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Examining the welfare effects of import tariff reforms in Ghana

A combined CGE-Microsimulation Approach

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Abstract

This paper applies a combination of a computable general equilibrium model and the GHAMOD microsimulation tool to examine the macroeconomic and welfare impacts of Ghana's recent import tariff reform. We link the CGE model to the GHAMOD microsimulation tool in a top-down fashion where changes in commodity prices derived from the CGE model are passed-down to the microsimulation model. We find that the new import tariff regime reduces overall economic performance, sectoral value added (*notably*, agriculture), government revenue from import duties and consumer prices while at the same time increases household consumption of goods and services – this is partly due to the decline in commodity prices. The microsimulation results suggest that the new import tariff regime leads to a marginal decline in the incidence of poverty and poverty gap along with an increase in the level of income inequality. Our findings have important implications for policy action.

Keywords: Import tariff reforms; Poverty; Income distribution; CGE; Microsimulation; Ghana.

JEL Codes: C68, D31, D58, H22, H23, Q43

1 Introduction

Ghana's recent economic history has been characterised by the introduction of a number of macro-economic and social development programmes with the ultimate goal of engendering inclusive growth and development.[2] Notable among these interventions includes the recent reform in the import tariff regime wherein the government of Ghana has from 4th April 2019 reduced the bench mark value of import duties by 50%.[3] This was done with the view to reducing the high taxes charged at the country's ports, and thus enhance the competitiveness of the country's import duty regime. Among the benefits of trade liberalisation include the promotion of technology transfer, investments, productivity and efficiency, and ultimately growth. However, trade liberation could exert negative impacts on economic growth, employment and government revenue (Clemens & Williamson, 2004; Baldwin & Robert-Nicoud, 2008).[4]

Given the huge fiscal implications of such a reform, it is worth investigating the distributional impacts of the new tariff regime, with a focus on household welfare. Thus, this study examines the economy-wide impacts of Ghana's recent import tariff policy shock on macroeconomic performance, the incidence of poverty and the distribution of income in Ghana. Specifically, the research questions that underpins this study are: (i) what is the impact of the import tariff reform on Ghana's macroeconomic performance? And (ii) what is the impact of the import tariff reform on poverty and inequality in Ghana?

To address these research questions, we combine a Computable General Equilibrium (CGE) model and a Microsimulation module, albeit in a static fashion. CGE models have been widely used to examine the economy-wide impacts of macroeconomic policies (see Thorbecke & Jung, 2001; Warr & Yusuf, 2014).[5] While this approach is interesting in its own right, it is nonetheless not without important weaknesses, especially, in terms of underscoring the distributional impacts of public policies. A combined CGE and microsimulation tools fills this gap by providing both macro-level impacts as well as a detailed micro-level distributional impacts by exploiting the rich detail of information contained at the household/individual level (Annabi et al., 2005; Hérault, 2010; Vandyck & Leuven, 2013).[6]

[2] Ghana has achieved sound economic performance over the past few decades with the incidence of poverty declining by over half between 1991/92 and 2012/13 (Danquah & Iddrisu, 2016).
[3] The importation of cars/vehicles, however, were to attract an import tariff reduction of 30%.
[4] Following a Grossman and Helpman-type of an economy (exogenous international knowledge spillover), Baldwin & Robert-Nicoud (2008) demonstrate that trade liberalisation unambiguously leads to slower growth.
[5] See also Iddrisu et al. (*forthcoming, PEP Working Paper)* and Danquah & Iddrisu (*forthcoming, IGC Working Paper*).
[6] The microsimulation model allows us to keep as many agents as there in the survey and it retains all the information about the household/individual heterogeneity with respect to endowments and consumption. Microsimulation models there comes across as one of the best tools for poverty and inequality analysis since they allow for the endogenous treatment of intra group variance (see Decaluwé, Dumont & Savard, 1999). However, given their partial nature, the application of microsimulation models to assess the impacts of public policies can be very limiting as they potentially ignore important general equilibrium effects such as price changes (see Bourguignon and Spadaro, 2005).

The remainder of the paper proceeds as follows: Section 2 details the methodological approach adopted by the study while section 3 presents the 2015 SAM for Ghana. Section 4 present the results of the study whereas section 5 concludes the study.

