The Inequality Bias of Africa's Trade Policy*

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Abstract

The objective of this paper is to estimate the potential bias in the trade policy of Sub Saharan Africa (SSA) and other countries against SSA poor households. To this end we start with a simple but well established framework (Winters et al., 2004) and propose and extension to include adjustments in labor income, associated with changes in unskilled and skilled wages. We then build indicators that capture differences in welfare changes across income levels associated with the elimination of SSA own trade protection, as well as trade protection on SSA's export bundle by the rest of the world. Results suggest that SSA's own trade policy is biased in favor of poor household, although it tends to generate real income losses that hurt poor households. Results are not affected by the inclusion of non-tariff measures (NTMs) in SSA, except in Malawi where trade policy becomes biased against poor households once NTMs are included. The trade policies of SSA's trading partners tend to be biased in favor of SSA's rich, and NTMs reinforce this bias.

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1 Introduction

Income redistribution is an unavoidable consequence of trade reform. Liberalization will make some individuals better off and others worse off in the absence of compensation mechanisms.[1] This income redistribution can systematically be in favor or against poor households. For example, the prediction of the Stolper-Samuelson theorem in a world where skilled and unskilled workers are the two factors of production available, is that unskilled (and generally poor) workers are more likely to benefit from trade liberalization in unskilled abundant countries, whereas skilled workers (generally richer) suffer losses. Regardless of whether the simple Stolper-Samuelson prediction holds when confronted to the data, poor and rich households are likely to be differently affected by trade reform as they generally consume different bundles, and are associated with the production of different goods. Thus, whether trade policy is biased in favor or against poor household (i.e., whether it redistributes income towards or away from poor households) is essentially an empirical question.

In this paper we examine whether trade policy in Sub-Saharan Africa (SSA), as well as the trade policy of SSA's trading partners shows a poverty bias. In other words, do existing trade policies tend to redistribute income from poor to rich households, exacerbating poverty in SSA. Some may argue that the relevant question is not whether the poor are better or worse off than rich households with the existing structure of trade protection in SSA and abroad, as there are potentially more efficient means of redistributing income to poor households than through distortive trade policies. We do not dispute this principle, and our exercise should not be seen as normative or advocating the use of trade policy to redistribute income from rich to poor households as a second-best. It is purely a descriptive exercise, which should help inform the direction and size of more direct means of redistribution, at least when these are available.

We define a pro-poor trade policy when the percentage change in welfare at the household level associated with the elimination of the existing structure of protection increases with household income per capita. This would mean that poorer households benefit more than

[1] See Dixit and Norman (1986) or Kemp and Wan (1986) for proofs of the gains from trade with heterogenous agents involving different income redistribution mechanisms.

richer households from the existing structure of protection, as its elimination will benefit rich households more than poor households. Because the evolution may be non-monotonic we also define a summary statistic to measure the inequality bias of trade policy which is given by the difference in the percentage change in real income of the average household in the top two and bottom two income quintiles following a move from free trade to the existing levels of protection. The largest the index the largest the poverty bias in the existing structure of trade protection, i.e., the largest the redistribution from poor to rich household associated with the existing levels of protection. The bias can be calculated for a country's own trade policy, as well as the structure of trade protection that trading partners impose on the country's exports.

In order to determine wether there is an inequality bias in the existing trade policy we therefore need to compute changes in welfare at the household level associated with the observed levels of protection. We put froward a framework where changes in welfare can be decomposed into a consumption, a production and a labor income effect. In order to compute the consumption and production effects we need data on the share of expenditure spent on each consumption good, as well as the share of income associated with the production of different goods at the household level. This is obtained by harmonizing the structure of household surveys in different SSA countries. We then combine this with measures of trade restrictiveness at the product level in each SSA country and in the rest of the world. In order to compute the labor income effect, we estimate for each Sub-Saharan African country the elasticity of skilled and unskilled wages with respect to changes in tariffs at the six digit level of the Harmonized System (potentially around 5000 goods). The combination of these three effects provides us with a measure of the change in welfare due to the existing levels of trade restrictiveness at home and in each country's trading partners.

Results in terms of changes in real income suggest that in general changes in domestic trade policy have a much larger impact on poor household's income than changes in rest of the world trade policies, and this is true for the three channels described above. SSA's trade policy generally leads to increases in skilled wages, and falls in unskilled wages, which is consistent with Stolper-Samuleson type predictions. But in most countries domestic trade

policy is is biased in favor of poor households, i.e., removal of trade barriers will bring relatively larger benefits to rich households. Note however, that this cannot justify trade protection in SSA as the bottom 40 percent always loses from trade protection in SSA, even though they lose less than rich households. Interestingly, rest of the world protection on SSA's export bundle tends to be biased in favor of rich households. Indeed, the removal of protection by the rest of the world will bring larger gains to poor households than rich households. And even though the changes in welfare tend to be smaller in the case of removal of rest of the world protection, in some countries the gains for the bottom 40 percent can be larger than 10 percent.

The remainder of the paper is organized as follows. Section 2 describes the analytical used setup to measure the inequality bias of trade policy. Section 3 describes our three step empirical methodology for the implementation of the analytical setup. The first step describes the harmonization of different household surveys to compute budget and income shares by household in each SSA country. The second step consisted in measuring the restrictiveness of trade policy in SSA, as well as the restrictiveness of SSA's trading partners on exports from SSA. In the last step we describe our empirical methodology to estimate the impact that changes in trade policy in SSA and abroad have on wages of skilled and unskilled workers in SSA. Section 4 presents the results and section 5 concludes.

2 Measuring the Inequality Bias of Trade Policy

Our measure of the inequality bias of trade policy is based on estimates of the differential impact of trade barriers on the real income of the poor vis-à-vis the non-poor and, or more generally, on the differential impact of trade on household incomes at different levels of living. The theoretical framework that we use to derive the welfare impacts of price changes is based on the standard model introduced by Deaton (1989, 1997) and expanded by Ravallion (1990), Porto (2006) and Nicita (2009). Household h welfare is measured with the indirect utility function V_h:

$$(1) \quad V_h = V_h(y_h, \mathbf{p}),$$

where y_h is household income and $\mathbf{p}$ is a vector of good prices. In our analysis, and because of limitations of our data, we focus on the prices of traded goods (non-traded goods, except for labor, are not considered here).

Household income is determined in a farm-household model, as in Sign, Squire and Strauss (1986) or Benjamin (1992). Each household has an endowment of labor, which needs to be allocated to various possible activities, and of other factors of production, such as land or assets (assumed for simplicity to be fixed). Households can consume some leisure, work on their own farm to produce goods to sell to the market, or sell labor off-farm (or purchase labor in the labor market). Household may also enjoy transfers. Household income is defined as:

$$(2) \quad y_h = wL_h + \sum_g \pi_{h,g}(\mathbf{p}) + G_h + \phi_h T,$$

where w is the wage rate, L_h is the (net) amount of labor sold in the market by household h, $\pi_{h,g}$ are profits obtained from selling good g in the market; G_h are government transfers to household h not associated with tariff revenue, ϕ_h is the share of tariff revenue redistributed to household h and $T = \sum_g t_g p_g^* m_g$ (where p_g^* is the international price of the good g) is the tariff revenue collected over all goods g subject to tariffs.

To derive the first order welfare impact of a change in price p_i, we need to totally differentiate (1) and (2). As in most of the literature, we assume that markets are perfect and complete, so that the principle of separability holds. This implies that households optimize production and consumption decisions based on market prices and that these market prices are also the relevant shadow prices faced by households.[2] Using Roy's identity and Hotelling Lemma, we get

$$(3) \quad \frac{dV_h}{y_h} = -s_h^i d\ln p_i + \theta_h^w \varepsilon_{wp_i} d\ln p_i + \theta_h^i d\ln p_i + \theta_h^T d\ln T,$$

where s_h^i is the share of good i in the consumption bundle of household h, ε_{wp_i} is the elasticity

[2]Benjamin (1992) provides evidence in favor of the separability principle in Indonesia but Le (2009) reports instead potential failures of this assumption in Vietnam.

of wages with respect to changes in p_i, θ_h^w is the share of household income derived from labor earnings, θ_h^i is the share of income from sales of the production of good i, and θ_h^T is the share of tariff revenue accrued by the household.

Our objective in this paper is to measure the different pieces of equation (3) and to use these estimates to assess the inequality bias of trade policy. Before discussing the empirical analysis, we begin with a brief conceptual interpretation of the first order approximation in (3).

Our starting point is the change in prices $d \ln p_i$ brought about by trade policy. It is clear that there should be a relationship between tariffs and product prices. How this relationship works, however, is more complicated. One issue is the extent of price transmission from trade policy to domestic prices. Due to lack of data to estimate these pass-through elasticities, here we will assume perfect price transmission (i.e., unitary elasticities). Since there is evidence that trade policy does not pass-through to prices one to one (Nicita, 2009; Goldberg and Knetter, 1997), we are overestimating the welfare impact of trade.[3] However, since in this paper we care about the inequality bias (or, more generally, the differential impact at different income levels) of trade policy, the inherent distributional conflict will be correctly identified.[4]

The other issue is the price effect of different trade policy. We study both protection at home, and protection abroad. Protection at home is simply the structure of tariff levied by each particular country on its imports. Protection abroad refers to market access barriers (that is, the rest of the world's trade policies) vis-à-vis Sub-Saharan Africa. Both types of trade protection affect border prices (and thus consumer and producer prices given our unitary pass-through elasticity assumption) and we compare below the difference in their inequality bias. In section 3.2, we explain how we utilize trade and protection data to generate estimates of protection at home and protection abroad and how we use these estimates to calculate price changes.

The first term on the right hand side of (3) measures the impact on a price change on

[3]Note that this does not imply that world prices, producer prices and consumer prices are equal, but simply that there are proportional to each other.

[4]Unless, of course, the pass-through elasticities are household specific. While they might as well be, if price transmission depends on regional or individual characteristics, it is extremely difficult to identify that heterogeneity in our data.

expenditures. When prices go up consumers are worse off because their real income declines (keeping nominal income constant); conversely, consumers are better off when prices go down. To first order, this effect can be well-approximated with the shares of the budget spent of good i (s_i). To implement this, we need information on those shares and we use the household surveys to retrieve them.

