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Food Price Changes and Consumer Welfare in Ghana in the 1990s

by

Charles Ackah and Simon Appleton

Abstract

In this paper, we analyse the effect of food price changes on household consumption in Ghana during the 1990s and assess the extent to which changes can be explained by trade and agricultural policy reforms. The measurement of the total household welfare effect, one that jointly considers (static) first order effects as well as (dynamic) consumption responses, is the object of this study. Food consumption behaviour in Ghana is analyzed by estimating a complete food demand system using the linear approximate version of the AIDS model with household survey data for 1991/92 and 1998/99. The estimated price elasticities are then utilized to evaluate the distributional impacts of the relative food price changes in terms of compensating variation. The results indicate that the distributional burden of higher food prices fell mainly on the urban poor. While it is difficult to attribute the price changes and by implication the welfare losses, to any particular policy *per se*, a simulation analysis indicates that trade liberalisation may not have been responsible for the welfare losses. Our simulation exercise suggests that further tariff liberalisation would tend to offset the welfare losses for all households although it is the poor and rural consumers who stand to gain the most.

Centre for Research in Economic Development and International Trade,

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Outline

1. Introduction
2. The Economic Reform Programme
3. Empirical Methodology
4. Data Description and Sources
5. Empirical Results
5. Conclusion and Policy Implications

The Authors

The authors are respectively Research Student and Associate Professor in Development Economics in the School of Economics, University of Nottingham.
Contact e-mail: lexcga@nottingham.ac.uk

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1. INTRODUCTION

Very few issues are more contentious today than the effects of structural reforms, in general, and trade liberalization in particular, on household welfare and poverty in developing countries. For many years, economists and policy makers have discussed the impact of economic reforms upon poverty. Structural reforms (of which trade liberalization is one aspect) offers new opportunities for accelerating development and poverty reduction, however, associated with these opportunities are costs and new challenges. For example, access to an increased variety of cheap, or cheaper (than domestically produced), goods is beneficial to consumers but a challenge to local producers of import-competing goods that face increased competition (Ackah and Morrissey, 2005). Hence, the proliferation of these reforms has been accompanied by much concern about whether the poor gain, and under what circumstances it may actually hurt them.

One potential impact of structural reforms on poverty is through the resultant price changes following, for example, the removal of import restrictions by reducing import tariffs and non-tariff barriers, which tend to lower domestic prices of importables, a devaluation of the local currency, which raises the relative prices of tradeables or the removal of export restrictions, which also tend to raise domestic prices of exportables. A similar example is the removal of input and food subsidies or other market-oriented reforms designed to change prices and thereby alter income distribution. The poverty ramifications of such reforms can be overwhelming, especially when they occur in the agricultural sector. The analysis of the impact on household consumption expenditure and income through changes in relative prices is thus imperative.

Perhaps not surprisingly, the impact of structural reforms on relative prices and their effects on the welfare of the poor has become an important subject of ongoing interest to researchers and policy makers alike. However, there has been limited empirical research on how these reforms affect poverty at the household level (Winters, 2002; Winters et al., 2004). While the impact of trade liberalization on the incomes (or wages) and government revenue in developing countries has been well documented in the literature, only a few studies have concentrated on the important consumption effects. Since the very poor are mainly net food consumers, such disregard can be difficult to justify. Moreover, the pattern of food consumption is an important indicator of

household welfare. In the case of Ghana, for example, in spite of the general concerns expressed in many quarters, relatively little is known about the consumption patterns of households and how households have adjusted to the price changes in the 1990s, which to some extent resulted from policy reforms. More than two decades after Structural Adjustment Programmes (SAPs) began the consumption impact of the reforms has not been systematically quantified. The lack of recent studies on household behavioural responses to price shocks in Ghana is puzzling given the high and variable inflation in the 1990s, the availability of surveys and the fact that Ghana was 'adjustment's star pupil' (Alderman, 1994).

This paper aims to fill some of the gaps in the literature by analyzing the food consumption behaviour of Ghanaian households using the Almost Ideal Demand System (AIDS) model developed by Deaton and Muellbauer (1980b) to obtain price and income elasticity estimates for six major food categories, which together comprise the basic subsistence staples for most poor households. The estimated price elasticities are then utilized to evaluate the welfare implications of the relative food price changes in terms of compensating variation. We then assess the extent to which welfare changes can be explained by agricultural trade policy reforms using counterfactual simulation analysis.

Typically, there are a number of factors that determine the extent to which households are impacted by food price shocks including the magnitude of the relative price changes, the relative importance of different food commodities in the consumption basket of different households as well as the degree to which households are compensated for the price shocks by changes in income. For the purposes of this paper, we concentrate on the partial equilibrium welfare effects of food price changes, given the food consumption choices of households in Ghana. In essence, we focus on changes in consumer welfare resulting from the variations in food price changes, assuming income effects away. While it would be appropriate to estimate the overall welfare changes (i.e. including producer welfare or allowing for income responses), we do not pursue this line of enquiry in this paper due to data limitations including adequate producer price data. Our analysis therefore does not account for supply responses through production and labour adjustments. The results must therefore be interpreted with these caveats in

mind.[1] However, the data constraints notwithstanding, our simple partial equilibrium analysis provides useful insights into household food consumption behaviour and the distributional implications of the variation in food price changes for household welfare in Ghana during the 1990s – a decade of remarkable food price inflation reminiscent of the economic crisis that precipitated the SAPs in the early 1980s. To our knowledge, this study is the first examination of the distributional impacts of changes in food prices and the potential effects of trade policy reforms on household welfare using demand analysis in the context of Ghana.

The remainder of this paper is organized as follows. Section 2 provides a general background to trade and agricultural reforms in Ghana. Section 3 presents the econometric model and describes the methodology used to measure welfare changes facing Ghanaian households during the 1990s. Section 4 discusses the dataset and sources and Section 5 reports the elasticity estimates and the welfare analysis due to the price changes in the 1990s. This section also assesses the impact of simulated trade policy reform. Section 6 concludes with some policy implications of the findings.

2. THE ECONOMIC REFORM PROGRAMME

2.1 Agricultural and Trade Policy Reforms

Ghana was one of the first countries in Sub-Saharan Africa (SSA) to initiate a programme of economic stabilisation and market reform under the banner of the Economic Recovery Programme (ERP) supervised by the IMF and the World Bank, to rectify the economic imbalances and distortions that contributed to the stagnation and decline of the economy in the 1970s and early 1980s. As discussed in Aryeetey et al. (2000), the main focus of Ghana's economic reforms has been in the area of trade and agricultural liberalisation, reflecting the importance of these sectors in the economy of Ghana. Like the vast majority of SSA countries, Ghana has had restrictive and distortionary agricultural policies since independence until the 1980s (at least), typically motivated by some desire to protect domestic producers. Prior to 1983, agricultural policy in Ghana was geared towards two main objectives, amongst others: (i) to increase food production, (ii) to provide raw materials and other inputs to the other sectors of the

[1] For example, if real incomes rose during the period of study, it is possible that households were adequately compensated for the price shocks. We show in Table 11 that in the case of Ghana it was not universally the case that real incomes increased across the income distribution and locality.

economy, and (iii) to ensure food security and adequate nutrition by improving the availability of food for consumers (Brooks et al., 2006). Policies used to achieve these objectives included price controls, input and credit subsidies, obligatory credit allocations, and heavy state involvement in production, distribution and marketing. The Ghana Food Distribution Corporation (GFDC), which was established in 1975 to replace the defunct Agricultural Development Board, which had been in place since the 1960s, were the two main institutions responsible for procurement and storage of maize and rice at the guaranteed prices (Brooks et al., 2006).

Table 1: Changes in Real Market Price of Fertilizer (%), 1991/92-1998/99

	Fertilizer (NPK)	Fertilizer (Amonia)
Region		
Western	73.9	197.6
Central	82.0	182.3
Greater Accra	88.7	197.6
Eastern	90.8	189.9
Volta	89.6	185.5
Ashanti	88.5	207.4
Brong Ahafo	108.3	222.4
Northern	105.2	259.9
Upper West	100.2	276.3
Upper East	100.5	277.5
Locality		
Rural	96.8	213.6
Urban	79.2	194.8
All Ghana	***90.9***	***207.5***

Source: Author's calculations from GLSS 3 & 4 price questionnaire.

