Aid versus Trade Revisited*

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Abstract

This paper examines the (non) equivalance between aid flows and trade preferences as alternative forms of donor assistance in the presence of learning-by-doing externalities in recipient country export production. Using a two-period model based on van Wijnbergen (1985), in which the productivity externality consistitues the only (inter-temporal) distortion, we show that switching donor support on the margin from aid to trade preferences can increase recipient country welfare. To evaluate the size of this potential welfare gain to small African economies we simulate donor policy reforms using a dynamic CGE model where the productivity externality may also interact with private capital accumulation. We show that for reasonable values of key behavioural parameters, the potential growth and welfare gains from a (donor) revenue neutral re-orientation of assistance to developing countries could be substantial. The paper concludes by considering why these potential dynamic gains appear to be unexpoited by both donors and recipients.

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1 Introduction

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. Johnson (1967), for example, provided a simple general equilibrium treatment of the question in which he showed that in circumstances where incentives in the recipient country were distorted in favour of import-substituting production, a developing country would unambiguously prefer a dollar of aid to an

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Johnson's presumption in favour of aid by considering how aid-tying or the degree of concessionality may reduce the value of a dollar of aid (for example, Thirlwall 1976, Mosley 1988, Morrissey and White 1996). In this paper we argue that by placing the implicit cost-benefit calculation in a context where the donor faces costs of alternative transfer arrangements but where there may also be unexploited dynamic gains to trade through learning-by-doing externalities, 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 recipient's real exchange rate. Van Wijnbergen (1985) used this observation to argue that aid to Africa should be 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 liberalization 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, 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 (e.g. Bayoumi, Coe and Helpman, 1999), export promotion policies are widely regarded as having played an important role in the growth of East Asian countries (e.g., Westphal, 1990). Recent empirical evidence also suggests that not only does export performance play an important role in African growth (for example, Ndulu and Ndung'u 1997), but also that export performance is significantly determined by real exchange rate movements (Bigsten *et al*, 1999, Elbadawi, 1999, and Sekkat and Varoudakis, 2000). Moreover, as GATT negotiations proceeded African governments were receiving billions of dollars in grants and technical assistance conditional on liberalizing their own import regimes. The logic of this paper suggests, first, that African countries should have been intensely interested in gaining trade concessions in developing 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 2 and 3 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 4 we move to a more fully articulated CGE model of a stylized African economy which embodies the essential mechanics of our theoretical model whilst enabling us 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 impose a realistically non-neutral tax structure. We then simulate the effects of a shift at the margin from grants to tariff preferences. The results are striking. Depending on the calibration of the spillover effect and the structure of domestic taxation, this switch from aid to trade raises exports by around 6 percent over a 5-year horizon and by as much as 16 percent in the new steady state. The associated learning-by-doing spillovers contribute to a permanent welfare increase on the order of 5 percent.

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 remain on the table. 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.

2 Static Effects of Aid and Trade Preferences

We consider a small open economy that produces and consumes a nontraded 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 labor moves freely between sectors to equalize 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 (see Dixit and Norman, 1980) we

[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.

express this relationship as:

$$E(P_N, P_M, U) = R(P_N, P_X; L) + P_M A. \tag{1}$$

Normalizing the world price of imports we re-express (1) as

$$E(Q, 1, U) = R(Q, T; L) + A \tag{2}$$

where A is aid measured in imports, U is utility, and subscripts denote partial derivatives with respect to the relevant arguments. By the properties of the revenue and expenditure functions, we can express the supply and compensated demand functions for nontraded goods as E_Q and R_Q leading to market clearing condition in the non-traded goods market

$$E_Q(Q, 1, U) = R_Q(Q, T; L). \tag{3}$$

GDP measured in imported goods is

$$R/P_M = QR_Q + TR_X. \tag{4}$$

In what follows we suppress the labor supply argument in the revenue function. Taken together, equations (2) and (3) imply that the trade balance is equal to exogenously given aid flows:

$$E_M(Q, 1, U) - TR_X(Q, T) = A. \tag{5}$$

Turning to the donor we can consider two alternative ways of generating a transfer of amount dZ measured in terms of the recipient's import good. One way to do this is simply to increase grants by $dA = dZ$. In doing so we assume that the donor calculates the "transfer" value of the trade preference as the amount of tariff revenue lost at the *original* export volumes. 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 recipients 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 $dPM = 0$). The donor's budget

[2]Hence we assume that the preference-receiving country is small relative to third-party exporters to the donor. The world price PM is thus determined by costs of the third-party exporters and the domestic price of the good in the donor country is $(1+\tau)PM$ 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.

constraint for alternative forms of the transfer is thus:[3]

$$dZ = dA + R_X dT. \tag{6}$$

Totally differentiating (2), (3), and (6) yields the following expressions for utility and the real exchange rate for imports where the symbol ($\hat{}$) denotes a proportional change:

$$\hat{U} = \frac{dA + R_X dT}{UE_U} = \left(\frac{1}{UE_U}\right) dZ \tag{7}$$

$$\hat{Q} = [(\Sigma_Q - \Delta_Q)E]^{-1} dZ + \left(\frac{\Sigma_Q}{\Sigma_Q - \Delta_Q}\right) \hat{T} \tag{8}$$

where $\Sigma_Q = \frac{QR_{QQ}}{R_Q} > 0$ and $\Delta_Q = \frac{QE_{QQ}}{E_Q} < 0$. A transfer therefore generates an income effect that increases utility (equation (7)). 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 in (8)) appreciates the real exchange since part of the increased overall spending falls on nontraded goods. Tariff preferences, however, draw resources out of the nontraded good sector (the final term in (8)), 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 summarized by the change in the real exchange rate for exports, Q_X This is calculated as

$$\hat{Q}_X = \hat{Q} - \hat{T} = [(\Sigma_Q - \Delta_Q)E]^{-1} dZ + \left(\frac{\Delta_Q}{\Sigma_Q - \Delta_Q}\right) \hat{T} \tag{9}$$

The spending effect of the transfer appreciates the real exchange 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.

[3]Strictly the donor's budget constraint is

$$dZ = dA + R_X dT[1 + (\tau + dT)\sigma_{XX}]$$

where τ is the initial tariff preference, dT is the preference increase, and $\sigma_{XX} = TR_{XX}/R_X$ is the elasticity of export supply. In the case where the preference is "closed" then $\sigma_{XX} = 0$ by constraint and the donor's cost is exactly as (6). For open preferences, equation (6) holds provided that the initial preference (τ) is zero and the change under consideration is small (so that dT^2 vanishes). In the simulation model presented below we maintain the assumption of zero initial preferences but consider non-marginal changes in the preference.

The absolute effect of tariff preferences depends in a familiar way on the relative strength of income and substitution terms in (9). Substituting for dZ using equation (6), we get the following expression for the elasticity of the export real exchange rate with respect to trade preferences

$$\frac{\partial \ln Q_X}{\partial \ln T} = [(\Sigma_Q - \Delta_Q)E]^{-1}\left(\frac{TR_X}{E} + \Delta_Q\right) \tag{10}$$

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.

3 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 $r_R > 0$.[4] 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:

$$E(Q, 1, U) = R(Q, T + S) + A - SR_X \tag{11}$$

$$E_Q(Q, 1, U) = R_Q(Q, T + S) \tag{12}$$

$$e(q, 1, u) = r(q, 1, R_X) \tag{13}$$

$$e_q(q, 1, u) = r_q(q, 1, R_X) \tag{14}$$

where we have set the (exogenous and fixed) second-period terms of trade equal to 1. Note that learning-by-doing provides the only inter-temporal linkage in the model because the trade balance is exogenously determined by aid flows. As before, tariff preferences amount to an improvement in the first-period terms of trade.

