Evaluating Poverty Impacts of Globalization and Trade Policy Changes on Agricultural Producers

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Ernesto Valenzuela
Purdue University

Thomas W. Hertel*
Purdue University

Maros Ivanic
Purdue University

Alejandro Nin Pratt
International Livestock Research Institute

* Contact author: Department of Agricultural Economics, Center for Global Trade Analysis, Purdue University, 403 W. State St., West Lafayette, IN 47907-2056. Phone: (765) 494-4199. Email: hertel@purdue.edu.

Abstract

The poverty effects and in particular the impact of trade liberalization on smallholder livestock producers in African and South East Asian developing countries (Malawi, Zambia, Uganda, Mozambique, Vietnam, Bangladesh, Indonesia, and Philippines) is addressed by disaggregating income sources within agriculture into earnings from crop and livestock production. Given that livestock production in our developing country sample is a marginal activity with very little concentration households are stratified according to a small dependence on livestock earnings, and thus separating them from crops specialized earnings households, households who are wage labor specialized, transfer dependent households, and diversified households. We combine a macro-economic framework based on a Computable General Equilibrium global model, with a micro-economic follow-up simulation drawing on information contained in eight countries' household surveys.

In the assessment of poverty impacts of global trade liberalization we find significant cross-country differences between the short and long run. For all countries in our sample, with the exception of Philippines in the short run and Zambia in the long run (no change), the national headcount measure of poverty is reduced after trade liberalization. We provide an in-depth look at poverty changes in one of these economies – Malawi – where a substantial portion of the population is engaged in small-holder agriculture.

The differential effects by stratum and the distributional welfare impact along the income distribution constitute a significant resource for policy makers concerned about the impact of trade liberalization on the agriculture sector and more specifically on livestock activities.

Introduction

The need to analyze the impacts of trade policy changes on poverty, and specifically on smallholder livestock producers, demands the use of methods that combine the analysis of macro-economic impacts with detailed micro-economic assessments of producers' specific socio-economic characteristics. A number of approaches have recently been developed to tackle this micro-macro interface. Most of these involve the use of a Computable General Equilibrium (CGE) model to handle macro-side of things, combined with a survey-based micro-simulation model of a specific targeted population.

One of the most salient findings in this literature to date is the importance of earnings specialization on the part of households (Hertel et al., 2004). Poor households tend to be less diversified in their income sources and therefore they are more exposed to relative commodity price changes of the sort caused by trade liberalization. Research to date has focused on the specialization of earnings at the level of the entire agricultural sector. For example, in Malawi forty six percent of the population is dependent on agriculture income, and the share of total poverty is fifty nine percent.

The goal of this project is to implement the approach laid out in Hertel et. al., (2004) to assess the effects of trade liberalization on poverty and particularly to evaluate the impact of global trade liberalization on smallholder livestock producers of developing countries in Africa and South East Asia. This work combines analysis of macro-economic impacts based on a modified version of the Global Trade Analysis Project (GTAP) database and model with a detailed micro-simulation

analysis of household level impacts drawing on survey data in Malawi, Zambia, Uganda, Mozambique, Vietnam, Bangladesh, Indonesia, and Philippines[1].

This document is structured as follows. We begin by examining the pattern of total earnings specialization and livestock earnings specialization in our sample of countries. Household stratification is defined based on systematic earning patterns. We then turn to the analytical framework which consists of two parts: a micro-simulation model, built upon the household survey data, and used to assess individual household impacts, and a global trade model used to generate price changes. We then proceed to analyze the short and long run impacts of global trade liberalization on poverty in our sample economies, with an emphasis on the livestock earnings stratum.

II. Specialization of Earnings in South East Asia and African Developing Countries

Given the importance of specialized earnings sources in our analysis of impacts of trade liberalization, it is helpful to examine its prevalence across our sample of developing countries. This set of surveys has been selected on the basis of: (a) availability (b) recent coverage, (c) a detailed treatment of household earnings, including disaggregation of agriculture income into crops and livestock components, and (d) matching country coverage in our trade modeling data base: GTAP version 6 (Table 1). In working with these surveys, our unit of analysis is the household, and we

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[1] Up to date this is the maximum number of country household surveys available for this type of analysis. Country surveys with detailed agriculture and livestock information, and matching country coverage in our trade modeling data base (GTAP version 6). We are grateful to Dr. Arndt for making available the Mozambique survey. The rest of surveys were available thanks to Dr. Martin at the World Bank

assume equal sharing of income within the household in order to obtain income on a per person basis.[2]

The survey data show that the share of crop earnings in total income falls as households become richer in Zambia and in Malawi, where the extremely poor are almost fully dependent on agricultural income[3]. The share of crop earnings in total income falls moderately as households become richer in Uganda, Philippines and Indonesia. This share is kept constant in Vietnam, Bangladesh, and Mozambique.

The share of crops earnings in poor households (individuals with per capita income less than one dollar a day) ranges from 17 % in Bangladesh to 52 % in Malawi (Table 2). The share of livestock earnings in poor households ranges from 1 % in Zambia to 9% in Mozambique.

We found that livestock activities in our sample of developing countries are a supplementary activity with few households fully specialized. This suggests that the focus to analyze the effects of trade liberalization on small livestock producers should be based on households with a livestock income share greater than 5 percent as opposed to an income share of 95%.

In this earnings group for Malawi, figure 3 shows that the poorest households are almost fully specialized in livestock production (a share of 80%), with a marked decrease of this share for the richest households (a share of 20%). This same pattern is observed in other countries, i.e. Zambia , where there is complete specialization in livestock raising activities for the lowest households and a switch to non agriculture activities in the richest households (the livestock income share decreases to 10%). Indonesia shows a homogenous livestock share of income ranging from the poorest to the third income quartile of the population. For the richest people in this Indonesian

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[2] This assumption will tend to understate income inequality, although the impact on poverty measures is less clear (Haddad and Kanbur, 1990).
[3] Graphs depicting composition of income, and livestock earnings specialization for individual countries are found in the appendix of this document.

stratum (the upper quartile) there is a high degree of substitution of livestock raising activities for other than crops agriculture production. Mozambique shows almost fully specialization for the poor and rich household, with a moderate average share of 45% for the households with median income. The livestock share of income is homogenous along the income distribution in Philippines with an average share of 25%, and in Uganda with an average share of 35%. Bangladesh shows a low level of livestock income share of about 15%. This low specialization in livestock activities is an important aspect to consider when trade liberalization aspects are analyzed for smallholder livestock producers.

The importance of focusing on a livestock raising household stratum is reflected when one looks at the share of livestock income on the impoverished population (Table 2). For instance in Malawi, while livestock raising income account for only five percent in the total population, it accounts for seven percent in poor households. However, for poor household with some level of livestock activity, this income accounts for more than one third (34%) of total income. Thus, these households are more sensitive to any trade liberalization effects. This change in the share of income is even more striking in Zambia, where the share of livestock income in total population is 1%, but in poor households with some income generated by livestock activities it accounts for 65%.

The rest of earnings-based strata are defined on specialization. Here, we define "specialization" as referring to households that earn 95% or more of their income from a agricultural profits (excluding the livestock producers), wage labor-specialized households, households that are specialized in non-agricultural profits (i.e. self-employed in non-agricultural sectors), those that are specialized in transfers, and those that are non-specialized, i.e. diversified.

Isolating these six earnings strata is justified by the differential effect on the share of total population, share of total poverty, and the poverty head count proportion of total population (Table

3). For illustration, Vietnam has a 43% share of poverty in the livestock stratum. Malawi has a 38% share of poverty in the agricultural stratum, Bangladesh has a 24% share of poverty in the wages stratum, Zambia has a 25% share of poverty in the non agricultural sector, and Uganda and Philippines have the larger share of poverty in the diversified stratum (almost 70%).

Given that the methodology of inputting returns from profit type income for long run analysis is documented in detail in Ivanic (2003), we will not elaborate on this aspect on this paper.

III. Analytical Framework

Micro-simulation Model

Following Hertel (2004) this analysis of the impacts of trade liberalization initiates with the specification of a utility function, and an associated consumer demand system, with which we can determine household consumption, as well as the maximum utility attainable by the household at a given set of prices and income. The utility of the household at the poverty line is defined as the poverty level of utility. As a result of trade liberalization, if some households' utility falls below this level, they are considered to have "fallen into poverty". Conversely, if they are lifted above this level of utility, they are no longer in poverty.

To obtain a utility function for each country, we use an implicitly directly additive demand system (AIDADS), due to its capability to capture expenditure patterns across the global income spectrum (Rimmer and Powell's 1992a, 1992b, 1996) using the estimation framework developed by Cranfield et al., 2004.

Having specified the form of the *per capita* utility function, which is common across all individuals within each country, we are now in a position to specify the household micro-simulation

model, which involves maximizing per capita utility, subject to a per capita budget constraint, based on the households' overall endowments:

Choose $(x_{1k},...,x_{ik},...,x_{nk})$, where i indexes the commodities and k households, to maximize per capita household utility, u_k, subject to:

$$\sum_{i=1}^{n} U_i(x_{ik}, u_k) = 1 ,\tag{1}$$

$$U_i(x_{ik}, u_k) = \varphi_{ik}(u_k)\ln\left(\frac{x_{ik} - \gamma_i}{A\exp(u_k)}\right) \quad \forall\, i \tag{2}$$

$$\varphi_{ik}(u_k) = [\alpha_i + \beta_i \exp(u_k)]/[1 + \exp(u_k)], \text{ and} \tag{3}$$

$$\sum_{i=1}^{n}(p_i x_{ik}) = Y^k = \sum_f W_f \overline{E}_f^k - \sum_f \delta_f P_f \overline{E}_f^k + T^k Y \tag{4}$$

In this formulation, (1) and (2) define the implicitly additive AIDADS utility function with parameters $\alpha_i, \beta_i, \gamma_i$ and A, and marginal budget share as defined by (3). Equation (4) is the *per capita* budget constraint, with income defined net of depreciation and inclusive of any transfers. The notation for the income expression is as follows: W_f is the wage paid to endowment $\overline{E}_f^k$, δ_i is the geometric rate of depreciation for endowment $\overline{E}_f^k$ (zero for non-capital items), P_f is the cost of replacing depreciable endowment f (the capital goods price), and T^k is the transfer rate for household k, which is assumed to be a constant share of net national income, Y.

In our subsequent analysis, we use the survey-based observations on endowments and transfers. The depreciation rate for capital stock is obtained from the national accounts. Trade liberalization will alter the wages associated with each endowment, the price of capital goods and transfers. The resulting level of income for household k can be computed using equation (4). Once

we know the new income level, it may be combined with the new vector of commodity prices to compute expenditure on each good, and hence individual demands. We then use equations (1) – (3) to compute per capita utility. Based on the post-liberalization utility level, we are in a position to compute the change in poverty headcount.

