Trade Agreements, Bargaining and Economic Growth

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Abstract
The two-sector endogenous growth model of Rebelo (1991) and Felbermayr (2007) is embedded within an asymmetric two-country international trade and bargaining framework. Starting with a free trade equilibrium, the analysis reveals that: (i) foreign aid can increase the total production of consumption goods and place both countries on a Balanced Growth Path (BGP); (ii) with bargaining, a trade agreement that endogenizes the linkage between foreign aid and adoption of trade policies generates higher welfare for both countries compared to autarky; (iii) despite the foreign aid transfer from the rich to the poor country, the richer country's welfare increases compared to its free trade equilibrium level, while the poor country's welfare decreases.

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1. Introduction

The economic relations between developing and developed countries are complex by nature. Roughly speaking, these relations are based on two different channels. The first involves the transfer of resources in the form of loan or foreign aid from the developed country to the developing one. The second involves the cross-country trade between the two countries. These two channels are implicitly linked, as developed countries, in their negotiation with developing countries over foreign aid, may condition or tie the aid (or loan) on changing the terms of trade in their favor. This often enhances the donor country's welfare at the expense of the developing country.

Foreign aid affects welfare either through promoting trade or growth, or by merely increasing income in the recipient country.[1] The linkage, however, between the three aspects - foreign aid, trade and growth - is somewhat vague in the literature.

Several studies explore the connection between aid and trade.[2] Among them, the theoretical ones typically assume that the trade policies of both countries and the size of the transfer are exogenous. They also assume, that when foreign aid is tied to some policy variables in the recipient country, the tying rule is exogenous, usually tying the aid to the poorer country's expenditure rather than to its trade policies. The few articles who abstract from such assumptions use static models, thus neglecting to consider the resulting growth implications of foreign aid-trade relationship. Moreover, these 'static' articles study tariff wars rather than trade agreements as a means of allocating surplus.[3] In

[1] Sometimes foreign aid might cause a *decline* in welfare in the recipient country. This phenomenon is the well-known 'transfer paradox'. This paradox is not analyzed in the paper.
[2] For a full survey of the linkage of aid and trade see Suwa-Eisenmann and Verdier (2007).
[3] For a more detailed survey of this strand of the literature see the introduction in Lahiri, Raimondos-Moller, Wong and Woodland (2002).

contrast, in this article we study a two-country growth model where the aid is tied to the trade policies by an agreement between the two countries.

We focus on bilateral trade agreements signed between a developing country and a developed one, akin to the kind of regional bilateral trade agreements that was common during the 1990's.[4] Both parties to such agreements typically have to make concessions on different issues, including curtailing protectionist policies that were in force prior the agreement. While the frequency of such agreements and their importance have increased in recent years, there are only few theoretical studies that attempted to study their general properties. Most of these studies concentrated on how bigger countries tend to win tariff wars, and typically employ static models, (e.g, Kennan and Riezman (1988)). The ones that do use dynamic models, like Devereux (1997), show that tariff wars reduce the world-wide growth rates compared to free trade, due to distortions inflicted by the tariffs. We examine in this paper what are the growth and welfare implications of tying foreign aid to costly trade policies even when such distortions are absent.

Multilateral trade agreements can often take resemblance to a bilateral agreement between developed and developing countries with conflicting interests. Most disputes preventing a new multilateral trade agreement among WTO members are between the block of developed countries led by European Union, US and Japan, and the block of developing countries led by India, Brazil, China and South Africa. Clearly, the leading developed countries involved are those that also contribute most of the foreign aid. Theoretical studies assume that foreign aid is often motivated by economic

[4] For instance, since the early 1990s the European Free Trade Association (EFTA) has established an extensive network of contractual free trade relations all over the world, including Singapore, Egypt, Israel, Chile, Mexico, Croatia, Colombia and Lebanon. For more details see http://www.efta.int/content/free-trade/fta-countries.

considerations.[5] Hence, it can be argued that for obtaining a comprehensive understanding of foreign aid tied to trade agreements, trade negotiations should be considered along with the developed country's decision to provide foreign aid, as we do in the paper.

We analyze how foreign aid tied to trade policies affects welfare in both the donor and the recipient countries. Unlike other models, we do so by examining the equilibrium implications of foreign aid which is tied to costly changes in trade policies. Following Felbermayr (2007) we construct a two-sector growth model of two open economies, North and South, based on the two-sector growth model of Rebelo (1991). The only difference between North and South lies in initial endowments of capital stock per capita. This model has several realistic virtues. First, it generates the empirically observed decline over time in the relative prices of capital goods in terms of consumption.[6] Second, in the equilibrium of this model the developed country exports capital goods and the developing one exports consumption goods, as is typically the case in rich-poor countries trade relationships.[7]

This model has a unique balanced growth path (BGP), which is stable. However, depending on initial capital endowments, a transfer from the rich to the poor country can put the countries on the BGP right from the start, rather than on a path that only converges to it asymptotically. Total production of consumption goods can thus increase

[5]While Alesina and Dollar (2000) argue that political rather than economic considerations underlie the aid given by developed countries in some cases, other studies, such as Asante (1985) claim that economic considerations typically motivate foreign aid.

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[6] As quoted in Felbermayr (2007), Cummins and Violante (2002) calculated a decline of the relative price of capital goods in the United Stated at a rate of 3%-4% since 1974.