Totally differentiating (11) - (14), we solve for the endogenous variables Q, U, q and u in terms of A and T and the subsidy rate S as follows:

$$E_U dU = dA + R_X dT - S[R_{XQ}dQ + R_{XX}(dT + dS)] \tag{15}$$

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

$$\Lambda dQ = \frac{\alpha_N}{Q}(dA + R_X dT) - (1 - \alpha_N s)R_{QX}(dT + dS) \tag{16}$$

$$e_u du = r_R[R_{XQ}dQ + R_{XX}(dT + dS)] \tag{17}$$

$$\lambda dq = \gamma\frac{r_R}{q}[R_{XQ}dQ + R_{XX}(dT + dS)] \tag{18}$$

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

Since export spillovers are the only inter-temporal linkage in the model, equations (15) and (16) fully determine dU and dQ as functions of dA, dT and dS.[5] Equation (15) solves for dU using the first-period income - expenditure equation (11); equation (16) then solves for dQ using (15) and the nontraded goods market-clearing equation (12).

Consider first the effect of dA, dT and dS on first-period relative prices (equation (16)). 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 $dZ = dA + R_X dT$ 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 -$(1 - \alpha_N s)R_{QX}$ in equation (16) 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 (16) as a direct result of their stimulative effect on exports.

Given the real exchange rate, first-period utility is determined in equation (15). 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. Since

$$R_{XQ}dQ + R_{XX}(dT + dS) = -(T + S)R_{XX}\hat{Q}_X \tag{19}$$

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 real depreciation in period 1 produces spillover benefits that raise utility in

[5] When $S = dS = 0$ so that there is no export subsidy (15) and (16) are identical to (7) and (8) in the static case.

period 2 (equation (17)); and the real exchange rate in period 2 appreciates (equation (18)).

The optimal export subsidy can now be calculated by choosing S to maximize the social welfare function $W = W(U, u)$. The first-order condition for this problem is $W_U U_S = -W_u u_S$. By inspection of (15) - (17), U_S/u_S is readily calculated as $Se_u/r_R E_U$. The optimal production subsidy for exports therefore satisfies the following condition:

$$S^* = \left(\frac{E_U W_u}{e_u W_U}\right) r_R = \frac{E_U}{e_u}\theta r_R \tag{20}$$

where $= \theta = W_u/W_U$. Equation (20) 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 $E_U^{-1} W_U S^*$. 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 equation (20).[6]

To determine the effect of alternative forms of transfer under the optimal subsidy policy we endogenize S^* by totally differentiating (20) which, under certain simplifying assumptions yields (see Appendix):

$$dS = -\frac{SW_{UU}}{E_U W_U} dZ + \alpha_N \frac{S}{Q} dQ - \gamma \frac{S}{q} dq \tag{21}$$

The effect of a transfer (dZ) 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 emphasized in the static analysis, via the impact of the transfer on dQ and dq: if 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 (16), (18) and (21) form a complete sub-system determining dQ, dq, and dS^* in terms of dA and dT 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.

[6] θ can be thought of as defining an implicit domestic real interest rate r: $\theta = 1 + r$. If the recipient were able to borrow and lend at a fixed world interest rate r^*, we would have $E_U/e_u = (1 + r^*)^{-1}$ and therefore $S^* = r_R$. As it is, $S^* > r_R$ in (20) under the assumption that the country is liquidity constrained so that the domestic real interest rate exceeds the foreign interest rate.

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.

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 internalize 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. Differentiating W yields

$$dW = W_U E_U^{-1} dZ - W_U E_U^{-1} R_{XX}(S - S^*)dT + W_S dS \tag{22}$$

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 $dS = 0$), 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.

4 Simulation Evidence

Our model has brought out some fundamental differences between aid and trade. In particular we stressed that unless internalized by an optimal export subsidy dynamic efficiency gains arising from export externalities will go unexploited. However, the model does not offer a sense either of the likely empirical importance of these differences for typical African countries or of how robust the results are in the presence of structural characteristics not included in the analytical model. Given data limitations and the comprehensive changes in policy regimes in Africa in the last decade, robust econometric estimation of export supply functions is likely to be fraught with difficulties (although see Elbadawi (1999) for a promising attempt). The alternative we pursue here is to simulate the effects of aid and trade

preferences in a more fully articulated version of our analytical model. For this purpose 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. Simulation using this model allows us not only to judge the empirical relevance of our analytical results but also to test the robustness of these results to the inclusion of structural features which otherwise would drastically complicate the analytical model.

We proceed as follows. Following a description of the basic features of the model and simulation experiments, we develop a computable representation of the model of Sections 2 and 3 in which factor endowments are fixed and where the learning-by-doing spillover is the only inter-temporal linkage in the economy (and where the export subsidy is financed via lump-sum taxation). We then examine how these basic results are altered by introducing domestic savings and investment (while retaining a closed private capital account) and by limiting the scope for non-distortionary taxation.

4.1 Model Structure

We consider a four-sector economy (manufacturing, agriculture, private sector services and the government sector). The economy is assumed to be a price taker for all tradable goods, but domestic goods and factor prices are fully flexible. Domestic production and imports are imperfect substitutes in consumption while gross output is imperfectly substitutable between domestic and export markets. The composition of demand and supply is governed by homothetic constant elasticity of substitution (CES) and constant elasticity of transformation (CET) functions respectively. Firms combine intermediate goods and value-added to produce gross output according to sector-specific Leontief fixed-coefficients function. Value added is defined by sector-specific Cobb-Douglas production functions exhibiting constant returns to private factors but increasing returns in the presence of public infrastructure capital. This type of model is widely used in analyzing trade policy in small open economies (see, for example, Devarajan *et al*, 1993).

Household welfare is defined in terms of an iso-elastic utility function

$$U = \int_0^\infty \left[\frac{v(c_h)^{1-\varepsilon}}{1-\varepsilon} \right] e^{-\beta t} dt \tag{23}$$

where β is the discount rate, $v(c_h) = u(c_h) X_{pub}^{\alpha G}$, $u(c_h)$ defines the utility from private market consumption (defined by a CES linear expenditure system) and X_{pub} is the level of recurrent government output (α_G is the weight of government output in private welfare). In the simulations considered below we take the limiting case of $\varepsilon = 1$ so that the term in square brackets is $\ln(v(c_h))$.

In the simplest version of the model, sector-specific capital stocks are fixed both in the long- and short run and capital does not depreciate. Labour, which is homogeneous and fully employed, is mobile across sectors. In the extended version, the capital stocks depreciate over time and gross investment responds to equalize sectoral returns to capital. Aid is defined as unrequited and untied grant-in-aid transfers. With a closed private capital account there is no private net accumulation of foreign assets and official reserves are assumed to be constant: hence domestic relative prices adjust to satisfy the balance of payments constraint.

The government sector differs substantially between the two versions of the model. In the simple version, the government acts only as a conduit, transferring aid to the private sector. The fiscal deficit/surplus after grants is transferred to the private sector through lump-sum taxes or rebates. These functions are carried out without consuming resources. The public capital stock in the simple model is fixed in perpetuity. In the extended version, the government levies taxes (on consumption and income) to fund the export subsidy, to meet recurrent expenditure, and to maintain the public capital stock. In this instance, taxes may be either lump-sum or distortionary.

