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Trading off the Income Gains and the Inequality Costs of Trade Policy

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Abstract

This paper characterizes the trade-off between the income gains and the inequality costs of trade using survey data for 54 developing countries. Tariff data on agricultural and manufacturing goods are combined with household survey data on detailed income and expenditure patterns to estimate the first-order effects of the elimination of import tariffs on household welfare. The paper assesses how these welfare effects vary across the distribution by estimating impacts on the consumption of traded goods, wage income, farm and non-farm family enterprise income, and government transfers. For each country, the income gains and the inequality costs of trade liberalization are quantified and the trade-offs between them are assessed using an Atkinson social welfare index. The analysis finds average income gains from import tariff liberalization in 45 countries and average income losses in nine countries. Across countries in the sample, the gains from trade are 1.9 percent of real household expenditure on average. We find overwhelming evidence of a trade-off between the income gains (losses) and the inequality costs (gains), which arise because trade tends to exacerbate income inequality: 45 countries face a trade-off, while only nine do not. The income gains typically more than offset the increase in inequality. In the majority of developing countries, the prevailing tariff structure thus induces sizable welfare losses.

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Produced by the Research Support Team

Trading off the Income Gains and the Inequality Costs of Trade Policy*

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1 Introduction

The recent wave of 'new' trade models has rekindled interest in the gains from trade. The results and theorems on the aggregate gains from trade in Dixit and Norman (1980, 1986) have been extended by Arkolakis, Costinot and Rodriguez-Clare (2012), Costinot, Donaldson and Komunjer (2012) and Costinot and Rodriguez-Clare (2014).[1] Concurrently, there has also been a renewed interest in the distribution of those gains. These are the focus of Porto (2006), Fajgelbaum and Khandelwal (2015), Atkin and Donaldson (2015), and Atkin, Faber and Gonzalez-Navarro (2018).[2] In this paper, we combine these two questions and assess the income gains relative to the inequality costs of trade policy. Using survey data for 54 developing countries, we explore the potential trade-off between the gains from trade and the distribution of those gains and we provide a quantification of the inequality-adjusted welfare gains from trade. The evaluation of this trade-off is important, especially because free trade is often opposed on inequality grounds.

We develop a comprehensive model that describes how trade policy affects the real income of different households. Tariffs determine domestic prices which affect households both as consumers and as income earners. As consumers, households are affected through the cost of the entire bundle of traded consumption goods. Similarly, household income is affected through changes in the returns to household production activities, crop growing, family businesses, labor earnings, and government transfers. Our model encompasses all these mechanisms. Following Deaton (1989), we use a first-order approximation to measure how changes in tariffs impact real income.

We then combine tariff data on various goods with household survey data on detailed income and expenditure patterns to estimate these first order welfare effects for 54 low and middle income countries. With estimates of the welfare effects of import tariff liberalization for each household, we study the aggregate gains from trade (as in Arkolakis, Costinot and Rodriguez-Clare, 2012) and the distribution of the gains from trade (as in Porto, 2006). Using

[1] See also Artuc, Lederman and Porto (2015), Caliendo and Parro (2015), Melitz and Redding (2015), Arkolakis, Costinot, Donaldson and Rodriguez-Clare (2015), and Caliendo, Dvorkin and Parro (2018).

[2] See also Nicita, Olarreaga and Porto (2014), Faber (2014), Goldberg and Pavcnic (2007), Topalova (2010), Kovak (2013), Autor, Dorn and Hanson (2013), Dix-Carneiro and Kovak (2017).

an Atkinson Social Welfare function (Atkinson, 1970), we assess the trade-off between the income gains and the inequality costs of trade. Our joint study of the gains from trade and their distribution across households contributes to an incipient strand of literature including Antras, de Gortari and Itskhoki (2017) and Galle, Rodriguez-Clare and Yi (2017).

It is useful to put our methodological approach into context. Arkolakis, Costinot and Rodriguez-Clare (2012) quantify the aggregate gains from trade by deriving a sufficient statistic to compare autarky with the status quo. Subsequent literature has developed extensions allowing for imperfect competition (Arkolakis, Costinot, Donaldson and Rodriguez-Clare, 2015), labor market frictions (Caliendo, Dvorkin and Parro, 2016), and productivity advantages (Melitz and Redding, 2015). Work on the distributional effects identifies instead winners and losers from trade. Much of this literature builds on Deaton's (1989) first-order effects approach. Porto (2006) studies the distribution of the household welfare effects across the income distribution, Nicita, Olarreaga and Porto (2014) explore the poverty bias of trade policy (the welfare effects of the poor relative to the welfare effects of the rich), and Atkin, Faber and Gonzalez-Navarro (2018) investigate the distribution of the household welfare effects from FDI. Another branch of the literature examines distributional effects in an Arkolakis, Costinot and Rodriguez-Clare (2012) setting. Fajgelbaum and Khandelwal (2015) introduce non-homothetic preferences and focus on expenditures only. Costinot, Donaldson and Komunjer (2012) and Galle, Rodriguez-Clare and Yi (2017) adopt a Ricardo-Roy model and focus on both expenditures and wages.

A distinctive feature of this paper is that we merge these two approaches by looking at both average gains from trade and their distributional impacts. As is standard in the literature, we rely on first order approximations. We offer a flexible model with extensive household heterogeneity in incomes and expenditures. As in Nicita, Olarreaga and Porto (2014), we allow for a more comprehensive set of sources of income heterogeneity than in most other papers. As in Fajgelbaum and Khandelwal (2015), we allow for non-homothetic preferences and heterogeneity in expenditure patterns. To operationalize this flexible framework, we need to impose some structure on our model. Our setting is compatible with perfect competition, constant returns to scale, and homogeneous products.

We find average income gains from import tariff liberalization in 45 countries and average income losses in the remainder 9 countries. On average, the developing countries in our study enjoy gains from trade equivalent to 1.9 percent of real household expenditure. This is mostly because the consumption gains from lower prices dominate the income losses from reduced protection.

The distributional impacts of import tariff liberalization are highly heterogeneous, across both countries and households. We find that the equality gains, the change in social welfare associated with these distributional impacts, are negatively correlated with the average income gains. Inequality costs arise primarily because trade exacerbates nominal income inequality, while the consumption gains tend to be more evenly spread. This creates trade-offs between the income gains and the equality gains in 45 of the 54 countries in our sample. The income gains typically more than offset the increase in inequality. In 39 countries, liberalization of import tariffs would result in inequality-adjusted welfare gains for a wide range of empirically plausible values of inequality aversion (between 1 and 2). In 9 countries that face trade-offs, protectionism would instead be welfare enhancing for plausible values of inequality aversion. Finally, there are 6 countries where the trade-offs are acute, in which the presence of welfare gains or losses depends crucially on the presumed level of inequality aversion and policy prescriptions are consequently more equivocal. These results imply that in the majority of developing countries in our study, the prevailing pattern of protection induces sizeable welfare losses.

The rest of the paper is organized as follows. Section 2 sets up the model and derives the formulas for the welfare effects of trade policy. Section 3 uses the tariff data and the survey data to estimate those welfare effects in 54 countries. Section 4 discusses the gains from trade and their distribution. Section 5 evaluates and quantifies the trade-off between income gains and inequality costs of trade. It also decomposes equality gains into consumption equality gains and income equality gains, presents robustness tests, and assesses the trade-offs that would arise if countries were to undertake protectionist trade reforms instead of liberalizing. Section 6 concludes.

2 Tariffs and Household Welfare

In this section, we develop a model to study the welfare effects of tariff changes. We adopt an extended agricultural household model to define household welfare (Singh, Squire and Strauss, 1986; Benjamin, 1993) and we derive the welfare effects using first order approximations (Deaton, 1989; Porto, 2006; Nicita, Olarreaga and Porto, 2014).

We begin by discussing production decisions. We assume that households are endowed with a fixed amount of resources v^h, which include land or capital, and labor L^h. There is no leisure choice but households can differ in the labor endowment because of differences in family size and composition. Assume for now that these factors can be allocated to the production of one (composite) agricultural good or to the labor market. The agricultural good i is produced with a constant return to scale production function $F_i(v^h, L^h)$. The household takes goods prices p_i and wages w as exogenous. There is no market for land or capital v, but labor can be traded, i.e., it can be hired in-farm, sold off-farm, or sold to the labor market. These different types of labor are perfect substitutes. Agricultural profit maximization requires using labor in-farm (own or hired) up to a point where $p_i \partial F_i/\partial L = w$. The profit function associated with this optimization problem is $\widetilde{\pi}_i(p_i, w, v)$. In this formulation, household income y^h is the sum of maximized profits $\widetilde{\pi}_i^h$ and the value of the labor endowment wL^h. To simplify the exposition that follows, let w^h be the labor income that household h derives *only* from the labor market and let π^h be maximized profits defined net of hired off-farm labor only.[3] Allowing for many goods (Singh, Squire and Strauss, 1986), total maximized household income y^h is

$$(1) \quad y^h(\mathbf{p}, v^h) = w^h + \sum_i \pi_i^h(\mathbf{p}) - T^h + \Omega^h,$$

where $\mathbf{p}$ is the vector of prices p_i, π_i^h are farm enterprise profits obtained from the sales of good i (such as cotton, tobacco, beans or maize), and T^h are taxes paid to (or transfers

[3] In particular, let L^{hired} be hired labor in-farm, L^{market} the supply of household labor to the labor market, and let L^{farm} be the own-farm family labor. Then, the labor endowment is $L^h = L^{market} + L^{farm}$, while farm employment is $L^D = L^{farm} + L^{hired}$. In addition, $\pi^h = p_i q_i - wL^{hired}$ and household income is $w^h + \pi^h$. See Benjamin (1993) for a full derivation.

received from) the government. All other potential sources of income, such as remittances, gifts, other types of public transfers (e.g. pensions) and income from non-traded household enterprises are included in Ω^h.[4]

Household h maximizes a utility function defined over a vector of consumer goods $\mathbf{c}$, $u^h = u(\mathbf{c})$, subject to a vector of given prices $\mathbf{p}$ and total household income. Assuming households are price takers in consumer markets, in production and in the labor market, the optimization problem is recursive because production decisions are independent of consumption decisions. Thus, households maximize $u(\cdot)$, subject to $\mathbf{p}$ and maximized income y^h. The solution to this optimization problem delivers a demand function for each good. Optimal consumption of good i is c_i^h and, given required utility u^h, the household expenditure function is

$$(2) \quad e(\mathbf{p}, u^h) = \sum_i p_i c_i^h(\mathbf{p}).$$

To derive the welfare effects of trade, we use the concept of compensating variation CV^h. For price changes, this is generally done using the expenditure function e^h. In our case, we need to consider the fact that trade affects nominal income y^h as well. Consequently, we follow Dixit and Norman (1980) and Anderson and Neary (1996) and use the *trade* expenditure function, V^h:

$$(3) \quad V^h(\mathbf{p}, v^h, u^h) = y^h(\mathbf{p}, v^h) - e(\mathbf{p}, u^h),$$

which depends on prices $\mathbf{p}$ via the maximized nominal income function $y^h(\cdot)$ and the expenditure function $e(\cdot)$. Note that the trade expenditure function is usually defined in the Hicksian tradition as $e^h - y^h$ but we work with (3) instead so as we can interpret the results as changes in real household income (Porto, 2006).

We proceed in two steps. We first derive general welfare effects of price changes in Proposition 1. Then, in proposition 2, we derive *estimable* welfare effects of trade policy. In particular, we list additional assumptions that we need to impose in order to obtain

[4]Because of data constraints, we do not deal with savings, debt, inventories, and other intertemporal considerations. Because very few surveys include detailed input expenditure data in the income modules, we do not deal with imported input prices (seeds, fertilizer) either.

estimates of the welfare effects that are compatible with our data. This proposition imposes restrictions on the price changes and on household impacts that we can accommodate in our data. Changes in these assumptions allow for different responses and different welfare effects. We discuss below some salient alternative model formulations, and present robustness tests in section 5.6.

Proposition 1 *Assume the household is a price taker in consumer, producer and labor markets. Given the income generating function $y(\mathbf{p}, v^h)$ in equation (1) and the expenditure function $e(\mathbf{p}, u^h)$ in equation (2), the impact of a price change on household welfare dV_i^h (as a share of household initial expenditure e^h) is given by*

$$(4) \quad \frac{dV_i^h}{e^h} = \left((\phi_i^h - s_i^h) + \phi_w^h \frac{\partial w^h}{\partial p_i} \frac{p_i}{w^h} \right) d\ln p_i - \frac{dT^h}{e^h}$$

where s_i^h is the share of traded good i in the consumption bundle of household h, ϕ_i^h is the income share derived from the sales of good i, and ϕ_w^h is the share of labor income. dV_i^h is the negative of the compensating variation CV^h, the monetary transfer that would allow household h to attain the same utility u^h before the trade shock and the price change.

Equation (4) follows from taking the derivative of (3) with respect to p_i and expressing the resulting expression in proportional terms. Thus, the proportional price change is $d\ln p_i = dp_i/p_i$. Hotelling's Lemma (i.e., the envelope theorem applied to the profit function) implies that $(\partial \pi_i/\partial p_i)dp_i = q_i^h dp_i$, where q_i^h is the quantity produced of good i. Multiplying and dividing by p_i and expressing the result relative to total income y^h gives $(p_i q_i^h/y^h)d\ln p_i = \phi_i^h d\ln p_i$. From Shephard's Lemma, the derivative of the expenditure function with respect to p_i is the quantity consumed c_i^h so that $(\partial e/\partial p_i)dp_i = c_i^h dp_i$ and $(p_i c_i^h/e^h)d\ln p_i = s_i^h d\ln p_i$.[5] This accounts for the first term within brackets in (4). The second term captures the labor income impacts, which are given by the product of the share of income derived from labor,

[5]This assumes that, ex-ante, household expenditures equal household income. This rules out savings and intertemporal considerations.

ϕ_w^h, and the wage elasticity with respect to the price $(\partial w^h/\partial p_i)/(p_i/w^h)$. This formulation allows for different assumptions about the functioning of labor markets that determine the nature of the labor income elasticities.[6] The last term in (4) accounts for any impacts on government transfers received or on taxes paid by household h.

Proposition 2 *Let τ_i be the level of tariff protection in sector i. Assume: (i) goods are homogeneous; (ii) the country is small and thus faces exogenously given international prices p_i^*; (iii) perfect price transmission from tariffs to domestic prices; (iv) labor is specific, that is, labor is perfectly immobile across sectors; (v) the loss of public revenue due to tariff cuts is compensated with increases in income taxes. Then, the* estimable *welfare effects are given by:*

$$(5) \quad \frac{dV_i^h}{e^h} = -\left((\phi_i^h - s_i^h) + \phi_{wi}^h\right)\frac{\tau_i}{1+\tau_i} + \Psi_i^h,$$

where now ϕ_{wi}^h is the share of labor income derived only from wages in sector i (and not other sectors) and Ψ_i^h is the increase in income tax accrued by the household.

This expression is the welfare effect of a simulated full unilateral tariff liberalization. This means that the country reduced its own tariffs individually. Under full import tariff liberalization, so that $d\tau_i = -\tau_i$, the perfect pass-through assumption implies that

$$(6) \quad d\ln p_i = -\tau_i/(1+\tau_i).$$

The unitary pass-through elasticity requires constant returns to scale in the production of the traded goods and perfect competition.[7] This is a simplification of our analysis that is rooted in the lack of data needed to estimate the pass-through elasticities for a broad range of products and countries (see Nicita (2009), Ural Marchand (2012), Atkin, Faber and

[6]Since we do not have information on input use, equation (4) omits the indirect effects of wages to hired in-farm labor, L^{hired} on farm profits. See Porto (2005) for a study of those effects in Moldova.

[7]See Goldberg and Knetter (1997) for a exhaustive discussion of the conditions needed for perfect pass-through. Note also that there is no role for entry and exit in our model.

Gonzalez-Navarro (2018), for estimates of imperfect pass-through for selected countries). Note that by simulating cases of own unilateral tariff liberalization, we are not accounting for the effects of foreign tariff reductions and market access effects.

The sector specificity of labor allows us to derive a simple wage-price elasticity, because with fixed labor $d\ln w = d\ln p_i$ for wages in sector i and $d\ln w = 0$ for wages in all sectors $j \neq i$. It is in principle possible to accommodate different assumptions on how labor markets work. Under full labor mobility, for example, labor would reallocate until a new equilibrium is reached. In the literature, such a model has been estimated by Porto (2006), Nicita (2009) and Nicita, Olarreaga, and Porto (2014). In our model, furthermore, labor is homogeneous and, in particular, there is no skill differentiation. Nicita, Olarreaga and Porto (2014) estimate wage-price elasticities for skilled and unskilled labor separately. Another possibility is to assume imperfect labor mobility and equilibrium inter-industry wage differences. In this case, a price shock can trigger labor reallocation responses across sectors and, consequently, there can be sector-specific wages elasticities. Artuc, Lederman, and Porto (2015) provide estimates of such a model for a wide range of countries. In section 5.6 we assess how our results change if we do not account for labor market responses to tariff changes.

The interpretation of equation (5) is straightforward. After a price change caused by tariff cuts $d\ln p_i = -\tau_i/(1+\tau_i)$, the first order effects on real income can be well-approximated with the corresponding expenditure and income shares. In the language of Deaton (1989), because we are working with tariff cuts and price declines, net-consumers benefit while net-producers suffer. In our setting, the net position of a household is defined in an extended model including not only consumption and production of traded goods but also labor income and government transfers.

As in Nicita, Olarreaga and Porto (2014), we want a measure of the welfare effects generated by the *entire* structure of tariff protection. To obtain it, we sum the changes in welfare in (5) over all traded goods i to get:

$$(7) \quad \widehat{V}^h = \frac{dV^h}{e^h} = \sum_i \frac{dV_i^h}{e^h},$$

where $\widehat{V}^h$ is the proportional change in household real income. In the remainder of the paper, we estimate the different components of equation (7) and study them in detail. We also use equation (7) to build ex-post counterfactual distributions. Let x_0^h be the observed, ex-ante level of real household income (from the data compiled in the household surveys). The counterfactual real income $\widehat{x}_1^h$ is

$$\widehat{x}_1^h = x_0^h(1 + \widehat{V}^h). \tag{8}$$

Much of what we do below hinges on the comparison of the ex-ante and ex-post distributions of income.

Since our propositions are derived from an agricultural household model, which is not often used in the trade literature, it is important to bear in mind some of the key features of our approach when interpreting the results. If we take the standard models at face value, it is clear that several data limitations would prevent us from fully accurately estimating the welfare effects of trade stemming from those models. These limitations are inherent to household surveys. For example, information on returns to capital, especially corporate profits and so on, is often patchy and typically missing altogether in the household surveys. Consequently, it is very difficult to map the results from those standard models to our empirical results which are based on household surveys. There might therefore be some discrepancies between some of our results and standard trade theory. For example, Stolper-Samuelson effects resulting in differential impacts on the returns to capital vs labor, or to skilled vs unskilled labor, may not be captured by our analysis. However, most of the discussion about poverty, inequality and household welfare is (to a large extent) based on household surveys, which remain the dominant instrument for measuring household consumption and income portfolios. Such surveys are thus a natural starting point for analyzing the distributional impacts of trade policy.

Our results also have interesting implications for trade theory. We argue that the most innovative feature of our approach is household heterogeneity, which is often missing in standard trade models. Heterogeneity takes two forms. One is consumption heterogeneity and non-homothetic preferences. In particular, since the poor and the rich allocate their

expenditure very differently across goods (most notably, food), this can have implications for the overall gains from trade as well as for the inequality costs of trade. These differences and their implications are not captured by standard models based on homothetic preferences. There are, of course, papers that rely on non-homothetic preferences, and the conclusions from those models are consistent with the conclusions from our paper.

The other important dimension of heterogeneity is income heterogeneity. In our model, households earn income from various sources not limited to labor markets. In particular, income from sales of different agricultural products plays a crucial role in agrarian economies and these sales include returns to non-labor household factors such as land and assets such as tractors, ploughs, and more humble tools such as shovels, carts, and wheelbarrows. The "distribution" of these factors across households in the surveys is highly heterogeneous. Households thus have very different sources of incomes and this matters for welfare and inequality. This income heterogeneity is missing in many neoclassical models.

3 Estimating the Welfare Impacts of Trade Policy

To estimate the welfare impacts of trade policy, we need to measure the different components of equations (5) and (7). The data needed to estimate impacts on consumption and production of traded goods, labor income and home enterprise income can be found in standard household surveys. Trade and trade policy data come from United Nations COMTRADE and UNCTAD TRAINS, which classify goods using the Harmonized System (HS) so that tariffs and imports are available at HS-6 level. Household surveys use different nomenclatures of goods produced and consumed. To match trade data and household survey data, we use and improve upon the templates and concordances developed by Nicita, Olarreaga and Porto (2014). In short, we first aggregate goods in the household surveys to 2-digit and 4-digit categories. We then aggregate tariff and trade data from COMTRADE to those categories. See Appendix A for details.

3.1 Trade Policy and Price Changes

In the empirical application that follows, good i represents one of the product classifications from the expenditure, income and home-consumption templates modules of the household surveys. Each of these classifications includes many finer product groups from the HS classification. We compute weighted average tariff rates τ_i for each of our survey categories:

$$(9) \quad \tau_i = \sum_{c,n \in i} \tau_{c,n} \frac{m_{c,n}}{\sum_{c,n \in i} m_{c,n}},$$

where n is an HS-category that belongs to survey-category i and $m_{c,n}$ are imports of good n from country c. The results are shown in Table 1. We report the average tariff for our 2-digit classification, Staple Agriculture, Non-Staple Agriculture, and Manufactures. Average tariffs are highest for non-staple agricultural goods (14.4 percent). They are lower for staple agricultural goods (10.8 percent) and manufactures (10.9 percent). These averages mask substantial variation in trade barriers across countries. Average tariffs on non-staple agricultural goods range from as high as 46.1 percent in Bhutan to as low as 1.9 percent in Indonesia. Countries with higher tariffs in agriculture (staple and non-staple) tend to have higher tariffs on manufactures as well.

Using the full price transmission assumption (equation 6), we calculate the price changes induced by the elimination of tariffs as follows:

$$(10) \quad \Delta \ln p_i = \frac{p_i^* - p_i^*(1+\tau_i)}{p_i^*(1+\tau_i)} = -\frac{\tau_i}{1+\tau_i}.$$

3.2 Expenditure and Income Shares

To measure the first order welfare effects we retrieve the expenditure shares s_i^h and the income shares ϕ_i^h and ϕ_w^h from the household surveys. Appendix Table A1 lists the countries included in the analysis, together with the corresponding household survey, the year of the survey and the sample size. Our analysis covers all low income countries for which appropriate household survey data were available, as well as the majority of lower middle

income countries. To minimize the role of measurement error, we exclude households in the top and bottom 0.5% of the status quo expenditure distribution in all our analyses. All statistics derived from household surveys presented in the remainder of the paper are weighted using survey weights. For the relatively few surveys for which survey weights are not available, we simply assume each household has the same weight.

Expenditure shares are reported in Table 2. We show averages for six major expenditure aggregates, namely Staple Agriculture, Non-Staple Agriculture, Manufactured Goods, Non-Traded Goods, Other Goods, and Home Consumption. Expenditure on food is the dominant expenditure category, accounting on average for 45 percent of all household spending across countries, which is not surprising since the bulk of countries in our sample are low income countries with an average poverty rate of 35 percent (using national poverty lines) and an average GDP per capita of US$ 1879. This focus on poor countries also helps explain why home consumption is important, accounting for an average budget share of 17 percent across countries and for more than a third of all expenditure in Ethiopia, Madagascar, Mali and Uzbekistan. Spending on manufacturing goods on average accounts for 17 percent of overall household expenditure, and spending on non-tradables accounts for 15 percent.

Average income shares for staple Agriculture income, Non-Staple Agricultural income, Wages, Family Enterprise Income, Other income, and Own Home Production are reported in Table 3. Wage income is the single most important source of income, accounting on average for 29 percent of household income across countries, and for 39 percent if we weigh countries by their GDP, suggesting that the importance of this source of income increases with development. The value of autoconsumption accounts for 23 percent of household income. Profits from running farms and other family businesses account for 17 and 13 percent of household income, respectively. These averages hide important heterogeneity across countries, which reflects differences in structural features of their economies and heterogeneity in survey design (including coverage of different sources of incomes and expenditures).

3.3 Labor Income and Transfers

As established in Proposition 2, we assume that labor is sector specific. This is consistent with a short-run model, in which households do not adjust labor to the trade shock. To implement this assumption empirically, we consider 10 different sectors (see the Income Template in the Appendix). This is convenient because in this setting the changes in prices transmit one to one to nominal wages and the elasticity of the wage in sector i with respect to its own price p_i is one, while the elasticities with respect to other prices j is zero. In robutsness tests, we also consider a model without labor income responses (as in Deaton, 1989).[8]

Lastly, we need to derive the cost of tax payments needed to compensate for the tariff revenue loss, Ψ_i^h. We assume that the government imposes a proportional income tax to do so at the moment it liberalizes. Denoting import quantity by m_i, we can approximate the loss of tariff revenue as $dR_i = -\tau_i p_i^* m_i$ (ignoring production and consumption responses). With a proportional income tax, the change in income tax paid by household h is $dT^h = d\psi y^h$, where $d\psi$ is the compensatory change in the tax rate. Consequently,

$$(11) \quad \Psi_i^h = -\frac{\tau_i}{1+\tau_i}\frac{M_i}{\sum_h y^h},$$

where $M_i = p_i^*(1+\tau_i)m_i$ is the value of imports. In the robustness exercises, we consider two additional cases, one where there is no compensation of the revenue losses via the income tax and another where there is progressivity in the income tax system.

4 Income Gains and Inequality Costs of Trade Policy

In this section, we investigate the potential income gains (or losses) and the potential inequality costs (or gains) from import tariff liberalization. The next section (section 5) investigates the potential trade-off between the two.

[8] In additional robustness exercises that are not reported here to conserve space we also estimate a model with perfectly mobile labor (as in Porto, 2006) as well as a model with imperfect labor mobility (as in Artuc, Chaudhuri and McLaren, 2010). The results are qualitatively consistent with those obtained using the baseline model with specific labor and the alternative model without labor income responses.

4.1 Income Gains from Trade

To be consistent with the literature (e.g., Arkolakis, Costinot and Rodriguez-Clare, 2012), the gains from trade G are defined as the proportional change in aggregate household real expenditures, after import tariff liberalization:

$$(12) \quad G = \frac{\sum_h (x_1^h - x_0^h)}{\sum_h x_0^h} = \sum_h \frac{x_0^h}{\sum_h x_0^h} \widehat{V}^h,$$

where $\widehat{V}^h$ is the proportional change in real expenditures of household h which we estimate with equation (7). Thus, G is a weighted average of the welfare effects $\widehat{V}^h$.

Table 4 reports G for 45 countries with positive aggregate gains from trade ($G > 0$). On average, the net gain from import tariff liberalization is a 2.5 percentage point increase in real expenditures. The highest gains accrue to Cameroon and Zambia (6.9 and 5.9 percent of real expenditure, respectively). The smallest gains, for Bangladesh, Burundi, and Mongolia, are about 0.5, 0.4 and 0.1 percent of initial expenditures, respectively.

Table 5 reports 10 countries in which import tariff liberalization causes losses ($G < 0$) which average –0.9 percent of real expenditures. In Cambodia, the country with the largest loss, households are estimated to lose 3.1 percentage points of real expenditure. There are also instances of very small, almost negligible, losses as in Rwanda.

Across all countries in the sample, the average gain from trade liberalization is equal to 1.9 percent of real expenditures. The developing world seems to gain from trade.

To establish the sources of the gains from trade, we decompose the average gains into different channels in columns 2-8 of Tables 4 and 5. Households gain on the expenditure side, but they lose on the income side. The consumption gains come from lower prices of tradables, which on average result in (gross) real income gains of 6.4 percent for the winners (Table 4) and 5.3 percent for the losers (Table 5). About two-thirds of these gains, on average, are due to lower prices of agricultural goods and one-third to lower prices of manufacturing goods. This is a consequence both of the higher expenditure shares on food items in developing countries, and the comparatively high tariffs on agricultural products. Households lose nominal income. Agricultural income losses account for average real income

declines of 1.5 percent across countries with gains and 2.0 percent across countries with losses. Wage income effects create losses of 0.6 percent in countries with gains and 1.1 percent in countries with losses. The reduction in income from enterprises producing tradable goods is small on average; –0.2 percent of income among winners and –0.1 percent among countries that lose. The biggest driver of income losses is the reduction in government revenue: this channel accounts for 1.6 of the 3.9 percentage points loss in income among winners and 3.2 of the 6.4 percentage point loss among losers.

4.2 The Distributional Effects of Trade

We now turn to the distribution of the gains from the trade, which have been the focus of Porto (2006), Nicita, Olarreaga and Porto (2014), Fajgelbaum and Khandelwal (2016), Atkin, Faber and Gonzalez-Navarro (2016), Faber (2014) and Atkin and Donaldson (2015). Indeed, the average impacts just discussed mask significant heterogeneity across households. This is because the net welfare impact is determined by a combination of initial tariffs as well as income and consumption portfolios. We combine two techniques to explore the distributional effects. We estimate kernel averages of the gains from trade, conditional on household initial well-being (per capita expenditure), and we estimate bivariate kernel densities of the joint distribution of the gains from trade and household per capita expenditure.

For the sake of exposition, we divide countries into two groups using the pro-poor index of Nicita, Olarreaga and Porto (2014). In our application, the pro-poor index is the difference between the average gains for the poor—the bottom 20 percent of the income distribution—and the rich—the top 20 percent. If the index is positive the poor gain proportionately more (or lose proportionately less) than the rich, while the opposite happens when the index is negative. According to this classification, import tariff liberalization would be pro-poor in 17 countries, while it would be pro-rich in the remaining 37 countries.

