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Article

Impacts of import restrictions on poultry producers in Ghana

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Abstract

This paper investigates the potential effects of trade restrictions and alternative tariff policies, including a tariff wedge between feed and final products on the Ghanaian poultry producers. We apply a hybrid approach that uses qualitative results of a Delphi study to define scenarios for a modified global general equilibrium model. The projected production changes are then used as inputs into a typical farm analysis that disentangles the effects for broiler farm types in Ghana. The effect of expanding a tariff wedge between final and feed products by 5 per cent, either through increasing the tariff rates of the final product or through abolishing the tariffs on feed products, is small in our case. However, increasing the tariff rate of the final product to the maximum level of bound tariff (i.e. 99 per cent) or a complete ban has a larger effect on domestic production. It increases the production by 104 per cent and up to 254 per cent, respectively. The typical farm analysis reveals that large-scale farms are better positioned to increase production than small and medium farm types.

Keywords: Import ban, Protection policies, Poultry, Ghana.

JEL codes: F14, Q18

1. Introduction

Poultry meat is an important source of animal protein in sub-Saharan Africa (SSA). Increasing urbanization and income combined with rapid population growth have led to a growing demand for animal products, including poultry meat, in many African countries (Mottet and Tempio 2017). To meet growing demand, poultry imports by some African countries are rapidly increasing and are much higher than the local production (FAOSTAT 2020). Analogous trends can be observed in the Ghanaian poultry sector, which has resulted in falling self-sufficiency rates, raising criticisms about imports (Sumberg *et al.* 2017; Asante-Addo and Weible 2020). In response, various tariff and non-tariff policies have been proposed to simultaneously protect local producers against cheap imported products and to improve their productivity (Benin 2016).

The imposition of import bans on poultry products has become a popular policy instrument among African policy makers as they aim to protect domestic production, prevent outbreaks of animal diseases, and in the long term increase self-sufficiency (Akunzule *et al.* 2009; Johnson 2011; Naggujja *et al.* 2020). Ghana's government has recently imposed an

import ban on poultry products from the Netherlands, Germany, Russia, Denmark, and the UK. According to an official letter written by the Ghanaian Ministry of Food and Agriculture on 10 November 2020, the ban was prompted by the recent outbreak of avian influenza subtype H5N8 in Europe. This is not the first time that Ghana has experienced a partial ban. During the 2006–7 avian influenza outbreak, Ghana applied a partial ban on imports from less important trading partners (Akunzule *et al.* 2009; Johnson 2011). Despite this ban, imports to Ghana continued to increase over the corresponding period. However, local production was protected from a large outbreak of avian influenza (Akunzule *et al.* 2009).

Tariff policy is another proposed option to protect domestic production. From a value chain perspective, not only the applied tariff of a specific product but also the tariff wedge between the output and intermediate commodities is important in determining the final effects of tariff policies (Hwang *et al.* 2017). While increasing import tariff rates on final products can increase the domestic price, reduction in tariff rates on intermediate products may allow producers to lessen production costs along the value chains (Boysen *et al.* 2019). Thus, changes in the import tax of intermediate inputs may affect the final product markets and should be considered in analyzing the tariff structure (McCorriston and Sheldon 2011).

The objective of the present study is to investigate the impacts of trade restrictions and tariff policies on the trade and production of poultry in Ghana. More specifically, this paper aims to explore the potential effects of two policy options: first, trade restriction policies in the form of a partial or complete import ban and second, increasing the tariff wedge between feed as an intermediate product for poultry productions and poultry meat as the final product. We use a global computable general equilibrium (CGE) model to investigate trade flows but combine it with the results of qualitative methods and a typical farm approach. This holistic framework allows policy makers to simultaneously incorporate stakeholders' views regarding the policy and to have a comprehensive representation regarding the spillover effects of the protection policies on macroeconomics and farm-level variables. The qualitative analysis is applied to define more realistic scenarios for the CGE model and the typical farm approach projects the production effects of the policies on different types of poultry farms. To assess these options, overall five scenarios are formulated. Two scenarios address the potential effect of complete and partial ban policies on domestic production and poultry imports, and three scenarios address tariff policies. Although the partial ban is implemented in response to the avian influenza outbreak, the complete ban policy mainly protects domestic producers against increasing imports of poultry meat. With respect to the tariff policies, we analyze how changes in the tariff rate of poultry meat relative to the maize tariff rate, as an important input for poultry production in Ghana, affect the whole poultry value chain. Consequently, we assess a reduction in the tariff rate of maize as a way to decrease the cost of poultry production as well as an increase in the tariff rate of final poultry meat to protect domestic producers.

