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**AID FOR TRADE POLICY
IN DEVELOPING AND LEAST DEVELOPED COUNTRIES:
A GTAP SIMULATION ANALYSIS**

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Abstract. Recent global initiatives on debt relief and development assistance call for increasing aid for trade to the poorest countries. We apply a multi-country computable general equilibrium model, to analyze if aid for trade offers the possibility that, instead of the developing and least developed countries' being worse off—as so many were as the result of the last round of trade negotiations—they will actually be better off. Alternative aid for trade scenarios have been evaluated in terms of effectiveness and equity. Our findings show that aid for trade policies expand trade and alleviate inequalities. The developing and least developed countries will benefit mainly from aid for trade assistance that helps these countries with any transitional adjustment costs from liberalization and increases factor productivity. Effectiveness of aid for trade is enforced if income transfers from donors are fairly divided amongst the recipient countries.

JEL Classification: C68; F13; F41; H77.

Keywords: aid for trade, computable general equilibrium model, equity, income inequality, welfare.

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1. Introduction

Aid for trade is financial and technical assistance that facilitates the integration of low-income countries into the global economy. Aid for trade includes initiatives that reduce transaction costs and enhance productivity in order to expand trade in recipient countries (Hoekman, et al. 2010a). Currently, politic uprising in Middle East and North Africa, rising food prices and energy prices, high inflation rates in many developing countries, debt crisis in the West and unexpected natural disasters prevent the global economy from recovering fully from this recession. The distribution of aid for trade is unevenly allocated by region and by sector. According to OECD aid data, Africa and Asia are the top recipients of foreign aid since 2002. Transportation and storage sector, energy sector are the top two sectors that receive the highest amount of foreign aid. Agriculture, forest and fishing sector ranks the third largest sector. Under this rapid changing geopolitical environment, multi-dimensional financial crisis and unevenly aid distribution, the analysis of effectiveness and equity effects of aid for trade is extremely vital at this critical point for the developing and least developed regions. Understanding and further quantifying the foreign aid would allow policy makers to have a more clear idea when they negotiate various aid for trade issues.

One of the key motivation of foreign aid can be traced back to Stern's paper (1974), that argued that people in rich countries have moral obligation to help poor people in least developed countries via foreign aid. This view has become an ideological foundation for pro-foreign aid policies for decades in the West. Critics about foreign aid focusing on the motivation of donors, especially whether the conditional foreign aid may associate with donors' interfering with the sovereignty of developing countries (Svensson, 2003). Economic efficiency is another key argument that some scholars are against foreign aid, they regard foreign aid may result in inefficiency, misspent or waste of money of tax payers in donor countries (Bauer, 1975). If we regard that those advocate foreign aid are more idealistic, because it is not easier to be perfect

from initiating the grant to finishing the implementation of foreign aid, then we could say that those who are against foreign aid are more realistic, because there are thousands of possibilities that the results may deviate from the original objective of foreign aid, which is closer to the reality and the “second best” of what we can achieve. However, the battle between for and against of aid for trade may never stop, no matter which side wins.

Shleifer (2009a) points out that the objective of foreign aid has transformed from economic growth to welfare, he argues that foreign aid should become a massive welfare program for developing and least developed countries, and the goal of foreign aid is no longer growth, but poverty alleviation. Furthermore, he argues that what must support continued and increasing foreign aid is not proof of effectiveness, but sympathy of the Western taxpayers. What Shleifer (2009a) implies is that the effectiveness of foreign aid should be viewed from donor side rather than recipient side. If this is true, this raises the question of how to really measure the effectiveness of foreign aid.

The supply side of aid for trade is through existing country-based allocation mechanism by bilateral donors and international development organization. The demand of aid for trade is aid targets identified by governments. (Hoekman, et al. 2010a). The need for further foreign aid assistance has been widely recognized by multi-donors and the international foreign aid community. The Organization for Economic Cooperation and Development (OECD) reports continuing growth in official development assistance (ODA) in 2009, despite the financial crisis. In fact, in 2009, the rise in ODA in real terms was about 7 percent. The largest donors were the United States, France, Germany, the United Kingdom and Japan. Also ODA increased by nearly 30% in real terms between 2004 and 2009, and is expected to rise by about 36% in real terms between 2004 and 2010. The continued growth in ODA has shown that aid pledges are effective when backed up with adequate resources, political and firm multi-year spending plans. There has also been an emerging consensus that the WTO Doha Round must be coupled with adequate

trade-related assistance to mitigate the detrimental effects of trade reforms and to enhance the trading capacity of developing countries. Specifically, in February 2005, G-7 Ministers called on the World Bank and the IMF to develop proposals for additional assistance to countries to ease adjustment to trade liberalization and to increase their capacity to take advantage of more open markets. Subsequently, in July 2005 Heads of State at the G8 Summit at Gleneagles agreed to increase help to developing countries to building their physical, human and institutional capacity to trade. In December 2005, at the 6th Ministerial Conference held in Hong Kong, the Ministerial Declaration endorsed the enhancement of the Integrated Framework and created a new WTO work programme on Aid-for-Trade (Hoekman *et al.*, 2010a).

Since 2005 donors and development agencies have increased the overall value of aid for trade and put in place several mechanisms to channel such aid and to ensure that it alleviates poverty and inequality. According to the data reported by the OECD, 25 percent of the official development assistance (ODA) was directed toward aid for trade in 2008. The supply of aid for trade has increased over 2002-2008 period by 21 percent (Hoekman *et al.*, 2010a).

Few studies exist on the empirical analysis of aid for trade, which are mainly concentrated on effectiveness rather than equity (e.g. Cali *et al.*, 2011). In part this is because of data limitation. Frequently, because it will be difficult to disentangle the impacts of aid for trade projects on welfare, income and equity. But measuring the impacts of aid for trade is challenging as summarized by Kharas *et al.* (2010). Differently to the existing studies, using a multi-country computable general equilibrium model, this paper attempts to analyse aid for trade policies in developing and least developed countries in terms of effectiveness and equity. Effectiveness requires that aid for trade policies achieve their stated goals, such as expanding trade and alleviating inequalities. We use welfare and income indicators to evaluate inequalities. Along with effectiveness, the evaluation of equity is essential for ensuring that the extent of aid for trade is fairly divided among their recipients. Four aid for trade scenarios have been analysed. In the

first scenario income transfers from the donor countries to the recipient countries have been simulated. The aid transfers are not constrained to any project or public expenditure. In the other three scenarios the transfers are constrained to reduce trade margins, to increase factor productivity and investments. Thus, the novelties of this paper with respect to the existing aid for trade studies are three. Firstly, this is an empirical analysis that it is not limited to one country, but allows of comparing the aid for trade effects in the developing and least developed countries. Secondly, we compare all the ODA categories in support of trade proposed in the international debate. Thirdly, we do not limit our analysis to effectiveness, but we discuss also the effects of aid for trade redistribution in terms of equity. Our findings show that aid for trade policies expand trade and alleviate inequalities. The developing and least developed countries will benefit mainly from aid for trade assistance that helps these countries with any transitional adjustment costs from liberalization and increases factor productivity. Effectiveness of aid for trade is enforced if income transfers from donors are fairly divided amongst the recipient countries.

