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AID VERSUS TRADE REVISITED: DONOR AND RECIPIENT POLICIES IN THE PRESENCE OF LEARNING-BY-DOING*

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We examine the (non) equivalence of aid and trade preferences as alternative forms of donor assistance in the presence of learning-by-doing externalities in recipient-country export production. Using a model based on van Wijnbergen (1985), we show that switching donor support on the margin from aid to trade preferences can increase recipient-country welfare. Simulations in which the productivity externality also interacts with private capital accumulation and fiscal distortions illustrate the potential growth and welfare gains from a revenue neutral re-orientation of donor assistance. We conclude by considering why these potential dynamic gains remain unexploited by both donors and recipients.

Developing and industrial countries are bound together by means of both aid and trade. Not surprisingly, therefore, the question of how to assess the relative value of these two types of transaction is a recurring one. In an influential early contribution, Johnson (1967), characterised developing-country trade regimes as excessively import-protecting and therefore as generating too little trade in equilibrium. The imports financed by a dollar of additional market access would be therefore worth more than the domestic resource cost of the exports, making 'trade' a potentially potent source of welfare improvements on the margin. But as Johnson pointed out, the recipient would clearly prefer to obtain the same imports at zero domestic resource cost, via aid. From the recipient's viewpoint, therefore, aid was unambiguously preferable to trade. A subsequent literature has appealed to aid-tying and other reductions in concessionality in largely unsuccessful attempts to overturn Johnson's presumption, for example, Thirlwall (1976), Yassin (1982), Mosley (1988), Morrissey and White (1996). Our view is that Johnson's analysis is subject to much more serious limitations as a framework for comparing aid to trade. The first is that it fails to place the discussion in a cost-benefit context. As emphasised by Kemp and Shimomura (1991) a meaningful discussion of policy alternatives requires that donor costs be explicitly weighed against the benefits to recipients. The second is that it abstracts from dynamic effects, and particularly from learning-by-doing externalities that are central to many contemporary treatments of trade and growth. We find that once these dimensions are incorporated, the balance shifts decisively in favour of market access (i.e. trade) rather than aid.

Our starting point is the observation that, other things equal, aid reduces export competitiveness in the recipient country by appreciating the real exchange rate. Van Wijnbergen (1985) used this observation to argue that aid to Africa should be

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conditional on the removal of policy biases against exports. We use this logic to shift the focus onto the policy choices of the donor rather than the recipient by developing a simple and obvious corollary, which is that a dollar of donor resources transferred to the recipient via the donor's own import liberalisation is better for the recipient's exports than a dollar transferred via grants. In the absence of distortions or distributional considerations, the effect on exports makes no difference for the recipient's welfare, and both donor and recipient are indifferent as to the form of assistance. But if there are externalities to exporting not internalised by an export subsidy, a shift from aid to trade can make *both* parties better off.

Concern with this is question is not merely academic. A striking feature of the Uruguay Round of trade negotiations was the almost complete absence of African countries at the bargaining table. At one level this absence was unremarkable: small trade volumes make many African countries uninteresting bargaining partners. But the situation is nonetheless unsettling. Presumably African countries have at least as much to gain from increased exports as do other countries. Although the empirical relevance of productivity spillovers from exporting is a matter of continuing debate (Clerides *et al.*, 1998; Bayoumi *et al.*, 1999), export promotion policies are widely regarded as having played an important role in the growth of East Asian countries (Westphal, 1990; Hobday, 1995; World Bank, 1993; Kraay, 1999). Recent empirical evidence suggests that export performance plays a critical role in African growth (Ndulu and Ndung'u, 1997) and that exposure to export markets increases productivity growth among African manufacturing firms (Bigsten *et al.*, 2000). Real exchange rate movements, in turn, have been found to exert a powerful influence on African export performance (van Wijnbergen, 1985; Bigsten *et al.*, 1999; Elbadawi, 1999; Sekkat and Varoudakis, 2000). Moreover, as GATT negotiations proceeded, African governments were receiving billions of dollars in grants and technical assistance conditional on liberalising their own import regimes. The logic of this paper suggests, first, that African countries should have been intensely interested in gaining trade concessions in developed country markets in return for their own reductions of trade barriers and, second, that some of the assistance flowing to Africa should have been devoted to strengthening Africa's engagement with the Uruguay Round.

The paper is structured as follows. In Sections 1 and 2 we develop a simple theoretical model to study the relationship between aid and 'open' trade preferences in the presence of learning-by-doing externalities.[1] We generate a set of presumptions about welfare comparisons in the context of a simple endowment economy. In Section 3 we use a more fully articulated CGE model of a stylised African economy to get a sense of the likely empirical magnitudes involved. To do so we disaggregate on the production and consumption sides, bring in savings and investment, and allow for a non-neutral tax structure to give meaning to distributional considerations. We then simulate the effects of a shift at the margin from

[1] An open or unrestricted preference is constrained only by country-of-origin restrictions and is thus equivalent to a terms of trade gain to a small recipient. This contrasts with a closed preference which is applicable to a fixed quantity of exports.

grants to tariff preferences. The results are striking; in circumstances where, for whatever reason, the learning-by-doing externality is not internalised by an appropriate export subsidy and depending on the calibration of the spillover effect and the structure of domestic taxation, this switch from aid to trade raises exports by between 5 and 8% over a 5-year horizon and by as much as 18% in the new steady state. The associated learning-by-doing spillovers contribute to a permanent welfare increase on the order of 5%.

That these results are sizeable poses a set of further questions that we explore in the final section, not the least of which is why such large efficiency gains are left on the table, either as a result of donors' trade policy choices or by recipient governments' unwillingness or inability to put in place appropriate export subsidies, or both. We appeal here to distributional considerations, arguing that these considerations increase both the supply of grants by donors and the demand for grants by recipients relative to trade preferences.

1. Static Effects of Aid and Trade Preferences

We consider a small open economy that produces and consumes a non-traded domestic good with price P_N and faces world prices P_X and P_M for its homogeneous export and import. Exports are not consumed at home and there is no competing production of imports. Capital stocks are sector-specific; a fixed endowment L of labour moves freely between sectors to equalise real consumption wages.

We begin by demonstrating the static equivalence of aid and tariff preferences in the absence of distortions. Using $Q = P_N/P_M$ and $Q_X = P_N/P_X$ to denote the real exchange rates for imports and exports respectively, then $T = Q/Q_X$ is the small country's terms of trade in international markets. Macroeconomic equilibrium holds when desired aggregate spending equals aggregate income at full employment and the trade balance is equal to the exogenously given aid inflow (there are no other international capital flows). Using revenue and expenditure functions (Dixit and Norman, 1980) we express this relationship as $E(P_N, P_M, U) = R(P_N, P_X; L) + P_M A$, or, normalising by the world price of imports as

$$E(Q, 1, U) = R(Q, T; L) + A \tag{1}$$

where A is aid measured in imports and U is utility. Using the subscript i to denote a partial derivative with respect to P_i, the supply and compensated demand functions for non-traded goods are given by E_Q and R_Q. The market-clearing condition in the non-traded goods market is therefore

$$E_Q(Q, 1, U) = R_Q(Q, T; L). \tag{2}$$

In what follows we suppress the labour supply argument in the revenue function. Taken together, (1) and (2) imply that the trade balance is equal to exogenously given aid flows: $E_M(Q,1,U) - TR_X(Q,T) = A$.