The model is recursively dynamic. In the basic model with fixed factor endowments the only inter-temporal linkage 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

$$X_{it} = A_{it} L_{it}^{\alpha Li} K_{it}^{\alpha Ki} K g_t^{\alpha Gi} \tag{24}$$

where L denotes labour, K private capital, Kg public capital, and t time, where $\alpha L_i + \alpha K_i = 1$ 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

$$A_{st} = f\left[\left(\frac{E^p}{\bar{E}^p}\right)_t ; \gamma, \phi\right] \tag{25}$$

where

$$E_t^p = \sum_{j=1}^{\infty} \frac{E_{t-j}}{(1+\gamma)^j} \tag{26}$$

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, and $0 < \gamma < \infty$ is the discount factor. The evolution of productivity in this sector is therefore governed by the cumulative level of exports, the discount factor, and the spillover parameter. To ensure that the simulation model converges to a new steady

state following a temporary policy experiment, (25) is parameterized as

$$A_{st} = A_{s0}[1 + \phi \log \left(\frac{E^p}{\bar{E}^p} \right)] \tag{27}$$

where A_{s0} is the value of A_{st} at the baseline calibration. A number of features may be noted here. First, the higher is γ the more rapidly past experience depreciates in determining current productivity, and the smaller and less persistent is the impact of a temporary change in the level of exports. Second, since γ is finite there will always be some persistence in $\left(\frac{E^p}{\bar{E}^p}\right)$. Temporary policy reforms will therefore have at least some permanent consequence for productivity. Third, the specification is symmetric: thus anything that reduces export volumes relative to the baseline will also depress sectoral productivity, although this may eventually be reversed by subsequent policy action or through other processes, such as capital accumulation, which lead to increased exports. Finally, since there is virtually no empirical literature that would allow us to calibrate the parameters ϕ and γ, parameter values were selected to ensure that the system arrives at a new steady state within a "reasonable" time-period following a temporary experiment (see below).[7]

In the extended model inter-temporal effects also operate through savings and investment. The simulations reported below assume a standard neo-classical closure: investment is savings-driven and households maintain a fixed savings rate independent of the average domestic return on capital, although the distribution of investment is determined by sectoral rates of return.[8]

4.2 Calibration and Experiment Design

Appendix Table 1 summarizes the baseline data and behavioural parameters with which the model is calibrated. With zero growth in the labour supply and net investment equal to zero (in both public and private sectors) the baseline calibration represents a steady-state equilibrium in which sectoral returns on capital are equalized. The spillover sector, denoted 'Manufacturing' consisting of manufacturing and agro-processing industries, is the larger

[7]Note that the spill-over is defined in terms of exports rather than total production. Thus, for example, a change in relative prices that skews the supply of manufactured goods towards the domestic market would reduce the externality even though total output may increasing. Under the chosen calibration, however, this possibility is limited since the spill-over sector is a net exporter and domestic consumption of manufactured goods is almost entirely in terms of intermediate goods which are characterised by a low price elasticity of substitution.

[8]Although the model is not explicitly forward-looking we assume that agents know the policy change is temporary and hence their savings decisions respond accordingly. Thus they alter their savings in response to the "windfall" income gains generated by the temporary resource transfer in order to smooth their consumption over time.

of the two net export sectors. It is also the most capital intensive activity in the economy. Gross private investment is partially financed from domestic savings, but predominantly from foreign aid (net of amortization) which represent approximately 11% of GDP. Total revenue is approximately 20% of GDP which generates a domestic current budget surplus of 4% of GDP, sufficient to maintain the public capital stock at its steady-state level.

The values chosen for the behavioural parameters reflect common practise in similar CGE models applied to low income developing countries.[9] In general elasticities of substitution in consumption and production are set low. In particular, we assume that for all sectors the price elasticity of substitution in consumption is less than unity. Hence, the income effect of a terms of trade change will outweigh the substitution effect implying that the import real exchange rate will appreciate (depreciate) following a positive (negative) change in the sectoral terms of trade.

We consider two variants of our aid versus trade experiment. The first, which closely follows the analytical model, considers a "temporary" increase in the resource flow from the donor effected either as an increase in aid or a change in trade preferences (denoted by a change in the exogenous world price faced by the recipient country) or some combination of the two. However configured, the initial cost to the donor is equivalent to a 10% decrease in the tariff, T, on the recipient country's exports. Second, we examine a "resource neutral" experiment in which the donor's baseline resource transfer is converted at the margin from a grant flow to a trade preference. We refer to this as the "trade-for-aid" experiment. In contrast to the other experiments, the trade-for-aid experiment avoids any unrealistic assumption of a rise in overall resource flows from donors. Moreover, since the donor's opportunity cost is zero by construction in this experiment, the welfare impact on the recipient provides a test of efficiency in the baseline configuration of foreign assistance. In all cases the resource flow, or the switch from aid to trade preferences, is assumed to be temporary.

A central question at this point is how we define "donor-equivalence" between aid and trade preferences. In Section 2 we assumed that equivalence could be 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. Since the analytical model restricts its attention to marginal changes in aid and preferences this is appropriate, but if we focus on non-marginal changes we need to define equivalence in terms of the full revenue loss allowing for the export response. The relevant donor budget constraint in the face of non-marginal transfers is thus

$$dZ = dA + [1 + (\tau + dT)\sigma_{XX}]R_X dT \tag{28}$$

where τ is the initial tariff preference (assumed to be zero in the simula-

[9]For example Collange and Cogneau (1999) and Davies *et al* (1998).

tions), dT is the increase in the trade preference, and σ_{XX} is the recipient's elasticity of export supply. Equation (6) in Section 2 clearly overstates the size of the donor-equivalent trade preferences that a reduction in aid can buy, by an amount $\sigma_{XX} R_X dT^2$. In the simulations, therefore, we use (28) as the basis for donor equivalence.

Even (28), of course, provides only a partial equilibrium approximation to the general equilibrium response of exports to changes in trade preferences. Exports respond in equilibrium to movements in domestic goods' prices or real wages, and to productivity spillovers and capital formation. Particularly for non-marginal changes, the net effect of these general equilibrium interactions may be poorly approximated by $\sigma_{XX} R_X$. In the simulations below, we explicitly compute the *ex post* deviation from revenue-neutrality in our experiments.

It is important to note that any nontrivial expansion of African exports creates a trade-diversion loss for the donor and recipient considered jointly. The problem is that a portion of the donor's revenue loss accrues not as producers' surplus for the recipient but as compensation for the additional real resources devoted to export production.[10] In the absence of spillovers from additional exporting, this resource cost tilts the efficiency calculation against trade preferences. As we shall see, however, reasonably parameterized spillover effects overwhelm this trade diversion cost.

The timing of event is as follows. Calibration occurs at time $t = 0$. Period $t = 1$ commences with the implementation of the experiment consisting of a change in the exogenous world price for manufactured exports, a change in the exogenous level of aid, or both. Changes in the baseline tax or subsidy rates are also implemented at this point. The model is then solved to generate the short-run equilibrium conditional on the existing capital stock. The short-run equilibrium solution includes new saving and investment vectors and the spillover-induced changes in the productivity in the spillover sector, if relevant. The new capital stock and productivity parameters are embodied between periods $t = 1$ and $t = 2$ and the model is re-solved 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. The model is re-solved until a new steady state is achieved. For all the experiments, given the spillover parameters, the economy returns to a steady state between $t = 10$ and $t = 25$ depending on the spillover parameters. In the tables reported in the next section we report the evolution of the economy on impact ($t = 1$), at the end of the temporary experiment ($t = 5$) and at the new steady state ($t = 25$).

[10] We refer to the loss as a trade diversion loss because the opportunity cost of the increased African exports is above the world price by the preference margin dT.

4.3 Results

4.3.1 The Basic Model

No Export Spillovers. We start by describing the results from the most basic model with fixed factor endowments, lump-sum taxation and no spillover externality. The purpose is to confirm the insights of the analytical model and to establish some baseline orders of magnitude. Table 1 reports these results. Since there are no inter-temporal linkages in this version, either through spillover effects or savings and investment, the economy necessarily returns to its steady-state baseline configuration after the end of the experiment (i.e. from $t = 5$ onwards), a feature unique to this set of results. Nonetheless, the movements in prices and quantities are as predicted in Section 2. The resource-pull effect of trade preferences - where the growth of exports draws resources out of the non-tradable sector – leads to a greater appreciation of the import real exchange rate (Q_M) than under a pure aid transfer, while the switch from aid to trade lowers the appreciation of the export real exchange rate (Q_X). In fact, given the elasticities of substitution used in these experiments, the substitution effect is sufficiently strong that we observe a *depreciation* in the export real exchange rate when the resource flow is solely through trade preferences. Similar results can be seen in column [4] where we have neutralized the income effect of the transfer by considering the resource neutral switch from aid to trade. In this case, unencumbered by the income effect, we observe a larger real exchange rate depreciation for exports and a milder appreciation of the import real exchange rate than under the trade-only case.

