Who Gained from Trade Liberalisation in Ghana? Unskilled vs. Skilled Households

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Abstract

In this paper, we present one of the first direct microeconometric evidence of the impact of trade protection on household poverty in Ghana. The study examines the impact of Ghana's trade policy reforms in the 1990s on poverty. We match trade policy measures at the two-digit ISIC level to household survey data for 1991/92 and 1998/99. We emphasize the possibility that the effect of protection on poverty might not be uniform across households characterized by different skill levels. Our analyses indicate that a decrease in an industry tariff tends to be associated with lower welfare being earned by households employed in the industry, controlling for household characteristics, geographic variables and industry fixed-effects. We find that this negative effect of trade liberalization is disproportionately greater for low skilled labour households. The results suggest an erosion of welfare of unskilled labour households from trade liberalization.

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1. Introduction

Despite decades of trade policy reforms and increased globalisation of developing countries, poverty remains a major challenge in most of SSA, Ghana being no exception. Compared to other regions, Africa, and especially SSA, has exhibited poor economic performance over at least the past two decades. While some countries have been exceptions to the trend and performed very well, the regional performance is cause for concern. Not surprisingly, the impact of trade reforms 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 *et al*, 2002).

The main objective of this paper is the estimation of the poverty effect of trade protection based on Ghanaian household data. This objective is motivated by a gap in the literature. Very little evidence in Ghana concentrates on trade effects and few studies are based on household data. Despite the general concerns expressed in many quarters, relatively little is known about the actual impacts of trade policy reforms on the livelihoods of the poor. While there has been some work on poverty measurement and descriptive analysis of the characteristics of the poor, to our knowledge, there is no accessible multivariate econometric analysis using policy variables, such as tariffs, to examine the impact of trade policy on household poverty. The lack of recent studies on the effects of globalisation, in general, and trade liberalisation, in particular, in Ghana is immensely puzzling given its economic relevance and the fact that Ghana was touted as 'adjustment's star pupil' (Alderman, 1994). The scarcity of studies on this important topic is primarily due to the lack of representative household panel data sets on one hand, and the non-availability of trade policy data coupled with the problem of identification of the trade policy effects on poverty at the household level.

This paper takes a step towards filling this gap. Specifically, this is the first study to use repeated cross-section data (RCS) from the Ghana Living Standards Survey (GLSS) against the background of trade reforms of the 1990s to gauge the poverty impact of trade liberalization in Ghana. By so doing we have moved beyond the limits of cross-sectional analysis into the realm of panel data that has long been acknowledged as required to address issues of endogeneity and heterogeneity. We demonstrate that even with limited data, it is still possible to assess some of the poverty effects of trade liberalization and therefore contribute to a more informed policy debate.

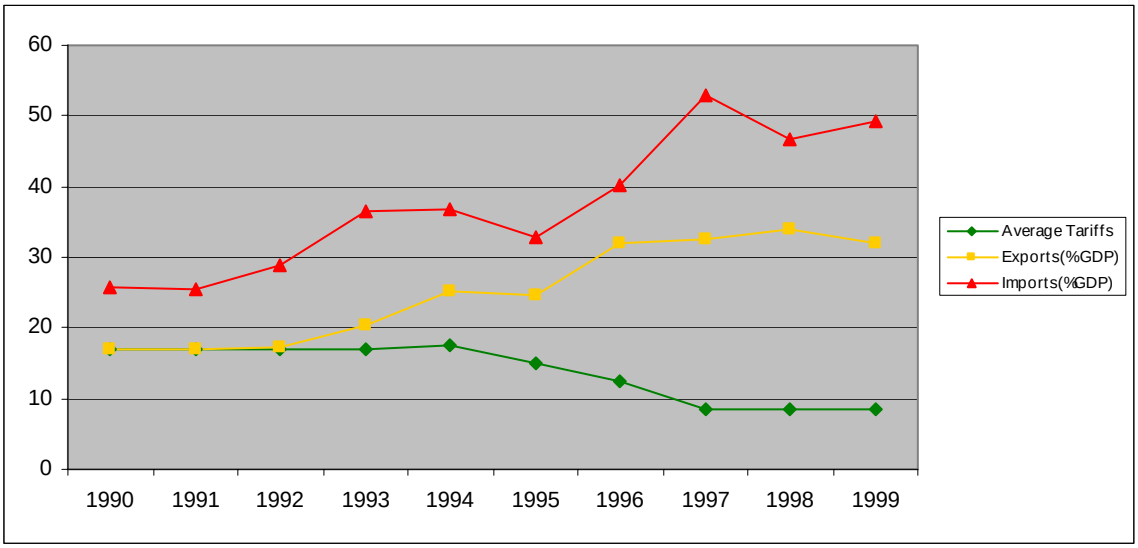
Our analyses includes static and dynamic, linear and non-linear, levels and first-difference models to indicate that a decrease in tariff in a given industry tends to be associated with lower welfare being earned by households affiliated to this industry, controlling for household-specific characteristics and geographic variables and industry fixed effects. We also find that this negative effect of trade liberalization is disproportionately larger for low skilled households (defined as households whose head has no more than basic education). Tariff reductions in Ghana during the 1990s were therefore not pro-poor. The results suggest an erosion of welfare of the unskilled households from trade liberalization. The remainder of the paper is organized as follows.

The next section presents some facts on Ghana's trade liberalization. Section 3 briefly reviews some relevant theoretical literature. Section 4 follows with a description of the empirical strategy and the data employed in the analysis. The section also reviews some developments in the theoretical pseudo-panel econometric literature. To the extent that it is relevant; we also present some empirical applications of the pseudo-panel technique. In section 5 we summarize and assess the econometric results. Section 6 provides additional robustness checks while Section 7 concludes.

2. Trade Liberalization and Macroeconomic Performance in the 1990s

Ghana is one of the first countries in sub-Saharan Africa to pursue Structural Adjustment Programmes (SAPs) under the auspices of the World Bank and the IMF, aimed at correcting the distortions that contributed to the stagnation and decline of the economy in the 1970s and early 1980s[2]. In Ghana, most of the economic policies during the structural adjustment period have been trade- and agricultural -related reflecting the importance of the agriculture sector in the economy of Ghana. The reforms since 1983 have focused, *inter alia*, on trade liberalisation, the elimination of exchange rate distortions, removing price distortions on crops, eliminating subsidies for agricultural inputs (including fertilizer) and privatization (see Aryeetey *et al*., 2000).

Figure 1: Trade Policy and Performance in the 1990s



Source: Author's with data from World Bank, *World Development Indicators* (WDI) 2002 CD-ROM.

Ghana has liberalized its trade regime significantly since the inception of the SAP in 1983.[3] The process of liberalisation entailed a gradual reduction of the tariff structure and

[2] These programmes included trade liberalisation, the elimination of exchange rate distortions, price-deregulation, privatisation and divestiture of public enterprises.

[3] McKay and Aryeetey, 2004:8) and Aryeetey (2005) provide an up-to-date discussion on the evolution of trade reforms in Ghana and the discussion here largely draws on their work.

level. By the year 1999 the simple average tariff rate had fallen from 17% in 1992 to 8.5% (Figure 1). In addition the tariff structure has been simplified and few non-tariff-barriers are applied. Trade reforms in the 1990s included specific export promotion measures aimed at improving the relative incentives to producers of exportables. A variety of export duties were removed, export licensing abolished in 1990 and export procedures significantly simplified. One key characteristic of the 1990s was the increasing openness of the economy, with both imports and exports increasing as a proportion of GDP, but with the latter consistently exceeding the former and to an increasing extent over time. A surge in imports is particularly evident in 1997 contributing to a large trade deficit (Figure 1).

Poverty Profile - The Nature of Poverty in Ghana

These and other reforms have had a dramatic positive impact on the economy. Per capita income has been on a steady path of recovery, a sharp drop in domestic inflation, and considerable improvement in the external balance-of-payments. Like many other developing countries, poverty has become the central problem confronting Ghana in the new millennium. Ghana still remains a low income country, with widespread and prevalent poverty at the national, regional and sectoral levels. In rural areas, and among food crop farmers, poverty is still widespread. Previous studies on Ghana have highlighted the fact that poverty is highly concentrated in rural areas with 80 percent of those persons classified as poor residing in the rural areas. In general, the overall trend in poverty during the 1990s has been encouraging. Taking the upper poverty line of 900,000 *cedis* (in constant prices of Accra in January 1999), the proportion of the population defined as poor decreased from 51.7 percent in 1991/92 to 39.5 percent in 1998/99. Extreme poverty fell from 36.5 to 26.8 percent while inequality, as measured by the Gini coefficient, decreased only marginally over this period from 0.373 to 0.368 (GSS, 2000b; Coloumbe and McKay, 2003; McKay and Aryeetey, 2004). Although overall poverty declined between the two surveys, the reduction in consumption poverty, however, is not evenly distributed according to ecological zones and regions. Accra and the forest ecological zone registered the highest declines. In the case of the Rural Savannah, the situation of the very poorest has rather worsened. In terms of (administrative) regions, poverty declined between the two surveys in seven (Western, Eastern, Greater Accra, Volta, Upper West, Ashanti and Brong Ahafo) out of the ten regions in Ghana, while for the remaining three (Central, Northern, Upper East) poverty increased.

Poverty by Socio-economic groups

Large poverty reductions have occurred among private sector employees in both the formal and informal sectors, and among public sector wage employees, but export farmers have experienced the largest reduction in consumption poverty. Poverty reduction among the large numbers of food crop farmers, on the other hand, has been modest. Reductions in the incidence of poverty over the period have been smaller also for the non-farm self employed and informal sector wage employees.

3. Theoretical Background

Winters (2000, 2002) developed an elaborate theoretical framework identifying the channels through which trade reform can impact on poverty.[4] Their framework enumerates mechanisms through which trade may potential impact the poor. In addition to the long-run effects operating through economic growth, he considers the static effects of trade shocks on households, directly via product and factor markets, and indirectly through the impact on government revenue and expenditure. The impact of trade policy on the poor is channelled mainly through variations in relative prices of their consumption bundle and through changes in their sources of income. Trade can affect the prices the poor pay for goods, the prices they receive for their products, their wages and employment prospects. While recognizing the importance of the other channels of transmission, (for the purposes of this empirical paper) we restrict our attention to focus on the factor market channel. This is motivated by the paucity of research in this area for developing countries, especially in Africa. The literature on how international trade affects incomes of the poor or poverty, more generally, is extremely scarce relative to the literature on wage inequality[5]. Moreover, this already small literature tends to be overly bias towards the US and Latin America. In his review of the recent empirical studies on estimating the impact of trade reforms on poverty, Reimer (2002), has suggested that the factor price, income, and employment link is the most crucial in developing countries. He argues that there are many households in developing countries that are highly specialized in their earnings patterns than their consumption.

