

Trade, Gender and Poverty in Agricultural Economies: The Case of Senegal

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1. Introduction

Small-scale often subsistence farming constitutes the predominant source of livelihood in many poor developing countries, particularly in the Sub-Saharan region. These farmers may be partly or, in extreme cases, entirely detached from domestic and international markets. The poverty effects that trade liberalization can have in this type of economies are dampened by the lack of transmission mechanisms linking trade policy and the incomes of the poor. Yet, as the world economy advances in its path towards integration, these “agricultural economies” could become more integrated with international markets, bringing about changes in domestic prices with the subsequent reallocation of resources across sectors and activities and, eventually, changes in the personal distribution of income.

As shown by Bourguignon (2002), the change in poverty brought about by any macroeconomic policy can be separated into a growth and a distribution component. The former is a scalar effect shifting incomes of the entire population without making any distinction across particular subgroups whilst the latter is formed by the changes in incomes across subgroups holding the overall average income constant.¹ In order to assess the distributional impact of trade integration, the population can be divided into subgroups. The partition of the population can help us identify subgroups of special interest such as the poor, farmers, the elderly, women, etc. The link between trade integration and the wellbeing of a particular subgroup will be given by the relationship between the trade-mandated changes in prices and the subgroup’s real income.

The objective of this paper is to assess the impact that trade liberalization has on poverty and gender inequality in a predominantly agricultural economy like Senegal. Senegal is an interesting case study, with almost 3/4 of its population living from activities in a rather small agricultural sector accounting for 20 percent of GDP. In a country with a low income per capita (\$PPP 1,745), such a high proportion of the population concentrated in this fairly small sector explains a poverty headcount ratio as high as 57 percent (IMF, 2005). Agricultural production in Senegal is specialized with sorghum and groundnut occupying around 80 percent of the total cultivated lands. Production of groundnuts itself provides income to about 1/3 of the total population in Senegal (Boccanfuso and Savard, 2005). A significant proportion of Senegalese groundnut is exported; hence the fortunes of many poor Senegalese households are determined by international commodity markets. Given these important characteristics about the Senegalese economy, the first set of empirical questions that will be answered in this study is the following: *are changes in the*

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¹ For a recent review with the empirical evidence linking trade and growth see Winters (2003); Anderson (2005) discusses the literature studying the trade and inequality linkages.

degree of integration with international markets affecting domestic prices in agriculture-based economies? If so, which agricultural activities tend to expand/contract as a result of the trade-mandated changes in domestic prices? What is the poverty effect of the trade-induced changes in prices in Senegal?

Although the short-term impact of trade liberalization might as well be poverty-reducing, the reform can redistribute resources within the household in an adverse way. For instance, if trade integration increases pre-existing gender inequalities hence reducing women's intra-household bargaining power, a lower budget could be allocated to the children's education and health, reducing the long-term prospects for development (Hoddinott and Haddad, 1995.) According to the OECD's gender-related development index, Senegal has one of the worst profiles in terms of gender equality raking 118 out of a total of 135 countries included in the sample.² Given that agricultural markets in Senegal are *gendered*, i.e. female and male productive activities are differentiated by commodity traded, scale of production and spatial location (Baden, 1998), the expected gender-related effects of trade integration are quite large. The second part of this study will address the following questions: *Is the trade-mandated redistribution across agricultural activities exacerbating pre-existing gender inequalities? Assuming that trade has an intra-household redistribution effect, are household budgets allocated to human capital formation (children's health and education) altered as a result of this intra-household reallocation of bargaining power?*

The paper is organized as follows. Next section shows information on the evolution of international prices for the major export commodities in Senegal as well as measures of trade integration like tariffs and volumes of exports and imports since the early 1990s. This same section presents inequality and poverty figures and evidence on the gendered nature of agricultural markets in Senegal. Section 3 describes the empirical framework which combines three different, though related, methodologies: the conventional price-transmission methodology described in McCulloch et al. (2002), the agricultural household model of Singh et al. (1986), and a model of intra-household bargaining power based on Hoddinott and Haddad (1995). The combined framework allows for disentangling the poverty and gender effects of trade integration from other simultaneous—external or policy-driven—shocks. The results are described and discussed in Section 4, and finally Section 5 concludes.