2 Methodology

In order to examine the potential economy-wide and distributional impacts of Ghana's recent import tariff reform, we utilise a PEP-type static CGE model combined with a non-behavioural microsimulation module. By linking the CGE model to the microsimulation model, we are able to account for household heterogeneity in terms of income sources (especially, factor endowments) and consumption patterns. In what follows, we briefly discuss these models.

2.1 The static CGE model

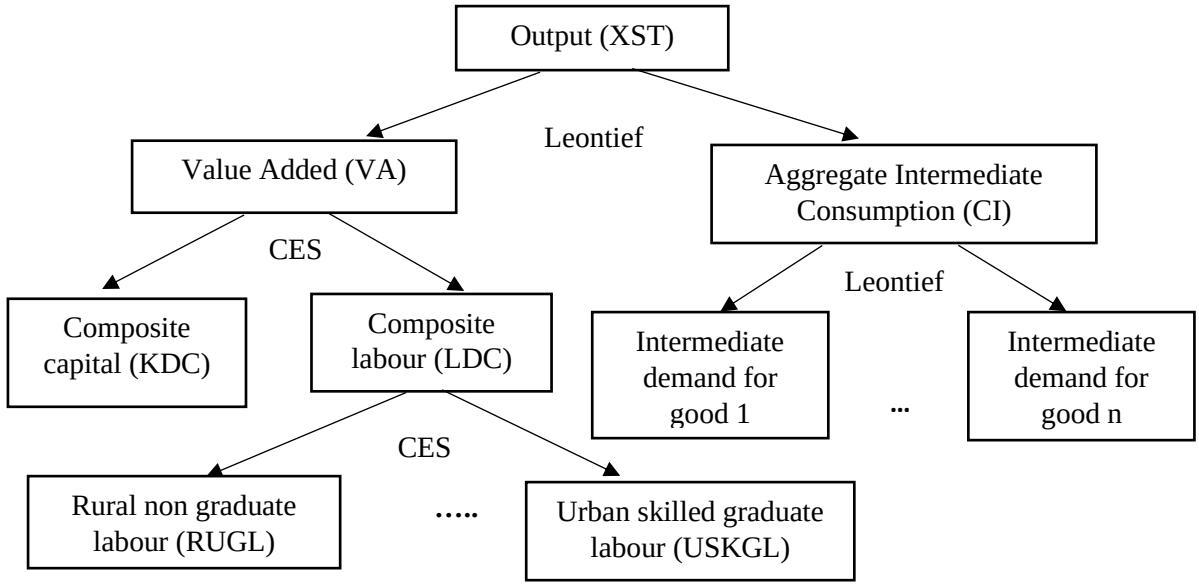
Our static CGE model is an adapted version of the PEP-1-1 standard CGE model, which is a one country, multi-sector, static CGE model (see Decaluwé et al., 2013). The standard PEP-type static CGE model has a neoclassical structure with equations that describes the production structure of various economic sectors, and the behaviour of various economic agents (private households, firms/enterprises, the government and the rest of the world). Also, the model describes the structure of import demands and export, market clearing conditions for factors of production and commodity markets as well as a number of macroeconomic variables and price indices. A detailed discussion of the salient features of the standard CGE model can be found in Decaluwé et al. (2013).

Figure 1 presents the structure of production in our CGE model. The production function in the model is a three-level nested production structure. In the first nest, total output (XST) is modelled as a Leontief function of value added (VA) and composite intermediate good (CI). One level down, value added is modelled as a Constant Elasticity of Substitution (CES) function between composite capital (KDC) and composite labour (LDC) while composite intermediate good is a Leontief function of various intermediate goods. At the lowest level, composite labour and composite capital are specified as a CES function of the different types of labour (non-graduate labour, skilled graduate labour and unskilled graduate labour) and of the different types of capital, respectively.

Our treatment of trade in the model is standard. Specifically, we follow the *Armington hypothesis* which assumes the presence of an imperfect substitutability between imported and domestically produced goods and services on the consumption side. Similarly, local producers supply their output to both home and export markets and the shares depend on the ratio of domestic prices to export prices. Hence, the allocation between domestic and foreign markets for demand and supply responds to the relative prices of foreign goods defined by exogenous international (import and export) prices, the real exchange rate and the local tax levels. We set the price elasticity of the world demand for exports at 2. In order to capture existing differences in labour market outcomes, our model classifies employed labour into six different categories,

namely, rural non-graduate labour, rural unskilled graduate labour, rural skill graduate labour, urban non-graduate labour, urban unskilled graduate labour, and urban skilled graduate.