The evolution of output and consumption follows directly. Resources transferred by way of aid reduce manufactured exports and total domestic output. Falling net exports, sustained by the appreciation of the import and export real exchange rates, facilitate the rise in domestic consumption. However, as trade preferences dominate the resource transfer so total output and consumption rise. Finally, since capital stocks are fixed over time, the composition of the resource transfer will have differential effects of real wages and profit rates. In the long run, given constant capital stocks and the absence of spillovers, steady state wages and the return on capital are unchanged. For the duration of the experiment, however, real wages increase but by a greater amount when the transfer comes through trade preferences, as firms in the expanding sector bid up average real wages in order to increase supply in the face of a fixed capital stock.

We turn next to the question of equivalence. In contrast with the theoretical model, neither donor nor recipient is indifferent as to the form of assistance. On the donor side, exact revenue equivalence falls due to the general equilibrium interactions discussed earlier. In the trade-only scenario, the general equilibrium elasticity of exports is lower than the partial equi-

librium one built into our *ex ante* revenue-equivalence calculation (equation (28)), with the result that the *ex post* cost of the tariff preference is some 4% lower than the *ex ante* cost over the lifetime of the experiment. In the trade-for-aid case, in contrast, the pure transfer component is absent and upward pressure on domestic prices is moderated; the naive calculation mow understates the full cost of trade preferences for the donor, but only marginally. Differences are of course more striking from the recipient's perspective, since the welfare gain associated with trade is net of the domestic resource cost of what proves to be a non-marginal increase in exports. In column [5], denoted "exact aid", we recompute the aid flow that would be required to compensate the recipient fully for additional costs of export production under the trade preference. For the calibration used here, aid flows would have to be 6.8% higher. In this static model, therefore the resource costs associated with non-marginal expansion of exports shifts the balance in favour of aid over trade. We now introduce learning-by-doing spillovers and export subsidies into the model.

The Basic Model with Export Spillovers The inter-temporal effect of the spillover ensures that the economy converges to a new steady state characterized by *permanently* higher or lower exports and output, and sustaining higher or lower factor incomes, consumption and welfare (Table 2). Consider first the "trade only" experiment in columns [2a] and [2b]. Compared with column [3] of Table 1, the spillover permanently raises exports by around 3% in the case of the moderate spillover and as much as 12% in the case of the high spillover, contributing to permanently higher output of between 1.4% and 6% and an increase in welfare of between 2.9% and 3.9%. By contrast in the "aid only" case (columns[1a] and [1b]) the initial crowding out of exports through the real exchange rate appreciation triggers a *decline* in total factor productivity in that sector and thus a further deterioration of export production and output. This decline feeds into falling real wages and profits and results in significantly lower consumption and welfare. In fact, despite the size of the initial resource transfer, the permanent impact on welfare is only just positive in the high-spillover case and full 2% lower than the case analyzed in Table 1. In this scenario, the lower spillover 'protects' the economy more from the adverse effects arising from the grant inflow, limiting the output decline to one quarter of the decline experienced in the high-spillover case.

Turning to the "trade for aid" case (columns [3a] and [3b]) we note that the long-run response of exports and output is greater than under the trade only case for any given level of the spillover parameter (even though the trade preference is only 5% of the baseline price). This difference simply reflects the absence of the counteracting 'drag' on the export sector generated by the pure transfer component of the trade preference. Notice also that this

time the donor's naive calculation of equivalence significantly *understates* the true cost of the policy switch: by virtue of the spillover and the absence of a net increase in resources the crowding-out of the export response noted above is substantially diminished so that in fact the cost of financing the transfer (over the lifetime of the experiment) is approximately 1% larger than the 'savings' on aid). To the extent that the trade-for-aid experiment neutralizes the income effect of the transfer, this experiment gives us the key benchmark for the gains accruing to a change in aid policy. The effects are sizeable with long-run per capita real consumption and welfare increasing by 4% and 2% respectively as a result of the temporary policy switch.

The model of Section 2 derived the optimal subsidy and showed that it leaves consumers indifferent (in a welfare sense) between aid or trade. Columns [4a] and [4b] illustrate the case were the recipient to use part of the grant aid inflow to fund an export subsidy just sufficient to replicate the long-run welfare consequences prevailing under the trade-only scenario. The export subsidy acts to neutralize the income effect of the aid transfer on the export real exchange rate so that the sector is able to still garner the benefits of the spillover externality.[11]

To briefly summarize, the results of Table 2 indicate that even in the case of a simple endowment economy with export induced productivity spillovers, the gains from a shift from aid to trade are substantial. At the margin, the simulation results imply a short-run export real exchange rate elasticity with respect to a switch from aid to trade is approximately 0.25, and the corresponding supply response in the region of 0.3 to 0.4. The price elasticities are somewhat lower than van Wijnbergen's (1985) point estimates of 0.84 based on Kenyan data for the 1980s, and the supply elasticities lie at the lower end of the estimates derived by Sekkat and Varoudakis (2000) for a panel of African economies over the period 1970-1992. Our relatively low elasticities are not altogether surprising given the maintained assumption that the economy's factor supplies are fixed and fully employed. In the next section we therefore relax this assumption.

[11] Since the simulations are based on open preferences, the dynamic evolution of the economy in the two cases will differ slightly. In the "trade only" case the full cost of the preference is borne by the donor (i.e. the transfer on the initial level of exports *plus* the preference granted on the additional exports). By contrast, in the "aid cum subsidy" case the aid flow is equivalent to the transfer on the *initial* level of exports only, with the cost of the subsidy on the additional exports financed from domestic resources. Because we assume that the government has access to lump-sum taxation, however, the welfare consequences are negligible. Nonetheless, since the changed fiscal balance alters the evolution of the domestic price PD, the import and export real exchange rates are slightly different relative to their values in the "trade only" case in transition to the new steady state.

4.3.2 The Extended Model

We now examine how these basic results are modified when we allow for private and public sector capital formation. Maintaining a closed private capital account we assume that private sector saving is used to accumulate domestic physical capital. The private sector has a fixed baseline propensity to save but we assume that it correctly recognizes the resource transfer to be temporary. Hence the saving rate on the 'windfall' resource transfer rises to smooth consumption over the simulation horizon. Private saving determines total private investment while its sectoral distribution is determined by sector-specific marginal products of capital. As noted above, the importance of government capital formation in this model resides in its role in augmenting the total return to private factors (see equation (24)). We consider two alternative scenarios, the first of which assumes that the government finances a constant public capital stock from lump-sum taxation. By contrast, the second scenario assumes that the government is constrained in its use of lump-sum taxation so that the opportunity cost of an export subsidy is represented by a decline in investment in public capital formation. These extensions necessarily widen the parameter space for our simulations and in order to avoid a proliferation of results we proceed in two steps, starting with an examination of the effect of introducing private sector saving and investment assuming lump-sum taxation before concluding with a discussion of the results under distortionary taxation.

The results of simulating the extended model are reported in Table 3. In both cases the baseline model has been re-calibrated relative to Tables 1 and 2 to optimize the baseline export subsidy on manufactured exports in line with equation (20). For the low spillover the optimal subsidy is 10% of the (baseline) world export price while for the high spillover the optimal subsidy is 15%.[12]

Private Capital Accumulation Introducing capital markets has important consequences for the dynamic behaviour of the economy by endowing the model with a second inter-temporal linkage. The principal implication of this extension is that the model with savings and investment is capable of magnifying the welfare gains, and moderating the losses, observed in the endowment model. When agents save in response to a temporary resource transfer, part of the income gain is diverted to capital formation which, given the fixed labour endowment, 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 externality independently of any relative price effect, and hence creates the possibility of a virtuous circle - with export growth feeding additional capital formation (which is biased towards

[12]Details on the baseline calibrations are available on request from the corresponding author.

the spillover sector) which further stimulates productivity in the spillover sector. By contrast, in the aid-only case positive investment-induced effects serve to mitigate the adverse relative price effects observed in Table 2. For example, with a high spillover, a trade-only resource transfer leads to a permanent increase in the capital stock of 7% (Column [2b]), permanently higher real wages and profits, and an output level 15% higher than the baseline. Together these contribute to an increase in welfare in the long run in excess of 16%, approximately 12% higher than the comparable outturn in Table 2. In the aid-only case, real output falls by 4.7% as opposed to 8.1% in the endowment economy, contributing to a long-run increase in welfare of 4% (as opposed to zero).[13]

The combined effect of the export spillover and capital accumulation means that the donor cost of trade preferences is markedly higher with the simple equivalence calculation understating the true cost of trade preferences by between 10% and 16% over the five-year experiment. However, even if the donor is assumed to fully internalize this cost, the qualitative nature of the results is unchanged and the switch from aid to trade still increases welfare.