2. Literature Review of Foreign Aid and Effectiveness of Aid

There are countless studies related to foreign aid, foreign aid and growth in the poor countries. The role of foreign aid in the growth process and to reduce international inequalities in developing and least developed countries has been a topic of intense debate for several decades. This issue has been analyzed by researchers for decades due to its complexity in nature. It links with political relationship between donor countries and recipient country, governance of public sector in recipient country, and how much the foreign aid is necessary and how long it should last. Past empirical research related to the relationship between foreign aid and international inequality have produced quite different views.

One group of empirical studies found positive relationship between foreign aid and growth. If trade for aid is viewed as a channel of reducing trade cost and increasing market access, which

can be regarded as trade liberalization, we would find a large number of empirical studies that have examined the relationship between international trade and economic growth. Main survey studies are Anderson *et al.* (1996) and Greenaway *et al.* (1994). Balassa (1978) investigates the relationship between exports and economic growth for eleven developing countries. Statistical evidences were provided subsequently in several studies. Furthermore, there have been some studies which have provided important insights on how international trade liberalization influences economic growth, such as Feder (1982), Levine *et al.* (1992) and Wacziarg (2001). According to these studies, trade impacts on growth through creating new investments, positive external effects, technology transfers, inflow of foreign direct investments, productivity growth, etc.. Winters *et al.* (2000) carry out a theoretical analysis of the relationship between trade measures and their impact on poverty using both simple forms of static, and short and long term dynamic analysis. He identified a number of possibilities of both pro- and anti-poor influences and state that the effects of trade on poverty are likely to be positive providing a view about how trade liberalization can be designed to foster poverty alleviation. A paper by Cockburn, Decaluwé and Robichaud (2005) draws on lessons on the impacts of trade liberalization on growth, poverty and inequality in seven Asian and African countries. The paper concludes that trade liberalization has a positive, although generally small, effect on growth and poverty reduction occurs in most countries studied. Burnside *et. al* (2000) and Collier (2002) argue that foreign aid promote growth only in good policy environment. Ang (2010) finds that while foreign aid exerts a direct negative influence on output expansion, its indirect effect via financial liberalization is positive. Dalgaard *et al.* (2001) suggest that there is a linear effect between the aid-growth relationship due to diminishing returns to foreign aid. Dollar (1992) argues that trade liberalization, devaluation of the real exchange rate, and maintenance of a stable real exchange rate could dramatically improve growth performance in many poor countries. Dollar *et al.* (2001)

suggest that good policies package such as private property rights, fiscal discipline, macroeconomic stability, and open to trade on average increases the income of the poor.

Although, there has been some disagreement on the empirical relationship between trade liberalization and growth, there is a broad consensus that the growth prospects of an economy can be enhanced through integrating the domestic economy with the world economy. A notion of positive relationship between foreign aid and growth found in these studies is that the authors found that embracing of free trade, capitalism, democracy and good institution environment have pro-growth effect. This school of studies focus on real exchange rate, income distribution by employing across countries empirical study.

Another school holds the opposite view about the effects of foreign aid on the poor countries. Bauer P.T. is best known as a persistent and articulate critic of foreign aid (Shleifer, 2009a). Bauer (1975) regards foreign aid as a failure for recipient countries defining foreign aid as “a transfer of resources from the taxpayer of a donor country to the government of a recipient country”. Bauer (1975) views that foreign aid destroys economic incentives, and leads to misallocation of scarce resources and rent seeking, and finally undermines recipient countries economic growth (Shleifer, 2009a). A large amount of empirical studies have failed to find positive or beneficial impacts of foreign aid. Mallik (2008) finds a negative relationship of the long run effect of aid on growth for the six poorest African countries. The most recent representative of this school is William Easterly. Based on both the history and the evidence on foreign aid, Easterly shares similar view as Bauer’s. (Easterly 2003, 2006, 2009). Easterly questions about the alternative definition of “aid,” “good policy” and “growth” which used in Burnside *et al.*(2000) to illustrate the complex relationship between foreign aid and growth and the high possibility of failure. Another argument about the failure of foreign aid that most economists interpret is aid-induced appreciation of real exchange rates, called Dutch disease (Hoekman *et al.*, 2010b)

The process of foreign aid may deviate from its original purpose or objective due to various factors in each stage of foreign aid creation, implementation, grant distribution, monitoring system between donors and recipient countries. For example, how is the foreign aid delivered? How does spend it and in what kind of format it is spent? What is the condition for recipient countries to accept the aid and how donors monitor the distribution of aid? Which sectors will the foreign aid be distributed in, tradable sector or non-tradable sector? Some key critics about foreign aid include poor governance of foreign aid funding, inefficient distribution of the foreign aid fund in the targeted projects; conditional requirements of donor countries on foreign aid may not meet the long term development objective. There are some studies that found ambiguous or conditional relationship between foreign aid and growth. Ekanayake *et al.* (2010) found mixed effect of foreign aid on economic growth in developing countries. Werker *et al.* (2008) argued that foreign aid affects most components of GDP, but it has no statistically identifiable impact on prices or economic growth. Inanga *et al.* (2008) conclude that foreign aid finance can generate economic growth if effectively utilized in a stable macroeconomic environment.

There is no single theoretical model nor empirical model that can address all these questions. One of theoretical foundation of solving these questions can be traced to endogenous growth model. The big push model (Rosenstein-Rodan, 1943) is one of foundation of supporting foreign aid. The idea of this model is that lack of sufficient investment or physical capital would hurdle economic growth, however, foreign aid provides investment capital, which would generate income and raise up the return to capital and promote economic growth. Holder (2004) argues that the relationship between foreign aid and growth turns out to be an inverted-U shaped under reasonable policy assumption, which is an Aid Laffer Curve. If we interpret these findings as only one point in the Aid Laffer Curve and different studies results are located in different parts of the curve, then the theoretical model developed by Holder (2004) is consistent with empirical findings, where positive relationship between foreign aid and growth located in the upward

sloped side of the Aid Laffer Curve, while the negative relationship is located at the downward sloped side of the Aid Laffer Curve.

There are quite little literature analyzing the effectiveness of foreign aid. Van Wijnbergen (1986) develops one rigorous theoretical model based on the two-gap model which was developed by Chenery and Bruno (1962). He argues that under Keynesian unemployment regime, foreign aid will increase the welfare while under classical unemployment regime, aid will reduce the welfare. The dynamic difference of real exchange rate and the wage-price rigidities under the two regime contribute the opposite welfare results. Lahiri *et al.* (1995) examines the effects of tied aid on welfare and argue that untied aid can not increase global welfare while tied-aid unambiguously does so.

3. Modeling framework

In order to assess the systematic general-equilibrium effects of aid for trade policy in developing and least developed countries we use a multi-country CGE model, labeled GTAP-AID, which is a modified version of the standard GTAP model (Hertel, 1997). The original GTAP model is a comparative static, multi-commodity, multi-region model with the assumptions of perfect competition, market equilibrium and open economy.