The second term is the first order impact of the price change on profits. This term shows that income increases when the price of a good produced by the household goes up and decreases when prices decline. To first order, this can be approximated by the share of income derived from the own-production of this good in total income (θ_h^i). This information can also be retrieved from the household surveys.

In fact, the major objective of the household survey collection and data work described in section 3 is to extract the budget shares, income shares and labor income shares in different economic activities. While there are no major difficulties in computing these pieces of information from the available data, some aggregation procedures will be needed to make the trade data compatible with the household survey data. We discuss these issues in section 3.1.

The third term on the right-hand side of the welfare impact (3) is the impact of prices on wage income. The estimation of this terms requires, first, estimates of the share of income derived from labor earnings, which can also be recovered from household surveys. Second, we need to estimate the wage-price elasticities linking the changes in prices with changes in wages. Conceptually, product prices affect factor prices via adjustments in factor markets. A higher price of good i causes firms in sector i to expand, and perhaps firms in other sectors to contract. Stronger demand for labor in expanding sectors increases the demand for labor and pushes wages up, but weaker demand for labor in contracting sectors pushes wages down. The final response of wages will depend on the relative size of these impacts. In section 3.3, we discuss how we estimate these wage-price elasticities in our sample of African countries.

Finally, the last term in (3) measures changes in household income due to changes in government transfers brought about by changes in tariff revenue. The way tariff revenue is

distributed back to the household is complex. Instead of monetary transfers, public revenues supposedly affect household via their consumption of public goods such as education, health or infrastructure. Measuring these impacts has proved to be extremely difficult in practice. Alternatively, assuming that households benefit from public transfers that are proportional to their level of pre-shock income implies that all households will experience the same percentage change in total income due to changes in government transfers following changes in tariff revenue.[5] This implies that we could abstract from changes in government transfers if we adopt a measure of inequality bias that is neutral to percentage changes in revenue that are common to all individuals. This will guide our choice of measure of inequality bias below, so that we do not have to worry about the last term in (3).

But before turning into a measure of the inequality bias in the structure of protection, we need to have a measure of the welfare change for each household associated with the entire structure of protection, and not the change in the price of a single good. This is simply done by summing the changes in welfare in (3) over all goods g. Assuming as argued before that government transfers are proportional to the pre-shock level of income, omitting changes in transfers, our measure of household welfare change is

$$(4) \quad \frac{dW_h}{y_h} = \sum_g -s_{h,g} d\ln p_g + \sum_g \theta_h^w \varepsilon_{wp_g} d\ln p_g + \sum_g \theta_h^i d\ln p_g + \sum_g \alpha_g.$$

where α_g is the good g change in government revenue (again note that α_g does not depend on h and therefore is common to all households).

Finally, we measure the inequality bias by the welfare differences between rich and poor households associated with the elimination of trade barriers (both tariffs and non tariff barriers). To operationalize this idea, we define first a vector of average welfare effects at varying level of well-being, $\overline{\Delta W}_{lpce}$:

$$(5) \quad \overline{\Delta W}_{lpce} = E[dW_h | \ln pce],$$

[5]Indeed, under this assumption $\theta_h^T d\ln T = T/(\sum_h y_h) d\ln T = dT/(\sum_h y_h)$, which does not depend on h).

where *pce* is the per capita expenditure of the household—our definition of well-being. We then compare the relative magnitudes of $\overline{\Delta W}_{lpce}$ for households at different points of the spectrum of the (log) per capita expenditure distribution. We define the index as the difference in the percentage change in real income (welfare) of the average household in top two income quintiles and the percentage change in real income of the average household in the bottom two income quintiles:

$$(6) \quad P_t = E[dW_h | Q_h = 4, 5] - E[dW_h | Q_h = 1, 2],$$

where Q_h is the quintile to which household h belongs to (in terms of its per capita expenditure). Several points are worth making. First, P_t does not depend on the value of $\sum_i \alpha_i$. Second, a positive value of P_t implies that following a trade reform the percentage change in income for rich households is larger than for poor households. Thus the trade reform is biased against the poor, as they will earn relatively less than the rich. This implies that the statu-quo (i.e., the existing trade policy) will tend to be pro poor when P_t is positive. Note that to ensure that the statu-quo is preferred by the poor one also needs to see whether the average change in trade policy leads to a gain or a loss for the average poor household. In that case, i.e., a positive P_t and a negative change in average welfare of the poor would no doubt indicate that there is a pro poor bias in the existing trade policy.

In order to check that our measure of inequality bias is not missing large changes in intra-poor or intra-rich inequality, we estimate equation (5) with standard non-parametric regression models of the welfare impacts given by (4) on the log of per capita expenditure, $\ln pce$.[6] Then, we inspect plots of these non-parametric regressions. If the regression function slopes up with $d \ln pce$, we say that the trade policy is pro-poor, as the elimination of the existing structure of protection will lead to larger welfare changes for rich households. Conversely, the existing trade policy is pro-rich if it slopes down.

Finally, we also report an alternative measured known as the Reynolds-Smolensky progressivity index, which is given by the difference in the value of the Gini coefficients before and after the introduction of the existing structure of protection, $RS = G_{\text{no protection}} -$

[6]Here we ignore the last term in (4) which will only shift uniformly the non-parametric regression.

$G_{\text{protection}}$. A positive value of the Reynolds-Smolensky index suggests that the removal of protection leads to a more unequal distribution of income, and therefore the existing structure of protection is pro-poor. A negative value suggests that the existing structure of protection leads towards a more unequal distribution of income, and is therefore pro-rich. It is important to compare our index of inequality bias with the the Reynolds-Smolensky index which tend to give more weight to changes in real income and inequality in the middle of the income distribution as it is usually the case with simple Gini measures of inequality. Our measure on the other hand puts all the weight wight to transfers between those at the top and bottom of the income distribution.

3 Implementing the Formulas

The empirical implementation of the formulas needed to estimate the inequality bias of trade policy, at home and abroad, requires several steps and different sources of data. Most of our analysis is based on household survey data, which provide the microdata on budget shares and income shares (including labor income shares) that allow us to estimate household-specific welfare impacts. Then, we need to match these data with the trade data that we use to measure protection at home and abroad. This requires first harmonizing the product disaggregation in household survey to a common level, so that our measure of inequality bias is comparable across countries, and then filtering this product disaggregation into the trade and trade policy classification system (the Harmonized System). Finally, to estimate changes in real income at the household level given in (4) we also need to estimate wage elasticities with respect to changes in prices. In this section, we undertake each of these steps in turn, by first describing the various types of data used in our analysis and the concordances we made to match these various datasets, as well as discussing the methodology used to estimate the wage-price elasticities for skilled and unskilled workers.

3.1 The Household Surveys: Budget Shares and Income Shares

Since household surveys are the first and most important building block of our work, we compiled all the surveys with reliable information on expenditures and incomes for as many Sub-Saharan African countries as possible. Most of the datasets used for this paper were obtained from the Development Data Platform (the DDP), a large dataset of household surveys maintained by the World Bank. Although the DDP is a very valuable source of survey data, it is not fully up to date. In those cases where a survey exists but was not in the DDP, our data collection efforts targeted the official statistical offices of those countries.

The product of this search effort is a set of twelve household surveys for the Sub-Saharan countries listed in Table 1. The Table presents a few basic characteristics of these surveys. Sample sizes range from over 25 thousand households in Ethiopia to below 5 thousands in Zambia. The share of the population residing in rural areas is often high. The highest shares are in Malawi (87 percent), Rwanda (82 percent), and Uganda (77 percent). In all the other countries, half or more of the population lives in rural areas, except in Cameroon (only 35 percent).

Table 2 presents demographic summary statistics from the surveys, including total population, its average age structure, the share of males, and average years of education of the working population, at the national level and both in rural and urban areas. As expected, there is a lot of variation in the total population of the sample countries: 55.5 million live in Ethiopia, and only 1.8 in Gambia. There are no striking differences in terms of average age or in the gender structure across countries and regions. The African population appears to be young, with average age of roughly 20-24 years in all countries (Banerjee and Duflo, 2007). In all countries, the gender structure is quite balanced with a participation of males of 50 percent or slightly lower. Note that African households tend to be large, especially in rural areas. The average household size is typically higher than 5 members. Finally, formal education (measured by years of education) is low everywhere. Countries with the highest average number of years of education are Côte d'Ivoire and Gambia, with close to 9 years of education, whereas Burundi, Burkina Faso and Ethiopia show less than two years of average education. The level of education is strikingly lower in rural areas.

While all the surveys we work with collect information on incomes and expenditures, they decompose expenditures and incomes into different sub-categories. This creates a problem when trying to build comparable aggregates across surveys. To tackle this issue, we aggregate both the expenditure and the income in the surveys into a common classification of goods across countries. To this end, we built "templates" to map the information at the highest level of disaggregation to the different homogeneous categories (across surveys) that we will use in the analysis. We used three different templates, two for the standardization of consumption and own-consumption categories, and another one for income standardization.

The expenditure template is in Table 3. There are four levels of disaggregation. The fourth level, the most detailed one, includes very disaggregated categories, such as corn, wine and cigarettes. At the third level, these products are aggregated into more comprehensive categories such as cereals, alcohol and tobacco. Similarly, level 2 includes categories such as staple-food, non-staple-food and energy, and level 1 includes the most aggregated categories, such as agriculture, manufacture and services. Table 4 displays the auto-consumption template, which is similar to the staple layers of the expenditure template. Finally, a similar template is used for income standardization, going from very disaggregated categories such as sales of corn, beans, rice, etc. (level 4), to sales of cereals (level 3), to sales of staple food or non-staple food (level 2), to sales of agricultural goods (level 1). This template is in Table 5.

The different cells in the template are filled up using the information from the household surveys. If the survey of a country has a high level of disaggregation, then we complete the information in all four levels of the template. In the case of less disaggregated surveys, we can only fill up the upper layers of the template. This tree-like structure allows us not only to have more homogeneous aggregates, but also to be able to use the data at different levels of disaggregation in the construction of the indices of inequality bias. This is important if we want to compare results across countries. To have an idea of the level of disaggregation allowed by each of the households Table 6 provides for each country the number of observations available on the expenditure and income side at different levels of disaggregation: one, two, three and four digits of the classification in Tables 3 and 5.