2. Stylized Facts (substitute this section with descriptive statistics for Senegal)

The framework developed here is useful to evaluate the poverty and gender effects of trade integration occurring in agricultural economies. Notice that there are many country-specific issues to be taken into account when embarked in applied research; nevertheless, the following are stylized facts that must be present in economies suitable for analysis under the present framework:

1. A substantial proportion of the households in these countries depend on incomes derived from agricultural activities

² For a description of the data, methodologies and working papers on this topic see: www.oecd.org/dev/institutions/GIDdatabase

2. Gender is an important determinant of poverty and inequality
3. Most trade, both imports and exports, is of agricultural products³
4. Agricultural markets are *gendered*, i.e. men and women tend to work in different crops
5. Trade liberalization in agricultural markets already took place (ex-post analysis)

3. Methodology

3.1. Conceptual Framework⁴

One of the most important shortcomings of trade policy evaluation lies on the difficulty to create an explicit link between changes in trade policy and changes in household welfare. Most of the empirical literature studying the welfare impact of trade have adopted either a before and after approach or the use of cross-country regression at the macro level. Although both strategies are useful to inform us about what are the possible explanations behind changes in household welfare, they are not able to isolate the impact of the policy under evaluation from all other contemporaneous macroeconomic changes taking place.

The study by McCulloch et al. (2002) shows that the *trade-mandated* changes in prices are the single most important mechanism linking trade policy and household welfare. McCulloch et al. (2002) shows how trade policy—in the form of unilateral, bilateral or multilateral trade agreements—has an effect on, both, the supply and demand sides of the economy. The overall effect will be the combination of net benefits derived from the consumption and production sides of the economy. *The trade-induced shifts in prices may have a positive or negative effect on a particular household depending on whether the household is a net consumer or a net producer of the goods experiencing the change in price.*

Figure 1 shows a summary of the theoretical links between trade, trade policy and household welfare. The total effect from trade to household welfare can be conceptualized as being formed by three building blocks: (1) At the macro level changes in tariffs and international prices are linked with domestic prices, (2) at the meso level, prices are linked with relative wages, employment and sectoral allocation and (3) at the micro level, household's real income is altered by the new wages, consumption baskets, and labour participation.⁵

Under some simplifying assumptions, the empirical questions raised in the Introduction can be answered using a simple econometric specification linking changes in the degree of market integration with changes in personal and household real income. In the remaining of this section we outline a methodology that derives directly from the conceptual framework depicted in Figure 1. Several variants of this

³ Groundnuts in the case of Senegal and coffee in Uganda account for around 40 percent of total exports.

⁴ For a detailed explanation of the theoretical linkages outlined in this section and an application for Mexico, see De Hoyos (2007).

⁵ In a recent literature review revising the trade and poverty linkages by Hertel and Reimer (2004), the authors find that the strongest effect of trade upon poverty works via the labour market and to a lesser extent through consumption effects.

methodology had been used in empirical analyses by Nicita (2004), De Hoyos (2007), and some of the studies included in the compilation by Hertel and Winters (2006).

3.2 Price-transmission Effects

Let us define $\mathbf{P}$ as a vector of domestic prices of tradable goods, similarly, $\mathbf{p}$ is defined as a vector of international prices for the same goods and let $\boldsymbol{\tau}$ be a vector of tariffs and the tariffs. In equilibrium, in the absence of market distortions and assuming that domestic and international goods are identical, domestic prices of tradable goods will be defined by the following expression:

$$(1) \quad P_i = \varepsilon_i * p_i (1 + \tau_i)$$

Equation (1) link the domestic price of a particular good with international prices, domestic and foreign trade policy and, the exchange rate (ε). The estimation/computation of the price transmission equation (1) will depend on the type of effect we are trying to capture. An econometric, partial equilibrium approach seems to be more appropriate for short-term trade policy evaluation (Davies, 2004). However, to capture the long-run, general equilibrium effects of the reform, a CGE is not only appropriate, but necessary (Annabi et al., 2006). The present study focuses on the short-term welfare and gender effects of trade integration; hence our analysis is placed within a partial equilibrium framework.

