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Can stability of foreign aid agreement reduce global income inequality?

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ABSTRACT

Global initiatives on debt relief call for increasing foreign aid assistance to alleviate income inequality. But the potential gains from foreign aid policy coordination may be limited by the willing participation of diverse and self-interested donor countries. If stability of the foreign aid agreement does not occur, then aid effectiveness fails. Thus, the aim of this paper is to investigate the effects of the stability of foreign aid agreement on income redistribution amongst countries. The findings show that stability has positive effects on income mobility from the rich to the poorest countries reducing global income inequality.

1. Introduction

Global initiatives call for increasing foreign aid assistance to alleviate income inequality. The Organization for Economic Cooperation and Development (OECD) reports continuing growth in Official Development Aid (ODA). In fact, during 1960–2013, total ODA disbursements has substantially increased and at least 3.5 trillion dollars have been given as foreign aid from rich to poor countries. The largest donors result to be the United States, France, Germany and the United Kingdom. Furthermore, Qian (2015) reports that 24% (on average) of ODA during 2006–2012 for all donors countries was not transferred to the recipient countries, but the aid money was instead spent on activities in donor countries, mainly for debt relief, administrative costs and expenditure on refugees.

The literature on foreign aid is really rich, but the theoretical and empirical studies report quite different views on the relationship between foreign aid and income. On the one hand, there exist studies supporting the positive effects of the foreign aid. The endogenous growth model developed by Rosenstein-Rodan (1943) shows that foreign aid provides investment capital, which would generate income and raise up the return to capital and promote economic growth. Dalgaard and Hansen (2001) show that there is a linear effect in the aid-income growth relationship due to diminishing returns to foreign aid. Burnside and Dollar (2000), Dollar and Kraay (2001) and Collier and Dollar (2002) suggest that foreign aid coupled with good policies, such as private property rights, fiscal discipline, macroeconomic stability and open to trade, increase the income of the poor countries. On the other hand, there are studies that show the failure of foreign aid to alleviate income inequality. Bauer (1975) defines foreign aid as "*a transfer of resources from the taxpayer of a donor country to the government of a recipient country*". Furthermore, he argues that as donors do not know which investments are appropriate for the recipient country, the transfer of foreign aid destroys economic incentives, leads to misallocation of scarce resources and undermines economic growth. Based on both the history and the evidence on foreign aid, Easterly (2003) shares similar view as

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Bauer (1975) questioning about the alternative definition of "aid" "good policy" and "growth" to illustrate the complex relationship between foreign aid and income and the high possibility of failure. Doucouliagos and Paldam (2008) conclude that the aid literature has failed to prove that the effect of aid on growth is statistically larger than zero. The existing empirical evidence on foreign aid also fails to prove an inequality decreasing effect on income distribution (i.e. Calderón et al., 2006; Herzer and Nunnenkamp, 2012). The failure of foreign aid may due to various factors, such as poor governance of foreign aid funding, inefficient and unfair aid distribution amongst the recipient countries, conditional requirements of donor countries, political instability in the recipient countries (Dollar and Kraay, 2001; Inanga, 2008; Younas, 2008; Brück and Xu, 2012; Kalyvitis et al., 2012a; Kalyvitis and Vlachaki, 2012b; Raschky and Schwindt, 2012). Furthermore, there are some studies that have found ambiguous or mixed relationship between foreign aid and growth in the poor countries (Inanga and Mandah, 2008; Werker et al., 2009; Ekanayake and Chatrna, 2010). 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. Positive relationship between foreign aid and growth is 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. Similarly, in a sample of 42 aid recipients covering the period 1970–2000, Kalyvitis and Vlachaki (2012b) find that there is a threshold level of aid, above which the growth impact of aid becomes positive. The different views on the relationship between foreign aid and income may related to the problems of data measurement and identification due to the heterogeneous nature of aid (Qian, 2015).