The rest of the paper is organized as follows: Section 2 presents an overview of the Ghanaian poultry market and a brief policy review. In Section 3, we review the existing literature on tariff and ban policies in the agri-food sector. Section 4 discusses the method framework of our analysis. Finally, in Section 5, we summarize our results and derive possible policy implications.

2. An overview of the Ghanaian poultry market and policy

The agriculture, forestry, and fishery sector in Ghana generated 11.63 billion USD added value, which equals 18 per cent of the total GDP, in 2018 (World Bank 2021a). In 2018, 410 thousand tons of meat (livestock and poultry) were consumed in Ghana, out of which 65 per cent was poultry meat (MoFA 2018). Fig. 1 presents the evolution of total supply (domestic production and imports) and total demand (domestic consumption and export) of poultry meat in Ghana. The increase in total domestic consumption can be attributed to the increase of per capita consumption from 1.6 kg in 1999 to 10.9 kg in 2019 and

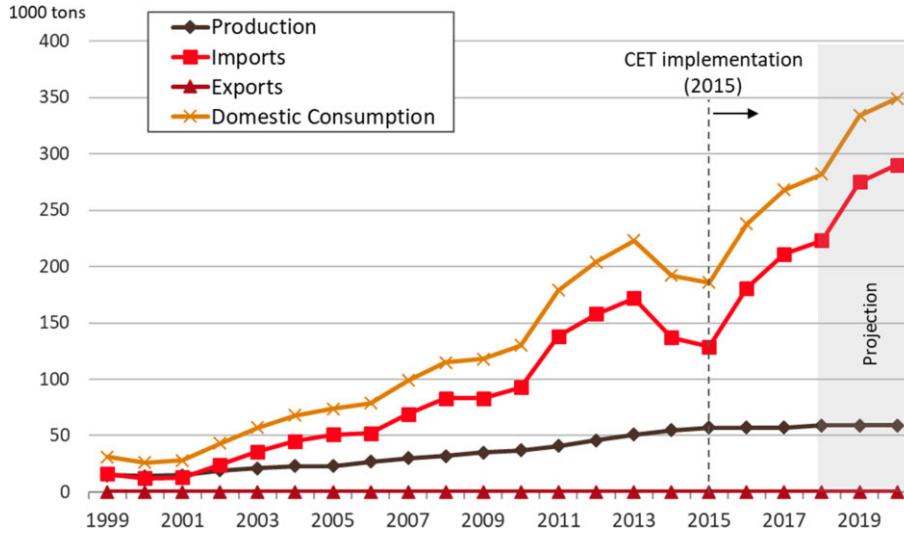

Figure 1. Development of the poultry meat sector in Ghana from 1999 to 2020 (1000 tons).
Source: Data set and projection based on USDA (2019).

the annual population growth between 2.6 per cent and 2.2 per cent in the same period (World Bank 2021b; Zamani *et al.* 2021). The sharp increase in poultry meat demand has led to rising Ghanaian poultry imports (Fig. 3). Additionally, the share of imports in the domestic consumption of poultry meat in Ghana has increased enormously during the last decades, whereas domestic production shows only a slight increase. To reduce dependency on imports and create jobs in the Ghanaian poultry sector, the improvement of self-sufficiency has been targeted by different governments (FAO 2015; Netherlands Enterprise Agency 2019). The self-sufficiency rate has fallen from 54 per cent in 2000 to 17 per cent in 2018.[1] During this period, we observe a low growth in production and a strong increase in consumption. The deficiency in domestic production is attributed to various factors, which include high production costs (chicks, feed, and vaccines), inefficient production technologies, lack of processing facilities, and limited knowledge of modern production management (Ashitey 2017; Netherlands Enterprise Agency 2019).

Ghana has been dependent on poultry imports for more than a decade (Asante-Addo and Weible 2020). With a significant difference, Ghana is the major importer of poultry meat in West Africa (Fig. 2). As shown, Ghana imported 261 million tons of poultry meat in 2019. Additionally, it was the leading importer of poultry meat from the EU in 2019 by importing 185.5 thousand metric tons (UN Comtrade 2019).

According to the UN trade statistics (2019), the Netherlands (60 per cent), and Belgium (18 per cent) make up over half of all EU poultry exports to Ghana. Although the EU, Brazil, and the USA are the main exporters, Fig. 3 highlights that Brazil and the USA have decreased their poultry exports to Ghana since 2011 and 2013, respectively. Nevertheless, the resulting gap has been compensated for by growing poultry exports from the EU.