Modeling Trade Liberalization

In theory, the preceding micro-simulation model could be used in conjunction with any policy simulation framework capable of producing the requisite price changes. We use a modified version of the GTAP global trade model (Hertel, 1997) to generate the price changes to be fed into the micro-simulation analysis. The modifications undertaken are aimed at obtaining national per capita consumption consistency between the global trade model and the micro-simulation framework. Building on the GTAP model has several advantages. First, this is a global model, so it is capable of producing results from a global trade liberalization scenario. Second, it is a relatively standard CGE model, assuming perfect competition and differentiated products in international trade. Owing in part to this simplicity, GTAP is the most widely used trade model available, with more than 2,000 users around the world. By demonstrating how this can be modified and rendered consistent with our micro-simulation model, we open the door to those users interested in addressing distributional issues in their analyses.

In order to reconcile differences in gross factor earnings in the micro-simulation and GTAP model, an estimate of national depreciation is introduced into the household survey database in proportion to household's estimated gross earnings from capital

Further we modify the specification of consumer demand in the GTAP model, replacing the Constant Difference of Elasticities (CDE) demand system with the econometrically estimated

AIDADS demand system discussed previously. This ensures that the specification of consumer demand in the two frameworks is fully consistent for all of the countries where we have survey data. Since the data used to calibrate the micro-simulation approach come from the 1996 International Comparisons Project (ICP), and ICP-based consumer expenditure shares are evaluated at consumer prices, and the GTAP consumption vector is evaluated at producer prices, we are also required to explicitly model wholesale/retail/transport margins applied to goods destined for private consumption. These are modeled using a Cobb-Douglas production function, which combines the producer good with margins services in order to produce the consumer good.

Several further steps are required in order to ensure consistency between the GTAP data base and the micro-simulation model. Depreciation is a critical component of the macro-economic accounts, but it is absent from the survey data. This makes it impossible to reconcile the net income effects of trade liberalization between the two frameworks. Therefore, national depreciation is shared out among the households in the micro-simulation model in proportion to estimated gross earnings from capital.[4] A final problem relates to transfer payments, which are unobserved in the GTAP data base, but which are assumed to be proportional to net national income. Accordingly, government spending, tax revenues and foreign borrowing, which are explicitly modeled in GTAP, are also tied to net national income in the model closure adopted in our subsequent simulation analysis.[5] We

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[4] National depreciation is obtained from the GTAP data base. This estimate comes originally from the World Bank. We compute the share of depreciation in gross capital income and apply this to the micro-simulation data base.

[5] This fixed share assumption for government spending is not strictly true in the standard closure for version 6.1 of the GTAP model – due to non-homotheticity of private consumption. Therefore, since we want this to hold exactly, we introduce a preference shift for regional household utility function such that the shares of private and public consumption and savings in net national income are fixed.

follow Harrison, Rutherford and Tarr (2002a, 2002b) in replacing the foregone tariff revenue with a value-added tax to maintain taxes' share in net national income. [6]

Factor market closure is the distinguishing feature between our short run and long run results. In the short run, wage and salaried laborers are mobile across sectors, but capital, land and self-employed labor are immobile and the returns to the latter factors are combined into sectoral "profits". The latter correspond to the agriculture and non-agriculture profits reported in the household surveys. The long run closure assumes that self-employed labor is perfectly mobile, and perfectly substitutable with wage labor of the same skill category. It also assumes that capital is perfectly mobile across sectors, while farm land is partially mobile across uses within the agricultural sector. The macro-closure of the model ensures that government spending, taxes, transfer payments and foreign borrowing are all tied to net national income.

Table 4 provides a summary of the extent of protection currently in place in our sample of countries and OCED countries as a reference. To identify the maximum potential impact of trade liberalization on poverty, our simulation experiment involves elimination of all the import barriers listed in table 4. In addition we remove agricultural export subsidies on developed economies. Domestic agricultural subsidies are left in place.

IV. Impacts of Trade Liberalization

Income Effects

Income effects of global trade liberalization are reported in table 5. The reported per capita earnings impacts are relative to the numeraire, which is the average earnings index worldwide. The

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[6] GTAP users will recognize that the MFA quota rents are treated as export taxes in the model. However, these rents rarely accrue in full to the government price, so we have omitted them from the tax replacement equations.

short-run and long-run average percentage increase in private household earnings in each of the eight focus countries is reported in the first column. The prices that consumers must pay for goods and services also are affected after trade liberalization, this is shown in CPI column (second column)[7]. So one must compare the two to evaluate the per capita welfare impacts of trade liberalization (third column). On this basis, we observe that per capita real income rises in every case. In Zambia in the short-run there is a decrease in the level of per capita earnings, however the decrease in CPI dominates leading to a positive effect of trade liberalization. The largest per capita gain in real income arises in Vietnam, followed by Mozambique, Bangladesh and Malawi. The rest of the countries show a modest per capita gain in real income from trade liberalization.

To analyze the income effect on the earnings strata, the last 6 columns of table 5 show the per capita earnings per stratum. Given our focus on the effect of trade liberalization on small livestock producers, the per capita earning in the livestock stratum (fourth column) is of particular interest for us. Malawi shows a high level of gains in the livestock stratum, only surpassed by the agricultural stratum. If we compare these figures with the CPI changes, this evidences that this stratum gains considerably after trade liberalization. Vietnam shows the most gains in the livestock stratum for our sample of countries at short and long run. Mozambique, Bangladesh and Indonesia show modest gains at short and long run. The Uganda and Philippines livestock stratum lose in the short run, when is compared to the CPI changes. However, for both countries this stratum is better off at long run. Zambia's livestock stratum loses at long run, and although it gains at short run, the increase is considerably lower than in the agricultural stratum.

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[7] Aggregated price changes for factors of production, and commodities at both producer and consumer prices for global trade liberalization are reported in the appendix.

The reason why returns to agriculture and livestock in most of our sample countries rise is due to the high level of protection for both activities in the OECD countries.

As indicated previously, Malawi is an interesting case to look the earnings structure in more detail. Fig 4 shows the percentage change in earnings structure of all strata in the long run. In general, earnings increase at a higher rate at higher levels of income; particularly for the agriculture and livestock strata. In contrast, a more homogeneous behavior is present in the short run (fig 5). At the particular livestock stratum level, fig 6 shows the percentage change in factor earnings contribution; all factors except skilled wage depict increasing earnings on income levels.

Before analyzing the poverty impacts of trade liberalization, we present a summary figure on Malawi's consumption pattern in the agriculture stratum (figure 7). The percentage change in consumption increases as income levels increase for all goods, but services where there is decrease as income levels increase.

Poverty Impacts

The micro-simulation model is now used to ascertain the likely impact on different household strata and on the overall rate of poverty in each country over both the short and long runs. These results are reported in table 6 as percentage changes in the national poverty headcount measures from table 3.

There is a decrease in the headcount poverty for all countries at short and long run scenarios. The only exception is Zambia at long run where there is no change, and an increase in the short run in Philippines.

In Malawi, the national poverty rate is 65% and more than half of the poor are earnings-specialized in agriculture and livestock. Therefore, any reduction in agricultural and livestock

poverty is bound to be good news at the national level. This is indeed the case, with poverty falling in both the short and long run, led by declines amongst the agriculture, livestock, and diversified strata. In the short run, the decrease in the headcount poverty in the livestock and agriculture strata help to offset the increase in poverty amongst the non agriculture and wage labor specialized household. Poverty falls in the diversified stratum, due to the prevalence of agricultural earnings amongst the poorest households in this group. The groups with rising poverty have lower than average earnings increases. When coupled with large budget shares devoted to food products (rising prices), and small budget shares devoted to manufactures (falling prices), some households above the poverty line are pushed into poverty by trade liberalization. Despite the rise in *per capita* real income, the real incomes of poor households in these strata fall. In the long run poverty decreases in all strata of Malawi's economy. In the long run, with agriculture and livestock expanding, the relative return to unskilled labor also rises. This sector represents a much larger share of the labor force. Nevertheless, the long run poverty reduction in Malawi is still smaller than in the short run, due to the benefits of the higher farm prices going to landowners, as well as smaller *per capita* real income gains in the long run.

In Uganda, Mozambique and Indonesia poverty falls in a relatively homogeneous way for all strata in the short and long run.

There is no change in Zambia's livestock and agriculture strata poverty headcount either at short or long run. The non agriculture and diversified strata benefits from trade liberalization.

As it was evidenced in the income effects, Vietnam experiences the greatest reduction in poverty headcount. The livestock stratum is a key component in this poverty reduction, as this stratum concentrates 43% of the total population. In the long run, the national poverty reduction in Vietnam is twice as large as in the short run.

The increase in poverty that Philippines experiences in the short run is mostly influenced by a relatively large increase in the poverty headcount in the livestock and agriculture strata. There is a decrease in poverty in the long run, in which the substantial change is the reduction in poverty in the livestock and agriculture strata. This difference has to do with the degree of inter-sector factor mobility. In the long run, it is assumed that self-employed labor and capital are perfectly mobile. This means that the losses that were previously endured by self-employed farmers are now dissipated across the economy.

The livestock stratum plays an important role in poverty reduction in Bangladesh at long run and a modest role in the short run.

Impacts Across the Income Distribution

This section provides a more comprehensive analysis of the impacts of trade liberalization on households' welfare across the income spectrum. We do so by computing the Equivalent Variation (EV) of the ensuing price and income changes. This involves solving the system of equations (1) – (4) for the transfer required to give each household the post-reform level of utility, at the pre-reform prices. This EV is subsequently normalized by initial income to show the proportionate gain across the income spectrum. If this curve is rising, then it indicates a regressive effect – i.e., proportionately larger gains for the wealthy. On the other hand, if it is falling, then it indicates that trade liberalization benefits the poor more than the rich.

Figures 8 and 9 report the relative EV impacts across the income spectrum in Malawi in the short and in the long run, respectively. Here, all households have been arranged along the horizontal axis from poorest to richest, and a line has been drawn connecting the households in each stratum. The results displayed in figure 8 (short run) shows an increase in welfare in all strata for all income

spectrum except for wages labor and diversified. The agriculture and livestock benefits the most, with a clear upward slope for the agriculture strata.. The long run impact (figure 9) shows a welfare increase for all strata along the income distribution, with increasing gains for the richer in agriculture and livestock strata.

Similar welfare changes are found for Uganda (appendix). All strata in the short run describe a U curve shape, which implies a larger benefit for the poorest and richest households. The only negative effects are in the agriculture stratum, which contrasts with the positive effects on welfare for the livestock stratum. In the long run, this U shape effect is much more marked suggesting that only the extremely poor and extremely rich in the Uganda economy benefit in the long run from a trade liberalization scheme.

In the short run in Zambia the livestock and agriculture strata perceive an increase in welfare, with much larger benefits for the richer members of these strata. In the long run, welfare increases only for the richest households for both strata.

Mozambique's short run and long run distributional effects show a welfare increase for all strata, being this effect fairly homogenous for the livestock and agriculture strata.

Vietnam is an interesting case of the usefulness of our distributional approach in showing welfare effects. Despite Vietnam facing the greatest per capita earnings, and a marked decrease in the percentage change in total poverty, there is a distinction along the income spectrum for the livestock stratum between what segment of the population is better off and who is worse off. The homogeneous negative impact on welfare in the agriculture stratum confirms our previous finding of an increase in the poverty headcount for this stratum. In the long run, there is a large positive change in welfare for all strata, except in agriculture where the poorest benefit the most and the richer experience a decrease in welfare.