From the analysis of this literature one aspect emerges, that is, the stability of foreign aid agreement has not been still now appropriately faced. The aim of foreign aid transfer may deviate from its original outcome of interest due to various factors in each stage (creation, implementation, distribution and monitoring system) generating instability of the foreign aid agreement. Generally, as the foreign aid increases the income of the recipient country and decreases that of the donors, the free-rider problem arises due to the presence of multiple donors who are motivated by self-interest. Thus, the mere coordination of aid, such as general budget supports, will not automatically guarantee the suboptimality of aid provisions (Rahman and Sawad, 2012). Berrittella (2011) shows that if the gains from cooperation are largest, there are countries that have incentive to defect from the foreign aid agreement. This suggests that the effects of the foreign aid agreement may be biased if stability is not taken into account. In fact, *ex-ante*, the initial aid distribution in the agreement is established to obtain defined outcome (i.e. economic growth, population well-being, institutional development, income redistribution) in the recipient countries under the condition that no donor country defects, if this condition does not occur, *ex-post*, aid effectiveness fails. Stability of the foreign aid agreement guarantees the aid effectiveness, both *ex-ante* and *ex-post*. In this context, first of all, one question that merits to be faced is if stability of foreign aid agreement can increase the income mobility from the rich to the poorest countries. Using a multi-country computable general equilibrium model (CGE), the aim of this paper is to investigate the relationship between stability and global income inequality. The main findings show that the stability of the foreign aid agreement has positive effects on income redistribution from the donor to the recipient countries and global income inequality decreases. As no country has incentive to free-ride, the income mobility from the donor to the recipient countries will be effective.

2. Modeling framework

In order to assess the systematic general-equilibrium effects of foreign aid, a multi-country CGE model, labeled AIDCGEM (Berrittella and Zhang, 2014), has been applied, which is a modified version of the standard GTAP model (Hertel, 1997).

A CGE model describes an economy in equilibrium with endogenously determined relative prices and quantities guaranteeing theoretical and accounting consistency. Differently to partial equilibrium models, CGE models allow of evaluating the effects of exogenous shift of policy variables on macroeconomic indicators (i.e. GDP, trade balance and welfare), taking into account the interdependence among all markets and regions. A CGE model builds on a closed accounting system of simultaneous equations representing market equilibrium: equality between supply and demand in each market in the economy. As compared to other methods, one of the advantages is that CGE models can provide concrete measures of changes in welfare due to policy change. This is particularly important for the aim of this paper, because the CGE model allows of answering to questions on who are the winners and losers from changing foreign aid policies, providing policy makers with a better understanding of the possible social results of the income redistribution from the rich to the poorest countries. An assessment of the usefulness of CGE models for policy analysis can be found in Borges (1986), Shoven and Whalley (1992) and Piermartini and The (2005). Furthermore, the CGE approach has been extensively used for the analysis of foreign aid (i.e. Nugent, 1988; Nechyba, 1996; Arndt and Tarp, 2001; Clausen and Schürenberg-Frosch, 2012).

AIDGEM is a comparative static, multi-commodity, multi-region model with the assumptions of perfect competition, market equilibrium and open economy.

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

$$U_r = C_r^{\alpha_{C,r}} G_r^{\alpha_{G,r}} S_r^{\alpha_{S,r}} \tag{1}$$

with $\alpha_{C,r}$, $\alpha_{G,r}$ and $\alpha_{S,r}$ income shares and $\alpha_{C,r} + \alpha_{G,r} + \alpha_{S,r} = 1$.

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 (Armington, 1969).

On the production side, the producers 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, 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 simplified by employing the Constant Elasticity of Substitution (CES) functional form:

$$y_{i,r} = \left(\sum_{j=1}^{n} \theta_j x_{j,r}^{1-\frac{1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{2}$$

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.

Both intermediate and final products from different regions are considered to be imperfectly substitutable with each other (Armington, 1969). All factor inputs (land, labor, capital and natural resources) are assumed to be fully employed and immobile across regions. Capital and labor are perfectly mobile across sectors and, hence, they earn the same market return regardless of where they are employed; land and natural resources are sluggish to adjust and their returns may differ across sectors.

Savings are exhausted on investment and capital markets are assumed to be in equilibrium only at the global level. If savings exceed investments for one country, then it has a trade surplus; otherwise, it has a trade deficit. A hypothetical world bank collects savings from all regions and allocates investments so as to achieve equality of changes in expected future rates of return:

$$\Delta\eta_r = \Delta\eta \tag{3}$$

where $\Delta\eta_r$ and $\Delta\eta$ are the percentage change, respectively, in region's rate of return and global rate of return.