The household surveys are useful for us because we need the data on budget and income shares to calculate the household-specific welfare impacts of trade policy. Tables 7 and 8 report the shares of income earned in different economic activities (at level 1) and various expenditure shares (also at level 1) for the top and bottom 40 percent of the income distribution. We only report the shares of income and expenditure that are related to trade policy. For example, autoconsumption, or services expenditure or income are not included in these totals. The sum of the columns gives an idea of the share of income and expenditure that is likely to be affected by trade policy. Not surprisingly, a large share of the income of African households at the bottom of the income distribution comes from sales of agriculture goods and other goods, and very little from unskilled labor.[7] At the top of the income distribution, sales are still the dominant source of income, but skilled labor takes a significant larger share reaching 23.7 percent of rich household's income in Zambia. Household expenditures are, for the most part, allocated to food consumption. Expenditure on other goods which prices can be changed by trade policy reforms never represent more than a third of total expenditure by either bottom or top income quintile households.

3.2 Trade and Protection Data: Trade Policy and Price Changes

Turning to trade and protection data, the import and export data are from United Nation's Comtrade. Trade flows are available at the six digit level of the Harmonized System for the year 2006. Trade policy data, including information on tariffs and non-tariff barriers is drawn from Kee, Nicita and Olarreaga (2009). This information is also available at the HS-6 digit level. The data on ad-valorem equivalents of NTBs are available for most of the large developed markets such as the US, the EU, Japan, and Canada (although only for the year 2001); however, the data for Sub-Saharan Africa is missing for many of the countries in the sample.

For the purpose of building the inequality bias, we need to convert the trade and trade policy information into the classification of goods and activities that we created to harmonize the household surveys. To do this, we constructed a concordance that converts

[7] A worker is defined as skilled if he has more than 9 years of education.

HS 6-digit lines into our standardized household survey classification. The concordances are cumbersome but straightforward.[8] Filtering the trade data (imports and exports) is simple as we just need to add up the different components within a given category (similarly as what we did with the household survey data). However, the trade policy aggregation is much more complex because of two major aggregation hurdles that arise when measuring trade restrictiveness: aggregation of different forms of trade policies, and aggregation across goods with different economic importance. The first aggregation problem arises because trade policy can take many different forms: tariffs, quotas, non-automatic licensing, antidumping duties, technical regulations, monopolistic measures, subsidies, and so on. This first aggregation problem is solved using the ad-valorem equivalents of non-tariff barriers estimates of Kee, Nicita and Olarreaga (2009).

The second aggregation problem arises when one wants to aggregate trade protection which is set at a very detailed level into some composite. Commonly used aggregation procedures, such as simple averages, import-weighted averages and frequency or coverage ratios, do not have a sound theoretical basis. For example, imports subject to high protection rates are likely to be small and therefore will be attributed small weights in an import-weighted aggregation. This would underestimate the restrictiveness of those tariffs. In the extreme cases, the contribution to the import-weighted average of goods subject to prohibitively high tariffs is the same as the contribution of goods subject to zero tariffs: none of these goods affect the import weighted-average. Similarly, when computing simple average tariffs, very low tariffs on economically meaningless goods would downward bias this measure of trade restrictiveness.

To tackle this problem, we follow Anderson and Neary (2005) and the empirical extension in Kee, Nicita and Olarreaga (2009) to create measures of trade restrictiveness, which include both tariffs and non-tariff barriers at different levels of our homogeneous classification of goods. More specifically, to measure the effect of a given country trade policies on its domestic prices we use the tariff trade restrictiveness index (TTRI) and the overall trade restrictiveness index (OTRI). The difference between the TTRI and OTRI is that the OTRI

[8] And they are available from the authors upon request.

includes the effect of both tariff and non-tariff measures (NTM), while the TTRI measures only the effect of tariffs. Both the TTRI and the OTRI represent the uniform tariff equivalent that would keep aggregate imports constant within a composite of the new classification of goods in the standardized household surveys. They are calculated as a weighed average of the levels of protection at the six digit of the harmonized system using import values and import demand elasticities as weights. By taking into account the elasticity of import demand with respect to prices, we give relatively more weight within the new composite to six digit goods with a more sensitive import demand (those goods for which smaller movements in prices produce larger shifts in imports). TTRI and OTRI are calculated at different levels of the new homogenous classification of goods described in Tables 3-5.

Formally, we define the tariff trade restrictiveness index (TTRI) as:

$$(7) \quad TTRI_{i,g} = \sum_{x,p\varepsilon g} t_{i,x,p} \frac{m_{i,x,p}\eta_{i,p}}{\sum_{x,p\varepsilon g} m_{i,x,p}\eta_{i,p}},$$

where i denotes the importing country for which we are calculating the TTRI, g is the composite good which includes a subset of goods p at the HS-6 digit level, and x identifies the exporting partner country from which country i is importing. $t_{i,x,p}$ is the tariff that importing country i imposes on imports of six digit HS product p from the exporting country x; $m_{i,x,p}$ are imports of six digit HS product p of country i from country x; and $\eta_{i,p}$ is the import demand elasticity of product p in country i. Import demand elasticities were borrowed from Kee, Nicita and Olarreaga (2008).

The OTRI is calculated in the same way but instead of using tariffs we use the sum of tariffs and ad-valorem equivalents of NTM provided by Kee, Nicita and Olarreaga (2009).

To estimate the welfare effects of trade protection, we need to transform $TTRI$ and $OTRI$ into price changes. Assuming perfect transmission of tariff changes to domestic prices, we have:

$$(8) \quad \Delta \ln p_g = \frac{\Delta TTRI_g}{1 + TTRI_g} = \frac{-TTRI_g}{1 + TTRI_g},$$

where the last equality follows from the assumption of full elimination of tariffs (so that

$\Delta TTRI_g = -TTRI_g$). This measure captures the bias in each country's own trade policy on good g.

We are also interest in estimating the inequality bias of protection abroad. To calculate the price changes brought about by this type of protection, we assume that the target countries face bilateral preferences with their trade partners and that they are small in world trade. Both assumptions are plausible. First, the African countries in our sample are indeed small in world trade and thus are unlikely to affect international prices. Second, most African countries have enjoyed some type of preferential access to major markets in the developed world via AGOA, MFA, EPAs? Our assumption imply that we can approximate the changes in the domestic price one to one with the change in foreign market access (i.e., the change in tariffs abroad is directly reflected in domestic prices).[9]

First, we estimate indices of the trade restrictiveness imposed by the rest of the world on each country's export bundle at the different level of disaggregation of our homogenous goods classification. As in the case of "own" trade policies, we build two indices, labeled as the MA-TTRI and the MA-OTRI where MA stands for market access. More formally, MA-TTRI is given by:

$$(9) \quad MA\text{-}TTRI_{i,g} = \sum_{x,p\varepsilon g} t_{i,x,p} \frac{e_{i,x,p}\eta_{i,p}}{\sum_{x,p\varepsilon g} e_{i,x,p}\eta_{i,p}},$$

where the subscripts are defined as before, but the tariff and the import demand elasticity are now those of the partner country and $e_{i,x,p}$ are the exports of HS–g product p of country i to country x. That is, the MA–TTRI is the average tariffs that an aggregated good g (composed of products p) originating from country i face when exported to x. The MA–OTRI is calculated in the same way, but instead of using tariffs in the rest of the world, we used the sum of tariffs and ad-valorem equivalents of NTMs in the rest of the world.

Once we have estimates of MA-TTRI$_g$, we calculate the price change of good g under a unitary pass-through elasticity assumption. The trade policy scenario that we study is the

[9]Abandoning these assumptions would require us to estimate the impact that the trade policy of every country in the world has on world prices, and this would involve having a model for the functioning of world markets. See Hoekman and Olarreaga (2008) for an illustration of such a model with applications to various countries around the world.

full elimination of protection on SSA's export bundle, or in other words, a situation where the MA-TTRI$_g$ goes to zero. In consequence, the price change is given by:[10]

$$(10) \quad \Delta \ln p_g = \frac{\Delta MA - TTRI_g}{1 + MA - TTRI_g} = \frac{MA - TTRI_g}{1 + MA - TTRI_g}.$$

This measure captures the percentage change in prices faced by producers if protection abroad on goods exported by African countries were to be eliminated. We also calculate price changes using the protection implied by the MA-OTRI$_g$ index. Note that the sums in (9) and for MA-OTRI are done over all trading partners, but they can easily be decomposed to assess the impact of the most imoportant trading partners.

Table 9 provides the values of MA-OTRI, MA-TTRI, OTRI and TTRI for all goods, for agriculture and food products, and for other goods. Interestingly for most African countries the level of trade restrictiveness faced on their exports by the trade policies of the rest of the world is larger than the level of trade restrictiveness they impose on their imports. This is mainly driven by non-tariff barriers.[11] And in particular non-tariff barrier imposed on their exports of agricultural and food products. In any case the measure of trade restrictiveness show quite a bit of heterogeneity even at this level of aggregation which suggests that different countries may have different experiences.

3.3 The Wage-Price Elasticities

The "wage-price elasticities," the change wages in response to changes in prices, are key parameters of the inequality bias of trade policy given by equation (4). In the literature, these elasticities are typically recovered by exploiting either the time series variation or the regional variation in prices and wages (Deaton, 1997; Nicita, 2009; Porto, 2006; Porto, 2010; Ravallion, 1990). In the case of Sub-Saharan Africa, this information is, however, not available. For this reason, here we propose a method to estimate price elasticities of labor

[10] Assuming as mentioned above that protection in the rest of the world on goods imported from elsewhere is unchanged and that these SSA countries are not too large to satisfy demand in any of rest of the world countries at existing domestic prices.

[11] Note that the measures of non-tariff barriers for SSA are not available for all products and all SSA countries.

income based on the model introduced by Kee, Nicita, and Olarreaga (2008). This is a novel method to estimate the price elasticity of wages and it is one of the main contributions of our paper. It utilizes data that is readily available and is thus much more accessible than the time-series or regional data used so far. In addition, our method allows for the estimation of wage-price elasticities at the 6-digit level of the HS. This rich heterogeneity will allows us, in turn, to exploit that detailed microdata in the household surveys when computing the inequality bias of trade policy.