Figure 1: Structure of Production



Source: Adapted from Decaluwe et al. (2013)

The following closure rules are observed in the CGE model. Labour is fully mobile across all sectors while capital (excluding land, crop and livestock) is not sector specific. Typical agricultural capitals (such as land, crop and livestock) are mobile only across agricultural sub-sectors. The commodity market follows the neoclassical market-clearing system in which prices adjusts to ensure equality between total endogenous demand and total supply. We choose as a numeraire, the nominal exchange rate. World import and export prices are set fixed following the small price-taking economy hypothesis. The current account balance is set fixed. Total investment expenditure is equal to the sum of savings by all economic agents with real investment adjusting to changes in savings (i.e. savings-driven investment). The sum of the different forms of investment expenditure is equal to total investment.

2.2 Link with microsimulation model

The microsimulation model used in this paper is the GHAMOD tax-benefit microsimulation tool (see Adu-Ababio, Osei, Pirttilä, and Rattenhuber, 2018). The GHAMOD microsimulation model is non-behavioural, indicating that household behaviour is not modelled explicitly at the micro-level. However, the model is well-suited to address the distributional impacts of tariff reforms since it allows for the incorporation of the heterogeneity in characteristics as well as behaviour across individuals and/or households. We use the top-down approach to link the

CGE model with the microsimulation model where percentage changes in commodity prices in the CGE model are passed down to the microsimulation model.

Specifically, our approach involves the following steps: first, we ensure consistency between the commodity accounts in the CGE model and that of the microsimulation model; second, we create a new "indirect tax policy" in the microsimulation model and apply the changes in commodity prices (based on the CGE model results) as (negative) taxes on commodities in the microsimulation model; Lastly, the distributional impacts of the policy are generated by comparing a baseline scenario (where our new indirect tax policy is *switch off*) and a reform scenario (where our new indirect tax policy is *switch on*) while accounting for net indirect taxes paid by households under a consumption based measure of welfare. In line with our approach, Chen & Ravallion (2003) employed a straightforward top-down link by transmitting CGE model changes in prices and wages to household survey data to examine the distributional impact of China's accession to the World Trade Organisation.[7] On the other hand, other scholars (see Buddelmeyer et al., 2012) attempts to ensure some consistency by reweighting the microdata in accordance with the CGE model aggregates.[8] Our microsimulation model is calibrated on the sixth wave of the Ghana Living Standards Survey (GLSS 6) – a nationally representative household survey dataset with more than 72,000 individuals and over 16,000 households.

3 The Social Accounting Matrix (SAM)

The static CGE model (discussed in section 2) is calibrated using a social accounting matrix (SAM) for the year 2015 for Ghana.[9] Our approach to categorizing labour and activity/commodity accounts in the Ghana SAM follows that of Danquah & Iddrisu (*forthcoming*).

3.1 Key characteristics of the Ghanaian economy in 2015

Before we present the results from the simulation exercise, it is important to discuss some of the salient features of the Ghanaian economy. Table 1 presents information on sectoral composition of value added, trade and investment. In terms of value added, the shares of agriculture, services and industry in total value added are about 20%, 49% and 31%, respectively. In addition, value-added share in total sectoral value is relatively higher in the agricultural sector than in the industrial and services sectors (column II of Table 1). In Ghana, the share of export in total sectoral output ranges from 9.9% for services, to 10.1 for agricultural

[7] The authors assume that quantities are fixed which comes down to unchanged labour and consumption behaviour of households.

[8] Buddelmeyer et al. (2012) employed this approach to analyse the distributional impacts of climate change policies in Australia. Employment and population changes are accounted for by adapting the sample weights of the households in the microdata.

[9] The 2015 Ghana SAM was prepared by the International Food Policy Research Institute (IFPRI), the Institute for Statistical, Social and Economic Research (ISSER) and the Ghana Statistical Service (GSS); see GSS, ISSER, and IFPRI (2017).

products and then to 27.8% for industrial products. In relation to commodities demanded for investment purposes, we observe that no agricultural or service product is demanded for investment purposes. About 4% of industrial products are demanded for investment purposes.