Turning to the donor we can consider two alternative ways of generating a transfer of amount $\mathrm{d}Z$. One way to do this is simply to increase grants by $\mathrm{d}A = \mathrm{d}Z$. Alternatively, however, the donor can reduce the tariff facing the recipient's export good. In doing so we assume that the donor calculates the 'transfer' value

of the trade preference as the recipient's revenue gain at the *original* export volume.[2] Measured in terms of the recipient's import good, this is $dP_X(R_X/P_M) = R_X\,dT$ (noting that $dP_M = 0$). The donor's budget constraint for alternative forms of the transfer is thus:

$$dZ = dA + R_X dT. \tag{3}$$

Totally differentiating (1), (2), and (3) yields the following expressions for utility and the real exchange rate for imports

$$\hat{U} = \frac{dZ}{UE_U}, \quad \hat{Q} = \frac{dZ}{(\Sigma_Q - \Delta_Q)E} + \left(\frac{\Sigma_Q}{\Sigma_Q - \Delta_Q}\right)\hat{T} \tag{4}$$

where $\Sigma_Q = QR_{QQ}/R_Q > 0$ and $\Delta_Q = QE_{QQ}/E_Q < 0$, and where $\hat{}$ denotes a proportional change. A transfer therefore generates an income effect that increases utility. Moreover, the recipient is indifferent as to whether the transfer comes in the form of aid or tariff preferences: only the total amount, dZ, affects utility. The response of the import real exchange rate, in contrast, depends on the form of the transfer. The spending effect of the transfer (the term involving dZ) appreciates the real exchange rate since part of the increased overall spending falls on non-traded goods. Tariff preferences, however, draw resources out of the non-traded good sector (the term involving $\hat{T}$), requiring a real appreciation (other things equal) to restore equilibrium. A terms-of-trade improvement therefore appreciates the real exchange rate for imports by more than an otherwise equivalent pure grant.

The effect of these developments on exports is fully summarised by the change in the real exchange rate for exports, Q_X. This is calculated as

$$\hat{Q}_X = \hat{Q} - \hat{T} = [(\Sigma_Q - \Delta_Q)E]^{-1} dZ + \left(\frac{\Delta_Q}{\Sigma_Q - \Delta_Q}\right)\hat{T}. \tag{5}$$

The spending effect of the transfer appreciates the real exchange rate for exports. Tariff preferences appreciate the real exchange rate by less than pure grants, however, since the demand elasticity Δ_Q is negative. It follows that tariff preferences unambiguously leave the recipient with higher exports than under an otherwise equivalent grant.

The net effect of tariff preferences on exports depends in a familiar way on the relative strength of income and substitution terms in (5). Substituting for dZ using (3), we get the following expression for the elasticity of the export real exchange rate with respect to trade preferences

$$\frac{\partial \ln Q_X}{\partial \ln T} = [(\Sigma_Q - \Delta_Q)E]^{-1}\left(\frac{TR_X}{E} + \Delta_Q\right). \tag{6}$$

[2] Hence we assume that the preference-receiving country is small relative to third-party exporters to the donor. The world price P_M is thus determined by the costs of the third-party exporters and the domestic price of the good in the donor country is $(1 + \tau)P_M$ where τ is the tariff. Assuming the recipient is small relative to other exporters allows us to ignore third-party welfare effects arising from trade diversion.

The real exchange rate for exports therefore depreciates (and exports rise) if substitution on the demand side is sufficiently high relative to the impact effect of the transfer on real income.

2. Dynamic Spillovers and Export Subsidies

To incorporate dynamic issues we consider the effects of temporary transfers in a two-period extension of the above model inspired by van Wijnbergen (1985). Using upper-case letters to refer to first-period values and lower-case to refer to second-period values, we assume that firms in the export sector benefit from learning-by-doing spillovers that are sector-specific but not appropriable by individual firms. Exports and income in period 2 therefore depend not only on the real exchange rate for exports, q, but also on first-period exports: denoting exports and GDP in period 2 by $r_t(q, t, R_X)$ and $r(q, t, R_X)$, we will assume $r_{qR} < 0$, $r_{tR} > 0$ and $r_R > 0$.[3] Letting S be the subsidy per unit (measured in imported goods) given to exports in the first period, so that $T + S$ is the price facing producers, the equilibrium conditions become:

$$E(Q, 1, U) = R(Q, T + S) + A - SR_X \tag{7}$$

$$E_Q(Q, 1, U) = R_Q(Q, T + S) \tag{8}$$

$$e(q, 1, u) = r(q, 1, R_X) \tag{9}$$

$$e_q(q, 1, u) = r_q(q, 1, R_X) \tag{10}$$

where we have set the (exogenous and fixed) second-period terms of trade equal to 1. As before, tariff preferences amount to an improvement in the first-period terms of trade. Note that we are assuming zero capital mobility, so that the trade balance is exogenously determined by aid flows. This means that learning-by-doing provides the only inter-temporal linkage in the model. Closing the capital account tends to reduce the optimal subsidy, because a liquidity-constrained aid recipient wants to shift consumption to the present. The most important impact of imperfect capital mobility for our purposes, however, is to generate a clear link between the temporary component of aid and the optimal degree of export promotion. The model brings this out dramatically by fully closing the capital account and concentrating aid in the first period.

Totally differentiating (7)–(10), we solve for the endogenous variables Q, U, q and u in terms of A and T and the subsidy rate S as follows:

$$E_U \mathrm{d}U = \mathrm{d}A + R_X \mathrm{d}T - S[R_{XQ}\mathrm{d}Q + R_{XX}(\mathrm{d}T + \mathrm{d}S)] \tag{11}$$

[3] Spillovers therefore create a biased shift in the production possibility frontier for period 2, so that at fixed relative prices the output of non-traded goods actually falls (the Rybczynski Theorem).

$$\Lambda \mathrm{d}Q = \frac{\alpha_N}{Q}(\mathrm{d}A + R_X \mathrm{d}T) - (1 - \alpha_N s)R_{QX}(\mathrm{d}T + \mathrm{d}S) \tag{12}$$

$$e_u \mathrm{d}u = r_R[R_{XQ}\mathrm{d}Q + R_{XX}(\mathrm{d}T + \mathrm{d}S)] \tag{13}$$

$$\lambda \mathrm{d}q = \gamma \frac{r_R}{q}[R_{XQ}\mathrm{d}Q + R_{XX}(\mathrm{d}T + \mathrm{d}S)] \tag{14}$$

where $\Lambda = (1 - \alpha_{NS})R_{QQ} - E_{QQ} > 0,\ 0 < \alpha_N = QE_{QU}/E_U < 1,\ 0 \leq s = S/(S+T) < 1$, $\lambda = r_{qq} - e_{qq} > 0$ and $\gamma = (qe_{qu}/e_u) - (qr_{qR}/r_R) > 0$.

Since export spillovers are the only inter-temporal linkage in the model, (11) and (12) fully determine $\mathrm{d}U$ and $\mathrm{d}Q$ as functions of $\mathrm{d}A$, $\mathrm{d}T$ and $\mathrm{d}S$.[4] Equation (11) solves for $\mathrm{d}U$ using the first-period income – expenditure equation (7); (12) then solves for $\mathrm{d}Q$ using (11) and the non-traded goods market-clearing equation (8).

Consider first the effect of $\mathrm{d}A$, $\mathrm{d}T$ and $\mathrm{d}S$ on first-period relative prices, (12). The income effect of a transfer appreciates the real exchange rate for imports in proportion to the marginal propensity to spend on non-traded goods, N; as before, this occurs whether the transfer comes as a grant or as the tariff-preference equivalent of a grant (recall that $\mathrm{d}Z = \mathrm{d}A + \mathrm{R}_X\,\mathrm{d}T$ is the value of the marginal transfer). Also as before, tariff preferences appreciate the real exchange rate for imports by more than pure transfers – the term $-(1 - \alpha_{Ns})R_{QX}$ in (12) is positive. As in the static case it follows that the real exchange rate for exports is depreciated relative to its level under pure transfers. Holding the subsidy rate constant, therefore, tariff preferences are unambiguously better for exports than pure grants. Export subsidies appreciate the real exchange rate for imports in (12) as a direct result of their stimulative effect on exports.

Given the real exchange rate, first-period utility is determined in (11). The income effect of a transfer raises utility. In this case, however, tariff preferences actually exert a drag on first-period utility relative to a pure transfer: as we have seen, the tariff preferences reduce exports by less (and may actually increase them on net) and hence leave a larger first-period distortion operating through the subsidy. By the same token, the effect of a higher export subsidy, other things equal, is to reduce first-period utility by increasing the distortion.