The standard argument with regard to trade and poverty is based on the Stolper-Samuelson theorem, which suggests that international trade will lead to a rise in the relative returns of the abundant factor; unskilled labour in the case of developing countries. Thus, according to this theory, the poor (unskilled labour) will be the largest beneficiary of trade liberalisation. In other words, we would expect trade reforms in developing countries to be inherently pro-poor, since these countries are more likely to have a comparative advantage in producing goods which use unskilled labour relatively more intensively[6]. These expected gains are conditional on several assumptions - including free mobility of labour, given technology and perfect competition[7]. However, the restrictive assumptions upon which the theorem is built are not sufficient to provide a viable interpretation of the complexity of the real world, in which benefits and costs of trade are unevenly distributed between producers and consumers of exported and imported goods. Moreover, the adjustment to trade may result in additional short and medium term costs and challenges for the poor (see Ackah and Morrissey, 2005:5-7 for a discussion of the benefits and costs of trade policy reforms).

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[4] See McCulloch et al (2001), Winters (2002), Winters *et al* (2002) and Bannister and Thugge (2001) for a more recent and detailed presentation of this framework.

[5] See, for example, Goldberg and Pavcnik (2004), Attanasio et al., (2004) and Topalova (2004); Hanson and Harrison (1999), Revenga (1997) and Feenstra and Hanson (1997).

[6] For an empirical example, see Hertel *et al*. (2003) who estimate that global trade liberalization leads in the long run (i.e. when labour and capital are mobile across sectors) to a decline in poverty for all strata of the population largely because of increased demand for unskilled labour.

[7] This is an assumption that is unlikely to hold, especially in the short- and medium-run, and in developing countries like Ghana, where labour markets are characterized by significant labour rigidities.

Recently these sharp predictions of the Stolper-Samuelson theorem have been challenged. According to the new theories, trade liberalization could reduce the wages of unskilled labour even in a labour abundant country, thereby widening the gap between the rich and the poor. Many observers find the Stolper Samuelson theorem quite restrictive, in that the theorem does not offer definitive conclusions if one or more assumptions are relaxed (see Davis, 1996). Davis and Mishra (2004 cited in Harison, 2005), argue that the popular expectation that trade openness should increase the incomes of the poor in low income countries is based on a very narrow interpretation of the standard Heckscher-Ohlin model. Davis and Mishra show that in a world of many factors and many goods, a poor country might no longer have a comparative advantage in producing unskilled intensive goods. Similarly, if a poor country has large supplies of non-labour factors of production (like land or mineral resources); trade liberalization may not benefit the labour-intensive sectors.

The specific sector and the Ricardo-Viner models have become the natural alternative to the Heckscher–Ohlin model and the associated Stolper–Samuelson theorem. According to these models workers may gain from trade reforms depending on which sectors (import-competing or exporting) they are attached to. The models focus on the short- to medium-run and assume imperfect factor mobility with one factor mobile across sectors while the other is taken to be sector-specific. With these assumptions the models predict a positive association between protection and returns to factors of production (e.g. wages). Protection reduces imports and reduced imports increase labour demand, which in turn increases wages. When the price of a good falls following trade liberalisation the model predicts that the factor specific to the sector that experienced price reduction loses while the other specific factor gains in real terms. In other words, if trade liberalisation occurred households affiliated to the industries that experience large tariff reductions would see a decline in their incomes relative to the economy-wide average income, while households attached to relatively protected industries would gain, relatively.[8]

Given the apparent ambiguity in the theoretical literature discussed above the question of the effect of trade liberalization on poverty appears an empirical matter. Empirically it is not simple to disentangle the effects on incomes of trade reform from other macroeconomic policies and technological changes occurring simultaneously. Although many economists tend to agree, in general, that in the long run openness to trade is good for growth and poverty reduction, in the short and medium run significant adjustment costs have been acknowledged. In fact, in the short run, trade liberalization appears to increase poverty and inequality (McCulloch et al., 2001). Winters et al. (2004) offer a detailed and valuable review, observing that the heterogeneity of poverty "forbids" attempts to draw quick general conclusions.

[8] Given the underdeveloped labour markets in most developing countries, this model appears a plausible starting point for thinking about the relationship between trade protection and income poverty in Ghana. (see Attanasio et al., 2004). There are good reasons to believe that the assumption of perfect labour mobility across sectors is unlikely to hold in most developing countries including Ghana. Even though we do not propose, in this chapter, to subject these theories to empirical testing, we hope that in the end we are able to find a theoretical basis for explaining the observed changes in poverty and inequality *vis a vis* the trade reforms in the 1990s.

4. Empirical Methodology and Data Description

In this section we have one main objective: to investigate the links between trade liberalization (one facet of globalization) and poverty observed in Ghana during the 1990s. Of particular interest here is the potential contingency of the effect of trade liberalization on educational qualification or skill type of the household. We are also interested in systematically distinguishing the long-run impact of trade reforms on poverty from that of the short-run. In the end, we hope to provide answers to the following questions: (1) Does trade liberalisation affect every household equally or does it help those who are already relatively well off while leaving poorer households worse off. In other words, is the effect of trade liberalisation felt equally across households (skilled and unskilled)? (2) Is the effect of trade liberalization constant or time-dependent?

In order to investigate such questions, longitudinal data with multiple observations on the same households over time would be ideal. Unfortunately, such data are seldom available in developing countries, Ghana being no exception. The analysis in this paper will therefore proceed applying pseudo-panel econometric techniques to repeated cross-sectional GLSS data. We consider what can be learnt from analyzing repeated cross-sections as is predominant in studies interested in consumption and labour supply issues (see for e.g. Browning, Deaton, and Irish (1985). We extend these approaches for the analysis of poverty in Ghana. In this way, this study circumvents the absence of 'true' panel data for Ghana, while still exploiting some of the attractive features of panel data analysis such as the ability to control for household-specific effects and unobserved heterogeneity (Deaton, 1985).

4.1 Pseudo Panel Data from Repeated Cross Sections: A Review of the Literature

There is by now a rapidly growing literature on pseudo panel data models constructed from repeated cross sections. The use of 'pseudo-panel' data was introduced by Deaton (1985) for the analysis of consumer demand systems. In his seminal paper, Deaton (1985) suggests grouping individuals (cases, observational units) into cohorts on the basis of shared characteristics such as sex or age[9]. He then shows that averages within these cohorts could be treated as observations in a pseudo (synthetic) panel. The cohorts are then traced over time as "they" appear in successive surveys, forming a panel, from which standard panel data models can be identified and consistently estimated.

Assuming we have a time series of T independent cross-sections with N observations in each, we can write the linear model with individual effects as following:

$$w_{it} = \mathbf{x}_{it}'\beta + f_i + \varepsilon_{it} \qquad i = 1,...,NT, \quad t = 1,...,T. \tag{1}$$

[9] Note that while the use of "cohorts" has become synonymous with the grouping of individuals by year-of-birth, whenever the term "cohorts" is used in this chapter we refer to groups of units (individuals, households, etc.) sharing some common characteristics (not exclusive to year-of-birth). A broader term used, often to mean the same thing, is "cell".

where w_{it} is equivalent adult consumption in period t of household i, $\mathbf{x_{it}}$ is a set of characteristics (socio-economic or demographic), β is a vector of parameters to be estimated, f_i is the household fixed effect and ε_{it} represents an error term. Since, in general, f_i, will be correlated with the other explanatory variables, such an equation can only be consistently estimated from panel data. However, assume the case where i is a member of well-defined cohort group c, whom we can follow via its (randomly chosen) representatives through repeated cross sections. Deaton's suggestion is to take simple means of equation (1) over all households that happen to be observed in period t belonging to cohort c to obtain

$$\overline{w}_{ct} = \overline{\mathbf{x}}_{\mathbf{ct}}'\beta + \overline{f}_{ct} + \overline{\varepsilon}_{ct} \qquad c = 1,...,C. \tag{2}$$

The problem with estimating equation (2) derives from the fact that the cohort fixed effect $\overline{f}_{ct}$ can be correlated with $\overline{\mathbf{x}}_{\mathbf{ct}}$ (if f_i is correlated with $\mathbf{x_{it}}$), is unobserved and not constant over time due to the changing membership of the cohorts as new surveys are conducted. Likewise, all the other *observed* cohort mean variables ($\overline{w}_{ct}$ and $\overline{\mathbf{x}}_{\mathbf{ct}}$) are merely error ridden estimates acting as proxies for the true cohort means. In this case, the standard within estimator based on the pseudo panel will be inconsistent. Thus, he proposes an errors-invariables technique to account for the measurement error.

However, Verbeek and Nijman (1993), have shown that consistency of Deaton's errors-in-variables estimator (hereafter, EVE) requires that the number of available cross-sections tends to infinity. The authors also note that Deaton's estimator increases variance at the same time that it reduces bias, giving rise to a mean-squared error trade-off. They have suggested several modifications of EVE which do not suffer from an inconsistency due to a small number of time periods. In particular, Verbeek and Nijman have suggested that when the cohort size is fairly large (at least 100 members), and the time variation in the cohort means is sufficiently large, the bias in the standard within estimator will be small enough that the measurement error problem can be safely ignored[10]. Hence, to avoid the measurement error problem, most researchers would usually divide the sample into a smaller number of cohorts, C, (between 10 and 20) to ensure that observations per cell, n_c, is reasonably large (see, for example, Browning *et al* (1985), Attanasio and Weber (1993), and Blundell *et al* (1993, 1998)).[11] Unfortunately, there is no general rule as to how large is 'large enough' to attenuate the bias in the within-estimator. For example, some authors including Devereux (2003 cited in Verbeek

[10] Often, the time series dimension of the data set is large so that even with a small number of groups the total number of observations in the panel is fairly large.

[11] When cell sizes are large, most applied researchers tend to treat pseudo-panel data as though they were genuine panels thereby employing standard econometric methods for panel data, such as the fixed-effects estimator. Collado (1998), however, notes that this approach is only valid if one wants to estimate linear models. He argued that in the case of discrete choice models this approach is unnecessary. The reason being that in these models the estimators do not rely on asymptotics in the cross-sectional-time-series dimension of the data (CxT). For such models, he shows that a reasonably large number of cohorts are needed to guarantee efficiency.

and Vella, 2005) have more recently argued that there can still be substantial bias in the standard within estimator even if cohort sizes are 'reasonably' large. He recommends that cell sizes should be larger, at least 2000, possibly. In practice, however, it is almost impossible to construct cohorts with cell sizes that large. Note that many observations per cohort imply a small number of cohort observations C, in the pseudo panel, resulting in inefficient estimators (Verbeek and Nijman, 1993:4).