Since the reforms which begun in 1983, and especially in the 1990s, the sector has undergone dramatic changes. The reforms since 1983 have involved the removal of price distortions on crops, eliminating subsidies for agricultural inputs including fertilizer, and reducing the role of parastatals (Nyanteng and Seini, 2000). The government eliminated the guaranteed minimum price paid to farmers for food crops (mainly maize and rice) in 1990 and subsequently abolished subsidies on inputs (mainly fertilizer) in 1992. As detailed in Nyanteng and Seini (2000), the low level of productivity, particularly in food crops, can partly be attributed to poor farming practices and very low use of fertilizer, following the withdrawal of government subsidies on agricultural inputs. The authors have pointed to the existence of a vacuum in the procurement, supply and distribution of inputs following the withdrawal of government support and the failure of the private sector to assume such responsibilities. One of the consequences of such actions is the decreased availability and large increases in the real prices of such critical inputs as fertilizers, insecticides and fungicides. The

prices of fertilizers, for example, increased on average between the range of 74 and 277 percent, increasing relatively more in the three Northern regions (the poorest) and the Brong Ahafo region (Table 1). Teal and Vigneri (2004), for example, show that the real prices of inputs rose far faster than the consumer price index after the removal of the subsidies.

In the late 1980s agricultural policies were guided by the *Ghana Agricultural Policy: Action Plan and Strategies 1986-88*. Its key objectives were: (a) achieving self-sufficiency in cereals, starchy staples and animal proteins, with priority for maize, rice and cassava in the short term; (b) price stabilization and food security through the maintenance of adequate buffer stocks; and (c) improving institutional capacity in research, credit and marketing (see Brooks et al, 2006:17). However, weak institutional capacity was soon identified to be one of the key obstacles to a successful implementation of the present initiative, culminating in the *Agricultural Services Rehabilitation Project* covering the period 1987-1990. This joint Ghana government/World Bank project was aimed at improving the institutional capacity of the country mainly through privatisation. A number of successes were recorded in the area of agricultural research, extension and irrigation. Encouraged by these successes, the government, in collaboration with the World Bank, launched the *Medium Term Agricultural Development Program* with the key objective of increasing productivity and competitiveness in the agricultural sector during the period 1991-2000. Major areas for reform included reducing government interventions in the input and output markets while increasing government support for agriculture through the provision and development of key institutions and infrastructure.

These reforms notwithstanding, the performance of the agricultural sector has not been impressive relative to other sectors of the economy. Between 1988 and 1998 agriculture is reported to have grown on average by about 2.7% per annum and 2.5% per annum during the 1990s. In fact, with population growing at a similar rate, the growth rate of agriculture in per capita terms is probably zero. As expected, agriculture's relative importance has been declining with economic development in Ghana. By 1998 for example, the share of agriculture in GDP had decreased from 45 percent in 1985 to 36

percent.[2] Nonetheless, as in most of SSA, agriculture still remains the mainstay of the Ghanaian economy. As the main source of employment and income, agriculture plays a very important role in rural Ghana. It is estimated that about 70 percent of the population of Ghana (mainly rural households) is dependent on agriculture for its livelihood (Dordunoo, 1997).

2.2 Trade and Exchange Rate Policies

Over the course of the late 1980s and throughout the 1990s, there have been several macroeconomic and trade policy reforms, including tariff policy and devaluation (depreciation) of the Ghanaian cedi, all of which have the potential to impact on food consumption and poverty. In the case of import tariff liberalisation, the reform process was, perhaps, not dramatic and has generally lagged behind reforms of quantitative restrictions. At the start of the 1990s Ghana operated a tariff regime of five lines (i.e. 0%, 10%, 15%, 20% and 25%) but the tariff system was subsequently changed to the present four-tier structure with rates of zero, 5%, 10% and 20%. Most food imports attract the highest duty rate of 20%, although the simple average tariff declined from 17% in 1992 to 13% in 2000 (WTO, 2001). In the unique case of poultry, the import tariff was raised from 20% in 1993 to 40% by the year 2000, as a concession to the National Poultry Farmers' Association which called for higher tariffs aimed at protecting the nascent domestic poultry industry from unfair imports from the European Union. In addition to these import duties the government charges a 12.5 percent (previously 10 percent until 2000) Value Added Tax (VAT) on both imported and domestically produced goods and services. Special import taxes have been a common feature of Ghana's tariff regime with a previous rate of 17.5% only abolished in March 1999 but soon re-introduced at a higher rate of 20% on mainly consumer goods, covering some 7% of tariff lines, which in effect adds a fifth tariff rate of 40% (WTO 2001). Table A1 in the Appendix provides information on tariffs and tariff changes for the major food items in Ghana in the 1990s. It is apparent that in spite of some significant tariff reductions, the levels of protection in 2000 (a modal average of 20%) remain high on most of the food products important for poor households.

[2] Hutchful (2002) attributes this to the often contradictory and poorly coordinated ERP. The author highlights especially the substantial fall in the share of agriculture in public expenditure and in particular the abolition of fertilizer subsidies and the decline in access to credit.

Another major change in government policies included the removal of control measures on foreign exchange transactions. As part of measures aimed at exchange rate liberalization, a wholesale foreign-exchange auction was introduced to replace the retail auction in 1990 before being replaced by an interbank market in 1992. Since the early 1990s when the national currency (the Cedi) was floated, its value has depreciated considerably. The nominal exchange rate has been on a downward trend throughout the 1990s. The Cedi has depreciated from less than ¢350 per US$1 in 1983 to almost ¢3000 per US$1 in 1999. The effect is to increase the value of exports and the domestic prices of imported commodities, which is likely to benefit the export crop farmers, largely cocoa producers at the expense of a large number of (net) food consuming households.

3. EMPIRICAL METHODOLOGY

3.1 The Demand Model

In this section, we discuss the estimation strategy used and some of the econometric issues encountered. We adopt the estimation of a linear *approximate* Almost Ideal Demand System (AIDS) for food demand using cross-sectional data. The AIDS model has been widely applied in many empirical studies of consumer behaviour using both cross-sectional and time series data. The model is adopted in this study because of its many attractive properties relative to other models for analyzing demand for food in developing countries (Deaton and Muellbauer, 1980b). An advantage of the AIDS model is that it is able to treat zero and non-zero consumption in the same way. Another desirable property of the AIDS model is that it is simple to estimate and free from the restrictive assumption of homotheticity, therefore allowing the model to capture any differences in the consumption bundles among different income groups. Other advantages include its tractability and flexibility in allowing us to overcome the problem of aggregation (see Deaton and Muellbauer 1980b).

The AIDS model with the addition of household demographic factors can be specified for the M -good system as

$$w_{ihc} = \alpha_i + \beta_i \ln\left(\frac{x_{hc}}{a(p)}\right) + \sum_{j=1}^{M} \gamma_{ij} \ln p_{jc} + \delta_1 Z_{hc} + u_{ihc} \tag{1}$$

where w_{ihc} is the share of the budget devoted to the *i*th commodity of household h in cluster c, x is the household's food expenditure, p_{jc} is the *j*th commodity price in

cluster c and Z is a vector of household characteristics. α_i, β_i, γ_{ij} and δ_1 are parameters to be estimated, and u_{ihc} is the random error term with the standard properties. The aggregate price index, $a(p)$, used to normalize food expenditure x, is defined as

$$\ln a(p) = \alpha_0 + \sum_{i=1}^{M} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{M} \sum_{i=1}^{M} \gamma_{ij} \ln p_i \ln p_j \tag{2}$$

The Stone (1954) price index, which permits us to linearise the AIDS model as presented in equation (1) is used to approximate the price aggregator in equation (6) (Deaton and Muellbauer, 1980b). Thus, $\ln a(p)$ is substituted by the Stone price index defined as

$$\ln P_c^* = \sum_{i=1}^{M} \overline{w}_{ic} \ln p_{ic} \tag{3}$$

The Stone price index is computed using the cluster mean expenditure shares, $\overline{w}_{ic}$, and thus like all other price variables, is invariant within the same cluster.