The real exchange rate for imports and the subsidy-inclusive terms of trade, $T + S$, are parameters of the second-period equilibrium in (13) and (14). Since

$$R_{XQ}\mathrm{d}Q + R_{XX}(\mathrm{d}T + \mathrm{d}S) = -(T + S)R_{XX}\hat{Q}_X \tag{15}$$

we can see that both utility and the relative prices in period 2 depend only on the real exchange rate for exports from period 1. Anything that creates a subsidy-inclusive real depreciation in period 1 produces spillover benefits that raise utility in period 2, (13); and the real exchange rate in period 2 appreciates, (14).

[4] When $S = \mathrm{d}S = 0$ so that there is no export subsidy, (11) and (12) are identical to (4) in the static case.

The optimal export subsidy can now be calculated by choosing S to maximise the social welfare function $W = W(U, u)$. The first-order condition for this problem is $W_U U_S = -W_u u_S$. Differentiating (7) and (9) with respect to S and using (8) and (10) to eliminate terms, we obtain $U_S/u_S = Se_u/r_R E_U$. The optimal production subsidy for exports therefore satisfies the following condition:

$$S^* = \left(\frac{E_U W_u}{e_u W_U}\right) r_R = \frac{E_U}{e_u}\theta r_R \tag{16}$$

where $\theta = W_u/Wu$. Equation (16) has an appealing interpretation. At an optimum, an additional unit of exports reduces first-period spending by S^*. In terms of overall welfare, the cost of this additional unit is $E_U^{-1}\mathrm{W}_U\mathrm{S}^*$. The learning-by-doing benefit appears in the second period, when output rises by r_R for each additional unit of first-period exports. Measured in terms of overall welfare, the marginal benefit is $e_u^{-1} W_u\ r_R$. At an optimum the marginal cost must equal the marginal benefit, which leads to (16).[5]

To determine the effect of alternative forms of transfer under the optimal subsidy policy we endogenise S^* by totally differentiating (16) which, under certain simplifying assumptions yields (see Appendix):

$$\mathrm{d}S^* = -\frac{S^* W_{UU}}{E_U W_U}\mathrm{d}Z + \alpha_N \frac{S^*}{Q}\mathrm{d}Q - \gamma\frac{S^*}{q}\mathrm{d}q. \tag{17}$$

The effect of a transfer ($\mathrm{d}Z$) on the margin is to increase the optimal subsidy to exports. With $W_{UU} < 0$, the receipt of temporary aid leads to a desire to smooth spending across periods and since the export subsidy is the only inter-temporal linkage, this smoothing can only occur by creating additional productivity spillovers into the future. Further effects operate through the channel emphasised in the static analysis, via the impact of the transfer on $\mathrm{d}Q$ and $\mathrm{d}q$: since the real exchange rate for imports appreciates in the first period, this strengthens the tendency for S to rise; similarly if the real exchange rate for exports appreciates in period 1, then (as we have seen) q falls, encouraging a further rise in the subsidy.

Equations (12), (14) and (17) form a complete sub-system determining $\mathrm{d}Q$, $\mathrm{d}q$, and $\mathrm{d}S^*$ in terms of $\mathrm{d}A$ and $\mathrm{d}T$ which can be used to derive the comparative statics of the model. Specifically, the real appreciation caused by the spending effect of a transfer requires an offsetting increase in the subsidy to export production: this is true regardless of the form of the transfer. Tariff preferences directly support exports, however, so the required increase in the subsidy is *smaller* if the transfer comes as tariff preferences. If the demand-side substitution effect arising from trade preferences is sufficiently strong in period 1 relative to inter-temporal substitution and the real income effect of the tariff preferences, the optimum subsidy to exports actually falls with an increase in tariff preferences.

[5] The term $(E_U/e_u)^{\theta}$defines an implicit domestic real interest rate in terms of the imported good: $E_U/e_u = (1 + r^*)^{-1}$. If the recipient could borrow and lend at a fixed world interest rate r^*, (16) would simply equate the subsidy rate to the discounted spillover: $S^* = r_R/(1 + r^*)$. With a closed capital account, the implicit domestic interest rate is likely to exceed r^*, leaving the optimal subsidy smaller than it would be under perfect capital mobility.

The asymmetries of the static analysis therefore carry over to the dynamic case. The transfer component of international grants or tariff preferences tends to undermine export competitiveness by appreciating the real exchange rate for exports. Tariff preferences, however, are unambiguously better for developing country exports than pure grants. If exports are 'special' in the sense of delivering learning-by-doing externalities, an export subsidy is called for to internalise these externalities. A rise in pure transfers then requires an offsetting rise in the export subsidy. If aid comes in the form of tariff preferences, the required increase in subsidies is smaller and a reduction in subsidies may well be indicated.

Finally, we consider the effect of alternative transfers on recipient-country welfare.[6] Differentiating W yields

$$\mathrm{d}W = W_U E_U^{-1}\mathrm{d}Z - W_U E_U^{-1} R_{XX}(S - S^*)\mathrm{d}T + W_S \mathrm{d}S. \tag{18}$$

When the optimum subsidy is in place, $S - S^* = W_S = 0$ and the final two terms on the right-hand side vanish and recipient country utility is invariant to the form of the transfer. However, if the subsidy is below the optimal levels (or is absent, so that $\mathrm{d}S = 0$), the second term becomes strictly positive ($S - S^* = -S^* < 0$) and tariff preferences unambiguously deliver higher welfare than the equivalent pure grant. Welfare effects therefore mirror those in the static case provided the optimal subsidy is in place. If it is not, a shift of aid from grants to tariff preferences increases recipient-country welfare.

3. Simulation Evidence

Our model has brought out some fundamental differences between aid and trade. In particular we stressed that unless internalised by an optimal export subsidy dynamic efficiency gains arising from export externalities will go unexploited. To develop a sense of the likely empirical importance of these differences for typical African countries, and to investigate the robustness of the results in the presence of structural characteristics not included in the analytical model, we simulate the effects of aid policy reform in a more fully articulated version of our analytical model. We use a CGE model whose structure, while consistent with our analytical model, is more sympathetic to the characteristics of many low-income African countries.

We simulate two versions of the model, the 'basic model' in which factor endowments are fixed, there is no explicit role for government and the learning-by-doing spillover is the only inter-temporal linkage in the economy. This version

[6] An anonymous referee referred us to Kemp and Shimomura (1991), who study a similar question in a 2-country, 2-good model with no spillovers. They find that when the recipient country maintains a zero tariff, tariff reductions by the donor are unambiguously superior to grants as a means of raising recipient welfare (note that the donor's tariff is the only distortion, so reducing it unambiguously raises world welfare). In our case, the recipient of tariff preferences is small enough that an expansion of preferences by the donor leaves world prices unaffected. But as in Kemp and Shimumura, the trade instrument acquires potency relative to grants when exercising it reduces an extant distortion in our case, the recipient's failure to internalise an export spillover (second-best complications are potentially present in our case, but are neutralised by the small-country assumption). Below we use simulations to extend the welfare analysis to cover non-marginal changes in the presence of multiple distortions.

therefore provides the simulation analogue to the model developed in Sections 1 and 2. We then examine how the results from the basic model are modified by the introduction of domestic savings and investment (while retaining a closed private capital account) and a more realistic characterisation of the government's fiscal behaviour, in particular by limiting its scope for lump-sum deficit financing. This latter model, which provides some purchase on distributional issues, we refer to as the 'extended model'.

3.1. *Model Structure and Calibration*

We consider a four-sector economy (manufacturing, agriculture, private sector services and the government sector) of the type widely used for analysing trade policy in small open economies; see, for example, Devarajan *et al.* (1993). The calibration equilibrium, summarised in Appendix Table 1 is chosen to describe an archetypical small open African developing country.[7] This economy is a price taker for all tradable goods, but domestic goods and factor prices are fully flexible. There is a single representative household whose welfare is defined as

$$U = \sum_{t=0}^{\infty} \beta^t \left[\frac{u(c_h)^{1-\varepsilon}}{1-\varepsilon} \right] \tag{19}$$

where β is the discount rate, and $u(c_h)$ is a vector of domestically-produced and imported consumption goods. We take the limiting case of $\varepsilon = 1$ so that the term in brackets is $\ln[u(c_h)]$. Domestic production and imports are imperfect substitutes in consumption while gross output is imperfectly substitutable between domestic and export markets, with both relationships governed by homothetic constant elasticity of substitution/transformation functions respectively. Production exhibits constant returns to private factors but potentially increasing returns in the presence of public infrastructure capital.