In the short run Bangladesh shares the same welfare distributional characteristics as Vietnam (a homogenous pattern), with a negative impact on the agriculture stratum. The long run welfare impacts show an upward sloping pattern (the richer benefit the most) with a positive impact along the whole income spectrum.

Philippines' short run welfare effects are homogenous along the income distribution. With negative impacts on the agriculture and livestock strata, and the richest households in the diversified stratum benefits in contrast with the rest of the members of that earnings group. In the long run, the richer benefit the most in all strata, except in the wage labor stratum where an inverse pattern is illustrated.

Indonesia's short run welfare impacts describe a homogenous upward sloping behavior, with gains along the whole income distribution. In the long run the welfare impacts are all positive along the income space, but the curves describe a sinusoidal path (except for the transfer stratum), implying that starting from the lowest household the positive change in welfare increases as the richer the household hitting a plateau and then a minimum for middle income groups and a large increase for the richest households.

V. Summary and Conclusions

The impact on smallholder livestock producers in African and South East Asian countries is addressed by stratifying households according to a small dependence on livestock earnings, and thus separating them from crops specialized earnings households. In doing this, we are able to show in detail the role of livestock raising activities in the wake of trade policy impacts, while preserving analytical tractability and comparability across countries.

In the assessment of poverty impacts of global trade liberalization we find substantial cross-country differences between the short and long run. For all countries in our sample, with the exception of Philippines in the short run and Zambia in the long run (no change), the national headcount measure of poverty is reduced after trade liberalization.

The differential effect by stratum, and the distributional welfare impact along the income distribution constitute a significant resource for policy makers concerned about the impact of trade liberalization on the agriculture sector and more specifically on livestock activities.

Table 1: Household surveys used in the study

Country	Sample Size	Year	Name of Survey
Malawi	9,243	1998	Integrated Household Survey
Uganda	10,680	1999	Uganda National Household Survey
Zambia	15,268	1999	Living Conditions Monitoring Survey
Mozambique	8,700	2002-2003	IAF Household Survey
Vietnam	5,999	1998	Household Living Standards Survey
Bangladesh	7,417	1996	Household Expenditure Survey
Philippines	37,393	1999	Annual Poverty Indicators Survey
Indonesia	59,111	1993	National Socio-Economic Survey

Table 2. Decomposition of income (sources of earnings), in total population, poor households, and poor households with at least a 5 % of income share generated by livestock activities.

	Lvstk	Crops	Oth Ag	Non Ag	Trans	Skl Wage	Unskl Wage
Malawi							
share in total population	0.05	0.41	0.06	0.13	0.12	0.08	0.15
share in poor hh	0.07	0.52	0.06	0.14	0.13	0.01	0.07
Share in poor lvstk hh	0.34	0.43	0.05	0.06	0.10	0.00	0.02
(lvstk income share > .05)							
Uganda							
share in total population	0.05	0.42	0.18	0.19	0.04	0.10	0.05
share in poor hh	0.04	0.45	0.13	0.27	0.00	0.08	0.04
Share in poor lvstk hh	0.38	0.25	0.10	0.25	0.00	0.02	0.38
(lvstk income share > .05)							
Zambia							
share in total population	0.01	0.22	0.36	0.09	0.07	0.25	0.01
share in poor hh	0.01	0.29	0.34	0.11	0.04	0.21	0.01
Share in poor lvstk hh	0.65	0.27	0.07	0.01	0.00	0.01	0.65
(lvstk income share > .05)							
Mozambique							
share in total population	0.07	0.24	0.02	0.24	0.18	0.02	0.23
share in poor hh	0.09	0.35	0.03	0.22	0.20	0.00	0.11
Share in poor lvstk hh	0.59	0.20	0.00	0.07	0.09	0.00	0.05
(lvstk income share > .05)							
Vietnam							
share in total population	0.04	0.31	NA	0.21	0.09	0.02	0.33
share in poor hh	0.05	0.32	NA	0.14	0.14	0.01	0.34
Share in poor lvstk hh	0.15	0.44	NA	0.05	0.08	0.00	0.26
(lvstk income share > .05)							
Bangladesh							
share in total population	0.03	0.18	0.03	0.32	0.08	0.06	0.31
share in poor hh	0.03	0.17	0.03	0.21	0.08	0.01	0.46
Share in poor lvstk hh	0.15	0.29	0.04	0.11	0.05	0.01	0.36
(lvstk income share > .05)							
Philippines							
share in total population	0.02	0.26	NA	0.26	0.09	0.08	0.28
share in poor hh	0.01	0.31	NA	0.23	0.12	0.01	0.31
Share in poor lvstk hh	0.22	0.48	NA	0.13	0.06	0.01	0.10
(lvstk income share > .05)							
Indonesia							
share in total population	0.03	0.16	0.36	0.16	0.03	0.08	0.19
share in poor hh	0.05	0.33	0.22	0.15	0.04	0.01	0.19
Share in poor lvstk hh	0.31	0.42	0.06	0.16	0.00	0.00	0.04
(lvstk income share > .05)							

Table 3. Structure of Poverty, by Earnings-based Stratum

	LVTK income share $\geq .05$	Ag	Wages	Transfer	Non Ag	Diverse	Total
Malawi							
share of total population	0.14	0.30	0.14	0.05	0.07	0.30	1.00
share of total poverty	0.17	0.38	0.06	0.06	0.09	0.25	1.00
Poverty headcount as a proportion of total pop.	0.11	0.25	0.04	0.04	0.06	0.16	0.65
Uganda							
share of total population	0.12	0.09	0.04	0.01	0.04	0.69	1.00
share of total poverty	0.09	0.13	0.03	0.03	0.03	0.69	1.00
Poverty headcount as a proportion of total pop.	0.03	0.05	0.01	0.01	0.01	0.25	0.37
Zambia							
share of total population	0.02	0.20	0.21	0.05	0.25	0.27	1.00
share of total poverty	0.02	0.28	0.17	0.06	0.25	0.22	1.00
Poverty headcount as a proportion of total pop.	0.01	0.20	0.12	0.05	0.18	0.16	0.72
Mozambique							
share of total population	0.11	0.17	0.17	0.10	0.15	0.30	1.00
share of total poverty	0.15	0.26	0.07	0.12	0.15	0.24	1.00
Poverty headcount as a proportion of total pop.	0.08	0.14	0.04	0.07	0.08	0.13	0.54
Vietnam							
share of total population	0.43	0.01	0.04	0.02	0.10	0.41	1.00
share of total poverty	0.43	0.02	0.06	0.03	0.06	0.40	1.00
Poverty headcount as a proportion of total pop.	0.16	0.01	0.02	0.01	0.02	0.15	0.37
Bangladesh							
share of total population	0.14	0.07	0.15	0.02	0.19	0.42	1.00
share of total poverty	0.16	0.09	0.24	0.03	0.13	0.35	1.00
Poverty headcount as a proportion of total pop.	0.05	0.03	0.07	0.01	0.04	0.10	0.29
Philippines							
share of total population	0.09	0.08	0.14	0.02	0.07	0.60	1.00
share of total poverty	0.06	0.07	0.09	0.03	0.06	0.68	1.00
Poverty headcount as a proportion of total pop.	0.01	0.01	0.01	0.00	0.01	0.08	0.12
Indonesia							
share of total population	0.10	0.13	0.15	0.01	0.16	0.45	1.00
share of total poverty	0.16	0.30	0.10	0.03	0.13	0.29	1.00
Poverty headcount as a proportion of total pop.	0.02	0.04	0.02	0.01	0.02	0.04	0.15

Table 4. Average Rates of Import Protection, by Sector and Country.

Country	Primary AG	Primary Nonag	Proc food	Textiles, apparel	Other Manuf.
Malawi	23	12	24	35	22
Uganda	40	13	15	19	16
Zambia	6	13	11	20	13
Mozambique	8	12	18	31	13
Vietnam	14	15	43	34	14
Bangladesh	14	20	24	29	15
Philippines	14	7	18	14	6
Indonesia	7	7	15	16	10
OECD*	16	2	21	10	2

*Excludes Mexico

Table 5. Impacts of Global Trade Liberalization on earnings (% change). Short and Long run effects.

Country	Total *Per capita* earnings	CPI	Difference	*Per capita earnings by stratum*					
				LVTK	Ag	Wages	Transfer	Non Ag	Diverse
Malawi									
SR	1.54	0.09	1.45	4.02	5.66	-0.27	1.95	-0.18	2.31
LR	2.98	1.75	1.23	3.39	4.48	1.85	3.36	2.93	3.42
Uganda									
SR	0.95	0.72	0.23	0.71	0.52	1.25	1.01	1.5	0.95
LR	-0.03	-0.11	0.08	-0.01	0.02	-0.19	-0.02	0.01	-0.03
Zambia									
SR	-0.32	-0.47	0.15	0.15	0.92	-0.78	-0.07	-0.14	-0.16
LR	0.78	0.66	0.12	0.5	1.81	0.24	0.92	1.07	0.92
Mozambique									
SR	3.18	1.57	1.61	2.36	2.07	3.69	3.55	3.64	3.35
LR	2.84	1.27	1.57	2.68	2.61	2.76	3.15	3.13	2.87
Vietnam									
SR	17.23	8.85	8.38	15.04	7.53	24.75	17.66	16.83	18.91
LR	17.78	9.26	8.52	17.61	11.25	19.22	18.11	17.66	18.01
Bangladesh									
SR	1.48	0.04	1.44	0.77	-0.37	1.37	1.06	2.24	1.52
LR	6.99	5.18	1.81	6.94	6.94	6.84	6.82	7.17	6.96
Philippines									
SR	2.11	1.23	0.88	0.33	-0.39	1.38	2.01	3.38	2.06
LR	3.43	1.97	1.46	2.77	2.63	2.36	3.41	4.36	3.34
Indonesia									
SR	1.48	0.69	0.79	1.41	1.38	1.51	1.38	1.49	1.48
LR	2.83	2.11	0.72	2.79	2.61	2.79	2.74	2.88	2.79

Table 6. Short and Long Run Changes in Poverty, by Stratum and Country: Percentage Change in Poverty Headcount.