The demand system is estimated for each of the six food categories as listed in Table 2. While it would clearly be preferable to estimate the entire demand system, we do not have suitable price data for the important non-food items, e.g. housing, education and durable ownership. In the absence of such data (and in some cases, for simplicity) the usual practice, which is followed in this paper, is to adopt weak separability as a working (and perhaps reasonable) assumption. By excluding non-food goods from the model, we are implicitly assuming that the utility of food is weekly separable from the quantities consumed of non-food. In other words, we assume that the demand for food does not depend on prices of non-food items given total food spending (or real income). We believe such a structure is plausible. However we need to recognise that total food spending is necessarily endogenous. Hence, we allow for the endogeneity of all the food expenditures. Instruments include the logarithm of income (which should be correlated with food spending).

For the demand system to be theory-consistent, we impose the restrictions for implied by consumer demand theory, namely adding-up, homogeneity and symmetry. Adding-up is satisfied if $\sum_i w_i = 1$ for all x and p which requires $\sum_i \alpha_i = 1$, $\sum_i \beta_i = 0$ and

$\sum_i \gamma_{ij} = 0$. We fulfil the condition of adding-up by dropping one of the M demand equations from the system and recovering the parameters of the omitted food equation from the estimates of the M -1 equations. The homogeneity property is satisfied by treating the price of the 'other foods' as a numeraire and setting its price to unity. In our empirical estimation, we omit the price term for the other food category and express the other price variables relative to the omitted price. Note that the demand functions are homogenous of degree zero in prices and income. This means that an equal proportional change in prices and income will leave commodity demands unchanged. (Slutsky) symmetry requires that $\gamma_{ij} = \gamma_{ji}$ which could be met by employing the Seemingly Unrelated Regressions (SUR) procedure to estimate the demand equations simultaneously.[3]

Beginning with a Stone approximation to $a(p)$, we estimate the remaining parameters by linear regression, imposing symmetry. We then update the linearly homogeneous price index $a(p)$ and repeat estimation until convergence. The income or expenditure, Marshallian (uncompensated) own-price and cross-price and the Hicksian (compensated) elasticities for equation (1) are computed at the sample means respectively as follows

$$e_i = \frac{\partial \ln q_i}{\partial \ln x} = 1 + \frac{1}{w_i}\frac{\partial w_i}{\partial \ln x} = 1 + \frac{\beta_i}{w_i} \tag{4}$$

$$\varepsilon_{ii} = \frac{\partial \ln q_i}{\partial \ln p_i} = -1 + \frac{1}{w_i}\frac{\partial w_i}{\partial \ln p_i} = -(1 + \beta_i) + \frac{\gamma_{ii}}{w_i} \tag{5}$$

$$\varepsilon_{ij} = \frac{\partial \ln q_i}{\partial \ln p_j} = \frac{1}{w_i}\frac{\partial w_i}{\partial \ln p_j} = \frac{\gamma_{ij}}{w_i} - \beta_i\left(\frac{w_j}{w_i}\right) \tag{6}$$

$$\varepsilon^*_{ij} = \varepsilon_{ij} w_j e_i \tag{7}$$

[3] Consistent estimation of all parameters requires an iterative (maximum likelihood) method. Hence we employ Zellner's Iterative Seemingly Unrelated Regression (ITSUR) procedure. Formal tests based on the likelihood ratio test for the system as a whole fails to reject homogeneity and symmetry, implying that it is not unreasonable to impose these restrictions on the food demand system.

where, q_i denotes quantity demanded of the i^{th} commodity and all other variables are as previously defined.

3.2 Consumer Welfare Evaluation

This section describes the methodology used to determine welfare changes facing Ghanaian households during the 1990s. Since structural reforms are, in principle, designed to change prices, our interest is in linking observed food price changes to changes in household welfare, especially the partial equilibrium effects on welfare of changes in the prices of the main staple foods. Abstracting away from transmission mechanisms, we treat the policy-induced effect as captured by proportional changes in food prices. The welfare impact of food price changes on households can be measured in monetary terms by using the money metric indirect utility function. Using a set of reference prices, we can compute how well - or worse off households were, moving from their initial utility level to the new or post-reform utility level in response to the changes in food prices. Following the usual practice in this literature (Deaton, 1989 and 1997; Friedman and Levinsohn, 2002; and Niimi, 2005), we characterize the welfare effects of food price changes as the compensating variation (CV).

Suppose $c(u, p)$ denotes the expenditure function which defines the minimum expenditure required to achieve a specific utility level, u, at a given price vector p facing the household (see Deaton and Muellbauer, 1980a). Assume that prices change from p_0 to p_1 as a result of the removal of export tariffs or input subsidies. The money measure of the resultant welfare effect is the difference between the minimum expenditure required to achieve the original utility level, at the new prices, and the initial total expenditure. In other words, CV is the amount of money the household would need to be given at the new set of (higher) prices in order to attain the pre-reform initial level of utility. Subscripts refer to before (0) and after (1) prices, in this study 1991/92 and 1998/99 respectively. Hence, in terms of the expenditure (cost) function:

$$CV = c(p_1, u_0) - c(p_0, u_0) \tag{8}$$

The CV can be approximated using a second order Taylor expansion of the minimum expenditure function as:

$$\Delta \ln c \approx \sum_{i=1} w_i \Delta \ln p_i + \frac{1}{2} \sum_{i=1} \sum_{j=1} w_i \varepsilon^*_{ij} \Delta \ln p_i \Delta \ln p_j \quad (9)$$

where, w_i is the budget share of commodity i in the initial period (1991/92), $\Delta \ln p_i$ approximates the proportionate change in the price of commodity i, and ε^*_{ij} is the compensated price elasticity of commodity i with respect to the price change of good j. Clearly, equation (9) indicates that the impact of a price change upon a household is a function of both the magnitude of the price change as well as the relative importance of different food items in the consumption basket. The first order effect is proportional to quantity consumed. The second order effect depends on the compensated price elasticity. To account for consumption responses, we estimate first and second order impacts using the budget shares and the compensated demand elasticities.

4. DATA DESCRIPTION AND SOURCES

The GLSS datasets for 1991/92 and 1998/99 are used to match household level data on food consumption with cluster level information on food prices. A total of 4523 households were surveyed in 1991/92 while 5998 households were surveyed in 1998/99. These surveys contain detailed consumption data on about 100 food items. For estimation purposes, expenditures (including both cash purchases and imputed own-consumption) on various food commodities were aggregated into 5 composite categories: cereals, roots and tubers, fish, meat and alcohol. All remaining food items were aggregated into a miscellaneous category referred to as 'other food' giving a total of 6 food categories. The 5 main aggregates which are the focus of this study represent about 61% and 68% of the food consumption basket of households in 1991/92 and 1998/99 respectively.[4] Unlike most household surveys in developing countries, the GLSS also include a community price questionnaire which collects data on prevailing prices of a variety of mainly food commodities and some non-food items in the local markets. In principle, these prices should reflect prices faced by households. In practice, there are some concerns about the reliability of such data as the prices may not refer to exactly the same type or quality of goods or that the prices quoted do not involve actual

[4] Fruits and vegetables is an important food category - constituting about 10 percent of average household consumption expenditure – and thus deserves specific attention but data limitations necessitated its exclusion from our analysis. The available data for vegetables in the 1998/99 survey represents consumption of home produce only.

purchases (Deaton and Grosh, 2000). Nonetheless, this is a preferred source of price data when information regarding quantities is not collected from households as is the case of the GLSS (see Deaton and Zaidi, 2002).

4.1 Dependent and Explanatory Variables

The dependent variables in the demand analysis are the budget shares of the 6 food aggregates which are the shares of consumption expenditure of each food commodity in total food consumption expenditure. In addition to the price variables, the explanatory variables include total food expenditure and a set of demographic and household characteristics: (log) household size, age and squared age of the household head, regional and urban dummies.

4.2 Descriptive Statistics

Table 2 presents the mean budget shares for the overall sample while Tables 3 and 4 present the same information for households categorized into per capita household expenditure deciles. The major components of food consumption in 1991/92 were: tubers (23.8%), fish (17.7%) and cereals (13.6%). A similar pattern was registered for 1998/99; tubers (23.5%), fish (19.9%) and cereals (17.1%). In general, consumption baskets in Ghana were remarkably uniform across income groups. However, there were considerable differences in the composition of the consumption basket between the richest 10% and the poorest 10%.