In the basic model there is no domestic capital market so that sector-specific capital stocks are fixed and do not depreciate. The private capital account is closed, there is no private net accumulation of foreign assets and we assume that net official reserves are constant: domestic relative prices therefore adjust to satisfy the balance of payments constraint. In the extended version with domestic saving and investment, the private capital account remains closed but the domestic capital stock depreciates over time. The model is closed by assuming that aggregate investment is savings-determined. The household savings rate is independent of the average domestic return on capital, although the intersectoral distribution of investment is determined by sectoral rates of return. The model is recursively dynamic but the representative household is assumed to know that donor policy changes are temporary so that its savings behaviour adjusts during the experiment to smooth consumption over time.

[7] The baseline calibration represents a steady-state equilibrium in which population/labour supply growth is zero, net investment is zero, and returns on capital are equalised across sectors.

There is, in effect, no role for government in the basic model. The public capital stock is fixed in perpetuity while aid flows, which are fully fungible, are transferred costlessly to the private sector (although some part of the aid flow may be directed to fund an export subsidy). There are no other taxes, distortionary or lump-sum, in this version. This structure is replaced in the extended model by one in which government current and capital expenditure is financed through a standard combination of direct income taxes, value added tax on domestic consumption, *ad valorem* import duties and foreign grants. The overall budget is balanced in the baseline equilibrium.

With no capital account, the only inter-temporal linkage in the basic model is the spillover externality operating directly on the production function for manufactured goods. We represent this as a Hicks-neutral technological innovation. Production functions for each sector, i, are defined as

$$X_{it} = A_{it} L_{it}^{\alpha p_i} K_{it}^{(1-\alpha p_i)} Kg_t^{\alpha g_i} \tag{20}$$

where L denotes labour, K private capital, Kg public capital, t time, and $\alpha g_i \geq 0$. For the non spillover sectors $A_{it} = A_i$ for all t, while for the spillover sector, denoted s, the technology parameter is defined as

$$A_{st} = A_{s0}\left[1 + \phi \ln\left(\frac{E_t^p}{\bar{E}_t^p}\right)\right] \tag{21}$$

where $E_t^p = \sum_{j=1}^{\infty} \Gamma^j E_{t-j}$ is the (discounted) sum of exports in the spillover sector up to and including $t-1$ under the simulation experiment, and $\bar{E}_t^p$ is the correspondingly defined cumulative exports under the baseline trajectory for the economy. $\phi \geq 0$ measures the extent of the spillover, $\Gamma = (1+\gamma) > 1$ is the gross discount factor, and A_{s0} is the value of A_{st} at the baseline calibration. Hence the higher is γ the lower the impact of past experience on current productivity. Since $\gamma > 0$ there will always be some persistence in $(E^P/\bar{E}^P)$ so that temporary policy reforms will have at least some permanent consequence for productivity.

In the absence of an empirical consensus that would allow us to calibrate the spillover parameter directly, we look for values for ϕ that would justify export subsidies consistent with the experience of successful developing country exporters. The average countervailing duty imposed on developing country exports by the US between 1980 and 1985 – which under GATT rules could not exceed, product-by-product, the subsidy judged to have been received by foreign firms – was 11.5% (Nam, 1987). While US legal proceedings may incorporate upward-biased assessments of foreign subsidies, these subsidies are in turn undoubtedly restrained by the prospect of countervailing action and are therefore well below what would be justified by spillovers alone. We therefore view a spillover parameter of 0.05, which in our baseline model generates an optimal subsidy of 12.5%, as a conservative value for our simulation experiments. Larger spillover parameters generate larger impacts on exports and welfare; we report results for spillover parameters of 0.10 and 0.25, which generate optimal subsidies of the order of 24.5 and 33.5% respectively.

All three values have the property that the system is dynamically stable for the experiments we consider and returns to a new steady state within a 'reasonable' time-period. The values of other behavioural parameters reflect common practice in similar CGE models applied to low income developing countries.[8]

3.2. *Experiment Design*

We consider two variants of our 'aid-versus-trade' experiment. The first examines an increase in the resource flow from the donor effected either as an increase in aid or a change in trade preferences (represented by a change in the exogenous world price faced by the recipient country), the initial cost to the donor being equivalent to a 10% decrease in the tariff, T, on the recipient country's exports. This case might correspond, for example, to the net resource flow accruing under a debt cancellation programme. Second, we examine a resource neutral 'trade-for-aid' experiment in which an unchanged level of donor support is converted on the margin from a grant to a trade preference. In either case the resource flow, or the switch from aid to trade preferences, is assumed to be temporary.

A central question at this point is how to define 'donor-equivalence' between aid and trade preferences. In Section 1 equivalence was defined as the tariff revenue lost at the *original* export volume, which necessarily ignores the donor's revenue loss on any expansion of exports from the preference-receiving country. The analytical model restricts its attention to marginal changes in aid and preferences and hence this is appropriate. Since the simulations are run for non-marginal changes in the face of 'open' trade preferences, we define equivalence in terms of the full revenue cost to the donor allowing for any export supply response. The donor's budget constraint in this case is

$$\mathrm{d}Z = \mathrm{d}A + [1 + (\tau + \mathrm{d}T)\sigma_{XX}]R_X \mathrm{d}T \tag{22}$$

where τ is the initial tariff preference (assumed to be zero in the simulations), $\mathrm{d}T$ is the increase in the trade preference, and σ_{XX} is the recipient's elasticity of export supply.[9] Equation (3) above clearly overstates the size of the donor-equivalent trade preferences that a reduction in aid can buy, by an amount $\sigma_{XX}R_X\mathrm{d}T^2$. The simulations reported below therefore use (22) as the basis for computing model-consistent donor equivalence.

The timing of events is as follows. Calibration occurs at time $t = 0$, with changes in the exogenous world price for the recipient's manufactured exports, in the exogenous level of aid, or both occurring at $t = 1$. The model is then solved to generate the short-run equilibrium including the new saving and investment vec-

[8] For example Devarajan *et al.* (1993). Elasticities of substitution in consumption are all less than unity so that the income effect of terms of trade changes dominate and import real exchange rate will appreciate (depreciate) following a positive (negative) change in the sectoral terms of trade.

[9] Notice that for non-marginal changes $\mathrm{d}Z$ recipient domestic prices will also change, rising in response to the pure grant component of trade preferences. To ensure that (22) is model consistent, σ_{XX} therefore measures the general equilibrium elasticity of export supply given the change in the relative price (Px/Pd) facing exporters.

tors and the spillover-induced changes in productivity, if relevant. The new capital stock and productivity parameters are embodied between periods $t = 1$ and $t = 2$ and the model resolved conditional on these values. This is repeated until $t = 5$. For the remainder of the run all exogenous variables are returned to their baseline values so that the evolution of the economy is determined exclusively by the interaction of the cumulative change in productivity, the capital stock, and the fiscal stance of government. For all experiments the economy returns to a steady state between $t = 10$ and $t = 25$ depending on the spillover parameters. The tables in the next Section report the evolution of the economy at three points in time: on impact ($t = 1$); at the end of the temporary experiment ($t = 5$); and at the new steady state ($t = \infty$).

3.3. *Results*

The Basic Model: Table 1 reports the results from simulating the basic model with fixed, sector-specific capital stocks, no government and no productivity spillovers. These results serve to illustrate the properties of the model from Section 1 in circumstances where we no longer consider only marginal changes in aid and trade preferences.