	LVTK income share ≥ .05	Ag	Wages	Transfer	Non Ag	Diverse	Total
Malawi							
Short run	-1.3	-1.5	0.9	-0.4	0.3	-1.2	**-1.1**
Long run	-0.5	-0.7	-0.7	-0.3	-0.1	-0.8	**-0.6**
Uganda							
Short run	-0.4	-0.2	-0.9	-0.1	-1.5	-0.6	**-0.5**
Long run	-0.3	-0.5	-0.2	-0.1	-0.3	-0.3	**-0.3**
Zambia							
Short run	0	0	-0.1	0	-0.2	-0.2	**-0.1**
Long run	0	0	0.1	0	-0.2	-0.1	**0**
Mozambique							
Short run	-0.5	-0.2	-2.1	-0.6	-0.8	-1.1	**-0.7**
Long run	-0.6	-0.3	-1.4	-0.6	-0.7	-1	**-0.7**
Vietnam							
Short run	-5.6	0.4	-8.6	-2.4	-7	-10.3	**-7.5**
Long run	-9.6	-3.9	-5.9	-2.5	-9.5	-9.4	**-9**
Bangladesh							
Short run	-1	0.5	-1.4	-0.5	-3.5	-2.1	**-1.6**
Long run	-3	-2	-1.7	-0.7	-2.7	-2.8	**-2.4**
Philippines							
Short run	4.8	6.2	0.4	0.2	-1.5	1.3	**1.6**
Long run	-1	-0.7	-1.8	-1.7	-1.7	-1.5	**-1.4**
Indonesia							
Short run	-0.4	-0.2	-1.7	-0.1	-0.3	-0.9	**-0.6**
Long run	-1.6	-1.4	-1.6	-0.2	-1.4	-1.7	**-1.5**

Figure 1. Composition of income in Malawi, ranging from lowest to highest ventiles.
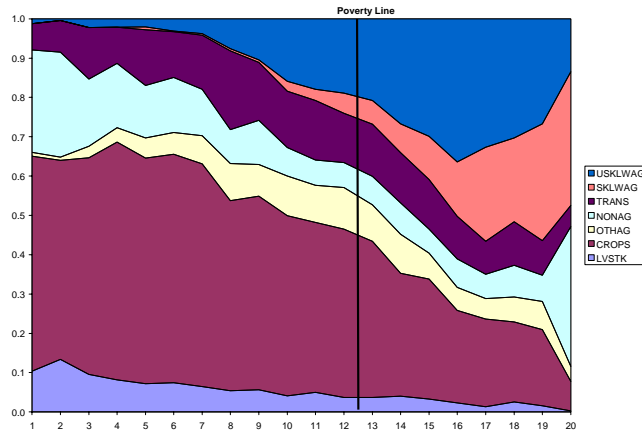
Figure 2. Livestock Earnings Specialization in Malawi Households
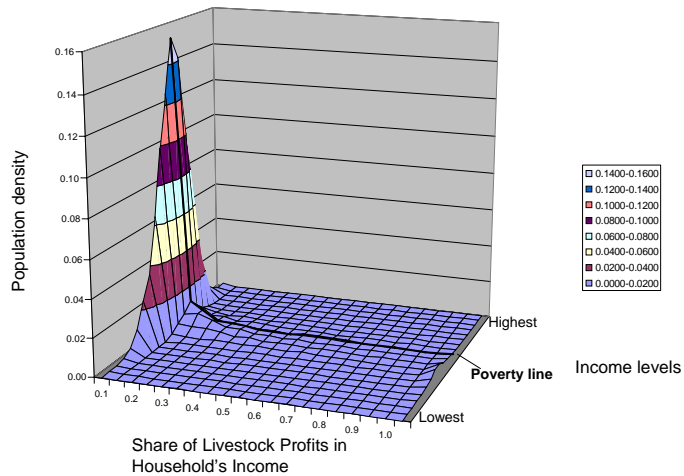
Figure 3. Composition of income in Malawi's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.
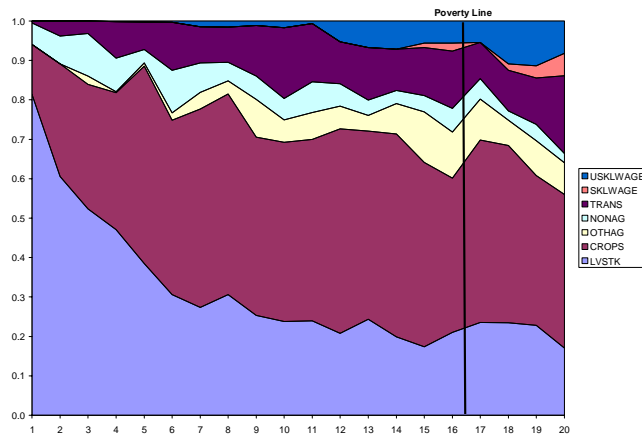
Fig 4. Percentage change in earnings per stratum in Malawi at long run (x –axis: 1=lowest income level, 20=highest income level).
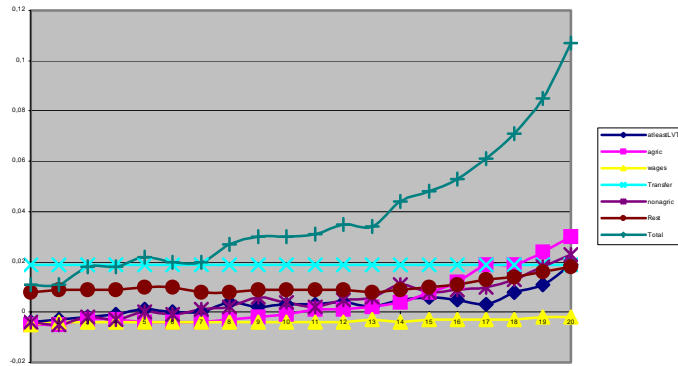
Fig 5. Percentage change in earnings per stratum in Malawi at short run (x –axis: 1=lowest income level, 20=highest income level).
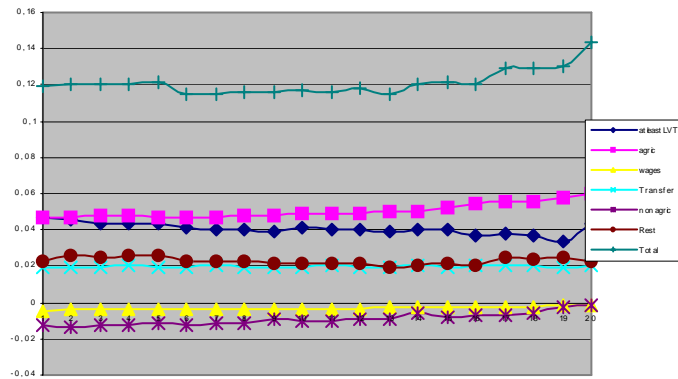
Fig 6. Percentage change in factor earnings in Malawi's livestock stratum in the long run (x –axis: 1=lowest income level, 20=highest income level).
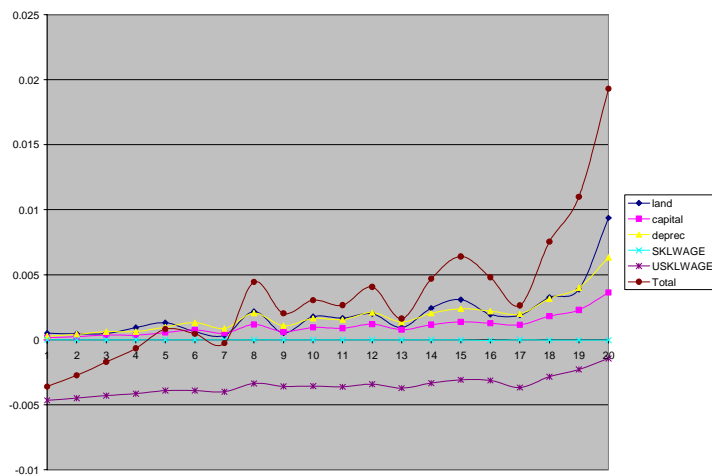
Fig 7. Percentage change in consumption in Malawi's agriculture stratum in the long run (x –axis: 1=lowest income level, 20=highest income level).
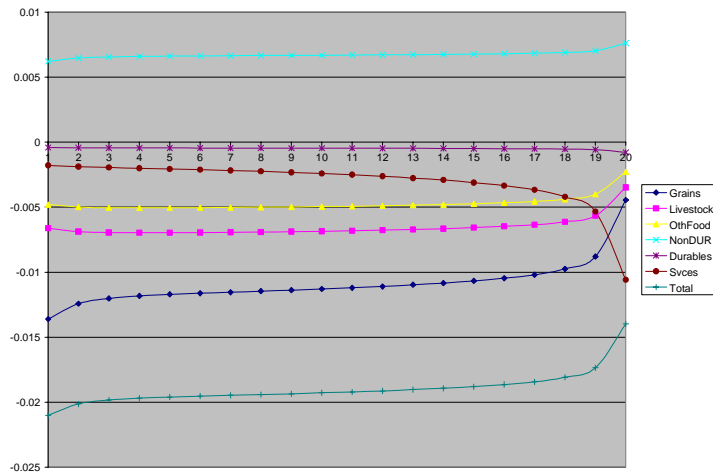
Figure 8. Impacts of Global Trade Liberalization on Welfare. Percentage change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Malawi. Short-run effects.
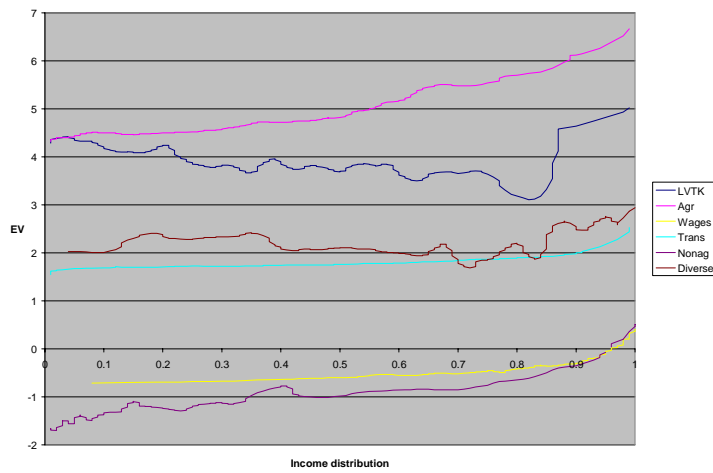
Figure 9. Impacts of Global Trade Liberalization on Welfare. Percentage change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Malawi. Long-run effects.
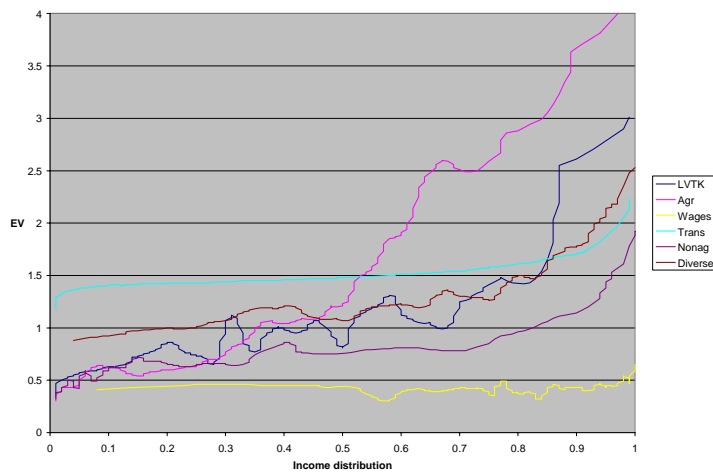
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Appendix

Household Surveys Income Information

This section groups the composition of income, and livestock earnings specialization.