So far, we have we only looked at the case of estimating the linear fixed-effects model on the cohort means and how to correct for the measurement errors arising from using the observed but error-filled cohort means to proxy for the unobserved cohort population means. An important microeconomic study that uses RCS methods is Browning, Deaton, and Irish (1985), who use British household survey data to study consumption and labour supply issues. The variables used in their models are constructed by computing means over cohort-year groups (as in equation 2). The Browning, Deaton, and Irish study fostered other work on the econometric properties of RCS estimation, most notably by Moffitt (1993). Moffitt's study shows that estimation of RCS models can proceed using the individual level data, and he provides insight on the identification issues with RCS methods. Unlike Deaton (1985), Moffit (1993) analyzes pseudo-panel data in which the number of individuals per group is large relative to the number of groups and time periods.[12] Furthermore, he stresses the importance of constructing cohorts by time-invariant characteristics and shows that RCS estimation can be viewed as instrumental variable estimation. Moffitt (1993:105) argues strongly that grouping individuals into cohorts and estimating the model on the cell means is "unnecessary for identification and point estimation". He suggests rather that the underlying individual data be employed to achieve efficiency.[13]

Another strand that can be discerned in the literature, and which we believe to be important in shaping public policy discourse, is whether one can estimate parameters of a dynamic relationship (models with lags) from RCS data. Up to this point we have only considered the case of the static pseudo-panel linear models with individual effect. However, in many applications estimating a dynamic linear model may be of interest, in its own respect, or required by economic theory.[14] In the absence of genuine panel data, the dynamic equation cannot be estimated directly on individual level data. However, some indirect estimation is possible by considering successive observations of individuals in the same cohort, even though those individuals are not the same across surveys.[15]

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[12] Deaton (1985) assumes that the number of cohorts C tends to infinity which is equivalent as saying that the number of individuals N tends to infinity as cohort sizes remain constant. On the other hand, Moffit's (1993) asymptotic properties relies on the assumption that C is constant while N tends to infinity.

[13] Since the procedure he suggests here is a corollary of his proposal for identification and estimation of dynamic fixed effects linear models, we do not discuss the static case further. See Moffit (1993) and Ridder and Moffit (2006) for exhaustive discussion.

[14] See Collado (1998) for a flavour of the use of pseudo panel techniques in the case of binary choice models.

[15] However, here the units for which the group mean of lagged dependent variable is computed are different from those for which the group mean of the dependent variable is computed.

Moffitt (1993) breaks new grounds in this area by providing an interesting discussion of estimating dynamic models from RCS data. He proposes a two-stage least squares estimator to address this issue. Let us consider the simple first-order autoregressive model given by

$$w_{i(t),t} = \alpha w_{i(t),t-1} + \mathbf{X}'_{i(t),t}\beta + \varepsilon_{i(t),t}, \;\; i = 1,...,N; \;\; t = 2,...,T; \;\; i(t) = 1,...,N_t.^{16} \qquad (3)$$

where all variables are as previously defined in equation (1) with the vector $\mathbf{X}_{i(t),t}$ defined to include both time-varying and time-invariant covariates. The lagged dependent variable, $w_{i(t),t-1}$ refers to the value of w at time $t-1$ (say GLSS 3) for individual i observed in cross-section t (say GLSS 4). The main problem facing the researcher using RCS data is that the true value of the lagged dependent variable, $w_{i(t),t-1}$, is unobserved because the same individuals are not tracked over time. Following Moffit (1993), however, equation (9) can still be estimated if an instrument for $w_{i(t),t-1}$ can be constructed by using information on the w-values of other individuals observed at $t-1$. If we let $z_{i(t)}$ denote the set of time-invariant variables in $\mathbf{X}_{i(t),t}$, then one could consider a linear orthogonal projection of $w_{i(t)}$ upon $z_{i(t)}$ using the observations at $t-1$:[17]

$$w_{i(t-1),t-1} = m'_{i(t-1),t-1}\delta_2 + z'_{i(t-1)}\delta_3 + u_{i(t-1),t-1}, \qquad (4)$$

where $m_{i(t-1),t-1}$ is a set of time-varying covariates contained in the vector $\mathbf{X}_{i(t),t}$. $w_{i(t-1),t-1}$ here refers to the value of w at time $t-1$ for individual i observed in cross-section $t-1$. Once the predicted lagged dependent variable, $w_{i(t),t-1}$ has been obtained from OLS estimation of (10) it is now possible to obtain consistent estimates of the parameters from the original model (9), substituting $\hat{w}_{i(t),t-1}$ in place $w_{i(t),t-1}$ such that,

$$w_{i(t),t} = \alpha \hat{w}_{i(t),t-1} + \mathbf{X}'_{i(t),t}\beta + \varepsilon_{i(t),t}, \qquad (5)$$

Moffit recognizes, however, that consistency hinges upon the assumption that $\hat{w}_{i(t),t-1}$ is asymptotically uncorrelated with $\varepsilon_{i(t),t}$.

Recently, Verbeek and Vella, (2005) have taken an issue with Moffitt's (1993) estimator arguing that some of the underlying assumptions may be indefensible and too restrictive for empirical analyses. Their argument is that regardless of how $\hat{w}_{i(t),t-1}$ is estimated, its inclusion in the original model (9) implies that at least one of the regressors is error-

[16] It is conventional in the literature to index individuals (or variables) by a double subscript to indicate the non-panel nature of the data.

[17] In most applications $z_{i(t)}$ represents a set of cohort dummies (Collado, 1998, Girma, 2000). In this case it becomes apparent that Moffit's estimator is a special kind grouping consistent with taking cohort means of the samples (Verbeek and Vella, 2005).

ridden. The authors show that once the predicted lagged dependent variable, $\hat{w}_{i(t),t-1}$, is inserted into the original model, equation (9) is no longer valid. Rather, one would expect

$$w_{i(t),t} = \alpha \hat{w}_{i(t),t-1} + \mathbf{X}'_{i(t),t}\beta + \varepsilon^{*}_{i(t),t}, \tag{6}$$

where,

$$\varepsilon^{*}_{i(t),t} = \varepsilon_{i(t),t} + \alpha\left(w_{i(t),t-1} - \hat{w}_{i(t),t-1}\right). \tag{7}$$

Their main disagreement has to do with the "inappropriateness" (in their view) of the key assumption that $\mathbf{X}_{i(t),t}$ is uncorrelated with the prediction error. This assumption is implausible and will result in inconsistency when time-varying exogenous regressors are used (Verbeek and Vella, 2005). As a solution, Verbeek and Vella (2005), propose an *augmented instrumental variables estimator* using time-invariant instruments. Essentially, one needs to instrument $\mathbf{X}_{i(t),t}$ even though its members are assumed exogenous in the original model (9). If, for simplicity, we assume a set of potential instruments, $I_{i(t),t} = z_{i(t)}$, and $z_{i(t)}$ are assumed (not necessarily) to be cohort dummies, we can allow for "cohort effects" by including $z_{i(t)}$ explicitly as regressors in (11) as,

$$w_{i(t),t} = \alpha \hat{w}_{i(t),t-1} + \mathbf{X}'_{i(t),t}\beta + z'_{i(t)}\lambda + \eta_{i(t),t}, \tag{8}$$

where

$$E\left(\eta_{i(t),t} z_{i(t)}\right) = 0. \tag{9}$$

In sum, (14) would be the estimating equation using standard IV methods with $z_{i(t)}$ interacted with time dummies, serving as instruments.

4.2 Data Description and Variable Selection

In this subsection we describe the data and the main features of the variables that are relevant for the subsequent econometric analysis. Two sources of data from Ghana are used to assess how household poverty was impacted by trade reforms during the 1990s. The primary data source is the Ghana Living Standard Surveys (GLSS) the recent two of which were conducted in 1991/92 and 1998/99[18]. The second data source is the Most Favoured Nation (MFN) tariff data for years close to the two household surveys. Tariff, our main measure of exposure to globalization covers the period 1993 and 2000[19]. We construct a database of annual tariff data for 1993 and 2000 at the two-digit ISIC level to calculate average industry-level tariffs. The result is a two-digit classification of 26 industries per year, of which 19 are in the traded-goods sector and 7 in the non-traded

[18] The main advantage of using these two surveys is that they employed almost identical questionnaires which aids in analysing changes in poverty between the two survey years.

[19] Ideally, we would have required tariff data for 1998/99. However, for some reason this data is not readily available. This imposes a limitation on this study. Nonetheless, it is reasonable to assume that the tariff data captured in 2000 fairly represents tariffs prevailing in 1998/99. Evidence from Figure 1 suggests that tariff remained stable during the latter part of the 1990s (from 1997) and we believe this pattern may have continued into 2000.

sector[20]. Our sample is restricted to households with heads aged between 18-64 inclusive, employed in any sector (tradable or non-tradable). The sample is selected conditional on working so that the effects of protection conditional on being in the labour force are examined. Non-working households are excluded[21]. Each of the selected households is mapped unto one of the 26 sectors according to the sector of main employment of the household head. These exclusion restrictions leave us with a sample of 3350 and 4484 households from GLSS 3 and GLSS 4 respectively.

Table 1: Summary Statistics

	1991/92		1998/99	
Variable	***Mean***	***Std. Dev.***	***Mean***	***Std. Dev.***
Welfare (consumption expenditure)	1457110	1293483	1668206	1483357
Log Welfare	13.927	0.710	14.056	0.729
Age of head	38.169	9.823	42.281	10.504
Age of head squared	1553	767	1898	921
Female-headed household	0.304	0.460	0.308	0.462
Household head has -				
No Education	0.323	0.468	0.280	0.449
Basic Education	0.574	0.495	0.578	0.494
Secondary Education	0.057	0.231	0.066	0.248
Post-secondary Education	0.035	0.183	0.066	0.248
Tertiary Education (University)	0.008	0.091	0.006	0.074
Log Value of Land	3.510	5.597	3.419	6.283
Economic Activity indicators				
Public Sector	0.159	0.366	0.114	0.318
Private Formal	0.053	0.224	0.060	0.237
Private Informal	0.040	0.197	0.035	0.185
Export Farmer	0.047	0.211	0.071	0.257
Food Crop Farmer	0.396	0.489	0.371	0.483
Non-farm Self-employment	0.304	0.460	0.347	0.476
Observations	**3350**		**4484**	

Note: The reported figures are weighted using survey weights. Values (welfare and land) are in constant prices of Accra in January 1999.