Since there are no inter-temporal linkages in this version, the economy necessarily returns to its steady-state baseline from $t = 5$ onwards. A comparison of columns (1) and (2) confirms the effects emphasised in Section 1. Under trade preferences, export growth draws resources out of the non-traded goods sector, leading to a greater appreciation of the import real exchange rate (Q_M) than under a pure transfer and reducing the degree of appreciation of the export real exchange rate (Q_X). Given the low elasticities of substitution used in these simulations, the substitution effect is sufficiently strong that increased preferences generate a depreciation in the export real exchange rate. In column (3) we eliminate the income effect of the experiment by considering a revenue-neutral shift from aid to trade. The real exchange rate depreciation for exports is stronger, and the import real exchange rate depreciation weaker, than under the trade-only case.

The evolution of output and factor prices follows directly from these real exchange rate effects. The sectoral reallocation of labour reduces real GDP at baseline prices in all cases, as sectoral outputs (and manufactured exports) respond to changed relative prices. In the long run, given constant capital stocks and the absence of spillovers, steady-state wages and the return to capital are unchanged. For the duration of the experiment, real consumption wages increase but by a greater amount when the transfer comes through trade preferences.[10]

[10] Under trade preferences the value of the marginal product of labour in the expanding export sector rises in terms of both the price of imports and domestic goods whereas under aid it falls relative to the price of domestic goods and does not change relative to import prices. Given the initial capital intensity of manufacturing, the nominal wage increase is also higher under trade; taken together these imply that real consumption wages will rise by more under trade than aid.

Table 1

Aid and Trade with no Distortions

	Time period	Aid only (%)	Trade only (%)	Trade for Aid (%)
Experiment		(1)	(2)	(3)
Spillover Parameter‡		0.00	0.00	0.00
Change in grant aid		34.7	0.0	−36.2
Change in trade preference to manufacturing sector		0.0	10.0	10.0
Welfare*	to $t = 1$	1.70	1.64	−0.06
	to $t = 5$	2.84	2.74	−0.10
	to $t = \infty$	1.91	1.87	−0.04
Relative prices†				
Exportables: $Q_X = P_d/P_x$	to $t = 1$	4.92	−2.61	−7.76
	to $t = 5$	4.92	−2.61	−7.76
	to $t = \infty$	0.00	0.00	0.00
Importables: $Q_M = P_d/P_m$	to $t = 1$	4.92	6.72	2.04
	to $t = 5$	4.92	6.72	2.04
	to $t = \infty$	0.00	0.00	0.00
Quantities†				
Manufacturing Exports	to $t = 1$	−4.38	3.13	7.50
	to $t = 5$	−4.38	3.13	7.50
	to $t = \infty$	0.00	0.00	0.00
Real GDP	to $t = 1$	−0.33	−0.28	−0.46
	to $t = 5$	−0.33	−0.28	−0.46
	to $t = \infty$	0.00	0.00	0.00
Factor Markets†				
Real wage	to $t = 1$	4.79	13.53	8.83
	to $t = 5$	4.79	13.53	8.83
	to $t = \infty$	0.00	0.00	0.00
Average profit rate	to $t = 1$	−0.55	0.57	1.17
	to $t = 5$	−0.55	0.57	1.17
	to $t = \infty$	0.00	0.00	0.00

Notes: **Welfare* measures the difference in the discounted cumulative utility from $t = 0$ relative to the steady state baseline.
†Percentage difference relative to baseline calibrated values (see Appendix Table 1).
‡Not in %.

Both forms of assistance have a nontrivial impact on the recipient's discounted welfare in our model economy (the row labelled 'to $t = \infty$' shows the change in the recipient's discounted welfare over all periods). In the absence of distortions, promotion of the recipient's exports is Pareto inefficient, as it generates a trade diversion cost that must be absorbed by the donor and recipient. We showed in Section 1 that this effect – which is borne by the recipient under our assumption of donor-equivalence – vanishes if the preference is initially zero and the increase is small. The recipient is not, however, indifferent to non-marginal changes; column (3) shows that welfare clearly falls with a substantial shift from aid to trade. To this extent, therefore, Johnson's (1967) argument about the superiority of aid over trade is robust to the incorporation of donor-equivalence. But the welfare loss from a shift to preferences is barely 2% of the increase generated by either form of transfer, even for the substantial change in donor policy contemplated here. The advantage of grants is therefore extremely small. As we show in the remainder of

the paper, reasonably parameterised spillover effects can overwhelm this effect and reverse the welfare ranking of aid and trade.[11]

Table 2 introduces productivity spillovers in the manufactured export sector. In columns (1) to (3) we reproduce the experiments of Table 1 under the assumption that the recipient does not subsidise exports. The initial impact of each policy experiment is identical to that in Table 1 up to $t = 1$. However, once the intertemporal effect of the spillover starts to operate, the economy converges to a new steady state characterised by permanently higher or lower factor incomes, consumption and welfare, depending on the strength of the spillover. A clear preference for trade over aid emerges from the differential performance of manufactured exports in these experiments. Columns (1) and (2) show that spillover effects reduce the welfare impact of grants and enhance the welfare impact of preferences. The two alternatives now differ substantially, in terms of their effect on recipient welfare; comparing columns (2) and (3), the welfare impact of preferences that are fully financed by reductions in grant aid is well over half the impact of preferences financed by new donor resources.

The source of the welfare gains in column (3) is clear: by conducting a trade-for-aid switch, the donor is implementing a temporary export subsidy that is justified by the underlying market failure. In columns (4a) to (4c), we allow the recipient to finance its own export subsidy in the baseline, using lump-sum taxation and subject only to the constraint that the subsidy be time-invariant.[12] A spillover parameter of 0.05 generates an optimal subsidy of 12.5%, which we motivated earlier by reference to US anti-dumping findings against developing country exporters. Doubling the spillover parameter to 0.1 doubles the optimal subsidy, but the relationship is strongly concave: an increase in the spillover parameter from 0.1 to 0.25 increases the optimal subsidy by less than 50%. Relatively modest increases in the export subsidy rate, therefore, if interpreted as optimal responses to spillovers, imply substantially higher spillover parameters. The welfare impact of a given trade-for-aid switch, in contrast, is convex in the spillover, provided that no subsidy is actually in place, (column (3)). Spillover parameters that are sufficient to generate modestly higher optimal subsidy rates therefore generate disproportionately large benefits from a trade-for-aid switch. These benefits are contingent, of course, on the recipient's own failure to subsidise exports adequately, an issue to

[11] Yanos and Nugent (1999) identify a 'transfer paradox' whereby increases in aid can lower recipient-country welfare. They model aid as a non-fungible inflow of physical capital and show that with an (inefficient) import tariff in place, an increase in the capital stock can reduce welfare if it creates a sufficient combination of contraction in the export sector and expansion in the non-traded goods sector. In their analysis, the first-round effects of a transfer are on sectoral supply functions rather than on international purchasing power, and real exchange rate effects are correspondingly unconventional (expansion of non-traded goods is associated with real depreciation rather than with the 'Dutch disease' real appreciation that is central to our analysis). When we bring sectoral capital accumulation into our own model, the income effect of the transfer remains sufficient to generate a net gain and a real appreciation even in the presence of pre-existing distortions. Our simulations therefore, show no evidence of a transfer paradox. While Yanos and Nugent (1999) do not analyse trade preferences, preferences would produce a smaller contraction of exportables and a smaller expansion of non-tradeds in their model than donor-equivalent grants, corroborating our argument about the relative appeal of aid and trade.

[12] This yields an approximation to the fully optimal export subsidy, which in general will be time-varying.