[7] Felbermayr (2007) showed that developing countries are net importers of capital goods and net exporters of consumption goods.

as a result of foreign aid without reducing the growth rates. This can motivate the North to give aid to the South, provided the division of the surplus created is favorable to it.

We assume that the foreign aid is tied to trade policies that both countries must agree upon. We do not specify the particular policies that the negotiating parties bargain over, but instead assume that they are costly in terms of on-going welfare transfers over time from the recipient to the donor. Thus, while resembling in some sense a 'give and take' agreement, we refrain from modeling an explicit borrowing and lending between the countries. The countries involved negotiate over the division of the consumption goods surplus *before* the aid is given.

We model this negotiation as a Nash bargaining (1950) process. This axiomatic mechanism is advantageous to alternative non-cooperative bargaining mechanisms because it alleviates the need to specify the procedure and structure of the negotiations, and predicts an outcome which depends only on feasible allocations of the surplus to be created by the agreement and on the consequences of non-agreement. The use of bargaining to model trade agreements is supported by evidence provided in Steinberg (2002). In describing the decision making process in the WTO and GATT, Steinberg claims that through multilateral bargaining among WTO members, the powerful states can, and in fact do, pass legislative packages that favor their own interests and yet are accepted by all participating states and generally considered legitimate to them.

We show that along the BGP the total world production of consumption goods is maximal given the implied growth rate. Accordingly, the optimal *level* of the foreign aid is one which places the world immediately on the BGP. We show that any bargaining-based trade agreement Pareto dominates autarky, regardless of initial capital

endowments. We also show that trade agreement makes the richer country better off and the poorer country worse off compared to a free-trade equilibrium. Since the foreign aid in our model is tied to implementing some trade policies, and since the richer country decides whether or not to give the foreign aid, unfettered free trade would not be the equilibrium between the two countries.

The results of this paper shed some light, then, on how developed countries manage to gain more than developing countries from establishing bilateral trade relationships, as seem to be indicated by WTO empirical evidence. Computable general equilibrium of the Uruguay Round show, for example, a disproportional benefit of GDP of the developed countries compared to the developing ones (Ackerman, 2005). Furthermore, Stiglitz (2002) argues, that through the Uruguay Round the developed countries set a lopsided division of profits gained by globalization in favor of their own interests, either through maintaining agricultural subsidies given to farmers in the developed countries, or by legislating property rights that reflect solely the interests of firms in the developed world. Understanding the procedure of reaching the agreements can help in understanding their outcomes.

The rest of the paper is structured as follows. Section 2 sets up the basic growth and trade model. Section 3 describes the free trade scenario, the BGP of which is characterized in section 4. Section 5 describes the bargaining-based trade agreement equilibrium, and section 6 concludes.

2. The Model

Consider a world consisting of two economies,[8] North and South, denoted *N* and *S*. Each economy has a constant population. A representative agent in each economy seeks to maximize the following utility function:

$$(1) \qquad U^i(t) = \int_0^\infty e^{-\rho t} \cdot \frac{c^i(t)^{1-\theta}}{1-\theta} dt,$$

where $c^i(t)$ is per-capita consumption at economy *i* at *t*, $i \in \{N, S\}$. The agent has one unit of labor which is supplied inelastically, and owns the (per capita) amount of capital in the economy, which is rented to firms each period.

The lifetime budget constraint of the representative agent in each economy is given by

$$(2) \qquad \int_0^\infty c^i(t) \cdot e^{-r^i(t)t} dt = P_q^i(0) k^i(0) + \int_0^\infty w^i(t) \cdot e^{-r^i(t)t} dt$$

where $P_q^i(t)$ is the relative price of capital in terms of consumption goods in country *i* at time *t*; $r^i(t)$ is the interest rate in country *i* at time *t*; $k^i(t)$ is the capital per capita in country *i* at time *t*, and $w^i(t)$ is the wage in country *i* at time *t*.

[8] These economies may be either two countries or two blocks of countries, as in the case of WTO negotiations. Without any loss of generality, we do not distinguish between the two options along the paper.

Each economy has two competitive production sectors, one for consumption goods and the other for capital goods. Consumption goods (per capita) produced in country *i* at time *t*, denoted by $c_P^i(t)$, are given by:

(3) $$c_P^i(t) = B\left[k_C^i(t)\right]^\alpha, \ 0 < \alpha < 1$$

where $k_C^i(t)$ is the amount of capital (per unit of labor) employed in producing consumption goods in country *i*. *B* is a technology productivity factor. The *P* –subscript denotes production.

Capital goods are producible factors of production. New capital goods in country *i* at time *t*, $q_P^i(t)$, are produced according to the linear technology:

(4) $$q_P^i(t) = A\left[k^i(t) - k_C^i(t)\right],$$

where *A* is a technology productivity factor and $k^i(t)$ is the per-capita amount of capital in country *i* at time *t*. With capital depreciation rate δ, the capital stock in each country evolves through time according to:

(5) $$\dot{k}^i(t) = q^i(t) - \delta k^i(t).$$

In a competitive equilibrium all markets clear at each point in time; firms maximize current profits, and the representative household rents labor and capital to firms, and chooses his consumption so as to maximize the lifetime utility in (1). [9]

2.1 Autarky Equilibrium

The case of no trade reported in this sub-section follows Rebelo (1991). Hence, results are just presented here without proof, to be used as a benchmark for evaluating free trade and trade agreements outcomes later on.