The expenditure side of the economy is modeled by a representative household in region r , whose Cobb-Douglas utility function allocates expenditures between private consumption (C), government consumption (G) and savings expenditure (S) as follows:

$$U_r = C_r^{\alpha_C} G_r^{\alpha_G} S_r^{\alpha_S} \quad (1)$$

with α_C , α_G and α_S income shares and $\alpha_C + \alpha_G + \alpha_S = 1$.

The regional income is entirely exhausted over the three forms of final demand. The constrained optimizing behavior of the household in region r for private consumption is represented by a non-homothetic Constant Difference of Elasticity (CDE) expenditure function for the set of goods and services. A Cobb-Douglas sub-utility function is employed for government spending.

In this case the expenditure shares are constant across all commodities. Private and government consumption are split in a series of alternative composite Armington aggregates. In more details, household consumption of goods i in region r , with $i=1,...,n$, is assumed to be a Constant Elasticity of Substitution (CES) composite good of domestically produced goods ($Q_{D,i,r}$) and imported goods, ($Q_{M,i,r}$):

$$C_{i,r} = \left[\mu_{i,r} Q_{D,i,r}^{1-\frac{1}{\sigma_i}} + (1 - \mu_{i,r}) Q_{M,i,r}^{1-\frac{1}{\sigma_i}} \right]^{\frac{\sigma_i}{1-\sigma_i}} \quad (2)$$

where σ_i is the substitution elasticity and $\mu_{i,r}$ is the subsistence household consumption quantity.

Savings decision do not present any life cycle properties but are instead a fixed share of income. Savings are exhausted on investment and capital markets and are assumed to be in equilibrium only at the global level. In fact, a hypothetical world bank collects savings from all regions and allocates investments so as to achieve equality of expected future rates of return. Future returns are determined, through a kind of adaptive expectations, from current returns, where it is also recognized that higher future stocks will lower future returns. Since the world bank sets investments so as to equalize expected returns, an international investment portfolio is created, where regional shares are sensitive to relative current returns on capital. In this way, savings and investments are equalized at the international, but not at the regional level. All savers face a common price for the savings commodity. Investors behave in such a way that changes in regional rates of return are equalized across regions:

$$\Delta \eta_r = \Delta \eta \quad (3)$$

where $\Delta \eta_r$ is the percentage change in region's rate of return and $\Delta \eta$ is the percentage change in global rate of return. The global supply of capital goods is equal to the sum of regional capital goods demand and beginning-of-period capital stock minus the capital depreciation in r .

On the production side, the firms receive payments for selling consumption goods to the private households and the government, intermediate inputs to other producers and investment goods to

the savings sector. Under the zero profit assumption employed in the CGE modeling framework, these revenues must be precisely exhausted on expenditures for intermediate inputs and primary factors of production. The nested production technology exhibits constant returns to scale and every sector produces a single output. The technology is assumed to be weakly separable between primary factors of production and intermediate inputs. Profit maximizing firms therefore choose their optimal mix of primary factors independently of the prices of intermediate inputs. Utilizing this type of separability also means that the elasticity of substitution between any individual primary factor and different intermediate inputs is equal. This technology is further simplified by employing the Constant Elasticity of Substitution (CES) functional form in the aggregation of primary factors, as well as in the combination of value-added and intermediate inputs in order to produce output:

$$y_{i,r} = \left(\sum_{j=1}^n \theta_j x_{j,r}^{1-\frac{1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad (4)$$

where, in region r , $y_{i,r}$ is the production of the good i , $x_{j,r}$ is the input j , θ_j is a non-negative parameter, with $\sum_{j=1}^n \theta_j = 1$, and σ is the elasticity of substitution.

The model assumes that commodities produced in each region are either used to meet domestic demand (as intermediate inputs in production or final products in consumption) or exported to other regions. Both intermediate and final products from different regions are considered to be imperfectly substitutable with each other (Armington, 1969). Among the primary factors (capital, labor, land and natural resources) the GTAP model additionally distinguishes between endowment commodities, which are perfectly mobile and those which are sluggish to adjust. In the former case, the factor earns the same market return regardless of where it is employed. In the case of sluggish endowment commodities, returns in equilibrium may differ across sectors. Full employment is assumed in the labor market.

Every economy also includes government interventions. Private households and the government not only spend their available income on consumption goods, but also pay taxes to the regional household. In the case of the government, taxes consist of consumption taxes on commodities. In the case of private household, taxes consist of consumption taxes and income tax net of subsidies. The accounting relationships of these two agents therefore include taxes as additional expenditures. This is captured by the distinction between market prices and agent's prices inclusive of tax. Because producers are also the object of taxation, their accounting relationships change as well. Beside buying intermediate inputs and primary factors, firms now also have to pay taxes to the regional household. These value flows represent taxes on intermediate inputs and production taxes net of subsidies. Trade generated tax revenues and subsidy expenditures are computed in a manner analogous to the ones which are being raised by policy instruments used in the domestic market. The only difference is that now the tax or subsidy rates are defined as the ratio of market prices to world prices. If there is an import tax (subsidy), the market price is higher (lower) than the world price, so that the power of the ad valorem tax is greater (smaller) than one. In the case of an export tax (subsidy), the market price lies below (above) the world price and the power of the ad valorem tax is smaller (greater) than one. All taxes levied in the economy always accrue to the regional household. As a result, the regional income consists of the output value at agents' price paid for the use of endowment commodities and the sum over all taxes net of subsidies.

International transport is a world industry, which produces the transportation services associated with the movement of goods between origin and destination regions, thereby determining the cost margin between f.o.b. and c.i.f. prices. Transport services are produced by means of factors submitted by all countries, in variable proportions.

The identity between the aggregate demand and the aggregate supply drives the modeling solutions. The regional aggregate demand is divided into private consumption (C_r), public

consumption (G_r), investments (I_r) and exports (X_r). Supply commodities is provided by national income (Y_r) and imports (M_r). It follows that:

$$Y_r + M_r = C_r + I_r + G_r + X_r \quad (5)$$

Let a and b be parameters, with $a > 0$, $0 < b < 1$, the private consumption is a function of income and taxation (T_r):

$$C_r = a + b(Y_r - T_r) \quad (6)$$

The investment is a function of the interest rate (η):

$$I_r = c - d\eta \quad (7)$$

where c and d are parameters, with $c > 0$, $0 < d < 1$.