We illustrate the case of pro-poor bias in Figure 1 for the cases of the Central African Republic (panel (a)) and Mauritania (panel (b)). Appendix B provides figures for all countries. In the Central African Republic, the kernel average is positive everywhere, so that there are average gains from trade across the income distribution, but the slope of the

kernel regression is negative (so that the poor gain proportionately more than the rich). This pro-poor bias with positive kernel average gains also appears in Azerbaijan, Central African Republic, Ecuador, Indonesia, Moldova, Nepal, Pakistan, Papua New Guinea, Rwanda, the Republic of Yemen and Zambia (see Appendix B). In these countries, import tariff liberalization raises incomes across the income distribution and may reduce inequality. Liberalization would not be Pareto improving, however. The bivariate density of the welfare effects and initial income illustrates the dispersion in the welfare effects and the existence of winners and losers in all segments of the per capita expenditure spectrum. A more extreme version of this pattern is shown in panel (b) for the case of Mauritania, where there are average gains for the poor but average losses for the rich. This implies a very strong pro-poor bias. Similar patterns are also observed in Guinea-Bissau, Mali, Mongolia and Sri Lanka (see Appendix B). In all these countries, import tariff liberalization raises average income and may reduce inequality significantly.

We illustrate the pro-rich bias in Figure 2. In Uzbekistan (panel (a)), the kernel average is always positive at all levels of per capita expenditure, and the slope of the kernel regression is positive, indicating that, on average, the rich gain proportionately more than the poor. Again, some individual households stand to lose, as the underlying bivariate kernel density graph shows. Import tariff liberalization lifts incomes throughout the income distribution, but at the expense of potentially higher inequality. This pattern is found in Armenia, Bolivia, Cameroon, Côte d'Ivoire, the Arab Republic of Egypt, Ethiopia, Georgia, Guatemala, Guinea, Iraq, Kyrgyz Republic, Liberia, Malawi, Mozambique, Nicaragua, Niger, Sierra Leone, South Africa, Tajikistan, Tanzania, Uganda, and Ukraine (see Appendix B). The case of pro-rich bias with average gains for the richest households and losses for the poorest is illustrated in panel (b) for Togo. Import tariff liberalization is strongly pro-rich and inequality significantly exacerbated. Similar patterns arise in Bangladesh, Benin, Burkina Faso, Burundi, The Gambia, Kenya, Nigeria, and Vietnam. In panel (c), we show the case of average losses and a pro-rich bias for Ghana. In this country, as well as in Bhutan, Cambodia, Comoros and Madagascar, the poor lose proportionately more than the rich. This is a scenario with average losses as well as increased inequality.

5 The Trade-Off between Income Gains and Inequality Costs

Given the patterns of gains from trade and of the distribution of those gains, we now assess whether there is a trade-off between the income gains and the inequality costs of import tariff liberalization. This necessarily involves value judgments because different societies, individuals or policy makers may value the gains or losses of some households differently. A tool to describe the trade-off between income inequality and average incomes is the Atkinson social welfare function (Atkinson, 1970):

$$(13) \quad W = \frac{1}{H} \sum_{h} \frac{\left(x^h\right)^{1-\varepsilon}}{1-\varepsilon},$$

where W is social welfare and $\varepsilon \neq 1$ is a parameter that measures the dislike for inequality.[9] When ε=0, every household counts the same and social welfare is just the sum (average) of per capita expenditures. As ε increases, the weight attached to the well-being of poorer households increases. In the limit, as ε approaches infinity social welfare is determined by the well-being of the very poorest household (as in a Rawlsian social welfare function). It is very important to interpret the Atkinson social welfare function correctly. As Deaton (1997) explains, W in (13) is not necessarily (and more precisely, it seldom is) the object that policy makers maximize when choosing among policy options. Rather, it provides a means of quantifying potential tensions between mean income and its distribution across households.

An important property of the Atkinson social welfare function is that it can be decomposed in a way that is conducive to the assessment of this trade-off. Concretely, we can write

$$(14) \quad W = \mu * (1 - I),$$

[9]For completeness, when $\varepsilon = 1$, we define $\ln W = (1/H) \sum_h \ln x^h$

where μ is mean income and

$$(15)\quad I = 1 - \left(\frac{1}{H} \sum_{h=1}^{H} (x^h/\mu)^{1-\varepsilon} \right)^{1/(1-\varepsilon)},$$

is an implicit measure of income inequality. Social welfare thus depends on average income μ and on the aggregate level of "equality" $(1 - I(\varepsilon))$. This measure of inequality $I(\varepsilon)$ (or the measure of equality $(1 - I(\varepsilon))$) depends on ε and nests a whole family of inequality measures.

Using $W(\varepsilon)$, we can define a measure of the gains from trade that includes a correction for the inequality costs:

$$(16)\quad G(\varepsilon) = \frac{W_1(\varepsilon) - W_0(\varepsilon)}{W_0(\varepsilon)},$$

where W_0 is the ex-ante social welfare, calculated with the observed (x_0^h) income distribution in the presence of trade protection and $W_1(\varepsilon)$ is the counterfactual social welfare under import tariff liberalization $(\widehat{x}_1^h)$. Given the initial situation and the post-liberalization situation, we can compare W_0 and W_1 using (16). For $\varepsilon = 0$, this is a comparison of mean income, that is, the calculation of the gains from trade (Arkolakis, Costinot and Rodriguez Clare, 2012; Costinot, Donaldson and Komunjer, 2012; Costinot and Rodriguez-Clare, 2014; Artuc, Lederman and Porto, 2015; Caliendo and Parro, 2015; Melitz and Redding, 2015; Arkolakis, Costinot, Donaldson and Rodriguez-Clare, 2015; and Caliendo, Dvorkin and Parro, 2015). For $\varepsilon > 0$, this comparison involves the calculation of the gains from trade with an implicit correction for inequality (Antras, de Gortari, Itskhoki, 2017; and Galle, Rodriguez-Clare, and Yi, 2017). With estimates of $G(\varepsilon)$ for different ε, we can establish whether there is a trade-off between the gains in average incomes and the costs of inequality in its distribution, we can quantify this trade-off, and we can assess it.

For the discussion that follows, we exploit the decomposition of W in equation (14). Note that we can write

$$(17)\quad G(\varepsilon) = G(0) + \frac{\mu_1}{\mu_0} \frac{I_0(\varepsilon) - I_1(\varepsilon)}{1 - I_0(\varepsilon)}.$$

The inequality-adjusted gains from trade are thus equal to the income gains from trade $G(0)$ plus a correction for changes in inequality, which we will refer to as equality gains. The gains from trade $G(0)$ can be positive or negative, as shown in section 4.1. The correction for inequality is governed by the Atkinson inequality index $I(\varepsilon)$, which may depend non-monotonically on ε. If inequality increases for some $\varepsilon_a > 0$ so that $I_1(\varepsilon_a) > I_0(\varepsilon_a)$, then $G(\varepsilon_a)$ incorporates a downward correction for these inequality costs. Conversely, if $I_1(\varepsilon_b) < I_0(\varepsilon_b)$ at some ε_b, then the gains from trade are amplified. Note that $G(\varepsilon) > 0$ does not imply no inequality costs per se but rather that their welfare impacts are dominated by the income gains.

Trade-offs arise when income gains and equality gains move in opposite directions, i.e. when $G(0)$ and $\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$ have opposite signs. This is the case in countries where trade exacerbates inequality but improves average income, and in countries where it reduces inequality at the expense of lowering mean income. In some countries, these trade-offs can even result in reversals of trade policy preferences, in the sense that for certain levels of inequality aversion ε, the inequality adjusted gains from trade may be negative (positive) even though import tariff liberalization leads to an increase (reduction) in average income. Since the sign and magnitude of the equality gains can vary with ε both the existence and acuteness of the trade-offs depend on the level of inequality aversion. No trade-offs occur in countries where import tariff liberalization leads to both income and equality gains (for all ε) or in countries where it leads to lower income and higher inequality (for all ε).

One of the main findings of our paper is the high prevalence of trade policy trade-offs between average incomes and income inequality in the developing world. Among the 54 countries in our sample, 45 face a trade-off and only 9 do not. In 27 of the 45 countries the trade-offs can be severe enough to generate (potential) reversals in the ranking of trade policy preferences. We present countries without trade-offs (section 5.1), countries with trade-offs but without trade policy preference reversals (section 5.2) and with reversals (section 5.3). Sections 5.4 and 5.5 evaluate such trade-offs and some of the underlying factors. Finally, we run robustness tests in section 5.6 and we explore protectionists scenarios in section 5.7.

5.1 No Trade-off Countries

When average income gains emerge together with equality gains, there is no trade-off. The case of the Central African Republic is shown in Figure 3, which plots $G(\varepsilon)$ for $\varepsilon \in [0, 10]$.[10] To obtain confidence intervals for $G(\varepsilon)$ we resample from the observed distribution and bootstrap using 1000 replications. In the Central African Republic, import tariff liberalization leads to average welfare gains with a pro-poor bias (see Figure 1). The gains in average incomes of 4.2 percent are independent of ε and the pro-poor bias implies that liberalization also leads to equality gains. As ε increases and more weight is put on the poor, these equality gains actually get bigger. As a result, the inequality adjusted welfare gains are increasing in the inequality aversion parameter ε, and exceed 6 percent for large ε. Other countries in which import tariff liberalization yields both equality gains and lifts average incomes are Guinea-Bissau, Jordan and Yemen. In these countries, import tariff liberalization is unambiguously social welfare enhancing.

At the other end of the spectrum lie 4 countries, Comoros, Ghana, Madagascar and Rwanda, which are characterized by average income losses and inequality costs for all ε. In these countries import tariff liberalization would be unambiguously social welfare depressing. Figure 4 illustrates the case of Ghana. Since income losses are disproportionately borne by the poor, the inequality adjusted gains from trade are negative and decreasing with ε. For instance, the aggregate losses of –1.9 percent (for $\varepsilon = 0$) are augmented to –4.3 percent when inequality aversion is high.

5.2 Trade-off Countries without Trade Policy Preference Reversals

There are 45 countries with evidence of a trade-off. In 18 countries, this trade-off is not strong enough to generate reversals of trade policy preferences because import tariff liberalization dominates protection at all levels of inequality aversion (in 16 countries) or because protection dominates liberalization (in only 2 countries, notably Bhutan and Cambodia). Figure 5

[10] For presentational purposes, we examine $G(\varepsilon)$ for a limited range of $\varepsilon \in [0, 10]$ but the results hold more generally. Results are available upon request but omitted to conserve space.

illustrates the case of Uzbekistan, where liberalization creates average income gains at the expense of inequality costs. In Uzbekistan inequality increases smoothly with ε and, as a consequence, the inequality adjusted welfare gains $G(\varepsilon)$ decrease as inequality aversion rises. The gains from trade are $G(0) = 3.5$ percent, while the inequality-adjusted gains for large ε can go down to about 1.1 percent. Other countries exhibiting a similar pattern are Armenia, Azerbaijan, Cameroon, the Arab Republic of Egypt, Guinea, Indonesia, Iraq, the Kyrgyz Republic, Moldova, Pakistan, Tajikistan, Uganda, Ukraine, Uzbekistan, South Africa, and Zambia. Since G(ε) is positive and statistically significant for all ε, import tariff liberalization would unambiguously lead to higher social welfare.

Plots of $G(\varepsilon)$ for all these countries are given in Appendix C. We summarize the information contained in Figures 3, 4 and 5 in Table 6, which reports the income gains from trade $G(0)$ (column 1) as well as the equality gains $((\mu_1/\mu_0)(I_0(\varepsilon) - I_1(\varepsilon))/(1 - I_0(\varepsilon))$ for several values of inequality aversion ε. To illustrate, consider the case of Guinea-Bissau (a country without a trade-off) in panel (a). The gains from trade are 2.0 percent (column 1). Because inequality declines with import tariff liberalization, the equality gains increase with ε. The correction is thus positive and increasing with ε. At $\varepsilon = 0.5$, for instance, the correction is 0.5 percent and the inequality-adjusted gains are 2.5 percent. At $\varepsilon = 1$ (ε=10), the correction is 0.7 (0.8) percent and the total inequality-adjusted gains go up to 2.7 (2.8) percent. Another interesting example is Madagascar, where there are losses from trade of -1.1 percent and increases in inequality costs so that, at $\varepsilon = 1$, the inequality-adjusted losses from trade drop to -1.8 percent and at $\varepsilon = 10$, to -3.4 percent. To illustrate a country with trade-offs (Panel (b)), consider Ukraine. The gains from trade are 3.2 percent, but inequality increases and consequently there is a downward correction to G. At $\varepsilon = 1$, this correction is very small, –0.1 percent and the inequality adjusted gains drop to 3.2; at $\varepsilon = 10$, the correction is –0.7 percent and the inequality adjusted total gains are 2.5 percent. The table reports many other interesting patterns.

5.3 Trade-off Countries with Trade Policy Preference Reversals

In the remaining 27 countries in our sample, we find evidence of a stronger trade-off which may induce a potential reversal of the ranking of trade policy preferences. This reversal occurs when $G(\varepsilon)$ changes sign, going from positive to negative or from negative to positive, as ε increases. This means that, depending on the value judgement parameter ε, the social welfare function points to welfare gains associated with import tariff liberalization or with trade protection. Figures 6 and 7 show two examples of the existence of such trade-offs. In Benin (Figure 6), there are significant average income gains of 2.2 percent so that $G(0) > 0$. However, as ε increases, import tariff liberalization creates larger and larger inequality costs so that, eventually, $G(\varepsilon)$ becomes significantly negative. At very large ε, the inequality-adjusted gains are -4.4 percent. It follows that free trade dominates protection when ε is low, whereas protection dominates free trade when ε is high. Other countries that exhibit similar trade-offs are Bangladesh, Burkina Faso, Burundi, Ethiopia, The Gambia, Guatemala, Kenya, Liberia, Malawi, Mozambique, Nigeria, Papua New Guinea, Togo, and Vietnam.[11]

Mali (Figure 7) exhibits the opposite pattern; There are small but statistically significant average losses from trade ($G(0) = -0.3$) but, as ε increases, the equality gains from liberalization end up strictly dominating those losses and the inequality-adjusted gains $G(\varepsilon)$ approach 3 percent. Consequently, protection dominates free trade at low ε, while free trade dominates protection at high ε. This also happens in Mauritania and Sri Lanka.

To quantify these policy preference reversals, we define the cutoff value ε^* such that $G(\varepsilon^*) = 0$. The cutoff ε^*, which we refer to as trade-ε^*, is a measure of the inequality aversion to import tariff liberalization. It is a sufficient statistic to describe the trade-off between mean income and inequality in the presence of trade policy preference reversals. Defining the trade-off in terms of the gains, the value of ε^* shows how intolerant towards inequality a society would have to be in order to make the gains from trade not worthwhile from a social welfare perspective.[12] A high value of ε^* implies a soft trade-off: a society

[11] See below for a more detailed discussion of some of these countries and their trade-off.

[12] Alternatively, the ε^* shows how much a society would have to value equality to forgo the average gains from trade.

needs to put a heavy weight on the cost of higher inequality to be willing to forgo the gains (always in a social welfare function sense). In the limit case, when trade-ε^* tends to infinity or when trade-ε^* does not exist (as in the countries discussed in sections 5.1 and 5.2), there is no reversal in trade policy preference rankings and, given gains from trade, import tariff liberalization leads to higher social welfare for any ε. By contrast, a low trade-ε^* implies a very hard trade-off because relatively light weights on the inequality costs are enough to offset the gains from trade. It is important to note that while the value of ε^* describes the nature of the trade-off, it is silent about whether this trade-off is socially acceptable.

Table 7 presents estimates of the trade-ε^* (column 1) and its 95% confidence interval (columns 2 and 3). Since the interpretation of the trade-ε^* depends on the sign of the gains, we report results separately for countries that enjoy income gains in panel (a) and countries that suffer income losses in panel (b). The select few countries characterized by multiple (potential) reversals are presented in panel (c).

Among the countries with gains (Panel (a)), the trade-ε^* vary a lot. In some cases, the cutoff can be as low as 0.1 (Burundi), or 0.57 (Burkina Faso and Bangladesh). In other cases, it can be much larger, as in Malawi (7.1) or Guatemala (7.0). To put these numbers in perspective, we canvassed the literature for guidance on what a reasonable value for ε is. Deaton (1997) recommends exploring values of $\varepsilon \in [0, 2]$ when doing policy evaluations. Using experiments, Carlsson, Daruvala and Johansson-Stenman (2005) estimate $\varepsilon \in [1, 2]$ and Layard, Mayraz and Nickell (2008) estimate a value of ε of 1.3. A high ε^* consequently suggests that the trade-offs are soft in the sense that one would have to be implausibly inequality averse in order not to prefer liberalization. This implies a strong presumption in favor of lower tariffs. By contrast, in Burundi, Bangladesh or Burkina Faso, the trade-off would be quite stark. Since the gains from trade are positive but very small, even at low levels of inequality aversion one would prefer protection. In the remaining countries, the trade-off appears to be more moderate, with a substantial number of the estimates of trade-ε^* lying in the [1,2] interval (1.2 in The Gambia, 1.2 in Togo, 1.5 in Benin, 1.9 in Nigeria, and 2.0 in Vietnam). Kenya (2.5), Ethiopia (3.1), Mozambique (3.5), Papua New Guinea (4.4), and Liberia (4.5) are countries with relatively high trade-ε^*, but not quite as extreme as Malawi

or Guatemala.

There are countries with trade-offs where the evidence on trade policy reversals is not so compelling. This occurs when the inequality-adjusted gains from trade are not statistically indistinguishable from zero, that is the null hypothesis that $G(\varepsilon) = 0$ cannot be rejected for a range of ε. We report these cases in columns 4 and 5 of Table 7. In Sierra Leone, for instance, for $\varepsilon > 4.0$, there are inequality adjusted gains from trade ($G(\varepsilon) > 0$) that are not statistically different from 0. Consequently, we cannot rule out a *potential* reversal (from preferring liberalization to preferring protection). Similar scenarios emerge in Bolivia ($\varepsilon > 4.1$), Niger ($\varepsilon > 6.0$), Nicaragua ($\varepsilon > 6.3$), Côte d'Ivoire ($\varepsilon > 7.0$), Georgia ($\varepsilon > 7.1$), Nepal ($\varepsilon > 9.3$), Tanzania ($\varepsilon > 8.9$), and Ecuador ($\varepsilon > 9.9$). In all these countries, however, the trade policy preference reversal would come about only for levels of inequality aversion that are arguably implausibly large.

Among the countries with aggregate losses (Panel (b)) of Table 7), the estimated trade-ε^* tend to be low. For instance, we get $\varepsilon^* = 0.3$ in Sri Lanka (at the first reversal) and $\varepsilon^* = 0.4$ in Mali. Note that the interpretation in these cases is different because for low ε, trade protection is preferred to liberalization, and, conversely, liberalization is preferred to protection for higher ε. In these countries, a low ε^* thus implies a presumption in favor of lower tariffs, too. In Mauritania ($\varepsilon^* = 1.6$), trade protection would be preferred under more moderate values of inequality aversion making it harder to infer trade policy prescriptions.

5.4 Assessment

While our results attest to highly heterogeneous welfare impacts of trade liberalization across households and countries, overall the analysis provides overwhelming evidence of a trade-off between income gains and inequality costs of trade policy. In most cases, however, the income gains outweigh the inequality costs, suggesting countries are better off with freer trade. We summarize these observations and results in Figure 8. We plot the value of the inequality-adjust gains from trade $G(\varepsilon)$ against the gains from trade $G(0)$. For our assessment, we use $\varepsilon = 1.5$ because it is in the middle of the empirically plausible interval $[1, 2]$ and because it yields a measure of the Atkison inequality index I that is, in general,

close to the Gini coefficient. Since the Gini is often used in discussions about inequality, this is a useful benchmark. If there were only small corrections for inequality, then the pairs $(G(1.5), G(0))$ would lie along the 45 degree line, with larger corrections for those pairs further away. Orthant I hosts countries with average gains as well as gains after inequality corrections; orthant III hosts countries with average losses with and without inequality corrections. In orthant II, we see countries with losses from trade that turn into gains after the inequality adjustments, and, in orthant IV, those countries with gains from trade that turn into losses with inequality considerations.

For an inequality aversion parameter of $\varepsilon = 1.5$, 17 countries would not face a trade-off. Eleven of them would unambiguously benefit from liberalization as they enjoy both income and inequality gains. These countries, which lie in orthant I, above the 45 degree line, are Azerbaijan, Central African Republic, Ecuador, Guinea-Bissau, Indonesia, Jordan, Mongolia, Pakistan, Papua New Guinea, Nepal, and Yemen. The remaining six countries, Bhutan, Cambodia, Comoros, Ghana, Madagascar and Rwanda, would unambiguously prefer protectionism as trade liberalization leads to both income losses and inequality costs (they lie in orthant III, below the 45 degree line).

A total of 37 countries would exhibit trade-offs (for $\varepsilon = 1.5$). In 30 of these countries, the trade-off is resolved in favor of liberalization. Twenty-eight countries would show income gains and inequality costs, but inequality-adjusted gains from trade liberalization. These are the countries in orthant I, below the 45 degree line. Two countries (Mali and Sri Lanka) would show instead income losses but sufficiently high equality gains so that there are inequality-adjusted gains from trade in the end (for $\varepsilon = 1.5$). These are the countries in orthant II.

In 7 countries the trade-off is instead resolved in favor of protection because tariffs lead to higher inequality-adjusted welfare. One country, Mauritania (orthant III, above the 45 degree line), would face income losses and equality gains, which, for $\varepsilon = 1.5$, are not enough to compensate for those losses. In six countries, Bangladesh, Benin, Burkina Faso, Burundi, The Gambia and Togo, the inequality costs dominate the income gains. These are in orthant IV.

It turns out that the resolution of the trade-off is very stable for different values of plausible inequality aversion. In Figure 9, we reproduce Figure 8 for $\varepsilon = 1$ (panel (a)) and $\varepsilon = 2$ (panel (b)). As it can be seen, there are only a few countries where the trade policy prescriptions are more equivocal. For $\varepsilon = 1$, Benin, The Gambia, and Togo jump from orthant IV to orthant I (thus preferring liberalization instead of protection). For $\varepsilon = 2$, Vietnam and Nigeria jump from orthant I to orthant IV (thus preferring protection) while Mauritania jumps from orthant III to orthant II (thus preferring liberalization).

A fundamental conclusion of this analysis is therefore that many of the countries that face a trade-off between mean income and its distribution are better off with lower tariffs (liberalization) than with higher tariffs (protection). Concretely, for empirically plausible levels of inequality aversion, liberalization is expected to enhance welfare in 39 countries and to reduce it in 9 countries. Only in the remaining 6 countries are the policy implications more equivocal.

These results raise questions about why these countries protect their economies. Perhaps countries are not maximizing the Atkinson social welfare function when setting tariffs. Alternatively, they may be maximizing this function, but subject to constraints. These could include political economy considerations such as rent re-distribution to non-labor income (capital) and tariff revenue capture (Grossman and Helpman, 1994; Krueger, 1974). In addition, tariffs may be an appealing means of collecting revenue in a context in which income (and other) taxes are difficult to collect (Besley and Persson, 2013). Theories of social mobility and redistribution that combine psychology and political economy may also rationalize the political constraints faced by policy makers (Piketty, 1995; Benabou and Tirole, 2006). Finally, there may be dynamic considerations. Whatever the reason for it, our findings show that protection can be very costly in terms of the social welfare aggregator W.

5.5 Underlying Factors: Expenditure and Income Household Heterogeneity

How do the gains from trade and trade-offs described above emerge? We argue that a distinctive element of our approach is the vast heterogeneity in household expenditures and incomes. We showed in section 4.1 that this heterogeneity helps explain the gains from trade. Across-household differences in the consumption gains and in the income losses of the elimination of tariffs show that countries are more likely to benefit from liberalization if food expenditure shares are large, relative to agricultural production income shares.

Household heterogeneity underlies the patterns of trade-offs as well. In Table 8, we decompose the equality gains (or losses) into consumption equality gains and (nominal) income equality gains. To calculate these, we estimate two counterfactual scenarios; one in which liberalization solely impacts consumption (and does not impact income), and one in which it solely impacts income (and does not impact consumption). We compute the consumption and income equality components using equation (17) (recall that equality gains are equal to $\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$).[13]

As much as there is heterogeneity in the trade-offs, there is a marked heterogeneity in the income and consumption equality components. Note, however, that the consumption equality gains are positive yet small in the majority of countries. As consumers, the poor seem to benefit disproportionately from liberalization, in part because they spend a larger share of their budget on food items, which are subject to comparatively high tariffs. By contrast, the income component is overwhelmingly negative across countries, reflecting the fact that trade liberalization creates income inequality costs that are disproportionately borne by poorer households. Whereas the consumption equality gains on average increase only slightly as inequality aversion rises, the average income inequality costs tend to increase sharply (i.e., become more negative) with ε. The trade-offs between the aggregate gains and aggregate

[13]Consumption and income impacts may interact, such that the total equality gains from trade are not simply equal to the sum of the consumption equality gains and income equality gains; to assess the importance of these types of interaction effects, we calculated "residual" equality gains as the difference between total equality gains and the sum of income and consumption equality gains. The residual was typically very small and is therefore not presented here.

inequality costs are thus predominantly driven by nominal income inequality. This finding shows that the income losses associated with trade liberalization are borne disproportionately by the poorer segment of the income distribution, whereas the consumption gains are more widely spread.

The role of household heterogeneity is typically underplayed in much of trade theory. There are theories that postulate non-homothetic preferences and expenditure heterogeneity, but income heterogeneity is often ignored. This can help rationalize potential discrepancies between our results and the intuitions regarding the gains from trade and their distributive impacts that stem from many trade models. For example, the Stolper-Samuelson result could imply a reduction in inequality for low-income, unskilled intensive countries that integrate with the world. Our model shows that this effect can be offset and fully dominated by impacts on other sources of income also affected by trade.[14]

5.6 Robustness

To assess the robustness of our results, we use two different permutations of our model. To start with, we show results of a model that does not allow for labor market responses to tariff changes. With this alternative model, we find income gains in 50 countries and losses in 4 countries. The estimated average income gains from trade are 2.5%. Yet, the estimated pattern of inequality adjusted gains is very similar. Gains from trade are negatively correlated with equality gains, which tend to become lower (i.e. more negative) as inequality aversion increases. Nonetheless, in spite of the widespread prevalence of trade-offs, countries are typically better off when pursuing free trade policies. Our results are thus robust to using this alternative model.

Second, we re-evaluate our model using two alternative assumptions about tariff redistribution, notably (i) that no tax response is observed and (ii) that the government makes up for lost revenue by imposing additional personal income taxes which respect the progressivity of the existing personal income tax system (see appendix E for details).

[14]Of course, the heterogeneity at the household level is in itself a consequence of additional underlying factors, such as endowments, policies, institutions and so on. However, the analysis of these factors is beyond the scope of our paper.

Excluding the loss of tariff revenue from the model nearly doubles the estimated average income gains from trade to 3.7% on average across countries (relative to 1.9% in the main model). Moreover, income gains are now positive in 53 out of the 54 countries. Yet, equality gains continue to be negatively correlated with income gains and trade-offs remain widespread.

If instead of assuming away tariff redistribution we assume that the government makes up for the loss in tariff revenue by imposing progressive taxes (calibrated using the World Tax Indicators (WTI) database (Andrew Young School of Policy Studies, 2010)), the inequality costs of trade liberalization show some minor difference, but the overall pattern of results is not impacted. Income gains are negatively correlated with equality gains. Yet, the latter typically are dominated by the former such that countries facing trade-offs are typically better of with freer trade.[15]

5.7 Protectionist Scenarios

Thus far, we have analyzed the inequality-adjusted gains from liberalization, but our framework also lends itself to evaluating trade-offs that might arise if countries become more protectionist. To explore this, we evaluate the welfare impacts associated with three protectionist scenarios that move the economy closer to autarky: (i) a uniform increase in tariffs of 10 percentage points (i.e. adding 10% to all existing tariffs); (ii) a relative increase in tariffs of 10 percent (i.e. multiplying all pre-existing tariffs by 1.1); and (iii) increasing all tariffs to 62.4%.[16] The aim of this exercise is to establish whether the trade-offs that may arise under protectionist scenarios are in general consistent with those derived when countries liberalize. Accordingly, we summarize the results in Table 10 which presents estimates of the (inequality adjusted) gains from trade, the number of countries that exhibit trade-offs, and the trade policy reversals. Country-specific estimates of the gains from trade are presented in Appendix F.[17]

[15] See Appendix E for details.

[16] Following Ossa (2014), this is the level of tariffs that would prevail if countries did not fear retaliation from the rest of the world.

[17] These country-specific losses/gains from trade under these various scenarios are not necessarily the mirror image of the results obtained when liberalizing. This is because the autarky scenarios may have

As expected, the average gains from these protectionist trade reforms are now negative in the vast majority of countries. While there are 45 winners under liberalization, we find between 43 and 48 losers with increased protection. The estimated average income gains ($G(0)$) across countries in the three scenarios are, respectively –0.2%, –1.3% and –5.7% (Panel A of Table 10). More importantly, the prevalence of trade-offs is widespread (Panel B). There are only 8-10 countries without trade-offs and, of these, between 6 and 9 prefer the status quo to more protection. There are between 44 and 46 countries with trade-offs. The resolution of these trade-offs is fairly stable in favor of the status quo for plausible levels of ε (1, 1.5 or 2). That is, in all three protectionist scenarios the vast majority of countries attain higher levels of welfare with the pre-existing structure of trade protection rather than with more protection. Most countries would be hurt by protectionist trade reforms, even after inequality impacts are taken into consideration.

6 Conclusion

Using household survey data for 54 low and middle income countries harmonized with trade and tariff data, this paper offers a quantitative assessment of the income gains and inequality costs of trade liberalization and the potential trade-off between them.

A stylized yet comprehensive model that allows for a rich range of first-order effects on household consumption and income is used to quantify welfare gains or losses for households in different parts of the expenditure distribution. These welfare impacts are subsequently explored by deploying the Atkinson social welfare function that allows us to decompose inequality adjusted gains into aggregate gains and equality (distributional) gains.