In Equilibrium, profits maximizing firms are indifferent at the margin between employing capital for producing consumption and capital goods. That is:

$$(6) \qquad P_q^i(t) \cdot A = \alpha B\left[k_C^i(t)\right]^{\alpha-1}$$

where $P_q^i(t)$ is the relative price of capital goods in terms of consumption. The relative price declines over time at a constant rate as given below. The interest rate is constant over time and is given by:[10]

$$(7) \qquad r = A - \delta - g_P$$

[9] Since all equations are in per-capita variables, labor does not appear explicitly in the paper.

[10] The interest rate measures how many consumption units the representative consumer receives in the next instantaneous period by giving up one now. A unit of consumption can be exchanged for $1/P_q^i(t)$ units of capital. Since the net marginal productivity of capital in producing capital goods is $A-\delta$, and $P_q^i(t)$ declines at the constant rate g_P the interest rate is constant over time, and is given by (7).

where g_P is the rate of change of the relative price of capital. The optimal growth rate is given by

(8) $$g_C = \frac{1}{\theta}(r - \rho).$$

Since the interest rate is constant over time, consumption grows at a constant rate in equilibrium. Each economy experiences no transitional dynamics, and grows along a Balanced Growth Path (BGP) in which capital grows at a constant rate of

(9) $$g_k = \frac{A - \delta - \rho}{1 - \alpha(1-\theta)},$$

and consumption grows at a constant rate of $g_C = \alpha g_k$. Along the BGP the relative price of capital goods changes at a constant rate of $g_p = -[(1-\alpha)g_k] < 0$, and the share of capital allocated to producing consumption is constant over time, and given by $\gamma = \frac{\alpha(1-\theta)(A-\delta)-\rho}{A[\alpha(1-\theta)-1]}$. The consumption level path in each country is then given by:

(10) $$c_A^i(t) = B[\gamma \cdot k^i(t)]^\alpha ,$$

where the A-subscript refers to autarky.

Throughout the analysis we maintain the following parametric assumptions:

Assumption 1 $A-\delta > \rho > \alpha(1-\theta)(A-\delta)$

The first inequality in *Assumption 1* ensures a positive growth rate, while the second suffices to satisfy the transversality condition, so that utility is bounded.

3. A Free Trade Equilibrium

Assume that at t=0 the two economies unexpectedly start trading with each other. Thus, from that moment on, both countries face the same relative price between the two goods. As the characterization of a free trade equilibrium closely follows Felbermayr (2007), results in this section are presented without proofs.

Prior to cross country trade, the price of capital goods in the North was lower than in the South, suggesting that with trade the South imports capital goods, and exports consumption goods. If the South is small enough, it specializes in producing consumption goods. This is the case we focus on. The world equilibrium relative price of capital goods at t=0 satisfies:

$$(11) \qquad P_q(0) \le \frac{\alpha B}{A}\left[k^S(0)\right]^{\alpha-1}.$$

As will be shown below, the South specializes in producing consumption goods, and keeps on doing so, while the North diversifies in producing both goods.

Capital evolves in each economy according to (5). However, unlike the autarkic scenario, local demands alone do not determine local production, and therefore we can have $q^i(t) \neq q_P^i(t)$ and $c^i(t) \neq c_P^i(t)$. In addition, in the free trade scenario, while goods markets are integrated, international lending and borrowing are ruled out by assumption.[11] This implies that the trade balance in each country equals zero at all times,

$$(12) \qquad P_q(t) \cdot \left[q_P^i(t) - q^i(t)\right] = c_{FT}^i(t) - c_P^i(t), \ \forall t \quad .$$

where the FT-subscript represents free trade. Thus, capital stocks in the two countries evolve according to:

$$(13) \qquad \dot{k}^N(t) = A\left[k^N(t) - k_C^N(t)\right] - \frac{c_{FT}^N(t) - B\left[k_C^N(t)\right]^\alpha}{P_q(t)} - \delta k^N(t)$$

$$(14) \qquad \dot{k}^S(t) = \frac{B\left[k^S(t)\right]^\alpha - c_{FT}^S(t)}{P_q(t)} - \delta k^S(t)$$

[11] Obviously, ruling out B&L does not imply that the capital stock in each country is produced domestically. This assumption reflects both theoretical and empirical findings. Bulow and Rogoff (2005) justify theoretically why development banks give grants rather than loans to developing countries. Cohen, Jacquet and Reisen (2006) show that bilateral donors have favored grants over loans during the past three decades, and that in recent years, this preference has been emulated by multilateral aid agencies as well.

As a result of specialization in the South, its interest rate may differ from the autarkic interest rate, and now depends on $k^S(t)$.[12] Consumption growth rates in the two countries are:

$$(15) \qquad \frac{\dot{c}_{FT}^N(t)}{c_{FT}^N(t)} = \frac{1}{\theta}\left[A - \delta - \rho - (1-\alpha)g_k^N\right]$$

$$(16) \qquad \frac{\dot{c}_{FT}^S(t)}{c_{FT}^S(t)} = \frac{1}{\theta}\left[\frac{\alpha B\left[k^S(t)\right]^{\alpha-1}}{P_q(t)} - \delta - \rho - (1-\alpha)g_k^S\right]$$

In a free trade equilibrium firms maximize profits, while the representative consumer in each country rents capital and labor to firms, and chooses his consumption to maximize his utility given by (1). Producers in the South specialize in producing consumption goods. Producers in the North are indifferent at the margin between producing capital and consumption goods (equation (6)). In addition, a clearing market condition must hold at all times:

$$(17) \qquad c_{FT}^N(t) + c_{FT}^S(t) = B\left[k_C^N(t)\right]^\alpha + B\left[k^S(t)\right]^\alpha .$$