The composition of income figures blur distinction from households fully dependent on agriculture income and those with no dependence on agriculture income at a given income level. Thus, in order to explore the differential effects of income sources on a group of livestock-specialized households, we construct a three dimensional distribution of households in country surveys with the data arranged according to the share of household income derived from livestock profits (x-axis) and log of income level (y-axis). This graph puts in evidence that livestock activities in our developing country sample are a marginal activity with very little concentration. This suggests that the focus to analyze the effects of trade liberalization on small livestock producers should be based on households with a livestock income share greater than 5 percent.

Figure A1. Composition of income in Uganda, ranging from lowest to highest ventiles.
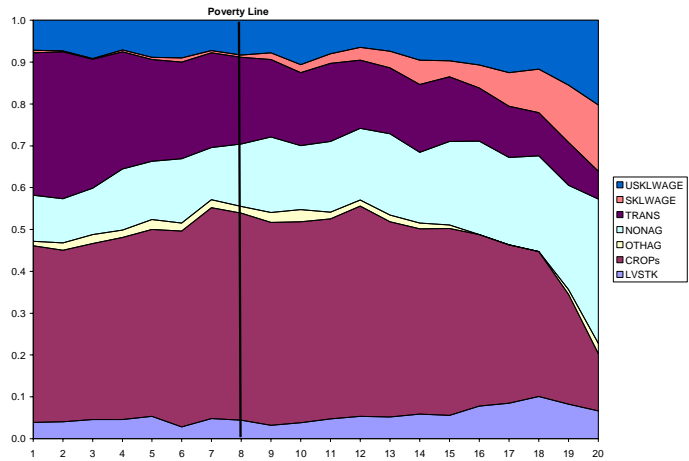
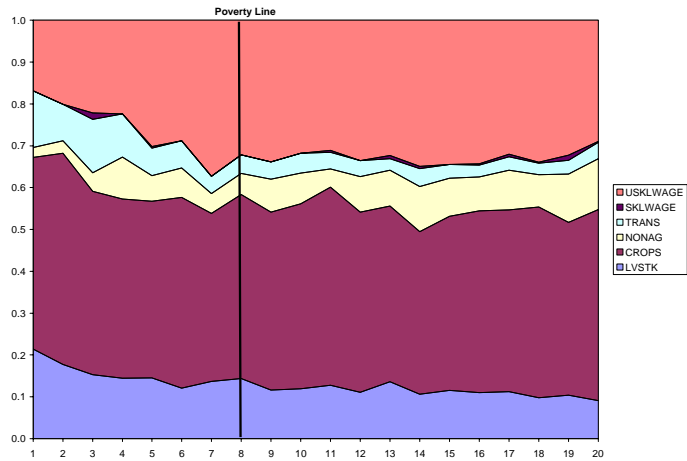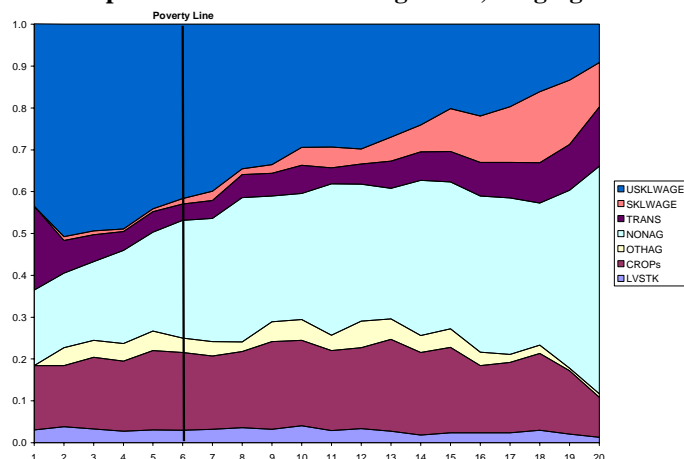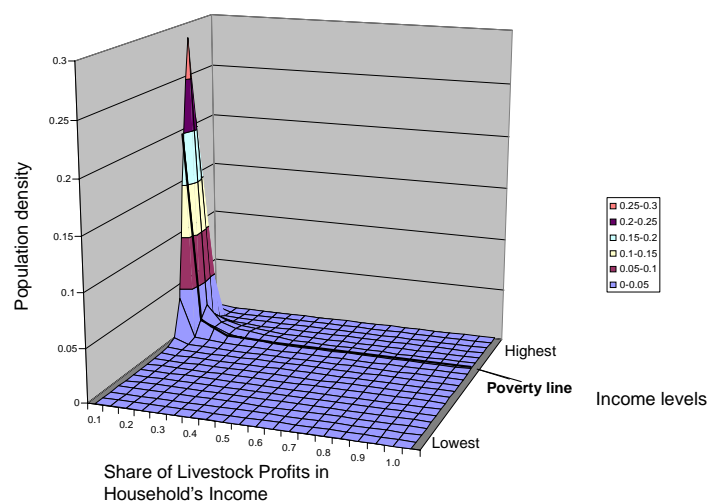**Figure A2. Livestock Earnings Specialization in Uganda Households**
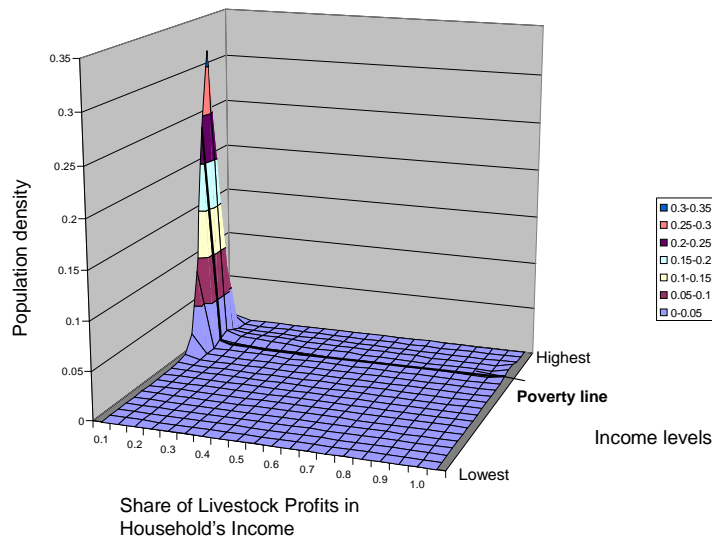
Figure A3. Composition of income in Uganda's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.
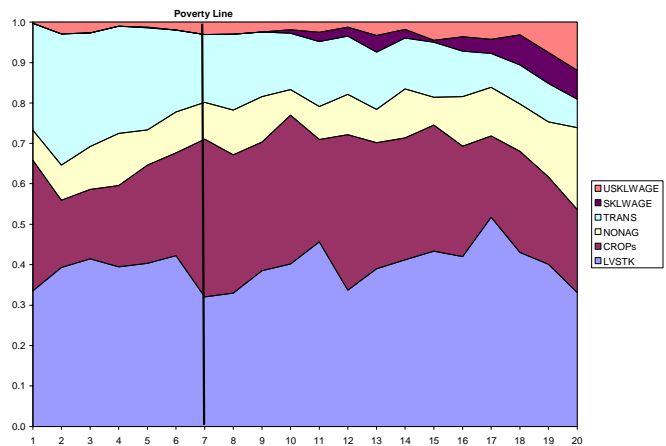
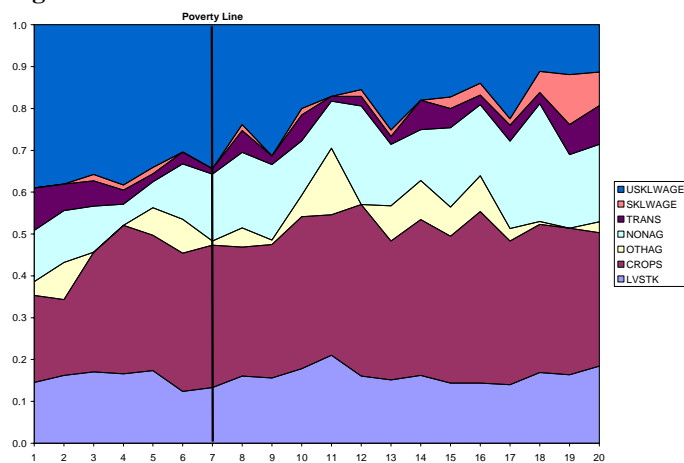**Figure A4. Composition of income in Zambia, ranging from lowest to highest ventiles.**
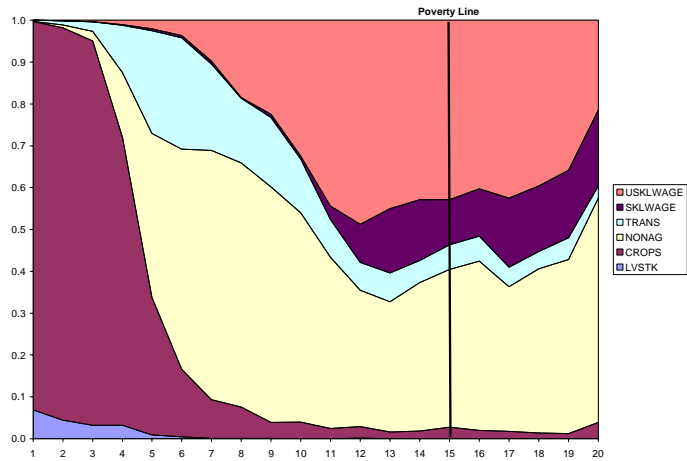
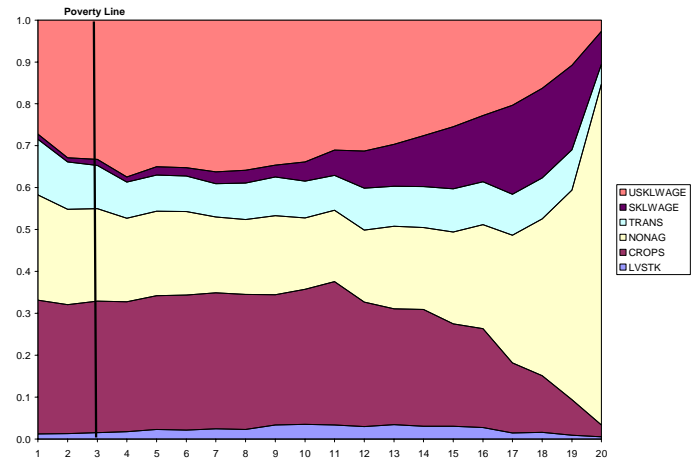