As we would expect from Engel's law, poorer households spend a greater share of their budget on food than rich households in both survey years (71 percent for those in the bottom decile compared with 56 percent in the top decile in 1991/92, for example). As Tables A4 and A5 in the Appendix show, food consumption patterns vary considerably for the various regions and geographical locations in Ghana. Tubers and fish are consistently consumed largely by rural households. Cereals, meat and alcohol are consumed more intensively in the north (i.e., Northern, Upper East and Upper West). Tubers and fish on the other hand are not favourites in the north.

Table 2: Summary Statistics - Dependent Variables (Expenditure Shares)

Commodity Group	1991-92		1998-99	
	Mean	Std. Dev.	Mean	Std. Dev.
Cereal	0.136	0.126	0.171	0.115
Rice	0.036	0.047	0.056	0.057
Maize	0.044	0.077	0.053	0.080
Sorghum	0.011	0.050	0.007	0.036
Other cereal products				
Tubers & Starchy Roots	0.238	0.171	0.235	0.164
Cassava	0.084	0.099	0.090	0.104
Yam	0.048	0.091	0.047	0.076
Plantain	0.050	0.074	0.046	0.070
Other starchy roots				
Fish	0.177	0.118	0.199	0.118
Meat (Poultry)	0.020	0.045	0.027	0.047
Alcohol	0.041	0.078	0.044	0.071
Other Food	0.389	0.160	0.324	0.159
Oils & fats	0.032	0.032	0.001	0.007
Pulses	0.025	0.047	0.029	0.044
Prepared meals	0.098	0.133	n/a	n/a
Other miscellaneous foods				

Source: Authors' calculations from GLSS 3 & 4.. *Notes:* n/a means data was not available.

Table 3: Expenditure Shares in Ghana, by decile of per capita consumption in 1991/92

Commodity	Poorest	2	3	4	5	6	7	8	9	Richest
Cereal	0.187	0.142	0.139	0.138	0.121	0.130	0.131	0.134	0.129	0.131
Rice	0.025	0.029	0.029	0.030	0.031	0.038	0.036	0.039	0.039	0.043
Maize	0.076	0.053	0.058	0.048	0.043	0.042	0.043	0.040	0.037	0.028
Sorghum	0.037	0.023	0.016	0.018	0.008	0.011	0.010	0.007	0.005	0.003
Tubers	0.230	0.280	0.277	0.289	0.264	0.252	0.248	0.230	0.225	0.175
Cassava	0.075	0.108	0.099	0.106	0.091	0.090	0.090	0.078	0.080	0.056
Yam	0.048	0.057	0.052	0.054	0.051	0.051	0.042	0.046	0.045	0.041
Plan	0.038	0.049	0.052	0.057	0.057	0.055	0.054	0.053	0.049	0.041
Fish	0.156	0.203	0.193	0.190	0.187	0.185	0.185	0.183	0.165	0.152
Meat	0.016	0.014	0.014	0.013	0.017	0.017	0.019	0.020	0.023	0.030
Alcohol	0.053	0.036	0.043	0.035	0.038	0.042	0.036	0.033	0.040	0.048
All Food	0.71	0.69	0.69	0.70	0.66	0.66	0.65	0.65	0.65	0.56

Source: Authors' calculations from GLSS 3.
Note: Deciles are by per-adult equivalent household expenditure.

Table 4: Expenditure Shares in Ghana, by decile of per capita consumption in 1998/99

Commodity	Poorest	2	3	4	5	6	7	8	9	Richest
Cereal	0.273	0.207	0.176	0.168	0.169	0.159	0.156	0.154	0.154	0.153
Rice	0.050	0.047	0.048	0.054	0.057	0.056	0.056	0.060	0.060	0.060
Maize	0.113	0.082	0.075	0.059	0.059	0.055	0.045	0.039	0.035	0.026
Sorghum	0.041	0.020	0.006	0.007	0.004	0.003	0.003	0.002	0.001	0.001
Tubers	0.138	0.216	0.266	0.268	0.261	0.275	0.262	0.249	0.235	0.195
Cassava	0.048	0.090	0.114	0.118	0.112	0.113	0.105	0.088	0.081	0.058
Yam	0.029	0.044	0.048	0.047	0.051	0.049	0.048	0.053	0.052	0.046
Plan	0.008	0.023	0.037	0.046	0.044	0.058	0.052	0.054	0.057	0.051
Fish	0.177	0.196	0.215	0.213	0.219	0.223	0.212	0.207	0.193	0.168
Meat	0.018	0.018	0.018	0.018	0.019	0.020	0.024	0.029	0.037	0.046
Alcohol	0.057	0.046	0.035	0.041	0.033	0.029	0.036	0.039	0.045	0.061
All Food	0.63	0.64	0.63	0.63	0.61	0.61	0.61	0.59	0.58	0.57

Source: Authors' calculations from GLSS 4.
Note: Deciles are by per-adult equivalent household expenditure.

Table 5: Market Prices ('000 Cedis per kilogram)

	Nominal Prices		Real Prices	
Commodity Group	**1991-92**	**1998-99**	**1991-92**	**1998-99**
Cereals	0.144 (0.075)	0.951 (0.821)	0.919 (0.486)	1.056 (0.865)
Tubers	0.109 (0.040)	0.787 (0.777))	0.684 (0.228)	0.883 (0.871)
Fish	0.219 (0.048)	4.886 (2.800)	1.400 (0.323)	5.508 (3.170)
Meat	0.174 (0.016)	5.654 (1.918)	1.114 (0.096)	6.338 (2.053)
Alcohol	0.073 (0.018)	2.335 (1.010)	0.467 (0.117)	2.658 (1.177)

Source: Authors' calculations from GLSS 3 & 4.
Note: Figures in parentheses are standard deviations. Price of alcohol is per 1 beer bottle. All price averages are computed across all clusters reporting positive consumption for a given commodity group.

Table 5 summarises the price variables employed in the empirical estimation.[5] Following standard practice in the literature, we assume that households surveyed in the same cluster face the same prices (Deaton and Grimard, 1992). Each commodity price is a weighted-average of the prices of the individual food items that constitute the commodity group.

[5] Note that the price for the 'other food' category is treated as a numeraire and is thus set to unity.

Table 6: Median Real Market Food Price Changes (%), 1991/92-1998/99

	Cereals	Tubers	Fish	Meat	Alcohol
Region					
Western	-17.5	22.9	129.2	177.7	161.4
Central	17.1	-1.7	134.0	208.4	197.7
Greater Accra	27.6	-2.7	124.1	196.3	113.9
Eastern	4.3	-6.7	132.5	166.5	165.1
Volta	10.7	4.7	101.8	180.4	167.6
Ashanti	-46.8	8.3	137.5	172.7	171.1
Brong Ahafo	50.5	29.5	115.2	115.5	207.8
Northern	0.5	26.8	69.2	135.1	201.4
Upper West	28.6	-9.8	119.2	160.1	211.1
Upper East	-5.1	-11.3	91.8	133.7	211.3
Locality					
Rural	13.9	6.9	126.9	168.8	192.1
Urban	-18.0	5.8	122.2	170.8	134.2
All Ghana	***3.1***	***7.9***	***123.5***	***173.4***	***178.4***

Source: Authors' calculations from GLSS 3 & 4

Based on the law of one price within clusters, the cluster price for each food item is first assigned to all households within the cluster.[6] We then calculate the group price indices using the cluster mean budget shares of the individual food items in the group expenditure as the weights.[7] In dealing with the effect of outliers, we follow Cox and Wohlgenant (1986) by replacing prices more than five standard deviations from their cluster means with the cluster means. The real prices were computed by deflating the nominal prices by the Paasche cost-of living indices (COLI) provided in the GLSS and used for the published report on poverty trends (GSO 2000a), so that all prices are now expressed in the constant prices of Accra in January 1999.[8] Fish and meat emerge as the most expensive commodities in 1991/92. But by 1998/99, meat had become the highest priced food product in Ghana, followed by fish and alcohol. Tubers passed alcohol to become the lowest priced food product in the country. As the standard deviations depict,

[6] Following Niimi (2005), whenever the cluster price is missing, we assign the mean price for the urban/rural sector of each region surveyed in the same quarter to the households in that cluster conditional on at least one household in the cluster making a purchase of that particular food item. If the cluster price remains missing after this correction, it is then replaced by the regional-quarter price. This is done to overcome the cost of dropping such observations from the analysis, including sample selection problems.