If the domestic and international markets are perfectly integrated within a competitive framework, then the law of one price (LOP) holds and $P_i = p_i$. The LOP can be tested using a static or a dynamic approach. In the static approach, a gap between international and domestic markets, $P_i \neq p_i$, emerges as a consequence of market imperfections like a domestic monopolistic structure, price controls, subsidies, etc. In the dynamic version, if domestic markets are completely detached from the international markets *movements* in the exchange rate, the international prices or trade tariffs (trade policy) will have no impact on domestic prices which will imply that the covariance between P_i and p_i is equal to zero.

3.3 Household Welfare Effects

Estimating the distortions in the domestic market ($P_i \neq p_i$) and the degree of transmission effects from international to domestic prices ($Cov(P_i, p_i) \neq 1$) is the first step to quantify the change in domestic real income or consumption as a result of trade integration (macro level in Figure 1). The second step is to link changes in domestic prices with changes in consumption and production across different agricultural activities. The changes in production will have a further effect on the labour market: real wages and employment. The present study does not measure the impact of trade integration at the *meso* level; instead, it concentrates in the short-term household welfare impact of price changes. In other words, we are evaluating the marginal welfare effect of price changes keeping production and consumption constant (equivalent variation). Theoretically, the welfare impact of a change in domestic prices is easily quantified using the following indirect utility function linking welfare in household " h " with prices and household monetary incomes:

$$(2) \quad \psi_h = \psi_h(Y_h, P)$$

where Y_h is the money income of household “ h ”. For households involved in agricultural or any other entrepreneurial activities, Y_h can be defined as the sum of earnings and profits (Singh et al. 1986):

$$(3) \quad Y_h = \sum_i P_i(Q_i^s - Q_i^d) - \sum_j \omega_j(V_j^d - V_j^s)$$

where Q_i^s are commodities sold in the market (cash crop), and Q_i^d is the household’s consumption; V_j^d are the inputs demanded by the household, V_j^s is the family’s inputs supply (including labour), and ω_j are the input prices. Therefore, if $Q_i^s > Q_i^d$, then $P_i(Q_i^s - Q_i^d)$ is the household income derived from profits, and as long as $V_j^s > V_j^d$, $\omega_j(V_j^d - V_j^s)$ are the household earnings.⁶ From equations (2) and (3) we can derive the first-order welfare effects of changes in $\mathbf{P}$ (see Dixit and Norman, 1980 for details):

$$(4) \quad \frac{d\psi_h}{dP_i} = \lambda_h(Q_i^s - Q_i^d)$$

where λ_h is the marginal utility of money income. Therefore, for every commodity within each household, we will have the net—production minus consumption—effect of changes in prices of tradable goods. For instance, money income of household “ h ” producing commodity “ i ” can decrease due to a reduction in import tariffs of “ i ” which, in turn, depresses the domestic price of “ i ”; nevertheless the reduction in price, will allow a cheaper consumption of commodity “ i ”. Net producers of “ i ”, i.e. $(Q_i^s - Q_i^d) > 0$ will worsen from the change in tariffs and the contrary will be true for net consumers.

3.4 Gender Effects and Intra-Household Reallocation

So far we had taken the household as a utility maximizing entity, omitting the discussion on how resources within the household are being distributed. Using data for Cote d’Ivoire, Hoddinott and Haddad (1995) show that “gender-specific control of income translates into changes in expenditures”. This result suggests that household consumption patterns are, indeed, the outcome of a bargaining process amongst its members. Trade integration, with its subsequent change in prices can redistribute income between men and women, which, in turn can translate into a change in household consumption patterns.