[12] As in the autarky, the interest rate measures how many consumption units the representative consumer receives in the next instantaneous period by giving up one now. The net marginal productivity of capital in the South is $\frac{\alpha B\left[k^S(t)\right]^{\alpha-1}}{P_q(t)} - \delta$, and the relative price of capital grows at the rate $-\left[(1-\alpha)g_k^S(t)\right]$. Therefore, the South interest rate at *t* is $r^S(t) = \frac{\alpha B\left[k^S(t)\right]^{\alpha-1}}{P_q(t)} - \delta - \left[(1-\alpha)g_k^S(t)\right]$.

4. The Balanced Growth Path

Along a Balance Growth Path (BGP) capital and consumption grow at the same constant rates in both countries, (Felbermayr, 2007). For consumption to grow at the same rate in both countries, consumers in both countries must face the same interest rate.[13] Since capital is used to produce consumption in both countries using the same production technology, interest rates equality implies equal marginal products of capital, so that $k_C^N(t) = k^S(t), \forall t$. This in turn implies that the share of capital allocated to producing consumption goods in the North is constant over time, since $k^S(t)$, $k^N(t)$, and $k_C^N(t)$ must all grow at the same rate.

Using $k_C^N(t) = k^S(t), \forall t$, and equal interest rates in both countries, we substitute (15) and (16) into the time derivative of (17) with $g_k^N = g_k^S$. From this we get that the capital stock grows along the BGP at the same rate it does in autarky, as in equation (9), (recall that capital growth rate in autarky is independent of the capital endowments, and depends on technology and preference parameters which are equal across the two countries) .

When trade initiates, South moves along a transitional dynamics path that converge to the BGP. The North experiences higher growth rate of consumption that converges to the BGP, while North's capital growth is on the BGP to begin with, (Felbermayr, (2007)).

The following Lemma establishes the *productive efficiency* of the BGP, a property that we use in analyzing foreign aid tied to trade policy in a cooperative trade agreement.

[13] Unlike the transitional dynamics described below, where interest rates differ across countries and change over time, along the BGP consumers in both countries face the same constant interest rate.

Lemma 1 *The capital allocation between North and South along the BGP with free trade maximizes world-wide consumption levels among all feasible capital allocations preserving the BGP capital growth rate.*

Proof: Along the BGP, $k^S(t) = k_C^N(t)$, $\forall t$, ensuring equal marginal products of capital in producing consumptions across North and South at each point in time. This proves the claim given identical and concave production technologies. ■

According to lemma 1, if initial conditions place the two countries on the BGP, then the BGP is the free-trade equilibrium, and the equilibrium consumption allocation is Pareto optimal given the curvature and time-preference parameters in the two countries. However, initial capital endowments need not be on the BGP. If $k^S(0)$ is too small, so that equality (11) becomes inequality, the world experiences transitional dynamics during which consumption grows in both countries at higher rates than along the BGP. This does not imply that consumption levels during the transitional dynamics are higher than along the BGP. On the contrary, during the transitional dynamics the relative price of capital decreases more slowly than along the BGP, so that interest rates are higher in both countries than they are on the BGP, (recall equation (7)). Higher interest rates, which constitute the returns to capital investment, shifts consumers budget resources from consumption to investment goods, in both countries. Hence, consumption levels are lower along the transitional dynamics phase compared to the BGP.

We now turn to analyze how endogenous foreign aid tied to trade policy through bargaining affects welfare in both countries.

5. The Bargaining-Trade Equilibrium

The two countries initiate trade at t=0. They may do so without any foreign aid in a free-trade equilibrium, (sections 3 and 4), and converge asymptotically to a BGP, (unless capital endowments are just right, so that they immediately jump to the BGP). However, there exists a Pareto superior outcome that the two countries can reach by foreign aid tied to trade.

Due to diminishing marginal product of capital in producing consumption goods, as long as $k^S(0) < k_C^N(0)$, a capital transfer from the North to the South would increase world-wide consumption without reducing future capital stocks. Accordingly, a *surplus* of consumption goods can be created by a capital transfer from North to South. But, the parties must agree before hand how to divide this surplus. We first find the optimal size of the aid, and then employ the Nash-bargaining mechanism to divide the surplus created by this transfer.

5.1 The optimal size of foreign aid

In sections 2, 3 and 4 we analyzed the competitive equilibrium and the BGP derived of it. However, the BGP is also a solution to a central planner problem. A central planner would maximize the utility of the representative agent given by equation (1), subject to the transversality condition, the resource constraint and the evolution of capital constraint. Note that the BGP satisfies the transversality condition, the optimal

consumption path of the (identical) representative agents (equation (8)) that imposes the evolution of capital and the resource constraint (that its implications are given by equation (17)). Along the BGP the marginal product of capital is equal in both countries (equations (6) and equation (10) that along the BGP becomes equality). Therefore, the BGP is the unique solution for the central planner maximization problem.