The model, which builds on the GDP function approach, is based on Kee, Nicita and Olarreaga (2008) adaptation of Kohli (1991) and Harrigan (1997) setup. We assume that the GDP function is common across all countries up to a country specific term, which controls for country productivity differences. Let $G(\mathbf{p};\mathbf{v})$ be this well defined GDP function, which depends on a vector of prices for goods ($\mathbf{p}$) and endowments ($\mathbf{v}$). $G(\mathbf{p};\mathbf{v})$ is twice differentiable and it is convex in $\mathbf{p}$ and concave in $\mathbf{v}$. Then by Young theorem we have that:

$$(11) \quad \frac{\partial^2 G}{\partial p_n v_m} = \frac{\partial^2 G}{\partial v_m p_n},$$

where p_n is price of good n and v_m is factor endowment m. By the envelope theorem we know that $\partial G/\partial p_n = q_n$, where q_n are quantities of good n, and $\partial G/\partial v_m = w_m$, where w_m is the price of factor endowment m. Thus, we have:

$$(12) \quad \frac{\partial q_n}{\partial v_m} = \frac{\partial w_m}{\partial p_n}.$$

The left-hand-side of equation (12) is the Rybczynski effect: it measures the change in output at the product level for a given change in factor endowments; the right-hand-side is what we are after, i.e., the change in wages following a given change in prices. To capture the important variance in trade policy at the tariff line level, we would like to estimate these wage elasticities at the most disaggregated possible level. Thus, instead of working with production data as in Harrigan (1997), we adopt the Kee, Nicita and Olarreaga (2008) approach and use imported (and exported) goods instead, assuming that they are inputs to the production of other goods, and a substitute to domestically produced goods (q_n will

appear with a negative sign in the GDP function when the good is imported—as all imported goods are assumed to be inputs into the production process,—and a positive sign when we are estimating the reaction of wages to exported prices, or rather exports to changes in labor endowment).

To implement the above GDP function empirically, we approximate $G(\mathbf{p};\mathbf{v})$ with a flexible translog functional form with respect to prices and endowments:

$$\begin{aligned}(13)\quad \ln G(\mathbf{p},\mathbf{v}) &= a_{00}+\sum_n a_{0n}\ln p_n+\frac{1}{2}\sum_n\sum_k a_{nk}\ln p_n\ln p_k+\\ &+ \sum_m b_{0n}\ln v_m+\frac{1}{2}\sum_m\sum_\lambda b_{m\lambda}\ln v_m\ln v_\lambda+\sum_n\sum_m c_{nm}\ln p_n\ln v_m,\end{aligned}$$

where a, b and c are the translog parameters. Ensuring that the GDP function satisfies all the classic homogeneity and symmetry restrictions, the derivative of the GDP function with respect to prices yields the share of good n (and imported or exported good in our case) in GDP:

$$(14)\quad s_n=\frac{p_nq_n}{GDP}=a_{0n}+a_{nn}\ln p_n+\sum_{k\neq n}a_{nk}\ln p_k+\sum_m c_{nm}\ln v_m.$$

Our parameter of interest is c_{nm} which captures the Rybczynski effect of changes in factor endowment m on imports (or exports) of good n. The derivative of s_n with respect to factor endowment v_m is given by:

$$(15)\quad \frac{\partial s_n}{\partial v_m}=\frac{p_n}{G}\frac{\partial q_n}{\partial v_m}-\frac{s_n}{G}\frac{\partial G}{\partial v_m}=c_{nm}\frac{1}{v_m}$$

Solving the last equality for $\partial q_n/\partial v_m$, and noting that by the envelope theorem $\partial G/\partial v_m = w_m$, yields:

$$(16)\quad \frac{\partial q_n}{\partial v_m}=\frac{1}{p_n}\left[c_{nm}\frac{G}{\partial v_m}+s_nw_m\right]=\frac{w_m}{p_n}\left[\frac{c_{nm}}{s_m}+s_n\right],$$

where s_m is the share of factor income m in GDP. Since $\partial q_n/\partial v_m = \partial w_m/\partial p_n$, it follows that

the elasticity of the wage of factor m with respect to prices of good n is given by:

$$(17) \quad \varepsilon_{w_m p_n} = \frac{c_{nm}}{s_m} + s_n.$$

Thus with data on the share of good n in GDP (which is nonpositive for imported goods and positive for exported goods) which we take from United Nation's Comtrade, and on the share of unskilled labor and skilled labor income in GDP (which is drawn from the household surveys), as well as an estimate of c_{nm}, we can then provide our estimate of the price elasticity of unskilled and skilled wages for different 6-digit HS goods.

Note that c_{nm} (the parameter of the GDP function) can be positive or negative depending on good n factor intensity, but its value and sign is common across all countries. When c_{nm} is positive, this implies that an increase in the labor endowment (v_m) will lead to a reduction in imports of good n (given that s_n is negative when considering imports). This implies that good n is labor intensive. However the wage elasticity will vary by country according to each countries labor abundance and the importance of imports of good n in GDP.

To obtain values for c_{nm} , we estimate equation (14) for both imports and exports of each HS 6 digit good assuming that all goods imported or exported are homogeneous. This allow us to replace the world price of each HS 6 digit good by a year dummy (given that we estimate these equations for each HS 6 digit good separately). Given that the share equation in (14) depends on domestic prices and not world prices we also introduce country dummies to control for what we assume is time invariant trade policies which will affect domestic prices.[12] We do not directly introduce trade policy because the available time series are only available for a few countries before the late 1990, and even fewer are located in SSA. We then introduce as factor endowments capital, land, unskilled labor and skilled labor. The sample expands from 1988 when the HS was introduced to 2009.

Thus, we estimate c_{nm} for each HS 6 digit good n with ordinary least squares using the

[12]See Harrigan (1997) for similar assumptions when estimating Rybczynski elasticities.

following specification first for exports and then for imported goods:

$$(18) \quad s_{c,t} = a_c + a_t + \sum_m c_{nm} \ln v_{m,c,t} + \varepsilon_{c,t}.$$

And then use (17) to compute the price elasticities of wages for unskilled labor and skilled labor for both exported and imported goods. The average elasticities for changes in export and imported prices at the six digit of the HS for each country are given in Table (10). All average elasticities are negative and very small, but this hides some significant variation across goods and within countries, as shown by the very large standard deviation relative to the mean elasticity in each country. The fact that the average elasticity is very small is to be expected as we are talking of changes in prices of goods at the six digit of the HS. The average share of imports and exports of an HS 6 digit good in the economy is very small, and therefore changes in their prices should lead to small changes in wages.

More importantly note that we are not interested in the price elasticities of wages per se, but rather how changes in the whole tariff structure affect household welfare (see the third term in equation (4)). Define

$$(19) \quad \widehat{w} = \sum_i \varepsilon_{wp_i} d \ln p_i,$$

so that

$$(20) \quad \sum_i \theta_h^w \varepsilon_{wp_i} d \ln p_i = \sum_i \theta_h^w \widehat{w}.$$

The proportional change in labor income is simply given by the sum across all goods of the product of price elasticities of wages and the proportional change in prices. The set of goods over which the sum is undertaken clearly depends on whether we are considering protection at home or protection abroad. When studying own trade reforms, the sum is done over the universe of imported goods and therefore equation (19) is estimated across countries and time using import data at the six digit of the HS, and when studying changes in markets access the sum is done over the universe of exported goods and therefore equation (19) is

estimated using export data at the six digit of the HS.

Results of percentage changes in labor income associated with the existing levels of trade protection at home and abroad are given in Table (11). They show that the impact of the restrictiveness of SSA's own trade policy on wages seems to be more important than the impact of the restrictiveness of the rest of the world trade polices on SSA's wages. The average percentage change in wages is much larger when looking at SSA's own trade policy. Interestingly, we found Stolper-Samuelson type effects associated with SSA's own trade policy which leads to declines in the ratio of unskilled to skilled wages in the region. In other words, the structure of protection in SSA favors skilled over unskilled workers. When it comes to the impact of rest of the world's trade policy on SSA's wages, effects are smaller, and they do not necessarily tend to show Stolper-Samuelson type effects with only half of the countries experiencing a decline in the ratio of unskilled to skilled wages due to the existing structure of rest of the world protection on SSA's export bundle. This ambiguous result on the export side could be partly explained by the fact that price shocks to which SSA exporters are exposed reflect the structure of protection in the rest of the world, which may tend to protect more skilled jobs, and therefore may benefit skilled workers more than what would have been expected by a simple Stolper-Samuelson prediction.

4 Results

We first discuss the results obtained using the index of inequality bias, we then turn to the non parametric regression of changes in household welfare and household income, and we finally present the results obtained using the Reynolds-Smolensky progressivity index. We always start presenting the evidence regarding the changes in welfare following the elimination of each SSA country own trade policy and then we turn to the impact following the elimination of ROW's trade policy on each SSA country export bundle. We also distinguish between changes following the elimination of tariffs only (TTRI and MA-TTRI), and the elimination of both tariffs and NTMs (OTRI and MA-OTRI).

Table 12 shows the results of the computation of the index of inequality bias given by

equation (6) associated with the elimination of both tariffs and NTM. The first four columns show the the index of each SSA country own trade policy and the last three columns the index for each of SSA country associated with the trade barriers that the rest of the world imposes on their export bundle. In the case of each SSA country's own trade policy, the first column, labeled *overall*, provides the value of the index of inequality bias, and the following three columns decompose the overall impact into an expenditure, sales and wage effect as in (3). In the case of rest of the world trade policies, the first column provides the value of the index of inequality bias, and the following two columns provide the decomposition into sales and wages effects.[13] Let us recall that a positive value indicates that the elimination of trade barriers benefited more rich households than poor households. In other words, the existing trade policy is pro-poor, as removing will lead to a larger increase in rich household income. . A negative value, on the other hand, indicates that the poor benefit more than the rich from the elimination of trade barriers, and therefore the existing trade policy is pro-rich.

In eight of the twelve countries the index takes a positive value, indicating that the existing trade policy has a pro-poor bias. Its elimination would bring larger benefits to rich households than poor households. The largest pro-poor bias is to be found in Gambia, where the elimination of the existing trade barriers would bring a change in rich households income which is 4.26 percentage points larger than the change in the real income of poor households. In four of the twelve countries the existing trade policy has a pro-rich bias. The largest pro-rich bias is to be found in Rwanda, where the elimination of its own trade policy would bring a change in the real income of the poor 2.85 percentage points larger than the real income of rich households. In most countries the index is driven by either differences in the composition of the expenditure bundle, or by differences in the sales bundle. The impact of the wage effect on the inequality bias index is relatively small, even though it tends to be negative in most countries suggesting that through the labor market channel there may be a pro-rich bias in the existing trade policy of most SSA countries, with the exception of Burundi and Gambia.