A second, but much less powerful, effect introduced in the extended model arises from the composition of expenditure. In the data used here, which are broadly representative of many low income African economies, capital expenditure is slightly more intensive in non-tradable goods than is consumption. As a consequence, a switch from consumption to investment expenditure at the margin will tend to appreciate the consumption real exchange rate. Although the effect is mild in this model, in principle given that foreign asset accumulation is not possible, if this composition effect is strong enough, high short run saving could be inimical to spillover-based growth for the standard "construction boom" reasons. Clearly in circumstances where capital expenditure is heavily skewed towards tradable goods the reverse may be expected.

Columns [4a] and [4b] in Table 3 illustrate the gains that could accrue in circumstances where, for whatever reason, there is no export subsidy present in the baseline. In this case since the economy has not already internalized the spillover externality, the output and welfare gains from a switch in the form of resource transfer at the margin are correspondingly larger than those shown in Columns [3a] and [3b]. Importantly however, as is seen from the lower panel of Table 3, the fiscal consequences differ markedly. In the presence of an export subsidy a switch from aid to trade necessarily

[13]The strength of the capital accumulation effect necessarily reflects the closure rule adopted and in particular the assumption that the private sector's propensity to save rises in response to the temporary resource transfer so that short-run investment effects are quite powerful. It follows therefore that as the short-term savings response weakens (for example if no attempt is made to smooth consumption) the effect of the spillover weakens correspondingly.

raises the cost of the subsidy and has a deleterious effect of the overall fiscal balance, both absolutely and relative to the case where there is no subsidy in place. Rather naturally, the cost to the donor is also correspondingly higher. In the latter case, with no subsidy, the trade for aid switch improves the fiscal balance principally as a results of the growth in the economy's tax base.[14]

In either case, however, we assume that changes in the overall fiscal balance are financed by changes in non-distortionary lump-sum transfer to or from the private sector. In the final section we therefore consider the implications for changes in the form of the resource transfer when access to lump-sum taxation is limited.

Fiscal Effects The domestic fiscal consequences of the experiments can be separated into two components (see bottom panel of Table 3). The direct fiscal effect - picked up in the analytical model - reflects the change in the value of export subsidies brought about by the change in the volume (and domestic price) of manufactured exports. Export subsidies rise in line with the growth of manufacturing exports, and therefore higher trade preferences are associated with a worsening fiscal balance, *ceteris paribus*. This increased direct fiscal cost may, however, be offset by revenue gains from other taxes accruing from the initial income transfer (whether by aid or by trade) and, in the presence of spillovers, by subsequent growth in the total tax base. These actual magnitude of these indirect effects reflect a number of features of the calibration. First the calibration assumes that imports and non-tradable goods attract indirect taxes while exports do not, so that an increase in net exports will reduce the tax base, *ceteris paribus*. This is accentuated by the fact that the import real exchange rate appreciation is greater under trade preferences which reduces the value of *ad valorem* trade taxes expressed in units of GDP. Taken together these effect mean that total revenue rises more slowly than GDP in response to a switch from aid to trade. Finally, it is ambiguous whether the cost of government expenditure should rise or fall since it depends its composition relative to that of GDP. The calibration used here assumes government expenditure to be intensive in non-tradables so that an appreciation of the (import) real exchange rate reduces the cost of government expenditure when measured in units of GDP.

Taking these factors together, reallocating support from aid to trade at the margin in the presence of the optimal export subsidy worsens the net fiscal balance as the increased direct cost of the subsidy outweighs the indirect fiscal gains from growth, particularly when there is a high spillover

[14]In both cases, the real volume of govenment expenditure and the structure of taxation is fixed at their baseline values. Thus the govenment is not assumed to re-optimize its tax structure as the economy grows so that the changes in the fiscal balance reflect the change in total revenue (inclusive of the export subsidy) and the change in the cost of government expenditure given the change in relative prices.

(see columns [3a] and [3b]). Hence the government must raise additional revenue to finance the subsidy. Since the resource flow accrues in the first instance to the private sector through higher export prices, the government must tax away from the private sector some of the pure transfer component of the resource transfer in order to finance the net cost of the export subsidy, and thus the question of potential tax distortions arises. In the presence of lump-sum taxation this does not undermine the welfare effects of the resource switch, but will do when recourse to non-distortionary taxation is not possible.

To illustrate the phenomenon we consider a very simple characterization that assumes that the quantity of government consumption (and thus factor demands) remains constant. To introduce a relevant distortion we assume that the extra cost of the subsidy falls on the ability of the public sector to maintain the level of public capital formation.[15] This scenario is reported in columns [5a] and [5b] of Table 3. Initially the effects are similar, but since public capital formation competes directly with export subsidies for a share of the (fixed) expenditure vote, the new long-run equilibrium is characterized by a lower public capital stock. Given its externality for private productivity, this lowers the return on private capital, output growth and hence welfare. The gains from a switch from aid to trade are still positive but when the spillover and private capital accumulation effects conflict with an offsetting fiscal distortion these effects are necessarily less powerful. Indeed, with a sufficiently large latent fiscal distortion we could reverse the presumption in favour of trade at the margin since a pure aid transfer would allow the authorities the ability to eliminate the binding growth-restraining fiscal distortion even at the cost of blunting the incentive to access the export-generated spillover.

4.4 Simulation Model: Summary

The simulations presented in this section confirm the insights of the analytical model but suggest 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. This asymmetry holds even when major portions of temporary grant financing are saved, as in our simulations. The mechanism is straightforward: the long-run real exchange rate for exports is nearly 17 percentage points more depreciated, in our experiments (Table 3), when a

[15]The same distortion could be achieved by assuming that the government could only increase subsidies by increasing other distortionary taxes. However since the model does not explicitly embody a household labour supply decision (i.e. there is no valuation of lesiure) and since all goods are subject to uniform and linear tax schedules the tax structure in this model is, in fact, non-distortionary and buoyant. The rather crude mechanism adopted here at least has the virtue that it approximates the second-best problem facing government seeking to accommodate higher export subsidies.

third of temporary aid comes in the form of trade preferences than when it comes entirely as donor-equivalent grants. The key here is not whether aid is spent or saved, because in either case a temporary aid flow creates a boom in the nontraded goods market (driven, in the latter case, by the nontraded component of investment).[16] The key, instead, is that trade preferences raise export prices while grants leave them unchanged.

In the absence of spillovers, or when spillovers are appropriately internalized via an export subsidy, the recipient is indifferent to a small change in the composition of transfers received. Our simulations suggest, however, that there is considerably more at stake in practice. First, the recipient is not indifferent to non-marginal changes. Even with modest export spillovers (sufficient to justify a 10 percent subsidy in the initial equilibrium), shifting a third of the aid budget for a period of 5 years, while holding the export subsidy rate constant, increases the recipient's permanent income by 2 percent Table 2 (column 3a). If spillovers are sufficient to justify a 15 percent initial subsidy, this impact increases to 5.4 percent (Table 3 column 3c). Second, the non-marginal nature of the changes appears to be more important quantitatively than the question of whether the recipient has an optimal subsidy in place. The impact of a trade-for-aid shift is indeed larger if learning-by-doing externalities are not initially internalized, but for non-marginal shifts of the size we are considering, the difference is relatively small: a gain of 6 percent rather than 5.4 percent in the high-spillover case.

