, the production of which is now supply determined (cf (13a)). The mirror image of that is excess supply of T-goods and therefore reduced effectiveness of aid since that comes in the form of T-goods (or assets easily exchangeable for such goods).
Of course aid still pushes up the virtual exchange rate $\bar{Q}_C$:

$$\frac{d\bar{Q}_C}{dF} = \frac{-C_N}{(1 - C_N (Q - \bar{Q}_C))^2} E_{QQ} > 0$$

(15)

since concavity of $E$ implies $E_{QQ} < 0$.

This also suggest another interpretation of the difference between the Walrasian effect $E_{U}^{-1}$ and $\left.\frac{dU}{dF}\right|_{C}$, similar to the explanation of this wedge in the $K$-region. In the $C$-region, the exchange rate $Q$ is already too low in that $Q < \bar{Q}_C$; aid pushes up $\bar{Q}_C$ and so increases the distortionary costs of the exchange rate misalignment in this macro-economic regime (a cost which, in Harberger fashion, is proportional to $(Q - \bar{Q}_C)^2$). Accordingly the welfare effect of aid in the saving-gap/Classical Unemployment regime is below the Walrasian welfare effect $E_{U}^{-1}$ and therefore also below the welfare effect of aid in the Trade-gap/Keynesian unemployment regime:

$$\left.\frac{dU}{dF}\right|_{K} = E_{U}^{-1} + \phi_K(Q - \bar{Q}_K) > E_{U}^{-1}$$

$$> E_{U}^{-1} + \phi_C(Q - \bar{Q}_C) = \left.\frac{dU}{dF}\right|_{C}$$

(16)

(16) is not easily applied in practice. First of all it is probably more convenient to assess the welfare effects of aid in terms of the extra consumption it allows, since no judgment on the curvature of $U$ is needed in that case (although inter-country comparison would bring that problem back in if per capita consumption levels are very different). Therefore we look at:

$$E_U \frac{dU}{dF} = 1 + \bar{\phi}_i (Q - \bar{Q}_i) \ i \ = \ C, K$$

$$\bar{\phi}_i = (1 - C_N (Q - \bar{Q}_i))^{-1}$$

(17)
C_nQ, the marginal budget share of NT goods is a number that can easily be obtained. Remains the problem of evaluating the virtual exchange rate \( \bar{Q}_1 \). Two cases need to be distinguished, the K and C regime. Assume a decision is made on which regime is relevant (more on that below).

Consider first the Keynesian Regime. There the virtual exchange rate \( \bar{Q} \) follows from:

\[
E_Q = R_Q (\bar{Q}_K, 1; L(W, Q_K))
\]

\[
= R_Q (Q, 1; L(W, Q)) + (R_{QQ} + R_{QL} L_Q) (\bar{Q}_K - Q)
\]

or

\[
\frac{\bar{Q}_K - Q}{Q} = \frac{E_Q - R_Q (Q, \ldots)}{R_Q (Q, \ldots)} \frac{Q(R_{QQ} + R_{QL} L_Q)}{R_Q (Q, \ldots)}
\]

or percentage overvaluation is equal to the Okun-gap (excess capacity at given real traded product wage \( W \)) as a share of capacity output \( R_Q (Q, \ldots) \), divided by the total supply elasticity of NT goods.

The Classical regime presents more difficulties. There \( Q \) is determined by

\[
R_Q (Q, W) = E_Q (\bar{Q}_C, 1, U)
\]

\[
= E_Q (Q, 1, U) + E_{QQ} (\bar{Q}_C - Q)
\]

or

\[
\frac{\bar{Q}_C - Q}{Q} = \frac{E_Q (Q, 1, U) - R_Q}{E_Q (Q, 1, U)} \frac{(-\varepsilon_Q)}{(-\varepsilon_Q)}
\]
$e^D_Q$ is the **demand** elasticity of NT goods. $R_Q$ is actual output of NT goods. The hard part is $E_Q(Q, l, U)$, the demand for NT goods at the actual exchange rate $Q$, since $E_Q(Q, l, U)$ is unobservable in this regime.

A somewhat loose short cut could be based on the observation that this regime is characterized by excess demand for NT goods. An unusual (i.e. above trend) inventory decumulation might be a reasonable approximation of $E_Q(Q, l; U) - R_Q$. This is loose since inventories are not incorporated in this model and cannot reasonable be introduced without also introducing uncertainty. Moreover such indicators are not available for large NT sectors like electricity generation. Other, more indirect indicators may be available in such sectors.

Finally how do we decide whether we are in the Keynesian or Classical regime? In most, if not all, LDCs a full fledged non-linear maximum likelihood estimation 1/ which would allow probability statements on whether $K$ or $C$ unemployment obtains, is out of the question. Some indirect indicators could, once again somewhat loosely, be derived from the observation that the $C$-region is characterized by excess demand for home goods and the $K$-region by excess supply. A proper intertemporal specification will show that the $C$-region will have an **appreciating** real exchange rate while the $K$-region has an overvalued but **depreciating** real exchange rate (see van Wijnbergen (1984c)).

Similarly one expects inventories to fall more than trend in the $C$-region and rise more than trend in the $K$-region.

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1/ That is needed if we want to determine regimes based on data available; linear estimators are only available if we determine sample separation across regimes a priori.
4. **Conclusion**

We have analyzed macro-economic aspects of the welfare effects of foreign aid. First we point out the relevance of the literature on the "Dutch Disease": substantial but temporary aid flows will lead to temporary appreciation of the real exchange rate and will, therefore, ceteris paribus, lead to a decline in Traded goods production and exports.

We then construct a simple open economy disequilibrium model to assess the relation between different macro-economic regimes and the welfare effects of aid. Aid is shown to have different effects in different unemployment regimes (Classical and Keynesian), basically because it increases the costs of the wage-price rigidities in the classical regime, but decreases these costs in the K-region.

A link is made with the two gap model (Chenery and Bruno (1962)) by demonstrating that the K-region with excess supply of Non-Traded goods and therefore excess demand for Traded goods correspond to what that literature refers to as the regime with a binding trade gap. Similarly, the C-region with excess demand for NT goods and accordingly excess supply of traded goods correspond to the regime often referred to as one where the savings gap binds.

Another way of looking at it is to note that in the K-region the real exchange rate is overvalued; since increased aid increases the equilibrium (NT goods market clearing) exchange rate, the discrepancy between the actual and market clearing real exchange rate goes down, thereby reducing the distortionary cost of the price rigidity (which is proportional to the square of that discrepancy), and so increasing the welfare effects of aid.

In the classical regime however the actual exchange rate is below the market clearing one (there is excess demand for NT goods), so here aid
increases the discrepancy between the actual and equilibrium real exchange rate, reducing the welfare effects of aid in that regime.

We finish by providing some simple versions of the formula's for the welfare effects of aid in different regimes that should help in empirically applying this framework.
References


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Figure 1  Effects of an increase in foreign aid