Among the household-level variables, we start by considering the following categories of variables: a set of demographic variables, variables relating to educational attainment, household size, linear and quadratic terms in the age of the head of the household are also

[20] Following Topalova (2005:16) all households employed in non-tradable industries are assigned a tariff of zero.

[21] This was necessitated by the fact that the survey questionnaire only solicited information about industry of employment for working individuals and since our tariff data is at the industry level.

included to capture possible life-cycle effects. We include agro-climatic zones in our model as dummy variables to control for the effects of agro-ecological zone characteristics on household welfare. Doing so allows us to gauge the effects of the other determinants on household welfare independent of the effect of agro-climatic conditions on the household. To ascertain whether there were any significant changes in household welfare between the two periods, we introduce a survey-year dummy, *GLSS 4*. Furthermore, we allow for sectoral heterogeneity by including a dummy for households located in urban sectors, *Urban*. Using the information on the highest qualification obtained, we define five education indicators: No education, Basic education, Secondary education, Post-secondary education and Tertiary Education (university degree). For each cross section, Table 1 reports summary statistics of our key variables.

Over the period we observe a decrease (from 15.9 to 11.4 percent) in the share of households employed in the public sector, consistent with the public sector retrenchment which began in the mid 1990s under SAP/ERP (see Aryeetey, 2005). Even though food crop farming is the largest source of employment for a great majority of households, its share declined significantly from about 40% in 1991/92 to 37% in 1998/99. On the other hand, the share of export farming increased by a massive 51% between the two surveys, but only from 5% to 7%. The non-farm self-employment saw a 14% increase in its share to maintain its position as the second largest employer. Table 2 provides information on the incidence of poverty and contribution to national poverty by each occupation. In 1991/91 the incidence of poverty in food crop and export farming households were quite similar, 68% and 64% respectively. However, by 1998/99 poverty incidence decreased to 39% in export farming households, whilst food crop farmers recorded about 59%. In terms of poverty shares, food crop farmers actually saw a marginal increase in their share of national poverty from 57.3% to 58.1%. Similarly, the non-farm self-employed experienced an increase in their contribution to national poverty despite a drop in the incidence of poverty.

Spatially, poverty in Ghana is almost entirely a rural phenomenon. With a population share of just about 64% the rural sector contributes disproportionately 82% to total poverty, while urban households account for only 18%. The story that emerges from Tables 1 and 2 suggests that those who appear to have benefited the most from the trade reforms of the 1990s were the urban and export farming households.[22] The rural households and food crop farmers who form the bulk of the population appear to have benefited the least. What is clear is that trade liberalisation has had differential impact on different groups of households. Indeed, our simple measure of inequality defined as the standard deviation of the log welfare, increased slightly over this period (from 0.71 to 0.73). This is broadly consistent with inequality as measured by the Gini coefficient

[22] The economic reforms and trade liberalisation are expected to shift incentives towards the production of tradeable goods. Thus, participation in the export sector should become attractive and lead to a rise in returns to households in that sector. Aryeetey (2005) has argued, however, that one of the reasons why the export farming sector performed relatively better than food crop farmers is due to the fact that when agricultural subsidies were removed in the food sector as part of the reforms, the export farmers have been benefiting from governmental support in terms of technical training and other export promotion packages.

which suggests a modest increase from 0.37 in 1991/92 to 0.39 in 1998/99 (McKay and Coloumbe, 2004).

Table 2: Poverty by Economic Activity and Location, 1991/92 and 1998/99

	1991/92		1998/99	
Economic Activity	***Poverty incidence***	***Contribution to national poverty***	***Poverty incidence***	***Contribution to national poverty***
Public sector employment	0.35	9.1	0.23	6.2
Private formal employment	0.30	2.3	0.11	1.4
Private informal employment	0.39	2.3	0.25	1.9
Export farmers	0.64	7.8	0.39	6.9
Food crop farmers	0.68	57.3	0.59	58.1
Non-farm self employment	0.38	20.5	0.29	24.5
Non-working	0.19	0.7	0.20	1.1
Location				
Rural	*0.63*	*82.2*	*49.50*	*83.7*
Urban	*0.27*	*17.8*	*19.40*	*16.3*
All Ghana	**0.52**	**100.0**	**0.40**	**100.0**

Source: Author's calculation from GLSS, 1991/92 and 1998/99

Table 3: Economic Activity Shares by Skill Levels, 1991/92

	Skill			
Economic Activity	***Unskilled***	***Semi-skilled***	***Skilled***	***All***
Public sector employment	0.61	0.19	0.20	1.00
Private formal employment	0.82	0.14	0.05	1.00
Private informal employment	0.89	0.10	0.01	1.00
Export farmers	0.98	0.01	0.01	1.00
Food crop farmers	0.99	0.01	0.00	1.00
Non-farm self employment	0.94	0.03	0.02	1.00

Source: Author's calculation from GLSS, 1991/92 and 1998/99

Note: Unskilled households are households whose head has completed basic or no education, semiskilled for heads who have completed secondary or post-secondary and skilled for households with university graduate heads.

Table 4: Share of Skill Levels by Rural/Urban Location, 1991/92

	Location		
Skill	***Rural***	***Urban***	***All***
Unskilled	0.67	0.33	1.00
Semi-skilled	0.27	0.73	1.00
Skilled	0.45	0.55	1.00

Source: Author's calculation from GLSS, 1991/92 and 1998/99

Note: Unskilled households are households whose head has completed basic or no education, semiskilled for heads who have completed secondary or post-secondary and skilled for households with university graduate heads.

Table 3 takes issues further by looking at the skill composition of these occupational groups while Table 4 does the same for the rural and urban sectors. Skilled (or semi-skilled) households are largely wage earners in either the public sector (39%) or the private formal sector (19%). Even though the unskilled dominate all socio-economic groups, almost all agriculture households (about 99% of food crop farmers and 98% of export farmers) are disproportionately unskilled. Moreover, while the unskilled are predominantly rural (67%) the semi-skilled (73%) and skilled (55%) are largely located in urban centres. The foregoing descriptive evidence is instructive. The main message is that trade liberalisation in the 1990s could not have been pro-poor if indeed it benefited unskilled households the least. [23] Of course the assumption here is that trade liberalisation is accountable for the observed evolution of poverty and inequality. But, one needs to test this with econometric methods, which we take up in Section 5. Nevertheless, on the face value, one cannot explain the above observations away. How do we reconcile this evidence with the Stolper-Samuelson theorem?

One way out of this apparent theoretical quagmire is to say that trade is actually not to blame but rather skill-biased technological change is the problem (see for example, Görg and Strobl, 2002). Görg and Strobl (2002), using firm-level data on manufacturing in Ghana, have shown that skill-biased technical change arising from increased purchase of foreign machinery after the trade reforms, has resulted in increased demand for skilled workers. However, to the extent that skill-biased technological change is an endogenous product of trade liberalisation, the relative non-performance of unskilled rural and food crop farming households could be attributed, at least partially or indirectly, to trade liberalisation. Moreover, Teal (1999, 2001), using both firm-level and household data, respectively, finds no evidence of any underlying technical progress in explaining the increased income inequality in the 1990s. In a related study, Teal (2000) provides evidence which suggests that high rates of inflation and low investment are the two major factors responsible for the substantial falls in the real wages of the unskilled in manufacturing between 1992 and 1998. Unfortunately, Teal did not consider the role of trade policy in his analysis. We argue that the role of trade policy is particularly important in explaining the observed trends in poverty and income inequality in Ghana during the period in question.

Table A1 shows the average tariff levels and changes across all the 19 traded sectors between 1993 and 2000. It is worth pointing out that whereas the average unweighted scheduled tariff across *all* industries declined from 17% in 1992 to 8.5% in 1999 (see section 2, Figure 1) the structure and pattern of tariff reductions was not uniform across sectors. Hence, our data reveals that for a sizeable number of manufacturing industries (usually, relatively skilled sectors) the average tariff actually increased during the 1990s. Most manufacturing sectors continued to enjoy high levels of protection with the average tariff for the industry increasing by 12.41 percent. The agriculture and allied industries enjoyed especially high levels of protection to begin with but these are also the sectors where tariff reductions were intensive. This suggests that Ghana protected relatively unskilled, labour-intensive sectors during the era of import substitution industrialization

[23] Teal (2000) provides further evidence that the 1990s witnessed a continuing fall in the wages for the unskilled in the Ghanaian economy.

which continued to persist into the early 1990s, notwithstanding the economic reforms of the 1980s. The rapid and substantive liberalization of trade in agriculture in the 1990s was not accompanied by similar reforms in manufacturing. What is unique about the 1990s was the sudden attempt to change the structure of protection from low-skilled agriculture and relatively low-skilled manufactures to relatively high skilled sectors.

Since Ghana's trade reforms entailed larger tariff reductions (and hence largest reductions in the price of their output) in relatively unskilled and relatively protected sectors, the logic of the Stolper-Samuelson theorem would imply that unskilled labour households will lose, relatively[24]. If labour is really perfectly mobile, i.e., if we assume away labour market rigidities (which is very unlikely for Ghana), as the theory assumes very strongly, we would expect an accompanying reallocation of labour across sectors. We would expect to see labour reallocation from the sectors with the largest tariff reductions (the contracting unskilled sectors) to the sectors with the smaller tariff reductions (the expanding skilled sectors). The theory further predicts that the share of unskilled labour in industry employment should rise as firms substitute away from skilled labour with the rising relative return to skilled labour. However, both predictions are not borne out by the evidence in Table A2. First, we fail to observe any discernible shifts in employment between sectors (see right panel of Table A2). In fact, shares of industries in total employment remained relatively stable between 1991/92 and 1998/99.

4.3. Empirical Framework

In this section, we discuss the econometric models estimated and some econometric issues encountered. After matching each household with the relevant industry tariff information, we examine how poverty relates to trade protection. The approach is based on modelling the natural logarithm of per adult equivalent consumption expenditure of survey households, adjusted for variations in prices between localities and over time (*Welfare* , used here to proxy for poverty). One of the key features of the recent policy reforms in Ghana as well as other African countries has been the significant reduction in barriers to imports. In the case of Ghana, household incomes and consumption expenditures are likely to have been significantly affected by the large changes in tariffs[25]. We formalize the determinants of household poverty as follows:

[24] There is compelling evidence that the relative incomes of skilled labour in Ghana rose over the period under study (see Görg and Strobl (2002) and Teal (2000)).