Table 1: Sectoral composition of value added, trade and investment in Ghana, 2015

Sector	Share in Value Added	Value Added share	Import share	Export share	Investment share
	I	II	III	IV	V
Agriculture	0.20	0.72	0.10	0.10	0
Industry	0.31	0.33	0.44	0.28	0.04
Services	0.49	0.51	0.10	0.10	0
Total	1.00	-	-	-	-

Source: 2015 Ghana SAM

In Table 2, observe that the average capital-labour ratio for the agriculture, industry and service sectors is 4.37, 5.14 and 8.41, respectively. This implies that the services sector has the highest capital-labour ratio, followed by the industry and then the agricultural sector. The share of graduate labour in total agricultural labour is about 8% on average while that for the industrial and services sectors stood at 7% and 30%, respectively, on average.

Table 2: Relative factor intensity in main economic sectors, 2015

Sector	Capital-Labour Ratio	Land-Labour Ratio	Capital-Land Ratio	Graduate Labour share
Agriculture	4.37	0.69	1.03	0.08
Industry	5.14	0	0	0.07
Services	8.41	0	0	0.3

Source: 2015 Ghana SAM

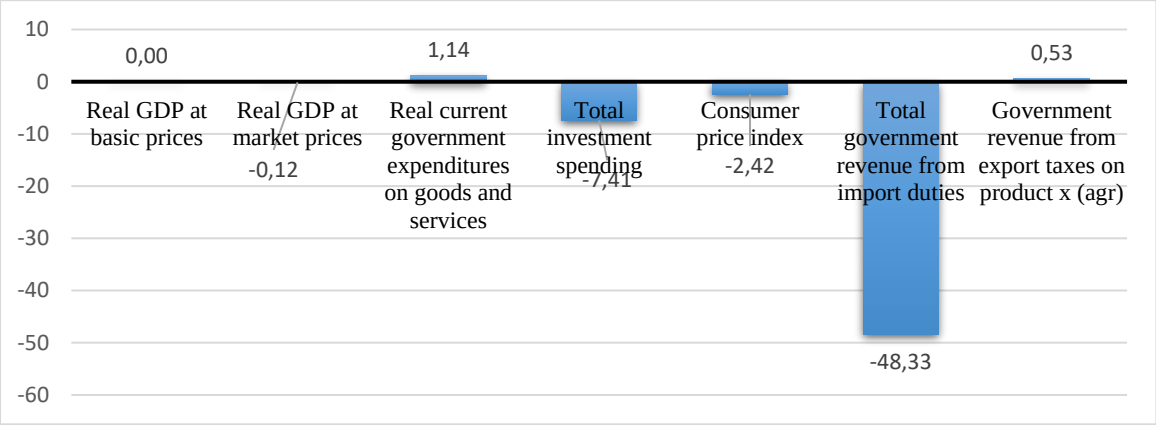
4 Application and results

This section presents the empirical results of the study. First, we discuss the impacts of the new import tariff reform on Ghana's macroeconomic performance, focusing on sectoral value added, overall GDP, consumer prices and government revenue. Second, we discuss the distributional/welfare impacts of Ghana's new import tariff regime.

4.1 Macroeconomic impacts of the import tariff reform

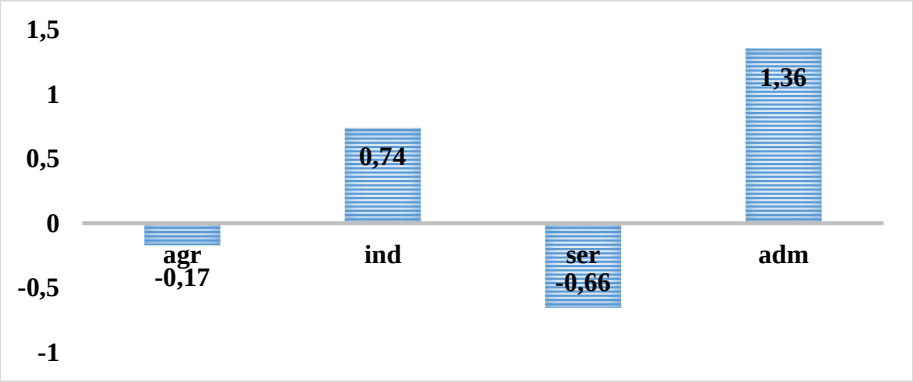
Strikingly, we observe that Ghana's new import tariff reform is not likely to engender positive economic performance, at least in the short-run. Specifically, relative to the Business as Usual (BAU) scenario of no import tariff reduction, the imposition of a 50% reduction in import duties reduces real GDP by 0.12% (Figure 1). Also, total investment spending and government revenue from import duties drop by about 7.4% and 48.3%, respectively, relative to their BAU levels. The consumer price index falls by 2.4%, perhaps, reflecting Ghana's high dependency on imported food and non-food products.