To account for the gender effects of trade integration, we develop a model which combines an agricultural household model (equations 2 and 3) with a model of intra-household bargaining process developed in Hoddinott and Haddad (1995). Total household income (equation 3) has to be separated into income earned by women (Y_F) and income earned by men (Y_M), $Y_h = Y_F + Y_M$. The functional forms of Y_F and Y_M are identical to the one determining household income (equation 3). Define Q_F and Q_M as

⁶ Notice that, as opposed to Singh et al. (1986), we allow for members within the same household to be involved in different cropping activities; this is an important feature of the model that allows for testing the gender impact of trade liberalization.

the vectors of consumption *being financed* with Y_F and Y_M , respectively. Assume that household members “ F ” and “ M ” differ in their preferences thence disagreeing about what the household optimal consumption basket should look like. In this setting the household members “ F ” and “ M ” have to choose their consumption basket based on the prices, household income and intra-household bargaining power. Following Hoddinott and Haddad (1995) “ F ” and “ M ” optimize their own consumption vector taking their counterpart’s as given (Nash non-cooperative solution.) Hence “ F ” will select Q_F such that:

$$(5a) \quad \max_{Q_F} U_F(\bar{Q}_M, Q_F) \quad \text{subject to } PQ_F \leq Y_F$$

Consequently “ M ” will select Q_M such that:

$$(5b) \quad \max_{Q_M} U_M(Q_F, \bar{Q}_M) \quad \text{subject to } PQ_M \leq Y_M$$

Notice that the bars on top of Q_M and Q_F in equations (5a) and (5b) indicate that “ F ” and “ M ” take those values as given. The solution of equations (5a) and (5b) yields a set of demand functions that could also be interpret as *reaction* functions:

$$(6a) \quad Q_F = R_F(Q_M, Y_F, P)$$

$$(6b) \quad Q_M = R_M(Q_F, Y_M, P)$$

Q_F^* and Q_M^* will yield a Nash equilibrium satisfying (6a) and (6b):

$$(7a) \quad Q_F^* = R_F^*(Y_M, Y_F, P)$$

$$(7b) \quad Q_M^* = R_M^*(Y_M, Y_F, P)$$

Using the results in Ulph (1988), Hoddinott and Haddad (1995) argue that under this setting, as the income share of one of the members (“ F ”, “ M ”) rises, the share of household expenditures on the set of commodities preferred by that individual will rise. Therefore, if there is substantial price-transmission effects, trade integration can, indeed, redistribute household income (bargaining power) between men and women, changing household expenditure patters. If Q_F^* including more elements improving children’s *quality* like education and health (see Haddad, 1999), than Q_M^* , increasing gender inequality and hence reducing women’s bargaining power can create a serious obstacle for long-term development progress.

4. Data Description

For the pass-through, a time series from the early 1990s to the present of the following:

- Tariff information for the major agricultural products traded (exports and imports)
- International and domestic prices for the major agricultural products traded
- Nominal exchange rate

- Other controls like GDP, inflation, time trends, etc.

For the price-incidence analysis and intra-household allocation:

- Household consumption and expenditure patterns (this is available from the income and expenditure household surveys)
- Information on the *gendered* nature of the important crops, i.e. gender distribution by crops

5. Results

In this section we will present the results of three different empirical exercises. In the first part of this section we show and discuss the estimation for equation (4) linking changes in prices with household welfare. In the second part of this section we show evidence supporting an intra-household bargaining process as the one described by equations (7a) and (7b). Taking the Masters' (2007) results for price distortions in the three most important commodities in Senegal (groundnuts, rice, and millet), in Section 5.3, we are able to quantify the poverty and gender effects of trade integration.

5.1 The Poverty Effects of Changes in Prices

Pending: information on agro-ecological regions is needed.