[25] As we have argued elsewhere in this chapter, there has been little empirical work on the direct effect of trade policy on poverty. Among the existing studies there has been a tendency towards modelling wages as opposed to absolute measures of well-being, such as poverty (Goldberg and Pavcnik, 2004). This study aims to contribute to the scanty literature on trade policy and income poverty. In many developing countries, wage income is not the primary source of income for the poor. The GSS (2000 & 1995) reports that in Ghana, for example, wage employment, whether formal or informal, represents the main economic activity in only around one fifth of households, and this proportion declined marginally over the 1990s, mainly due to public sector retrenchment in the early 1990s. In contrast, 69 percent were involved in self-employment (39% in agriculture and 30% in non- agricultural activities). To the extent that trade liberalisation affects the returns to different economic activities, rents and remittances, an appropriate means of investigating the effect of policy on poverty is to look at incomes and/or consumption expenditure. Modelling household incomes is ideal because it permits one to consider, and also to compare income from engaging in different activities. However, on theoretical grounds, most development

$$\ln w_{it} = \alpha + \beta_1 age_{it} + \beta_2 age_{it}^2 + \beta_3 hsize_{it} + \beta_4 educ_{it} + \beta_5 urban_{it} + \beta_6 ecoz_{it} + \beta_7 land_{it} + \delta_1 tariff_{jt} + f_i + \lambda_j + \gamma_t + \varepsilon_{it} \quad (10)$$

where the dependent variable is as previously defined, *age* is the age of household head at the time of the survey, age^2 is squared age, *hsize* is the size of the household, *educ* is education of the household head, *urban* is a 0/1 dummy which is 1 for households in urban localities, *ez* is agro-climatic zone, *land* is the value of land owned by the household (instead of the actual land cultivated, in order to implicitly account for land quality), *tariff* is the average (most-favoured-nation) tariff applied to imports of industry j's products in year t, f is the household fixed effects, λ is the fixed effects for the household's industry affiliation, γ is the year fixed effect and ε is the error term. Subscripts i and t index households and survey years respectively. Year fixed effects are included to absorb economy-wide shocks (such as, technological change) that may affect welfare while industry dummies control for sector-specific effects.

Unmeasured or unobservable individual heterogeneity is a problem that faces all survey research. A pooled analysis of the data based on equation (16) will be seriously flawed, in part because such analysis cannot control for unobservables, and in part because it assumes that repeated observations on each household are independent. The presence of f and λ in the model implies that we need panel data to consistently estimate the parameters in the model.[26] So to address these issues, we employ the ideas espoused by Deaton (1985) by constructing a pseudo panel from our repeated cross-sectional data. Following the pseudo panel data literature, the first extension is to take cohort averages of all variables and estimate (16) based on the cohort means as shown in (2).

$$\ln \overline{w}_{ct} = \alpha + \beta_1 \overline{age}_{ct} + \beta_2 \overline{age}_{ct}^2 + \beta_3 \overline{hsize}_{ct} + \beta_4 \overline{educ}_{ct} + \beta_5 \overline{urban}_{ct} + \beta_6 \overline{ecoz}_{ct} + \beta_7 \overline{land} + \delta_1 \overline{tariff}_{ct} + \overline{f}_{ct} + \overline{\lambda}_{ct} + \overline{\gamma}_{ct} + \overline{\varepsilon}_{ct} \quad (11)$$

Equation (11) can be estimated via random- or fixed-effects estimators. The random-effects estimator generates consistent parameter estimates if the individual effects are uncorrelated with the other explanatory variables. The fixed-effects estimator is also consistent under this assumption, but is less efficient. Under the alternative hypothesis that the individual effects are correlated with other explanatory variables, only the fixed-effects estimator is consistent. We will use both methods to estimate (11), and report

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economists prefer consumption expenditure. McKay (2000) for example, finds that in the case of Ghana average household income in 1991/92 was underestimated by about 55% of average consumption expenditure in the same year. Hence, consumption expenditure is used as the standard of living measure in setting the poverty line in Ghana.

[26] Pooling individuals across years has obvious advantages but generates a number of estimation issues regarding individual heterogeneity. It is likely that observations over time for the same individual will be more similar than observations across different individuals. This might be due to persistence in or unmodeled characteristics of household living standards. This is particularly pertinent to our analysis because, there are good reasons to think that unobserved factors may affect household poverty. So we allow f to vary across households to capture unmeasured or unobserved heterogeneity.

diagnostics to evaluate the estimators. To examine whether the trade policy changes can be directly linked to changes in living standards we will also estimate a differenced model based on (11) as an alternative econometric specification.

The consumption (welfare) models (10) and (11) both assume preferences to be time separable. However, some recent studies have drawn our attention to a class of time non-separable preferences, exhibiting habit formation or persistence. The distinctive characteristic of these models is that current utility depends not only on current consumption, but also on a habit stock formed from past consumption (see Fuhrer, 2000; and Deaton, 1992)[27]. In effect, equation (11) may be misspecified (dynamically) if dynamics really matter. The best solution would obviously be to directly model the dynamics; unfortunately this is very difficult without panel data. But failing to deal with the dynamics can cause serious problems. To test this we employ an alternative dynamic econometric specification, introducing the lagged dependent variable as additional regressor[28]. Here, for the same reasons discussed earlier, we follow Moffit's (1993) guidance to estimate the model using the underlying micro data.

$$\ln w_{it} = \alpha + \beta_1 age_{it} + \beta_2 age_{it}^{\,2} + \beta_3 hsize_{it} + \beta_4 educ_{it} + \beta_5 urban_{it} + \beta_6 ecoz_{it} + \beta_7 land_{it} + \beta_8 \ln w_{it-1} + \delta_1 tariff_{jt} + \lambda_j + \gamma_t + \varepsilon_{it} \qquad (12)$$

Equation (12) imposes a uniform and linear restriction on the parameter δ_1; the effect of tariff on poverty. However, in light of the discussions in section 4.2 the above specification may suffer from an un-modelled contingency in the relationship between tariffs and poverty. In other words, the assumption that all households would derive the same benefits from trade liberalisation is not supported by the evidence in section 4.2. Equation (13) is a variant of (12) except now the structure explicitly allows the effect of tariffs on households to differ. We hypothesize that differences can, at least partially, be attributed to skill differentials among households and returns effects on education. The resulting estimating equation is of the form:

$$\ln w_{it} = \alpha + \beta_1 age_{it} + \beta_2 age_{it}^{\,2} + \beta_3 hsize_{it} + \beta_4 educ_{it} + \beta_5 urban_{it} + \beta_6 ecoz_{it} + \beta_7 land_{it} + \beta_8 \ln w_{it-1} + \delta_1 tariff_{jt} + \delta_2 Tariff_{jt} \mathrm{x} Skill_{it} + \lambda_j + \gamma_t + \varepsilon_{it} \qquad (13)$$

where *Skill* are three mutually exclusive educational dummies (unskilled, semi-skilled & skilled) denoting the skill category of the household. *Unskilled* labour comprises households whose head has at least primary education; *semi-skilled* labour includes households with secondary education; and *skilled* labour is represented by households with graduate heads. This identification strategy assumes that the tariff reductions during the 1990s affected households differentially according to their skill type. We are thus able

[27] A dynamic specification could be justified on several grounds. First, households are likely to incur short-term costs resulting from trade liberalisation due to rigidities. It may also take time to adjust to any policy shocks such as switching jobs form industries whose wages are declining to ones where wages are rising.

[28] A significant coefficient on the lagged dependent variable is evidence that the previous models were mis (under) -specified.

to assess whether trade protection is beneficial for households regardless of the level of skill.

4.4 Construction of the Pseudo Panel

Following the seminal work of Deaton (1985), we can construct a pseudo panel and track cohorts of households through our two cross-sections. While we continue to wait for panel data to become available, we follow Deaton's procedure to create a pseudo panel for the econometric analysis in this paper. Cohorts can be defined in terms of a single characteristic or multiple characteristics. In our case, since we have only two cross-sections, if the cohorts contain a large number of households, the number of cohort-groups will be small and hence the cross-sectional dimension of the panel will not be large. Thus, we construct our pseudo-panel by grouping households into cohorts based on some common multiple characteristics varying by generation (age category of head), gender of head and household's region of domicile. Since we are interested in a panel of households with heads between the ages of 18 to 64 and we have two cross-sections that are seven years apart then for the first cross-section (1991/92) the sample only includes households whose heads are aged 18 to 57, while the second cross-section (1998/99) only includes households with heads aged 25 to 64 so that all are in the normal working span in both surveys. Note that we add seven years to the age limits as we move to the next cross-section; this allows the households to "age" over time. We used 5-year bands in defining the generational cohorts resulting in eight birth cohorts constructed for each region in each survey year. For example, the first age cohort studied here 18-22 in 1991/92 and 25-29 in 1998/99. Households whose heads are of these ages and found in the relevant cross-sections are pooled to form the pseudo cohorts. Although the actual households surveyed will differ at each point in time, they will be representative of the full cohort in the population.

5. Econometric Results

In this section we discuss the econometric results, focusing on estimates of equations (17) to (19). Our main findings are reported in Tables 5 and 6. For a start, Table 5 reports the simple impact of the degree of openness on welfare. The first column lists the results for the case where we apply conventional OLS, based on equation (10), to the pooled cross-sections[29]. Columns 2 to 4, on the other hand, are based on the pseudo panel equation (11). Columns 2 and 3 report random-effects and fixed-effects results respectively. Even though the key message is the same across these two models, we employed the Hausman specification test but do not report the results here for brevity[30]. To examine whether the trade policy changes can be directly linked to changes in living standards we also estimate the first-difference model in column 4 based on (11). This specification could

[29] Data limitations, especially for developing countries, have led to the widespread utilization of OLS regression on cross-section datasets in order to estimate the effects of public policy on poverty. One consequence is that the estimated coefficients are likely to be contaminated by unobserved fixed effects leading to biases.

[30] The test statistic equals 21.16 (prob. 0.98). This clearly fails to reject the null, at the 0.05 level of significance, that the unobserved heterogeneity is uncorrelated with the regressors, i.e. it finds that the random effects estimates are not significantly different from the fixed effects estimates. The more efficient random effects specification is therefore the preferred one.

also mitigate the potential for any spurious correlation between tariffs and welfare. The effects of protection on welfare are positive and significant in all regressions in Table 5. In other words, holding other factors constant, the pseudo panel econometric evidence presented here suggests that welfare is higher (poverty is lower) in households (or cohorts) employed in protected sectors (sheltered from competition). The coefficient on *Tariff* implies that increasing protection in a particular sector raises consumption expenditure in that sector. The magnitude of the effect in the differenced model (0.068) suggests that conceptually reducing tariffs to zero would translate to a 6.8% decrease in consumption expenditures in this sector, *ceteris paribus*.