Let M_r/P_r be the supply of real money balance in region r and

$$L(\eta_r, Y_r) = eY_r - f\eta_r \quad (8)$$

be the demand for money, where e and f are parameters, with $e > 0$ and $0 < f < 1$. As money market clearing condition requires that there is only one equalized interest rate η^* in the global market, the equilibrium interest rate can be expressed as follows:

$$\eta_r^* = \frac{e}{f}Y_r - \frac{1}{f}\frac{M_r}{P_r} \quad (9)$$

The net exports (NX_r), equal to exports (E_r) minus imports (M_r), are a function of income and the exchange rate (ε):

$$NX_r(\varepsilon) = gY_r + h\varepsilon \quad (10)$$

where g and h are parameters, with $0 < g < 1$ and $0 < h < 1$. Substituting the equations (6)-(10) in equation (5) and let $\Omega = \left(1 - b + \frac{de}{f} - g\right)$, we have that, in equilibrium, the national income is given by

$$Y_r^* = \frac{a+c}{\Omega} + \left(\frac{1}{\Omega}G_r - \frac{b}{\Omega}T_r\right) + \frac{d}{f\Omega}\frac{M_r}{P_r} + \frac{h}{\Omega}\varepsilon \quad (11)$$

The first term is constant, the second one is fiscal policy instrument, the third item is monetary policy instrument and the fourth item can be called trade policy instrument. Foreign aid can be

introduced through all these three policy instruments. For example, if we focus on trade policy instrument:

$$\frac{\partial Y^*}{\partial \varepsilon} = \frac{h}{\Omega} \quad (12)$$

If $\Omega > 0$, then $\frac{\partial Y^*}{\partial \varepsilon} > 0$; otherwise if $\Omega \leq 0$, then $\frac{\partial Y^*}{\partial \varepsilon} \leq 0$.

The key trade policy instrument is channeled via exchange rate between source country and destination country, which is the relative price ratio between domestic and foreign country.

For each country, capital account depends on domestic interest rate, and current account (NX_r) and capital account (CF_r) must balance at the equilibrium:

$$NX_r + CF_r(\eta) = 0 \quad (13)$$

The current account balance is assumed fixed at benchmark levels and regions that run a deficit are assumed to maintain a real deficit in counterfactual scenarios.

Furthermore, let S_r be regional savings, in equilibrium we have that

$$S_r - I_r = NX_r(\varepsilon) = -CF_r(\eta) \quad (14)$$

As global exports need to be equal to global imports such that

$$\sum_r X_r = \sum_r M_r \quad (15)$$

global investment must equal global savings by Walras' law:

$$\sum_r S_r = \sum_r I_r \quad (16)$$

GTAP-AID is a modified version of the original GTAP model. The following refinements have been modeled: (1) income transfers; (2) exogenous investments; (3) labour supply; (4) international income inequality.

Aid for trade policies implies that donors transfer income to the recipients. this element is inserted into the equation computing the national income as the total value of all domestic primary resources. Thus, let AID_r be the aid for trade transfer in r , the regional income is equal to:

$$Y_r = \sum_{i=1}^n P_{i,r} E_{i,r} + T_r + AID_r \quad (17)$$

where $E_{i,r}$ is the endowment i and $P_{i,r}$ is the market price of the endowment i . The aid transfer will increase (decrease) the regional income of the recipient (donor) country. To be consistent with general equilibrium conditions, the algebraic sum of all income transfers introduced in the model equations must be zero. This ensures that the redistribution of income is globally neutral and that income shocks have the same sign as demand shocks.

Investment has been fixed exogenously such that the endogenous change of the capital goods demand, ΔK_r^D , must be equal to the endogenous change of the capital goods output, ΔK_r^S , and to the exogenous change of the regional investment, ΔI_r^S . Thus, the following two equations must be satisfied to obtain the equilibrium for capital goods market:

$$\Delta K_r^D = \Delta K_r^S \quad (18)$$

$$\Delta K_r^D = \Delta I_r^S \quad (19)$$

Furthermore, to ensure the equalization of global savings and investment, an endogenous adjustment of regional saving has been set up assuming that all regional investments increase by the same percentage. In this way, the assumption of perfect international mobility of capital is respected.

In the original GTAP, there is the assumption of full employment, but this is not realistic, particularly, in developing and least developed countries, where there are high unemployment rate. For this, we adopt the assumption of no full employment and a labour supply curve has been modelled, which specifies the relation between labor supply and the real wage:

$$L = L^S \left(\frac{w}{p} \right) \quad (20)$$

A description of modeling the labour supply function appears in the Appendix.

Finally, two representative international income inequality measures (coefficient of variation and Atkinson's index) have been introduced in the original GTAP model.

The coefficient of variation is calculated as the sum of income squared deviations:

$$c = \frac{\sqrt{\frac{1}{n} \sum_{r=1}^n (y_r - \bar{y})^2}}{\bar{y}} \quad (21)$$

where \bar{y} is the regional mean income. The procedure of forming the square places more weight on income that are further away from the mean.

The Atkinson's index is defined by

$$A = 1 - \frac{MEDE}{\bar{y}} \quad (22)$$

where MEDE is the equally distributed equivalent income.

These two measures of income inequality have been chosen with respect to others, because they respect all of the following properties: (a) weak principle of transfers; (b) scale independence; (c) principle of population; (d) decomposability. The income inequality measures are summary indices, that are explained within the model and their values are endogenously changed (determined).

4. Data Source

GTAP data base, around which the model has been built, is a cross-section data of international trade flows and national input-output tables. All the information in the data base is reported in values converted to US dollars. The behavioral parameters utilized in the GTAP model are described in Dimaran *et al.* (2006). They define the magnitude of behavioral responses to changes in relative prices. There are four sets of behavioural parameters in GTAP data base: (i) elasticities of substitution, in both consumption and production; (ii) transformation elasticities, that determine the degree of mobility of primary factors across sectors; (iii) the flexibilities of regional investment allocation; (iv) consumer demand elasticities.

We use the GTAP data base, version 6, which includes 87 regions and 57 commodities adjusted to year 2001 values. For our analysis, the regions are aggregated from 87 regions to 16 regions.

The regional aggregation has been selected primarily based on importance in the world production, consumption, international trade, economic development and geographic location.

Thus, the 16 regions have been aggregated in three groups:

- (i) developed countries including the United States (USA), Canada (CAN), Western European countries (WEU), Japan (JPK), Australia New Zealand and Oceania (ANZ), Eastern European countries (EEU), Former Soviet Union (FSU);
- (ii) developing countries including Middle East (MDE), Central America (CAM), South America (SAM), Southeast Asia (SEA), China(CHI);
- (iii) least developed countries including South Asia (SAS), North Africa (NAF), Sub-Saharan Africa (SSA), Rest of the World (ROW).

The economy of each region is further divided into five sectors or commodity groups: Agriculture, Energy, Manufacture, Market services and Public services.

As the GTAP 6 data base contains data for 2001, a baseline scenario is calibrated to provide a status quo projection of the global economy in the year 2010 using the methodology described in Arndt et al. (1997). To this end, we apply World Bank projections of population and unemployment rate (Table 1). We have calibrated the technical parameters so that we achieve growth in regional GDP consistent with the World Bank projections. Figure 1 shows the convergence results to the real data in terms of GDP.