5.2 Women's Incomes and Children's Wellbeing

In this section we present the results of the intra-household bargaining model explained by equations (5a) to (7b). The main objective of the model is to test if a *ceteris paribus* increase in women's income has a positive effect on household expenditure in human capital formation (food, health, education). Following Hoddinot and Haddad (1995), we use an expended version of the Working-Leser expenditure system as our empirical specification. In this model, the budget share allocated to expenditure category "j" is a function of the log of household size, the log of per capita expenditure, demographic, regional and other controls:

$$(8) \quad s_j = \alpha_j + \beta_{j,1} \ln(H) + \beta_{j,2} \ln(E) + \beta_{j,3} \left(\frac{Y_F}{Y} \right) + \sum_{l=1}^L \gamma_{j,l} \left(\frac{K_l}{H} \right) + \delta_j X + \varepsilon$$

Where H is the household size, E is per capita household expenditure, K_l is the number of household members within demographic category " l ", X is a vector with regional and other controls; α, β, γ , and δ are parameters to be estimated, and ε is a random component assumed to be normally distributed.⁷ The novelty introduced to the expenditure functions by Hoddinot and Haddad (1995) is element $\left(\frac{Y_F}{Y} \right)$, which according to equations (7a) and (7b), captures the bargaining power of women within

⁷ Notice that since $\sum_j s_j = 1$, OLS estimates of equation (8) imply that $\sum_j \theta_j = 0$ and $\sum_j \alpha_j = 1$

where θ_j are all the parameter-slopes estimated. This is a feature of the model known as the adding up restriction. For details on the properties and limitations of this model see Deaton and Muellbauer (1980), pg. 19.

the household. If women have a stronger preference for, say, education of the children, and the intra-household budget processed is characterized by equations (7a) and (7b), then an increase in $\left(\frac{Y_F}{Y}\right)$ will caused an increase in the expenditure shares in education, i.e. $\beta_3 > 0$ in the expenditure function (8).

We apply model (8) to 11 expenditure categories, four of which are expected to have a positive effect upon human capital formation: food, health, education and children's clothing. The other seven expenditure categories include: adults' clothing, alcohol, tobacco, accommodation, transportation, entertainment, and other expenditures. The shares of household members in different categories as a proportion of household size are used as the demographic controls. In particular, we use gender and age to form 8 demographic categories: females 6 years old or younger, females between 6 and 14, females between 15 and 59, and females 60 or older; the same age categories were formed for men. Other controls included a dummy variable for each of the 10 regions in Senegal, a dummy variable for female headed households, and a rural/urban control. All the data comes from the Senegalese household income and expenditure survey for 1995 ESAM I. The ratio $\left(\frac{Y_F}{Y}\right)$ is formed by adding, for each household, the monetary income of female spouses of household heads and then dividing it by the sum of all monetary incomes at the household level.

The results of model (8) are shown in Table 1. The first thing to notice is the high degree of variation in the R-square across expenditure categories. Specification (8) captures 47 per cent of the total variation across households in food expenditure shares, but as little as 1 per cent in the case of alcohol. The results show that larger and richer households tend to invest more in human-capital formation (health and education). On the contrary, rural households in Senegal allocate a higher budget share to food and less to education with respect their urban counterparts. Expenditure shares in clothing (both children and adults'), transport, and entertainment increases with household size and per capita expenditure, showing that these goods can be classified as a *luxury* in Senegal. Female headed households tend to spend a lower proportion of the household's budget in food, tobacco, transports and entertainment and more in adults' clothing and accommodation.

Controlling for differences in household size and expenditure, household's demographic composition, gender of the household's head, and regional variations, *an increase in women's income raises the budget allocated to education and reduces expenditure in tobacco*. A one percentage point increase in the proportion of household's monetary income controlled by women increases expenditure share in education by 0.4 percentage points and reduced tobacco expenditure share by 0.2 percentage points. These effects are far from being trivial. Redistributing one percent of total household monetary income from men to women will have the same effect on the budget allocated to education that an increase of one percent in per capita household expenditure. For instance, assume that there is a generalized increase in men's monetary income leading to an increase of 1 per cent in per capita expenditures. This change will have, as a direct impact, an increase of 0.4 percentage points in education's expenditure share; nevertheless since women's income share will reduce in 1/3 of a percentage point, the final increase in education expenditure

share will be 0.28 percentage points (i.e. 1/3 lower than the direct impact).⁸ In the case of an increase in women's income leading to a 1 per cent increase in per capita expenditures, the total (direct and indirect) effect on education will be 1/3 higher than the pure expenditure impact, i.e. a total increase in the budget share allocated to education equal to 0.53 percentage points.