Table 5: Trade Protection and Poverty: Evidence from Static Regressions

Dependent Variable: Welfare (Consumption per adult equivalent)

	Cross-Sectional	**Pseudo Panel**	**Pseudo Panel**	
	Pooled OLS	*Random Effects*	*Fixed Effects*	*Differenced*
	(1)	**(2)**	**(3)**	**(4)**
Hsize	-0.109***	-0.085***	-0.096***	-0.096***
	(0.003)	(0.014)	(0.025)	(0.025)
Urban	0.268***	0.310***	0.332**	0.332**
	(0.016)	(0.077)	(0.146)	(0.140)
Basic	0.135***	0.103	0.126	0.126
	(0.016)	(0.087)	(0.165)	(0.193)
Secondary	0.360***	0.434	-0.787	-0.787
	(0.029)	(0.293)	(0.562)	(0.723)
Post-sec	0.344***	0.414	0.303	0.303
	(0.033)	(0.311)	(0.511)	(0.542)
Tertiary	0.768***	1.880**	1.956	1.956
	(0.085)	(0.892)	(1.391)	(1.845)
Tariff	0.010**	0.056***	0.068**	0.068**
	(0.005)	(0.020)	(0.027)	(0.029)
GLSS 4	0.127***	0.154***	0.185***	-
	(0.015)	(0.047)	(0.058)	
Constant	14.798***	15.818***	14.948***	0.185***
	(0.135)	(0.897)	(1.498)	(0.050)
Industry dummies	Yes	Yes	Yes	Yes
N0. of Obs	7834	310	310	152
R-squared	0.42	0.74	0.35	0.32

*Note: Robust standard errors in parentheses, * denotes significant at 10%; ** denotes significant at 5%, *** denotes significant at 1%.*

Although the regressions in Table 5 provide interesting results, we can be sceptical about their static nature and the unwarrantable linearity (homogeneity) restriction on the coefficient of *Tariff*. Thus, Table 6 presents results based on the dynamic models (12) and (13). The specifications as in column 1 of Table 6 and its variant as in column 2 are dynamically specified (with the lag of the dependent variable, log welfare, as a regressor) and estimated using 2SLS applied to RCS data as reviewed in Section 4.1. Moreover, column 2 presents the estimates of the differential impact of the reforms using a measure of the relative degree of unskilled to skilled labour in each industry. In column 2, based

on (13), *Tariff* is interacted with the *Skill* dummy to show the differential effect of trade protection on households[31].

Table 6: Trade Protection and Poverty: Evidence from Dynamic Regressions

Dependent Variable: Welfare (Consumption per adult equivalent)

	(1)	(2)
Lagged Welfare	0.386**	0.386**
	(0.156)	(0.156)
Hsize	-0.063***	-0.063***
	(0.018)	(0.018)
Urban	0.067	0.067
	(0.070)	(0.070)
Basic	0.066***	0.096***
	(0.023)	(0.028)
Secondary	0.186***	0.227***
	(0.065)	(0.069)
Post-sec	0.195***	0.237***
	(0.062)	(0.065)
Tertiary	0.391**	0.447***
	(0.156)	(0.158)
Tariff	0.009*	0.012**
	(0.005)	(0.005)
Tariff x Skill		-0.002*
		(0.001)
GLSS 4	0.093***	0.093***
	(0.033)	(0.033)
Constant	8.057***	8.042***
	(2.473)	(2.473)
Industry dummies	Yes	Yes
No. of Observations	7834	7834
R-squared	0.45	0.45

*Note: Robust standard errors in parentheses, * denotes significant at 10%; ** denotes significant at 5%, *** denotes significant at 1%. Regressions include controls for cohort group (dummies) suppressed here.*

As discussed already, the main problem we face in estimating (13) is that the true value of the lagged dependent variable (lagged welfare), is unobserved because the same individuals are not tracked over time. Following Moffit (1993), however, the regressions in Table 6 are estimated by regressing the dependent variable (welfare) on the time-invariant explanatory variables using the observations in the first cross-section (1991/92). We then obtain the predicted dependent variable from the OLS estimation. In the second stage the predicted dependent variable is substituted in the original model (13) as the lagged dependent variable and estimated by OLS using all observations in both cross-sections; on the assumption that the (predicted) lagged dependent variable is asymptotically uncorrelated with the error term[32].

[31] The assumption of homogeneity implies that the coefficient on the interactive term should equal to zero. This restriction is obviously rejected as indicated by the significant coefficient on the interactive term. This suggests that the regressions in Table 5 may suffer from an unmodelled heterogeneity.

[32] It is important to mention that we test for the sensitivity of our results to this assumption in the section devoted to robustness checks.

Interestingly, we do find robust evidence regarding the effects of tariff on poverty. In both regressions (Table 6) the average welfare reacted positively to tariffs, so that the tariffs cuts led to a decline in welfare. In other words, poverty higher in households employed in protected sectors which were exposed to import competition. This finding supports the interpretation that incomes fell most in those industries where openness increased the most. It is seen that greater openness is associated with lower welfare. Thus, we again find a positive and statistically significant correlation between trade protection and household welfare. Although the magnitude of the tariff coefficient changes, the positive and statistically significant relationship between tariffs and welfare is robust. The estimated effect of liberalization on welfare drops however from an average of about 0.064 in columns 2 to 4 of Table 5, to 0.009 and 0.012 in columns 1 and 2 respectively of Table 6. These results suggest that trade policy had a significant effect (albeit marginally) on poverty and inequality. Households whose heads work in (agriculture and allied) industries with the largest tariff reductions experienced a decline of their welfare relative to the economy-wide average[33]. The evidence seems to suggest that increasing tariffs offered more protection to 'average earnings', at least in manufacturing. Whether inequality increased depends on whether the sectors with the largest tariff reductions were the ones in which the poor are located, relatively intensively. Anecdotal evidence and the results contained in the descriptive analysis of this paper, however, point to the contrary. The poor in Ghana are predominantly rural, unskilled and employed relatively intensively in agriculture (mostly as landless peasant food crop farmers).

Table 7: Contribution of Trade Protection to Household Welfare

	1991/92			1998/99		
	Skill Type of Household			Skill Type of Household		
	Unskilled	*Semi-*	*Skilled*	*Unskilled*	*Semi-*	*Skilled*
Actual Welfare (log)	13.875	14.456	14.324	13.981	14.586	14.482
Predicted Welfare (log)	13.870	14.480	14.378	13.984	14.571	14.458
Residual	0.004	-0.024	-0.055	-0.003	0.016	0.025
Contribution of Tariff to Welfare	0.200	0.184	0.182	0.176	0.168	0.168
Number of Observations	3016	190	144	3869	294	321

Note: Author's calculations based on regression in column 1 of Table 6.
Figures are simple averages over all households in each skill type except tariff which is over households in traded sectors only.

In Table 7 we show the three skill types of all households in our regressions, along with their actual welfare as reported in the data and the predicted welfare from the regression in column 1 of Table 6. In addition, we estimate how much of the variations in within-household welfare is explained by trade policy. Overall, the model explains reasonably well the experience of all households irrespective of the skill type. The unexplained welfare (residual) is negligible, ranging between 0.3% and 5.5% in absolute terms. The

[33] The only exceptions are households engaged in export farming (predominantly cocoa farmers). Aryeetey (2005) has argued, however, that one of the reasons why the export farming sector performed relatively better than food crop farmers is due to the fact that in the face of the severe agricultural import liberalization, the export farmers have been benefiting from governmental support in terms of technical training and other export promotion packages.

first main message from this table is that, for all the households in traded sectors the contribution of protection to welfare is positive. Second, the results in this table corroborate the non-linear specification employed in column 2 of Table 6 (the model with the interactive term). We find that the contribution of tariff to welfare is relatively higher (20%) for unskilled households. Without any special safety nets or complementary policies one can expect that trade liberalisation, alone, would have disproportionate negative consequences for households in this skill type, *ceteris paribus*. Finally, the results reveal, that over the period of seven years the contribution of tariff to welfare has fallen for all skill types while average welfare for each skill type has increased slightly. This seems to suggest, perhaps unsurprisingly, that in the medium to long-run there appears to be a negative relationship between trade protection and welfare. If this were the case, it would be good news for free trade protagonists. The second and final messages from this table are the basis for the subsequent empirical analysis in this paper. First, we investigate further the apparent non-linear tariff-welfare relationship. Then, given the inherent dynamics in our model we estimate the long-run welfare responses to trade protection.

Non-linearity

It appears reasonable to expect that trade protection and for that matter trade liberalization will impact differentially, either by direction or magnitude, on households with different levels of education. To examine how the effect of trade liberalization on households may vary by education, we hypothesize a potential contingency in the relationship between protection (liberalization) and poverty. To attempt to capture this contingency, we introduce an interaction term between *Tariff* and s*kill* which is a categorical dummy variable constructed from the highest education completed dummies. The interaction term is meant to capture the non-linearity in the impact of trade policy on poverty, in order to ascertain whether the impact of greater openness is borne disproportionately by different skill groups[34]. Evidence of a contingent relationship is provided by a significant coefficient on the interaction term suggesting an un-modelled contingency bias in the results discussed previously.

The results reported in column 2 of Table 6 are quite revealing. This specification reveals a significant interaction effect under which the marginal impact of tariff on welfare is decreasing in skill. We find that the positive tariff effect applies to all households but is more pronounced for less skilled households, suggesting that greater openness is associated with significantly lower returns to lower levels of education (the unskilled). This leads to the inference that households with higher education (skilled) in highly protected industries have lower welfare than households with only one of those attributes. A corollary is that unskilled households in highly protected industries enjoy relatively higher welfare than they otherwise would. Hence trade liberalization will worsen their plight disproportionately. It is therefore reasonable to conjecture that only skilled households (because they are more educated and more mobile) would have benefited from trade liberalization in the 1990s. This evidence on the differential impact of trade

[34] Alternatively, we could simply conduct separate regressions for households in different skill categories. However, this approach will impose too much restriction on the data and will also not permit us to explore how the marginal effect of trade policy varies for more-skilled and less-skilled households.

protection on poverty is consistent with our earlier descriptive results concerning the finding that the rural, food crop farmers and non-farm self-employed, all of whom are relatively unskilled, benefited the least from trade reforms of the 1990s. Trade liberalization in Ghana seems to accord with an increase in income inequality in favour of skilled households.