Liberalization is estimated to lead to income gains in 45 countries in our study, and to income losses in 9 countries. The developing world as a whole would enjoy gains of about 1.9 percent of real household expenditures, on average. These income gains are negatively correlated with equality gains, such that liberalization typically entails a trade-off between average incomes and income inequality. In fact, such trade-offs arise in 45 out of 54

different impacts on prices and because the household heterogeneity noted above implies that the inequality implications of a positive welfare effect may be quite different from those of negative effects.

countries, and are primarily the result of trade exacerbating income inequality. By contrast, consumption gains tend to be more evenly spread across households.

While trade-offs are prevalent, our findings also suggest that liberalization would be welfare enhancing in the vast majority of countries in our study: in a large part of the developing world, the current structure of tariff protection is inducing sizable welfare losses. Explaining what drives these patterns is beyond the scope of this paper but an interesting avenue for future research.

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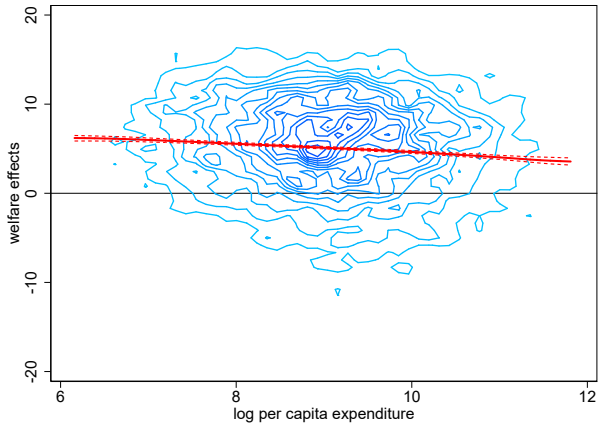
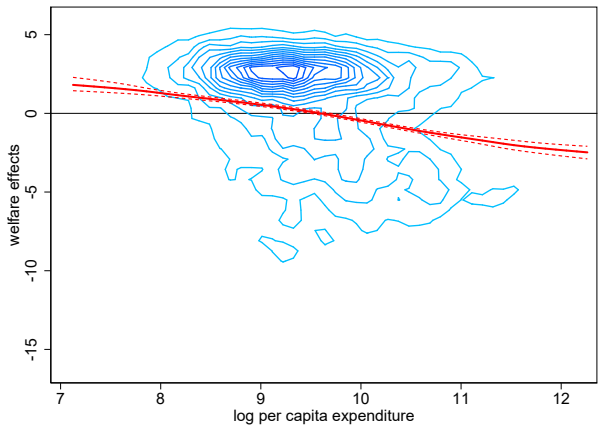
Figure 1
Patterns of Distributional Impacts
Pro-Poor Bias

(a) Central African Republic



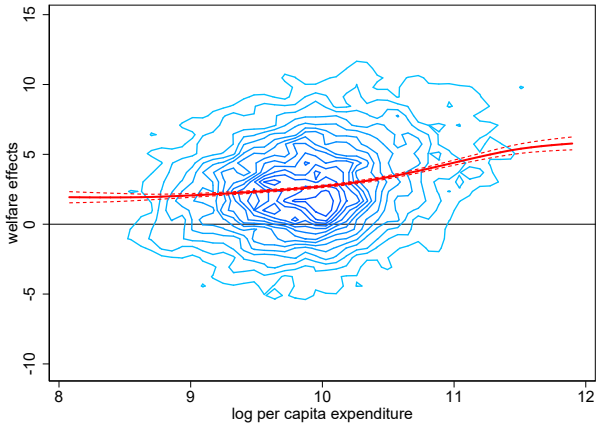
(b) Mauritania



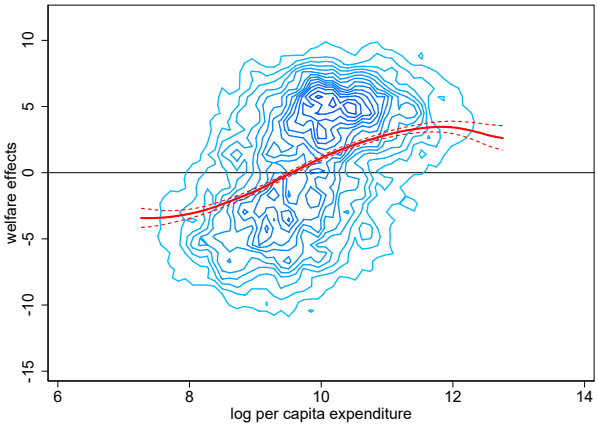
Notes: The solid curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The dotted curves are the corresponding 95% confidence bands. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

Figure 2
Patterns of Distributional Impacts
Pro-Rich Bias

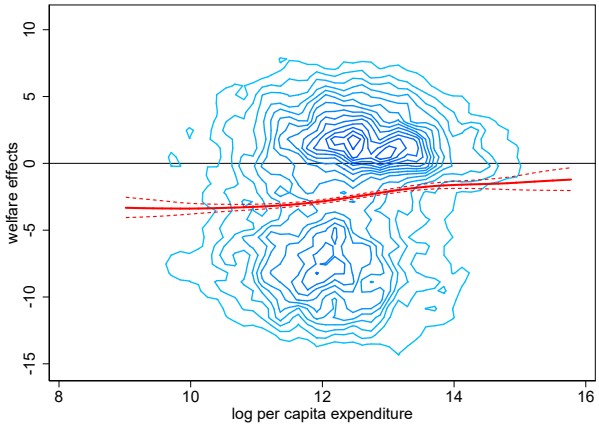
(a) Uzbekistan



(b) Togo



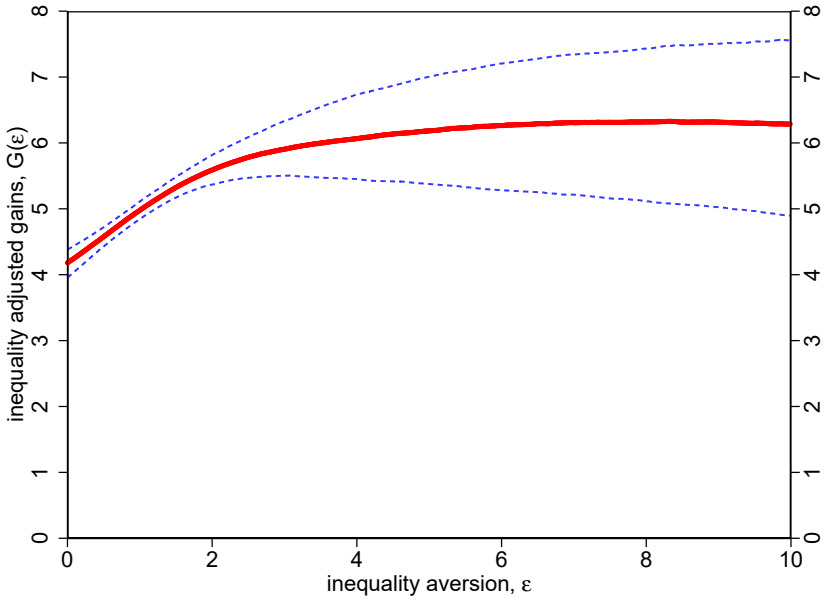
(c) Ghana



Notes: The solid curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The dotted curves are the 95% confidence bands. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure 3
No Trade-off
Income Gains and Equality Gains

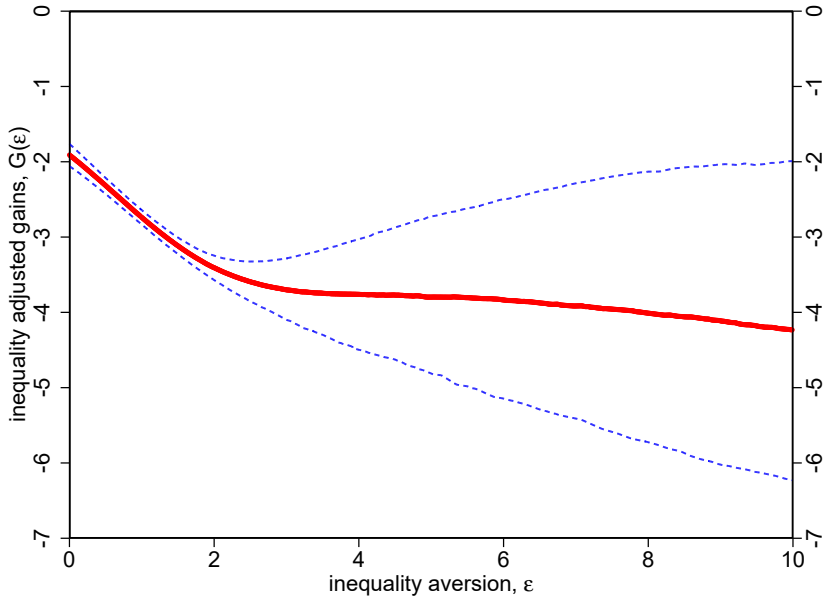
(a) Central African Republic



Notes: The solid line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 4
No Trade-off
Income Losses and Inequality Costs

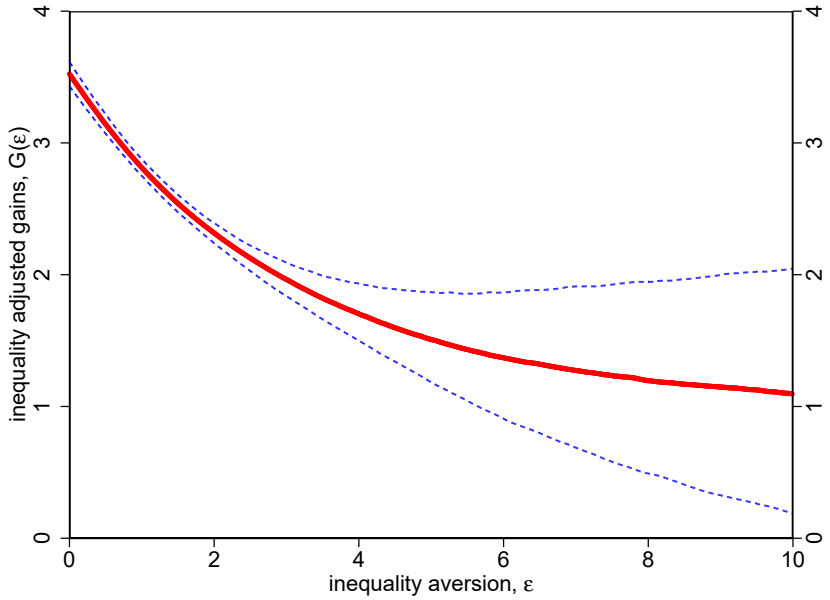
(a) Ghana



Notes: The solid line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 5
Trade-off Without Policy Preference Reversal
Income Gains and Inequality Costs

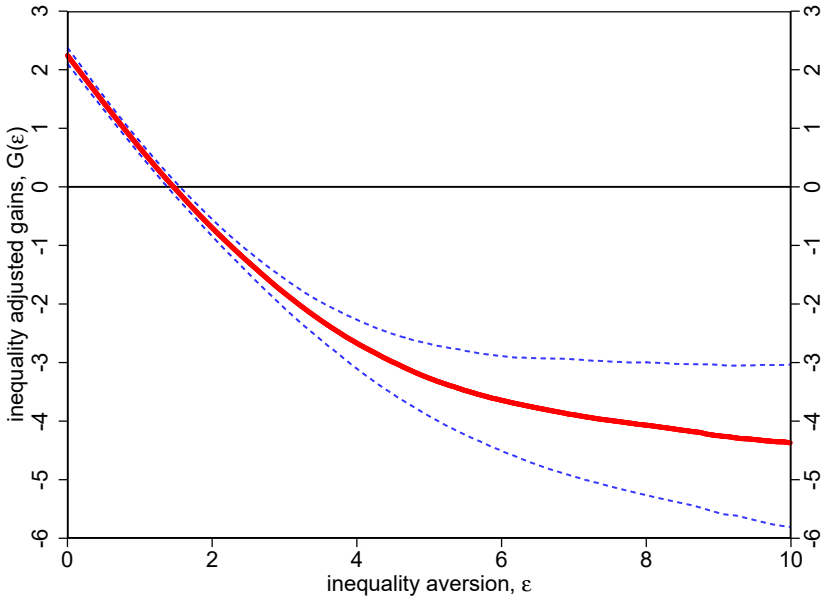
(a) Uzbekistan



Notes: The solid line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 6
Trade-off with Trade Policy Preference Reversal
Income Gains and Inequality Costs

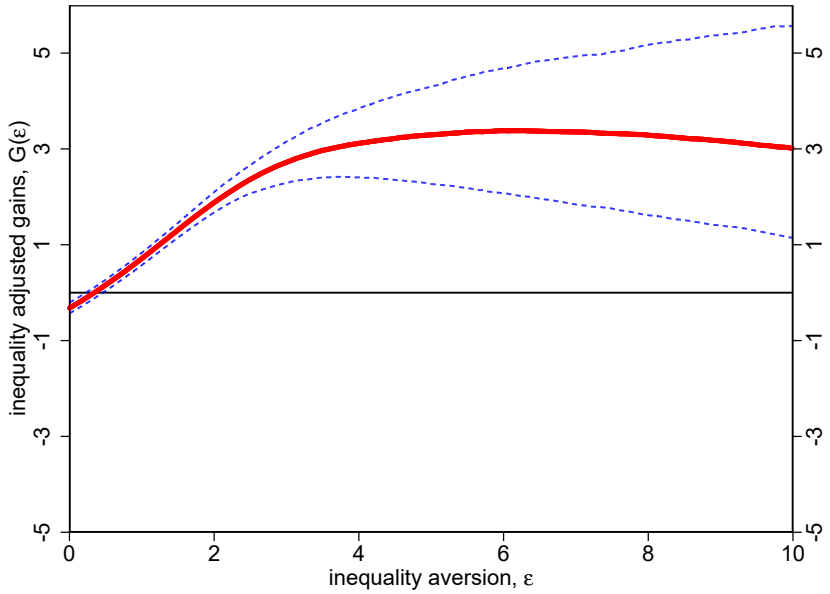
(a) Benin



Notes: The solid line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 7
Trade-off with Trade Policy Preference Reversal
Income Losses and Equality Gains

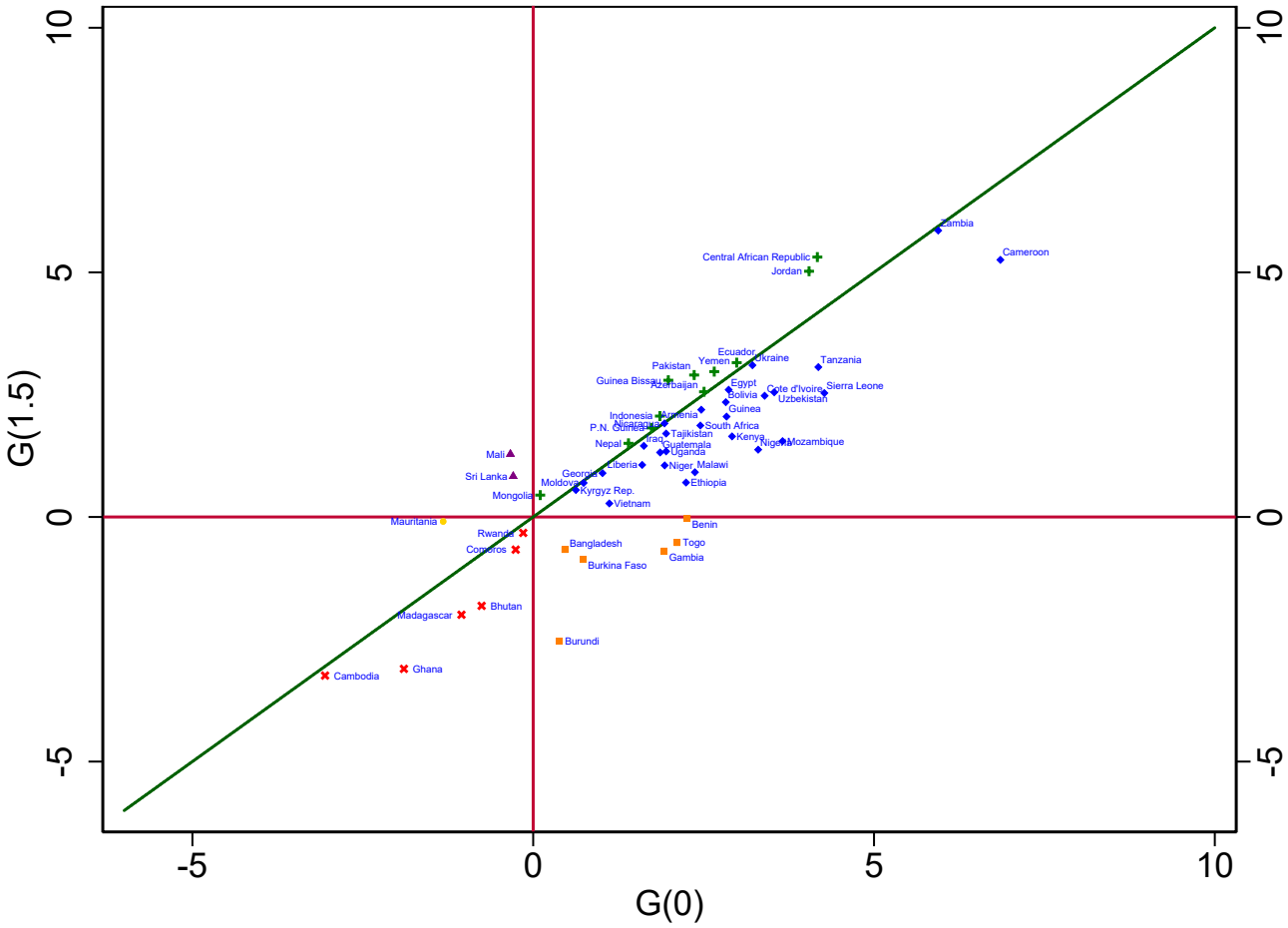
(a) Mali



Notes: The solid line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 8
Trade-Off Resolution

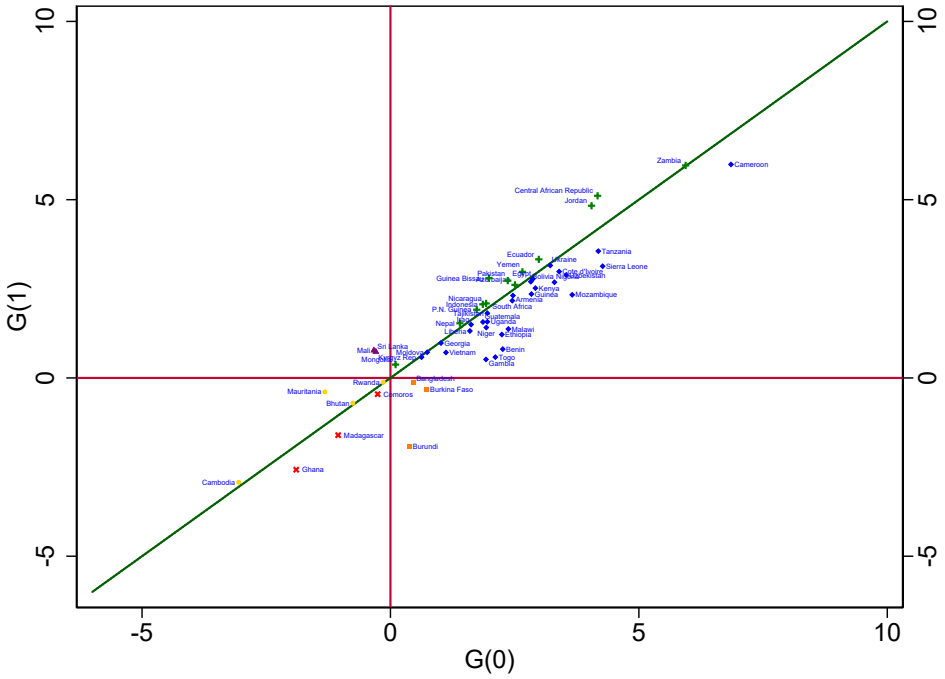
(a) $\varepsilon = 1.5$



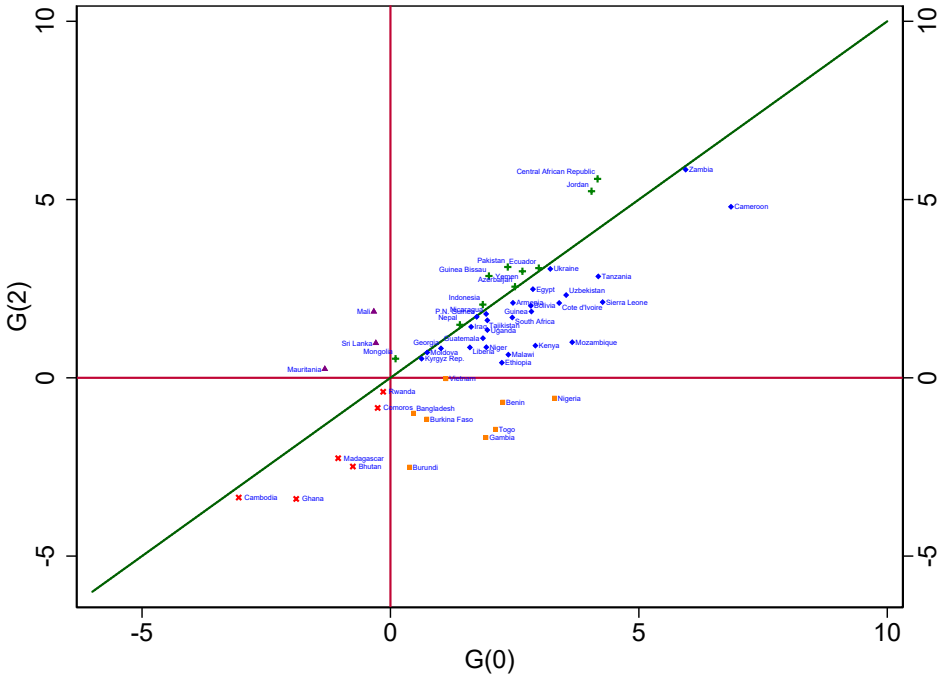
Notes: scatter plot of the inequality-adjusted gains from trade $G(\varepsilon)$, at $\varepsilon = 1.5$, against the gains from trade $G(0)$. The symbols represent the trade-off resolution: ✚: no trade-off, liberalize; ◆: soft trade-off, liberalize; ■: policy reversal, liberalize; ✖: no trade-off, protect; ▲: policy reversal, protect; ●: soft trade-off, protect.

Figure 9
Trade-Off Resolution

(a) $\varepsilon = 1$



(b) $\varepsilon = 2$



Notes: scatter plot of the inequality-adjusted gains from trade $G(\varepsilon)$ against the gains from trade $G(0)$, for $\varepsilon = 1$ (panel a) and $\varepsilon = 2$ (panel b). The symbols represent the trade-off resolution: ✚: no trade-off, liberalize; ◆: soft trade-off, liberalize; ■: policy reversal, liberalize; ✖: no trade-off, protect; ▲: policy reversal, protect; ●: soft trade-off, protect.

Table 1
Average Tariffs

Country	Staple Agric.	Non-Staple Agric.	Manufactures
Benin	12.2	16.9	10.8
Burkina Faso	12.0	18.3	9.3
Burundi	23.8	21.6	10.8
Cameroon	13.8	22.5	23.0
Central African Rep.	16.6	23.7	21.8
Comoros	1.8	10.4	8.9
Côte d'Ivoire	10.4	10.2	9.2
Egypt, Arab Rep.	7.1	28.0	18.0
Ethiopia	10.1	13.3	12.4
Gambia, The	6.6	13.5	13.9
Ghana	16.4	11.6	14.3
Guinea	13.9	18.9	9.5
Guinea-Bissau	13.5	15.7	12.8
Kenya	18.7	25.1	11.0
Liberia	6.3	5.6	16.4
Madagascar	8.3	9.6	14.8
Malawi	8.2	22.0	9.3
Mali	11.2	16.8	8.8
Mauritania	9.2	14.8	15.9
Mozambique	8.8	13.9	7.4
Niger	12.2	17.6	9.3
Nigeria	11.3	19.8	11.0
Rwanda	21.0	30.1	11.0
Sierra Leone	11.8	16.2	9.7
South Africa	7.1	6.4	16.8
Tanzania	12.6	29.1	10.7
Togo	11.6	18.6	9.5
Uganda	11.4	29.7	10.0
Zambia	17.1	19.7	6.8

Country	Staple Agric.	Non-Staple Agric.	Manufactures
Armenia	6.9	7.3	6.7
Bangladesh	7.4	4.9	18.8
Bhutan	43.7	46.1	23.5
Cambodia	13.0	6.4	10.1
Indonesia	6.0	1.9	6.1
Iraq	5.0	5.0	5.0
Jordan	7.9	18.6	8.3
Kyrgyz Republic	6.1	6.1	4.0
Mongolia	5.3	6.5	4.9
Nepal	9.0	11.7	13.9
Pakistan	3.7	8.1	17.4
Papua New Guinea	4.7	12.4	0.9
Sri Lanka	7.8	16.3	15.3
Tajikistan	7.4	5.8	8.3
Uzbekistan	14.8	11.4	8.5
Vietnam	11.1	6.3	9.8
Yemen, Rep.	4.4	7.6	7.7
Azerbaijan	5.7	4.0	10.4
Georgia	6.0	6.4	0.5
Moldova	7.9	10.7	3.3
Ukraine	4.8	5.1	4.8
Bolivia	11.0	12.6	15.1
Ecuador	14.4	15.4	14.0
Guatemala	10.3	10.2	7.4
Nicaragua	12.1	9.8	9.1
Average	10.8	14.4	10.9
Pop. weighted average	9.0	12.1	11.8
GDP weighted average	8.1	10.2	10.9

Notes: Authors' calculations based on United Nations COMTRADE and UNCTAD TRAINS data. The average tariff is expressed in percentage points.

Table 2
Expenditure Shares

Country	Staple Agric.	Non-Staple Agric.	Manuf.	Non-Traded	Other Cons.	Home	Country	Staple Agric.	Non-Staple Agric.	Manuf.	Non-Traded	Other Cons.	Home
Benin	34.4	3.8	23.3	10.7	6.1	21.6	Armenia	55.5	8.0	7.1	21.2	0.0	8.2
Burkina Faso	24.4	12.3	16.1	8.8	8.3	30.1	Bangladesh	45.3	9.0	14.1	16.2	4.4	11.0
Burundi	41.8	9.9	20.2	12.7	10.8	4.6	Bhutan	26.9	7.2	25.5	15.8	12.4	12.3
Cameroon	46.8	6.1	17.1	14.7	5.9	9.4	Cambodia	31.2	12.4	16.0	18.8	8.5	13.0
Central African Rep.	40.4	18.5	21.3	7.9	0.2	11.7	Indonesia	29.3	11.7	11.4	22.8	13.5	11.3
Comoros	48.1	9.5	10.8	17.3	5.2	9.2	Iraq	32.3	5.2	35.2	23.0	3.4	0.8
Côte d'Ivoire	35.7	3.9	22.2	20.5	6.5	11.3	Jordan	35.1	15.2	19.1	29.1	1.2	0.2
Egypt, Arab Rep.	45.5	4.9	13.8	31.4	2.0	2.4	Kyrgyz Republic	42.3	5.5	25.5	13.6	3.4	9.7
Ethiopia	23.1	9.1	17.0	2.9	10.1	37.7	Mongolia	47.6	8.9	14.3	8.8	1.1	19.3
Gambia, The	45.3	11.5	11.3	12.0	10.4	9.6	Nepal	27.3	4.8	11.7	27.6	4.7	23.9
Ghana	7.7	1.4	30.8	33.0	15.5	11.5	Pakistan	28.2	7.7	23.4	12.9	6.6	21.3
Guinea	33.0	11.9	18.3	12.6	5.0	19.2	Papua New Guinea	36.2	12.2	5.8	5.0	13.7	27.1
Guinea-Bissau	50.7	6.3	6.6	7.4	4.2	24.7	Sri Lanka	32.6	10.2	9.4	19.4	21.7	6.7
Kenya	30.2	9.7	23.4	24.9	2.4	9.4	Tajikistan	37.8	5.5	24.8	14.8	3.2	13.9
Liberia	47.1	7.2	12.4	15.2	2.5	15.6	Uzbekistan	36.5	5.1	7.5	10.5	1.9	38.5
Madagascar	37.2	7.2	12.0	3.6	0.7	39.4	Vietnam	37.3	6.5	19.6	15.3	10.6	10.7
Malawi	25.8	5.7	29.1	6.9	0.7	31.8	Yemen, Rep.	39.2	20.4	17.5	15.5	4.4	3.1
Mali	25.6	7.6	4.2	4.9	0.5	57.1							
Mauritania	47.2	11.5	14.6	6.7	0.7	19.3	Azerbaijan	51.1	5.9	20.9	11.6	1.6	9.0
Mozambique	44.7	5.3	14.7	3.9	1.5	29.9	Georgia	34.1	7.8	23.7	27.6	4.7	2.1
Niger	35.7	8.8	17.1	6.5	10.2	21.7	Moldova	16.4	2.2	32.1	15.3	7.0	27.1
Nigeria	47.9	3.6	18.0	9.4	0.5	20.6	Ukraine	44.8	11.4	20.0	16.3	0.1	7.4
Rwanda	24.3	4.9	10.6	9.0	29.0	22.2							
Sierra Leone	46.2	10.4	12.4	10.8	4.4	15.8	Bolivia	44.0	7.7	16.8	23.9	1.3	6.4
South Africa	31.6	8.3	31.8	16.4	11.8	0.1	Ecuador	42.2	3.9	16.8	21.5	8.5	7.2
Tanzania	29.4	6.6	19.1	9.9	6.2	28.8	Guatemala	37.7	5.3	19.8	17.8	4.8	14.6
Togo	39.0	7.8	15.1	26.2	5.8	6.1	Nicaragua	40.8	4.9	16.6	19.1	1.0	17.7
Uganda	24.2	7.6	16.4	17.9	2.0	31.9							
Zambia	53.5	4.8	6.3	10.1	0.6	21.8	Average	37.0	8.0	17.4	15.1	5.8	16.6
							Pop. weighted av.	35.4	7.9	17.5	15.9	6.6	16.6
							GDP weighted av.	35.9	8.0	18.5	18.3	7.5	11.7

Notes: Authors' calculations based on household survey data. The average expenditure shares are expressed in percentage points.