Let $k_0^N(0)$ and $k_0^S(0)$ denote the initial pre-transfer values of capital in North and South, and let $T_k(0)$ denote the size of the capital transfer. Then the lifetime budget constraint (equation (2)) determines the magnitude of $T_k(0)$ needed for BGP, (see Appendix A for details)[14]:

$$(18) \quad T_k(0) = \frac{\alpha(1-\theta)(A-\delta)-\rho}{A[\alpha(1-\theta)-1]} \cdot \frac{k_0^N(0)+k_0^S(0)}{2} - k_0^S(0)$$

From Assumption 1 we have: $0 < \frac{\alpha(1-\theta)(A-\delta)-\rho}{A[\alpha(1-\theta)-1]} < 1$. We further assume that initial capital endowments are such that $T_k(0) \geq 0$. Otherwise, the transfer goes from South to North, contradicting the specialization in the South used to derive (18).

Along the BGP each country produces half of the world-wide output of consumption goods. The South exports some of it to the North and imports in return capital goods. The foreign aid exploits the diminishing marginal products of capital in producing consumption goods to increase worldwide consumption output. The total amount of capital allocated to consumption producing sectors worldwide equals the amount allocated to these sectors in autarky, (and so is the amount allocated to the capital goods sector). However, the foreign aid provides the optimal allocation worldwide,

[14] Note that if international borrowing and lending are allowed, equation (18) provides the size of the equilibrium loan taken by South, assuring equal returns to capital in both countries. The reasons for ruling out international B&L were discussed in a previous footnote.

enabling the two countries to enjoy the same growth rates they did in autarky, but with possibly higher levels of consumption, subject to the outcome of the negotiations we describe below.

The following Lemma proves that getting the capital transfer right is not enough: North may become worse off as a result of giving the aid, and may need some 'compensation' to make that transfer.

Lemma 2 – *If the foreign aid given as capital transfer by North to South puts both countries on the BGP, and if this transfer is tied to a free-trade policy from that moment on, then South enjoys higher welfare, and North may be better or worse off, compared to autarky.*

Proof: The BGP is the optimal solution to the problem of a central planner in the integrated economy, as explained above. Thus, both growth rates of consumption and capital are constant, and the equilibrium paths are not Pareto dominated by any other path along which capital grows at same rate. However, this does not necessarily imply that North is better off along the BGP than it is under autarky.

From the lifetime budget constraint (2) consumption levels in each economy are:

$$(19) \quad c_{FT}^{N}(0) = \frac{\alpha(1-\theta)(A-\delta)-\rho}{\alpha(1-\theta)-1} \cdot P_q(0) \cdot k^N(0) + (1-\alpha)B\left[k_C^N(0)\right]^{\alpha}$$

and

(20) $$c_{FT}^{S}(0)=\frac{\alpha(1-\theta)(A-\delta)-\rho}{\alpha(1-\theta)-1}\cdot P_q(0)\cdot k^{S}(0)+(1-\alpha)B\left[k^{S}(0)\right]^{\alpha},$$

where $k^{N}(0)$ and $k^{S}(0)$ are *post*-transfer initial capital stocks the two countries, (see detailed derivation in Appendix A).

Since $P_q(0)=\frac{\alpha B\left[k^{S}(0)\right]^{\alpha-1}}{A}$, and since the capital stock in the South is higher with free trade than in autarky scenario (because of the capital transfer it received), by substituting the price into (20) we see that consumption is higher in the South with free trade than in autarky. In the North, the relative price is higher under free trade than in autarky, but both capital stock and wages are lower. In order to show that foreign aid in the form of capital transfer coupled with free trade may not be beneficial to North, we bring two examples showing that higher capital good prices may or may not be sufficient to offset lower wages and capital stock in the North.

Let $k_0^{S}(0)$ be very small. Then, given the transfer in (18), it is straightforward to show that North's consumption levels are lower under free-trade than under autarky. For the opposite conclusion, consider a shift to a free-trade regime with zero foreign aid, so that $T_k(0)=0$. Then the consumption levels in the North are higher under free trade scenario than under autarky.

Thus, for some initial values of capital endowments, North is better off giving the aid in (18) and shifting to free-trade, but for some other capital endowments North is better off under autarky. ■

According to Lemma 2, the 'right' capital transfer coupled with free-trade may or may not be Pareto improving. If it is, then North is better off even if the capital transfer is

given as a gift (i.e. as a grant), thus providing a simple, purely economic motivation for giving the aid. However, if the grant is not Pareto improving, foreign aid and trade require that the North be compensated for the loss of capital by some kind of tying rule between aid and trade. These compensating changes in trade policies can take many different forms, including tariffs, trade quotas, subsidies, etc. We do not specifically model any of these policy concessions. Instead, we assume that these compensating trade arrangements can be represented by a welfare transfer from South to North. This allows us to use the bargaining mechanism as a solution concept for analyzing how can the North be compensated for the economic cost of giving foreign aid, without invoking non-economic (e.g. political) justifications. While the role of non-economic considerations is obvious and can be considerable, we want in this paper to examine how far purely economic considerations can go towards explaining observed ties between aid and trade policies.

5.2 The Bargaining Setup

Both countries have mutual interest in reaching an agreement, because foreign aid in the form of capital transfer creates a surplus of consumption without changing the growth rate. However, their interests are not identical, since each country desires a larger portion of the surplus.

We employ The Nash (1950) axiomatic bargaining approach seems best suited to study this situation. This approach is often criticized for neglecting to provide the mechanism through which its normative solution can be implemented. Eventually, Binmore, Rubinstein and Wolinsky (1986) showed how the equilibrium in a non-

cooperative bargaining game coincides with the Nash bargaining solution. It is useful in our context precisely because its does not depend on the particulars content of the surplus to be divided, and the nature of the concessions players have to make to reach an agreement.