Every economy 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 firms have to pay taxes to the regional household. These value flows represent taxes on intermediate inputs and production taxes net of subsidies. Also trade generated tax revenues and subsidy expenditures are included in the GTAP model. All taxes levied in the economy always accrue to the regional household.

The foreign aid is inserted into the equation computing the national income as the total value of all domestic primary resources. Thus, let AID_r be the income transfer in region r, the regional income is equal to:

$$Y_r = \sum_{i=1}^{n} P_{i,r} E_{i,r} + T_r + AID_r \tag{4}$$

where $E_{i,r}$ is the endowment i and $P_{i,r}$ is the market price of the endowment i, T_r are the tax revenues. The income 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.

2.1. Data calibration

The AIDCGEM model is calibrated for the year 2001 using the GTAP data base, version 6, which 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 Dimaranan (2006). They define the magnitude of behavioral responses to changes in relative prices. In particular, there are four sets of behavioral 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.

The GTAP data base includes 87 regions and 57 commodities. For this 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 regional aggregation includes five donor countries and eleven recipient countries (Table 1).

As the GTAP 6 data base contains data for 2001, but the aid policy is designed for the year 2010, the methodology described in Arndt et al. (1997) has been applied to provide a *status quo* projection of the global economy in the selected year. The approach is based on a two-stage procedure. Firstly, "pseudo-calibrations" have been generated from 2001 to 2010 by calibrating the technical parameters related to population growth, capital and labour stock change, labour and land

Table 1
Regional aggregation.
Source: Author's modelling aggregation based on GTAP v.6 data base.

Acronym	Region	Type
USA	United States	Donor
CAN	Canada	Donor
WEU	Western Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom)	Donor
JPK	Japan and South Korea	Donor
ANZ	Australia, New Zealand and Oceania	Donor
EEU	Eastern Europe (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia)	Recipient
FSU	Former Soviet Union	Recipient
MDE	Middle East (Turkey, Rest of Middle East)	Recipient
CAM	Central America (Mexico, Central America, Caribbean)	Recipient
SAM	South America (Colombia, Perù, Venezuela, Rest of Andean Pact, Argentina, Brazil, Chile, Uruguay, Rest of South America)	Recipient
SAS	South Asia (Bangladesh, India, Sri Lanka, Rest of South Asia)	Recipient
SEA	Southeast Asia (Taiwan, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam)	Recipient
CHI	China (China, Hong Kong)	Recipient
NAF	North Africa (Morocco, Rest of North Africa)	Recipient
SSA	Sub-Saharan Africa (Botswana, Rest of SACU, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe, Other Southern Africa, Uganda, Rest of Sub-Saharan Africa)	Recipient
ROW	Rest of the world	Recipient

productivity change, so that to achieve growth in regional GDP consistent with the World Bank projections, as showed also in Berrittella and Zhang (2014). The resulting scenario in this first stage is called "baseline". Subsequently, conventional comparative analysis is conducted in the policy design simulations.

3. Stability conditions

A multi-country agreement is stable if each country gains, in terms of welfare, from joining it. The gains from the agreement for country i (GfC^i), with $i = 1, \ldots, n$, are the difference between the welfare if there is the agreement, W_C^i, and the welfare if there is no agreement, W_{NC}^i, that is:

$$GfC^i = W_C^i - W_{nc}^i. \tag{5}$$

Let T^i be the minimum non-negative payment to country i necessary to make foreign aid agreement more attractive than no agreement (called also side-payment), we have:

$$T^i = \max\left\{0,\ W_{nc}^i - W_c^i\right\}. \tag{6}$$

The side-payment is a measure of the difficulty that will be encountered in reaching the agreement. The difficulty to agreement refers to the incentive to do *ex-ante* negotiations, and not to the gains that will be sustained with *ex-ante* negotiations by the countries. Clearly, T^i may be zero for all i (i.e. in the extreme case, if the countries would be homogeneous), but it cannot be positive for all i, otherwise, the world welfare from foreign aid agreement would be less than the world welfare if there is no agreement.

The willingness to pay of country i, WTP^i, is equal to the positive gains from the agreement, that is

$$WTP^i = \max\left\{0,\ W_c^i - W_{nc}^i\right\}. \tag{7}$$

An agreement is stable if the sum of the willingness to pay is greater than the sum of the side-payments, that is if

$$\sum_j WTP^j \geq \sum_i T^i \quad \text{with } j + i = n. \tag{8}$$

In other words, let us define the agreement rate, s, as follows:

$$s = \frac{\sum_j WTP^j}{\sum_i T^i} \tag{9}$$

if $s \geq 1$ then the foreign aid agreement is stable.