Our simulations incorporate private capital accumulation and also a fiscal distortion, two features that were absent from the theoretical model. The impact of these extensions accords with intuition. Incorporating investment allows the transfer component of aid to generate positive spillovers via the effect of capital accumulation on manufacturing exports. This enhances the welfare effect of donor support, whether it comes in the form of grants or trade preferences, by mitigating the adverse effects of pure grants and augmenting the spillover effect of preferences. It also strengthens the argument for trade over aid, because preferences now generate even stronger spillovers by drawing investment into the manufacturing sector. Fiscal distortions, in contrast, reduce the attractiveness of preferences relative to grants. The reason is that with a fixed export subsidy rate, the export expansion that accompanies a shift from aid to trade creates a fiscal burden. Revenues must be raised, or (as in our case) productive spending decreased, to finance the increased subsidies. The welfare cost of this fiscal adjustment - which would be zero if lump-sum taxation were available - reduces the relative attractiveness of preferences. In our simulations a donor-equivalent shift from aid to trade remains beneficial for the recipient, but this result could be reversed

[16]Recall that the capital account is closed. If it were open, a portion of domestic saving would be used to accumulate foreign assets, limiting the boom in the domestic non-traded goods market.

if fiscal distortions were sufficiently strong relative to export spillovers.

5 Conclusions

The analysis in the previous sections raises an obvious question: if open trade preferences are more efficient than aid, 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? In this final section we consider why these gains have been left unexploited.

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 with the production of traded manufactured goods more generally. Helleiner (1990), for example, suggests that productivity spillovers are associated primarily with noncompetitive imports of differentiated inputs, a theme that has been developed in the endogenous growth literature (e.g., Bayoumi, Coe and Helpman, 1999). 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 enhances import capacity, because the induced real appreciation exerts only a second-order effect. Spillovers rise rather than falling, 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 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 export subsidies). Shifting a dollar of assistance from grants to greater market access 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 mobilize 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 temperate zone exports over manufactured exports, since the former do not compete directly with domestic production. A tariff concession on a product line already covered by a quantitative export limit is the equivalent of a pure grant: exports cannot rise. An open preference on temperate zone exports allows exports to rise, but since these exports are not typically associated with learning-by-doing effects this generates welfare gains only if it is import capacity, rather than exports, that generates spillovers.

Distributional effects on the demand-side may also be important. The key here is that aid is an official transaction, while the direct benefits of market access are diffused across the private sector. The form of assistance therefore has a first-order effect on the distribution of income between the public and private sectors in the receiving economy. In discussing the impact of fiscal distortions we suggested above what amounts to a normative argument for aid over trade. The idea is that domestic revenue collection is distortionary and also that export subsidies are only one of a number of attractive public projects. For example, it might be socially optimal to spend half of a temporary aid increase on export subsidies and half on public infrastructure. These plans can be carried out costlessly if aid comes as a grant to the government. But if it comes as trade preferences, the portion that is channeled into infrastructure must be financed by higher taxes. In this case, the non-fungibility of trade-generated resources imposes a social cost, and the recipient is better off with a donor-equivalent grant. The underlying point is familiar from the public finance literature: absent differences in preferences between donor and recipient, fungible grants are likely to preferable on efficiency grounds to non-fungible ones.

As on the supply side, however, positive considerations are probably more decisive than normative ones in raising the demand for aid relative to trade. 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 over 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 aid. And 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 market access. These considerations are of course not decisive; elites can be strongly committed to private sector development, as in Mauritius or Botswana. But Ake (1996), Mkandawire and Soludo (1999) and others

suggest that such elites were relatively unlikely to emerge in the political environment of post-independence Africa.

We have argued that distributional considerations explain the failure of donors and recipients to unlock the dynamic gains to a shift from aid to trade. For the countries of Africa, we should perhaps go further and argue that it is ultimately the domestic politics that count. The point is that when preferences are open - so that quantitative restrictions, if any, are not binding - recipients can unilaterally mimic a donor-equivalent shift from aid to trade by using aid inflows to pay export subsidies to domestic producers. This strategy is not open to middle-income aid recipients, because the manufactured exports of these countries typically face quantitative restrictions. Nor will it be a possibility after some of these restrictions (including those of the long-standing Multi-Fiber Arrangement) have been removed as a result of the Uruguay Round, because the new WTO restrictions on export subsidization will prevent an aggressive export response. But with few exceptions, the manufactured exports of low-income developing countries - a category that includes most African countries - have not been large enough to attract quantitative restrictions. Although evidence suggests that such restrictions will emerge endogenously if exports rise substantially, if our analysis is correct, aid recipients should shift fungible aid resources into the promotion of exports. Donors skeptical of the intentions or political resolve of recipient governments should do this unilaterally.

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 liberalization 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 emphasized a direct and adverse effect operating through export competitiveness. In contrast to pure grants, transfers in the form of open trade preferences have an intrinsically export-promoting dimension. Any logic that sees exports as an engine of growth therefore leads to a strong concern for the form of aid.

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6 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 $S = (E_U/e_u)r_R$. Totally differentiating and imposing $E_{UU} = e_{uu} = r_{RR} = dt = 0$, we get

$$dS + \left(S\frac{e_{uq}}{e_u} - \frac{E_U\theta}{e_u}r_{Rq} \right) dq - \frac{\theta r_R E_{UQ}}{e_u}dQ = \frac{E_U r_R}{e_u}d\theta \tag{A1}$$

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

$$d\theta = \frac{W_{uU}}{W_U}(dU - \theta du) - \theta\frac{W_{UU}}{W_U}\left(dU - \frac{W_{uu}/W_u}{W_{UU}/W_U} \right) \tag{A2}$$

Equation (A2) is potentially complicated because dU and du each depend on dA, dT and dS. 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

$$d\theta = -\theta\frac{W_{UU}}{W_U}\left(dU + \theta du - \left(\frac{W_{uu}/W_u}{W_{UU}/W_U} + \theta du \right) \right) \tag{A3}$$

Recalling that the first-order condition for S requires $\theta = -U_S/u_S$, it is clear from inspection of (15) and (17) that the term $dU + \theta du$ involves only the direct effects of dA and dT in equation (15) (i.e., dQ and dS cancel out). The final term in du, in contrast, involves both dQ and dS; but this term drops out of (A5) if S is small. In particular, substituting equations (15) and (17) into (A7) and then substituting the resulting expression for $d\theta$ into (A5), we get after simplification:

$$dS + \gamma\frac{S}{q}dq - \alpha_N\frac{S}{Q}dQ = \frac{W_{UU}}{W_U E_U}dZ + o(S^2) \tag{A4}$$

The notation $o(S^2)$ refers to a term that vanishes as S^2 goes to zero. For small S, therefore, we get equation (21) in the text.

TABLE 1
EQUIVALENCE OF AID AND TRADE WITH NO DISTORTIONS

[Percentage Changes Relative to Baseline Calibration]