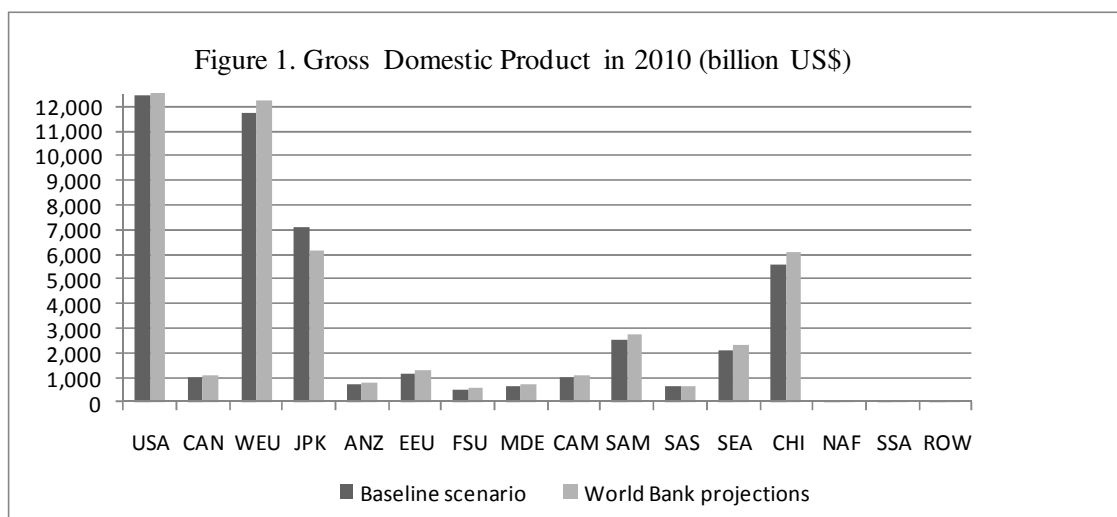


Table 1. Population and unemployment rate in the baseline scenario (2010)

Region	Population level (Million)	Unemployment rate (%)
United States	341	12.55
Canada	39	7.8
Western Europe	493	21.95
Japan	152	16.7
Australia, New Zealand and Oceania	19	7.8
Eastern Europe	100	24.8
Former Soviet Union	141	8.41
Middle East	75	12.25
Central America	107	5.1
South America	356	10.45
South Asia	1321	6.77
Southeast Asia	521	4.1
China	1338	4.4
North Africa	208	40
Sub-Saharan Africa	800	60
Rest of the World	79	10

Source: World Bank Development Indicators (2010).

5. Experimental design

The aid for trade experiments are carried out as comparative static changes with respect to the baseline scenario in variables that are exogenous in the closure of the model. In the standard general equilibrium closure prices, quantities of all non-endowment commodities and regional incomes are endogenous variables. Endowment quantity, population, technical change and policy variables are exogenous.

We assess and compare two sets of experiments. The first set of experiments includes four scenarios aimed to test the effectiveness of aid for trade (Table 2). The first scenario, called “trade adjustment assistance”, involves fiscal support and policy advice to help countries cope with any transitional adjustment costs from liberalization. This scenario implies an income transfer from the donors to the recipient countries. The aid transfer is not constrained, that is, it is not related to any project or public expenditure. The aid for trade data comes from OECD data base. The aid for trade to developing and least developed countries is equal to the 25% of the Official Development Assistance (ODA). Table 3 reports the income transfers and aid for trade shares applied in this scenario.

Table 2. Scenario description

<i>Scenario</i>	<i>Intervention for the recipient countries</i>	<i>Simulation</i>
<i>1. Trade adjustment assistance</i>	Increase in the aid budget	Boost income transfer from donor countries to recipient countries
<i>2. Institutional reform</i>	Reduce transaction costs & introduce quality assurance	Reduce export tax revenues
<i>3. Technical assistance and capacity building</i>	Update the production processes	Raise efficiency for all factors
<i>4. Infrastructure</i>	Improve infrastructure	Raise investments

Table 3. Aid for trade

<i>Donors</i>	<i>Aid transfer (US \$ million)</i>	<i>%</i>
United States	-3998.94	19.9
Canada	-3617.13	18
Western Europe	-4240.08	21.1
Japan	-4300.37	21.4
Australia, New Zealand and Oceania	-3938.65	19.6
<i>Recipient</i>		
Eastern Europe	742.63	3.70
Former Soviet Union	342.94	1.71
Middle East	3271.26	16.28
Central America	1606.96	8.00
South America	1635.11	8.14
South Asia	2959.25	14.73
Southeast Asia	1684.83	8.38
China	482.96	2.40
North Africa	492.50	2.45
Sub-Saharan Africa	6209.75	30.90
Rest of the World	667.00	3.32

Source: Our calculation from OECD data (<http://www.oecd.org/dataoecd/50/17/5037721.htm>).

In the other three scenarios, the amount of aid transfer is unchanged with respect to the first scenario, but the aid for trade is now constrained for the recipient countries. In fact, the second scenario, called “institutional reforms”, is designed to reduce transaction costs and introduce quality assurance such that the demand for exports expands. This is simulated through a reduction of the export tax for the recipient countries. The third scenarios, called “technical assistance and capacity building”, aims to improve the productivity of factors, through supplying training and awareness of production process. This is simulated by augmenting the productivity for all factors. The fourth scenario, called “Infrastructure”, involves infrastructure improvements, widespread throughout the economy. This is simulated by increasing investment. Table 4 reports the details of the additional shocks applied in the simulations.

Table 4. Constrained aid for trade

<i>Region</i>	<i>Institutional reform</i>	<i>Technical assistance and capacity building</i>	<i>Infrastructure</i>
	<i>Export tax revenues (million US \$)</i>	<i>Factor productivity (%)</i>	<i>Investment (%)</i>
Eastern Europe	-3.85	0.08	0.05
Former Soviet Union	-342.94	0.08	0.09
Middle East	-1408.37	0.63	0.74
Central America	-1273.37	0.19	0.21
South America	-1635.11	0.07	0.07
South Asia	-2959.25	0.61	0.54
Southeast Asia	-1684.83	0.09	0.07
China	-482.96	0.01	0.00
North Africa	-492.50	1.29	1.11
Sub-Saharan Africa	-0.06	10.20	12.43
Rest of the World	-34.24	1.26	1.53

The second set of experiments aims to evaluate the equity of aid for trade scenarios, which requires that the total amount of aid for trade is fairly divided amongst the recipient countries. Several equity criteria can be used . The population criteria would allocate the highest amount of aid for trade to the country with the highest population level. The GDP per capita criteria would allocate the highest amount of aid for trade to the country with the lowest GDP per capita. The population and GDP per capita criteria would allocate the highest amount of aid for trade to the country with the highest population level and the lowest GDP per capita, that is the aid share for the recipient countries is a mean of the population and GDP per capita criteria. The latter criteria has been applied to analyze equity of aid for trade as it allows of moderating the aid for trade change with respect to the initial distribution, that with either population or GDP per capita criteria would result too much extreme. Some countries such as Sub-Saharan Africa (SSA) and Middle East (MDE) will have substantially reduced the amount of aid for trade. The opposite effect will occur for other countries, such as China (CHI) and North Africa (NAF). Table 5 and 6 report the details of the shocks applied in the simulations for equity analysis.