[13]In the case of rest of the world trade policies, there is no expenditure effect, because as discussed in the previous section we assume that the improvement in market access is preferential and therefore only producer prices are affected by the elimination of trade barriers on each SSA country export bundle.

When it comes to the trade barriers that the rest of the world imposes on SSA export bundle, in eight of the twelve countries the index takes a negative value, suggesting that the elimination of rest of the world trade barriers on SSA exports would tend to benefit more poor than rich households. There is therefore a pro-rich bias in the existing trade policy of the rest of the world. However, most of the values of the index are small, suggesting that there is not much differences between the changes in welfare for rich and poor households. The exceptions are Burundi and Côte d'Ivoire, where the pro-rich bias is very strong. The values of the index are mainly driven by household sales in all countries, as the wage effect does not seem to be very different across rich and poor households.

Table 13 provides the same computations but using tariffs only. The indices are generally smaller simply reflecting that the distortions introduced by tariffs are obviously smaller than the distortions induced by tariffs and NTMs. The only notable exception is Malawi, where the there is a pro-rich bias in their trade policy when we include NTMs, but a pro-poor bias when using tariffs only. So when looking at the tariff structure, there are nine out of twelve countries showing a pro-poor bias in their existing own tariff structure.

It is important to note that the even if SSA's trade policies have a pro-poor bias, this does not necessarily imply that the poor are better off with protection. It simply suggests that protection makes poor household relatively better than rich households. But their real income in levels may fall. To check this, figures 1 and 2 show the inequality bias index of each country's own trade policy and of the trade policy faced by their exports in the rest of the world plotted against the percentage change in real income faced by the 40 percent poorest households. It shows that poor households in all countries are better off after the elimination of their own trade polices. Poor households in Zambia and Côte d'Ivoire experience increases in real income that are above 10 percent when trade protection is removed, even though in both countries the gains experience by rich households are larger (positive values for their inequality bias index). In Malawi, Rwanda and Uganda the removal of trade barriers would not only increase the real income of poor households, but the increase in their income will be significantly larger than the increase in real income of rich households.

In the case of rest of the world trade polices, changes in poor household income are

generally small as illustrated in figures 1 and 2. The exceptions are Burundi, Cte d'Ivoire and Madagascar where poor household would see their income increase by almost 10 percent. Moreover, the existing trade polices of the rest of the world imposed on these three countries are pro-rich. In the rest of SSA countries in our sample changes in household income are small, and sometimes negative (Zambia) with no strong pro-poor or pro-rich biased. Interestingly when comparing 2 with 1 the strong changes in poor household income in Burundi, Côte d'Ivoire and Madagascar associated with the removal of rest of the world trade policies tend to vanish when we do not take into account NTM. When only considering tariffs, the changes in welfare and the bias associated with rest of the world trade polices are very small.

In order to check whether our index of inequality bias misses some interesting heterogeneity within rich and poor households, figure 3 plots the non-parametric regression of changes in real income following the elimination of each SSA country's own trade policy or the elimination of the rest of the world trade barriers on their export bundle. A negative slope suggests that the poor benefit more than the rich from the elimination of the existing trade policy, and therefore the existing trade policy is pro-rich. A positive slope suggests that the rich benefit more than the poor from the elimination of the existing trade policy, and therefore the existing trade policy is pro-poor. The local regressions are estimated for changes in real income following the elimination of both tariffs and NTMs (labeled "Tariff + NTB"), but also tariffs only (labeled "Tariff").

Results broadly confirmed the results reported in Tables 12 and 13. Uganda's own trade policy, for example, is clearly pro-rich, as the change in welfare monotonically decreases with household income. More interesting, poor households in Uganda would benefit from the reform, whereas rich household will see their income decline. Changes in household income associated with the removal of rest of the world trade policies monotonically increase with income in Uganda, and this is mainly driven by NTMs. In Gambia the strong pro-poor bias of their trade policy is also confirmed by a monotonically increasing curve. In Côte d'Ivoire the pro-poor bias is also confirmed, but the relationship is non-monotonic, and peaks for middle income households who experience the largest increases in household income following

the removal of their own protection. There are also some non-monotonicities in Ethiopia, Madagascar, Malawi, Togo and Rwanda.

Finally, in order to check whether changes in the middle of the income distribution may yield different conclusions table 14 provides results for the Reynolds-Smolensky index for each SSA country own trade policy as well as the trade barriers imposed by the rest of the world on their export bundle. Table 14 also reports the value of the index of inequality bias discussed earlier. Again in eight of twelve countries the Reynolds-Smolensky index take a positive value suggesting in the case of own trade policies, suggesting that the existing structure of protection is pro-poor (the removal of protection leads to larger levels of inequality). The largest value is obtained in Côte d'Ivoire which confirms the strong pro-poor biased of our inequality index, in spite of the larger increase for middle income households. The correlation between our index P and the Reynolds-Smolensky index is 0.4. In most cases when one indicates a pro-poor bias, so does the other index. The exceptions are Cameroon, Madagascar Malawi and Rwanda in the case of own trade policies. Note that these countries are also among those for which we observed some non-monotonicities in the relationship between changes in household income and level of income. In Cameroon P suggests a strong pro-poor bias, where the Reynolds-Smolensky index suggests a strong mild pro-rich bias, probably driven by the redistribution from middle income households towards rich households associate with the existing structure of protection, as shown in figure 3. In Malawi and Rwanda it is the opposite case. We have a strong pro-rich bias suggested by P whereas the Reynold-Smolensky index suggests a mild pro-poor bias. From the patterns in figure 3 in the case of Rwanda this could be explained by redistribution from middle and low income household to very poor households associated with the existing tariff structure. In the case of Malawi this apparent contradiction seems to be due to redistribution from very rich to middle income households.

5 Conclusions

Trade reforms affect different households differently, depending on individual preferences and factor endowments. This paper is an attempt at trying to disentangle the impact of trade policy reforms on SSA's poor households. To this end we start with a simple but well established framework (Winters et al., 2004) and propose and extension to include adjustments in labor income, associated with changes in unskilled and skilled wages.

Our objective is to try to measure the potential inequality bias (against poor households) in the trade policy of SSA countries, as well as the trade policies of its trading partners. Our index of inequality bias is given by the difference in the percentage gain associated with the elimination of trade barriers for rich and poor households. A large and positive value of the index indicates that rich household tend to win more from the removal of trade barriers than poor households in percentage terms, and therefore it is an indication of a pro-poor bias in the existing trade policy. Similarly, a negative value indicates that the poor will win relatively more than the rich from the elimination of trade barriers and therefore is an indication of a pro-rich bias in the existing structure of protection. We calculate these indices for two different shocks: first, the elimination of SSA's own trade policies, and then the elimination of trade policies by SSA's trading partners.

Results suggest that SSA's own trade policies are generally biased in favor of poor households, with a few exceptions such as Malawi, Rwanda and Uganda. However, the fact that the existing tariff structure benefits relatively more poor households than rich households does not imply that poor households are better off with protection. Indeed in all countries the income of the bottom 40 percent increase following the elimination of protection. And in some countries significantly so: in Zambia and Côte d'Ivoire the income of the bottom 40 percent would increase by more than 10 percent. In Cameroon and Malawi by almost 10 percent. In Rwanda, Togo, Ethiopia, Burkina Faso and Gambia by more than 5 percent, and in Madagascar and Uganda by more than 2 percent. Burundi poor households would be the ones to experience the smallest increase in real income (around 1 percent) after the elimination of their trade protection. Thus even if SSA's structure of protection tends to make poor households relatively better off than rich households, their income is lower with

protection.

SSA's trading partners' trade polices generally impose small changes in the real income of poor households, except in Burundi, Côte d'Ivoire and Madagascar where changes are above 8 percent. More interestingly, the structure of protection imposed by the rest of the world on these three countries export bundle tends to be pro-rich. Removing the protection in the rest of the world will bring larger increases in welfare for poor than rich households in these three countries. Generally, even though changes in poor household income are not very large, the structure of protection of the rest of the world on SSA's export bundle tends to be pro-rich, hurting more poor than rich households. And this is mainly driven by NTMs rather than tariffs.

To conclude, Africa's own trade policy tend to redistribute income from rich to poor households, i.e., there are pro-poor. Trade barriers imposed by the rest of the world on SSA's export bundle, in particular NTM, tend to redistribute income from poor to rich households, i.e., there are pro-rich. What can explain this? The answer is agricultural protection, which is high both in SSA and in the rest of the world. High levels of protection in agriculture in SSA tend to hurt the poor relatively less than the rich because net production of agricultural goods by poor household is larger than for rich households. At the same time, higher levels of agricultural protection in the rest of the world tend to be biased against poor households because they lead to lower agricultural prices which are more costly for poor households which have a larger net production of agricultural goods. This implies that the neglect of the agricultural sector by the GATT during many rounds of tariffs (but more importantly non-tariff) negotiations appear to be particularly costly for poor farmers in SSA. The fact that WTO negotiators are currently having trouble finding an agreement in the agricultural sector in the Doha Round has led some observers to suggest that it would be better to aim for a modest deal not far from the statu-quo, and move on into more important topics such as trade and the environment, or trade facilitation. There is no doubt that these are important topics from a global perspective, but our analysis here tends to suggest that a modest agricultural deal is likely to be very costly for those which are the most needed: poor SSA households.