Table 2
Foreign aid distribution: first step.
Source: Author's calculation.

Region	Income transfer	ΔW_r (M ln US $)
Donor		
United States	−26 076	−32 485
Canada	−5277	−6293
Western Europe	−42 585	−57 010
Japan	−10 515	−13 393
Australia, New Zealand & Oceania	−3832	−4560
Recipient		
Eastern Europe	3159	4483
Former Soviet Union	1435	1833
Middle East	2588	4430
Central America	6238	7657
South America	2915	3999
South Asia	14 722	16 831
Southeast Asia	5696	6615
China	1791	1936
North Africa	1666	2299
Sub-Saharan Africa	25 742	32 005
Rest of the World	22 333	28746

4. Policy design and results

The procedure to calculate the optimal foreign aid distribution includes two steps. Firstly, the simulation of the initial aid distribution, which will give the welfare change for any country r, ΔW_r. If welfare change is positive for country r, then country r has incentive to participate to the foreign aid agreement both *ex-ante*, in terms of side-payments, and *ex-post* in terms of gains from cooperation. The opposite effects occur if welfare change is negative. Furthermore, if the stability condition in Eq. (8) occurs (that is: $s \geq 1$) then no country has incentive to defect from the agreement. Otherwise, the initial foreign aid distribution must be modified to guarantee the stability condition in Eq. (8). Secondly, given the initial aid transfer for country r, the associated endogenous welfare change for country r is recalculated such that the sum of welfare changes is equal to zero, as follows:

$$\Delta\tilde{W}_r = \Delta W_r - \sum_r \Delta W_r \frac{|\Delta W_r|}{\sum_r |\Delta W_r|}. \tag{10}$$

The values of welfare change, calculated in Eq. (10), are exogenously simulated and this simulation will give the endogenous foreign aid distribution.

This two-step procedure allows of identifying the aid distribution that satisfies the stability conditions given the initial aid allocation.

Tables 2 and 3 report the simulation results of this two-step procedure. Table 2 identifies the initial aid distribution in terms of income transfer, negative for the donor countries and positive for the recipient countries. Data on the initial foreign aid distribution is extracted from the OECD STAT database (OECD, 2012) and World Bank data set (World Bank, 2012), and the standard measure of aid is used, which corresponds to the Net Official Development Assistance. The largest donors are the European countries (mainly France, Germany and the United Kingdom) and the United States, contributing, respectively, by 50% and 30%. The main recipients are the Sub-Saharan African countries, that result to have received almost 30% of the total amount of foreign aid. The simulation of the income transfer related to the foreign aid increases welfare of the recipients and decreases that of the donors.

Furthermore, Table 3 reports the welfare change for country r such that the sum of welfare changes is equal to zero. These values are exogenously simulated in the second step that will give the endogenous foreign aid distribution. Stability requires an increase of the foreign aid for the donor countries, except for Japan. The donors with the lowest initial income transfer (Canada, Australia New Zealand and Oceania) have to increase the foreign aid more than the other donors. Furthermore, stability requires a redistribution of the foreign aid amongst the recipient countries, with a substantial increase for the Middle East and South America. Foreign aid redistribution implies that the recipients with the highest initial income transfer (such as the Sub-Saharan African countries) will have a decrease in their income transfer. Many of the recipient countries will receive an increase in their income transfer due to the foreign aid redistribution.

The aid effects on income per capita are negative for the donor countries and positive for the recipient countries. This means that there is an income redistribution from the rich to the poor countries. In particular, the donors with the lowest income transfer yield the highest negative change in income per capita. For the recipient countries, the results suggest a U-inverted curve in the relationship between foreign aid distribution and change in income per capita. If on the one hand, the recipients that receive the highest income transfer have also the highest change in income per capita, for example Rest

Table 3
Foreign aid distribution: second step.
Source: Author's calculation.