The results presented in Table 1 are robust to several specifications. By including an interaction term between the rural dummy and women's income share, we tested the hypothesis that women's bargaining power had a different impact in rural versus urban households, we also included a similar interaction for women working in the agricultural sector; none of these two interactions was significant. In a different specification, we tested the hypothesis that differences in daughter's income shares lead to different expenditure patterns. The results showed that, indeed, daughters behaved different than spouses. Increases in daughters' income shares lead to no increase in education expenditure but it raises expenditure shares in adults' clothing. Finally, the results are robust to endogeneity in per capita expenditure and women's income share. Contrary to the results presented by Hoddinot and Haddad, the Hausman specification test could not reject the null hypothesis of exogeneity in these right hand side variables.

5.3 Assessing the Effects of Trade Integration

6. Conclusions

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⁸ The ratio of 1/3 comes from the fact that women's income is 1/3 of the total household monetary income.

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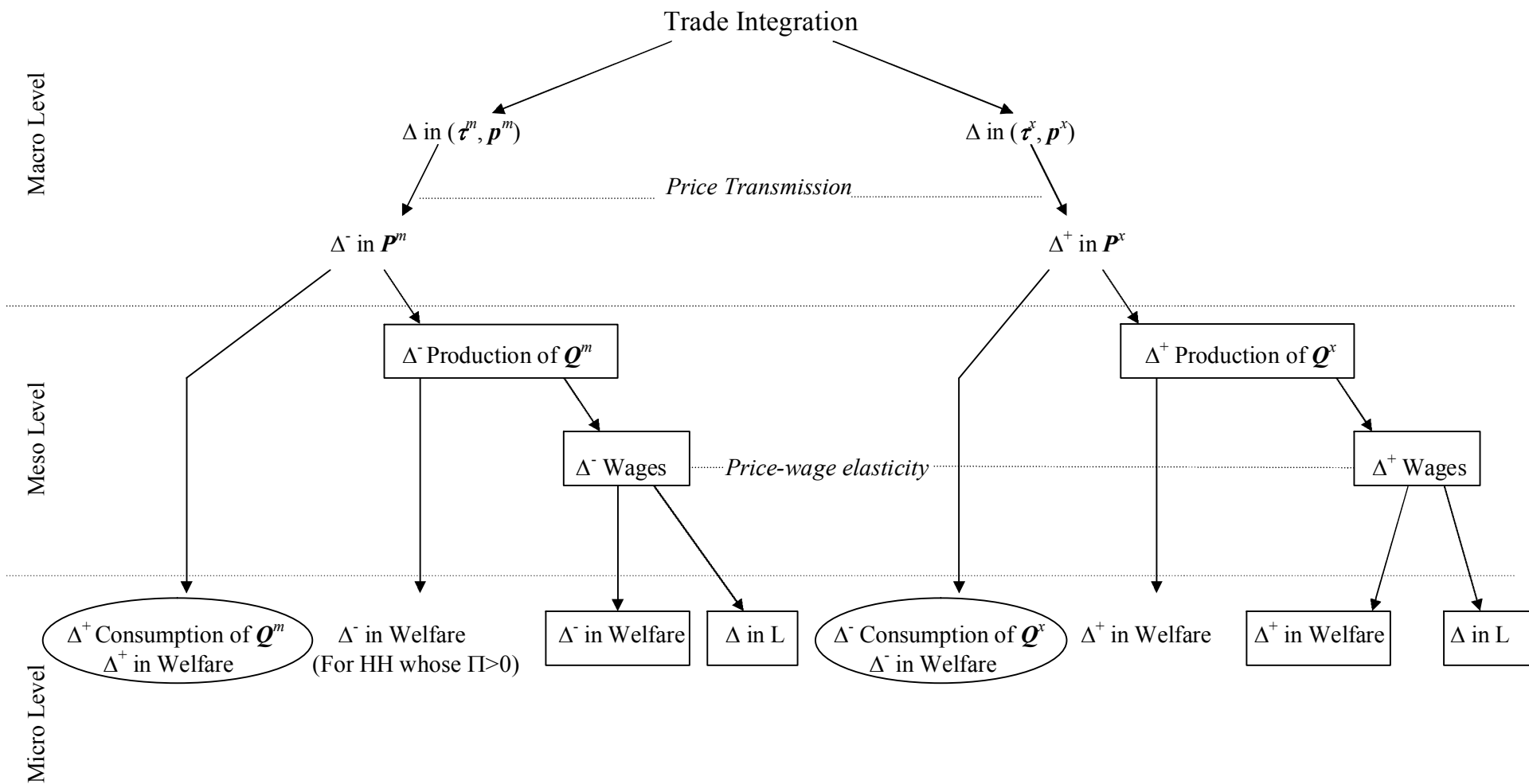