[7] Note that in the case of fish we take the simple average of the individual fish prices in the price questionnaire since the consumption data does not distinguish between different types of fish.

[8] We also experimented by using the monthly national consumer price index (CPI) for Ghana as our price deflator with September 1997 as the base. The resultant relative prices and price movements are not reported here for brevity. It is however apparent that the overall price movements are qualitatively consistent between the two deflators, confirming that the general pattern of real price changes is not sensitive to alternative price deflator used.

there was remarkable variation in the average price of individual food items across clusters.

Table 6 provides evidence on food price movements between 1991/92 and 1998/99. There is evidence that food prices fell relative to non-food during the 1990s. The CPI for food increased by 415.8 points between the two survey years as compared with 471.3 points for non-food (see Table A7 in the Appendix). The monthly changes in the CPI indicate that food price inflation was higher relative to non-food during the 1991/92 survey period (see Table A10 in the Appendix). However, the changes in the CPI for food were lower than the changes which occurred in the CPI for non-food commodities during the 1998/99 survey period. Yet, even within food, prices have increased significantly, possibly in response to the market-oriented reforms. Prices of all the five major food commodities increased substantially during the 1990s, imposing considerable food security implications for many poor households in the country. There are perceptible variations (across goods and location) in the degree of price changes observed. It is clear that there has been a significant increase in food price inflation, in both rural and urban areas, and across the country, with alcohol (178.4%), meat (173.4%) and fish (123.5%) registering the largest average increases. the prices of cereal and tubers, the two major staples in Ghana, increased by the lowest proportion of 3.1% and 7.9% respectively. This may be due partly to increased production and also imports, at least for rice. The real prices of all food commodities, except meat, increased the most in rural Ghana relative to urban locations. In fact, the real price of cereal fell by 18% in the urban areas compared with an increase of about 14% in the rural areas. It is the variation in these price changes that we seek to exploit in examining the distributional impacts on household welfare of the food price changes.

5. EMPIRICAL RESULTS

Tables A2 and A3 in the Appendix report the structural parameters together with their p-values from the demand system estimated using the SURE procedure based on the 1991/92 and 1998/99 GLSS data respectively. The estimated coefficients obtained by imposing the conventional homogeneity and symmetry demand restrictions are mostly significant at the 5% level or better indicating that the expenditure shares for each commodity are responsive to prices and income and to most of the household and

demographic variables included in the model. With the budget shares as dependent variables (not the quantities consumed), a positive and statistically significant expenditure coefficient implies that the budget share increases with total food spending, suggesting that the expenditure elasticity would be greater than one and the commodity is a luxury good (see Table A9 in the Appendix). This is the case for meat and alcohol in 1991/92 and for, meat, alcohol and tubers in 1998/99. Household size is a strong determinant of all expenditure shares. Household size is strongly negatively correlated with budget shares for meat and alcohol in both 1991/92 and 1998/99, implying that budget shares for these goods are falling with household size. Regional dummies and urban locality are also good determinants of household spending patterns. The estimates suggest that households located in the three northern regions have the largest budget shares for cereals, and the lowest shares for tubers and fish.[9]

5.1 Demand Elasticities

We now turn to the discussion of the estimated demand elasticities, which are needed to properly evaluate the welfare consequences of the reforms discussed earlier. The Marshallian (ordinary) elasticity matrices for 1991/92 and 1998/99 evaluated at the sample means are reported in Tables 7 and 8 respectively, which include the cross-price elasticity estimates. Tables A6 and A8 in the Appendix contain the Hicksian (income-compensated) demand elasticity matrices for 1991/92 and 1998/99 respectively. The expenditure (income) elasticities computed at the sample means using equation (4) are also presented in Table A10 in the Appendix.

Table 7: Marshallian (Ordinary) Demand Elasticity Matrix, 1991-92

Commodity	With Respect to the Price of					
	Cereal	Tubers	Fish	Meat	Alcohol	Other Food
Cereal	**-1.027**	-0.304	-0.170	-0.034	-0.092	-0.349
Tubers	-0.066	**-1.409**	0.002	-0.031	-0.091	-0.198
Fish	-0.151	-0.257	**-0.874**	-0.062	-0.070	-0.437
Meat	-0.421	-0.156	-1.618	**-2.014**	0.452	0.691
Alcohol	-0.227	-0.085	-0.288	0.055	**-0.969**	-0.702
Other Food	-0.113	-0.204	-0.324	0.040	-0.083	**-1.308**

Source: Authors' calculations from GLSS 3.

[9] Although there are no accessible estimates for Ghana to be used as points of reference, we believe that the estimates are plausible and are generally consistent with *a priori* expectations.

Table 8: Marshallian (Ordinary) Demand Elasticity Matrix, 1998/1999

Commodity	With Respect to the Price of					
	Cereal	Tubers	Fish	Meat	Alcohol	Other Food
Cereal	**-1.102**	-0.328	-0.127	0.010	-0.088	-0.295
Tubers	-0.372	**-1.037**	-0.520	0.034	0.016	-0.370
Fish	-0.067	-0.433	**-0.988**	-0.114	-0.026	-0.203
Meat	-0.107	0.088	-0.935	**-0.758**	0.015	-0.718
Alcohol	-0.422	0.136	-0.217	0.040	**-1.004**	-0.615
Other Food	-0.175	-0.166	-0.190	-0.041	-0.071	**-1.356**

Source: Authors' calculations from GLSS 4.

As shown in Table 7, all the estimated Marshallian (uncompensated) own-price elasticities are negative. Consistent with consumer demand theory, there exists an inverse relationship between changes in own-price indexes and quantities demanded. In most cases the absolute value of the own-price elasticity is greater than unity, meaning that they are price elastic. The Hicksian (compensated) own-price elasticities reported in Tables A6 and A8 in the Appendix corroborate the information in Tables 7 and 8. As expected, in all cases, the compensated elasticities are lower than the uncompensated ones. Even after the income-compensation, tubers and meat (in 1991/92) remain the only commodities with own-price elasticity exceeding unity. For the remainder of the foods, the absolute values of the own-price elasticities are smaller than unity, meaning that they are not price elastic.

For both 1991/92 and 1998/99 all goods had positive consumption expenditure elasticities, implying that no commodity was classified as "inferior"; all were "normal goods". The expenditure elasticities for all goods appear to change over the period, even if marginally. As expected, commodities that constitute the diet of poorer households have lower income elasticities. In 1991/92, cereals, tubers, fish and 'other food' were necessities ($e_i < 1$) while meat and alcohol were found to be luxury ($e_i > 1$). In 1998/99, cereals and fish remained necessities whereas the expenditure elasticity for tubers increased above unity. Recall that by the end of the 1990s cereals (27.3%) and fish (17.7%) alone constituted 45 percent of the food expenditures for the average poorest household.

5.2 Price Changes and Consumer Welfare

The estimated elasticities can be used to assess the welfare consequences of the food price changes that occurred during the 1990s. The measurement of the 'dynamic' household welfare effect, one that jointly considers (static) first order effects in consumption as well as consumption responses, is the object of this sub-section. While the first term in equation (9) – the first order approximation – may capture a large part of the impact of price changes on welfare, ignoring household behavioural responses in welfare analysis – the second order approximation - may lead to significant biases and inappropriate inferences (see Banks et al., 1996; McCulloch, 2003; Niimi, 2005; Nicita, 2004b; Friedman and Levinsohn, 2002). The first order approximation of impact of price changes implicitly assumes that households are unable to change their consumption patterns when prices change (equivalent to assuming that all elasticities are zero). Given the substantial observed price changes, substitution effects can be non-trivial, and therefore, first order approximations can be seriously biased (Banks et al., 1996). However, for purposes of comparison, we report results from both first order and second order approximations.

We utilize the estimated Hicksian (compensated) elasticities for 1991/92 to measure the welfare impact of the food price changes observed between 1991/92 and 1998/99. Following some recent literature (see Niimi, 2005; Nicita, 2004b; Friedman and Levinsohn, 2002; Minot and Goletti, 2000), we estimate the change in consumer welfare, measured as compensating variation (CV).[10] The CV measures the total transfer required to compensate all households for the price changes they experienced between 1991/92 and 1998/99, as a percentage of their initial total expenditure. In doing this, we also recognise the importance of determining how different population groups are affected in different ways by these reforms. Thus, to illustrate which groups of households were relatively disadvantaged by the price changes, we disaggregate the CV measure by income group, locality and region.