Table 3
Income Shares

Country	Staple Agric.	Non-Staple Agric.	Wages	Family Enterp.	Other	Home Cons.	Country	Staple Agric.	Non-Staple Agric.	Wages	Family Enterp.	Other	Home Cons.
Benin	14.2	10.0	13.1	0.0	40.9	21.8	Armenia	9.2	0.1	35.1	6.5	40.6	8.5
Burkina Faso	19.1	2.9	13.4	17.7	12.9	34.0	Bangladesh	33.0	2.1	31.4	14.3	12.1	7.1
Burundi	39.5	29.4	8.1	7.5	11.0	4.5	Bhutan	12.9	0.0	44.2	9.3	8.6	25.1
Cameroon	15.4	0.1	27.3	23.1	0.0	34.1	Cambodia	24.2	0.5	30.8	23.6	5.3	15.6
Central African Rep,	42.5	9.3	2.4	3.4	4.3	38.1	Indonesia	4.6	1.2	38.2	0.6	20.9	34.4
Comoros	24.2	3.7	26.7	16.4	11.1	17.8	Iraq	8.1	1.6	49.2	11.9	28.4	0.8
Côte d'Ivoire	7.1	13.7	17.0	28.4	15.7	18.2	Jordan	1.7	2.1	45.2	8.9	41.0	1.0
Egypt, Arab Rep.	6.9	6.9	41.1	15.1	29.8	0.2	Kyrgyz Republic	12.2	1.4	40.4	12.0	27.4	6.6
Ethiopia	14.3	0.5	5.2	24.3	10.9	44.8	Mongolia	10.1	0.3	38.1	8.7	31.6	11.1
Gambia, The	2.7	6.7	45.7	21.9	8.6	14.4	Nepal	4.1	1.2	25.8	11.1	22.1	35.7
Ghana	8.5	5.5	58.5	0.0	12.0	15.6	Pakistan	7.6	3.1	45.9	12.1	13.8	17.5
Guinea	17.5	3.2	7.0	18.2	13.5	40.5	Papua New Guinea	13.8	6.5	14.8	9.6	17.9	37.2
Guinea-Bissau	5.5	21.9	21.7	7.8	10.4	32.8	Sri Lanka	13.1	4.6	48.8	19.3	0.0	14.2
Kenya	21.8	3.1	35.4	5.3	17.8	16.6	Tajikistan	0.9	1.5	38.7	8.5	22.4	28.0
Liberia	10.2	3.4	22.2	29.2	9.9	25.1	Uzbekistan	7.4	0.2	20.3	11.2	20.7	40.2
Madagascar	27.1	3.0	23.0	13.1	5.1	28.8	Vietnam	21.1	3.5	35.3	19.6	13.1	7.4
Malawi	18.4	4.6	21.4	12.7	3.8	39.0	Yemen, Rep.	7.8	9.2	43.7	15.3	21.2	2.8
Mali	8.7	2.8	8.3	10.5	15.4	54.3							
Mauritania	13.4	0.0	3.7	10.1	30.8	42.0	Azerbaijan	28.8	1.9	26.1	2.9	26.2	14.1
Mozambique	10.4	7.1	15.1	10.4	10.0	46.9	Georgia	7.3	1.9	29.2	7.8	51.9	1.9
Niger	17.3	3.1	4.0	1.5	38.2	35.9	Moldova	5.5	2.1	30.4	1.7	26.3	33.9
Nigeria	15.5	5.6	33.2	10.3	4.6	30.8	Ukraine	2.8	0.0	43.5	0.1	48.0	5.6
Rwanda	10.5	3.7	24.7	2.5	11.8	46.7							
Sierra Leone	18.7	4.6	11.0	13.3	19.6	32.7	Bolivia	6.3	7.6	36.1	27.3	16.2	6.5
South Africa	0.6	0.0	54.9	0.0	43.6	0.8	Ecuador	10.6	1.1	48.4	16.7	17.3	5.8
Tanzania	10.9	3.0	23.0	5.5	11.6	46.0	Guatemala	6.4	2.9	45.2	18.0	14.1	13.4
Togo	8.7	6.5	30.2	37.2	9.7	7.7	Nicaragua	10.9	2.8	40.4	18.4	13.5	14.0
Uganda	9.7	2.9	21.6	18.7	13.9	33.1							
Zambia	5.7	1.7	21.0	13.3	18.8	39.5	Average	12.9	4.2	29.0	12.5	18.6	22.8
							Pop. weighted av.	12.8	3.3	33.0	11.2	17.0	22.7
							GDP weighted av.	9.4	2.7	39.0	8.1	21.6	19.3

Notes: Authors' calculations based on household survey data. The average income shares are expressed in percentage points.

Table 4
Gains from Trade - Winners

	Gains	Expenditure			Income				
		agric.	manuf.	total	agric.	wage	enter.	rev.	total
Cameroon	6.9	8.9	3.6	12.5	-1.7	-1.3	-0.7	-1.9	-5.6
Zambia	5.9	7.8	1.2	9.0	-1.0	-0.5	-0.7	-0.8	-3.0
Sierra Leone	4.3	5.8	1.7	7.4	-1.5	-0.1	-0.1	-1.5	-3.1
Tanzania	4.2	4.7	4.1	8.8	-1.7	-1.1	-0.2	-1.7	-4.6
Central African Rep,	4.2	7.1	3.7	10.8	-4.5	-0.0	0.0	-2.1	-6.6
Jordan	4.0	6.2	2.1	8.3	-0.3	-0.4	-0.1	-3.4	-4.2
Mozambique	3.7	6.0	1.2	7.2	-1.1	-0.3	-0.1	-2.0	-3.6
Uzbekistan	3.5	5.0	1.9	7.0	-0.7	-1.1	-0.4	-1.2	-3.4
Côte d'Ivoire	3.4	4.6	2.6	7.2	-1.7	-0.6	-0.4	-1.1	-3.8
Nigeria	3.3	6.2	2.2	8.3	-1.6	-1.8	-0.3	-1.3	-5.0
Ukraine	3.2	3.7	0.9	4.6	-0.2	-0.2	-0.0	-0.9	-1.3
Ecuador	3.0	5.9	1.5	7.3	-1.6	-1.4	-0.3	-1.0	-4.4
Kenya	2.9	6.1	2.5	8.6	-2.8	-1.2	-0.1	-1.6	-5.7
Egypt, Arab Rep.	2.9	4.7	1.9	6.6	-1.3	-1.1	-0.4	-1.0	-3.7
Guinea	2.8	4.9	2.9	7.8	-1.9	-0.1	-0.2	-2.9	-5.0
Bolivia	2.8	4.2	2.3	6.5	-1.2	-0.6	-0.6	-1.3	-3.7
Yemen, Rep.	2.7	4.1	1.3	5.4	-0.8	-0.4	-0.1	-1.5	-2.8
Azerbaijan	2.5	3.9	2.3	6.2	-2.3	-0.1	0.0	-1.3	-3.7
Armenia	2.5	3.8	0.4	4.1	-0.5	-0.3	-0.0	-0.9	-1.7
South Africa	2.5	1.2	2.9	4.2	-0.0	-1.0	0.0	-0.7	-1.7
Malawi	2.4	4.1	2.8	6.9	-2.4	-0.6	-0.3	-1.2	-4.5
Pakistan	2.4	2.0	3.7	5.7	-1.4	-0.8	-0.3	-0.8	-3.3
Benin	2.3	4.8	2.9	7.7	-2.0	-0.2	-0.0	-3.2	-5.4
Ethiopia	2.2	3.7	3.6	7.3	-2.9	-0.0	-0.7	-1.4	-5.1
Togo	2.1	5.3	1.8	7.1	-0.9	-1.0	-0.9	-2.3	-5.0
Guinea-Bissau	2.0	4.7	0.8	5.5	-0.9	-0.3	-0.0	-2.3	-3.5
Tajikistan	2.0	3.3	1.4	4.7	-0.2	-0.6	-0.0	-2.0	-2.8
Uganda	2.0	5.4	1.1	6.6	-2.0	-1.0	-0.3	-1.4	-4.6
Niger	1.9	4.3	2.0	6.3	-2.4	-0.0	-0.0	-1.9	-4.4
Nicaragua	1.9	5.0	1.1	6.1	-1.7	-0.9	-0.3	-1.3	-4.1
Gambia, The	1.9	6.5	1.5	8.0	-0.7	-1.1	-0.6	-3.7	-6.1
Guatemala	1.9	3.6	1.2	4.8	-0.8	-1.0	-0.2	-0.9	-2.9
Indonesia	1.9	2.8	0.5	3.2	-0.2	-0.6	-0.0	-0.6	-1.4
Papua New Guinea	1.7	4.3	0.4	4.7	-2.3	-0.2	-0.0	-0.5	-3.0
Iraq	1.6	1.5	2.0	3.5	-0.3	-0.3	-0.1	-1.2	-1.8
Liberia	1.6	3.3	1.3	4.6	-0.8	-0.4	-0.5	-1.3	-3.0
Nepal	1.4	2.7	1.6	4.4	-0.5	-0.3	-0.1	-2.0	-3.0
Vietnam	1.1	5.1	2.0	7.1	-2.8	-1.0	-0.4	-1.8	-5.9
Georgia	1.0	2.1	0.1	2.2	-0.6	-0.0	-0.0	-0.6	-1.2
Moldova	0.7	1.4	1.5	2.9	-0.6	-0.1	-0.0	-1.4	-2.1
Burkina Faso	0.7	3.8	2.3	6.1	-2.4	-0.6	-0.5	-1.9	-5.4
Kyrgyz Republic	0.6	1.8	1.4	3.2	-0.7	-0.2	-0.0	-1.6	-2.6
Bangladesh	0.5	4.9	2.3	7.2	-3.8	-1.5	-0.1	-1.3	-6.7
Burundi	0.4	6.9	2.2	9.0	-6.2	-0.5	-0.0	-1.8	-8.6
Mongolia	0.1	2.7	0.6	3.4	-0.6	-0.2	-0.1	-2.4	-3.3
Average	2.4	4.5	1.9	6.4	-1.5	-0.6	-0.2	-1.6	-3.9
Pop. weighted av.	2.3	4.1	2.1	6.2	-1.6	-0.9	-0.2	-1.2	-3.9
GDP weighted av.	2.4	3.7	1.8	5.4	-1.0	-0.9	-0.2	-1.0	-3.1

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table 5
Gains from Trade - Losers

	Gains	Expenditure			Income				
		agric.	manuf.	total	agric.	wage	enter.	rev.	total
Cambodia	-3.1	4.4	0.9	5.4	-4.5	-0.8	0.0	-3.1	-8.4
Ghana	-1.9	1.0	2.9	3.9	-1.2	-2.8	0.0	-1.8	-5.8
Mauritania	-1.3	4.5	1.8	6.3	-1.1	-0.1	-0.0	-6.5	-7.6
Madagascar	-1.1	3.2	0.8	3.9	-2.3	-0.9	-0.1	-1.7	-5.0
Bhutan	-0.8	8.5	5.3	13.8	-3.1	-2.8	0.0	-8.7	-14.6
Mali	-0.3	2.4	0.2	2.6	-0.9	-0.0	-0.0	-2.0	-3.0
Sri Lanka	-0.3	3.3	0.8	4.1	-1.4	-1.2	-0.7	-1.0	-4.4
Comoros	-0.3	1.6	1.3	3.0	-0.6	-0.3	-0.3	-2.0	-3.2
Rwanda	-0.1	3.7	1.4	5.1	-2.5	-1.1	-0.0	-1.6	-5.2
Average	-1.0	3.6	1.7	5.3	-2.0	-1.1	-0.1	-3.2	-6.4
Pop.weighted av.	-1.2	2.9	1.3	4.2	-1.9	-1.2	-0.2	-2.0	-5.4
GDP weighted av.	-1.0	2.8	1.4	4.2	-1.7	-1.5	-0.3	-1.8	-5.3

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table 6
Income Gains and Inequality Costs
without Trade Policy Preference Reversals

	Income Gains $\frac{\mu_1-\mu_0}{\mu_0}$	Equality Gains $\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$		
		$\varepsilon = 0.5$	$\varepsilon = 1$	$\varepsilon = 10$
A) Countries without Trade-offs				
Guinea-Bissau	2.0	0.5	0.7	0.8
Central African Republic	4.2	0.4	0.8	2.1
Jordan	4.1	0.4	0.7	0.3
Yemen, Rep.	2.7	0.2	0.3	0.1
Mongolia	0.1	0.1	0.2	0.5
Comoros	-0.3	-0.1	-0.2	-1.8
Rwanda	-0.2	-0.2	-0.2	-4.9
Madagascar	-1.1	-0.3	-0.7	-2.4
Ghana	-1.9	-0.4	-0.8	-2.3
B) Countries with Trade-offs				
Indonesia	1.9	0.1	0.2	-0.4
Pakistan	2.4	0.0	0.3	-0.2
Azerbaijan	2.5	0.0	0.0	-0.6
Zambia	5.9	-0.0	-0.1	-0.0
Moldova	0.7	-0.0	-0.0	0.6
Kyrgyz Republic	0.6	-0.0	-0.1	-0.0
Ukraine	3.2	-0.0	-0.1	-0.7
Egypt, Arab Rep.	2.9	-0.1	-0.2	-0.8
Tajikistan	1.9	-0.1	-0.2	-0.6
Iraq	1.6	-0.1	-0.1	-0.3
Armenia	2.5	-0.1	-0.2	-1.0
South Africa	2.5	-0.1	-0.4	-1.2
Guinea	2.8	-0.3	-0.6	-0.8
Uganda	1.9	-0.3	-0.5	0.3
Uzbekistan	3.5	-0.4	-0.7	-2.4
Cameroon	6.8	-0.5	-1.1	-5.0
Cambodia	-3.0	0.0	-0.1	-0.8
Bhutan	-0.8	-0.1	-0.5	-7.5

Notes: Authors' calculations. The table presents the decomposition of the inequality-adjusted gains from trade $G(\varepsilon)$. The first column reports the average income gains from trade (the proportional change in real household expenditures). The three remaining columns show the equality gains (due to changes in inequality) for different values of inequality aversion ($\varepsilon = 0.5$,$\varepsilon = 1$, and $\varepsilon = 10$). The inequality-adjusted gains from trade is the *sum* of the income gains and the equality gains.

Table 7
Income Gains and Inequality Costs with Trade Policy Preference Reversals

	Trade Policy Preference Reversals			Potential Reversals	
	$\varepsilon*$	Lower Bound	Upper bound	Lower Bound	Upper Bound
A) Countries with Income Gains					
Burkina Faso	0.6	0.5	0.7		
Bangladesh	0.6	0.5	0.7		
Gambia, The	1.2	1.1	1.3		
Togo	1.2	1.2	1.3		
Benin	1.5	1.4	1.6		
Nigeria	1.9	1.8	2.0		
Vietnam	2.0	1.8	2.1		
Kenya	2.5	2.4	2.7		
Ethiopia	3.1	2.7	3.6		
Mozambique	3.5	2.9	8.5		
Papua New Guinea	4.4	3.1	–		
Liberia	4.5	3.6	–		
Guatemala	7.0	5.2	–		
Malawi	7.1	4.1	–		
Sierra Leone				4.0	–
Bolivia				4.1	–
Niger				6.0	–
Nicaragua				6.3	–
Côte d'Ivoire				7.0	–
Georgia				7.1	–
Tanzania				8.9	–
Nepal				9.3	–
Ecuador				9.9	–
B) Countries with Income Losses					
Mali	0.4	0.2	0.5		
Mauritania	1.6	1.5	1.8		
C) Countries with multiple (potential) reversals					
Countries with Income Gains					
Burundi	0.1	0	0.2	5.6	7.1
Countries with Income Losses					
Sri Lanka	0.3	0.2	0.4		
	8.9	7.2	–		

Notes: Authors' calculations. The table presents estimates of the trade-ε^*, the cut-off value of inequality aversion at which there is a reversal of trade policy preference in terms of social welfare. The standard errors are bootstrapped using 1000 replications.

Table 8
Decomposing Equality Gains

	Consumption Equality Gains			Income Equality Gains		
	$\varepsilon = 0.5$	$\varepsilon = 1$	$\varepsilon = 10$	$\varepsilon = 0.5$	$\varepsilon = 1$	$\varepsilon = 10$
Benin	0.9	1.4	2.9	-0.4	-0.7	-1.1
Burkina Faso	0.8	1.4	2.8	-0.3	-0.6	-3.0
Burundi	0.6	1.3	6.7	-0.1	-0.3	-3.5
Cameroon	0.5	1.0	3.3	-0.1	-0.1	0.7
Central African Republic	0.3	0.5	0.2	0.1	0.2	0.6
Comoros	0.4	0.8	0.8	-0.0	-0.1	-0.5
Côte d'Ivoire	0.3	0.6	1.4	-0.2	-0.3	-1.2
Egypt, Arab Rep.	0.1	0.2	0.8	0.0	0.0	-0.4
Ethiopia	0.6	1.0	1.6	-0.4	-0.9	-4.4
Gambia, The	0.2	0.4	0.3	-0.1	-0.2	-0.7
Ghana	0.2	0.4	1.0	-0.1	-0.3	-2.2
Guinea	0.2	0.4	0.6	-0.1	-0.3	-9.4
Guinea-Bissau	0.3	0.5	0.3	-0.2	-0.4	-2.4
Kenya	0.2	0.6	1.8	-0.2	-0.3	-2.0
Liberia	0.4	0.6	0.5	-0.3	-0.6	-1.3
Madagascar	0.2	0.3	0.6	-0.1	-0.3	-1.2
Malawi	0.0	0.0	-0.3	-0.0	-0.1	-0.5
Mali	-0.0	-0.0	0.4	-0.0	-0.0	0.2
Mauritania	0.1	0.2	0.5	-0.1	-0.3	-0.7
Mozambique	-0.0	-0.0	-0.1	-0.0	-0.0	0.1
Niger	-0.0	-0.0	-0.3	-0.0	-0.0	-0.4
Nigeria	0.2	0.4	1.0	-0.3	-0.5	-1.8
Rwanda	-0.0	-0.0	-0.2	-0.1	-0.1	-0.4
Sierra Leone	0.2	0.4	-0.1	-0.3	-0.6	-2.7
South Africa	-0.0	0.0	0.4	-0.1	-0.1	-0.7
Tanzania	-0.0	-0.1	-1.0	-0.0	-0.1	0.0
Togo	0.1	0.1	-0.4	-0.2	-0.3	-1.4
Uganda	0.9	1.5	2.0	-1.0	-2.0	-11.7
Zambia	-0.0	-0.2	-1.5	-0.1	-0.2	0.3
Armenia	-0.1	-0.2	-0.2	-0.1	-0.2	-1.8

Notes: The table presents the decomposition of the equality gains from trade $G(\varepsilon) - G(0)$. The first three column report the average consumption equality gains from trade for different values of inequality aversion ($\varepsilon = 0.5$, $\varepsilon = 1$, and $\varepsilon = 10$). These consumption equality gains are calculated by assuming that liberalization only impacts consumption and not income. The three remaining columns report the income equality gains from trade for different values of inequality aversion ($\varepsilon = 0.5$, $\varepsilon = 1$, and $\varepsilon = 10$), calculated by assuming that liberalization only impacts income but not consumption.

Table 8
Decomposing Equality Gains (Continued)

	Consumption Equality Gains			Income Equality Gains		
	$\varepsilon = 0.5$	$\varepsilon = 1$	$\varepsilon = 10$	$\varepsilon = 0.5$	$\varepsilon = 1$	$\varepsilon = 10$
Bangladesh	0.1	0.2	0.0	-0.3	-0.5	-2.2
Bhutan	0.3	0.7	1.7	-0.4	-0.9	-6.7
Cambodia	1.0	1.6	-0.2	-1.2	-2.3	-9.7
Indonesia	0.1	0.2	0.7	-0.3	-0.7	-3.8
Iraq	0.2	0.4	-0.6	-0.5	-0.9	-2.9
Jordan	-0.1	-0.3	-4.3	-0.2	-0.5	-5.0
Kyrgyz Republic	-0.1	-0.1	-0.3	-0.2	-0.4	-0.7
Mongolia	-0.0	-0.1	1.4	-0.3	-0.5	-2.5
Nepal	-0.1	-0.1	2.3	-0.2	-0.4	-2.4
Pakistan	-0.1	-0.2	0.3	-0.2	-0.5	-2.8
Papua New Guinea	-0.4	-0.8	-2.6	0.0	0.0	-0.3
Sri Lanka	0.0	-0.0	-0.9	-0.4	-0.8	-2.8
Tajikistan	0.2	0.4	0.7	-0.6	-1.3	-3.2
Uzbekistan	0.1	0.1	-0.1	-0.6	-1.0	-3.7
Vietnam	0.2	0.3	0.1	-0.7	-1.4	-6.1
Yemen, Rep.	-0.4	-0.7	-1.2	-0.2	-0.4	-1.5
Azerbaijan	-0.0	-0.2	-0.5	-0.6	-1.3	-6.4
Georgia	-0.2	-0.4	-1.1	-0.4	-0.7	-3.3
Moldova	-0.3	-0.5	-1.9	-0.4	-0.7	-2.4
Ukraine	-0.1	-0.2	-4.3	-0.5	-1.1	-0.5
Bolivia	-0.5	-1.1	-3.8	-0.2	-0.4	-2.7
Ecuador	0.1	0.1	-0.7	-0.8	-1.8	-5.3
Guatemala	-0.4	-0.7	-3.3	-0.4	-0.8	-3.4
Nicaragua	0.9	1.9	0.5	-2.6	-4.5	-9.4
Average	0.2	0.3	0.1	-0.3	-0.6	-2.6
Pop. weighted av.	0.1	0.2	0.4	-0.3	-0.6	-2.8
GDP weighted av.	0.1	0.2	0.2	-0.3	-0.6	-2.7

Notes: The table presents the decomposition of the equality gains from trade $G(\varepsilon) - G(0)$. The first three column report the average consumption equality gains from trade for different values of inequality aversion ($\varepsilon = 0.5$, $\varepsilon = 1$, and $\varepsilon = 10$). These consumption equality gains are calculated by assuming that liberalization only impacts consumption and not income. The three remaining columns report the income equality gains from trade for different values of inequality aversion ($\varepsilon = 0.5$, $\varepsilon = 1$, and $\varepsilon = 10$), calculated by assuming that liberalization only impacts income but not consumption.

Table 9
Robustness Tests

	Baseline	No Wage Response	No tariff redistribution	Alternative redistribution
N winners	45	50	53	45
N losers	9	4	1	9
Average (Inequality Adjusted) Gains from trade reform				
G(0)	1.9 %	2.5 %	3.7 %	1.9 %
G(1)	1.5 %	2.4 %	3.3 %	2.3 %
G(1.5)	1.3 %	2.2 %	3.1 %	2.2 %
G(2)	1.1 %	2.1 %	3.0 %	2.1 %
G(10)	-0.4 %	0.9 %	1.5 %	0.7 %
Countries without tradeoffs	11	11	8	12
of which prefer freer trade	5	10	8	12
Countries with tradeoffs	43	43	46	42
of which prefer freer trade				
$\epsilon = 1$	39	39	42	38
$\epsilon = 1.5$	36	39	42	37
$\epsilon = 2$	35	38	42	35
$\epsilon = 10$	27	27	30	23
Total number of countries that prefer freer trade				
$\epsilon = 0$	45	50	53	45
$\epsilon = 1$	44	49	50	50
$\epsilon = 1.5$	41	49	50	49
$\epsilon = 2$	40	48	50	47
$\epsilon = 10$	32	37	38	35

Notes: The table summarizes the results of various alternative models to assess the robustness of the results obtained using our baseline model present in column 1. The alternative model presented in column 2 does not allow for labor market responses. Column 3 shows the results of a model without tariff redistribution, i.e. in which governments do not increase taxes to make up for the loss of government revenue. Column 4 shows the results of model in which the government makes up the loss in tariff revenue by means of progressive taxes. Both of these last two models are discussed in greater detail in the Appendix, which also presents country specific results for all these models.

Table 10
Protectionist Scenarios

	Baseline (Liberalization)	10% relative increase	10% absolute increase	Increase to 62.4%
N winners	45	6	11	11
N losers	9	48	43	43
Average (Inequality Adjusted) Gains from trade reform				
G(0)	1.9 %	-0.2 %	-1.3 %	-5.7 %
G(1)	1.5 %	-0.2 %	-1.3 %	-7.2 %
G(1.5)	1.3 %	-0.2 %	-1.3 %	-7.8 %
G(2)	1.1 %	-0.2 %	-1.3 %	-8.3 %
G(10)	-0.4 %	-0.2 %	-1.7 %	-17.9 %
Countries without tradeoffs	11	8	9	10
of which prefer freer trade	5	6	7	9
Countries with tradeoffs	43	46	45	44
of which prefer freer trade				
$\epsilon = 1$	39	42	39	37
$\epsilon = 1.5$	36	43	38	37
$\epsilon = 2$	35	41	36	37
$\epsilon = 10$	27	33	36	42
Total number of countries that prefer freer trade				
$\epsilon = 0$	45	48	43	43
$\epsilon = 1$	44	48	46	46
$\epsilon = 1.5$	41	49	45	46
$\epsilon = 2$	40	47	43	46
$\epsilon = 10$	32	39	43	51

Notes: The table summarizes the results of three alternative protectionist trade reforms. Column 1 replicates the results of our baseline exercise in which a country eliminates its own import tariffs as a benchmark. Column 2 shows what would happen if countries were to increase their tariffs by 10% in relative terms, i.e. if all tariffs were multiplied by 1.1. Column 3 shows what would happen if all countries were to increase all of their import tariffs by 10 percentage points. Column 4 demonstrates the gains from trade and trade-offs between income gains and inequality costs if countries were to increase all of their tariffs to 62.4%, or leave them at their pre-existing levels in case tariffs were already in excess of 62.4%. See the Appendix for country specific results.

Appendix A: Household Surveys and Data Harmonization

Table A1 displays basic information on the household surveys used in the analysis. We report the name of the survey, the year when the data were collected and sample sizes (number of households). The harmonization of the household surveys and the trade and trade policy data was done in two steps. First, all household surveys product and income sources were standardized to common templates, which are shown in Figures A1-A3 below. Second, these harmonized household survey data were merged with HS6 tariff and trade data using custom-made concordances.