	Time Period	Aid Only	Aid and Trade	Trade Only	"Trade for Aid"	"Exact" Aid
Experiment		**[1]**	**[2]**	**[3]**	**[4]**	**[5]**
Spillover Parameter		0.00	0.00	0.00	0.00	0.00
Change in Aid		36.4%	17.5%	0.0%	-17.5%	43.2%
Change in Trade Preferences (Mfg)		0.0%	5.0%	10.0%	5.0%	0.0%
Donor Cost	**grant**	0.864	0.416	0.000	-0.416	1.025
($ millions)	**preferences**	0.000	0.400	0.830	0.418	0.000
	Total	0.864	0.816	0.830	0.002	1.025
% of grant		0.0%	-5.6%	-3.9%	0.4%	18.6%
SOCIAL WELFARE						
Discount	**10% to t=1**	2.7%	2.8%	3.1%	0.4%	3.1%
	to t=5	4.4%	4.7%	5.2%	0.6%	5.2%
	to t = 25	2.1%	2.3%	2.5%	0.3%	2.5%
	to t = inf	2.1%	2.2%	2.4%	0.3%	2.5%
RELATIVE PRICES						
Exportables: Qx=Pd/Px	**t=1**	5.3%	1.2%	-2.4%	-3.9%	6.2%
	t=5	5.3%	1.2%	-2.4%	-3.9%	6.2%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%
Importables: Qm=Pd/Pm	**t=1**	5.3%	5.9%	7.0%	1.1%	6.2%
	t=5	5.3%	5.9%	7.0%	1.1%	6.2%
	t=25	0.0%	0.0%	7.0%	0.0%	0.0%
QUANTITIES						
Manufacturing Exports	**t=1**	-4.4%	0.0%	3.8%	4.4%	-5.6%
	t=5	-4.4%	0.0%	3.8%	4.4%	-5.6%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%
Total Output	**t=1**	-0.3%	0.6%	1.7%	1.1%	-0.5%
	t=5	-0.3%	0.6%	1.7%	1.1%	-0.5%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%
Consumption	**t=1**	3.6%	4.0%	4.4%	0.2%	4.4%
	t=5	3.6%	4.0%	4.4%	0.2%	4.4%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%
FACTOR MARKETS						
Average Real Wage	**t=1**	5.0%	8.7%	12.9%	4.0%	6.0%
	t=5	5.0%	8.7%	12.9%	4.0%	6.0%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%
Average Profit Rate	**t=1**	-0.5%	0.6%	1.6%	1.1%	-0.6%
	t=5	-0.5%	0.6%	1.6%	1.1%	-0.6%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%

Notes:

[1] Social welfare measures the difference in the discounted cumulative utility from t=0 relative to the steady state baseline.
[2] All other results report the percentage difference relative to the baseline calibrated values. [see Appendix 1]

TABLE 2
AID VERSUS TRADE WITH SPILLOVERS AND EXPORT SUBSIDIES

[Percentage Changes Relative to Baseline Calibration]

	Time Period	Aid Only		Trade Only		Trade for Aid		Aid cum Subsidy	
Experiment		**[1a]**	**[1b]**	**[2a]**	**[2b]**	**[3a]**	**[3b]**	**[4a]**	**[4b]**
Spillover Parameter		0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25
Change in Aid		36.4%	36.4%	0.0%	0.0%	-17.5%	-17.5%	36.4%	36.4%
Change in Trade Preferences		0.0%	0.0%	10.0%	10.0%	5.0%	5.0%	0.0%	0.0%
Export Subsidy		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-10.0%	-15.0%
Donor Cost	**grant**	0.864	0.864	0.000	0.000	-0.416	-0.416	0.864	0.864
($ millions)	**preferences**	0.000	0.000	0.832	0.837	0.419	0.421	0.000	0.000
	Total	0.864	0.864	0.832	0.837	0.003	0.005	0.864	0.864
% of grant		0.0%	0.0%	-3.7%	-3.1%	0.6%	1.2%	0.0%	0.0%
SOCIAL WELFARE									
Discount	**10% to t=1**	2.6%	2.6%	3.1%	3.2%	0.4%	0.4%	3.2%	3.2%
	to t=5	4.3%	4.1%	5.3%	5.5%	0.7%	0.9%	5.5%	5.6%
	to t = 25	1.6%	0.3%	2.9%	3.8%	0.8%	1.8%	3.0%	3.8%
	to t = inf	1.5%	0.1%	2.9%	3.9%	0.8%	1.9%	2.9%	3.9%
RELATIVE PRICES									
Exportables: Qx=Pd/Px	**t=1**	5.3%	5.4%	-2.4%	-2.4%	-3.9%	-4.0%	-2.2%	-2.2%
	t=5	5.6%	6.0%	-2.5%	-2.9%	-4.1%	-4.5%	-2.4%	-2.7%
	t=25	1.4%	6.9%	-1.1%	-4.5%	-1.3%	-5.0%	-1.1%	-4.3%
Importables: Qm=Pd/Pm	**t=1**	5.3%	5.4%	6.9%	6.9%	1.0%	1.0%	7.1%	7.1%
	t=5	5.6%	6.0%	6.8%	6.5%	0.8%	0.5%	7.0%	6.6%
	t=25	1.4%	6.9%	-1.1%	-4.5%	-1.3%	-5.0%	-1.1%	-4.3%
QUANTITIES									
Manufacturing Exports	**t=1**	-4.4%	-5.0%	3.8%	3.8%	4.4%	4.4%	3.8%	3.8%
	t=5	-5.0%	-6.3%	4.4%	5.6%	5.0%	6.3%	4.4%	5.0%
	t=25	-3.8%	-16.9%	3.1%	12.5%	3.1%	14.4%	3.1%	11.9%
Total Output	**t=1**	-0.5%	-0.5%	1.7%	1.7%	1.1%	1.1%	1.7%	1.7%
	t=5	-0.6%	-1.2%	1.9%	2.4%	1.4%	1.9%	1.9%	2.3%
	t=25	-1.8%	-8.1%	1.4%	6.0%	1.7%	6.8%	1.4%	5.8%
Consumption	**t=1**	3.6%	3.6%	4.4%	4.4%	0.4%	0.7%	4.7%	4.7%
	t=5	3.6%	3.3%	4.7%	5.1%	0.7%	1.1%	4.9%	5.1%
	t=25	-1.1%	-5.6%	0.9%	4.0%	1.1%	4.2%	0.9%	3.8%
FACTOR MARKETS									
Average Real Wage	**t=1**	5.0%	4.9%	12.9%	13.0%	4.1%	4.2%	13.1%	13.2%
	t=5	4.5%	3.6%	13.4%	14.3%	4.5%	5.5%	13.5%	14.3%
	t=25	-2.7%	-12.2%	2.2%	9.5%	2.5%	10.8%	2.1%	9.1%
Average Profit Rate	**t=1**	-0.6%	-0.6%	1.6%	1.6%	1.2%	1.2%	1.6%	1.6%
	t=5	-0.9%	-1.4%	1.9%	2.3%	1.5%	2.0%	1.8%	2.3%
	t=25	-1.8%	-8.4%	1.5%	6.2%	1.7%	7.1%	1.4%	6.0%

Notes:

[1] Social welfare measures the difference in the discounted cumulative utility from t=0 relative to the steady state baseline.
[2] All other results report the percentage difference relative to the baseline calibrated values. [see Appendix 1]

TABLE 3
AID VERSUS TRADE WITH SPILLOVERS, CAPITAL ACCUMULATION AND EXPORT SUBSIDIES

Neo-Classical Savings Closure
[Percentage Changes Relative to Baseline Calibration]