Table 2

Aid Versus Trade with Spillovers and Export Subsidies (all in % except spillover parameter)

	Time period	Aid only		Trade only		Trade for Aid			Trade for Aid with Export subsidy		
Experiment no:		(1*a*)	(1*b*)	(2*a*)	(2*b*)	(3*a*)	(3*b*)	(3*c*)	(4*a*)	(4*b*)	(4*c*)
Spillover parameter		0.05	0.10	0.05	0.10	0.05	0.10	0.25	0.05	0.10	0.25
Change in grant aid		−34.74	−34.82	0.00	0.00	−36.40	−36.42	−36.84	−41.35	−46.32	−50.40
Change in trade preference to manufacturing sector		0.0	0.0	10.00	10.0	10.0	10.0	10.0	0.0	0.0	0.0
Export subsidy*		0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	24.50	33.50
Welfare†	to $t = 1$	1.70	1.70	1.65	1.65	−0.06	−0.05	−0.05	−0.52	−1.06	−1.56
	to $t = 5$	2.81	2.78	2.77	2.80	−0.05	0.02	0.21	−0.81	−1.66	−2.30
	to $t = \infty$	1.76	1.57	1.98	2.11	0.39	1.24	2.48	−0.10	−0.19	−0.11
Relative prices‡											
Exportables: $Q_X = P_d/P_x$	to $t = 1$	4.93	4.95	−2.61	−2.62	−7.80	−7.81	−7.93	−8.66	−9.49	−10.20
	to $t = 5$	5.02	5.15	−2.68	−2.76	−7.95	−8.12	−8.74	−8.44	−9.89	−11.39
	to $t = \infty$	0.49	1.21	−0.34	−0.84	−0.84	−2.00	−7.77	−0.97	−2.69	−11.32
Importables: $Q_M = P_d/P_m$	to $t = 1$	4.93	4.95	6.71	6.71	2.00	1.99	1.88	1.22	0.47	−0.18
	to $t = 5$	5.02	5.15	6.66	6.59	1.86	1.71	1.15	1.06	0.10	−1.27
	to $t = \infty$	0.49	1.21	−0.34	−0.84	−0.84	−2.00	−7.77	−0.97	−2.69	−11.32
Quantities‡											
Manufacturing Exports	to $t = 1$	−4.38	−4.38	3.13	3.13	8.13	8.13	8.13	8.89	10.05	11.21
	to $t = 5$	−4.38	−5.00	3.13	3.75	8.13	8.75	10.63	9.44	11.56	14.95
	to $t = \infty$	−1.25	−3.13	1.25	2.50	2.50	5.62	24.38	2.78	7.54	35.98
Real GDP	to $t = 1$	−0.12	−0.12	−0.17	−0.17	−0.61	−0.61	−0.53	−0.74	−0.77	−0.77
	to $t = 5$	−0.02	−0.08	0.19	0.27	−0.61	−0.63	−0.82	−0.77	−0.77	−1.41
	to $t = \infty$	−0.37	−1.02	0.46	0.93	−0.12	−0.40	−1.72	−0.08	−0.50	−2.91
Factor markets‡											
Real wages	to $t = 1$	4.77	4.77	13.55	13.57	8.84	8.88	8.95	8.85	9.02	9.31
	to $t = 5$	4.60	4.42	13.70	13.87	9.21	9.63	10.98	9.28	10.04	12.43
	to $t = \infty$	−0.89	−2.19	0.64	1.55	1.55	3.77	15.68	1.62	5.17	24.41
Average profit rate	to $t = 1$	−0.56	−0.58	0.58	0.59	1.20	1.23	1.31	1.47	1.82	2.25
	to $t = 5$	−0.69	−0.83	0.68	0.79	1.44	1.71	2.61	1.74	2.46	4.19
	to $t = \infty$	−0.67	−1.64	0.47	1.16	1.16	2.81	11.61	1.33	3.71	17.35

Notes: *Export subsidies are fixed over time: see text for explanation.
†*Welfare* measures the difference m the discounted cumulative utility from $t = 0$ under the experiment relative to the steady state baseline.
‡Percentage difference relative to the baseline calibrated values (see Appendix Table 1).

which we return below. Column (4) demonstrates that if spillovers are initially properly internalised by the recipient, a trade-for-aid switch leaves the recipient's welfare approximately unchanged.

The Extended Model: The extended model goes beyond the analysis of Sections 1 and 2 in two key respects, first by introducing private capital formation and then by ruling out the use of lump-sum taxation on the margin. Table 3 shows how these features alter the results of an aid-for-trade switch, assuming as in column (3) of Table 2 that the recipient does not have an export subsidy in place.

The introduction of capital accumulation provides the economy with a second inter-temporal linkage. Even though the labour supply remains constant, increased private capital formation, whether out of aid or through endogenous output growth, raises the economy-wide value of the marginal product of labour, the level of output and welfare. This investment-induced effect stimulates the export spillover independently of relative price effects and hence creates the possibility of a virtuous circle – with export growth feeding additional capital formation (which is biased towards the spillover sector) which further stimulates productivity in the spillover sector. The welfare effects of an aid-for-trade shift, in columns (1*a*) to (1*c*), are therefore uniformly higher in the presence of capital accumulation than in its absence. Higher spillover parameters magnify this difference; in the high-spillover case, shifting a third of the aid budget for a period of 5 years raises the private capital stock by 2.26% and increases discounted welfare by close to 5% – nearly twice the increase observed in the absence of capital accumulation.

Changes in donor policy have potentially important fiscal effects in the recipient economy, and up to this point we have assumed that any change in the distribution of income between the public and private sectors is neutralised via lump-sum taxes and transfers. As a second extension of the model we make the realistic assumption that the recipient government lacks non-distortionary instruments. The fiscal impacts of donor policy now have welfare consequences of their own. To get a sense of magnitudes, we examine the case in which the adjusting instrument is government capital formation. A trade-for-aid switch now causes a reduction in public capital formation, the joint result of a fall in external financing – the value of which now accrues, as export revenues, to the private sector – and a loss of tax revenue as real depreciation shrinks the non-tradables-intensive tax base. With low or medium spillovers, the reduction of productive infrastructure more than offsets the stimulus from real depreciation and exports stagnate or rise only weakly relative to their baseline value. Welfare falls in these cases: here the fiscal contribution of aid is more important on the margin than its contribution to export promotion. Only in the high spillover case does the real depreciation crowd in enough private investment to generate strongly higher spillovers and raise discounted welfare.

To conclude, the simulations presented in this Section confirm the insights of the analytical model while suggesting some important extensions. As predicted by the model, the form in which foreign transfers are provided affects the recipient's export incentives. Open preferences drive exports up; grants drive exports down.

Table 3

Aid Versus Trade with Spillovers, Capital Accumulation and Export Subsidies
(all in % except spillover parameter)