Figure 1: Impact on key macroeconomic variables; % Deviation from BAU



Closely related to the above, we observe important impacts at the sectoral levels. Sectoral value-added declines marginally by about 0.2% and 0.7% in the agricultural and services sectors while the industrial sector records an increase in value added by 0.7% (Figure 2).

Figure 2: Impact on Sectoral Value Added; % Deviation from BAU



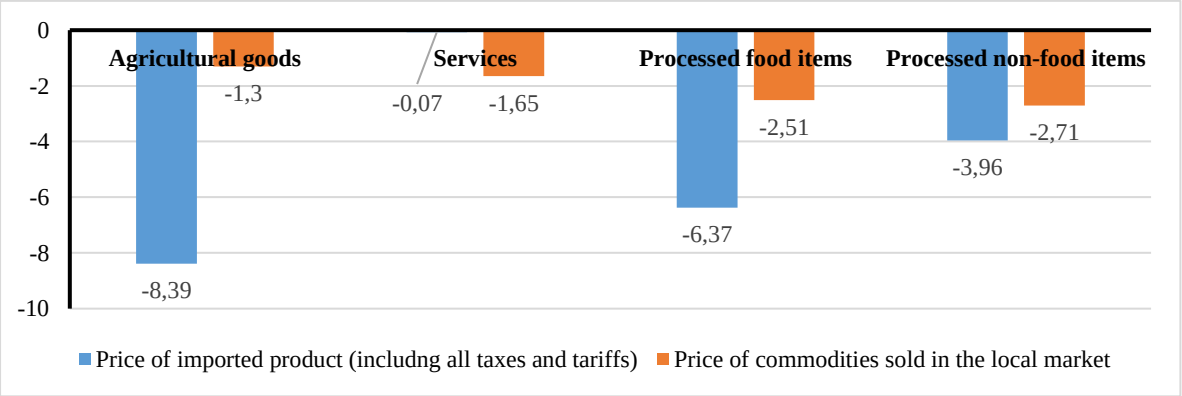
Further, the reduction in the import tariff leads to an increase in the imports of agricultural commodities – such maize, rice, millet and sorghum – by more than 15%. The importation of manufactured food and non-food products also witness an increase under the new tariff system (see Table 3). Considering exports, we find that all the various commodity groups witnesses an increase in export, albeit at rates below the import levels, thus leading to negative net-export rates. Consistent with the decline in real GDP, we find that the domestic demand for all commodities, especially, processed food and non-food items declines by more than 1.2%.

Table 3: Impact on exports, imports, domestic demand, and total intermediate demand; % Deviation from BAU

	Agricultural goods	Services	Processed Food Items	Processed Non-food Items
Exports	1.07	1.12	2.38	2.38
Imports	15.63	-3.47	7.09	1.29
Domestic demand	-0.39	-0.36	-1.22	-1.28
Total intermediate demand	0.44	-0.01	-0.3	0.34

Unsurprisingly, we show that the prices of goods sold in the local market as well as the prices of imported commodities falls under the import tariff reduction scenario compared to the BAU scenario. Specifically, the prices of imported agricultural goods drops by about 8.39% while that of processed food and non-food products reduces by 6.37% and 3.96%, respectively (Figure 3).