Ghana's trade agenda is aligned with the Economic Community of West African States (ECOWAS) regulation, its regional partnership agreement with the EU, and the long-term vision of Ghana (FAO 2015). Within the context of ECOWAS protocols, the trade of Ghana with non-ECOWAS members is subject to the ECOWAS Common External Tariff (CET) adopted in 2015. Moreover, Ghana was the second country after the Ivory Coast to sign a bilateral interim Economic Partnership Agreement (iEPA) with the EU. According to the interim EPA, Ghana will gradually remove its import duties for 78 per cent of EU exports in the period from 2020 to 2029. Based on Ghana's iEPA, poultry meat is excluded from

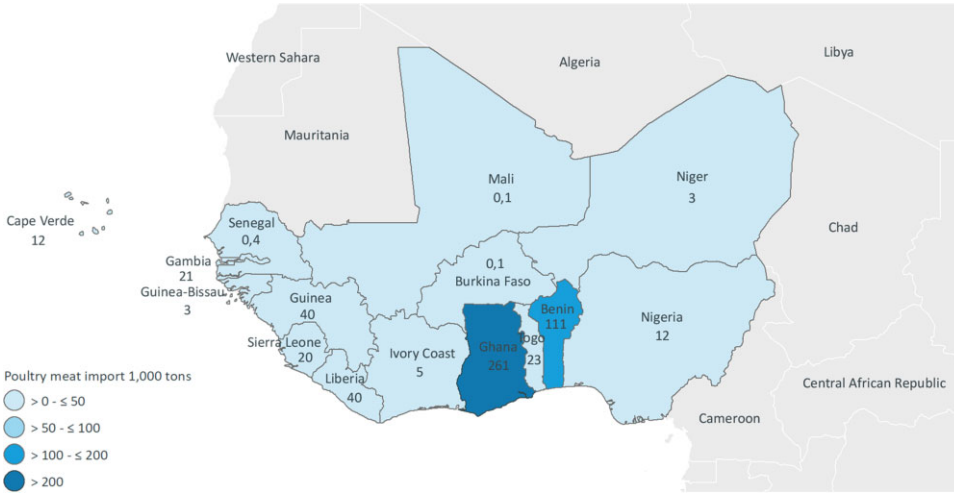

Figure 2. Main importers of poultry products in West Africa (1000 tons).
Source: Own elaboration based on the data from UN Comtrade (2019). HS code: 0207. Maps, Esri 2020.

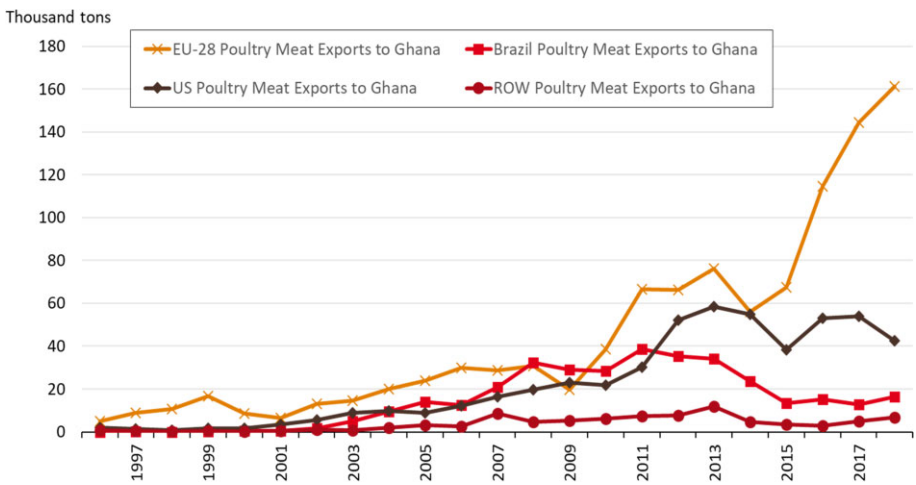

Figure 3. Main exporters of poultry meat to Ghana from 1996 to 2018 (1000 tons).
Source: UN Comtrade (2019). HS code: 0207. ROW stands for 'rest of the world'.

liberalization and it is subject to a tariff of 35 per cent for poultry meat and 5 per cent for feed, including maize. As laid out above, the most recent intervention is related to a partial ban on poultry imports from five European countries in reaction to the avian influenza outbreak in Europe.

3. Tariff and trade restriction policies in the agri-food value chain

Agricultural protection and market access strategies remain controversial topics in international trade negotiations and agreements. Using empirical literature, this section attempts to elaborate on the potential effects of two protection policies, namely tariff wedges along the vertical processing stages and trade bans on the agriculture sectors.