Figure 1: Trade and household welfare linkages (taken from De Hoyos, 2007)

Table 1: Expenditure functions

	Food	Health	Education	Children's Clothing	Adults' Clothing	Alcohol	Tobacco	Accommodation	Transport	Entertainment	Other
Log of household size	-0.054***	0.011***	0.005***	0.001***	0.028***	0	-0.002***	0.001	0.005**	0.001***	0.005***
Log of per capita exp.	-0.012	0.012***	0.004***	0	0.011***	0	-0.001	-0.049***	0.020***	0.001***	0.014***
Women's income share	0.002	0	0.004***	0	-0.004	0	-0.002***	0.001	-0.001	0	0.001
Rural HH	0.180***	0	-0.004***	-0.001***	-0.001	0	0	-0.176***	0.002	0	-0.001
Female headed HH	-0.026***	0	-0.002	0	0.005*	0	-0.002**	0.033***	-0.009***	-0.000**	0

Demographic Controls											
Males between 0-6	0.136***	-0.035***	-0.012***	0.007***	-0.060***	-0.001	0.009***	-0.058***	-0.001	0	0.015**
Males between 6-15	0.064**	-0.033***	0.009**	0.007***	-0.048***	0	0.006**	-0.018	0	0.001	0.012*
Males between 15-59	0.032	-0.059***	0.002	0	-0.018*	0.001	0.016***	0.013	-0.001	0.002**	0.013**
Males 60 and over	0.025	-0.040**	-0.017***	-0.004**	-0.048***	0.003	0.012	0.133***	-0.043**	-0.001	-0.020**
Females between 0-6	0.114***	-0.019	-0.010**	0.010***	-0.034***	0	0.007**	-0.081***	-0.005	0.002*	0.017**
Females between 6-15	0.106***	-0.026**	0.013***	0.008***	-0.050***	0	0.002	-0.049**	-0.008	0.001	0.001
Females 60 or over	-0.076*	-0.036***	-0.006*	0	-0.075***	-0.002*	0.009*	0.189***	-0.017	0	0.015
Intercept	0.695***	-0.070**	-0.042***	0.001	-0.072**	0.003	0.015*	0.831***	-0.193***	-0.014***	-0.153***
Regional Controls											
	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.472	0.096	0.165	0.118	0.15	0.011	0.099	0.419	0.136	0.067	0.111
N	2,899	2,899	2,899	2,899	2,899	2,899	2,899	2,899	2,899	2,899	2,899

- Notes:
- (1) The dependent variable is the household expenditure share in each of the categories in the first row.
 - (2) *, **, ***, significant at the 10%, 5% and 1% level respectively with Huber-White robust standard errors.
 - (3) The demographic controls are the share of household members within the different categories as a proportion of total household size.