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Table 1
List of Household Surveys
Sub Saharan Africa

Country	Year	Survey	Households	Rural share
BURUNDI	1998	ENQUÊTE PRIORITAIRE	7086	0.56
BURKINA FASO	2003	ENQUÊTE BURKINABE SUR LES CONDITIONS DE VIE DES MENAGES	8500	0.69
COTE D'IVOIRE	2002	ENQUÊTE NIVEAU DE VIE MÉNAGES	10801	0.48
CAMEROON	2001	DEUXIEME ENQUÊTE CAMEROUNAISE AUPRÈS DES MÉNAGES	10992	0.35
ETHIOPIA	2000	HOUSEHOLD INCOME, CONSUMPTION AND EXPENDITURE SURVEY	25861	0.67
GAMBIA	1998	HOUSEHOLD ECONOMIC SURVEY	2085	0.51
MADAGASCAR	2005	ENQUÊTE PÉRIODIQUE AUPRÈS DES MÉNAGES	11781	0.50
MALAWI	2004	INTEGRATED HOUSEHOLD SURVEY	11280	0.87
RWANDA	1998	ENQUÊTE INTEGRALE SUR LES CONDITIONS DE VIE DES MÉNAGES	6420	0.82
TOGO	2006	QUESTIONNAIRE DES INDICATEURS BASE DU BIEN-ÊTRE	7500	0.65
UGANDA	2005	UGANDA NATIONAL HOUSEHOLD SURVEY	7425	0.77
ZAMBIA	2003	LIVING CONDITIONS MONITORING SURVEY III	4837	0.48

Source: World Bank Development Data Platform (DDP) and various Country Statistical Offices.

Table 2
Demographic Characteristics
Sub Saharan Africa

Country	National					Urban					Rural				
	Pop. (million)	Age	Male Share	HH size	Educ Years	Pop. (million)	Age	Male Share	HH size	Educ Years	Pop. (million)	Age	Male Share	HH size	Educ Years
BDI	6.08	20.8	0.47	5.0	1.8	0.31	21.9	0.50	4.9	8.0	5.76	20.7	0.47	5.0	1.4
BFA	9.90	24.4	0.49	5.6	1.4	1.85	25.2	0.50	5.0	4.7	8.05	24.2	0.48	5.7	0.5
CIV	17.13	22.2	0.50	5.4	9.0	8.59	21.7	0.50	4.9	9.7	8.27	22.7	0.50	5.9	7.8
CMR	15.47	22.3	0.49	5.0	6.4	6.65	21.7	0.50	5.0	8.8	8.83	22.7	0.48	4.9	4.3
ETH	55.50	21.2	0.49	5.3	1.5	7.54	23.1	0.45	4.8	5.6	47.96	20.9	0.50	5.5	0.8
GMB	1.80	22.0	0.50	7.7	9.1	0.72	21.4	0.49	7.6	9.2	0.96	21.2	0.49	9.8	8.0
MDG	18.85	21.7	0.49	4.9	4.0	4.14	23.0	0.49	4.6	6.0	14.70	21.3	0.50	4.9	3.4
MWI	12.51	21.3	0.49	4.6	4.8	1.43	21.4	0.49	4.4	8.4	11.08	21.4	0.50	4.7	4.3
RWA	7.97	21.0	0.46	5.0	3.4	0.83	19.9	0.47	5.2	6.7	7.14	21.2	0.46	4.9	3.0
TGO	5.26	23.3	0.50	4.6	5.0	1.77	23.9	0.48	4.2	7.6	3.49	23.0	0.51	4.9	3.2
UGA	28.92	19.5	0.49	5.5	5.8	4.57	19.8	0.48	5.0	8.4	24.35	19.4	0.49	5.6	5.2
ZMB	11.22	20.9	0.49	5.3	7.3	4.66	20.7	0.49	5.5	9.1	6.57	21.0	0.49	5.2	5.6

Source: World Bank Development Data Platform (DDP) and various Country Statistical Offices.

Table 3
Template for Homogenized Expenditure Categories

Total Expenditure	1) Agriculture/Food	11) Staple food / livestock	111) Cereals/Flours/Bread	1111) Corn	1112) Wheat	1113) Rice	1114) Other Cereals			
			112) Legumens	1121) Beans	1122) Other					
			113) Fruits	1131) Banana	1132) Grapes	1133) Citrus	1134) Apples	1135) Other fruit		
			114) Vegetables	1141) Tomato	1142) Potato	1143)greens	1144)Other vegetables			
			115) Oils / Fats	1151) Vegetable o	1152) Animal fats	1153) Other oils/fats				
			116) Fish	1161) Fish	1162) shrimp	1163) Other crustacean				
			117) Meat/livestock	1171) Pork (Pig)	1172) Beef (Cattle	1173) Poultry (chic	1174) Other meat / animals			
			118) Dairy/Milk/Cheese/Eggs	1181) Milk	1182) Eggs	1183) Cheese	1184) Other Dairy			
			119) Other Staple Food/Other Processed food	1191) Other staple	1192) Other Processed Food					
		12) Non Staple food	121) Alcohol	1211) Wine	1212) beer	1213) Other alcohol				
			122) Tobacco Plant/Cigarettes	1221) Cigarettes	1222) Other tobacco					
			123) Oil Seeds	1231) Soya	1232) Other oil seeds					
			124) Spices/Herbs	1241) Cloves	1242) Pepper	1243) Vanilla	1244) Saffron	1245) qat (chat)	1246) Other Spices	
			125) Coffee/Tea/Cocoa	1251) Coffee	1252) Tea	1253) Cocoa				
			126) Nuts	1261) Cashew	1262) Coconut	1263) Other nuts				
			127) Cotton							
			128) Other non-Staple	1281) Sugar(any k	1282) Other non-staple					
	2) Manufacturing/HH items	21) Energy								
		22) Textiles / Apparel								
		23) Electric / Electronics								
		24) Household items / Furniture								
		25) Other Physical goods								
	3) Services	31) Transportation								
		32) Health								
		33) Education								
		34) Comunication								
		35) Other Services								
	4) Other Expenditures	41) Remittances/ Transfers given								
		42) Investment of any sort								
		43) Festivities								
		44) Other disboursment								

Table 4
Template for Homogenized Auto-Consumption Expenditure Categories

Total Autoconsumption	1) Agriculture/Food	11) Staple food / livestock	111) Cereals/Flours/Bread	1111) Corn	1112) Wheat	1113) Rice	1114) Other Cereals			
			112) Legumens	1121) Beans	1122) Other					
			113) Fruits	1131) Banana	1132) Grapes	1133) Citrus	1134) Apples	1135) Other fruit		
			114) Vegetables	1141) Tomato	1142) Potato	1143)greens	1144)Other vegetables			
			115) Oils / Fats	1151) Vegetable o	1152) Animal fats	1153) Other oils/fats				
			116) Fish	1161) Fish	1162) shrimp	1163) Other crustacean				
			117) Meat/livestock	1171) Pork (Pig)	1172) Beef (Cattle	1173) Poultry (chic	1174) Other meat / animals			
			118) Dairy/Milk/Cheese/Eggs	1181) Milk	1182) Eggs	1183) Cheese	1184) Other Dairy			
			119) Other Staple Food/Other Processed food	1191) Other staple	1192) Other Processed Food					
		12) Non Staple food	121) Alcohol	1211) Wine	1212) beer	1213) Other alcohol				
			122) Tobacco Plant/Cigarettes	1221) Cigarettes	1222) Other tobacco					
			123) Oil Seeds	1231) Soya	1232) Other oil seeds					
			124) Spices/Herbs	1241) Cloves	1242) Pepper	1243) Vanilla	1244) Saffron	1245) qat (chat)	1246) Other Spices	
			125) Coffee/Tea/Cocoa	1251) Coffee	1252) Tea	1253) Cocoa				
			126) Nuts	1261) Cashew	1262) Coconut	1263) Other nuts				
			127) Cotton							
			128) Other non-Staple	1281) Sugar(any k	1282) Other non-staple					
	2) Other goods	21) Energy (wood, coal)								
		22) Gathering (Forest, mushrooms, berries, etc)								
		23) Other goods collected for free								
		24) Other goods produced and consumed within the household								

Table 5
Template for Homogenized Income Categories

Total Income	1) Agriculture/Food	11) Staple food / livestock	111) Cereals/Flours/Bread	1111) Corn	1112) Wheat	1113) Rice	1114) Other Cereals			
			112) Legumens	1121) Beans	1122) Other					
			113) Fruits	1131) Banana	1132) Grapes	1133) Citrus	1134) Apples	1135) Other fruit		
			114) Vegetables	1141) Tomato	1142) Potato	1143)greens	1144)Other vegetables			
			115) Oils / Fats	1151) Vegetable o	1152) Animal fats	1153) Other oils/fats				
			116) Fish	1161) Fish	1162) shrimp	1163) Other crustacean				
			117) Meat/livestock	1171) Pork (Pig)	1172) Beef (Cattle	1173) Poultry (chic	1174) Other meat / animals			
			118) Dairy/Milk/Cheese/Eggs	1181) Milk	1182) Eggs	1183) Cheese	1184) Other Dairy			
			119) Other Staple Food/Other Processed food	1191) Other staple	1192) Other Processed Food					
		12) Non Staple food	121) Alcohol	1211) Wine	1212) beer	1213) Other alcohol				
			122) Tobacco Plant/Cigarettes	1221) Cigarettes	1222) Other tobacco					
			123) Oil Seeds	1231) Soya	1232) Other oil seeds					
			124) Spices/Herbs	1241) Cloves	1242) Pepper	1243) Vanilla	1244) Saffron	1245) qat (chat)	1246) Other Spices	
			125) Coffee/Tea/Cocoa	1251) Coffee	1252) Tea	1253) Cocoa				
			126) Nuts	1261) Cashew	1262) Coconut	1263) Other nuts				
			127) Cotton							
			128) Other non-Staple	1281) Sugar(any k	1282) Other non-staple					
	2) Wages	20) Agriculture, Forestry, And Fishing								
		21) Mining, Oil And Gas Extraction								
		22) Manufacturing1								
		23) Manufacturing2								
		24) Transportation, Communications, Electric, Gas, And Sanitary Services								
		25) Wholesale and Retail Trade								
		26) Finance, Insurance, And Real Estate								
		27) Services1								
		28) Services2								
		29) Public Administration								
	3) Sales of goods/services	30) Agriculture, Forestry, And Fishing								
		31) Mining, Oil And Gas Extraction								
		32) Manufacturing1								
		33) Manufacturing2								
		34) Transportation, Communications, Electric, Gas, And Sanitary Services								
		35) Wholesale and Retail Trade								
		36) Finance, Insurance, And Real Estate								
		37) Services1								
		38) Services2								
		39) Public Administration								
	4) Transfers	41) Remittances/ Transfers received (friend, relative)								
		42) Profits of investment (rent , interests)								
		43) Government Transfers								
		44) Non Goverment transfer (Donor, International Organization, NGO)								
		45) Other								