Since the agricultural value chains encompass products with different stages of processing, many empirical studies have focused on the potential effects of increasing applied tariff along the agri-food processing stages[2] (see e.g. Narayanan and Khorana 2014; Boysen *et al.* 2019). According to Corden (1966), decreasing import tax at the upstream stage of the processing chain, i.e. increasing a tariff wedge along the value chain, can increase effective protection. Although this policy setting may have a different effect at international and national levels, it has been systematically practiced in the value chain of agri-food in developing and developed countries (Aziz *et al.* 2017; Boysen *et al.* 2019). As already mentioned, the high production cost of poultry is one of the challenges faced by the Ghanaian producers, which makes the domestic products less competitive compared with the cheap imported frozen poultry meat. Tariff differential on products in the value chain may give incentive to producers to import unprocessed (primary or intermediate) products and thus, increase domestic production by reducing the production cost of the final commodity (McCorriston and Sheldon 2011).

According to the World Trade Organization (WTO), an import ban is prohibited for member countries. Exceptions are considered under defined conditions such as safeguarding mechanisms, and human, livestock, and plant health-related issues (see GATT 1994 article XI). Several papers in the literature discuss the potential consequences of trade bans in various contexts. For instance, the effects of an import ban on genetically modified (GM) food (e.g. Anderson *et al.* 2005; Philippidis 2010; Henseler *et al.* 2013), a ban to prevent livestock disease outbreaks (e.g. McDonald and Roberts 1998; Philippidis and Hubbard 2001; Rodriguez *et al.* 2007; Chatterjee *et al.* 2016; Kutlina-Dimitrova 2017), and the politically induced import bans like the Russian import ban on EU products (e.g. Boulanger *et al.* 2016; Banse *et al.* 2019) are analyzed, although the existing literature on import bans varies in terms of case studies and potential consequences and mainly CGE-based models are applied.

Chatterjee *et al.* (2016) report the economy-wide evidence of the EU's import ban on several GM foods produced in India using a modified GTAP (Global Trade Analysis Project) model. Following the EU's ban, the simulation shows that the domestic supply of GM food in India rises, while the domestic price decreases and the domestic consumption increases. Henseler *et al.* (2013) apply an integrated approach of general and partial equilibrium models to simulate the potential effect of a trade ban on soybean exports from Argentina, Brazil, and the USA to the EU. The findings projected a high feed cost in response to the trade restriction scenario, which affects the poultry and pork sectors the most.

The 2014 Russian agri-food import ban is one of the recent cases in the literature. In response to the Ukraine conflict and to 'protect the national security of the Russian Federation', Russia imposed a temporary ban on agri-food imports from the EU, the USA, Norway, Canada, and Australia. In this regard, Boulanger *et al.* (2016) apply a modified CGE model to analyze the short-term consequences of the Russian import ban. As the findings of the study show, the EU compensates for the negative shock related to the ban mainly by intra-EU trade, while Russia experiences a high income loss. Using the GTAP model, Kutlina-Dimitrova (2017) report that the impact of the Russian agri-food ban is negligible on the total EU exports. This limited effect may be evidence of a strong 'cushioning' effect by redirecting the banned product to the EU internal market. In a recent paper, Banse *et al.* (2019) show that removing the Russian food import ban may result in a minor change in the agricultural sectors of both Russia and the EU. According to existing literature, the final effects of a partial ban depend on various factors. From a trade perspective, the partial trade ban may affect bilateral trade flows by reallocating market shares in favor of non-banned countries (Nicita 2008). Thus, the total effects on the domestic market are highly influenced by the share of new competitors and changes in total imports following the partial ban implementation.

Although poultry import bans have some common effects in some West African countries, existing literature shows that the policy effects vary from country to country. In Senegal, the imposition of a poultry import ban has resulted in increased domestic production and consumption (FAO 2014). According to Arnoldus *et al.* (2020), the per capita consumption of chicken meat increased from 3.1 kg/person in 2007 to around 5 kg/person in 2019. In contrast, although there has been an increase in domestic production in Nigeria after the ban, Andam *et al.* (2017) report that the per capita consumption of chicken meat in Nigeria decreased from an annual average of 1.32 kg/person in 1995–9 to an annual average of 0.85 kg/person in 2011–5. Furthermore, Andriamananjara *et al.* (2009) and Golub (2012) suggest that the poultry import ban in Nigeria has also led to a significant illegal trade (smuggling) of frozen chicken products from Benin to Nigeria. Additionally, an import ban on inputs of poultry production leads to an increase in maize prices. Maize prices tripled from 2007 to 2008 and left many poultry producers unable to provide sufficient feed quantities (Killebrew *et al.* 2010).