In order to employ the Nash bargaining mechanism and satisfy its assumptions, we must assume the following assumptions, (see Chan (1988)):

Assumption 2 The two countries have full information about the preferences of their trading partners.

This assumption implies that the bargaining solution is efficient.

Assumption 3 Negotiators from each country have the same bargaining skill.

With this assumption and the fact that along the BGP the interest rates in both countries are equal, the bargaining solution should be symmetric in the sense that if the two countries are identical, their equilibrium payoffs are the same.

Finally, we exploit the fact that along the equilibria under consideration consumption grows at a constant rate, so that we can cast the bargaining problem in terms of initial consumption levels. Accordingly, initial consumptions at North and South are the solution to the following Nash bargaining problem:

(21) $$\left(c^{N*}(0), c^{S*}(0)\right) = \underset{c^N, c^S}{Arg\,Max}\left\{\left[U^N\left(c^N\right) - \overline{U}^N(0)\right]\cdot\left[U^S\left(c^S\right) - \overline{U}^S(0)\right]\right.$$

s.t.

(22) $$c^N + c^S = 2B\left[k^S(0)\right]^{\alpha}$$

where $c^{i*}(0)$ represents the consumption level in country *i* due to the Nash bargaining mechanism and $\overline{U}^i(0)$ is the utility obtained by the representative consumer of country *i* in case of *disagreement*.

The disagreement point in the model is the autarky payoffs for several reasons. First, we rely on the Shapley version of the Nash solution, where the disagreement point reflects the credible destructive power of each player, and therefore we use the disagreement point as the minimal guaranteed payoffs to each country. Another reason for choosing this disagreement point is the endogenous tying rule of aid to trade policies. Consider the following scenario: The North and the South negotiate over agreeable trade policies and aid in the form of capital transfer from North to South. Both countries know that compared to autarky, agreement will improve their welfare. The North can *condition* the capital transfer on the bargaining outcome. If the bargaining process fails, the North will not give the capital transfer, and both countries will continue on their autarkic BGP. Therefore, the disagreement point is the utilities under autarkic scenario.

Alternative disagreement points, such as the free-trade allocation without transfer, are not credible. In such a scenario each country may impose tariffs unilaterally in an attempt to extract welfare from the other country. Kennan and Riezman (1988) showed

how big countries win tariff wars. Hence, the free trade is not a credible disagreement point.

The disagreement points based on Johnson's Nash-Cournot tariff equilibrium, (see Mayer (1981) and Riezman (1982)), is a possible threat point. However, it may not be robust if other commercial policies (like quotas) are involved. Therefore, in order to generalize the solution to any commercial policies, we find the payoff in the autarky scenario more suitable. Since our analysis is valid either for bargaining over tariff rates or other trade policies (such as direct transfers from the South to the North in terms of consumption goods), the Nash-Cournot tariff equilibrium cannot be used as the disagreement point.

5.3 The Bargaining-Trade Outcome

Proposition 1 *Both countries are better off in equilibrium with trade and bargaining than in autarky, regardless of initial capital endowments.*

Proof: The total production of consumption goods is at least as high as with trade as in autarky, as claimed in Lemma 1. Moreover, the capital transfer from North to South increases worldwide production of consumption as shown in Lemma 2. The Nash product given by equation (21) is negative if only one of the economies is worse off with trade, and is positive if both countries are either better or worse off with trade. Its maximum value is obviously positive. Since the utility functions are strictly increasing and since the

Nash bargaining solution is efficient, both countries are better off at the solution $\left(c^{N*}(0), c^{S*}(0)\right)$ than they are in autarky . ■

While proposition 1 provides a possible motivation for trade agreement if North conditions the aid on a suitable trade agreement, it does not shed any light on whether the two countries prefer that trade agreement over free-trade. Proposition 2 resolves this issue.

Proposition 2 *For some initial capital endowments, the richer country is better off (and the poorer country is worse off) under bargaining over traid and aid than under free-trade.*

Proof: See Appendix B.

Proposition 2 implies that for some capital endowments if the North conditions the capital transfer in imposing trade policies that are in its favor, it may gain from it more than it could in free trade. In such cases, foreign aid to poor countries may improve these counties' welfare, but it first and foremost it benefits the richer countries. Since this is known to both countries, we can assume that the rich country would prefer trade negotiations over free trade without any preliminary conditions whenever this makes it better off. We can therefore predict that in such cases trade agreements would be the preferred mechanism for regulating trade between North and South, as is often observed.

Proposition 2 also proves that any trade agreement between the countries benefits the North at the expense of the South, since along the BGP the total production of consumption goods is determined by the capital stock in the South. Notice that this result depends only on the relative size of the North, without assuming that is has superior bargaining power. If the richer country also enjoys more bargaining power, the outcome will be tilted further in its favor.[15]

6. Conclusions

In this paper we construct a dynamic growth model that combines international trade and foreign aid. We evaluate welfare in the donor and the recipient countries, and argue that foreign aid need not affect growth rates in either country. We also argue that the consumption levels do change due to the foreign aid. The foreign aid in the paper is tied to international trade policies.