Figure A5. Livestock Earnings Specialization in Zambia Households
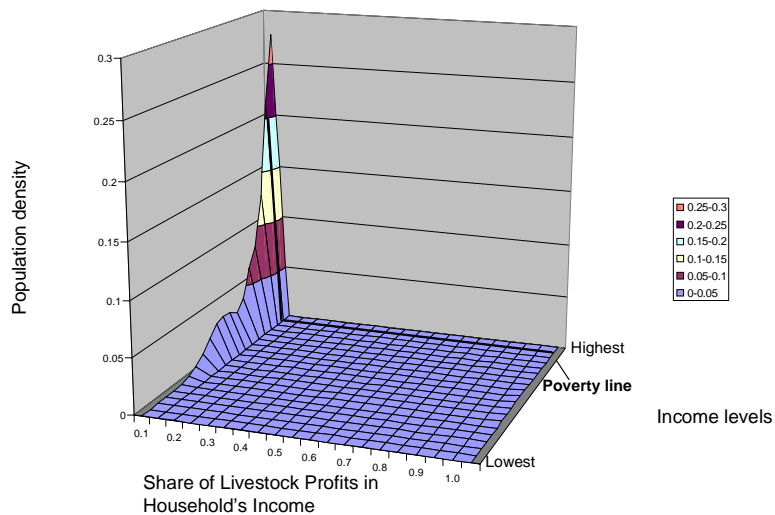
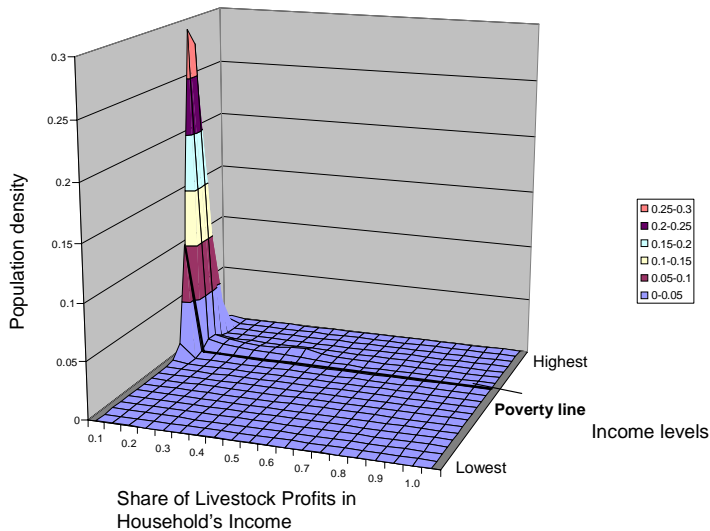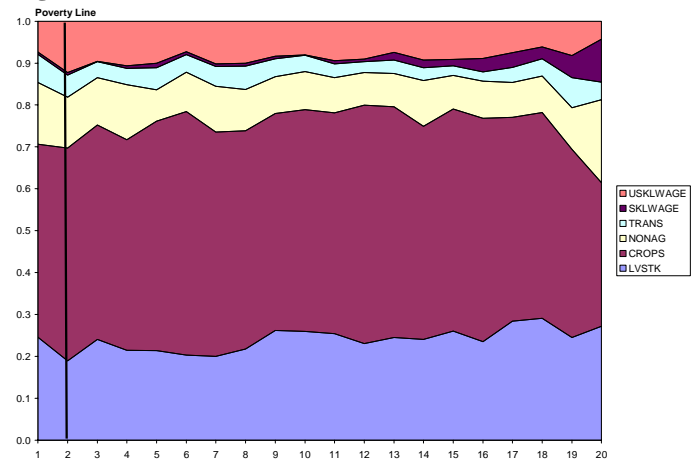**Figure A6. Composition of income in Zambia's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.**
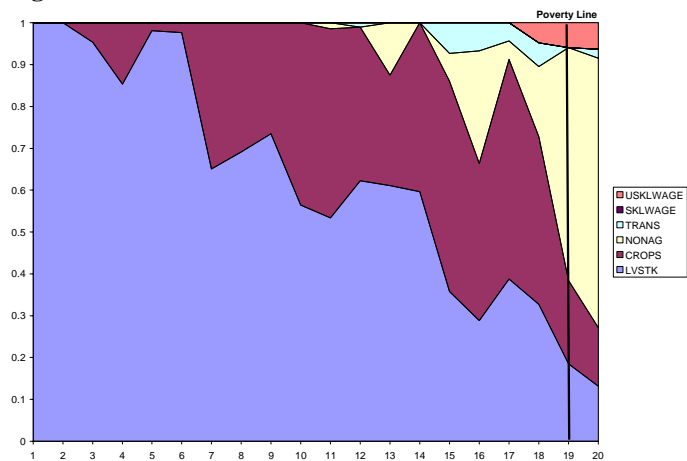
Figure A7. Composition of income in Mozambique, ranging from lowest to highest ventiles.
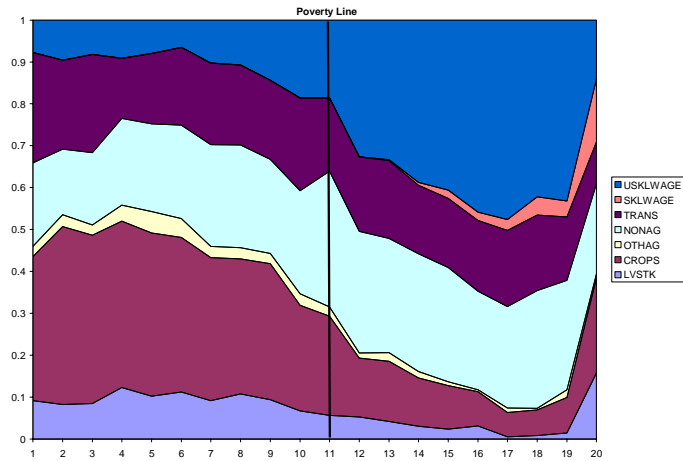
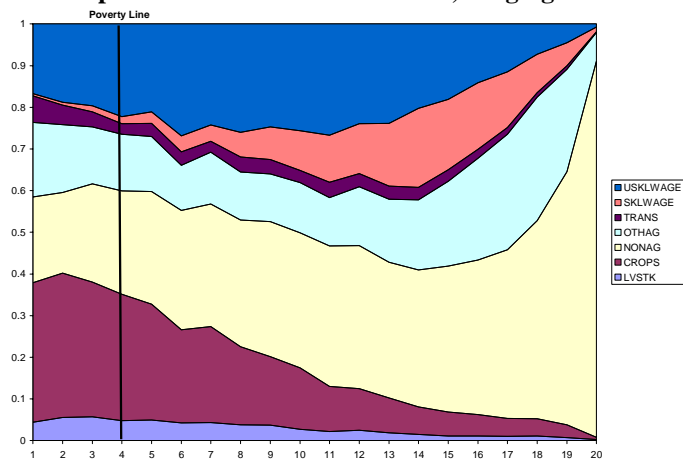**Figure A8. Livestock Earnings Specialization in Mozambique's Households**
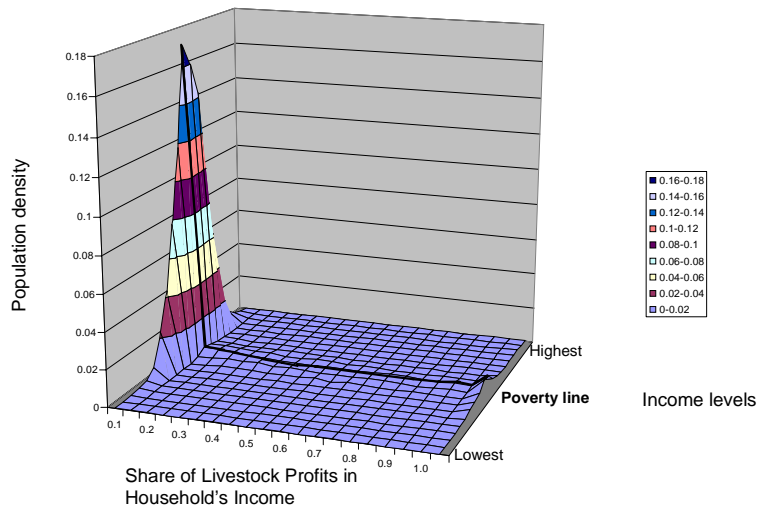
Figure A9. Composition of income in Mozambique's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.
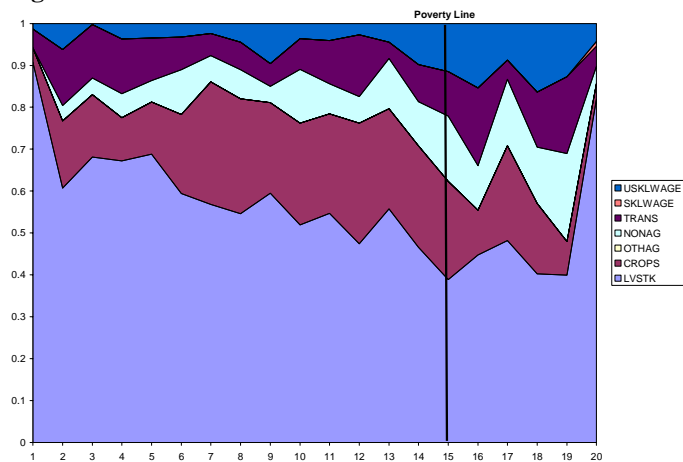
Figure A10. Composition of income in Vietnam, ranging from lowest to highest ventiles.
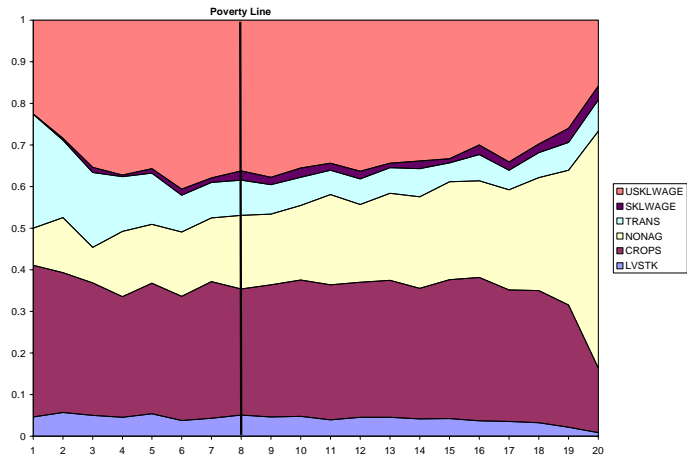
Figure A11. Livestock Earnings Specialization in Vietnam Households
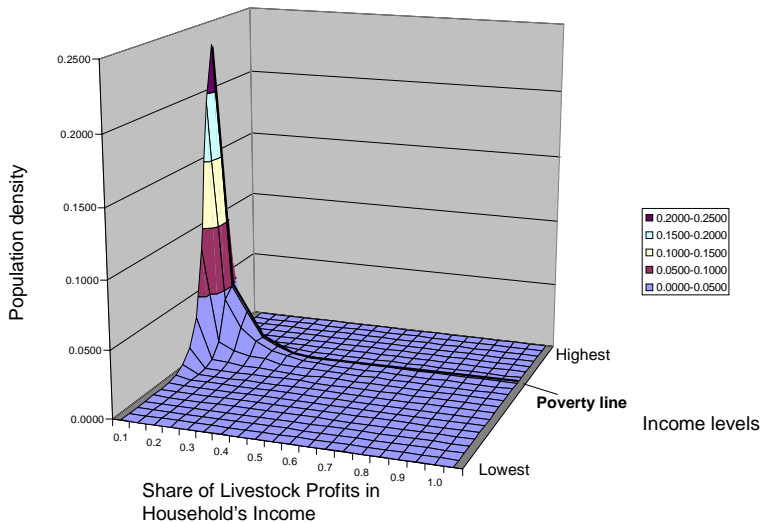
Figure A12. Composition of income in Vietnam's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.