	Time Period	Aid Only		Trade Only		Trade for Aid [with export subsidy]		Trade for Aid [no export subsidy]		Trade for Aid [with export subsidy and fiscal distortion]	
Experiment		**[1a]**	**[1b]**	**[2a]**	**[2b]**	**[3a]**	**[3b]**	**[4a]**	**[4b]**	**[5a]**	**[5b]**
Spillover Parameter		0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25
Change in Aid		36.4%	36.4%	0.0%	0.0%	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%
Change in Trade Preferences		0.0%	0.0%	10.0%	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Export Subsidy		10.0%	15.0%	10.0%	15.0%	10.0%	15.0%	0.0%	0.0%	10.0%	15.0%
Donor Cost	**grant**	0.864	0.864	0.000	0.000	-0.416	-0.416	-0.416	-0.416	-0.416	-0.416
($ millions)	**preferences**	0.000	0.000	0.952	1.005	0.460	0.484	0.418	0.420	0.458	0.479
	Total	0.864	0.864	0.952	1.005	0.044	0.068	0.002	0.004	0.042	0.063
% of grant		0.0%	0.0%	10.2%	16.3%	10.6%	16.3%	0.4%	0.9%	10.0%	15.2%
SOCIAL WELFARE											
Discount Rate =10%	**to t=1**	3.7%	3.9%	5.6%	5.7%	1.1%	1.0%	1.3%	1.4%	1.6%	1.9%
	to t=5	10.6%	11.1%	7.1%	7.1%	2.0%	2.2%	2.4%	3.0%	2.0%	2.4%
	to t = 25	6.7%	4.5%	10.9%	15.6%	2.2%	5.0%	2.4%	5.6%	0.8%	1.9%
	to t = inf	6.6%	4.0%	11.0%	16.2%	2.2%	5.4%	2.5%	5.9%	0.8%	2.0%
RELATIVE PRICES											
Exportables: Qx=Pd/Px	**t=1**	5.8%	5.9%	-2.3%	-2.3%	-4.2%	-4.2%	-4.1%	-4.1%	-4.2%	-4.4%
	t=5	5.4%	5.7%	-1.8%	-2.1%	-4.4%	-4.9%	-4.3%	-4.7%	-4.4%	-4.9%
	t=25	0.7%	4.8%	-3.5%	-11.9%	-1.5%	-6.5%	-1.4%	-5.6%	-1.1%	-4.3%
Importables: Qm=Pd/Pm	**t=1**	5.8%	5.9%	7.0%	7.0%	0.8%	0.7%	0.9%	0.9%	0.7%	0.6%
	t=5	5.4%	5.7%	7.5%	7.2%	0.6%	0.1%	0.7%	0.3%	0.6%	0.1%
	t=25	0.7%	4.8%	-3.5%	-11.9%	-1.5%	-6.5%	-1.4%	-5.6%	-1.1%	-4.3%
QUANTITIES											
Manufacturing Exports	**t=1**	-3.1%	-3.3%	5.1%	5.3%	4.3%	4.6%	4.2%	4.3%	4.2%	4.2%
	t=5	-3.2%	-4.6%	11.0%	13.4%	5.0%	6.2%	4.8%	5.8%	4.1%	4.7%
	t=25	-1.2%	-10.2%	9.3%	32.3%	3.6%	15.9%	3.4%	14.3%	2.2%	8.2%
Total Output	**t=1**	0.2%	0.1%	2.0%	2.1%	1.1%	1.2%	1.0%	1.0%	0.9%	0.9%
	t=5	0.6%	-0.1%	5.6%	6.8%	1.3%	1.9%	1.2%	1.7%	0.7%	0.8%
	t=25	-0.3%	-4.7%	4.9%	15.5%	1.7%	7.4%	1.6%	6.6%	0.8%	3.0%
Consumption	**t=1**	1.8%	1.9%	2.7%	2.7%	0.5%	0.4%	0.6%	0.6%	0.7%	0.9%
	t=5	3.9%	4.0%	2.4%	2.3%	0.6%	0.9%	0.8%	1.1%	0.3%	0.4%
	t=25	0.0%	-2.9%	3.9%	9.8%	1.2%	4.6%	1.2%	4.9%	0.4%	1.6%
FACTOR MARKETS											
Average Real Wage	**t=1**	4.0%	3.9%	12.4%	12.6%	4.2%	4.4%	4.0%	4.1%	4.3%	4.5%
	t=5	4.8%	4.0%	14.8%	16.6%	4.7%	5.8%	4.5%	5.4%	4.3%	5.0%
	t=25	-1.0%	-8.1%	7.5%	26.5%	2.9%	13.0%	2.7%	11.5%	1.8%	7.1%
Average Profit Rate	**t=1**	0.0%	-0.3%	8.3%	8.5%	4.4%	4.6%	4.0%	4.1%	4.3%	4.6%
	t=5	-1.8%	-2.6%	6.1%	7.5%	4.9%	6.0%	4.5%	5.3%	4.3%	4.9%
	t=25	-1.9%	-8.0%	3.3%	17.2%	2.3%	10.3%	2.1%	8.9%	1.4%	5.3%
SAVING AND INVESTMENT											
Aggregate Savings Rate	**t=1**	15.0%	15.2%	5.7%	5.6%	-3.8%	-4.0%	-3.6%	-3.6%	-5.2%	-6.1%
	t=5	9.5%	8.7%	18.0%	19.1%	-4.0%	-4.7%	-3.8%	-4.3%	-5.1%	-6.5%
	t=25	0.5%	5.0%	-4.2%	-12.7%	-1.6%	-6.8%	-1.5%	-6.0%	-1.4%	-6.0%
Private Capital Stock	**t=1**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	t=5	2.6%	2.4%	5.0%	5.2%	-0.1%	0.0%	-0.1%	0.0%	0.0%	0.1%
	t=25	1.0%	-0.4%	4.2%	7.3%	0.6%	2.3%	0.5%	2.0%	0.4%	1.3%
Public Capital Stock	**t=1**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	t=5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-2.0%	-3.0%
	t=25	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-1.8%	-6.4%
FISCAL BALANCE											
Export Subsidies	**t=1**	-7.1%	-7.1%	1.0%	1.0%	4.2%	4.2%	0.0%	0.0%	4.0%	3.8%
[% GDP]	**t=5**	-7.7%	-8.2%	3.4%	4.0%	4.3%	4.5%	0.0%	0.0%	4.1%	4.1%
	t=25	-0.4%	-3.3%	2.4%	7.1%	1.0%	4.0%	0.0%	0.0%	0.7%	2.2%
Revenue	**t=1**	1.4%	2.1%	-2.4%	-2.6%	-2.0%	-2.5%	-1.2%	-1.2%	-2.0%	-2.3%
[% GDP]	**t=5**	1.8%	2.8%	-3.3%	-4.1%	-2.1%	-2.6%	-1.2%	-1.3%	-2.0%	-2.4%
	t=25	0.2%	1.4%	-0.7%	-3.1%	-0.4%	-1.8%	-0.1%	-0.6%	-0.3%	-1.1%
Expenditure	**t=1**	-0.6%	-0.5%	-3.5%	-3.6%	-1.7%	-1.8%	-1.6%	-1.6%	-1.6%	-1.6%
[% GDP]	**t=5**	-0.6%	-0.4%	-5.0%	-5.3%	-1.7%	-1.9%	-1.6%	-1.7%	-1.5%	-1.5%
	t=25	0.0%	-1.1%	-1.2%	-2.8%	-0.4%	-1.5%	-0.3%	-1.2%	0.0%	-0.3%
Budget Balance	**t=1**	10.2%	13.4%	2.6%	2.0%	-3.5%	-5.5%	0.4%	0.4%	-3.4%	-5.1%
[%GDP]	**t=5**	12.5%	16.5%	3.8%	1.4%	-3.7%	-5.8%	0.4%	0.5%	-4.3%	-6.6%
	t=25	1.0%	0.3%	1.3%	-4.4%	-0.2%	-3.1%	0.6%	2.1%	-1.0%	-4.4%

Notes:
[1] Export Subsidies are set to optimal values of 10% and 15% given export spillovers of 0.10 and 0.25 respectively.
[2] Social welfare measures the difference in the discounted cumulative utility from t=0 under the experiment relative to the steady state baseline.
[3] All other results report the percentage difference relative to the baseline calibrated values. [see Appendix 1 for baseline values.]

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	2900	330	3230	995	425	1760	50	0	3230	2475	95	0.62
Manufacturing	4475	1210	5685	2690	1760	560	675	0	5685	2715	550	2.25
Services	3490	990	4480	3350	0	1005	125	0	4480	3490	-990	1.54
Public Services	545	220	765	0	0	0	0	765	765	545	-220	
Total	11410	2750	14160	7035	2185	3325	850	765	14160	9225	-565	1.00

As share of Total	X	M	Total Supply	ND	E	CD	ID	GD	Total Demand	XD
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	SIG C	SIG P	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	0.50 -1.00	-10.0%	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

As share of GDP					
GDP	4375	100%			
E	2185	50%	**TARIFF**	250	6%
M	2750	63%	**DUTY**	-160	-4%
CD	3325	76%	**INDTAX**	225	5%
ND	7035	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 normalized 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 ;
ALPHG = share weight of public capital in private production functions; **IOTA =** aggregate return elasticity of investment ; **TAU** = productivity spillover parameter ;
TE = export duty / (subsidy) as percent of world price; **TM =** import tariff (as percent of world price); **IT** = domestic VAT as percent of domestic factor cost.