[10] While it would be appropriate to estimate the overall welfare changes (i.e. including producer welfare), we do not pursue this line of enquiry due to lack of producer price data. We concentrate here on changes in consumer welfare from the change in prices, assuming income effects away. Our model therefore does not account for supply responses through production and labour adjustments. The results must therefore be interpreted with these caveats in mind.

Table 9: Compensating Variation Implied by the Price Changes

Household Category	First-order Effects (%)	Full Effects (CV) (%)
Locality		
Rural	37.9	21.5
Urban	29.0	17.7
Income group		
1st quartile	35.4	22.1
2nd quartile	35.2	20.4
3rd quartile	34.3	19.6
4th quartile	34.3	18.7
Poverty status		
Non-poor	34.6	19.4
Poor	35.2	21.5
Poverty status	*Rural*	*Rural*
Non-poor	39.3	21.7
Poor	36.6	21.4
Poverty status	*Urban*	*Urban*
Non-poor	29.2	16.7
Poor	28.1	22.1
Ghana	34.8	20.2

Source: Authors' calculations from GLSS 3 & 4.
Note: Compensating variation is measured as a proportion of 1991/92 total household expenditures.

Table 9 presents the welfare measure as a share of total household expenditure in 1991/92. For comparison purposes, we also present estimates from a first-order approximation to the price changes, which disregards substitution effects in consumption. The first column presents the first-order effects computed using equation (9) for the various categories of households while the second column displays the full-effects. The results suggest that all household groups suffered welfare losses arising from the food price increases during the 1990s. Consistent with our *a priori* expectations, it is clear that the first order effect overstates, albeit marginally, the welfare losses for all groups of households. On average, Ghanaian households need to be reimbursed to the tune of about 20.2% of their 1991/92 total household expenditures for the food price changes they faced during the 1990s. The results however, reveal some heterogeneity in the impact of price variations on households. The results indicate that the burden of higher consumer prices fell largely on the poor and on rural

households.[11] The distributional impacts of the price changes were quite similar for the rural poor and non-poor. However, within urban localities it is the poor who suffered disproportionately, requiring a compensation of about 22% of their 1991/92 household expenditures. It is probable that a combination of the relatively lower compensated own-price elasticities, which means that households are unable to substitute away from high-priced goods, and the higher budget shares (see Table 3), contributed to relatively higher welfare losses for poor households. For rural households, it appears that the relatively higher price increases (see Table 6), coupled with lower compensating price elasticities and higher budget shares (see Table 3) accentuated the welfare losses.

What can we infer from the results? As has already been noted, the linkage between policy reform and price changes is complex, especially when it involves the removal of quantitative restrictions. There could be a number of reasons that may account for welfare losses following the sharp food price changes such as exchange rate devaluation (depreciation), the abolition of fertilizer (and other input) subsidies or adverse weather conditions, which results in domestic production shortfalls. For example, while tariff liberalisation is expected to reduce the domestic price of imports, exchange rate devaluation (depreciation) would generally achieve the opposite. In essence, while it is difficult to attribute the price changes and by implication the welfare losses, to any particular policy per se, the results provide new insights into household consumption patterns and how household welfare was impacted by exogenous food price changes in the 1990s.[12] However, since our interest is in the effect of trade policy, the next sub-section adopts counterfactual experiments in an attempt to isolate the potential trade policy effects from that arising from other factors.

5.3 Trade Liberalisation and Consumer Welfare

In this sub-section, we use simulation techniques to analyse how trade liberalisation, defined here as tariff reductions, could have altered the effect of the actual food price changes that took place in the 1990s. Our motivation derives from the hypothesis that tariff reductions were possibly not dramatic enough to offset the price increases, which

[11] Poor households are defined as those whose per adult equivalent expenditure is below the lower poverty line of 700,000 *cedis* per year (in the constant prices of Accra in January 1999).

[12] We know from Table A1 that for all foods except poultry the import tariff fell or was unchanged during the 1990s which directly implies that consumer prices for such foods would have fallen, ceteris paribus, ruling out tariff reform as the culprit for the price increases and the subsequent welfare losses.

to some extent resulted from other policy reforms. Alternatively, one could argue that tariff reductions notwithstanding, other factors could have prevented price transmission from the border to local prices. Lacking suitable data to estimate a tariff pass-through model, our approach is to follow the largest strand of the literature by using simulation analysis to explore the effect on welfare of a hypothetical trade policy reform (see for example, Porto 2003; Minot and Goletti 2000; Ravallion and van de Walle 1991). Having already estimated price elasticities of demand and using a partial equilibrium framework, we explore the potential distributional effects of further import tariff liberalisation on household welfare.[13] For analytical convenience and due to data constraints, we assume that tariff reductions are fully transmitted to domestic prices. Further, for the model to be tractable, we abstract away from any potential general equilibrium effects on incomes, customs revenue and balance of payments, to mention just a few.[14]

For the purpose of the simulations, a policy change is described as the change in the price of a good resulting from the tariff reform. We focus on a scenario in which all tariffs are cut by 50 percent. For a small open economy the domestic price p_i^D for traded good i is related to the international price p_i^W through the following equation

$$p_i^D = p_i^W (1+t_i) \tag{10}$$

Where t_i represents the *ad valorem* tariff rate applied to the import of good i. Following Porto (2003), we write the change in the (logarithmic) price of the ith good as

$$d \ln p_i^D = d \ln (1+t_i) \tag{11}$$

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[13] Given the difficulty involved in attempting to assign price changes to any particular policy per se, the mainstream of the literature take changes in prices as given and do not make any attempt to decompose what portion of the observed price changes are actually due to the policy of interest. A number of authors conduct counterfactual simulations by assuming possible price changes expected from a hypothetical policy reform. The assumption of price changes 'is particularly valuable where the price changes likely to result from the implementation of a reform are not known with any degree of accuracy' (McCulloch, 2003:5)

[14] While these may be unrealistic assumptions, they are imposed by the lack of data including regional and producer food prices. Hence, the analysis ignores the 'real' long-run effects and concentrates on the short-term consumption effects alone. Tracing the 'full' feedback effects is a major undertaking, which would necessitate a multi-sectoral economy-wide CGE framework. However, whilst CGE models offer great potential to disentangle the complex linkages between trade reform and poverty, they may lead to conclusions that are embedded in assumptions on functional forms rather than being derived from the data (Deaton 1987; 1999).

Table 10: Compensating Variation due to Tariff Reform

Household Category	First-order Effects (%)	Full Effects (CV) (%)
Locality		
Rural	-6.3	-6.5
Urban	-4.8	-5.0
Income group		
1st quartile	-6.3	-6.5
2nd quartile	-6.1	-6.2
3rd quartile	-5.7	-5.9
4th quartile	-5.2	-5.4
Poverty status		
Non-poor	-5.5	-5.7
Poor	-6.2	-6.4
Poverty status	*Rural*	*Rural*
Non-poor	-6.2	-6.4
Poor	-6.5	-6.6
Poverty status	*Urban*	*Urban*
Non-poor	-4.8	-4.9
Poor	-5.2	-5.3
Ghana	-5.8	-6.0

Source: Author's calculations from GLSS 3 & 4.
Note: Compensating variation is measured as a proportion of 1991/92 total household expenditures.

Using data on pre-reform tariffs and prices, we use (11) to compute the price changes that would result from the tariff reform. The tariffs that apply to each of the six composite goods (and their components) are listed in Table A1 in the Appendix. Equation (11) is estimated using the MFN tariff rates that prevailed in 1993 as the benchmark. The average tariff on food imports in 1993 ranges between 20% (for cereal, fish and meat) and 25% (for tubers and alcohol). Applying (11) to the hypothetical reform of 50% tariff reductions results in the prices of cereal, fish and meat declining by 8.7 percent and the prices of tubers and alcohol falling by 10.5 percent. These price changes are employed in re-estimating equation (13). Table 10 presents the simulation results of the effects of the 50% across-the-board tariff reductions.