Figure A13. Composition of income in Bangladesh, ranging from lowest to highest ventiles.

Figure A14. Livestock Earnings Specialization in Bangladesh Households

Figure A15. Composition of income in Bangladesh's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.

Figure A16. Composition of income in Philippines, ranging from lowest to highest ventiles.

Figure A17. Livestock Earnings Specialization in Philippines' Households

Figure A18. Composition of income in Philippines's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.

Figure A19. Composition of income in Indonesia, ranging from lowest to highest ventiles.

Figure A20. Livestock Earnings Specialization in Indonesia's Households
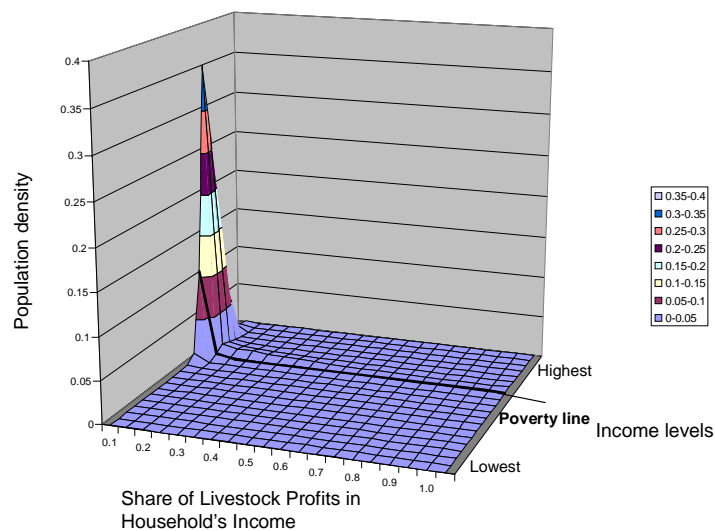
Figure A21. Composition of income in Indonesia's households with lvstk share greater than 5%, ranging from lowest to highest income distribution ventiles.
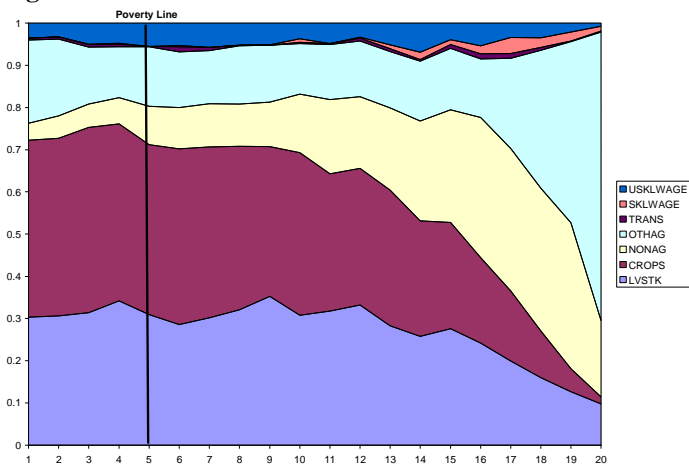
Relative Price Effects

Aggregated price changes for factors of production, and commodities at both producer and consumer prices for global trade liberalization are reported in table B1.

A rise in primary factors means that a country is experiencing a real appreciation as a result of trade liberalization. Sine the AIDADS demand system employed in the post-simulation analysis is estimated at consumer prices, it is the vector of consumer price changes in the bottom panel of table 6 that is pertinent for our evaluation of household welfare.

Table B1. Impacts of Global Trade Liberalization on Aggregated Market Prices (percentage change). Short and Long run effects.

		Malawi	Uganda	Zambia	Mozamb	Vietnam	Banglad	Philipp	Indonesia
Factors									
AgProf	SR	4.70	0.44	0.32	1.84	7.37	-0.37	-0.34	1.34
	LR	9.52	-0.04	1.60	1.36	-22.60	1.90	1.26	1.52
NonAgProf	SR	-1.37	1.35	-0.73	3.27	16.00	2.14	2.88	1.36
	LR	7.25	0.85	-4.58	5.19	-30.47	-5.89	0.19	-6.98
UskLab	SR	-0.48	1.22	-0.75	3.71	26.38	1.47	2.10	2.13
	LR	2.44	-0.18	0.23	2.62	19.31	6.97	3.06	3.23
SkLab	SR	-0.16	1.29	-0.84	3.65	21.37	0.82	0.40	0.82
	LR	1.52	-0.22	0.26	3.05	19.17	6.01	1.41	2.30
PubTrans	SR	1.94	1.01	-0.07	3.55	17.66	1.07	2.02	1.38
	LR	3.36	-0.02	0.92	3.15	18.12	6.82	3.41	2.74
Commodities	(Producer Prices)								
Grains	SR	1.58	-0.36	-0.59	3.35	15.41	0.54	-2.77	2.14
	LR	5.20	-0.91	0.54	3.99	12.99	6.57	1.08	3.60
Lvstk	SR	1.39	1.29	0.32	5.15	8.32	0.58	1.82	0.62
	LR	3.57	0.70	1.40	3.83	12.52	5.67	3.24	2.51
Othfd	SR	3.35	1.49	0.7	3.5	2.67	-1.13	3.83	3.36
	LR	3.02	0.65	1.56	2.92	3.38	3.37	2.56	2.92
Nondur	SR	-3.33	-2.83	-2.35	-8.61	-12.51	-4.38	-2.67	-0.28
	LR	-1.34	-2.44	-0.60	-7.65	-11.76	-1.32	-1.97	0.00
Dur	SR	-15.18	-12.2	-11.4	-13.09	-17.54	-7.4	-3.96	-12.72
	LR	-12.56	-11.24	-9.74	-11.41	-17.45	-0.01	-4.27	-5.92
Svces	SR	1.54	1.04	0.31	3.7	19.56	1.77	2.02	1.59
	LR	2.97	-0.30	1.21	3.01	19.80	7.53	2.89	3.41
Commodities	(Consumer Prices)								
Grains	SR	1.56	0.71	-0.38	3.35	16.55	1.03	-0.15	1.81
	LR	4.19	-0.44	0.70	3.99	14.86	6.95	2.07	3.48
Lvstk	SR	1.48	1.24	0.35	5.15	14.23	0.71	1.85	0.87
	LR	3.23	0.51	1.32	3.83	16.35	5.86	3.19	2.74
Othfd	SR	3.64	1.66	0.84	3.5	6.38	-0.18	4.15	3.21
	LR	3.03	0.99	1.68	2.92	6.98	4.73	2.50	2.96
Nondur	SR	-5.62	-1.93	-3.73	-8.61	-7.61	-2.4	-0.21	-0.35
	LR	-3.37	-1.94	-1.55	-7.65	-6.93	1.52	0.58	-0.12
Dur	SR	-1	0.44	-1.99	-13.09	-7.09	1.35	0.96	-7.36
	LR	0.61	-0.79	-0.93	-11.41	-6.96	7.18	1.63	-2.42
Svces	SR	1.54	1.04	0.31	3.7	19.56	1.77	2.02	1.59
	LR	2.97	-0.30	1.21	3.01	19.80	7.53	2.89	3.41

Percentage change in Equivalent Variation Measure along the income distribution.
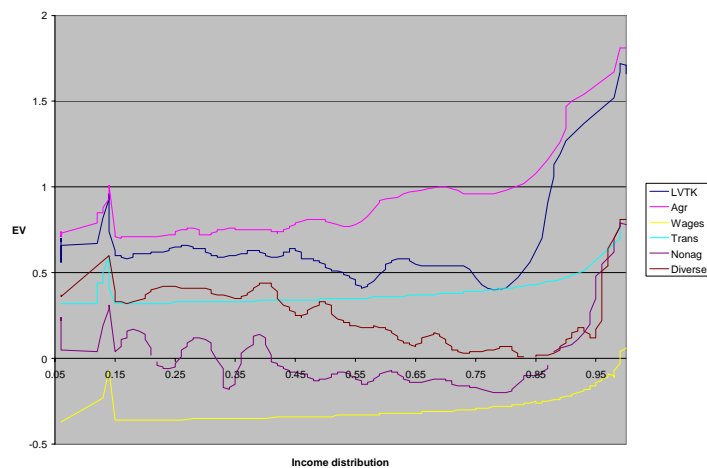
Figure C1. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Uganda. Short-run effects.
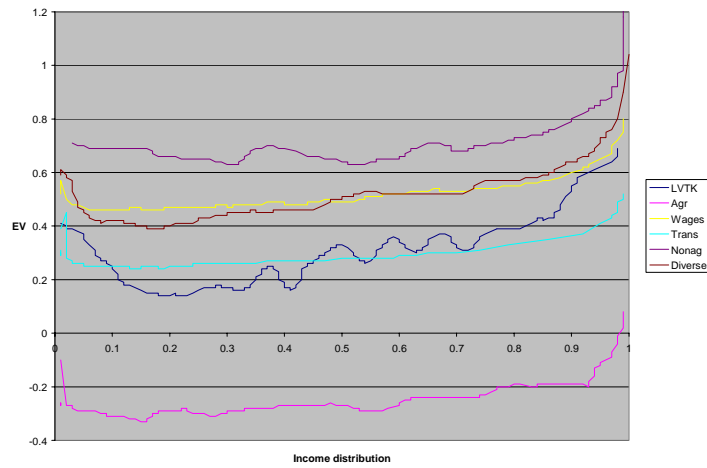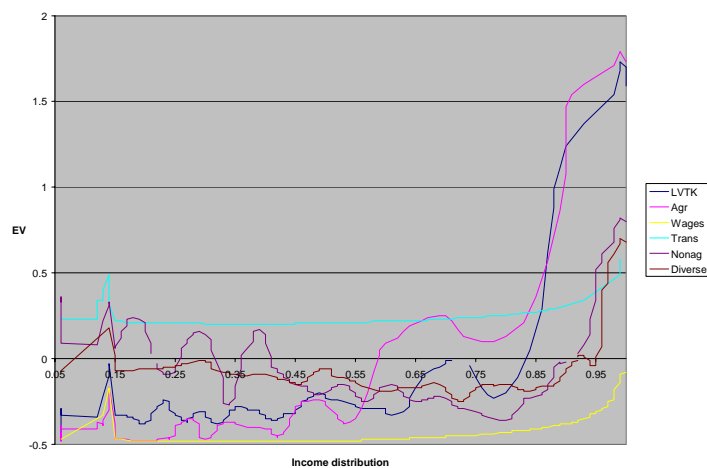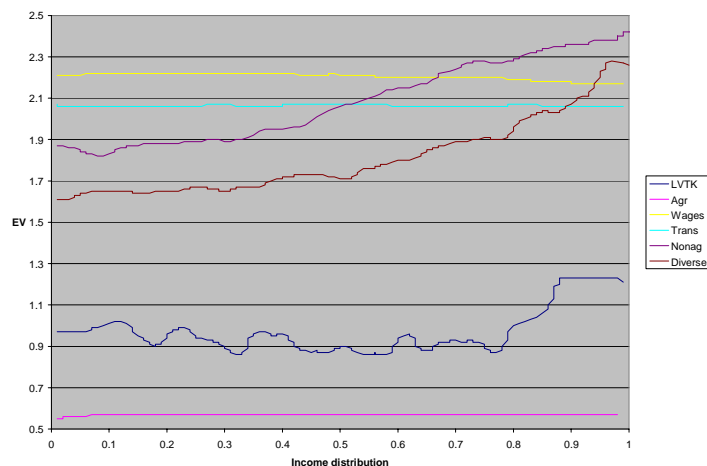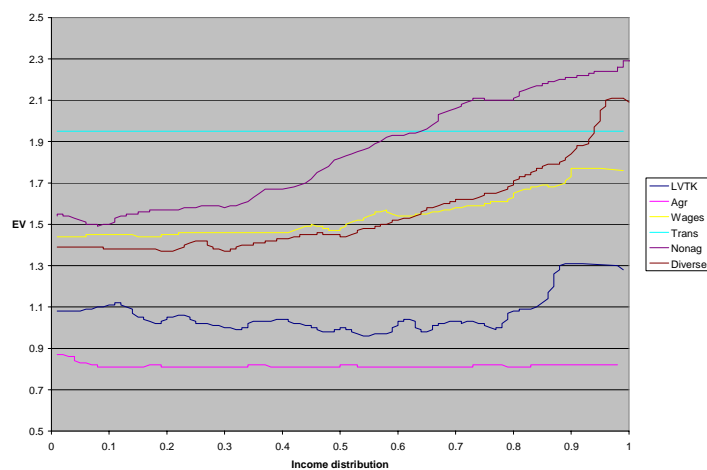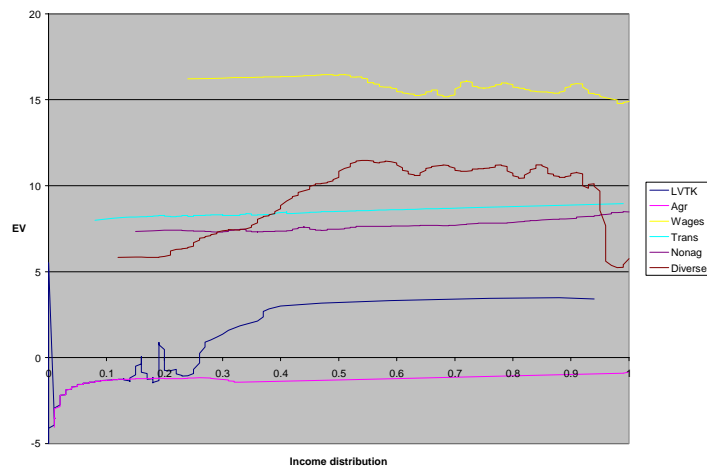