Table 8: Marginal and Long-run effects of Trade Protection on Poverty

	Unskilled	Semi-skilled	Skilled
Marginal effects	0.01 (2.01)**	0.009 (1.92)*	0.006 (1.20)
Long-run effects	0.016 (1.45)	0.01 (1.45)	0.01 (1.11)

Note: Author's calculations.

*Absolute t-ratios in parentheses, * denotes significant at 10%; ** denotes significant at 5%.*

In order to test the hypothesis that the simple slope (marginal effect of tariff) differs from zero, we approximate the standard error of the simple slope by the following equation: $s_b = sqrt\left[s_{11} + 2Zs_{12} + Z^2 s_{22} \right]$, where s_{11} is the variance of the tariff coefficient (i.e., the squared standard error of δ_1), s_{22} is the variance of the interaction coefficient (i.e., the squared standard error of δ_2) and s_{12} is the covariance of the two. These values are obtained from the asymptotic covariance matrix based on our regression model in Table 6 column 2.

These results imply that the impact of trade protection on poverty is a function both of the level of restriction and of the level of education (skill). To evaluate this conditional hypothesis, we use the three values for *skill* (1 for unskilled; 2 for semiskilled; 3 for skilled) to compute the marginal effects of trade policy and report the results in the first role of Table 8. From equation (13), the derivative of *welfare* with respect to *Tariff* is calculated as

$$\frac{\partial welfare}{\partial Tariff} = \delta_1 + \delta_2 \left(Skill \right)$$

Evaluated at *unskilled* and *semi-skilled*, we find a positive and statistically significant tariff effect. However, evaluated at s*killed* the marginal effect of *Tariff* becomes statistically insignificant. Thus, the regression indicates that the derivative of welfare with respect to tariff is a decreasing and linear function of the level skill. We know from the fact that the coefficient on the interaction term is negative that the positive effect of trade protection declines as the level of skill increases. Consequently, the potential adjustment costs resulting from any given trade policy reforms will not be universal across different skill groups. Thus, for two households with similar characteristics, affiliated to the same sector (and thus face similar tariffs) but belonging to different skill groups (unskilled and skilled), a tariff reduction in that sector will have different effects on their respective welfare. Skilled households stand to benefit more than unskilled households. Alternatively, unskilled households will benefit the least relative to skilled households.

Long-run Effects of Trade Protection

The short-run is important and deserves analysis. However, many economic policies have important long-run perspectives which equally deserve scrutiny. Most often, these long-run impacts are ignored by researchers and policy analysts. This is partly because of data constraints or because the electorates only care about the short-run costs and benefits of public policy. However, to the extent that it is possible we need to investigate the long-run impacts as well. The long-run entails further household adjustments and household adjustments imply cushions to negative shocks and boosts to positive ones. Thus, even if trade liberalization may increase poverty and even inequality in the short run, if there are positive long run effects through economic growth for example, the end result is likely to reduce poverty in the long run.

In our empirical application, we are interested in whether the long-run effects of trade policy are the same as the short-run consequences already documented. Fortunately, the dynamic specifications employed in Table 6 allow us to explore this. The estimated significant coefficient on the lagged dependent variable is 0.386 with a standard error of 0.156. This suggests that past shocks to household welfare do affect current levels of welfare, above and beyond the influence of household-specific characteristics. The estimated tariff coefficient is 0.012 with a standard error of 0.005. This estimate divided by one minus the coefficient estimate on the lagged dependent variable yields the *long-run* effect of trade protection on welfare. The last row of Table 8 reports this long-run impact for all three skill groups. There is an interesting twist. None of the long run tariff effects is statistically distinguishable from zero. In other words, conditional on controls for the persistence of household welfare the positive and significant tariff effect disappears. Hence, it seems reasonable to speculate that the arguments for protection are valid (especially for poor unskilled labour households) so long as the short-run is the period of interest. In the long-run, however, it is highly unlikely for any household, irrespective of the skill type and industry affiliation, to benefit for protectionism. Trade liberalization has therefore a potential role in enhancing welfare in the long run.

Results for the other control variables are also of interest. Household welfare correlates positively and significantly with land value. As expected, household size correlates negatively and significantly with welfare. The education variables show the expected pattern. All the estimated coefficients are positive and statistically significant, indicating that, other things being equal, all levels of education (relative to no education) of the household head improve welfare. It turns out that the returns to having progressively higher education are larger. The strong positive effect of education on welfare is increasing with the level of completed education of the household head. The incremental gain in welfare is smallest for households with heads with basic education and largest for graduate headed households. Note that the effects of post-basic education (i.e., secondary, post-secondary and tertiary) are quantitatively, the largest of all included explanatory variables. Hence, education emerges as the fundamental household characteristic determining the probability that a household experience poverty, *ceteris paribus*.

6. Sensitivity Analysis

To verify our main findings, we now turn to a number of robustness checks. Our first check was to take seriously the measurement error problem raised in the pseudo panel literature and reviewed in Section 4.1. We are interested in finding out whether the results are sensitive to the construction of the pseudo panel. With an average cell size of 54 we can be worried that the measurement error problem can be an issue in the results in Table 5. However, since the main conclusions in this paper are based on Table 6 in which the regressions are based on the underlying micro data (not on cell means), we can safely ignore the measurement error problem. Nevertheless, we follow most researchers in this field (upon the advice by Verbeek and Nijman, 1993) and divide the sample into a smaller number of cohorts to ensure that observations per cell are reasonably large. To do this, we construct a new pseudo panel by taking 10-year generation bands while maintaining the regional (10) and gender (2) categories[35]. Cohorts are defined by the interaction of four age intervals (GLSS 1991/92: 18-27, 28-37, 38-47 and 48-57; GLSS 1998/99: 25-34, 35-44, 45-54 and 55-64), two gender categories (male and female) of head and ten geographic regions. For example, now the first cohort here is aged 18-27 in 1991/92 and 25-34 in 1998/99. By so doing, the average number of observations per cell increases to 105 at the expense of a relatively small total number of observations (a potential of 160 but 157 realized). All the regressions in Tables 5 and 6 were re-estimated using this new data. In all cases, we find that cohort selection issues are not driving the results. Our results remain largely unaltered. Both the signs and statistical significance of the coefficients are preserved in most cases. Thus the model parameters are robust in that they show little sensitivity to changes in the data construction. We still find convincing evidence of a positive and statistically significant correlation between tariff and welfare which is contingent on skill (human capital). In fact, the orders of magnitude of the estimated tariff coefficient have actually become larger.

Next, we used the estimator proposed by Verbeek and Vella (2005) as a robustness check on using Moffit's version of estimating dynamic models from RCS. Our aim is to check if failure to instrument *Tariff* and the lag of the dependent variable as the authors suggest affected the estimated parameters. In effect, we relax the assumption that the (predicted) lagged dependent variable is uncorrelated with the prediction error. Essentially, we estimated (13) using standard IV methods with cohort dummies interacted with time dummies, serving as instruments for both lagged welfare and tariff. We found no big difference in the estimated coefficients. In other words we did not have any major changes in significance or signs of the estimated coefficients. In fact, the estimated coefficients on tariff and the interaction term becomes stronger and both are significant at the 1% level. Hence, our results are not driven by model specification and the choice of estimator.

Finally, we performed diagnostic tests for influential observations to confirm that the parameter estimates are not unduly influenced by a small subset of observations. Our

[35] The choice of 10-year intervals is essentially arbitrary, but meets the requirements for the cell sizes to be reasonably large (on average) so that the measurement error problem discussed previously is negligible.

examination of the data for the presence of outliers, high-leverage points or influential observations using Cook's distance (Cook, 1977), and the DFFITS and DFBETA statistics (Besley et al, 1980 and Welsch, 1982) identified three observations. However, the omission of all three observations flagged as high-leverage and influential does not affect the fit and hence the estimated coefficients.[36]

7. Conclusion and Policy Implications

This paper has shown that as Ghana became more integrated in the global economy, there were short-term adjustment costs which were disproportionately larger for poorer unskilled households. We have presented both descriptive and econometric evidence to show that trade liberalization in Ghana resulted in increases in poverty among certain sections of the population, especially the rural unskilled labour households. Following trade liberalization in Ghana, most households have experienced increases in poverty over this period, but to differing degrees. Unskilled households, predominantly employed in Agriculture, would experience the largest increases in poverty. This is consistent with the observations made by Aryeetey and McKay (2004) that the poorest of the poor participated much less in the growth and poverty reduction over this period.

In the econometric section of this paper, we regressed the living standards indicator, consumption per equivalent adult, on household-specific demographic characteristics, tariffs and industry indicators. In particular, we allow the relationship between welfare and trade policy to differ for households with different skill levels. The econometric results confirm our previous descriptive findings and suggest that higher tariff reductions are associated with a higher probability of being poor, at least in the short run, but with differing effects on different skill groups. In the short-run, all households regardless of skill type would have lost out from trade liberalization, but the poor unskilled households (because they are sector-specific and less mobile) lost disproportionately. Income and spatial inequality (rural/urban, or northern/southern divide) would have worsened as a result. The results suggest that within the same sector, a trade reform may lead to differing impacts on households with similar attributes but different skills.

This finding in turn has implications for policy evaluation. One policy implication of the results is that the effects of trade liberalization and economic reforms on the poor are highly differentiated and nuanced. This paper establishes that, in the case of Ghana, different households with different skill levels experienced differential effects of protection. We show that tariff reductions accentuate the incidence of poverty. More importantly, there is the tendency to aggravate income inequality between skilled and unskilled households and urban and rural sectors. However, the good news (for pro-free traders) is that these negative effects can be viewed as only short run adjustment costs. In the long-run we find no tariff effect on poverty. It is thus possible to speculate that as long as households are sufficiently patient, the long run potential gain from trade liberalization could compensate for the short run loss.

[36] All sensitivity analysis results are available from the author.

An important result is that we find evidence that human capital does contribute to welfare, and that this contribution to welfare is higher in an open economy. Our specification with the interactive term reveals a significant interaction effect under which the marginal impact of openness on welfare is increasing in human capital. In other words, human capital (skill) is fundamental to the ability of a household to benefit from trade liberalization. This is not to say that trade liberalization enhances skill, but rather it, in a sense, amplifies the returns to skill and augments its effect on welfare. This finding has serious implications for Ghana and most African countries in the globalisation process.