	Time period	Trade for aid (no export subsidy)			Trade for aid (no export subsidy fiscal distortion)		
Experiment no:		(1*a*)	(1*b*)	(1*c*)	(2*a*)	(2*b*)	(2*c*)
Spillover parameter		0.05	0.10	0.25	0.05	0.10	0.25
Change in grant aid		−36.15	−36.23	−36.46	−35.81	−35.92	−36.08
Change in trade preference to manufacturing sector		10.0	10.0	10.0	10.0	10.0	10.0
Initial export subsidy		0.0	0.0	0.0	0.0	0.0	0.0
Welfare*	to $t = 1$	0.01	0.00	0.00	0.05	0.05	0.10
	to $t = 5$	−0.01	0.16	0.67	−2.06	−1.97	−1.46
	to $t = \infty$	0.58	1.48	4.89	−2.96	−2.25	1.31
Relative prices†							
Exportable $Q_X = P_d/P_x$	to $t = 1$	−7.98	−8.00	−8.08	−7.74	−7.77	−7.83
	to $t = 5$	−8.12	−8.28	−8.81	−7.72	−7.87	−8.34
	to $t = \infty$	−0.74	−1.73	−6.35	−0.28	−0.88	−4.22
Importables: $Q_M = P_d/P_m$	to $t = 1$	1.84	1.81	1.74	2.06	2.03	1.97
	to $t = 5$	1.71	1.56	1.08	2.08	1.94	1.50
	to $t = \infty$	−0.74	−1.73	−6.35	−0.28	−0.88	−4.22
Quantities†							
Manufacturing exports	to $t = 1$	7.18	7.23	7.39	7.19	7.25	7.40
	to $t = 5$	7.50	7.95	9.40	5.33	5.74	7.03
	to $t = \infty$	1.96	4.66	18.15	−0.03	1.59	10.89
Real GDP	to $t = 1$	0.00	0.02	0.06	0.00	0.02	0.06
	to $t = 5$	0.06	0.22	0.74	−1.86	−1.71	−1.26
	to $t = \infty$	0.74	1.79	6.86	−0.60	0.04	3.58
Consumption	to $t = 1$	0.61	0.61	0.64	0.61	0.52	0.52
	to $t = 5$	0.77	0.77	1.13	0.77	0.11	0.09
	to $t = \infty$	1.21	1.21	4.88	1.21	0.46	1.75
Saving and Investment†							
Private capital stock	to t = 1	0.00	0.00	0.00	0.00	0.00	0.00
	to $t = 5$	−0.22	−0.21	−0.17	2.05	2.06	2.11
	to $t = \infty$	0.21	0.61	2.26	0.71	0.98	2.21
Public capital stock	to $t = 1$	0.00	0.00	0.00	0.00	0.00	0.00
	to $t = 5$	0.00	0.00	0.00	−11.28	−11.30	−11.36
	to $t = \infty$	0.00	0.00	0.00	−5.18	−5.19	−5.23
Fiscal Balance‡							
Export Subsidies	to $t = 1$	0.00	0.00	0.00	0.00	0.00	0.00
	to $t = 5$	0.00	0.00	0.00	0.00	0.00	0.00
	to $t = \infty$	0.00	0.00	0.00	0.00	0.00	0.00
Total revenue (incl subsidies)	to $t = 1$	−0.46	−0.46	−0.46	−0.46	−0.46	−0.46
	to $t = 5$	−0.46	−0.46	−0.46	−0.47	−0.47	−0.47
	to $t = \infty$	0.00	−0.01	−0.02	0.00	−0.01	−0.01
Current budget balance	to $t = 1$	−0.17	−0.17	−0.16	−0.16	−0.16	−0.15
	to $t = 5$	−0.16	−0.15	−0.13	−0.29	−0.28	−0.26
	to $t = \infty$	0.05	0.10	0.34	−0.04	−0.01	0.18

Notes: **Welfare* measures the difference in the discounted cumulative utility from $t = 0$ under the experiment relative to the steady state baseline.
†Percentage difference relative to the baseline calibrated values. (see Appendix Table 1).
‡Fiscal changes measured in percentage points of GDP.

In the absence of spillovers, or when spillovers are appropriately internalised via an export subsidy, the recipient is indifferent to small changes in the composition of transfers and for non-marginal shifts the recipient slightly prefers grants over

preferences. But if a subsidy is not present, the presence of spillovers flips the welfare ranking of donor-equivalent grants and preferences. The welfare impact of an aid-for-trade shift becomes large and positive, particularly in the presence of capital accumulation. Fiscal distortions reduce the relative attractiveness of preferences, but strong spillovers can still make a case for trade over aid.

4. Conclusions

Proceeding as in Johnson (1967), we have taken recipient-country trade policy as given and compared aid and trade as alternative approaches to increasing growth and welfare in poor countries. Imposing donor equivalence greatly reduces the advantage of aid over trade and, if – as an increasing body of evidence suggests – the export sector is an important potential source of productivity spillovers, the welfare contribution of preferences can be significantly higher than that of grants. In this concluding section we address three related questions raised by the analysis. First, if open preferences are more efficient than grants, what explains the coexistence during the GATT/WTO era of large aid flows with restrictions on developing country exports into industrial country markets through the operation of a system of closed preferences? Second, if the efficiency advantage of open preferences derives from the presence of productivity spillovers, why do aid recipients not adequately subsidise exports themselves? Finally, if poor-country governments choose not to subsidise exports, what guarantees that they will not offset any attempt by donors to do so?

Note first that the thrust of our analysis continues to hold if learning-by-doing externalities are associated with imports rather than with manufactured exports or the production of manufactured goods more generally. Helleiner (1990), for example, suggests that productivity spillovers are associated primarily with non-competitive imports of differentiated inputs, a theme that has been developed in the endogenous growth literature, Bayoumi *et al.* (1999), for example. The notion here is that gains in total factor productivity accrue in industrial countries and are embodied in their exports, which then are used in the accumulation of human and physical capital in the recipient country. Of course, if growth-enhancing spillovers are attached to imports rather than to exports, then the transfer component of aid is no longer at odds with their capture. A larger transfer enhanced import capacity, because the induced real appreciation exerts only a second-order effect. Spillovers rise rather than fall, and the case for an active subsidy (in this case, to imports) is weakened rather than enhanced as a function of aid volume. But our main argument relates to the form of aid, not to its overall amount. From this perspective, the key insight is that a shift from grants to donor-equivalent preferences also increases the recipient's import capacity, by generating new exports. By arguments similar to those employed above, such a switch increases the recipient's welfare even if spillovers occur solely on the import side.

Surely the deeper reasons for unexploited gains lie mainly in distributional considerations that we have omitted from the formal model? These considerations raise both the supply of aid and the demand for aid, relative to trade preferences. On the supply side, industrial countries routinely discriminate against imports

from developing countries in order to protect domestic producers, particularly in the textile, clothing and agricultural sectors (in the latter case, via production subsidies). Liberalising these restrictions would produce an efficiency gain for industrial countries, saving taxpayers slightly more in aggregate than is lost by workers and firms in the protected sectors. But the losses are highly concentrated and, as was borne out at the Seattle meetings of the WTO in 1999, are able to mobilise greater political support. The supply of market access is therefore low relative to the supply of grants or grant-equivalents. The same considerations produce a preference among donors for closed over open preferences and for preferences on tropical-zone exports over temperate-zone or manufactured exports, since the former do not compete directly with domestic production. A tariff concession on a product line already covered by country-specific QRs is the equivalent of a pure grant, since exports cannot rise. An open preference on tropical-zone exports allows exports to rise but, since these products are not generally associated with learning-by-exporting externalities, this generates welfare gains only if it is import capacity, rather than export volume, that generates spillovers.

On the demand side, recipient governments are not indifferent to the fact that aid accrues to the public sector while preferences accrue to the private sector. A governing elite concerned with its own continuation in power is likely to place a significantly higher value on public sector resources than would a representative consumer. Lacking the ability to tax away private incomes, such a government will prefer grants to donor-equivalent preferences even in the face of significant efficiency losses. Where constraints on executive authority are weak, the preferences of the elite will be decisive and the effective demand for market access will be weak relative to the demand for grants. Once the pattern of assistance is established, the familiar status-quo bias supports its persistence: aid beneficiaries, both inside and outside the public sector, form a coherent lobby capable of defeating the diffuse and uncertain group of potential winners from a donor-equivalent shift to preferences. These considerations need not be decisive, because elites can be strongly committed to private sector development, as in Mauritius and Botswana. But Ake (1996), Mkandawire and Soludo (1999) and others observe that such elites rarely emerged in the political environment of post-independence Africa.

We have argued that for many African countries, donors may be able to improve the development effectiveness of aid by shifting from aid to trade. But if aid is fungible, the recipient can mimic a wide range of aid-and-preferences packages by spending a portion of grants on domestic export subsidies. If recipient governments fail to do so, what is left of the argument that donors should – or even can – do so for them? The answer depends on the precise balance of forces in the aid and trade relationship. If recipients wish to promote manufactured exports but are prevented from succeeding by donor-imposed QRs, then our analysis creates a powerful argument for the lifting of existing QRs and the removal of mechanisms that trigger their imposition when poor-country exports rise. The latter process is documented in Dean (1995) and Mshomba (2000). Preferences, in this case, give donors scope for promoting poor-country exports without dropping the broader limitations on export subsidisation that emerged in the Uruguay Round. If, in

contrast, recipient governments are reluctant to spend public sector resources on subsidies to manufactured exports, then the scope for donor action depends on the source of this reluctance. A shift from aid to trade is, after all, an attempt to tie donor funds to particular uses. The tying can be accomplished by combining a shift to preferences with conditionality against export taxation, or by combining continued grants with conditionality on export subsidies. Either approach is subject to the limitations of policy conditionality. The former, however, leverages the substantial progress already achieved in removing both implicit and explicit export taxation in Africa (Oyejide *et al.*, 1999). At the same time it forces the donor into an explicit commitment on market access, thereby addressing a potentially important source of reluctance over export promotion on the part of recipients. In our view, these are important, perhaps even decisive practical advantages.