The negative CV estimates indicate that all households would gain from further tariff reductions, suggesting that the tariff liberalisation in the 1990s were probably not large enough. Implementing the 50% across the board tariff cuts and thus reducing domestic prices by 8.7 to 10.5 percent could have offset the adverse effects of the price

movements experienced in the 1990s. On average, the government would need to take away from each household about 6 percent of their 1991/92 total household expenditures to reduce its welfare to the pre-reform levels. The experiment further suggests that poor consumers, especially in the rural areas, would be the major beneficiary from further tariff liberalization. This means that tariff liberalisation would tend to benefit the poor (6.4%) over the rich (5.7%) and thereby potentially reduce inequality. Rural households also stand to gain substantially (6.5%), compared to their urban counterparts (5%). These findings indicate that trade policy may not have been responsible for the welfare losses observed in the previous analysis. The role of other factors and policies, such as the removal of fertilizer subsidies, exchange rate depreciation and domestic supply constraints could be decisive.

6. CONCLUSIONS AND POLICY IMPLICATIONS

In this study we had three main objectives: (1) to estimate for the first time a complete food demand system using recent household survey data for Ghana; (2) to measure the (consumer) welfare impact on households of food price changes in the 1990s; and (3) to assess the extent to which changes can be explained by trade and agricultural policy reforms. Using the linear approximate version of the AIDS model, we have calculated expenditure, own-price and cross-price demand elasticities for 6 food aggregates important for providing the caloric needs of most Ghanaian households. The results indicate that demand for most food commodities in Ghana is price sensitive. The estimated price and expenditure elasticities are plausible and consistent with economic theory: all own-price elasticities were negative and statistically significant. Similarly, estimated expenditure elasticities were positive and statistically significant for all food groups as is expected. The demand estimates presented in this essay provide the first information about the characteristics of food demand in Ghana.

With regards to our second and third objectives, we employed the estimated price elasticities to evaluate the welfare consequences of the relative food price changes in terms of compensating variation. Results suggest that Ghanaian household consumption did respond to relative price and real income changes, which to some extent resulted from policy reforms. We find that the remarkable increases in food prices resulted in severe erosion of real income and purchasing power for the urban poor, in particular. Although the food price changes have had differential effects on the population, the

general experience has been that, for the vast majority of households, the price changes have brought severe hardship through higher food prices. The results indicate that the burden of higher consumer food prices fell largely on the urban poor households.

While it is difficult to attribute the food price changes and by implication the welfare losses, to any particular policy *per se*, our counterfactual experiment indicates that trade liberalisation was not (for consumers) responsible for the welfare losses. The role of other factors and policies, such as the removal of fertilizer subsidies and exchange rate depreciation could be decisive. Our simulation exercise suggests that tariff liberalisation would tend to offset the welfare losses for all household groups although it is the poor and rural consumers that stand to gain the most. In sum, the results suggest, perhaps unsurprisingly, that although trade liberalisation may have a positive impact on welfare, at least from a consumption perspective, other factors may offset this, at least in the case of Ghana.

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APPENDIX

Table A1: Tariffs on Agricultural Food Imports

Commodity	1993	2000	% change
Meat			
Goat	20	20	0
Poultry	20	40	100
Pork	20	20	0
Beef	20	20	0
Mutton	20	20	0
Fish			
Herrings	20	0	-100
Cod	20	0	-100
Sardines (not tin)	20	0	-100
Haddock	20	0	-100
Mackerel	20	0	-100
Lobsters, Shrimps & Prawns	25	20	-20
Tubers & Starchy Roots (Cassava)	*25*	*20*	*-20*
Cereals			
Rice (paddy or rough)	20	20	0
Sorghum	20	0	-100
Wheat	20	20	0
Millet	20	20	0
Other cereals	20	20	0
Alcohol			
Beers	25	20	-20
Sparkling wine	25	20	-20
Whiskies & Rum	25	20	-20
Gin & Brandy	25	20	-20
Vodka.	25	20	-20
Other spirits	25	20	-20

Source: Authors' calculations using HS 6-digit level tariff data from UNCTAD TRAINS Database.

Table A2: Parameter Estimates for the AIDS Model, 1991-92

	Cereal		Tubers		Fish		Meat		Alcohol	
	coefficient	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**
Intercept	0.224	0.000	0.186	0.028	0.755	0.000	-0.033	0.477	-0.187	0.000
Total food expenditure	-0.017	0.002	0.019	0.040	-0.083	0.000	0.016	0.000	0.016	0.000
Relative prices (in logs)										
Cereal	0.010	0.002	-0.006	0.129	-0.003	0.311	0.000	0.961	-0.005	0.061
Tubers, Roots & Plantain	-0.006	0.129	-0.013	0.128	0.004	0.466	-0.007	0.012	-0.002	0.693
Fish	-0.003	0.311	0.004	0.466	0.007	0.545	0.005	0.396	0.020	0.000
Meat	0.000	0.961	-0.007	0.012	0.005	0.396	-0.014	0.100	0.001	0.749
Alcohol	-0.005	0.061	-0.002	0.693	0.020	0.000	0.001	0.749	-0.001	0.872
Demographic & Geographic										
Age of head	-0.001	0.211	0.000	0.717	0.002	0.000	0.000	0.182	0.003	0.000
Age of head squared	0.000	0.236	0.000	0.908	0.000	0.006	0.000	0.299	0.000	0.000
Log of household size	0.014	0.000	0.037	0.000	0.032	0.000	-0.008	0.000	-0.023	0.000
Urban dummy	0.029	0.000	-0.083	0.000	-0.004	0.417	-0.008	0.001	-0.025	0.000
Central	0.034	0.000	-0.052	0.000	0.043	0.000	-0.016	0.000	-0.022	0.000
Greater Accra	0.067	0.000	-0.128	0.000	-0.004	0.690	-0.011	0.006	-0.024	0.000
Eastern	0.018	0.007	-0.006	0.578	0.007	0.323	-0.007	0.020	-0.017	0.002
Volta	0.096	0.000	-0.092	0.000	-0.027	0.002	-0.006	0.084	-0.002	0.682
Ashanti	0.033	0.000	-0.017	0.138	-0.030	0.000	-0.008	0.014	-0.025	0.000
Brong Ahafo	0.009	0.251	0.015	0.208	-0.038	0.000	-0.013	0.000	-0.006	0.292
Northern	0.147	0.000	-0.185	0.000	-0.096	0.000	-0.028	0.000	-0.012	0.138
Upper West	0.224	0.000	-0.295	0.000	-0.164	0.000	0.004	0.522	0.098	0.000
Upper East	0.333	0.000	-0.293	0.000	-0.168	0.000	0.012	0.028	-0.005	0.560
R-squared		*0.34*		*0.30*		*0.29*		*0.05*		*0.11*

Source: Authors' calculations from GLSS 3.

Table A3: Parameter Estimates for the AIDS Model, 1998-99

	Cereal		Tubers		Fish		Meat		Alcohol	
	coefficient	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**	**coefficient**	**p-value**
Intercept	0.363	0.000	0.116	0.037	0.711	0.000	-0.097	0.001	-0.056	0.084
Total food expenditure	-0.027	0.000	0.010	0.050	-0.043	0.000	0.006	0.001	0.007	0.004
Relative Prices (in logs)										
Cereals	0.005	0.103	-0.005	0.067	-0.008	0.001	0.011	0.000	-0.007	0.000
Tubers, Roots & Plantain	-0.005	0.067	-0.012	0.007	0.000	0.906	-0.004	0.020	0.008	0.000
Fish	-0.008	0.001	0.000	0.906	-0.018	0.000	-0.001	0.466	0.004	0.040
Meat	0.011	0.000	-0.004	0.020	-0.001	0.466	0.006	0.015	0.000	0.804
Alcohol	-0.007	0.000	0.008	0.000	0.004	0.040	0.000	0.804	0.000	0.930
Demographic & Geographic										
Age of head	0.000	0.692	0.004	0.000	0.001	0.009	0.000	0.157	0.001	0.056
Age of head squared	0.000	0.778	0.000	0.000	0.000	0.158	0.000	0.446	0.000	0.012
Log of household size	0.028	0.000	0.040	0.000	0.021	0.000	-0.003	0.008	-0.015	0.000
Urban dummy	0.023	0.000	-0.073	0.000	-0.001	0.897	0.000	0.938	-0.008	0.006
Central	0.006	0.378	-0.031	0.001	0.011	0.102	0.000	0.889	0.003	0.474
Greater Accra	0.031	0.000	-0.081	0.000	-0.010	0.094	0.006	0.034	0.024	0.000
Eastern	0.052	0.000	-0.083	0.000	-0.009	0.139	0.004	0.127	0.023	0.000
Volta	-0.003	0.563	0.005	0.496	-0.014	0.020	0.010	0.000	0.010	0.011
Ashanti	0.007	0.241	0.010	0.216	-0.016	0.004	0.011	0.000	-0.007	0.059
Brong Ahafo	0.009	0.186	0.050	0.000	-0.041	0.000	0.003	0.311	-0.001	0.820
Northern	0.154	0.000	-0.158	0.000	-0.135	0.000	0.010	0.008	0.021	0.000
Upper West	0.263	0.000	-0.215	0.000	-0.216	0.000	0.013	0.013	0.152	0.000
Upper East	0.193	0.000	-0.272	0.000	-0.166	0.000	0.016	0.000	0.065	0.000
R-squared		*0.25*		*0.31*		*0.30*		*0.05*		*0.13*

Source: Authors' calculations from GLSS 4.