There are at least three main conclusions from this paper which are worth some consideration. First, trade protection presents both opportunities and challenges both of which are strongly contingent on how skilled or unskilled the poor are. There is no reason to suppose that the gains from protection are evenly distributed. The gains from trade protection are especially in favour of relatively unskilled households and sectors that need protection from foreign competition to ensure demand for their products. Relatively educated households may actually lose. Second, the gains from protection can only be short-lived. There is no reason to expect to increase living standards and reduce poverty in the long run on the basis of protectionism. In fact, the return to schooling is diminished under protectionism. If education is (and we find it is) a key determinant of welfare then this is enough food for thought. Finally, it is important for policy makers to understand that for trade liberalization to reduce poverty it is necessary for poor unskilled households to be able to participate in the process through expansion of education and training beyond what is currently available under the Free Compulsory Universal Basic Education (FCUBE) which only increases the quality of unskilled labour. There exists a direct or indirect complimentarity between education (human capital) and trade liberalization with human capital acting as one of the transmission mechanisms through which trade policy affects the poor. Maximizing the potential long-term benefits and minimizing the short-run costs of trade liberalization would therefore require active interventions to *weather the storm* with the poor in mind. A *laissez-faire* approach can be disastrous.

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APPENDIX

Table A1: Inter-Industry Trade Protection (Liberalisation) during the 1990s

Industry Classification(26)	Tariff 1992/93	Tariff 1999/00	Tariff Change (%)
Traded Sectors (19)			
Agric, Forestry and Fishing (3) *of which*			
Agriculture crop & Livestock	23.20	19.44	-16.18
Forestry & Logging	24.77	20.00	-19.27
Fishing	20.34	13.97	-31.36
Average (unweighted)	*22.77*	*17.80*	*-22.27*
Manufacturing (14) *of which*			
Food	18.94	24.94	31.63
Beverages	20.45	21.43	4.76
Furniture	19.73	27.84	41.10
Electrical	12.63	10.86	-14.08
Metals	7.89	11.03	39.83
Chemicals	10.61	12.08	13.84
Plastics	14.39	17.17	19.34
Footwear	19.00	20.00	5.26
Textiles	21.35	23.04	7.93
Wood	18.00	16.89	-6.16
Apparel	24.44	22.22	-9.09
Printing	20.00	23.33	16.67
Rubber	10.00	10.00	0.00
Other manufacturing	11.21	13.76	22.75
Average (unweighted)	*16.33*	*18.19*	*12.41*
Mining & Quarrying	9.77	11.64	19.14
Utilities	12.14	10.71	-11.76

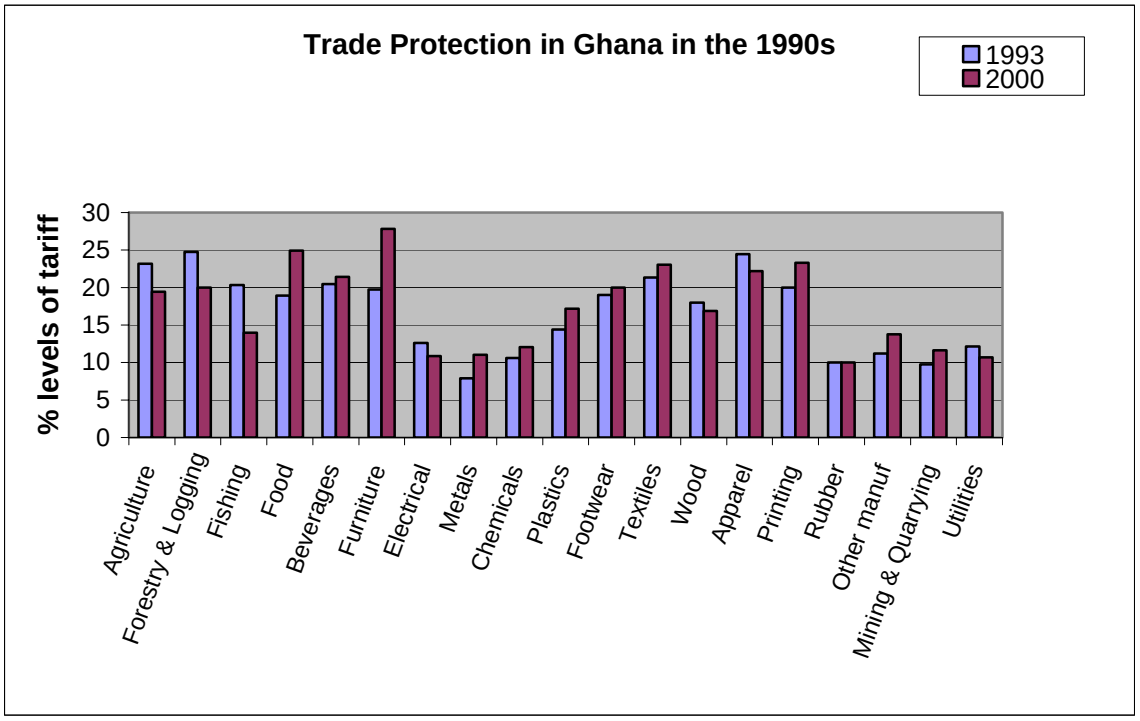
Source: Author's calculations from the tariff data.
Note: The other seven Non-traded sectors including Trading, Construction, Restaurant & hotel, Transport & communication, Financial services, Other services and Community & social care were all assigned a tariff of zero.

Table A2: Industry Employment Shares by Skill Levels

Industry Name	1991/92 Share of different skill levels in industry			1998/99 Share of different skill levels in industry			1991/92 Share of industry in total employment	1998/99 Share of industry in total employment
	Unskilled	*Semi-*	*Skilled*	*Unskilled*	*Semi-*	*Skilled*		
Agriculture crop & Livestock	0.982	0.014	0.004	0.969	0.022	0.010	0.481	0.486
Forestry & Logging	0.903	0.065	0.032	0.833	0.056	0.111	0.009	0.004
Fishing	0.960	0.000	0.040	0.988	0.000	0.012	0.015	0.018
Food	0.983	0.017	0.000	0.967	0.016	0.016	0.035	0.041
Beverages	0.957	0.000	0.043	0.903	0.065	0.032	0.007	0.007
Furniture	0.885	0.038	0.077	0.895	0.053	0.053	0.008	0.008
Electrical	0.667	0.000	0.333	0.000	1.000	0.000	0.001	0.000
Metals	0.889	0.111	0.000	0.810	0.143	0.048	0.005	0.005
Chemicals	1.000	0.000	0.000	0.500	0.500	0.000	0.001	0.000
Plastics	1.000	0.000	0.000	0.500	0.000	0.500	0.001	0.001
Footwear	1.000	0.000	0.000	0.818	0.182	0.000	0.001	0.002
Textiles	0.800	0.200	0.000	0.679	0.214	0.107	0.006	0.006
Wood	0.833	0.000	0.167	0.826	0.087	0.087	0.002	0.005
Apparel	0.944	0.037	0.019	0.882	0.082	0.035	0.016	0.019
Printing	0.571	0.429	0.000	0.545	0.273	0.182	0.002	0.002
Rubber	0.857	0.143	0.000	0.730	0.135	0.135	0.006	0.008
Other manufacturing	0.968	0.000	0.032	0.769	0.154	0.077	0.009	0.012
Mining & Quarrying	0.636	0.273	0.091	0.733	0.133	0.133	0.003	0.003
Utilities	1.000	0.000	0.000	0.500	0.500	0.000	0.001	0.000
Trading	0.931	0.063	0.006	0.877	0.085	0.038	0.142	0.147
Construction	0.931	0.056	0.014	0.793	0.103	0.103	0.021	0.026
Restaurants & Hotel	0.955	0.000	0.045	0.889	0.056	0.056	0.007	0.004
Transport & Communication	0.879	0.093	0.029	0.800	0.103	0.097	0.042	0.039
Financial Services	0.357	0.429	0.214	0.286	0.457	0.257	0.004	0.008
Other Services	0.796	0.122	0.082	0.632	0.211	0.158	0.015	0.013
Community & Social	0.632	0.163	0.206	0.540	0.138	0.322	0.160	0.134
Total	0.900	0.057	0.043	0.863	0.066	0.072	1.000	1.000

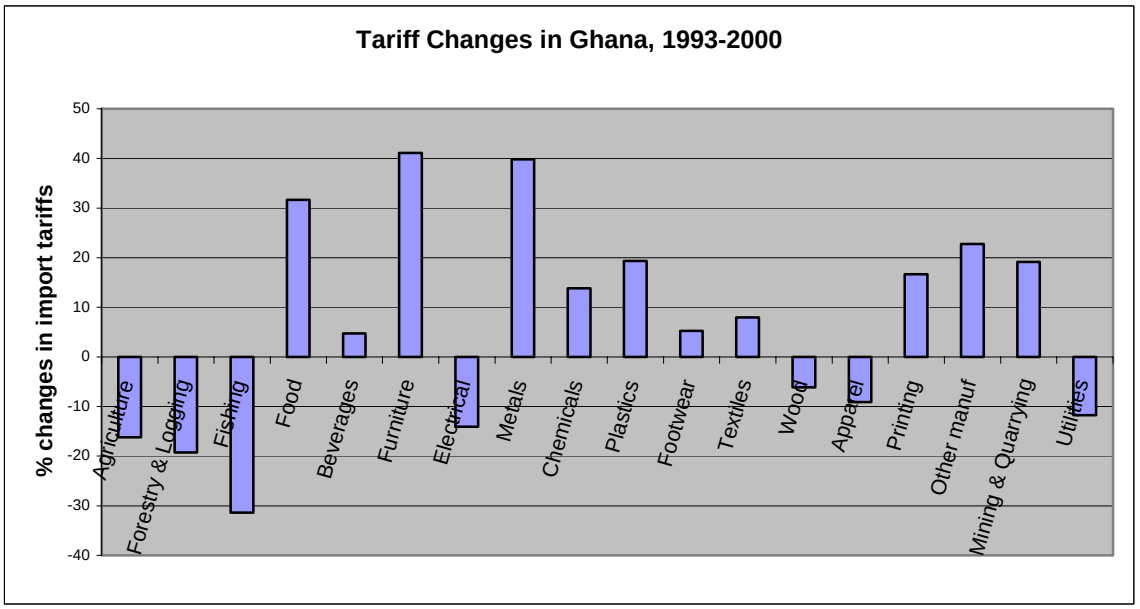
Source: Authors' calculations from GLSS surveys. Industry is by 2-digit ISIC code. These are the 26/68 sectors for which we successfully matched households by the main employment of head.

Figure A3: The Pattern of Trade Protection in Ghana during the 1990s



Note: These are all the 19 tradable sectors in our data. There are seven non-traded sectors with tariffs coded as zero.

Figure A4: The Pattern of Trade Liberalization in Ghana during the 1990s



Note: These were the 18 tradable sectors where tariff changes occurred. The other tradable sector is rubber where the tariff change was zero.