Table 5. Aid redistribution in recipient countries

<i>Recipient country</i>	<i>Aid transfer (US \$ million)</i>	<i>%</i>
Eastern Europe	967.8	4.82
Former Soviet Union	1211.11	6.03
Middle East	984.36	4.90
Central America	1028.69	5.12
South America	1572.57	7.83
South Asia	3626.66	18.05
Southeast Asia	1959.47	9.75
China	3585.12	17.84
North Africa	1414.93	7.04
Sub-Saharan Africa	2596.43	12.92
Rest of the World	1148.05	5.71

Source: Our calculation from OECD data (<http://www.oecd.org/dataoecd/50/17/5037721.htm>).

Table 6. Constrained aid for trade (equity analysis)

<i>Region</i>	<i>Institutional</i>	<i>Technical</i>	<i>Infrastructure</i>
	<i>Reform</i>	<i>assistance and capacity building</i>	
	<i>Export tax revenues (million US \$)</i>	<i>Factor productivity (%)</i>	<i>Investment (%)</i>
Eastern Europe	-3.85	0.10	0.06
Former Soviet Union	-1211.11	0.27	0.33
Middle East	-984.36	0.19	0.22
Central America	-1028.69	0.12	0.14
South America	-1572.57	0.07	0.07
South Asia	-3626.66	0.75	0.66
Southeast Asia	-1959.47	0.11	0.08
China	-3585.12	0.08	0.03
North Africa	-604.61	3.72	3.20
Sub-Saharan Africa	-0.06	4.27	5.20
Rest of the World	-34.24	2.16	2.64

6. Simulation results

Effectiveness requires that aid for trade policy achieves its stated goals, that are to expand trade and, jointly, to alleviate inequalities. In terms of trade, Figure 2 shows that China (CHI) substantially gains with the institutional reform scenario; South Asia (SAS) and Sub-Saharan Africa (SSA) have moderate gains with the technical assistance and capacity building scenario. The trade adjustment assistance scenario results to be the less appropriate to expand trade for almost all the countries. Usually, the effects on trade balance yield opposite effects on welfare. In fact, if on the one hand, the countries that become net importers have welfare gains; on the other hand, the countries that become net exporters have welfare loss. In fact, trade adjustment assistance scenario has negative trade effects, but it yields the highest positive effects on welfare change for almost all the countries (Figure 3). The magnitude of trade and welfare effects may differ, due to the fact, that the effects on welfare change are not limited to terms of trade, but include endowment, technical efficiency, allocative efficiency and income contributions. In fact, for example, if on the one hand, technical assistance and capacity building scenario has positive trade effects for South Asia (SAS) and Sub-Saharan Africa (SSA); on the other hand, it yields high positive effects on welfare, because the negative contribution to welfare change in terms of trade is compensated by the high positive contribution to welfare change of allocative effects. The welfare effects of the other two scenarios (institutional reform and infrastructure) are very small. The results in terms of welfare are reported in Figure 3. The effects on income per capita are mainly positive, but very small, except for Sub-Saharan Africa (SSA), that has substantial positive change in the trade adjustment assistance and technical assistance and capacity building scenarios (Figure 4). This result is due to the fact that it receives the highest amount of aid for trade, that yields high income and allocative effects on welfare change.

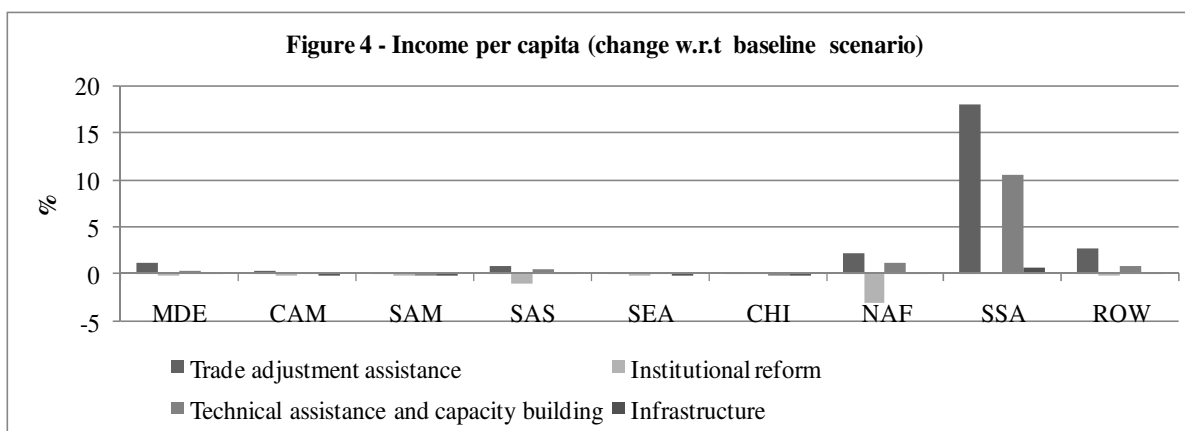
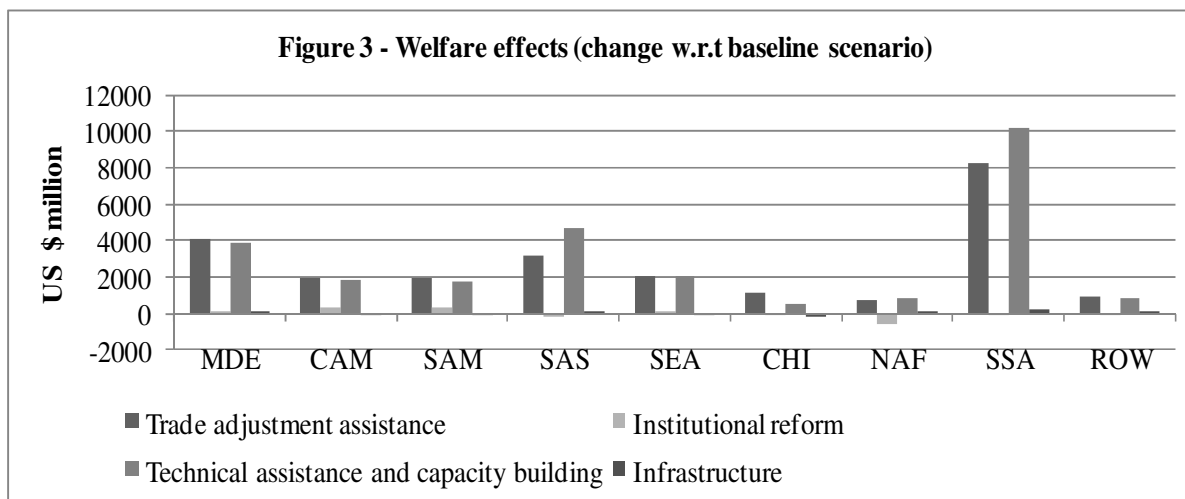
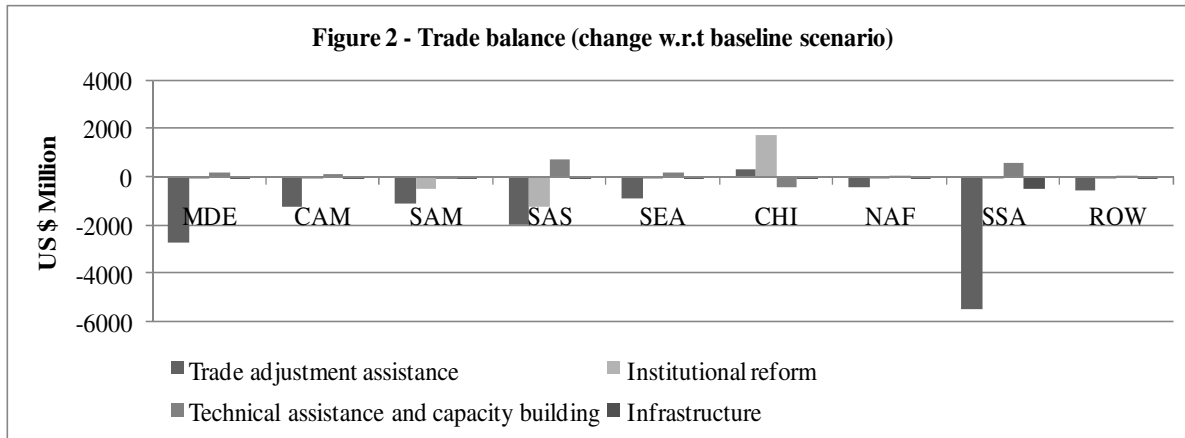