The paper suggests that while free trade is best to the developing country, it may not be so for the developed one. As a result, by endogenizing the tie rule of the foreign aid to international trade policies through a bargaining mechanism, welfare is transferred from the developing country to the developed one, via trade agreements which are 'good' for the developed country. While these trade agreements make both countries better off compared to autarky; for some initial capital endowments these agreements also make the developed country better off compared to free-trade. This implies, of course, that while the developing country prefers free trade to a trade agreement, it would still be better off

[15] The international trade and relationships literature often assumes that the richer countries have more bargaining power than poor countries. For several justifications, see for example, Bailer, 2004.

under the trade agreement than under autarky, and thus a trade agreement is still acceptable.

Although we do not model explicitly the trade policies over which countries bargain, we do show that there exist welfare transfers, reflecting direct resource transfers, subsidies or tariffs, which can then tie foreign aid to trade policies.

This result sheds some light over current negotiations between developed and developing countries, (in the context of the Doha Round), and the present stalemate in these talks. According to its proponents, the last round of negotiations aims to make trade fairer for the developing countries,[16] and it is frequently referred as "The Doha Developing Round". This round and its failure in Cancun, Mexico (2003), and later again in Geneva (2008) was partly attributed to the wide gaps between the developed and developing countries. Furthermore, most computable general equilibrium measures of the forecasted outcomes of the Doha Round show not only low gains on the aggregate, but also skewed outcomes towards developed countries (Ackerman, 2005). Since the round has not been terminated we cannot predict its ultimate conclusions. We can forecast in light of our analysis, that if an agreement is eventually obtained, it will favor the developed countries rather than the developing ones, despite declared goals to the contrary of these talks.

[16] For more details, see http://en.wikipedia.org/wiki/Doha_Round#cite_note-7.

Appendix A: BGP with Capital Transfer (equations (18)-(20))

The lifetime budget constraint of the representative agent in each economy is given by (2). Notice that since along the BGP $k_C^N(t) = k^S(t)$, wages in both countries are equal and given by $w(t) = (1-\alpha)B\left[k^S(t)\right]^{\alpha}$. It is straightforward that wages grow along the BGP at the same rate as consumption. Hence, the lifetime budget constraint in each country can be written as:

$$\text{(A1)} \quad \int_0^{\infty} c_{FT}^i(0) \cdot e^{(\alpha g_k - r)t} dt = P_q(0) \cdot k^i(0) + \int_0^{\infty} (1-\alpha) B k^S(0) \cdot e^{(\alpha g_k - r)t} dt .$$

From (7), $\alpha g_k = \frac{r-\rho}{\theta}$, hence:

$$\text{(A2)} \quad \int_0^{\infty} e^{(\alpha g_k - r)t} dt = \int_0^{\infty} e^{\left(\frac{\alpha(1-\theta)(A-\delta)-\rho}{1-\alpha(1-\theta)}\right)t} dt = \frac{\alpha(1-\theta)-1}{\alpha(1-\theta)(A-\delta)-\rho}$$

Substituting (A2) into (A1) and calculating $c_{FT}^N(0)$ and $c_{FT}^S(0)$ yields (19) and (20).

At *t*=0 South gets a capital transfer from North. As a result, the relative price of capital satisfies the following condition:

$$\text{(A3)} \quad P_q(0) = \frac{\alpha B\left[k_0^S(0) + T_k(0)\right]^{\alpha-1}}{A}$$

Notice that $k^N(0) = k_0^N(0) - T_k(0)$ and $k^S(0) = k_0^S(0) + T_k(0)$. Substituting these expressions into (19) and (20) and the latter expressions with (A3) into the clearing market condition (17) implies (18).

Appendix B: Proof of proposition 2

Maximizing the Nash product implies the following first order condition:

$$\text{(B1)} \quad \left[c^N\right]^\theta \cdot \left[\frac{(c^N)^{1-\theta} - c_A^N(0)^{1-\theta}}{1-\theta}\right] - \left[c^S\right]^\theta \cdot \left[\frac{(c^S)^{1-\theta} - c_A^S(0)^{1-\theta}}{1-\theta}\right] = 0$$

where $c_N^i(0)$ and $c_A^i(0)$ are consumption levels under agreement (if achieved) and autarky in country *i* at *t*=0, respectively.

Using the constraint $c_N^S(0) = 2B\left[k^S(0)\right]^\alpha - c_N^N(0)$, define the function:

.

$$\mathrm{N}\left(c^N\right) := \left[c^N\right]^\theta \cdot \left[\frac{(c^N)^{1-\theta} - c_A^N(0)^{1-\theta}}{1-\theta}\right] - \left[2B\left[k^S(0)\right]^\alpha - c_N^N(0)\right]^\theta \cdot \left[\frac{\left[2B\left[k^S(0)\right]^\alpha - c_N^N(0)\right]^{1-\theta} - c_A^S(0)^{1-\theta}}{1-\theta}\right]$$

Then, the function $N(\bullet)$ is strictly increasing in c^N. We now show that this function is negative when evaluated at the free trade allocation, implying that the argument that maximizes the Nash product is larger than the consumption level of the North under free trade.

The solution to the Nash maximization problem in (21) has the property that a player's outcomes improves with his own disagreement outcome, and decreases with his opponent's disagreement outcome. Consequently, since the function $N(\bullet)$ is continuous, if the proposition holds when $T_k(0) = 0$, then it is also true for some neighborhood of strictly positive capital transfers.