Table 6
Availability of information at different levels of disaggregation by household survey

	Expenditure				Income			
	1 digit	2 digits	3 digits	4 digits	1 digit	2 digits	3 digits	4 digits
Burundi	4	15	13	19	1	2	14	22
Burkina Faso	4	16	16	16	1	5	10	11
Côte d'Ivoire	4	11	16	34	1	2	11	23
Cameroon	4	16	17	42	1	3	9	15
Ethiopia	4	16	15	41	1	2	8	12
Gambia	4	10	13	30	1	2	6	6
Madagascar	4	10	14	31	1	2	13	29
Malawi	4	14	15	35	1	2	12	22
Rwanda	4	13	17	40	1	3	11	28
Togo	4	13	15	35	1	2	5	8
Uganda	4	14	15	33	1	2	14	36
Zambia	4	15	17	43	1	3	12	15

Table 7
Income Shares

Country	Bottom 40 %			Top 40 %		
	Sales[a]	Skilled[b] wages	Unskilled wages	Sales[a]	Skilled[b] wages	Unskilled wages
Burundi	83.3%	0.4%	6.9%	71.2%	1.0%	13.7%
Burkina Faso	3.9%	0.2%	33.7%	5.0%	1.6%	34.4%
Côte d'Ivoire	51.4%	1.0%	22.9%	25.7%	9.0%	27.6%
Cameroon	18.3%	2.4%	35.3%	9.3%	19.8%	33.7%
Ethiopia	14.8%	0.6%	30.8%	17.0%	9.8%	33.0%
Gambia	27.3%	0.5%	66.4%	8.2%	4.3%	71.2%
Madagascar	34.5%	1.0%	33.9%	28.0%	8.5%	31.6%
Malawi	10.7%	1.2%	33.9%	13.2%	11.8%	30.3%
Rwanda	14.3%	0.1%	27.8%	22.3%	5.1%	32.7%
Togo	5.6%	2.9%	60.7%	1.6%	7.9%	55.6%
Uganda	10.5%	2.2%	22.2%	20.3%	9.6%	10.8%
Zambia	2.9%	3.3%	27.5%	3.9%	23.7%	25.5%

[a]The category "sales" does not include sales in services or other categories that are not going to be directly affected by changes in trade policy.

[b]A worker is defined as "skilled" if he has more than 9 years of education.

Table 8
Budget Shares

	Bottom 40 %		Top 40 %	
Country	Food	Other[a]	Food	Other[a]
Burundi	51.3%	25.1%	51.4%	16.1%
Burkina Faso	37.7%	11.5%	36.0%	19.6%
Côte d'Ivoire	56.7%	19.2%	48.8%	13.7%
Cameroon	53.6%	16.0%	51.6%	18.1%
Ethiopia	32.9%	13.2%	32.1%	20.4%
Gambia	53.2%	17.4%	65.4%	10.7%
Madagascar	45.0%	12.6%	44.0%	11.9%
Malawi	25.7%	32.4%	30.9%	27.5%
Rwanda	38.3%	10.0%	25.6%	9.3%
Togo	37.7%	18.3%	40.5%	17.1%
Uganda	21.3%	12.6%	14.6%	11.4%
Zambia	39.6%	13.3%	42.8%	20.4%

[a]The category "other" does not include autoconsumption or expenditure in services that are not going to be directly affected by changes in trade policy.

Table 9
Trade policy indices in SSA and *vis-a-vis* SSA

	Overall index of restrictiveness				Index for Agriculture and Food				Index for Other goods			
Country	MA-OTRI	MA-TTRI	OTRI	TTRI	MA-OTRI	MA-TTRI	OTRI	TTRI	MA-OTRI	MA-TTRI	OTRI	TTRI
Burundi	0.26	0.04	0.10	0.10	0.35	0.02	0.06	0.06	0.08	0.06	0.10	0.10
Burkina Faso	0.21	0.15	0.11	0.09	0.26	0.02	0.20	0.07	0.19	0.19	0.10	0.10
Côte d'Ivoire	0.18	0.03	0.17	0.07	0.26	0.04	0.29	0.08	0.04	0.02	0.18	0.09
Cameroon	0.09	0.02	0.12	0.12	0.33	0.04	0.14	0.12	0.04	0.03	0.13	0.13
Ethiopia	0.20	0.02	0.12	0.12	0.23	0.02	0.14	0.14	0.06	0.01	0.12	0.11
Gambia	0.19	0.15	0.14	0.14	0.22	0.18	0.10	0.10	0.10	0.07	0.15	0.15
Madagascar	0.20	0.01	0.11	0.10	0.15	0.01	0.10	0.10	0.24	0.01	0.11	0.10
Malawi	0.15	0.09	0.05	0.04	0.15	0.10	0.19	0.08	0.10	0.02	0.11	0.09
Rwanda	0.20	0.08	0.13	0.11	0.33	0.15	0.09	0.09	0.17	0.02	0.17	0.13
Togo	0.22	0.06	0.09	0.09	0.32	0.01	0.09	0.09	0.21	0.11	0.09	0.09
Uganda	0.23	0.06	0.04	0.04	0.28	0.07	0.10	0.08	0.03	0.02	0.07	0.07
Zambia	0.04	0.01	0.08	0.07	0.09	0.02	0.20	0.11	0.04	0.01	0.07	0.07

Table 10
Average price elasticities of wages in SSA

Country	Exported goods				Imported Goods			
	Skilled wages		Unskilled wages		Skilled wages		Unskilled wages	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Burundi	-0.00006	0.00172	-0.00062	0.00643	-0.00005	0.00573	-0.00081	0.03834
Burkina Faso	-0.00003	0.00124	-0.00031	0.00686	-0.00004	0.00432	-0.00152	0.08907
Côte d'Ivoire	-0.00004	0.00134	-0.00044	0.00456	-0.00005	0.00483	-0.00046	0.02277
Cameroon	-0.00006	0.00150	-0.00030	0.00334	0.00002	0.00941	-0.00024	0.01162
Ethiopia	-0.00006	0.00144	-0.00034	0.00415	-0.00004	0.00651	-0.00042	0.01970
Gambia	-0.00001	0.00144	-0.00037	0.00744	-0.00010	0.00701	-0.00190	0.09056
Madagascar	-0.00004	0.00143	-0.00045	0.00496	-0.00003	0.00533	-0.00053	0.02601
Malawi	-0.00002	0.00142	-0.00036	0.00378	-0.00008	0.00680	-0.00037	0.01361
Rwanda	-0.00006	0.00156	-0.00058	0.00540	-0.00001	0.00713	-0.00048	0.02576
Togo	-0.00001	0.00134	-0.00038	0.00503	-0.00006	0.00505	-0.00063	0.03044
Uganda	-0.00017	0.00212	-0.00034	0.00374	0.00004	0.01594	-0.00036	0.01789
Zambia	-0.00008	0.00157	-0.00031	0.00373	-0.00004	0.00819	-0.00034	0.01418

Table 11
Percentage change in labor income associated with protection at home and abroad

Country	Tariffs and NTBs				Tariffs only			
	Exports		Imports		Exports		Imports	
	Unskilled wages	Skilled wages	Unskilled wages	Skilled wages	Unskilled wages	Skilled wages	Unskilled wages	Skilled wages
Burundi	0.26%	-1.06%	-1.97%	2.66%	0.20%	-0.57%	-1.97%	2.66%
Burkina Faso	-0.18%	1.23%	-2.54%	7.75%	0.01%	0.043%	-1.83%	7.78%
Côte d'Ivoire	-1.16%	0.30%	-5.53%	7.43%	-0.25%	-0.06%	-2.39%	2.98%
Cameroon	-0.05%	0.14%	-3.19%	2.41%	-0.01%	0.04%	-3.42%	2.23%
Ethiopia	-0.01%	-0.30%	-3.20%	2.17%	0.00%	-0.12%	-3.17%	1.69%
Gambia	-0.47%	1.13%	-3.67%	2.87%	0.00%	-0.00%	-3.67%	2.87%
Madagascar	0.54%	-1.30%	-2.53%	3.49%	0.15%	-0.41%	-2.34%	2.49%
Malawi	-0.39%	0.69%	-4.70%	0.81%	-0.09%	-0.19%	-3.01%	-0.01%
Rwanda	-0.11%	-0.08%	-3.85%	6.18%	-0.02%	-0.05%	-2.55%	4.15%
Togo	0.09%	-1.09%	-2.62%	1.47%	0.08%	-0.97%	-2.62%	1.47%
Uganda	-0.71%	-1.62%	-3.01%	0.67%	-0.09%	-0.58%	-2.95%	0.78%
Zambia	-1.29%	-1.01%	-3.73%	-0.10%	-0.23%	0.00%	-2.70%	-1.09%

Table 12
Index of the income inequality bias of trade policy (tariffs and non-tariff barriers)

	Own trade policy				Rest of the world trade policy		
Country	Overall	Expenditure	Sales	Wages	Overall	Sales	Wages
Burundi	-0.08%	-1.42%	1.23%	0.10%	-4.50%	-4.51%	0.01%
Burkina Faso	1.32%	1.39%	0.02%	-0.09%	0.25%	0.23%	0.02%
Côte d'Ivoire	2.50%	-4.29%	7.13%	-0.33%	-6.51%	-6.48%	-0.03%
Cameroon	1.61%	0.09%	1.99%	-0.47%	-0.63%	-0.66%	0.03%
Ethiopia	1.04%	1.38%	-0.21%	-0.13%	0.60%	0.63%	-0.03%
Gambia	4.26%	1.05%	3.14%	0.07%	-0.04%	-0.06%	0.02%
Madagascar	0.22%	-0.24%	0.79%	-0.32%	-0.56%	-0.45%	-0.11%
Malawi	-1.54%	-0.86%	-0.43%	-0.25%	0.35%	0.26%	0.09%
Rwanda	-2.85%	-0.56%	-2.18%	-0.12%	-0.05%	-0.04%	-0.01%
Togo	0.17%	0.15%	0.22%	-0.21%	-0.06%	-0.00%	-0.06%
Uganda	-2.38%	-0.49%	-1.49%	-0.39%	0.86%	0.90%	-0.04%
Zambia	0.83%	1.22%	-0.33%	-0.05%	-0.19%	-0.01%	-0.18%

Table 13
Index of the income inequality bias of trade policy (tariffs only)