Table A4: Expenditure Shares in Ghana, by region in 1991/92

	Cereals	Tubers	Fish	Meat	Alcohol	Other Food
Region						
Western	0.08	0.29	0.23	0.02	0.05	0.22
Central	0.10	0.26	0.24	0.01	0.03	0.25
Greater Accra	0.14	0.13	0.15	0.02	0.03	0.43
Eastern	0.09	0.30	0.23	0.02	0.04	0.22
Volta	0.16	0.23	0.21	0.02	0.05	0.23
Ashanti	0.10	0.29	0.16	0.02	0.03	0.31
Brong Ahafo	0.08	0.34	0.17	0.02	0.04	0.26
Northern	0.26	0.15	0.07	0.01	0.04	0.36
Upper West	0.30	0.05	0.04	0.03	0.15	0.31
Upper East	0.41	0.06	0.03	0.04	0.06	0.29
Locality						
Rural	0.14	0.27	0.19	0.02	0.05	0.23
Urban	0.13	0.18	0.15	0.02	0.03	0.38
All Ghana	0.14	0.24	0.18	0.02	0.04	0.29

Source: Authors' calculations from GLSS 3

Table A5: Expenditure Shares in Ghana, by region in 1998/99

	Cereals	Tubers	Fish	Meat	Alcohol	Other Food
Region						
Western	0.15	0.29	0.23	0.03	0.03	0.25
Central	0.13	0.26	0.27	0.01	0.03	0.28
Greater Accra	0.16	0.14	0.17	0.04	0.06	0.41
Eastern	0.20	0.22	0.24	0.02	0.05	0.25
Volta	0.14	0.29	0.24	0.03	0.04	0.24
Ashanti	0.14	0.28	0.21	0.03	0.03	0.29
Brong Ahafo	0.13	0.33	0.19	0.02	0.03	0.25
Northern	0.29	0.13	0.08	0.03	0.05	0.38
Upper West	0.43	0.08	0.04	0.02	0.18	0.21
Upper East	0.32	0.05	0.05	0.04	0.10	0.40
Locality						
Rural	0.17	0.26	0.21	0.02	0.04	0.25
Urban	0.17	0.18	0.18	0.03	0.04	0.37
All Ghana	0.17	0.23	0.20	0.03	0.04	0.30

Source: Authors' calculations from GLSS 4.

Table A6: Hicksian (Compensated) Demand Elasticity Matrix, 1991-92

Commodity	With Respect to the Price of					
	Cereal	Tubers	Fish	Meat	Alcohol	Other Food
Cereal	**-0.908**	-0.073	0.005	-0.014	-0.053	0.031
Tubers	0.025	**-1.094**	0.098	-0.005	-0.045	-0.049
Fish	0.001	-0.111	**-0.776**	-0.037	-0.008	-0.138
Meat	-0.109	0.387	-1.104	**-1.973**	0.545	1.744
Alcohol	-0.067	0.189	-0.015	0.082	**-0.904**	-0.195
Other Food	0.009	0.033	-0.144	0.061	-0.043	**-0.920**

Source: Authors' calculations from GLSS 3.

Table A7: Consumer Price Indices, 1991/92 – 1998/99 (September 1997=100)

Month	**Food**	**Non-Food**	**Combined**

	GLSS 3 (1991/92)		
Sep-91	21.2	18.0	18.9
Oct-91	21.0	18.1	19.0
Nov-91	21.0	18.2	19.0
Dec-91	21.0	18.2	19.1
Jan-92	21.1	18.3	19.1
Feb-92	21.7	18.5	19.5
Mar-92	22.7	18.7	19.9
Apr-92	23.4	19.1	20.4
May-92	24.2	19.2	20.7
Jun-92	24.4	19.3	20.8
Jul-92	24.5	19.7	21.1
Aug-92	24.4	19.9	21.3
Sep-92	24.0	19.9	21.1
Average	*22.7*	*18.9*	*20.0*
	GLSS 4 (1998/99)		
Apr-98	124.4	108.3	115.9
May-98	129.0	110.2	119.0
Jun-98	128.7	111.8	119.7
Jul-98	125.9	111.2	118.2
Aug-98	125.4	112.0	118.4
Sep-98	121.9	113.2	117.4
Oct-98	118.0	113.7	115.8
Nov-98	117.9	113.5	115.6
Dec-98	119.8	114.2	116.9
Jan-99	122.7	115.1	118.7
Feb-99	125.2	118.8	121.9
Mar-99	127.8	121.6	124.6
Average	*123.9*	*113.6*	*118.5*
% change in CPI between 1991/92 and 1998/99	*415.8*	*471.3*	*461.5*

Source: Statistical Service, Statistical Newsletter (various issues)

Table A8: Hicksian (Compensated) Demand Elasticity Matrix, 1998/1999

Commodity	With Respect to the Price of					
	Cereal	Tubers	Fish	Meat	Alcohol	Other Food
Cereal	**-0.951**	-0.125	0.046	0.034	-0.050	-0.009
Tubers	-0.114	**-0.729**	-0.245	0.075	0.082	0.121
Fish	0.045	-0.262	**-0.838**	-0.096	0.003	0.016
Meat	0.202	0.496	-0.592	**-0.711**	0.093	-0.161
Alcohol	-0.229	0.408	0.012	0.071	**-0.955**	-0.244
Other Food	-0.005	0.068	0.009	-0.014	-0.028	**-1.031**

Source: Authors' calculations from GLSS 4.

Table A9: Expenditure (income) Elasticity of Demand

Commodity	**1991-92**	**1998-99**
Cereal	0.966	0.876

Tubers, Roots & Plantain	0.723	1.439
Fish	0.781	0.699
Meat	2.556	1.742
Alcohol	1.306	1.146
Other Food	0.987	0.999

Source: Authors' calculations from GLSS 3 & 4.

Table A10: Monthly Change in Consumer Price Index, 1991/92 and 1998/99

Month	Food	Non-Food	Combined
	GLSS 3 (1991/92)		
Sep-91	-1.1	-0.2	-0.5
Oct-91	-0.8	0.6	0.1
Nov-91	0.1	0.5	0.4
Dec-91	0.0	0.2	0.1
Jan-92	0.2	0.2	0.2
Feb-92	2.9	1.3	1.8
Mar-92	4.8	1.0	2.2
Apr-92	3.2	2.2	2.5
May-92	3.3	0.5	1.5
Jun-92	0.5	0.6	0.6
Jul-92	0.5	2.0	1.5
Aug-92	-0.2	1.1	0.7
Sep-92	-1.7	-0.2	-0.7
Average	*0.9*	*0.8*	*0.8*
	GLSS 4 (1998/99)		
Apr-98	9.5	2.2	5.8
May-98	3.7	1.7	2.7
Jun-98	-0.2	1.5	0.6
Jul-98	-2.2	-0.6	-1.3
Aug-98	-0.4	0.8	0.2
Sep-98	-2.8	1.0	-0.9
Oct-98	-3.2	0.5	-1.3
Nov-98	-0.1	-0.2	-0.1
Dec-98	1.6	0.6	1.1
Jan-99	2.4	0.8	1.6
Feb-99	2.1	3.2	2.7
Mar-99	2.0	2.4	2.2
Average	*1.0*	*1.2*	*1.1*

Source: Statistical Service, Statistical Newsletter (various issues)