Table A1
Household Surveys

Country	Year	Obs	Survey
Benin	2003	5296	Questionnaire Unifié sur les Indicateurs de Base du Bien-Être
Burkina Faso	2003	8413	Enquête sur les Conditions de Vie des Ménages
Burundi	1998	6585	Enquête Prioritaire, Etude Nationale sur les Conditions de Vie des Populations
Cameroon	2001-2002	10881	Deuxième Enquête Camerounaise Auprès des Ménages
Central African Republic	2008	6828	Enquête Centrafricaine pour le Suivi-Evaluation du Bien-être
Comoros	2004	2929	Enquête Intégrale auprès des Ménages
Côte d'Ivoire	2008	12471	Enquête sur le Niveau de Vie des Ménages
Egypt, Arab Rep.	2008-2009	23193	Household Income, Expenditure and Consumption Survey
Ethiopia	1999-2000	16505	Household Income, Consumption and Expenditure Survey
The Gambia	1998	1952	Household Poverty Survey
Ghana	2005-2006	8599	Living Standards Survey V
Guinea	2012	7423	Enquête Légère pour l'Evaluation de la Pauvreté
Guinea-Bissau	2010	3141	Inquerito Ligeiro para a Avalicão da Pobreza
Kenya	2005	13026	Integrated Household Budget Survey
Liberia	2014-2015	4063	Household Income and Expenditure Survey
Madagascar	2005	11661	Permanent Survey of Households
Malawi	2004-2005	11167	Second Integrated Household Survey
Mali	2006	4449	Enquête Légère Intégrée auprès des Ménages
Mauritania	2004	9272	Enquête Permanente sur les Conditions de Vie des Ménages
Mozambique	2008-2009	10696	Inquérito sobre Orçamento Familiar
Niger	2005	6621	Enquête Nationale sur les Conditions de Vie des Ménages
Nigeria	2003-2004	18603	Living Standards Survey
Rwanda	1998	6355	Integrated Household Living Conditions Survey
Sierra Leone	2011	6692	Integrated Household Survey
South Africa	2000	25491	General Household Survey
Tanzania	2008	3232	Household Budget Survey
Togo	2011	5464	Questionnaire des Indicateurs de Base du Bien-être
Uganda	2005-2006	7350	National Household Survey
Zambia	2004	7563	Living Conditions Monitoring Survey IV

Table A1 (Continued)
Household Surveys (Continued)

Country	Year	Obs	Survey
Armenia	2014	5124	Integrated Living Conditions Survey
Bangladesh	2010	12117	Household Income and Expenditure Survey
Bhutan	2012	8879	Living Standards Survey
Cambodia	2013	3801	Socio-Economic Survey
Indonesia	2007	12876	Indonesian Family Life Survey
Iraq	2012	24895	Household Socio-Economic Survey
Jordan	2010	11110	Household Expenditure and Income Survey
Krygyz Republic	2012	4962	Intergrated Sample Household Budget and Labor Survey
Mongolia	2011	11089	Household Socio-Economic Survey
Nepal	2010-2011	5929	Living Standards Survey
Pakistan	2010-2011	16178	Social and Living Standards Measurement Survey
Papua New Guinea	2009	3776	Household Income and Expenditure Survey
Sri Lanka	2012-2013	20335	Household Income and Expenditure Survey
Tajikistan	2009	1488	Tajikistan Panel Survey
Uzbekistan	2003	9419	Household Budget Survey
Vietnam	2012	9306	Household Living Standard Survey
Yemen, Rep.	2005-2006	12998	Household Budget Survey
Azerbaijan	2005	4797	Household Budget Survey
Georgia	2014	10959	Household Integrated Survey
Moldova	2014	4836	Household Budget Survey
Ukraine	2012	10394	Sampling Survey of the Conditions of Life of Ukraine's Households
Bolivia	2008	3900	Encuesta de Hogares
Ecuador	2013-2014	28680	Encuesta de Condiciones de Vida
Guatemala	2014	11420	Encuesta Nacional de Condiciones de Vida
Nicaragua	2009	6450	Nicaragua - Encuesta Nacional de Hogares sobre Medición de Niveles de Vida

Figure A1
Expenditure Template

Expenditure								
1. Agriculture/Food								
11. Staple Food								
111. Cereals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 1282. Other non-staple
2. Manufacturing/Household 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. Communication 35. Other Services								
4. Other Expenditures								
41. Remittances/transfers given 42. Investment of any sort 43. Festivities 44. Other Disbursement								

Figure A2
Auto-Consumption Template

Autoconsumption								
1. Agriculture/Food								
11. Staple Food								
111. Cereals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 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								

Figure A3
Income Template

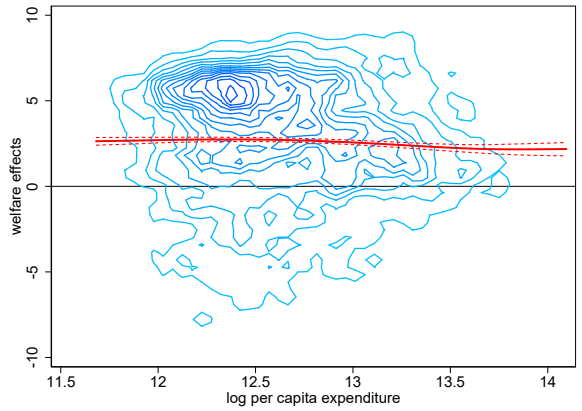
Income								
1. Agriculture/Food								
11. Staple Food								
111. Cereals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 1282. Other non-staple
2. Wages								
20. Agriculture, forestry, and fishing 21. Mining, oil, and gas extraction 22. Manufacturing 23. Construction 24. Transportation, communications, electric, gas, and sanitary services 25. Wholesale and retail trade 26. Finance, insurance, and real estate 27. Entertainment Services (Restaurant, entertainment, hotels, etc.) 28. Professional Services (Education, health, other professional occupations) 29. Public Administration								
3. Sales of Goods/Services								
30. Agriculture, forestry, and fishing (n.e.c.) 31. Mining, oil, and gas extraction 32. Manufacturing 33. Construction 34. Transportation, communications, electric, gas, and sanitary services 35. Wholesale and retail trade 36. Finance, insurance, and real estate 37. Entertainment Services (Restaurant, entertainment, hotels, etc.) 38. Professional Services (Education, health, other professional occupations) 39. Public Administration								
4. Transfers								
41. Remittances/transfers received (friend, relative) 42. Profits of investment (rent, interests) 43. Government transfers 44. Non-governmental transfers 45. Other								

Appendix B: Distributional Effects

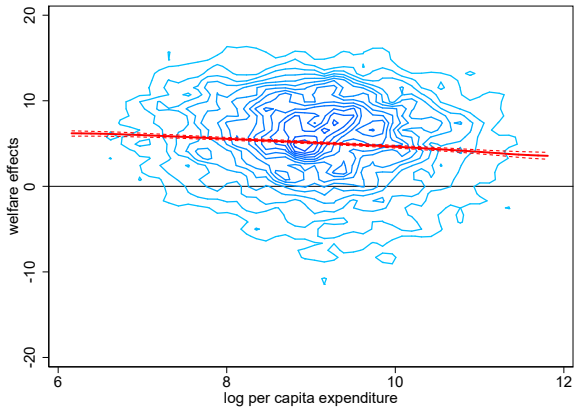
This Appendix includes plots of the distributional effects (kernel regressions and bivariate kernel densities) for each of the 54 countries. We first report 17 cases with a pro-poor bias (Figures B1 to B3), then show another 37 cases with a pro-rich bias (Figures B4 to B10).

Figure B1
Pro-Poor Bias

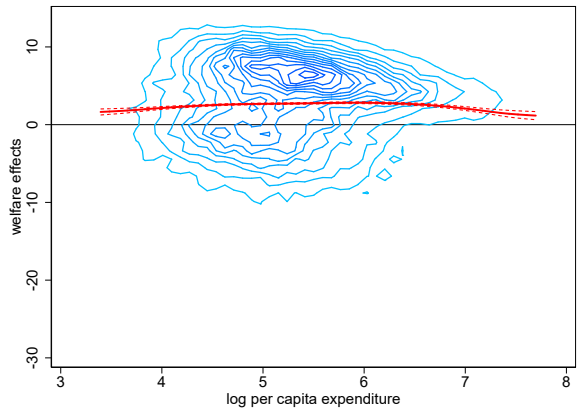
(a) Azerbaijan



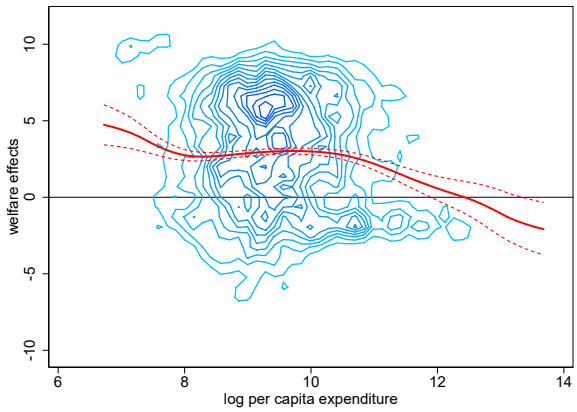
(b) Central African Republic



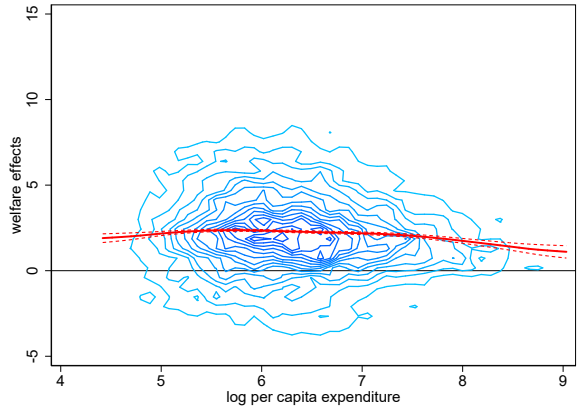
(c) Ecuador



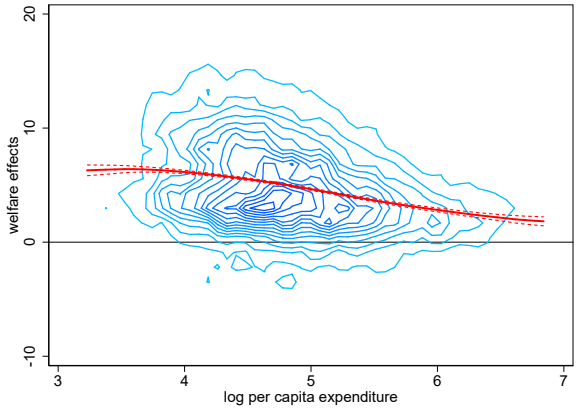
(d) Guinea-Bissau



(e) Indonesia



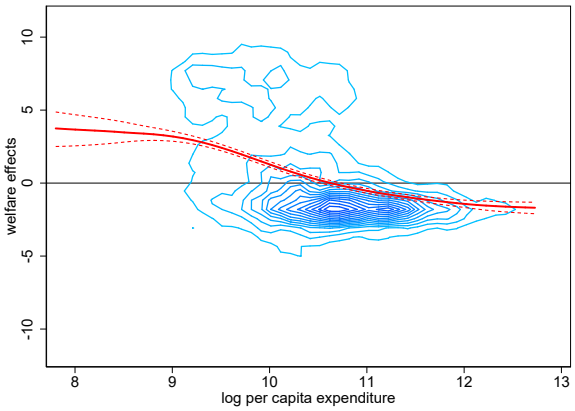
(f) Jordan



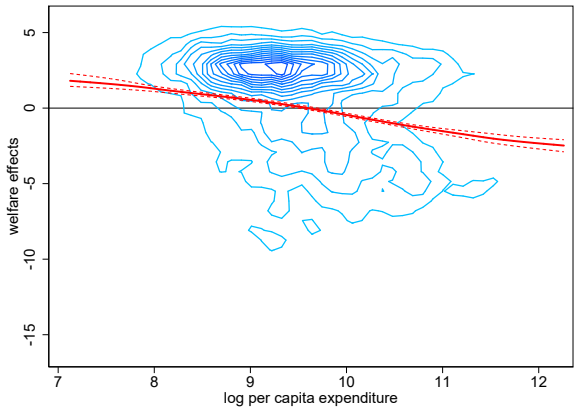
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

Figure B2
Pro-Poor Bias

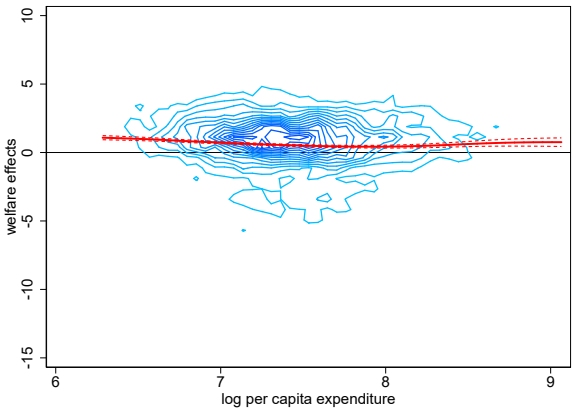
(a) Mali



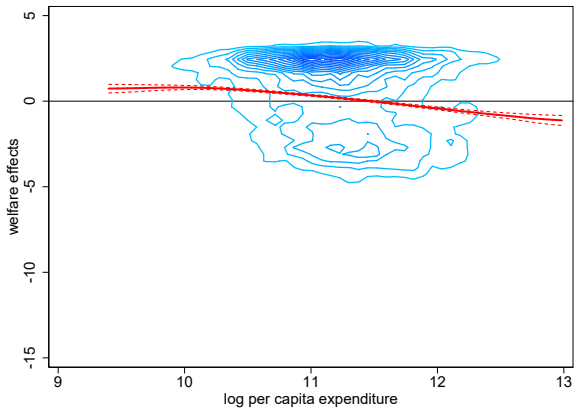
(b) Mauritania



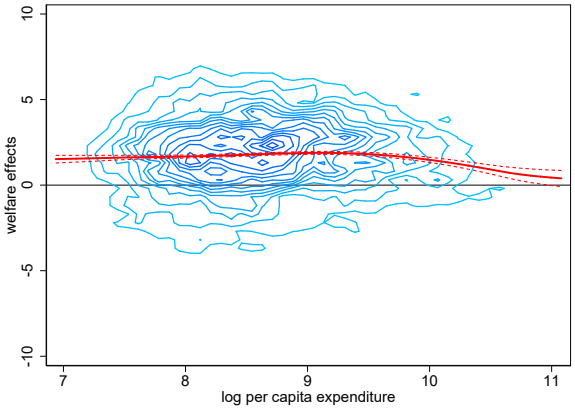
(c) Moldova



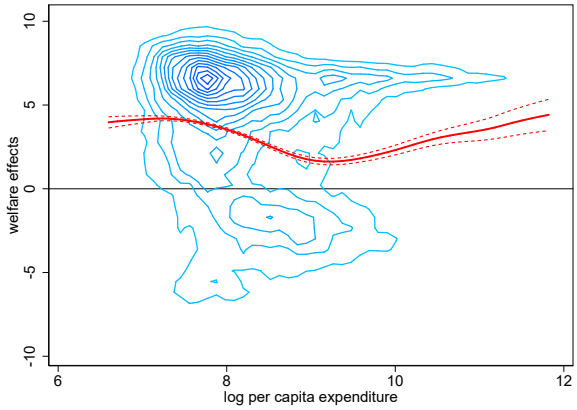
(d) Mongolia



(e) Nepal



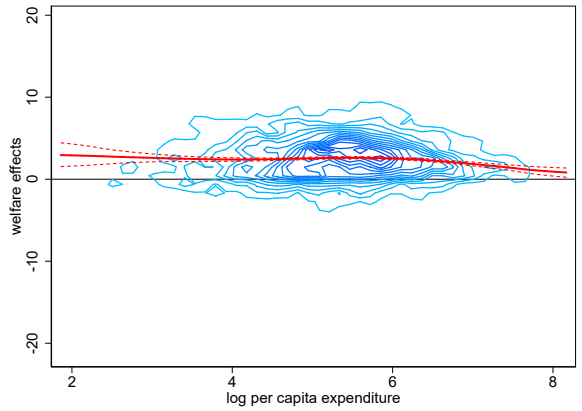
(f) Pakistan



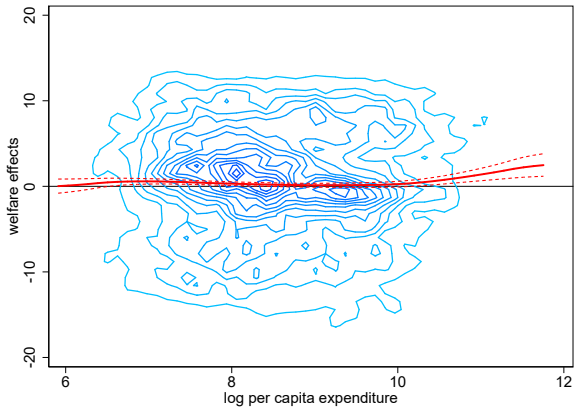
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

Figure B3
Pro-Poor Bias

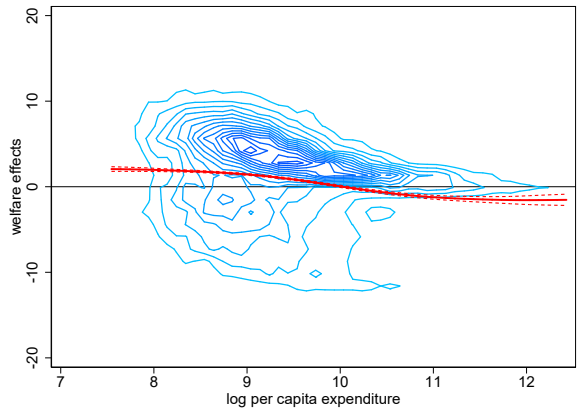
(a) Papua New Guinea



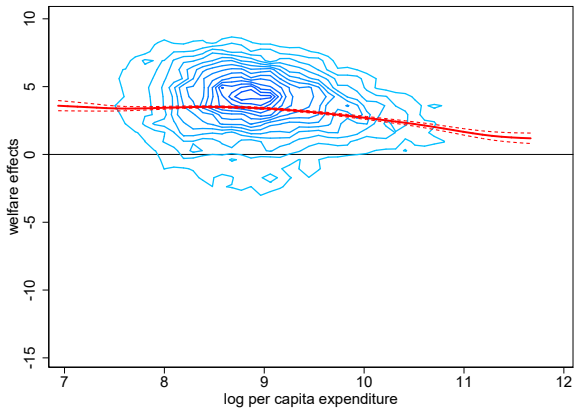
(b) Rwanda



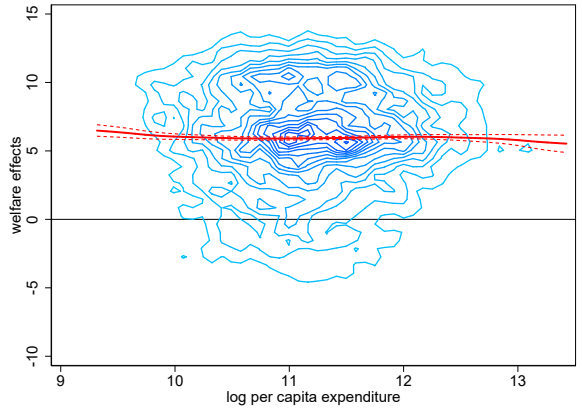
(c) Sri Lanka



(d) Yemen, Rep.

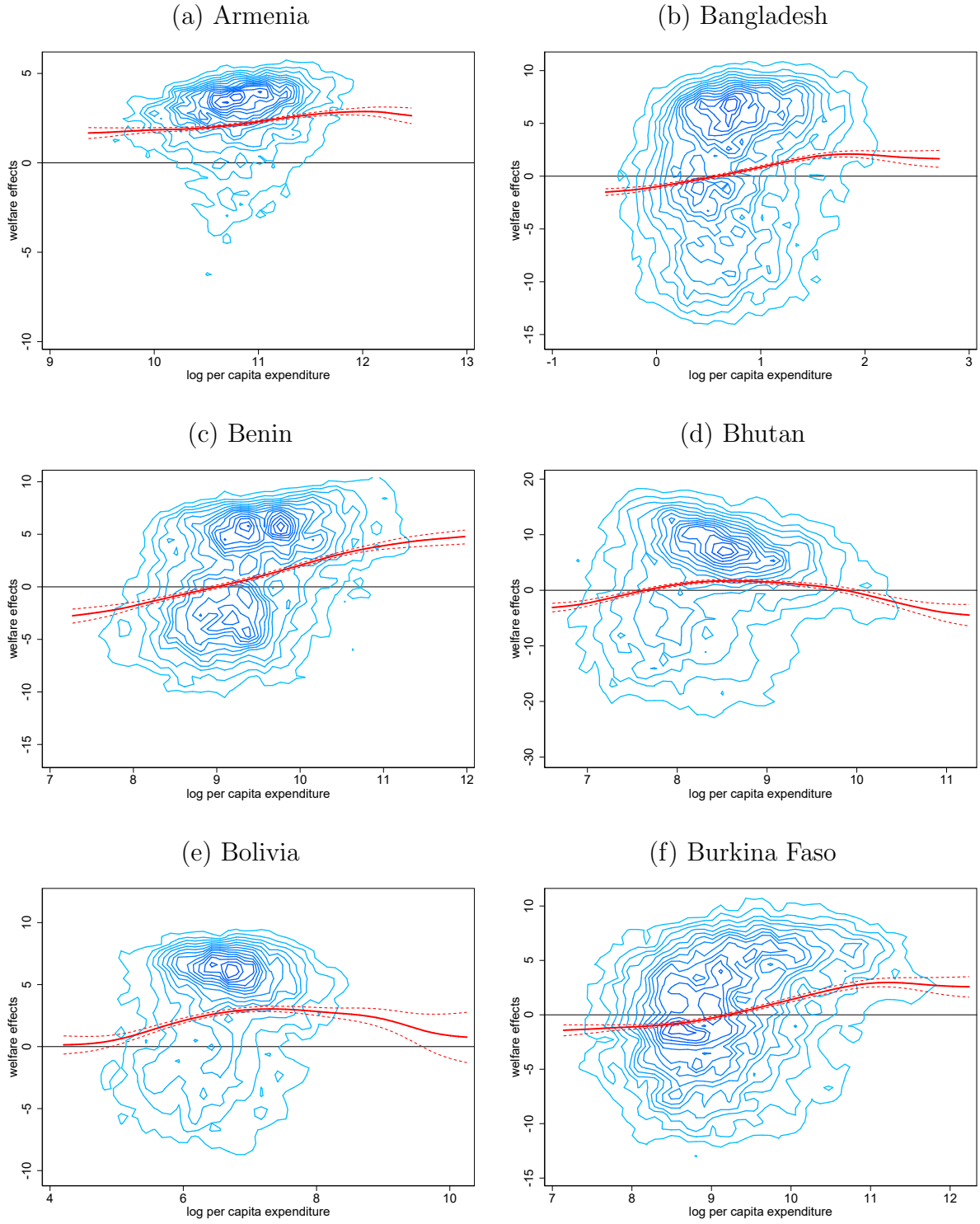


(e) Zambia



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

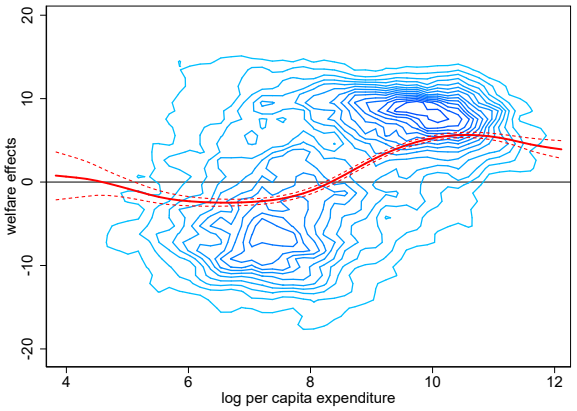
Figure B4
Pro-Rich Bias



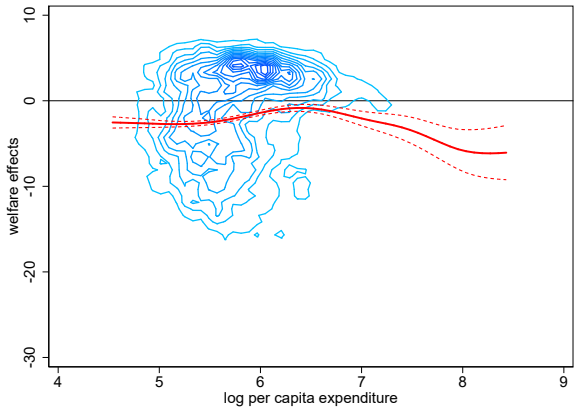
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B5
Pro-Rich Bias

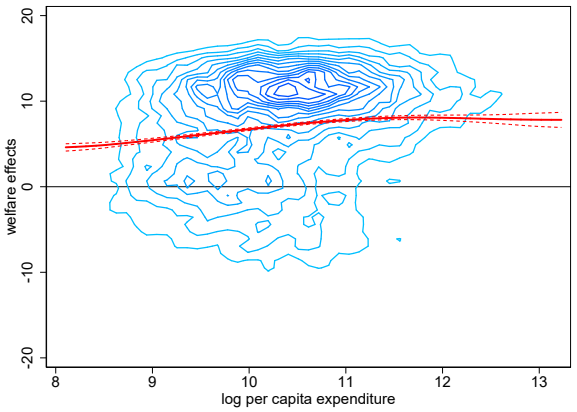
(a) Burundi



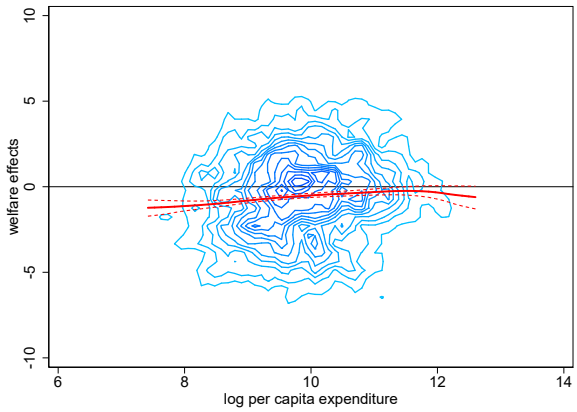
(b) Cambodia



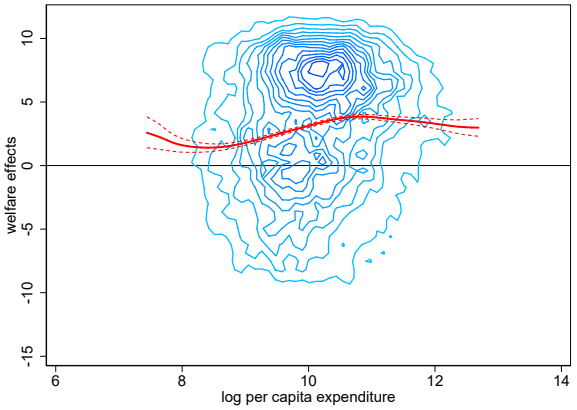
(c) Cameroon



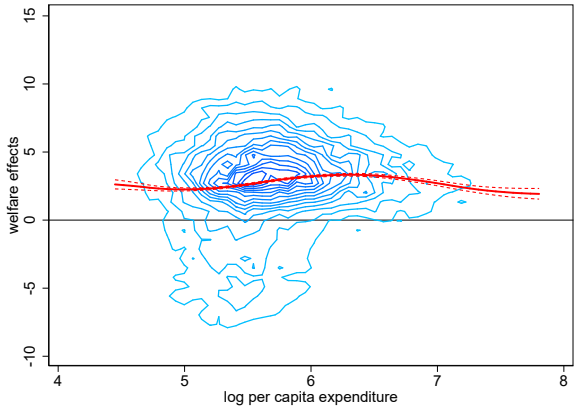
(d) Comoros



(e) Côte d'Ivoire



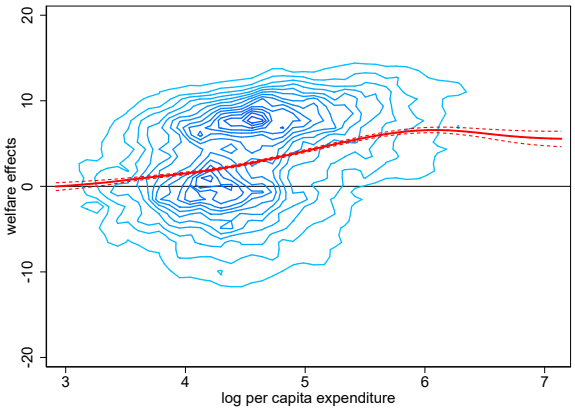
(f) Egypt, Arab Rep.



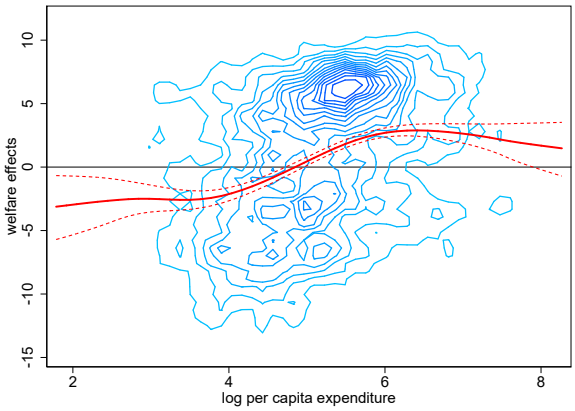
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B6
Pro-Rich Bias

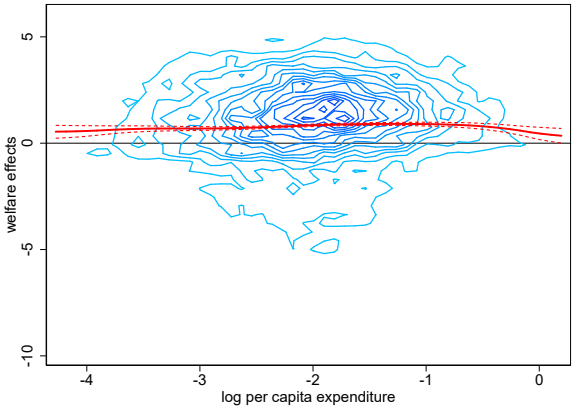
(a) Ethiopia



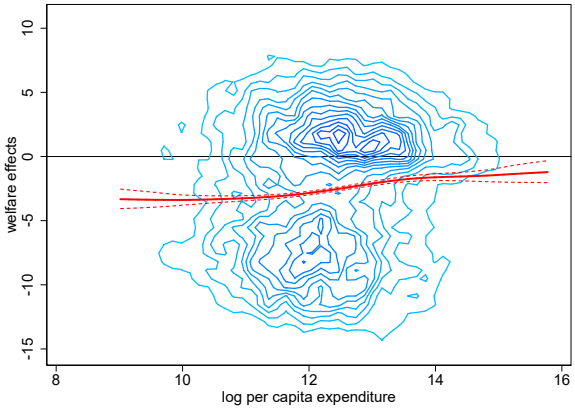
(b) The Gambia



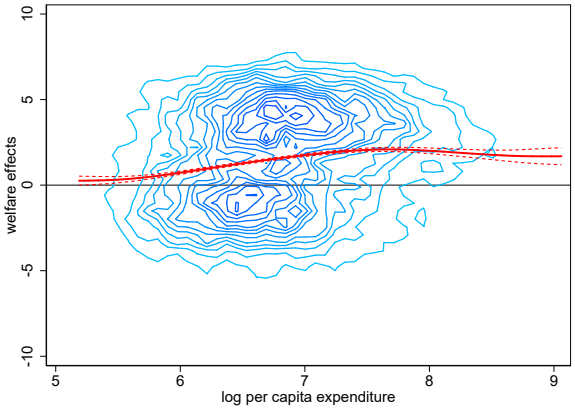
(c) Georgia



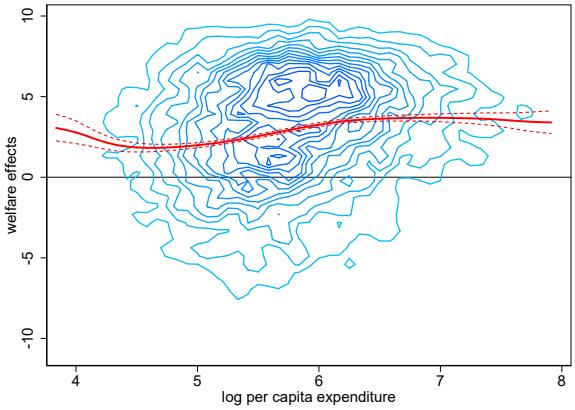
(d) Ghana



(e) Guatemala



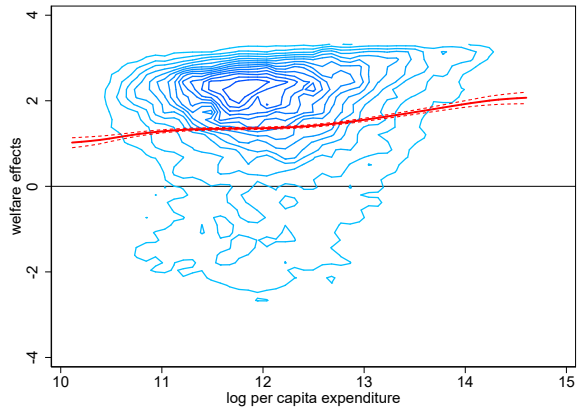
(f) Guinea



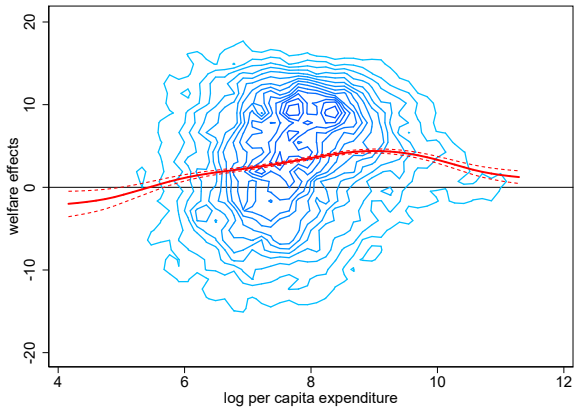
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B7
Pro-Rich Bias