	Own trade policy				Rest of the world trade policy		
Country	Overall	Expenditure	Sales	Wages	Overall	Sales	Wages
Burundi	-0.08%	-1.42%	1.23%	0.10%	-0.22%	-0.23%	0.01%
Burkina Faso	0.71%	0.81%	-0.01%	-0.09%	-0.03%	-0.03%	0.00%
Côte d'Ivoire	2.01%	-1.50%	3.63%	-0.13%	-1.64%	-1.62%	-0.02%
Cameroon	1.12%	0.02%	1.54%	-0.44%	-0.20%	-0.21%	0.01%
Ethiopia	0.98%	1.28%	-0.21%	-0.09%	0.04%	0.05%	-0.01%
Gambia	4.26%	1.05%	3.14%	0.07%	-0.02%	-0.02%	0.00%
Madagascar	0.30%	-0.24%	0.79%	-0.24%	-0.07%	-0.03%	-0.04%
Malawi	0.66%	0.93%	-0.17%	-0.11%	0.23%	0.25%	-0.02%
Rwanda	-2.82%	-0.56%	-2.18%	-0.08%	-0.02%	-0.02%	0.00%
Togo	0.17%	0.15%	0.22%	-0.21%	-0.05%	-0.00%	-0.05%
Uganda	-2.11%	-0.49%	-1.22%	-0.40%	0.27%	0.30%	-0.03%
Zambia	1.06%	0.98%	-0.09%	0.17%	0.02%	0.02%	0.00%

Table 14
Comparing P_t with a Reynolds-Smolesnky measure of trade policy inequality bias[a]

	Reynolds-Smolensky		Our index P_t	
Country	Own trade policy	Rest of the World	Own trade policy	Rest of the World
Burundi	-2.41	-3.99	-0.08	-4.50
Burkina Faso	0.47	-0.08	1.32	0.25
Côte d'Ivoire	3.02	1.19	2.50	-6.51
Cameroon	-0.12	-1.05	1.61	-0.63
Ethiopia	0.75	0.05	1.04	0.60
Gambia	1.21	0.29	4.26	-0.04
Madagascar	-0.13	-0.82	0.22	-0.56
Malawi	0.06	0.11	-1.54	0.35
Rwanda	0.91	-0.21	-2.85	-0.05
Togo	0.76	0.48	0.17	-0.06
Uganda	-0.31	0.11	-2.38	0.86
Zambia	0.32	-0.20	0.83	-0.19

[a]Our index (P_t) and the Reynolds-Smolensky index (the difference between the Gini coefficients without and with protection) are all multiplied by 100, so that in the case of P_t the number is the percentage points difference in real income change between rich and poor households. In both cases a positive number indicates that the poor benefit more than the poor from protection. The existing protection is pro-poor.

Figure 1
The inequality bias of Africa's and ROW's trade policy on SSA's households

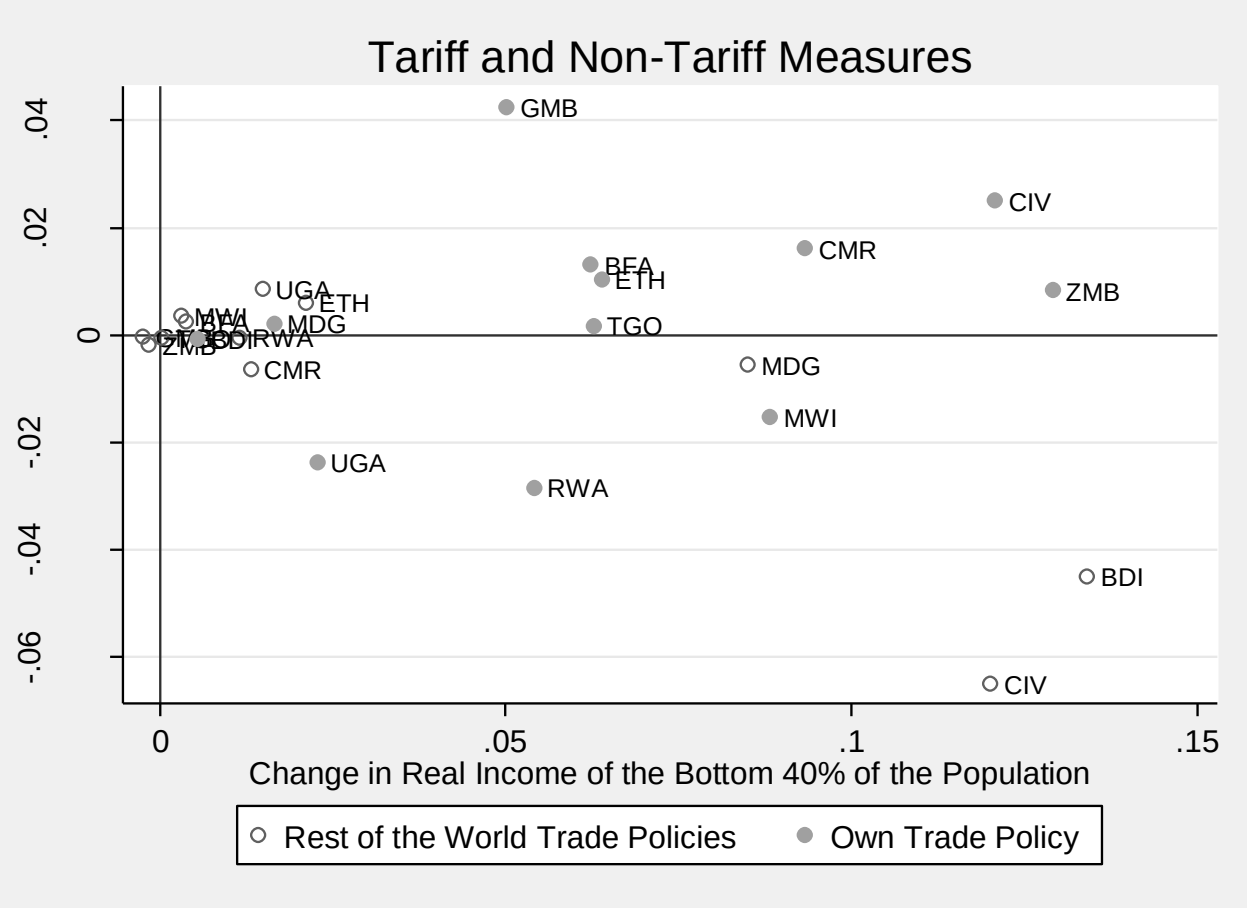

Figure 2
The inequality bias of Africa's and ROW's trade policy on SSA's households

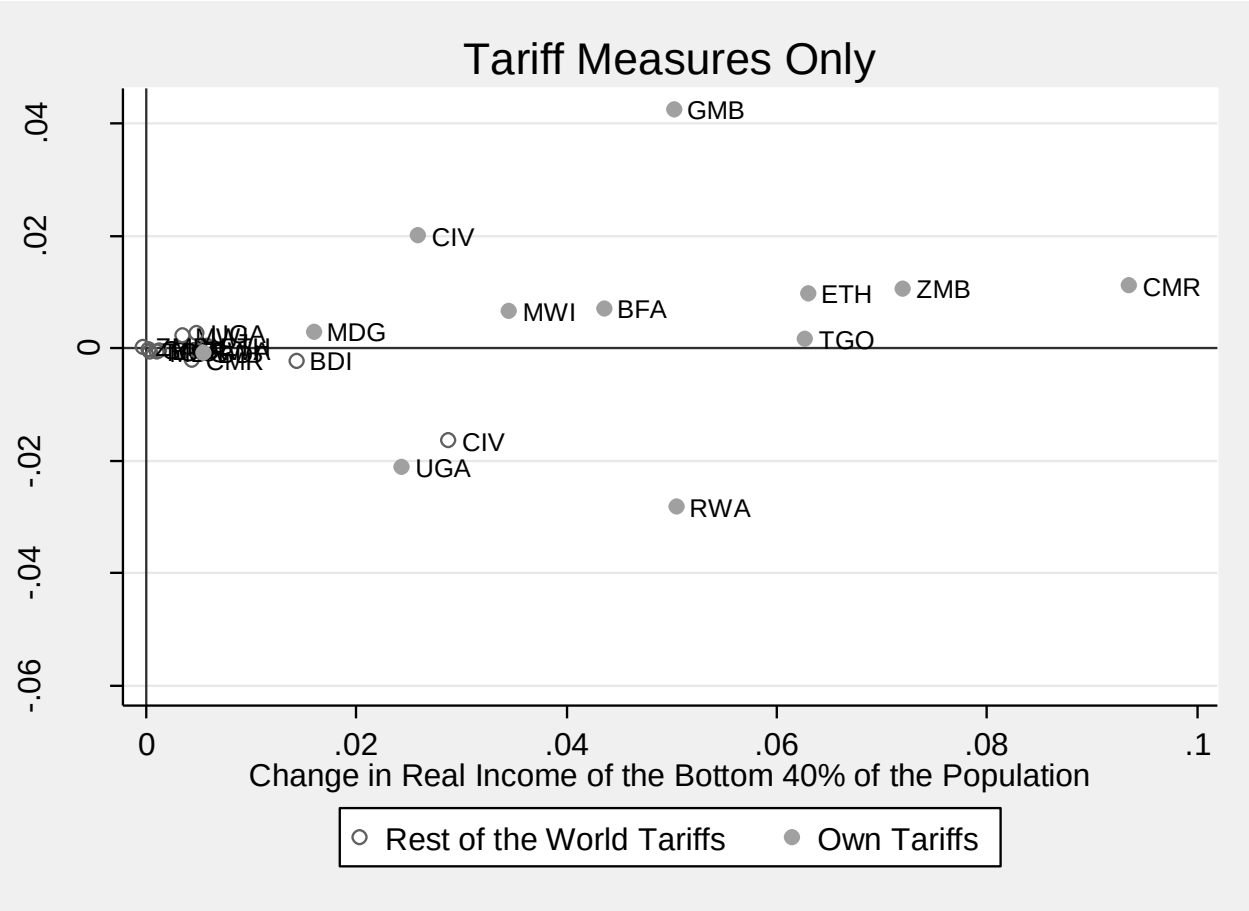

Figure 3
Changes in SSA's household welfare following the removal of own and ROW's trade barriers