To summarise, the analysis in this paper strengthens the case for open trade preferences over aid. The period since the mid-1980s has seen the industrial countries trading aid for import liberalisation by African countries while trading reciprocal trade concessions with other developing countries. While aid to Africa has primarily been thought of as trade-promoting, this paper has emphasised a direct and adverse effect operating through export competitiveness. The contemporary focus on social spending by donors, in the Poverty Reduction Strategy framework that has emerged from the HIPC Initiative, may in the medium run create a critical impetus for competitiveness in manufacturing, by addressing constraints on human capital formation and entrepreneurship. In the short run, however, the heavily non-traded composition of this spending plays into the Dutch disease effects emphasised in this paper. In contrast to grants, transfers in the form of open preferences have an intrinsically export-promoting dimension. Any logic that sees exports as an engine of growth therefore implies that trade access remains a critically important feature of the overall aid package.

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Appendix: The Optimum Subsidy

To simplify and interpret the resulting expression we assume: (i) the social welfare function is additively separable in U and u so that $W_{Uu} = 0$; (ii) that $E_{UU} = e_{uu} = 0$ which holds if $E(Q, 1, U)$ can be expressed as $E = f(Q,1)U$; and (iii) the production shift associated with higher first-period exports is linear, so that $r_{RR} = 0$. To start with note that $S = (E_U/e_u)\theta r_R$. Totally differentiating and imposing $E_{UU} = e_{uu} = r_{RR} = \mathrm{d}t = 0$, we get

$$\mathrm{d}S + \left(S\frac{e_{uq}}{e_u} - \frac{E_U\theta}{e_u}r_{Rq}\right)\mathrm{d}q - \frac{\theta r_R E_{UQ}}{e_u}\mathrm{d}Q = \frac{E_U r_R}{e_u}\mathrm{d}\theta. \tag{A1}$$

This is straightforward except for the term $\mathrm{d}\theta$. Since $\theta = W_u/W_U$, we have $W_U\mathrm{d}\theta = \mathrm{d}W_u - \theta\mathrm{d}W_U$, or using $W_{uU} = W_{Uu}$,

Appendix Table 1

Summary Data for Simulation Model

Sectors	*X*	*M*	Total Supply	*ND*	*E*	*CD*	*ID*	*GD*	Total Demand	*XD*	Net Exports	*K/L*
Agriculture	2,900	330	3,230	995	425	1,760	50	0	3,230	2,475	95	0.62
Manufacturing	4,475	1,210	5,685	2,690	1,760	560	675	0	5,685	2,715	550	2.25
Services	3,490	990	4,480	3,350	0	1,005	125	0	4,480	3,490	−990	1.54
Public Services	545	220	765	0	0	0	0	765	765	545	−220	
Total	11,410	2,750	14,160	7,035	2,185	3,325	850	765	14,160	9,225	−565	1.00
As % of Total												
Agriculture	25	12	23	14	19	53	6	0	23	59.5		
Manufacturing	39	44	40	38	81	17	79	0	40	8.3		
Services	31	36	32	48	0	30	15	0	32	32.3		
Public Services	5	8	5	0	0	0	0	100	5	0.0		

Calibration Parameters									
Sectors	*SIGC*	*SIGP*	*OMEGA*	*ALPHAG*	*IOTA*	*TAU*	*TE*	*TM*	*IT*
Agriculture	0.80	0.75	0.80	0.25	1.50	0.00	0.0	10.0	4.0
Manufacturing	0.80	0.75	0.80	0.25	1.50	0.10–0.25	0–19.5	10.0	18.0
Services	0.25	0.25	0.25	0.25	1.50	0.00	0.0	10.0	5.0
Public Services	n/a	n/a	n/a	0.25	n/a	0.00	n/a	10.0	n/a

Appendix Table 1

Continued

Sectors	*X*	*M*	Total Supply	*ND*	*E*	*CD*	*ID*	*GD*	Total Demand	*XD*	Net Exports	*K/L*
GDP	4,375	100										
E	2,185	50	*TARIFF*	250	6							
M	2,750	63	*DUTY*	−160	−4							
CD	3,325	76	*INDTAX*	225	5							
ND	7,035	161	*DIRTAX*	625	14							
GD	765	17	*GR*	940	21							
I (priv)	675	15	*HHSAV*	200	5							
I (gov)	175	4	*GSAV*	175	4							
DEPR	675	15	*AID*	475	11							

Notes: Data defined in billions of local currency with the nominal exchange rate set to 1000 per US$. All data are defined in market prices with world prices normalised to unity. *X* = Gross Domestic Output, *XD* = Domestic Supply to Domestic Market (*X* − *E*); *ND* = intermediate demand (by sector of origin). *M* = imports; *E* = exports *CD* = final consumption, *ID* = investment (by sector of origin), *GD* = government current consumption; *TARIFF* = import tariffs; *DUTY* = export duty/subsidy, *INDTAX* = domestic VAT ; *DIRTAX* = taxes on factor income, *GR* = total government revenue, *HHSAV* = household saving, *I*(*priv*) = private investment (by sector of destination) *I*(*gov*) = government investment, *GSAV* = government savings; *CA* = *AID* = current account deficit, fully financed by official net aid inflows, *K/L* capital labour ratio. *SIGC* = elasticity of substitution in consumption; *SIGP* = elasticity of substitution in intermed consumption; *OMEGA* = elasticity of transformation in production; *ALPHAG* = share weight of public capital in private production functions, *IOTA* = aggregate return elasticity of investment. *TAU* = productivity spillover parameter; *TE* = export duty/(subsidy) as % of world price, *TM* = import tariff (as % of world price): *IT* = domestic VAT as % of domestic factor cost.

$$\mathrm{d}\theta = \frac{W_{uU}}{W_U}(\mathrm{d}U - \theta \mathrm{d}u) - \theta \frac{W_{UU}}{W_U}\left(\mathrm{d}U - \frac{W_{uu}/W_u}{W_{UU}/W_U}\right). \tag{A2}$$

Equation (A2) is potentially complicated because $\mathrm{d}U$ and $\mathrm{d}u$ each depend on $\mathrm{d}A$, $\mathrm{d}T$ and $\mathrm{d}S$. But the first term vanishes if we assume that the utility function, W, is linearly separable in u and U ($W_{uU} = 0$). We can then write

$$\mathrm{d}\theta = -\theta \frac{W_{UU}}{W_U}\left[\mathrm{d}U + \theta \mathrm{d}u - \left(\frac{W_{uu}/W_u}{W_{UU}/W_U} + \theta \mathrm{d}u\right)\right]. \tag{A3}$$

Recalling that the first-order condition for S requires $\theta = -U_S/u_S$, it is clear from inspection of (11) and (13) that the term $\mathrm{d}U + \theta \mathrm{d}u$ involves only the direct effects of $\mathrm{d}A$ and $\mathrm{d}T$ in (11) (i.e., $\mathrm{d}Q$ and $\mathrm{d}S$ cancel out). The final term in $\mathrm{d}u$, in contrast, involves both $\mathrm{d}Q$ and $\mathrm{d}S$; but this term ultimately drops out of (Al) if S is small. To see this, substitute (11) and (13) into (A3) and then substitute the resulting expression into (Al). This yields, after simplification:

$$\mathrm{d}S + \gamma \frac{S}{q}\mathrm{d}q - \alpha_N \frac{S}{Q}\mathrm{d}Q = \frac{W_{UU}}{W_U E_U}\mathrm{d}Z + o(S^2). \tag{A4}$$

The notation $o(S^2)$ refers to a term that vanishes as S^2 goes to zero. For small S, therefore, we get (17) in the text.

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