Region	$\Delta\tilde{W}_r$ (M ln US $)	Aid distribution (%)[a]	Income per capita	
			(%)[b]	(%)[a]
Donor				
United States	−32 065	0.063	−0.694	0.002
Canada	−6211	0.402	−1.153	0.010
Western Europe	−56 273	0.023	−0.800	0.007
Japan	−13 219	−0.594	−0.459	−0.004
Australia, New Zealand & Oceania	−4501	0.391	−1.299	0.013
Recipient				
Eastern Europe	4541	0.151	1.613	0.018
Former Soviet Union	1857	0.625	0.455	−0.001
Middle East	4487	0.869	0.753	0.004
Central America	7756	−0.021	1.629	0.018
South America	4051	0.968	0.389	−0.003
South Asia	17 049	−0.115	4.576	0.051
Southeast Asia	6701	−0.014	0.605	0.005
China	1961	0.407	0.242	−0.001
North Africa	2328	0.160	1.138	0.011
Sub-Saharan Africa	32 419	−0.122	9.969	0.118
Rest of the World	29 118	−0.108	13.192	0.157

[a] Change with respect to the initial aid distribution (no stability).
[b] Change with respect to the baseline scenario.

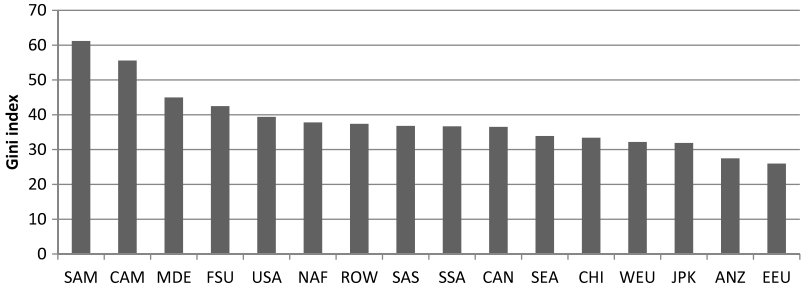

Fig. 1. Gini index.
Source: Author's calculation from UNU-WIDER (2005) and World Bank (2012).

of the World and Sub-Saharan Africa. On the other hand, we have that the recipients with the lowest income transfer not always have the lowest change in income per capita, for example, North Africa. The comparison with "no stability" scenario, in terms of income per capita, shows that stability enforces the income redistribution.

The income mobility from the rich to the poorest countries is also supported in terms of global income inequality (GII) index calculated as in Milanovic (2006):

$$GII = \sum_{i=1}^{n} G_i p_i \pi_i + \frac{1}{\mu} \sum_{i}^{n} \sum_{j>1}^{n} \left(y_j - y_i\right) p_i p_j \tag{11}$$

where y_i is the per-capita income of ith country, p_i is the population share of ith country in total world population, π_i is the share of ith country in total global income, μ is the income mean, n is the number of countries and G_i is the Gini coefficient of national income distribution.

Data on Gini coefficient of national income distribution (G_i) come from the World Income Inequality Database (WIID) compiled by UNU-WIDER (2005) and the World Bank data set (World Bank, 2012), which contains a comprehensive collection of within country inequality data from several thousand underlying statistical surveys and is a very broad collection of national income distributions data. Fig. 1 shows the income inequality per country. For each country, the most recent data on Gini coefficient has been selected over the period 2000–2010. The GII index decreases from 67.73 in the baseline equilibrium to 67.04 in the stability scenario allowing income mobility from the rich to the poorest countries.

5. Concluding remarks

As the stability of the foreign aid agreement is a critical challenge for the success of aid assistance, the aim of this paper has been to investigate if stability of foreign aid agreement promotes income redistribution from the donor to the recipient

countries. The main findings show that there is a positive effect of stability of foreign aid agreement on the income mobility from the rich to the poorest countries.

If the foreign aid distribution occurs on the basis of the stability conditions, then no country has incentive to free-ride and the income redistribution will be effective. This suggests that policy-makers must identify *ex-ante* the aid distribution that satisfies the stability conditions in order to avoid the failure of foreign aid.

The simulation analysis and results of this paper call for further research that investigates the relationship between stability of foreign aid agreement and income inequality; in particular, research on the design of global transfers that satisfy the requirement that income inequality decreases in both donor and recipient countries; application of alternative methodologies to the CGE modelling framework that take into account the problems of measurement and identification due to the heterogenous nature of foreign aid.

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