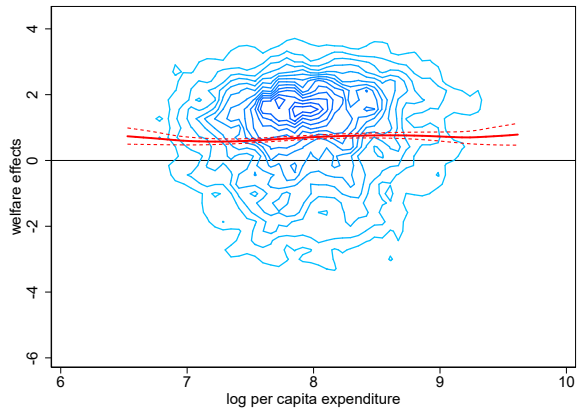
(a) Iraq



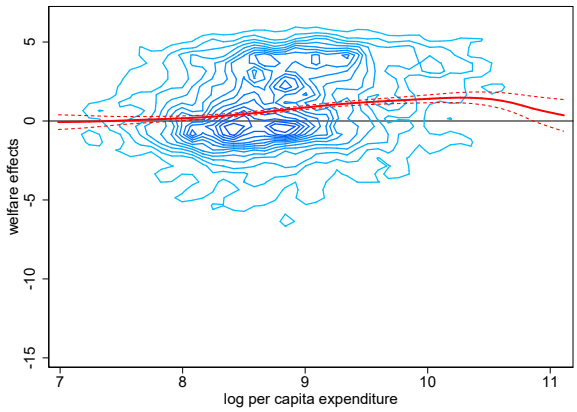
(b) Kenya



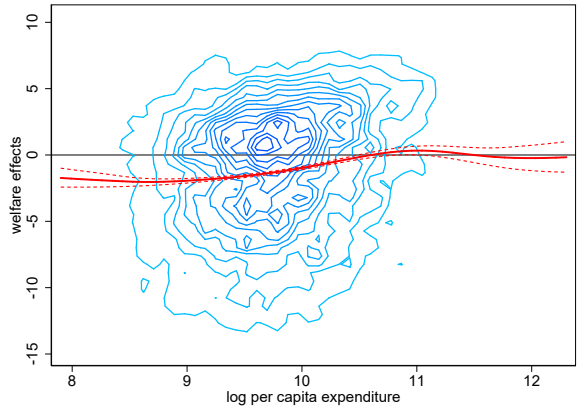
(c) Kyrgyz Republic



(d) Liberia



(e) Madagascar



(f) Malawi

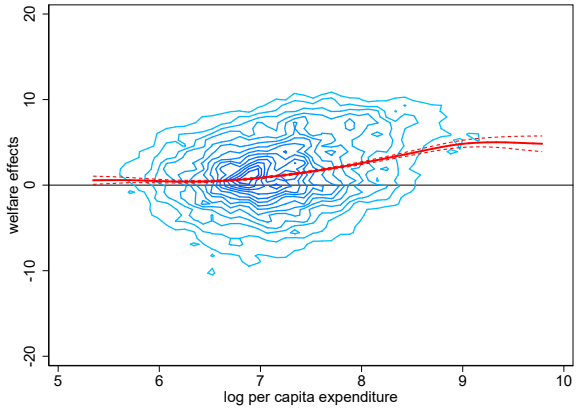


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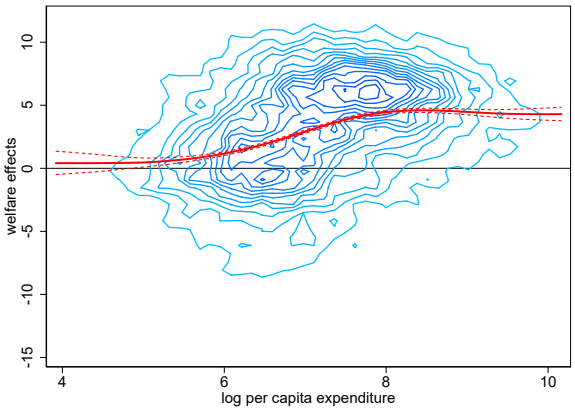
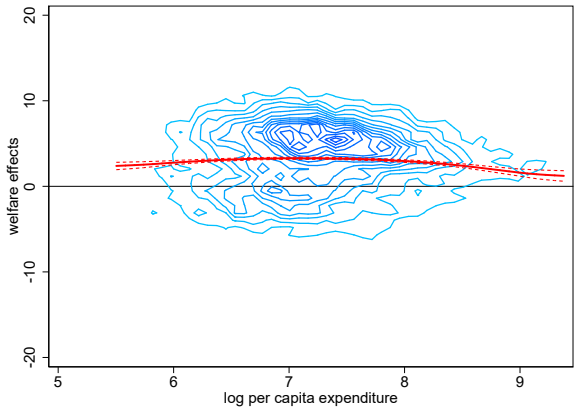
Figure B8
Pro-Rich Bias

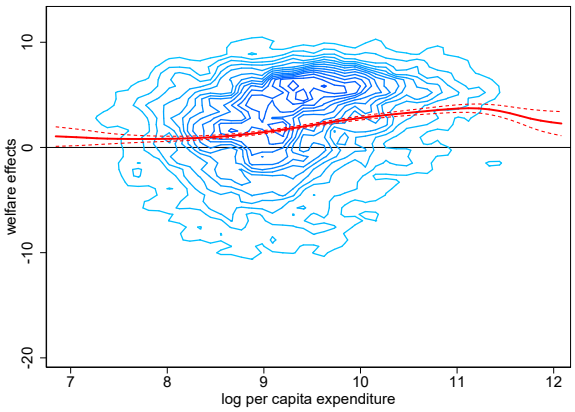
(a) Mozambique



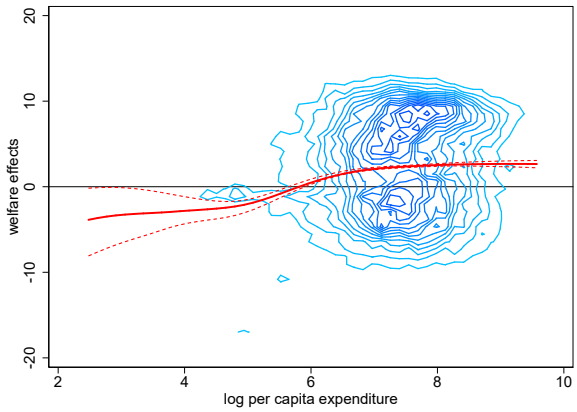
(b) Nicaragua



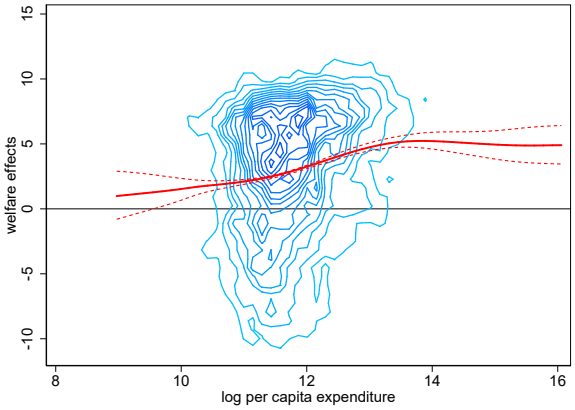
(c) Niger



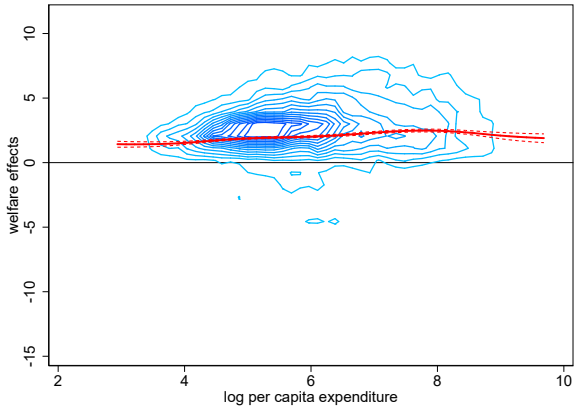
(d) Nigeria



(e) Sierra Leone



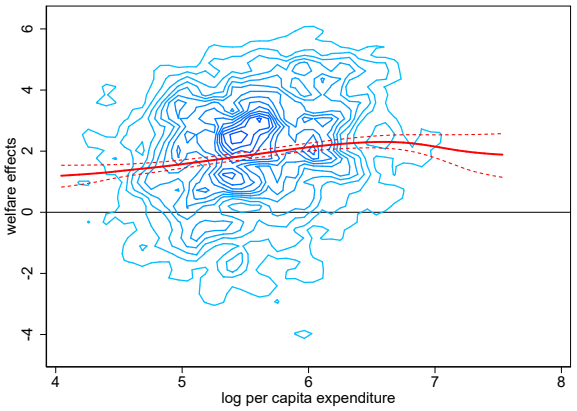
(f) South Africa



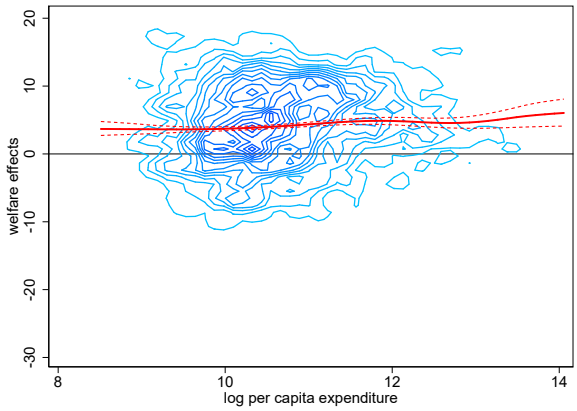
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B9
Pro-Rich Bias

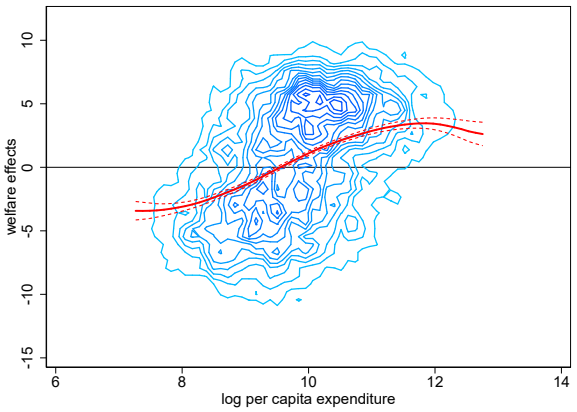
(a) Tajikistan



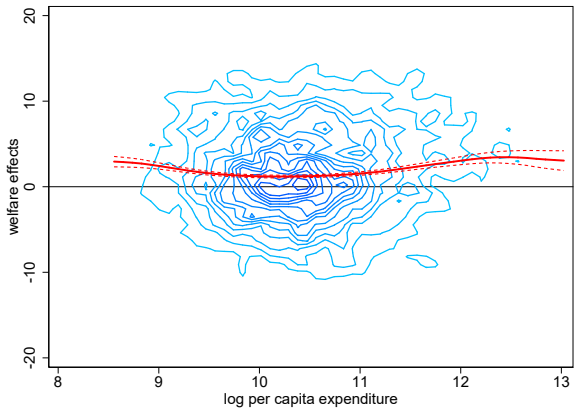
(b) Tanzania



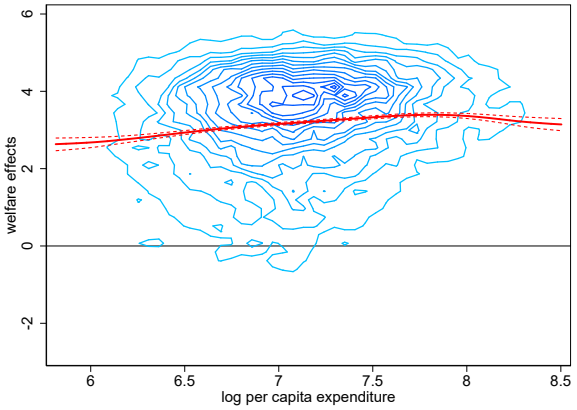
(c) Togo



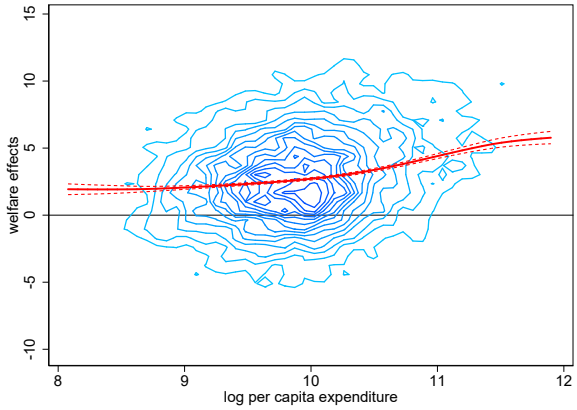
(d) Uganda



(e) Ukraine



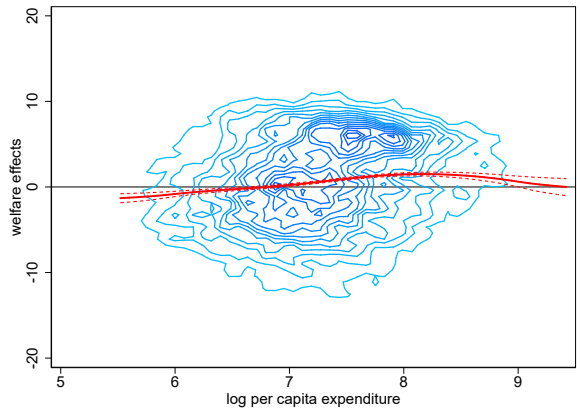
(f) Uzbekistan



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B10
Pro-Rich Bias

(a) Vietnam

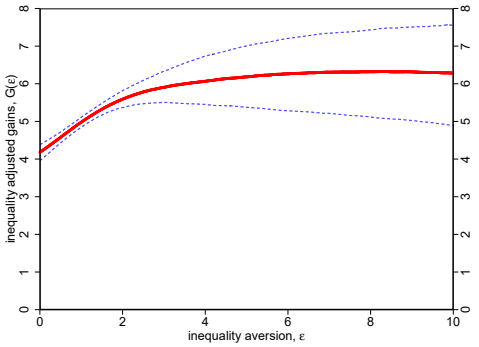


Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

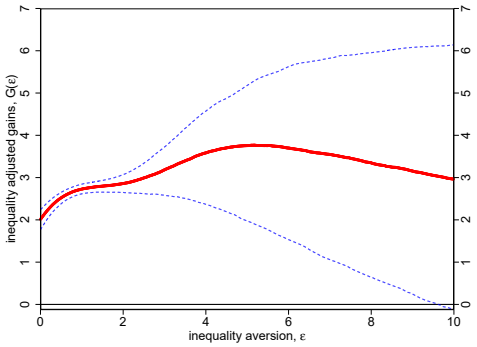
Appendix C: Inequality Adjusted Welfare Gains

Figure C1
No Trade-off
Income Gains and Equality Gains
No Trade Policy Preference Ranking Reversals

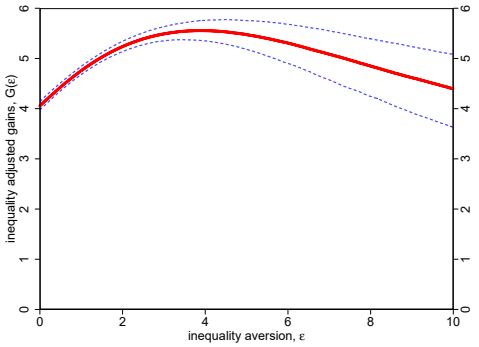
(a) Central African Republic



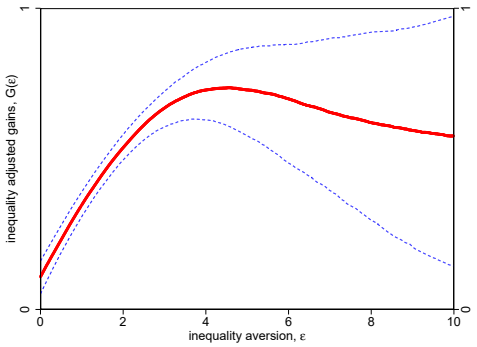
(b) Guinea-Bissau



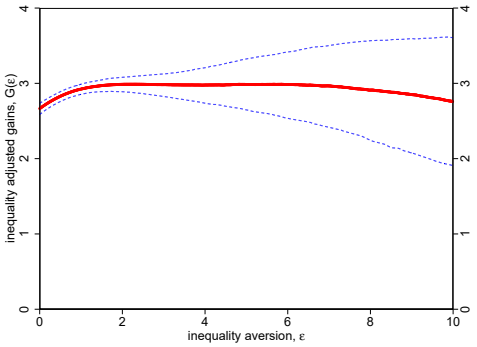
(c) Jordan



(d) Mongolia

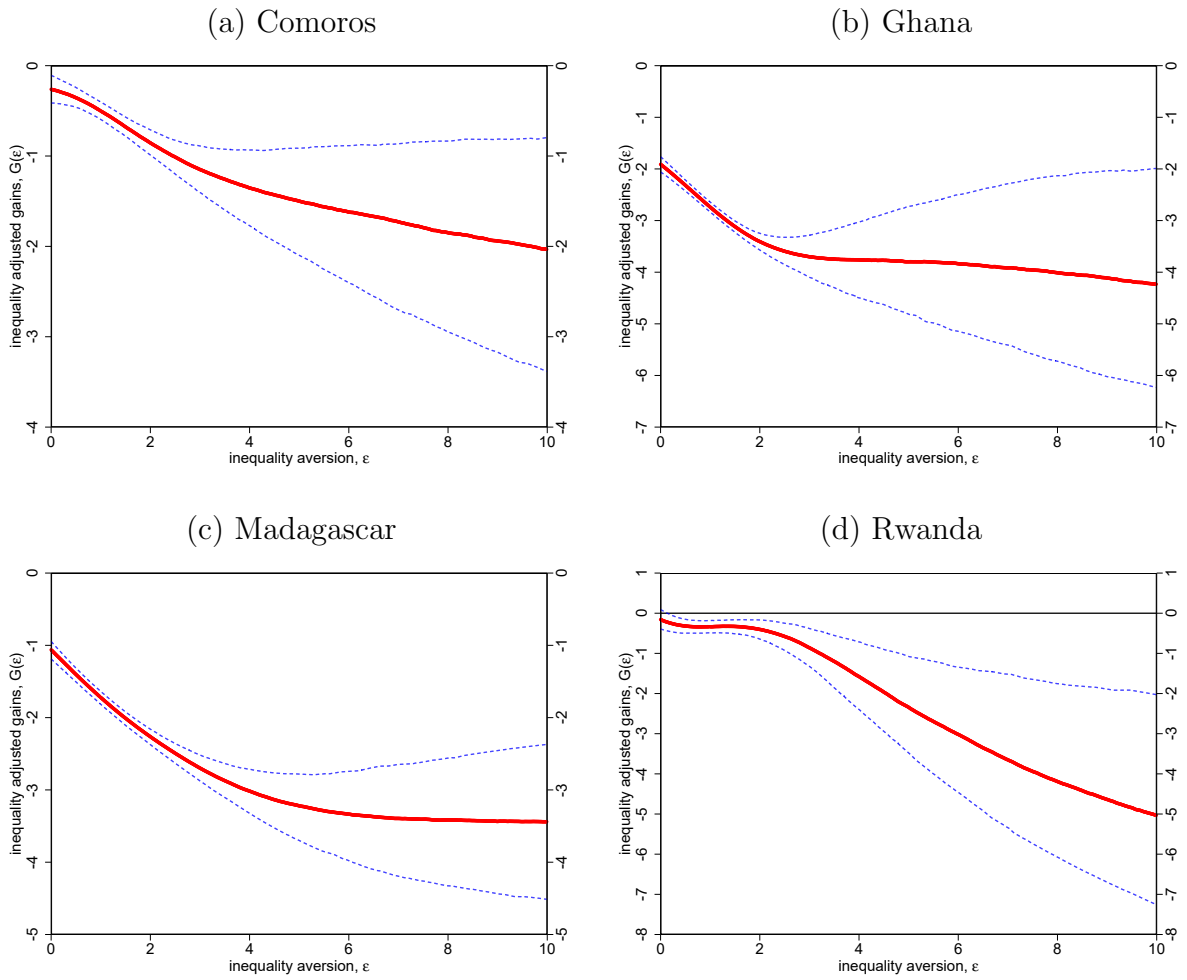


(e) Yemen, Rep.



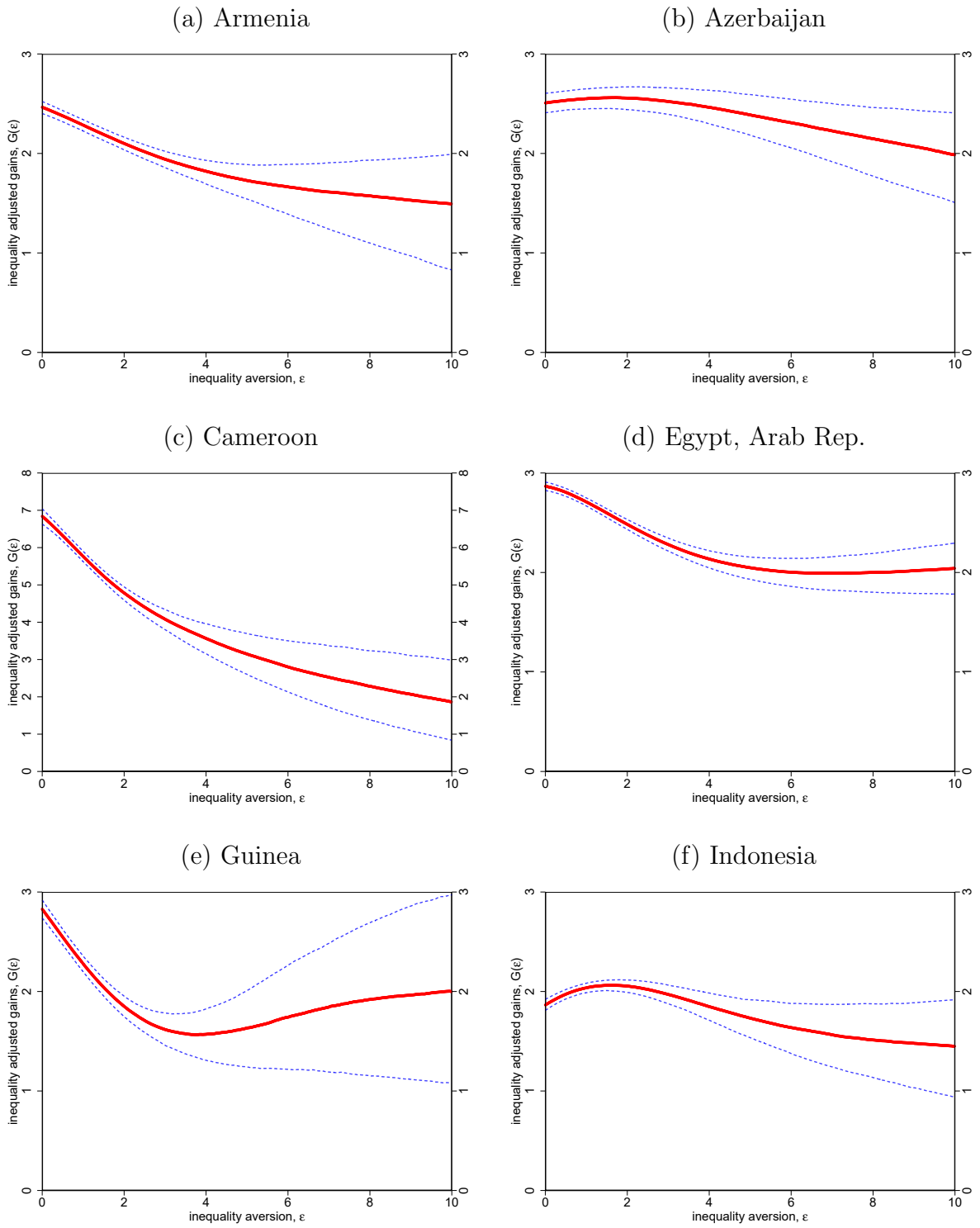
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C2
No Trade-off
Income Losses and Inequality Costs
No Trade Policy Preference Ranking Reversals



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

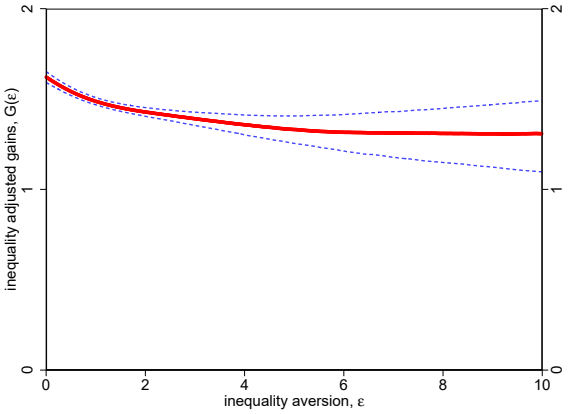
Figure C3-A
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals



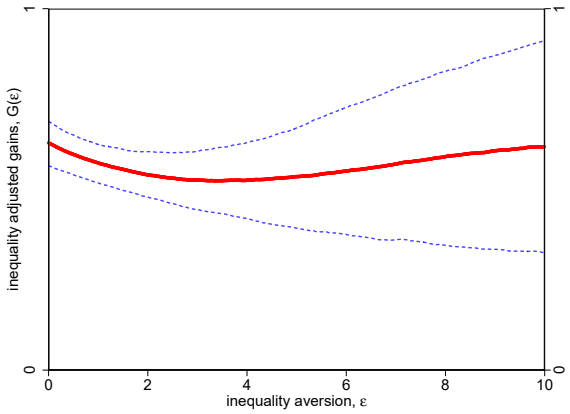
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C3-B
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals

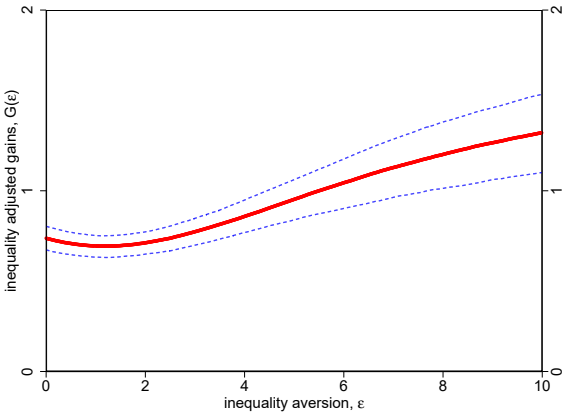
(a) Iraq



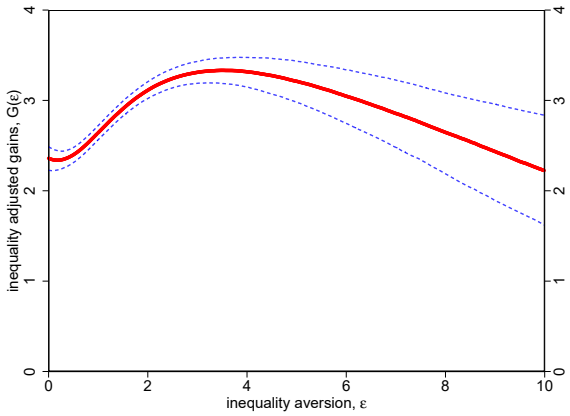
(b) Kyrgyz Republic



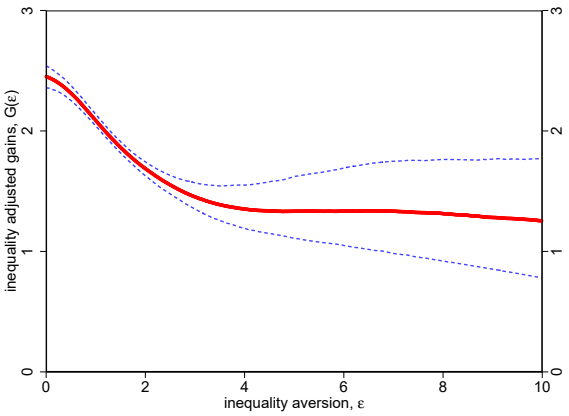
(c) Moldova



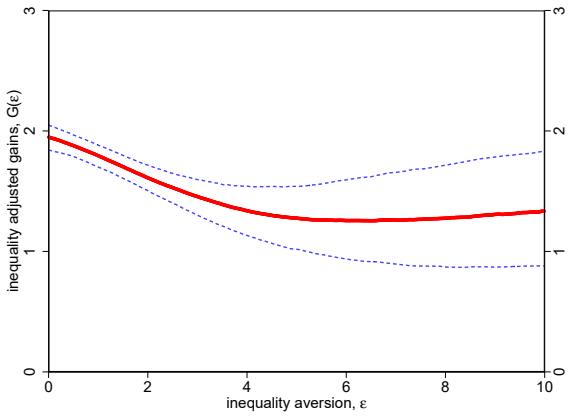
(d) Pakistan



(e) South Africa

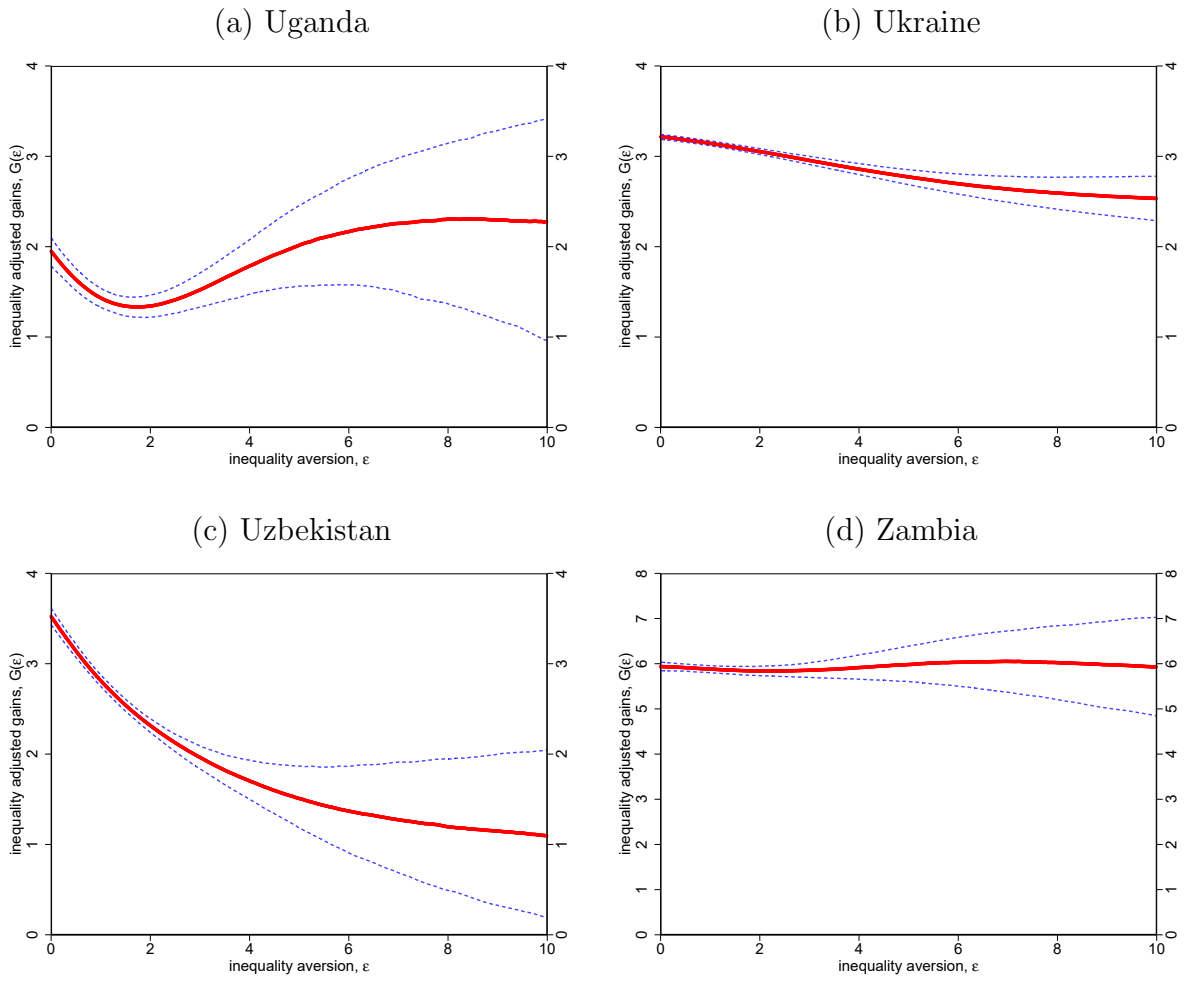


(f) Tajikistan



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

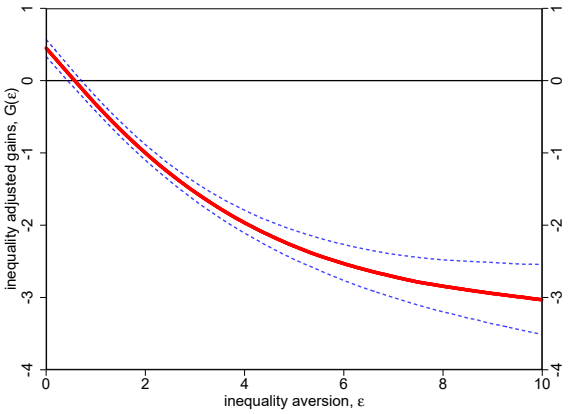
Figure C3-C
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals



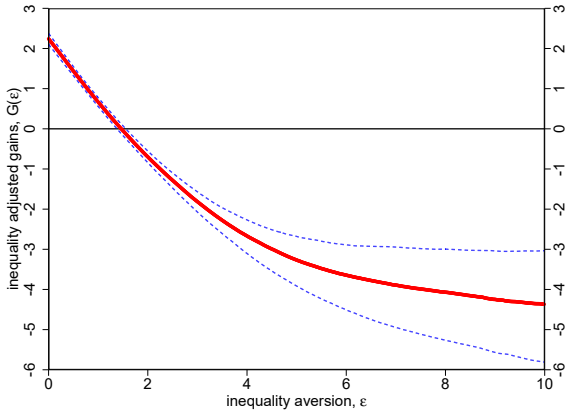
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-A
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

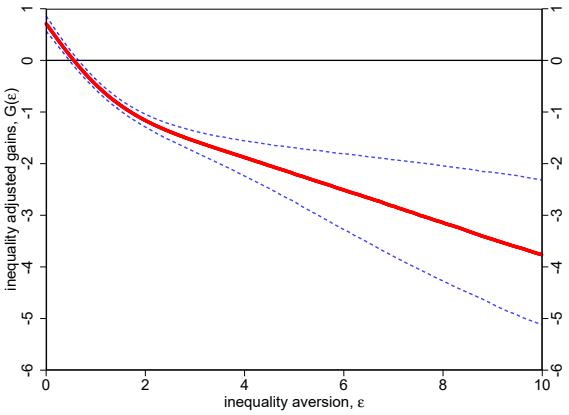
(a) Bangladesh



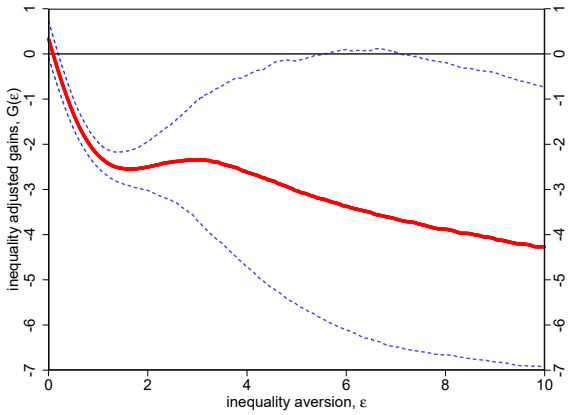
(b) Benin



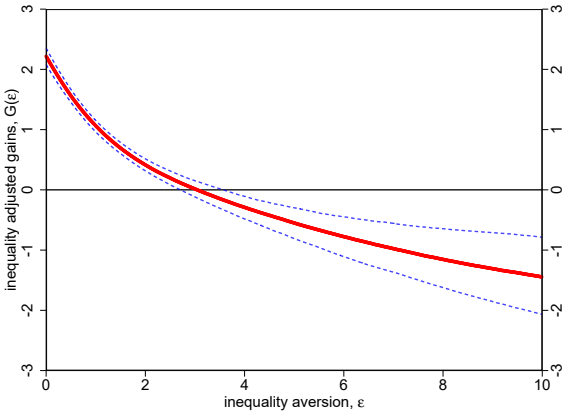
(c) Burkina Faso



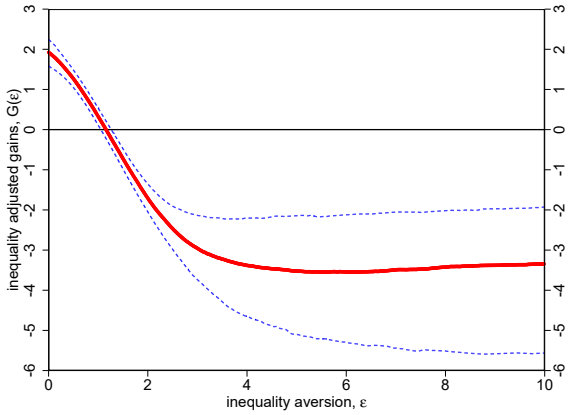
(d) Burundi



(e) Ethiopia



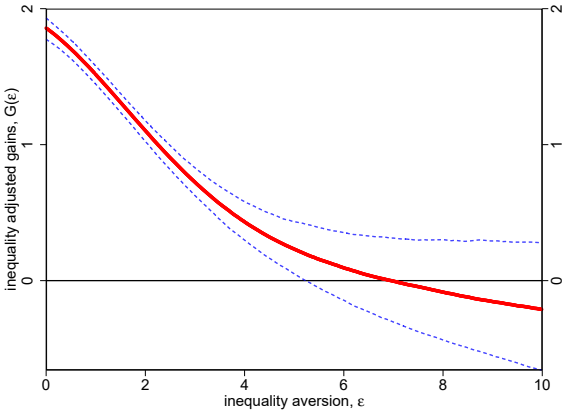
(f) The Gambia



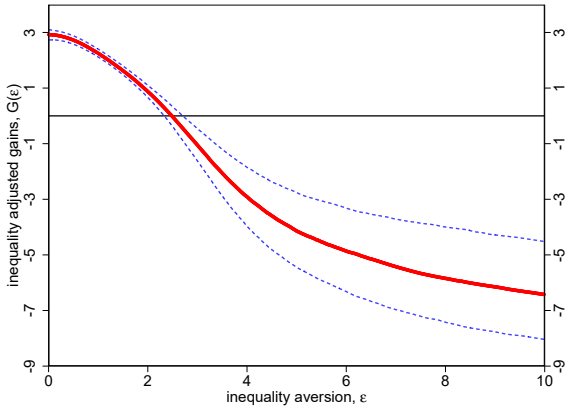
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-B
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

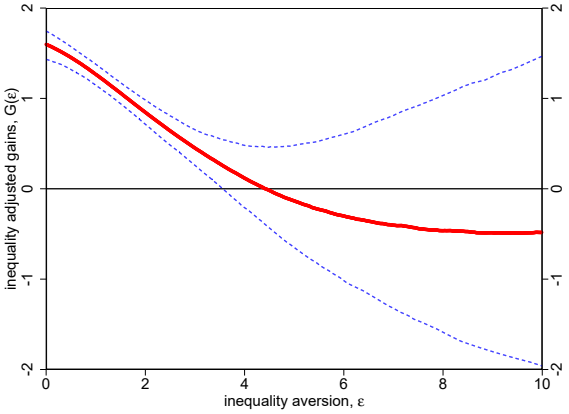
(a) Guatemala



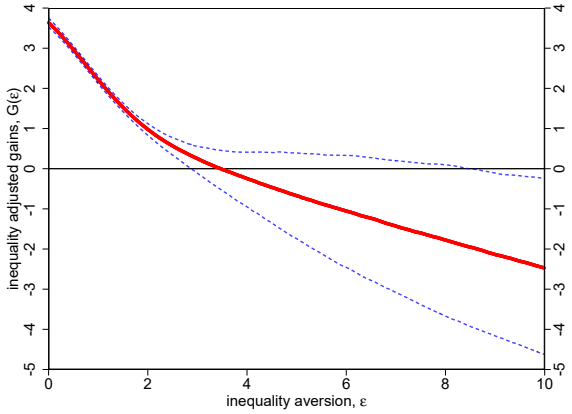
(b) Kenya



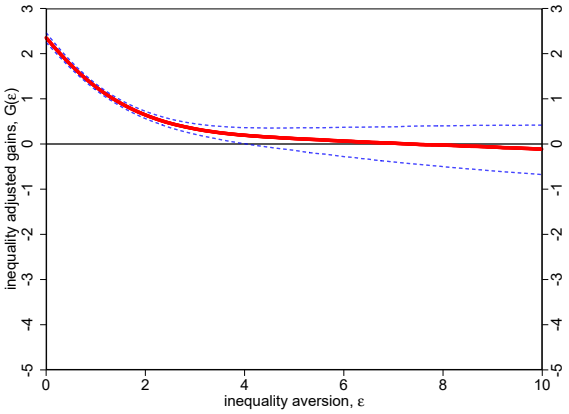
(c) Liberia



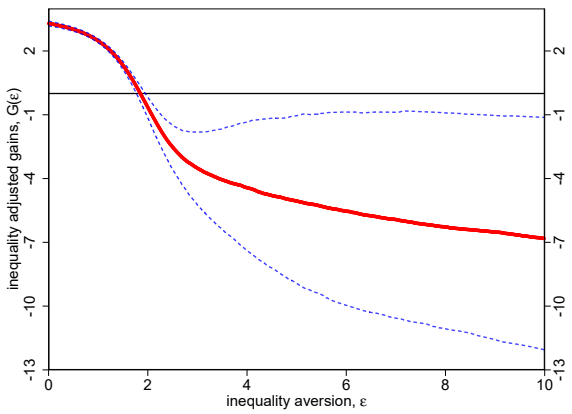
(d) Mozambique



(e) Malawi



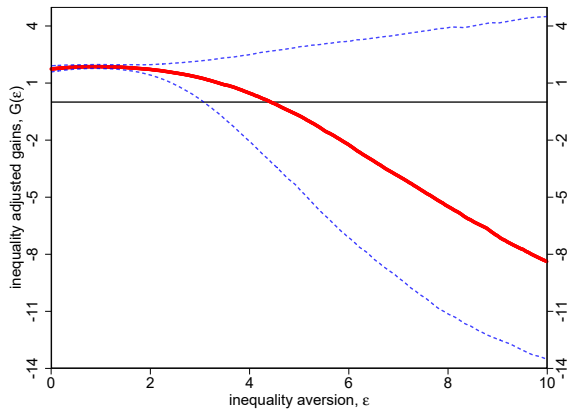
(f) Nigeria



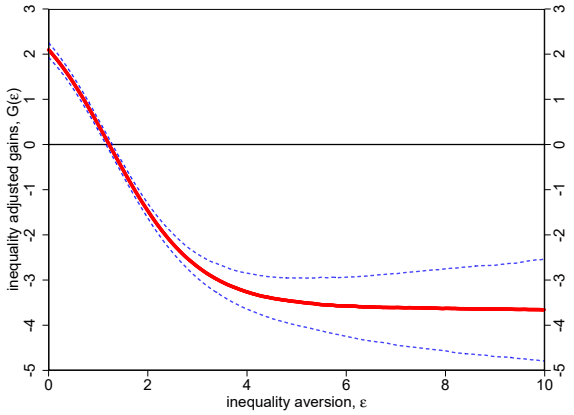
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-C
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

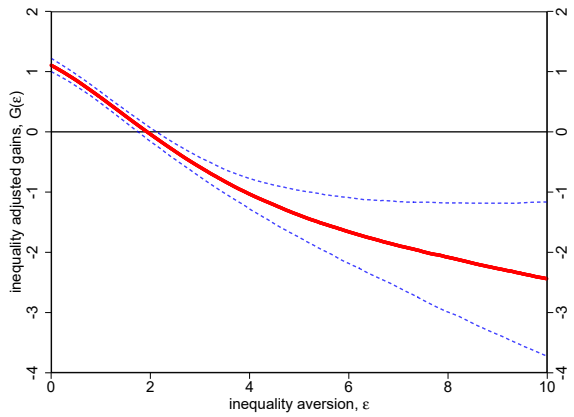
(a) Papua New Guinea



(b) Togo



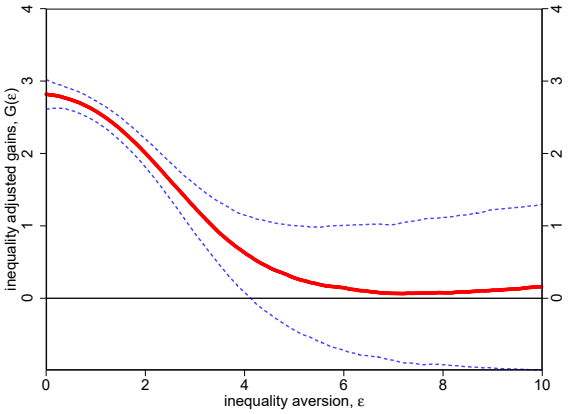
(c) Vietnam



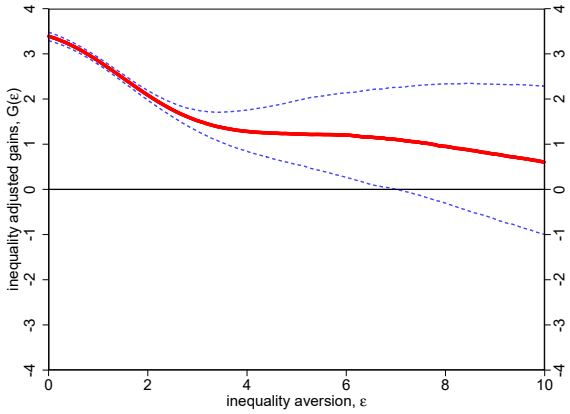
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C5-A
Trade-offs
Income Gains and Inequality Costs
Potential Trade Policy Preference Ranking Reversals

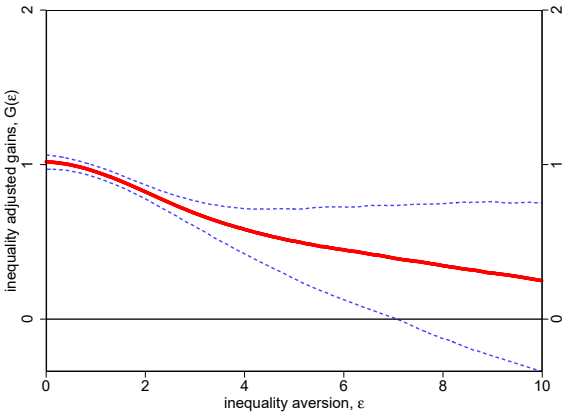
(a) Bolivia



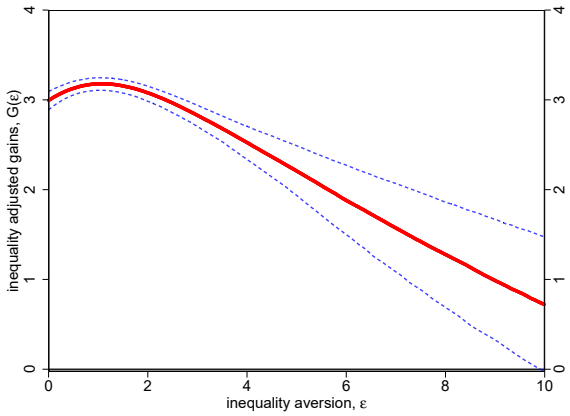
(b) Côte d'Ivoire



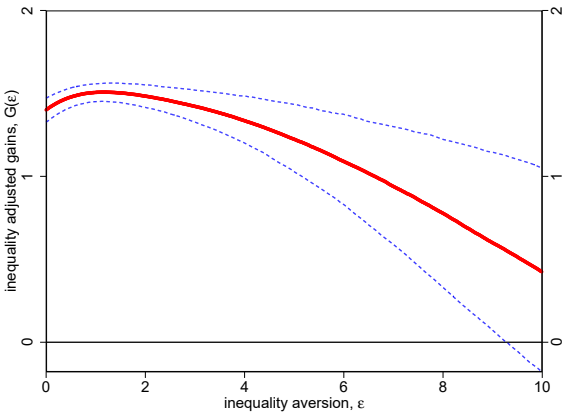
(c) Georgia



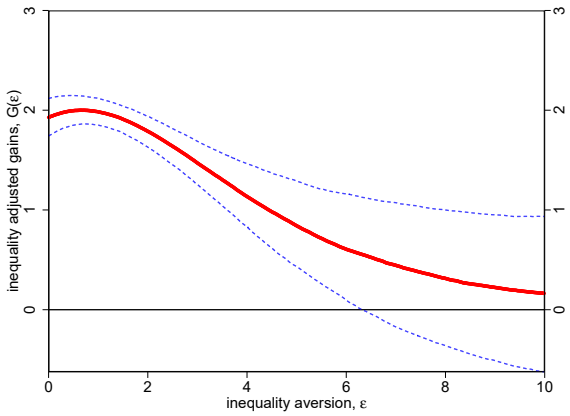
(d) Ecuador



(e) Nepal



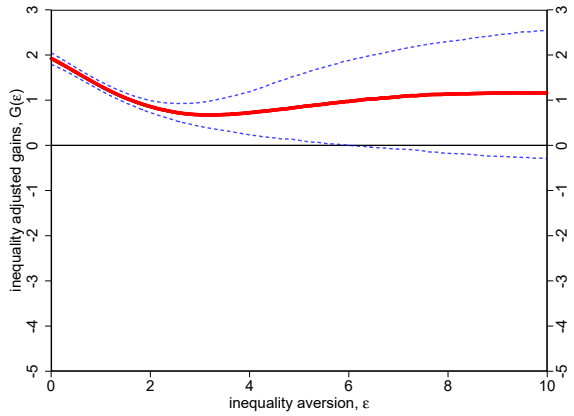
(f) Nicaragua



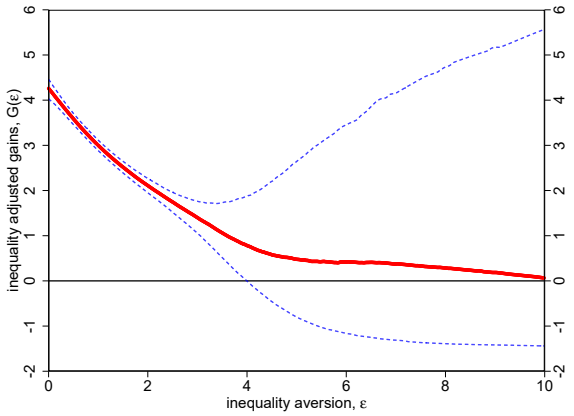
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C5-B
Trade-offs
Income Gains and Inequality Costs
Potential Trade Policy Preference Ranking Reversals

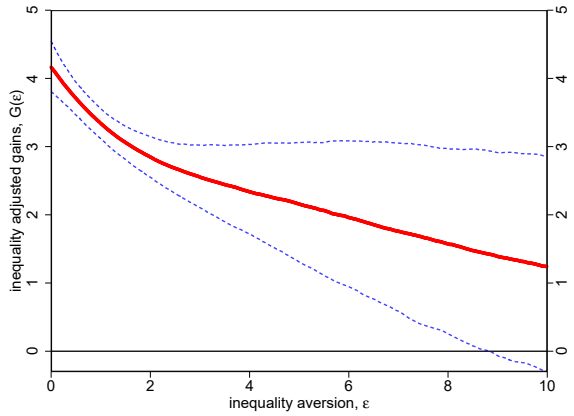
(a) Niger



(b) Sierra Leone



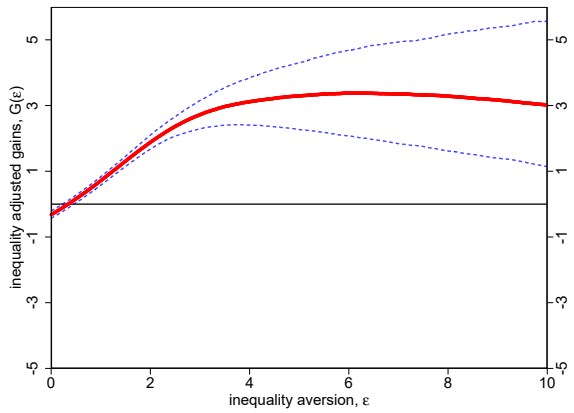
(c) Tanzania



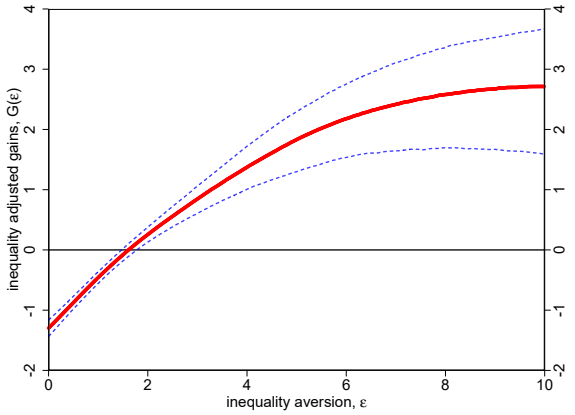
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C6
Trade-offs
Income Losses and Equality Gains
Trade Policy Preference Ranking Reversals

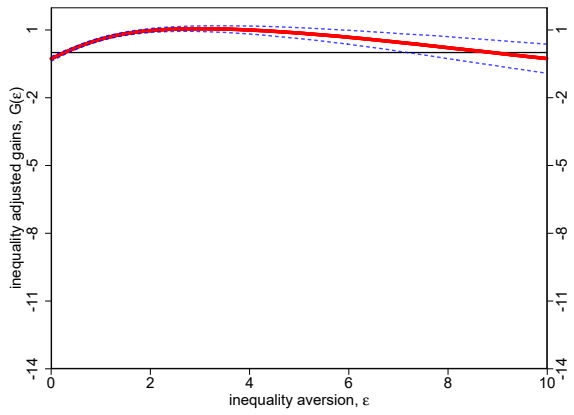
(a) Mali



(b) Mauritania



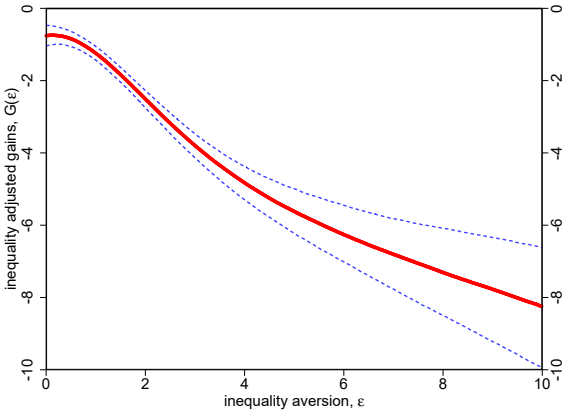
(c) Sri Lanka



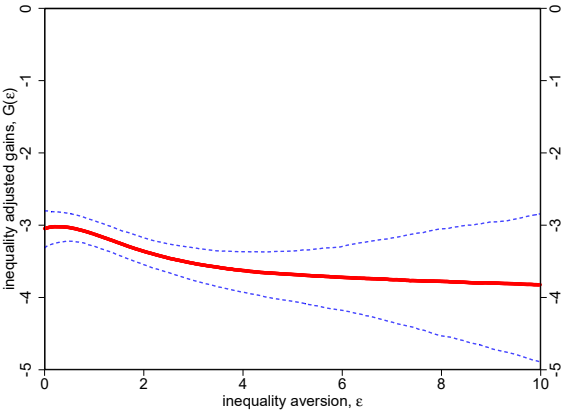
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C7
Trade-offs
Income Losses and Equality Gains
No Trade Policy Preference Ranking Reversals

(a) Bhutan



(b) Cambodia



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Appendix D: Alternative Model - No Labor Markets

Table D1
Inequality Adjusted Gains from Trade and trade ϵ
No Wage Responses
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Jordan	4.4	4.8	5.2	5.5	5.7	4.8	
Central Afr. Rep.	4.2	4.6	5.0	5.3	5.6	6.3	
Pakistan	3.2	3.5	4.0	4.5	4.8	4.5	
Yemen, Rep.	3.1	3.3	3.4	3.5	3.6	3.5	
Nicaragua	2.8	3.1	3.3	3.5	3.7	3.3	
Indonesia	2.4	2.6	2.8	2.8	2.9	2.6	
Guinea-Bissau	2.3	2.9	3.2	3.3	3.4	3.9	
Nepal	1.7	1.9	2.1	2.2	2.3	2.7	
Sri Lanka	1.0	1.8	2.6	3.1	3.5	4.3	
Mongolia	0.3	0.4	0.6	0.7	0.8	0.8	
Madagascar	-0.2	-0.4	-0.7	-0.9	-1.1	-2.5	
Countries with trade-offs							
Nigeria	5.1	4.9	4.4	3.2	1.1	-5.0	2.25
Kenya	4.2	4.1	3.6	3.0	2.2	-6.1	2.96
Mozambique	4.0	3.3	2.5	1.8	1.2	-2.2	4.20
Togo	3.1	2.8	2.3	1.8	1.2	-0.6	3.84
Gambia, The	3.0	2.5	1.8	1.0	0.3	-0.9	2.21
Benin	2.5	1.7	0.9	0.3	-0.4	-4.1	1.71
Ethiopia	2.2	1.6	1.1	0.7	0.4	-1.5	3.06
Vietnam	2.1	1.9	1.7	1.4	1.1	-1.9	4.09
Bhutan	2.0	2.3	2.3	2.0	1.7	-4.6	4.11
Bangladesh	2.0	1.7	1.4	1.1	0.9	-1.1	4.24
Papua New Guinea	1.9	2.0	2.0	1.9	1.8	-8.5	4.49
B. Faso	1.3	0.9	0.4	0.2	-0.1	-2.6	1.86
Burundi	0.9	-0.9	-1.9	-2.2	-2.3	-4.5	0.25
Ghana	0.9	0.9	0.8	0.7	0.5	-1.5	2.90
Comoros	0.1	-0.1	-0.2	-0.4	-0.6	-1.9	0.30
Mali	-0.3	0.1	0.7	1.3	1.9	3.0	0.37
Mauritania	-1.2	-0.8	-0.4	-0.0	0.3	2.7	1.52

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when wages do not respond to the tariff liberalization.