Table 7 reports the most preferred scenario per indicator for every developing and least developed countries. A combination of the adjustment trade assistance and technical assistance and capacity building scenarios would guarantee the effectiveness more than the other scenarios for all the countries Institutional reform will be preferred in China in terms of trade and in the Rest of the World to alleviate income inequalities.

The combination of the trade adjustment assistance and technical assistance and capacity building scenarios is also enforced at international level. In fact, these scenarios decrease international income inequalities, the opposite effect occurs for the institutional reform and infrastructure scenarios (Figure 5).

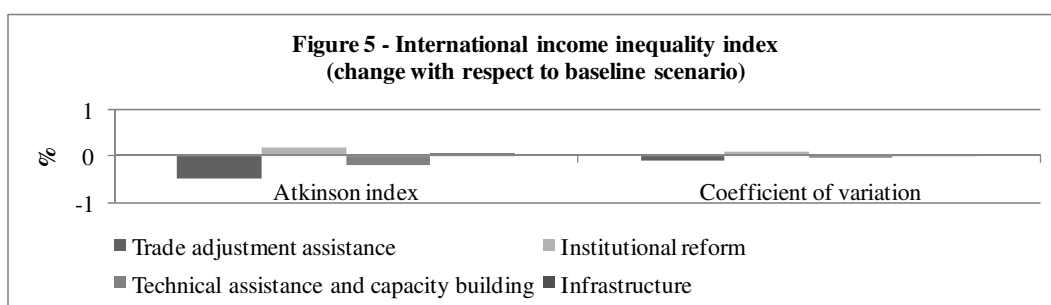


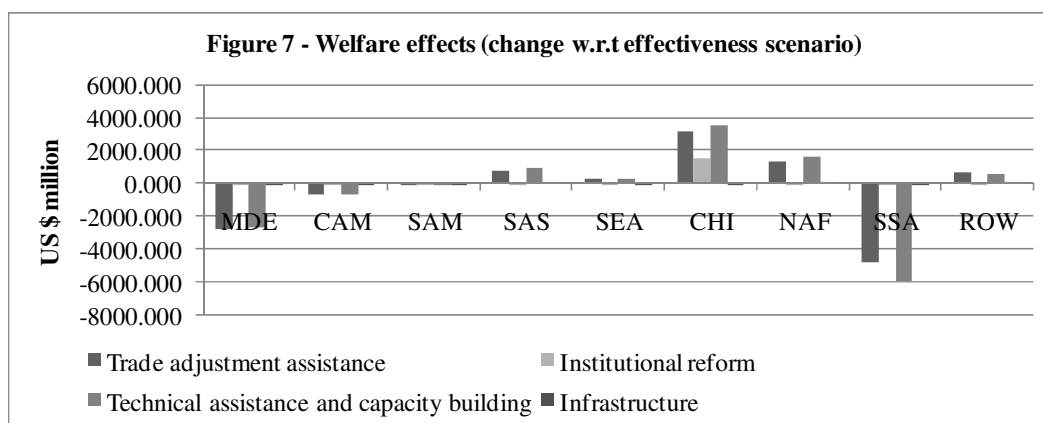
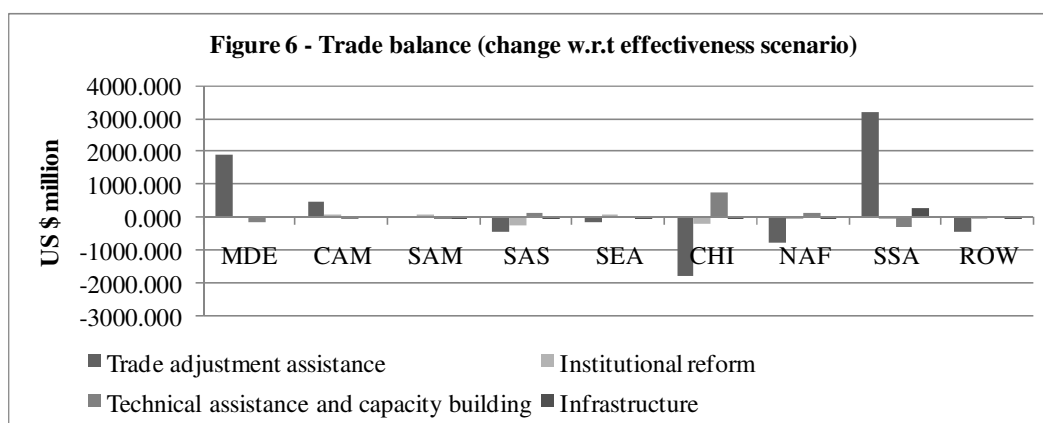
Table 7. Scenario Ranking of Effectiveness Analysis