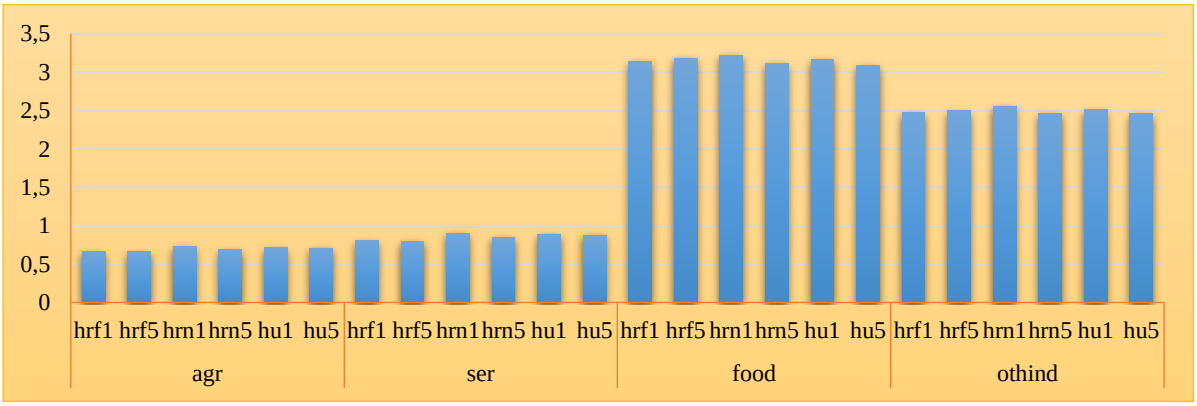
Figure 3: Impact on commodity prices (*imported and products sold in the local market*); % Deviation from BAU



4.2 Distributional/welfare impacts of the import tariff reform

Going beyond the macro-level impacts, we analyse the distributional impacts of the new import tariff regime in Ghana. In the first instance, we find that households' consumption of all commodity types saw an increase under the new import tariff regime relative to the BAU scenario. The increase in consumption is similar across the various categories of households. For instance, both rural farm households at the bottom quintile of the income distribution and urban households at the fifth quintile of the income distribution register a similar increase in their consumption of agricultural, processed food and non-food goods as well as services under the new import tariff regime (Figure 4).

Figure 4: Impact on households' consumption of goods and services; % Deviation from BAU



In terms of poverty and inequality impacts of the import tariff reform, the results from the microsimulation model reveal that the reform leads to a marginal reduction in the incidence of poverty and the poverty gap measures by about 0.30 percentage points and 0.15 percentage points, respectively, relative to the baseline scenario. These effects, however, vary across various types of households (see Table 4). However, there is a slight increase in inequality under the reform scenario compared to the baseline scenario; the Gini measure of inequality increase by 0.0005 points. Thus, aside promoting a reduction in the incidence of poverty (which may be explained by the reduction in commodity prices), the reform widens the income gap between the rich and the poor.

Table 4: Impact on government tax revenue, poverty and inequality

	Baseline scenario	***Reform scenario***	***Difference to base***
Government revenue through taxes, SSC and indirect taxes (Million 'GH₵)	6,671.22	6,006.87	-664.35
... direct taxes	3,629.13	3,629.13	0.00
... indirect taxes	1,489.97	825.61	-664.35
Share of poor population, in %			
All	**24.85**	**24.55**	**-0.30**
Poor households out of ...			
... male headed households	26.58	26.27	-0.31
... female headed households	19.67	19.37	-0.29
... households with children	27.42	27.09	-0.33
... households with older persons	33.60	33.40	-0.20
Poverty gap (average normalised poverty gap, FGT(1))			
All	**8.09**	**7.94**	**-0.15**
Poor households out of ...	0	0	0
... male headed households	8.80	8.63	-0.17
... female headed households	5.97	5.86	-0.11
... households with children	8.91	8.74	-0.17
... households with older persons	11.01	10.80	-0.21
Absolute national poverty line, in national currency, yearly:	1,289	1,289	0

Gini (household income)	**0.4149**	**0.4155**	**0.0005**
P80/P20	**3.50**	**3.51**	**0.01**
Quantiles of distribution and median			
20th	1,143.00	1,154.22	11.22
40th	1,756.73	1,771.97	15.25
50th	2,101.60	2,124.80	23.19
60th	2,543.09	2,567.09	24.00
80th	4,006.17	4,052.53	46.35
Absolute national poverty line, in national currency, yearly	1,289	1,289	

5 Concluding remarks

In this paper, we use a static CGE model combined with the GHAMOD microsimulation tool to examine the economy-wide and welfare impacts of recent reforms in Ghana's import tariff regime. We find that the new import tariff regime leads to a reduction in overall GDP, the consumer price index and government revenues. However, the impacts at the sectoral levels are mixed; while value added in the agricultural sector registers a decline under the reform, this is not the case for the industrial sector. Additionally, a marginal decline in the incidence of poverty and poverty gap along with an increase in the level of income inequality is observed from our microsimulation model. On the basis of these findings, we recommend that the current import tariff regime should be modified with a view to targeting sectors that are more likely to benefit the most from such a policy – i.e. industry.

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