Table D1
Inequality Adjusted Gains from Trade and trade ϵ
No Wage Responses
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs (continued)							
Cameroon	8.1	7.8	7.5	7.2	6.9	4.7	
Zambia	6.4	6.4	6.4	6.4	6.4	6.3	
Tanzania	5.3	5.1	5.0	5.0	5.1	5.1	
Uzbekistan	4.6	4.2	3.8	3.5	3.2	1.8	
Ecuador	4.4	4.7	5.0	5.2	5.3	3.5	
Sierra Leone	4.3	3.7	3.0	2.6	2.2	0.6	
Côte d'Ivoire	4.0	3.7	3.3	2.9	2.5	0.9	
Egypt, Arab Rep.	3.9	3.9	3.8	3.7	3.6	3.1	
Ukraine	3.5	3.4	3.4	3.4	3.3	2.9	
South Africa	3.5	3.4	3.3	3.0	2.7	1.8	
Bolivia	3.4	3.5	3.4	3.1	2.8	0.3	
Malawi	3.0	2.3	1.8	1.5	1.2	0.5	
Guinea	2.9	2.7	2.4	2.1	2.0	2.0	
Uganda	2.9	2.7	2.7	2.8	3.0	6.0	
Guatamala	2.9	2.9	2.9	2.9	2.9	2.8	
Armenia	2.7	2.6	2.5	2.4	2.4	1.9	
Azerbaijan	2.6	2.7	2.7	2.7	2.7	2.1	
Tajikistan	2.5	2.5	2.5	2.5	2.4	2.1	
Liberia	2.0	1.9	1.7	1.5	1.3	0.3	
Niger	2.0	1.7	1.3	1.1	0.9	1.2	
Iraq	1.9	1.8	1.8	1.7	1.7	1.5	
Georgia	1.1	1.0	1.0	1.0	0.9	0.5	
Rwanda	0.9	1.1	1.5	2.0	2.6	4.0	
Kyrgyz Republic	0.9	0.8	0.8	0.8	0.8	0.8	
Moldova	0.8	0.8	0.8	0.8	0.8	1.4	
Cambodia	-2.2	-2.1	-2.1	-2.2	-2.3	-2.6	
Average	2.5	2.5	2.4	2.2	2.1	0.9	2.61
Population weighted average	3.0	2.9	2.8	2.6	2.4	0.8	3.14
GDP weighted average	3.1	3.1	3.1	2.9	2.6	1.2	2.95

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when wages do not respond to the tariff liberalization.

Appendix E: Robustness to Alternative Tariff Redistribution Schemes

To assess the robustness of our results we consider two alternative tariff redistribution scenarios: (1) the government does not make up the budget loss (i.e. tariff redistribution is ignored) and (2) the government makes up for lost revenue by imposing additional personal income taxes which respect the progressivity of the existing personal income tax system. To proxy the progressivity of taxes we use the World Tax Indicator (WTI) database (Andrew Young School of Policy Studies 2010). This is the most comprehensive and comparable measure of tax progressivity available (see e.g. Heathcote et al., 2018). More specifically, it offers measures of the average tax rates faced by households in different segments of the income distribution.[18]

For each country we calculate the increase in segment j specific tax rates τ_j required to balance the budget to compensate for the revenue loss resulting from liberalization. To do so, we first calculate the scaling factor λ

$$(18) \quad dT = \lambda * \sum_{j=1}^{J} \sum_{i=1}^{N} I_{ij} y_i r_j$$

where dT is the anticipated tariff revenue loss associated with the liberalization, I_{ij} is a dummy variable that takes the value 1 if household i belongs to tax segment j and 0 otherwise, y_i is a measure of (pre- additional tax) income, and r_j is the average tax rate paid by households in segment j. After solving for λ we can calculate the "segment" specific tax increase as $\tau_j = \lambda * r_j$. These tax increases in turn are part of the income losses associated with liberalization imposing that the progressivity of the tax system is respected.[19].

Tables E1 and E2 presents estimates of the inequality adjusted gains from trade using

[18]These measures are adjusted for allowances/deductions, tax credits, significant local taxes and other main rules of the tax code. They are not, however, adjusted for deductions, exemptions, and credits that depend on taxpayer specific characteristics (for example, no adjustment is made for child credits). They also do not account for evasion and/or avoidance.

[19]This formula can be thought of as a crude approximation to the tax function $T(y) = y - \lambda y^{1-\tau}$.

these alternative tariff redistribution scenarios. Not considering tariff revenue losses almost doubles the average income gains from trade which are now 3.7% on average across countries (as opposed to 1.9% in our main model). Moreover, only 1 of the 54 countries (Ghana) experiences (very modest) income losses when trade is liberalized. Yet, trade-offs remain widespread, as they are prevalent in 45 countries. However, in the vast majority of cases social welfare would be higher in case a country would liberalize its own tariffs than in the status quo.

When imposing that the tax hikes introduced to compensate for the tariff revenue loss respect the progressivity of the existing income tax system, the estimated income gains from trade do not change of course. Yet, as expected, inequality costs are somewhat lower when using proportional income taxes, as these tend to reduce inequality. Crucially, however, the income and equality gains of trade continue to be negatively correlated. Yet, income gains tend to dominate inequality costs for plausible levels of inequality aversion.

Put differently, our main conclusions appear robust to different ways of modeling the response to the loss of tariff revenue that results from trade liberalization.

References

Andrew Young School of Policy Studies. (2010). Andrew Young School World Tax Indicators (Volume 1).

Heathcote, J., K. Storesletten, and G. Violante (2017). "Optimal Tax Progressivity: An Analytical Framework" Quarterly Journal of Economics, 132(4),1693-1754.

Table E1
Inequality Adjusted Gains from Trade and trade ϵ
No Tariff Redistribution
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Jordan	7.5	7.9	8.2	8.5	8.7	7.8	
Central Afr. Rep.	6.3	6.7	7.1	7.4	7.7	8.4	
Mauritania	5.2	5.6	6.1	6.4	6.8	9.2	
Guinea-Bissau	4.3	4.8	5.1	5.1	5.2	5.2	
Yemen, Rep.	4.1	4.3	4.4	4.4	4.5	4.2	
Mongolia	2.5	2.6	2.7	2.8	2.9	3.0	
Mali	1.7	2.1	2.7	3.3	3.9	5.0	
Sri Lanka	0.7	1.2	1.6	1.8	2.0	0.8	
Ghana	-0.1	-0.5	-0.9	-1.3	-1.6	-2.4	
Countries with trade-offs							
Mozambique	5.6	5.0	4.2	3.5	3.0	-0.5	8.5
Benin	5.5	4.7	3.9	3.2	2.5	-1.1	5.0
Nigeria	4.6	4.3	3.8	2.7	0.7	-5.5	2.2
Kenya	4.5	4.3	3.8	3.2	2.5	-4.7	3.3
Togo	4.4	3.7	2.7	1.8	0.9	-1.3	2.6
Ethiopia	3.7	3.0	2.5	2.1	1.9	-0.0	9.9
Vietnam	2.9	2.7	2.4	2.1	1.8	-0.6	6.8
Burkina Faso	2.6	1.9	1.4	1.0	0.7	-1.9	3.9
Papua New Guinea	2.3	2.4	2.4	2.3	2.2	-8.0	4.8
Burundi	2.2	0.6	-0.4	-0.7	-0.6	-2.6	0.8
Bangladesh	1.7	1.3	0.9	0.6	0.3	-1.8	2.5
Comoros	1.7	1.6	1.5	1.3	1.1	-0.1	8.7
Rwanda	1.5	1.3	1.3	1.3	1.2	-3.4	4.1
Madagascar	0.7	0.3	-0.0	-0.3	-0.5	-1.7	1.0
Cambodia	0.0	0.1	-0.0	-0.1	-0.3	-0.7	0.9

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when the loss in tariff revenue incurred when countries liberalize and the welfare consequences of the attendant loss in tariff revenue is not taken into consideration.

Table E1
Inequality Adjusted Gains from Trade and trade ϵ
No Tariff Redistribution
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs (continued)							
Cameroon	8.7	8.2	7.6	7.1	6.7	3.8	
Bhutan	7.9	7.9	7.5	6.9	6.3	0.8	
Zambia	6.7	6.7	6.7	6.6	6.6	6.7	
Tanzania	5.8	5.4	5.0	4.7	4.5	2.9	
Sierra Leone	5.7	5.1	4.5	4.0	3.6	2.1	
Guinea	5.7	5.4	5.1	4.9	4.7	4.9	
Gambia, The	5.7	5.0	4.1	3.1	2.1	0.4	
Uzbekistan	4.8	4.4	4.0	3.8	3.6	2.3	
Côte d'Ivoire	4.5	4.3	4.0	3.6	3.2	1.7	
Bolivia	4.2	4.1	3.9	3.7	3.4	1.5	
Ukraine	4.2	4.1	4.1	4.0	4.0	3.5	
Ecuador	4.0	4.2	4.2	4.2	4.1	1.8	
Tajikistan	3.9	3.9	3.8	3.7	3.6	3.4	
Egypt, Arab Rep.	3.9	3.8	3.7	3.6	3.5	3.1	
Niger	3.8	3.5	3.2	2.9	2.7	3.1	
Azerbaijan	3.8	3.8	3.8	3.8	3.8	3.2	
Malawi	3.6	3.0	2.5	2.1	1.9	1.1	
Nepal	3.4	3.5	3.6	3.5	3.5	2.4	
Armenia	3.4	3.3	3.2	3.1	3.0	2.4	
Uganda	3.3	3.0	2.8	2.7	2.7	3.6	
Nicaragua	3.3	3.3	3.3	3.3	3.1	1.5	
Pakistan	3.2	3.2	3.4	3.7	3.9	3.0	
South Africa	3.1	3.0	2.8	2.5	2.4	1.9	
Liberia	2.9	2.8	2.6	2.4	2.2	1.0	
Iraq	2.8	2.7	2.7	2.6	2.6	2.5	
Guatamala	2.8	2.6	2.4	2.2	2.0	0.7	
Indonesia	2.5	2.6	2.7	2.7	2.7	2.1	
Kyrgyz Republic	2.2	2.2	2.2	2.2	2.2	2.2	
Moldova	2.2	2.1	2.1	2.1	2.1	2.7	
Georgia	1.6	1.6	1.5	1.5	1.4	0.8	
Average	3.7	3.5	3.3	3.1	3.0	1.5	4.3
Population weighted average	3.4	3.2	3.0	2.8	2.5	0.7	4.3
GDP weighted average	3.3	3.2	3.1	2.9	2.6	1.0	3.5

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when the loss in tariff revenue incurred when countries liberalize and the welfare consequences of the attendant loss in tariff revenue is not taken into consideration.

Table E2
Inequality Adjusted Gains from Trade and trade ϵ
Alternative Tariff Redistribution Scheme
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Zambia	6.0	6.2	6.4	6.5	6.5	6.7	
Central Afr. Rep.	4.2	5.5	6.6	7.2	7.6	8.4	
Jordan	4.1	4.7	5.3	5.7	6.1	5.3	
Guinea	2.8	3.1	3.2	3.1	3.1	3.4	
Yemen, Rep.	2.7	3.0	3.2	3.4	3.4	3.2	
Pakistan	2.4	2.8	3.3	3.7	3.9	3.0	
Guinea-Bissau	2.0	3.7	4.6	4.9	5.1	5.2	
Uganda	2.0	2.3	2.5	2.6	2.7	3.6	
Iraq	1.6	1.7	1.8	1.8	1.8	1.7	
Nepal	1.4	2.5	3.1	3.4	3.5	2.4	
Moldova	0.7	0.8	0.9	1.0	1.0	1.7	
Mongolia	0.1	0.4	0.7	0.9	1.0	1.2	
Ghana	-1.9	-2.0	-2.2	-2.4	-2.7	-3.5	
Countries with trade-offs							
Mozambique	3.6	3.0	2.2	1.5	1.0	-2.5	3.5
Nigeria	3.3	3.2	2.7	1.7	-0.2	-6.4	2.0
Kenya	2.9	2.8	2.4	1.9	1.1	-6.1	2.6
Benin	2.3	2.7	2.8	2.6	2.3	-1.1	5.0
Ethiopia	2.2	2.1	2.0	1.9	1.7	-0.0	9.9
Togo	2.1	2.3	2.1	1.5	0.8	-1.3	2.6
Gambia, The	1.9	2.1	1.8	1.1	0.3	-1.3	2.2
Papua New Guinea	1.7	2.1	2.2	2.3	2.2	-8.0	4.8
Liberia	1.6	1.5	1.3	1.1	0.9	-0.4	4.5
Vietnam	1.1	1.2	1.2	1.0	0.8	-1.5	3.8
Burkina Faso	0.7	0.5	0.1	-0.1	-0.4	-2.9	1.28
Bangladesh	0.5	0.7	0.6	0.4	0.2	-1.8	2.4
Burundi	0.4	-0.3	-0.7	-0.8	-0.7	-2.6	0.3
Rwanda	-0.1	0.3	0.8	1.1	1.2	-3.4	0.2
Comoros	-0.2	-0.0	0.1	0.1	-0.0	-1.2	0.5
Sri Lanka	-0.3	0.8	1.4	1.8	2.0	0.8	0.1
Mali	-0.3	0.8	1.8	2.7	3.5	4.8	0.2
Bhutan	-0.7	1.6	2.8	3.1	2.8	-2.5	0.1
Mauritania	-1.3	0.2	1.4	2.1	2.7	5.4	0.5

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when the loss in tariff revenue incurred when countries liberalize is compensated for by an increase in income taxes that respects the progressivity of the existing labor income tax system.

Table E2
Inequality Adjusted Gains from Trade and trade ϵ
Alternative Tariff Redistribution Scheme
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs (continued)							
Cameroon	6.9	6.7	6.3	5.9	5.6	2.7	
Sierra Leone	4.3	4.5	4.3	3.9	3.6	2.1	
Tanzania	4.2	4.6	4.7	4.6	4.5	2.9	
Uzbekistan	3.5	3.2	2.9	2.7	2.5	1.2	
Côte d'Ivoire	3.4	3.4	3.3	3.0	2.7	1.2	
Ukraine	3.2	3.2	3.1	3.1	3.1	2.5	
Ecuador	3.0	3.6	4.0	4.1	4.1	1.8	
Egypt, Arab Rep.	2.9	3.0	3.0	2.9	2.8	2.5	
Bolivia	2.8	3.4	3.6	3.5	3.3	1.5	
Azerbaijan	2.5	2.6	2.6	2.7	2.7	2.1	
Armenia	2.5	2.4	2.3	2.2	2.1	1.5	
South Africa	2.5	2.6	2.6	2.5	2.3	1.9	
Malawi	2.4	2.3	2.1	2.0	1.8	1.1	
Nicaragua	2.0	2.6	3.0	3.1	3.1	1.5	
Tajikistan	1.9	1.9	1.9	1.8	1.7	1.5	
Niger	1.9	1.7	1.4	1.1	0.9	1.3	
Indonesia	1.9	2.0	2.1	2.2	2.2	1.5	
Guatamala	1.9	1.9	1.8	1.6	1.5	0.2	
Georgia	1.0	1.0	1.0	0.9	0.8	0.2	
Kyrgyz Republic	0.6	0.6	0.6	0.6	0.6	0.7	
Madagascar	-1.0	-0.7	-0.5	-0.6	-0.7	-1.7	
Cambodia	-3.0	-2.3	-2.0	-1.9	-1.9	-2.3	
Average	1.9	2.2	2.3	2.2	2.1	0.7	2.4
Population weighted average	2.1	2.3	2.3	2.2	1.9	0.1	3.4
GDP weighted average	2.2	2.4	2.4	2.3	2.0	0.4	2.6

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when the loss in tariff revenue incurred when countries liberalize is compensated for by an increase in income taxes that respects the progressivity of the existing labor income tax system.

Appendix F: Protectionist Scenarios

Table F1
Inequality Adjusted Gains from Trade and trade ϵ
10% Absolute Increase in Tariffs
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Vietnam	0.9	1.0	1.2	1.3	1.5	2.0	
Burundi	0.2	0.8	1.2	1.4	1.5	1.6	
Rwanda	-0.2	-0.4	-0.8	-1.1	-1.4	-2.4	
Jordan	-0.4	-0.6	-0.7	-0.9	-1.0	-1.9	
Kyrgyz Republic	-0.7	-0.8	-0.8	-0.9	-1.0	-1.7	
Nicaragua	-0.8	-0.9	-1.0	-1.1	-1.2	-1.5	
Tanzania	-0.8	-0.8	-0.8	-0.8	-0.9	-1.3	
Bangladesh	-1.2	-1.3	-1.3	-1.4	-1.5	-2.2	
Nepal	-1.2	-1.4	-1.6	-1.7	-1.9	-2.5	
Indonesia	-1.6	-1.9	-2.2	-2.4	-2.6	-3.6	
Ecuador	-1.7	-1.9	-2.0	-2.2	-2.3	-2.4	
Georgia	-1.8	-1.8	-1.9	-2.0	-2.0	-2.7	
Yemen, Rep.	-1.8	-2.1	-2.4	-2.5	-2.6	-3.2	
Guatamala	-1.9	-2.1	-2.2	-2.3	-2.4	-3.5	
Guinea-Bissau	-1.9	-2.5	-2.9	-3.0	-3.2	-5.2	
Azerbaijan	-2.0	-2.2	-2.3	-2.5	-2.6	-3.6	
Armenia	-2.3	-2.3	-2.4	-2.4	-2.4	-3.2	
South Africa	-2.5	-3.4	-4.6	-5.5	-6.1	-6.8	
Zambia	-3.0	-3.0	-3.0	-3.0	-3.1	-3.7	
Tajikistan	-3.0	-3.1	-3.1	-3.2	-3.2	-3.1	

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when all tariffs are increased by 10% in absolute terms terms.

Table F1
Inequality Adjusted Gains from Trade and trade ϵ
10% Absolute Increase in Tariffs
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs							
Mauritania	1.0	0.6	0.1	-0.2	-0.5	-2.6	1.2
Sri Lanka	0.9	0.3	-0.2	-0.6	-1.0	-3.0	0.8
Mali	0.8	0.4	-0.1	-0.7	-1.2	-2.6	0.9
Moldova	0.4	0.4	0.4	0.4	0.4	-0.4	6.4
Ghana	0.4	0.4	0.3	0.3	0.3	-0.4	4.2
Mongolia	0.3	-0.0	-0.3	-0.6	-0.8	-1.5	0.5
Madagascar	0.0	0.1	0.1	0.2	0.2	-1.2	4.6
Papua New Guinea	-0.1	-0.1	-0.1	-0.0	0.1	0.7	1.6
Burkina Faso	-0.6	-0.3	-0.1	0.0	0.1	-0.1	1.3
Central Afr. Rep.	-0.8	-0.6	-0.4	-0.2	-0.0	0.1	2.3
Togo	-0.9	-0.7	-0.4	-0.2	0.1	0.1	1.8
Benin	-1.1	-0.7	-0.3	0.1	0.5	1.6	1.4
Kenya	-1.3	-1.4	-1.3	-1.1	-0.8	2.1	2.8
Comoros	-1.4	-1.2	-1.0	-0.7	-0.4	0.3	2.9
Gambia, The	-1.5	-1.6	-1.4	-1.1	-0.7	0.4	3.1
Bhutan	1.2	1.2	1.2	1.2	1.2	1.3	
Cambodia	1.1	1.2	1.2	1.3	1.3	0.8	
Uganda	-0.6	-0.7	-0.8	-0.9	-1.1	-3.8	
Uzbekistan	-0.9	-0.8	-0.7	-0.7	-0.7	-2.1	
Ethiopia	-1.3	-1.0	-0.8	-0.6	-0.5	-0.2	
Guinea	-1.5	-1.3	-1.2	-1.1	-1.0	-1.7	
Côte d'Ivoire	-1.5	-1.6	-1.5	-1.4	-1.3	-2.5	
Malawi	-1.8	-1.6	-1.4	-1.3	-1.3	-0.6	
Egypt, Arab Rep.	-1.9	-2.0	-2.0	-1.9	-1.9	-2.4	
Mozambique	-2.2	-1.7	-1.1	-0.7	-0.4	-0.4	
Niger	-2.3	-2.2	-2.0	-1.8	-1.6	-2.3	
Bolivia	-2.4	-2.4	-2.4	-2.2	-2.0	-1.2	
Ukraine	-2.5	-2.5	-2.5	-2.5	-2.5	-2.3	
Pakistan	-2.8	-2.7	-2.9	-3.2	-3.5	-4.3	
Nigeria	-3.0	-2.9	-2.6	-2.0	-1.2	-4.0	
Cameroon	-3.1	-3.1	-3.0	-2.9	-2.9	-3.0	
Iraq	-3.2	-3.1	-3.0	-3.0	-3.0	-3.2	
Sierra Leone	-3.4	-3.0	-2.8	-2.6	-2.4	-1.1	
Liberia	-3.7	-3.6	-3.5	-3.3	-3.2	-2.7	
Average	-1.3	-1.3	-1.3	-1.3	-1.3	-1.7	2.4
Population weighted average	-1.6	-1.6	-1.7	-1.7	-1.7	-2.4	2.5
GDP weighted average	-1.8	-2.0	-2.2	-2.3	-2.3	-3.2	2.2

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when all tariffs are increased by 10% in absolute terms terms.

Table F2
Inequality Adjusted Gains from Trade and trade ϵ
10% Relative Increase in Tariffs
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Madagascar	0.1	0.1	0.1	0.1	0.1	0.1	
Comoros	0.0	0.0	0.0	0.0	0.1	0.2	
Mongolia	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	
Sri Lanka	-0.0	-0.1	-0.1	-0.2	-0.2	-0.3	
Rwanda	-0.1	-0.1	-0.1	-0.2	-0.3	-0.5	
Bhutan	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	
Nepal	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	
Indonesia	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	
Guinea-Bissau	-0.2	-0.3	-0.3	-0.3	-0.4	-0.6	
Nicaragua	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	
Azerbaijan	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	
Guatamala	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	
Yemen, Rep.	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	
Ecuador	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	
Jordan	-0.4	-0.4	-0.5	-0.5	-0.5	-0.6	
Central Afr. Rep.	-0.4	-0.5	-0.5	-0.6	-0.6	-0.7	
Zambia	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	
Countries with trade-offs							
Mauritania	0.1	0.1	0.0	-0.0	-0.0	-0.3	1.4
Mali	0.0	-0.0	-0.1	-0.1	-0.2	-0.4	0.4
Burundi	-0.1	0.1	0.2	0.2	0.2	0.2	0.2
Bangladesh	-0.1	-0.1	-0.0	-0.0	-0.0	0.0	2.6
Burkina Faso	-0.1	-0.1	-0.0	-0.0	0.0	0.1	1.7
Vietnam	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	5.3
Papua New Guinea	-0.2	-0.2	-0.2	-0.2	-0.2	0.3	6.7
Ethiopia	-0.2	-0.2	-0.1	-0.1	-0.1	0.1	5.1
Benin	-0.2	-0.2	-0.1	-0.0	0.0	0.3	1.9
Gambia, The	-0.2	-0.2	-0.1	-0.1	-0.0	0.1	2.2
Togo	-0.3	-0.3	-0.2	-0.2	-0.1	-0.0	5.3
Mozambique	-0.4	-0.3	-0.2	-0.2	-0.1	0.1	6.8
Kenya	-0.4	-0.4	-0.4	-0.3	-0.3	0.3	3.5
Nigeria	-0.4	-0.4	-0.4	-0.3	-0.1	0.4	2.3

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when all tariffs are increased by 10% in relative terms (i.e. then tariffs are pre-multiplied by 1.1)

Table F2
Inequality Adjusted Gains from Trade and trade ϵ
10% Relative Increase in Tariffs
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs (continued)							
Cambodia	0.3	0.3	0.3	0.3	0.3	0.2	
Ghana	0.0	0.0	0.0	0.0	0.0	0.0	
Kyrgyz Republic	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Moldova	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Georgia	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Iraq	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	
Liberia	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	
Niger	-0.2	-0.2	-0.1	-0.1	-0.1	-0.3	
Tajikistan	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	
Armenia	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	
South Africa	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	
Malawi	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	
Pakistan	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	
Uganda	-0.3	-0.3	-0.3	-0.3	-0.3	-0.7	
Guinea	-0.3	-0.3	-0.2	-0.2	-0.2	-0.3	
Bolivia	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	
Egypt, Arap Rep.	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	
Uzbekistan	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	
Ukraine	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	
Côte d'Ivoire	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	
Sierra Leone	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	
Tanzania	-0.5	-0.5	-0.5	-0.5	-0.5	-0.7	
Cameroon	-0.8	-0.7	-0.7	-0.7	-0.7	-0.7	
Average	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	3.2
Population weighted average	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	3.4
GDP weighted average	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	3.1

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when all tariffs are increased by 10% in relative terms (i.e. then tariffs are pre-multiplied by 1.1).

Table F3
Inequality Adjusted Gains from Trade and trade ϵ
Tariffs increase to 62.4%
(Table continues on the next page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries without trade-offs							
Bhutan	8.0	8.2	8.4	8.5	8.7	8.5	
Jordan	-0.2	-1.3	-2.4	-3.4	-4.3	-11.6	
Tanzania	-0.2	-0.7	-1.1	-1.3	-1.6	-6.3	
Madagascar	-0.5	-1.3	-2.3	-3.3	-4.5	-26.9	
Rwanda	-0.8	-2.1	-3.9	-5.7	-7.4	-13.1	
Uganda	-1.2	-1.8	-2.8	-4.1	-5.6	-22.5	
Uzbekistan	-2.1	-2.4	-2.8	-3.2	-3.7	-27.8	
Nicaragua	-2.5	-3.5	-4.6	-5.5	-6.5	-15.1	
Kyrgyz Republic	-3.7	-4.8	-5.8	-6.7	-7.5	-15.9	
Côte d'Ivoire	-5.9	-6.9	-7.5	-7.9	-8.3	-24.3	
Nepal	-5.9	-7.2	-8.3	-9.2	-10.0	-18.4	
Bangladesh	-6.5	-7.9	-9.4	-10.8	-12.2	-27.6	
Ecuador	-7.0	-8.1	-9.2	-10.1	-10.9	-15.8	
Indonesia	-8.1	-10.5	-12.7	-14.6	-16.3	-30.8	
Yemen, Rep.	-8.4	-10.6	-12.4	-13.7	-14.8	-24.0	
Egypt, Arab Rep.	-9.3	-9.7	-10.0	-10.3	-10.5	-17.2	
Guatamala	-9.3	-10.8	-12.1	-13.2	-14.1	-25.8	
Guinea-Bissau	-9.8	-13.4	-15.6	-17.0	-18.3	-30.5	
Georgia	-9.9	-11.0	-12.1	-13.1	-14.1	-23.8	
Azerbaijan	-10.3	-11.8	-13.4	-14.9	-16.4	-27.9	
Armenia	-11.8	-12.7	-13.5	-14.3	-15.2	-24.0	
Ukraine	-12.1	-12.6	-13.1	-13.4	-13.7	-16.6	
Zambia	-12.3	-12.8	-13.3	-13.8	-14.3	-21.7	
South Africa	-12.8	-19.6	-28.0	-34.0	-37.6	-44.4	
Tajikistan	-16.5	-17.4	-18.0	-18.4	-18.7	-21.4	
Countries with trade-offs							
Sri Lanka	5.4	1.9	-1.7	-4.7	-7.4	-23.6	0.8
Mauritania	5.2	2.2	-0.5	-2.6	-4.4	-14.7	0.9
Mali	4.7	2.1	-1.4	-5.0	-8.7	-27.3	0.8
Cambodia	4.0	4.1	4.2	4.1	4.0	-2.3	7.1
Moldova	3.3	3.1	2.8	2.5	2.1	-6.2	4.3
Ghana	2.1	1.5	1.0	0.5	-0.2	-18.4	1.9
Mongolia	1.8	-1.3	-4.1	-6.4	-8.4	-15.0	0.30
Burundi	1.6	3.6	4.8	5.2	5.2	-11.1	5.5
Papua New Guinea	1.1	0.6	0.6	0.6	0.6	-10.7	2.7
Central Afr. Rep.	-0.7	0.2	1.5	2.5	3.0	-3.3	0.4
Togo	-2.9	-2.5	-1.7	-0.9	-0.1	-6.0	2.1
Kenya	-4.5	-5.1	-5.1	-4.5	-3.4	4.2	3.0
Benin	-4.7	-3.5	-2.2	-1.0	0.1	-4.8	2.0

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ when all tariffs are increased to 62.4%, with tariffs already in excess of 62.4% left unaltered.

Table F3
Inequality Adjusted Gains from Trade and trade ϵ
Tariffs increase to 62.4%
(continued from previous page)

	G(0)	G(0.5)	G(1)	G(1.5)	G(2)	G(10)	ϵ
Countries with trade-offs (continued)							
Vietnam	6.8	6.9	7.1	7.4	7.7	4.6	
Burkina Faso	-2.4	-1.8	-1.5	-1.6	-2.0	-14.4	
Ethiopia	-5.7	-5.1	-4.6	-4.4	-4.4	-14.8	
Guinea	-6.3	-6.0	-5.6	-5.4	-5.3	-15.0	
Gambia, The	-7.0	-8.1	-8.2	-7.5	-6.2	-0.5	
Malawi	-8.8	-8.5	-8.4	-8.6	-8.9	-17.7	
Comoros	-9.0	-9.2	-9.1	-8.9	-8.8	-29.3	
Mozambique	-10.0	-8.2	-6.2	-4.8	-4.1	-20.2	
Cameroon	-11.9	-11.8	-11.7	-11.6	-11.6	-15.4	
Bolivia	-12.4	-13.0	-13.5	-13.6	-13.4	-23.8	
Niger	-12.7	-12.6	-12.1	-11.6	-11.1	-20.7	
Nigeria	-14.1	-14.4	-14.0	-12.6	-10.7	-43.6	
Pakistan	-15.0	-15.0	-16.4	-18.0	-19.6	-27.0	
Sierra Leone	-16.7	-15.7	-15.4	-15.4	-15.6	-17.2	
Iraq	-18.5	-18.3	-18.4	-18.6	-19.0	-23.9	
Liberia	-21.2	-21.4	-21.4	-21.4	-21.3	-26.1	
Average	-5.7	-6.4	-7.2	-7.8	-8.3	-17.9	2.4
Population weighted average	-7.5	-8.4	-9.4	-10.2	-10.8	-23.1	2.6
GDP weighted average	-9.0	-10.7	-12.5	-13.8	-14.8	-27.3	2.1

Notes: this table shows the gains from trade G(0), the inequality adjusted gains from trade, G(0.5), G(1), G(1.5), G(2) and G(10), and trade-ϵ, when all tariffs are increased to 62.4%, with tariffs already in excess of 62.4% left unaltered.