Figure C2. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Uganda. Long -run effects.
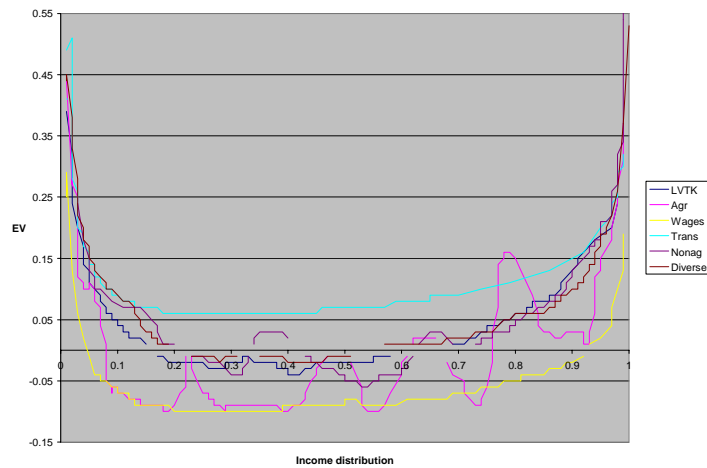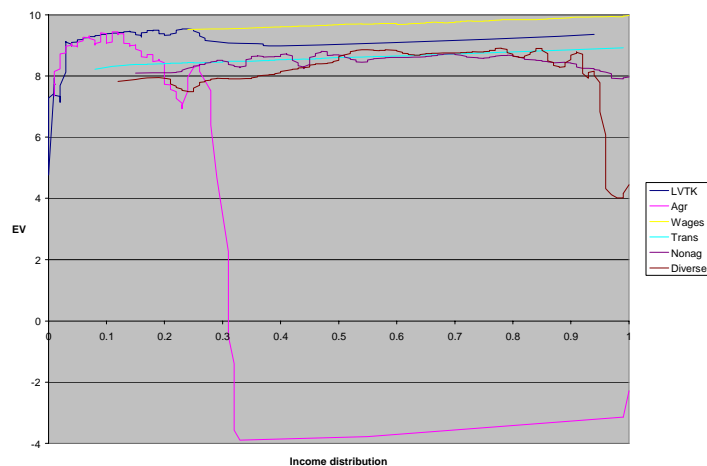

Figure C3. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Zambia. Short-run effects.
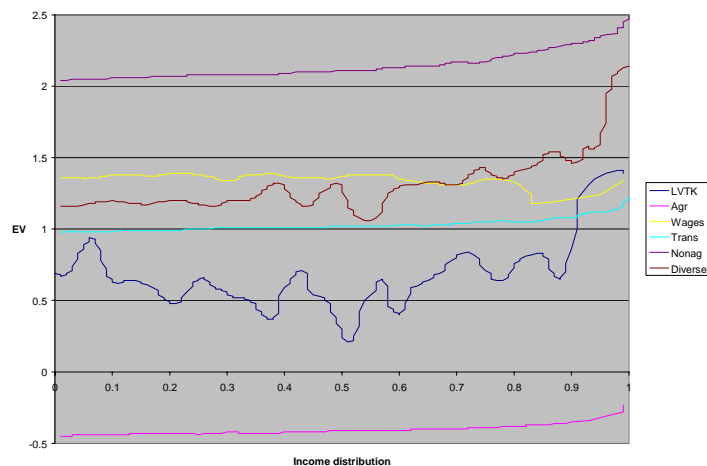
Figure C4. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Zambia. Long-run effects.

Figure C5. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Mozambique. Short-run effects.

Figure C6. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Mozambique. Long-run effects.

Figure C7. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Vietnam. Short-run effects.
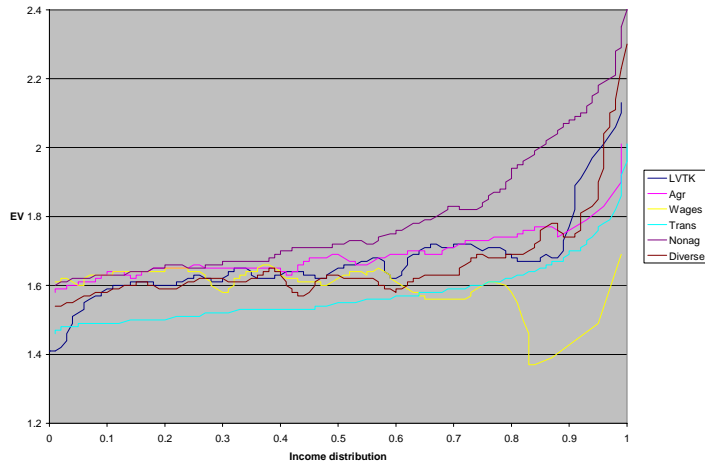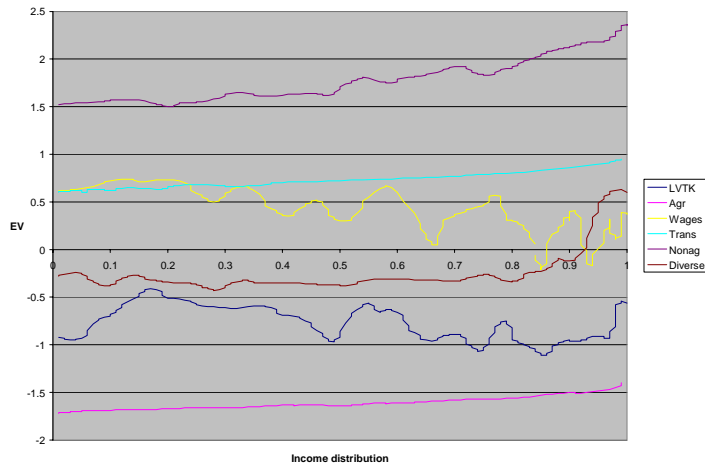

Figure C8. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Vietnam. Long-run effects.

Figure C9. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Bangladesh. Short-run effects.
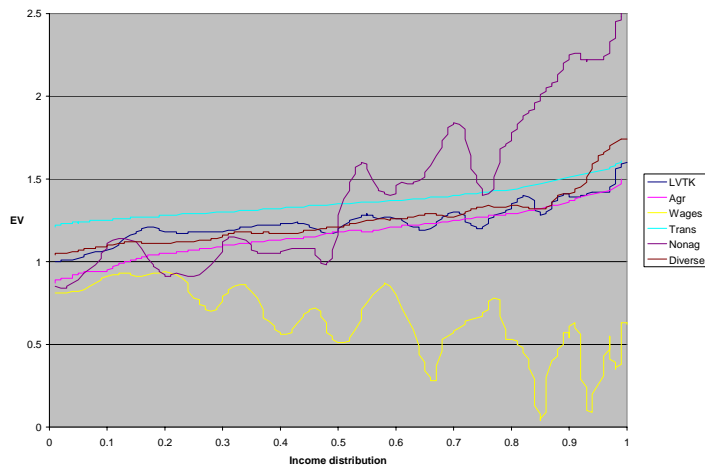
Figure C10. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Bangladesh. Long-run effects.

Figure C11. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Philippines. Short-run effects.
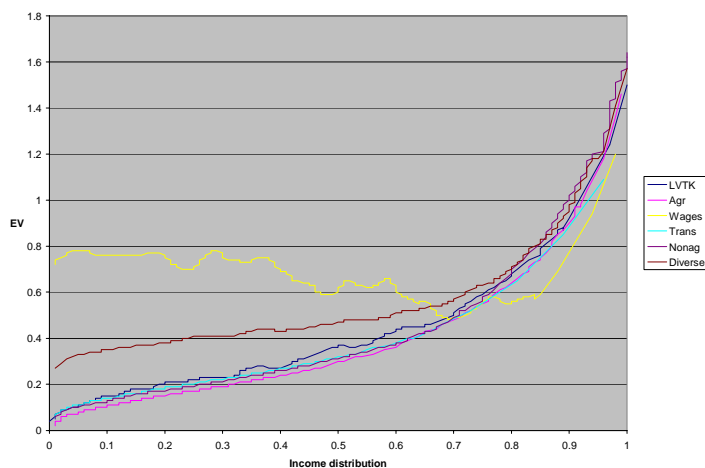

Figure C12. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Philippines . Long-run effects.

Figure C13. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Indonesia. Short-run effects.

Figure C14. Impacts of Global Trade Liberalization on Welfare. % change in Equivalent Variation Measure along the income distribution. Decomposition by Earnings Stratum Impact. Country: Indonesia. Long-run effects.