From (10) that when $T_k(0) = 0$,

(B2) $$\frac{k_0^N(0)}{k_0^S(0)} = \frac{2-\gamma}{\gamma}$$

where $\gamma \equiv \frac{\alpha(1-\theta)(A-\delta)-\rho}{A[\alpha(1-\theta)-1]}$.

Recall that the consumption levels in autarky for each country are given by

(B3) $$c_A^i(0) = B\left[\gamma \cdot k'^i(0)\right]^\alpha$$

while consumption levels under free trade when $T_k(0) = 0$ are given by:

(B4) $$c^N(0) = A\gamma \cdot P_q(0) \cdot k'^N(0) + (1-\alpha)B\left[k'^S\right]^\alpha = B\left[k'^S\right]^\alpha\left[1+\alpha(1-\gamma)\right]$$

and

(B5) $$c^S(0) = A\gamma \cdot P_q(0) \cdot k'^S(0) + (1-\alpha)B\left[k'^S\right]^\alpha = B\left[k'^S\right]^\alpha\left[1-\alpha(1-\gamma)\right]$$

Substituting equations (B2), (B3), (B4) and (B5) into the function $N(\bullet)$ yields:

(B6) $\mathrm{N}\left(c^{N}\right) =$

$$= \left\{B\left[k_0^S(0)\right]^{\alpha}\left[1+\alpha(1-\gamma)\right]\right\}^{\theta} \cdot \frac{\left\{B\left[k_0^S(0)\right]^{\alpha}\left[1+\alpha(1-\gamma)\right]\right\}^{1-\theta} - \left\{B\left[(2-\gamma)k_0^S(0)\right]^{\alpha}\right\}^{1-\theta}}{1-\theta}$$

$$- \left\{B\left[k_0^S(0)\right]^{\alpha}\left[1-\alpha(1-\gamma)\right]\right\}^{\theta} \cdot \frac{\left\{B\left[k_0^S(0)\right]^{\alpha}\left[1-\alpha(1-\gamma)\right]\right\}^{1-\theta} - \left\{B\left[\gamma k_0^S(0)\right]^{\alpha}\right\}^{1-\theta}}{1-\theta}$$

=

$$\frac{B\left[k_0^S(0)\right]^{\alpha}}{1-\theta} \cdot \left\{\left[1+\alpha(1-\gamma)\right] - \left[1+\alpha(1-\gamma)\right]^{\theta} \cdot (2-\gamma)^{\alpha(1-\theta)}\right\} - \left\{\left[1-\alpha(1-\gamma)\right] - \left[1-\alpha(1-\gamma)\right]^{\theta} \cdot \gamma^{\alpha(1-\theta)}\right\}$$

$$= \frac{B\left[k_0^S(0)\right]^{\alpha}}{1-\theta}\left\{2\alpha(1-\gamma) - \left[1+\alpha(1-\gamma)\right]^{\theta} \cdot (2-\gamma)^{\alpha(1-\theta)} + \left[1-\alpha(1-\gamma)\right]^{\theta} \cdot \gamma^{\alpha(1-\theta)}\right\}$$

We shall prove that the term in curly brackets is negative. Let:

(B7) $H(\theta) := 2\alpha(1-\gamma) - \left[1+\alpha(1-\gamma)\right]^{\theta} \cdot (2-\gamma)^{\alpha(1-\theta)} + \left[1-\alpha(1-\gamma)\right]^{\theta} \cdot \gamma^{\alpha(1-\theta)}$

Under the parametric assumptions, $0 < \gamma < 1$ and $0 < \theta < 1$.

(B8) $H'(\theta) = -\left[1+\alpha(1-\gamma)\right]^{\theta}(2-\gamma)^{\alpha(1-\theta)}\ln(\theta) - \left[1+\alpha(1-\gamma)\right]^{\theta}(2-\gamma)^{\alpha(1-\theta)}\ln(\alpha(1-\theta))$

$$+ \left[1-\alpha(1-\gamma)\right]^{\theta}\gamma^{\alpha(1-\theta)}\ln(\theta) + \left[1-\alpha(1-\gamma)\right]^{\theta}\gamma^{\alpha(1-\theta)}\ln(\alpha(1-\theta))$$

$$= \ln(\theta)\left\{\left[1-\alpha(1-\gamma)\right]^{\theta}\gamma^{\alpha(1-\theta)} - \left[1+\alpha(1-\gamma)\right]^{\theta}(2-\gamma)^{\alpha(1-\theta)}\right\}$$

$$+ \ln(\alpha(1-\theta))\left\{\left[1-\alpha(1-\gamma)\right]^{\theta}\gamma^{\alpha(1-\theta)} - \left[1+\alpha(1-\gamma)\right]^{\theta}(2-\gamma)^{\alpha(1-\theta)}\right\}$$

Since α and θ are between zero and one, both logarithms are negative. Furthermore, both of them are multiplied by negative terms. Hence, $H'(\theta) > 0$ for $0 < \theta \leq 1$. Evaluating $H(\theta)$ from (B7) at $\theta = 1$ we get:

(B9) $$H(1) = 2\alpha(1-\gamma) - \left[1+\alpha(1-\gamma)\right] + \left[1-\alpha(1-\gamma)\right] = 0$$

Since $\theta < 1$ and the $H'(\theta) > 0$ for any $0 < \theta < 1$, we conclude that $\mathrm{N}\left(c_{FT}^{N}(0)\right) < 0$. And since the function $N(\bullet)$ is continuous, it is also negative for free-trade allocations attained by some small enough capital transfers. ■

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