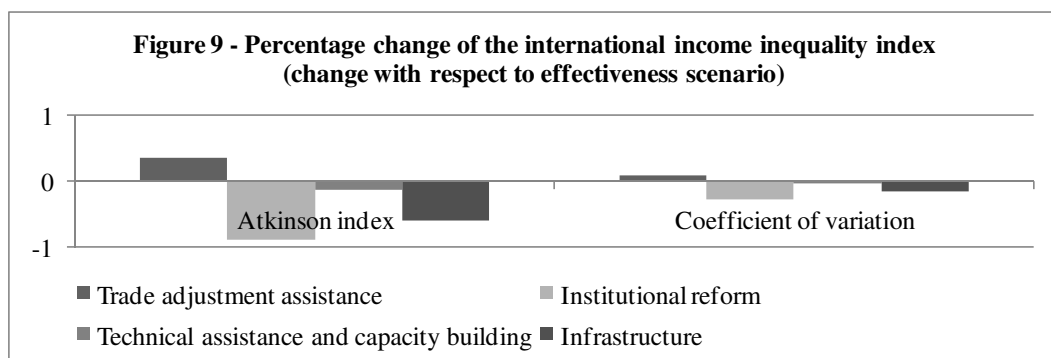
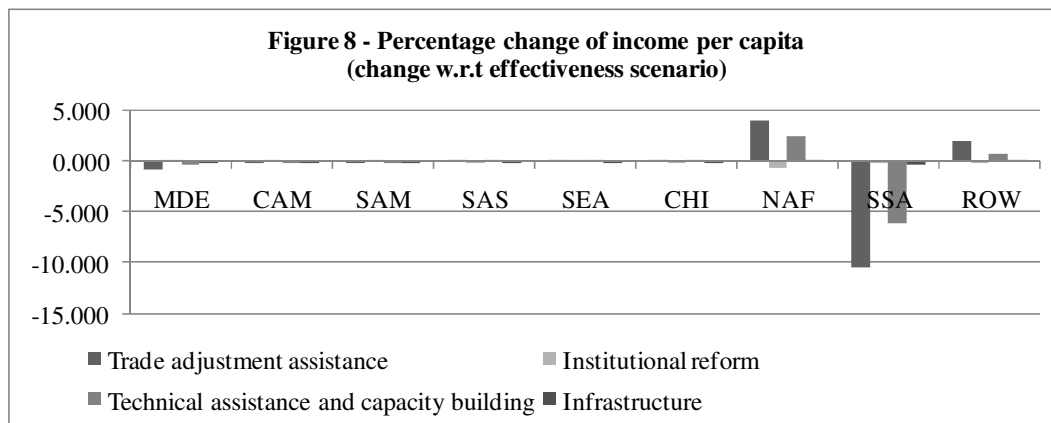
<i>Region</i>	<i>Trade</i>	<i>Welfare</i>	<i>Income Per Capita</i>
MDE	TA & CB	TAA	TAA
CAM	TA & CB	TAA	TAA
SAM	TA & CB	TAA	TAA
SAS	TA & CB	TA & CB	TAA
SEA	TA & CB	TAA	TAA
CHI	IR	TAA	TAA
NAF	TA & CB	TA & CB	TAA
SSA	TA & CB	TA & CB	TAA
ROW	TA & CB	TAA	IR

Note: TA & CB stands for technical assistance and capacity building, TAA stands for trade, Adjustment assistance, IR stands for institutional reform

For the equity analysis the four aid for trade scenarios (trade adjustment assistance, institutional reform, technical assistance and capacity building, infrastructure) have been developed such that the transfers of aid for trade are fairly divided amongst the recipient countries. The results are reported as change with respect to the effectiveness analysis. The highest impacts are for those countries that had the highest change (positive or negative) in the aid distribution, that is, Middle East (MDE), Sub-Saharan African (SSA) countries, China (CHI) and North Africa (NAF). For the other countries the impacts are usually very small. Also, the most affected scenarios by equity are the most preferred scenarios in the effectiveness analysis, that is trade adjustment assistance and technical assistance and capacity building scenarios. Figure 6 shows that equity significantly expands trade in the trade adjustment assistance scenario for Middle East (MDE) and Sub-Saharan African (SSA) countries. This is due to the fact that the reduction of aid for trade in these countries decreases the imports more than the exports. The opposite effect occurs in China (CHI) and North Africa (NAF) that sustain loss in terms of trade. Technical assistance and capacity building scenario reports the highest welfare change with respect to effectiveness analysis (Figure 7). Trade effects are the main contribution to welfare change for Middle East (MDE) and South Asia (SAS). In North and Sub-Saharan Africa, the income change is the main contribution to welfare change. The effects on income per capita, are very small in almost all the countries (Figure 8). Income per capita decreases for the Sub-Saharan African countries under the trade adjustment assistance and technical assistance and capacity building scenarios. The opposite effect occurs in North Africa and Rest of the World under the trade adjustment assistance and technical assistance and capacity building scenarios. Thus, almost all of the countries gain from the aid for trade redistribution in terms of equity, or at least have small loss. Only Sub-Saharan Africa suffer substantial welfare and income loss in the trade adjustment assistance and technical assistance and capacity building scenarios. Furthermore, the negative effects on income of Sub-Saharan Africa increase the international income inequality

for the trade adjustment assistance scenario (Figure 9). For this countries, a combination of the institutional reform and infrastructure scenarios would allow of alleviating income inequalities. Although, there are substantial impacts due to aid redistribution for some countries, equity does not change the scenario ranking reported in table 7. Thus, trade adjustment assistance and technical assistance and capacity building scenarios remain the most preferred scenarios in developing and least developed countries. Globally, these results suggest that effectiveness of aid for trade in expanding trade and alleviating inequalities will be enforced if aid for trade transfers are fairly divided amongst the countries.





7. Concluding remarks

Recent global initiatives on debt relief and development assistance call for increasing aid for trade to the poorest countries. Aid for trade is financial and technical assistance that facilitates the integration of low-income countries into the global economy. Although the distribution of aid for trade is unevenly allocated by region, the empirical studies have been concentrated mainly on effectiveness rather than equity.

Differently to the existing studies, using a multi-country computable general equilibrium model, this paper attempts to analyse aid for trade policies in developing and least developed countries in terms of effectiveness and equity. We use welfare and income indicators to evaluate inequalities. Our findings show that aid for trade policies expand trade and alleviate inequalities. The developing and least developed countries will benefit mainly from aid for trade assistance that helps these countries with any transitional adjustment costs from liberalization and increases

factor productivity. Effectiveness of aid for trade is enforced if income transfers from donors are fairly divided amongst the recipient countries.

Indeed, the spirit of foreign aid based on humanitarian support and moral obligation will continue prevalent in the future. This spirit of liberalizing trade, embracing democracy, and helping the poor out of poverty win the battle despite many imperfectness during this battle course. This trend has been reflected by the amount of foreign aid that has been expanded over decades and the reduction of poverty rate at the global level despite of recent global financial crisis. Bauer and other critics who hold the views of failure of foreign aid did not lose the battle either, their views have enhanced and will continue to improve economic efficiency of the constructing, modification and implementation of foreign aid. Several action plans or agreements regarding to implementing and monitoring foreign aid have been initiated and reemphasized via recent Doha Round meetings. The results of this paper suggest that increasing equity in the aid for trade distribution and focus on trade adjustment assistance and factor productivity will be the critical challenges for achieving the objectives of aid for trade policy.

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Appendix

Let S_r be the labor supply, it is modeled as function of the real wage

$$S_r = a_r - \frac{b_r}{w_r} \quad (\text{A.1})$$

where a_r is an asymptote, which can be interpreted as the maximal potential amount of available unskilled labour force, and b_r is a positive parameter. The labor supply elasticity in region r , ϵ_r in respect to the real wage, is equal to:

$$\epsilon_r = \frac{b_r}{a_r w_r - b_r} \quad (\text{A.2})$$

Given that the unemployment rate in region r , u_r , is equal to

$$u_r = 1 - \frac{S_r}{a_r} \quad (A.3)$$

the labour supply elasticity can be also expressed as function of the unemployment rate as follows:

$$\varepsilon_r = \frac{u_r}{1 - u_r} \quad (A4)$$