According to the above explanations, the difference in the impact of poultry import bans imposed by Nigeria and Senegal shows that the policy implications of a ban policy cannot be generalized based on the effects on other countries but should instead be investigated based on the specific local context. Additionally, previous literature focuses foremost on the macroeconomic aspects of trade restrictions. However, the final effects on different farm groups appear to be crucial in order to interpret the results based on the most accurate possible description of the market situation in Ghana. Given the heterogeneity of poultry farm types in Ghana, the potential effects of policies may vary over different farm types. However, it is difficult to capture such effects using the standard general equilibrium model only. We attempt to fill this gap in the literature using the so-called typical farm analysis.

4. Model framework

Our policy assessment approach is based on a framework connecting qualitative methods and a global CGE model for simulating the potential effects of policy decisions on macro and micro levels (see Fig. 4). First, the tariff data set is adjusted according to the recent trade policies in Ghana as the current version of the protection database does not include the recent Economic Community of West African States common external tariff (ECOWAS-CET). For the update of the protection structure, we apply the Tariff Aggregation and Simulation Tool for Economists (TASTE) that allows us to consider tariffs and tariff changes at a detailed sectoral level (HS6). Second, five scenarios are formulated according to the implemented government policy and our qualitative research results (semistructured interviews and Delphi study) in Ghana. The scenarios are identified in the next section. Third, the effects of the scenarios are simulated by using a global general equilibrium model known as MAGNET (Modular Applied General Equilibrium Tool). Based on the simulation results for production, the potential changes in different farm types are projected using typical farm analysis, i.e. TIPI-CAL (Technology Impact Policy Impact Calculations). Continuing the loop, the simulation results provide policy makers with a basis to evaluate different trade policy options. The components of modeling frameworks are discussed in the following sections.

4.1. Qualitative research (input data for the modeling)

Qualitative research methods that include semistructured interviews and the Delphi method served two purposes in the study. First, they provided information for designing the study scenarios. Second, they were used to gain in-depth insights into the Ghanaian poultry meat value chain. The insights were then used to interpret the results of the modeling. It is important to note that additional qualitative methods were also used for the typical farm approach and they are explained in Section 4.3.

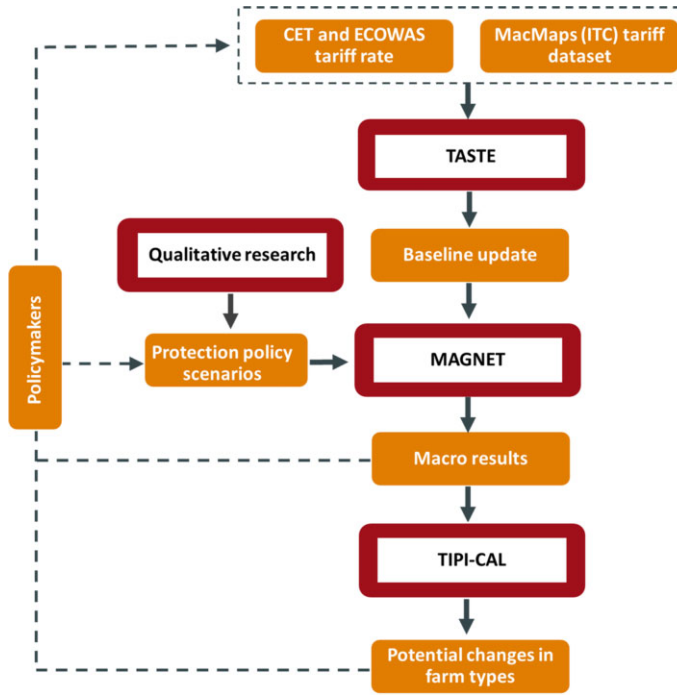

Figure 4. Policy assessment flowchart.
Source: Own presentation.

4.1.1. *Semistructured interviews*

In line with Akunzule *et al.* (2009), semistructured interviews were used to collect data from key informants with knowledge of the poultry value chain in Ghana. Semistructured interviews were used because they enabled key informants to freely express their points of view, allowing the researchers to gain an in-depth understanding of the various issues related to the poultry value chain. The interviews were conducted in Accra, Kumasi, and the Eastern region from November 2020 to February 2021. A total of 17 key informants were interviewed. The key informants included input suppliers (hatcheries, feed manufacturers, and veterinary product suppliers), poultry producers, processors (slaughterhouses), and distributors (retailers and wholesalers).

4.1.2. *The Delphi method*

The Delphi method was used to identify and rank the key challenges facing the Ghanaian poultry meat value chain. According to Grime and Wright (2014), the Delphi method is a qualitative research method that is used to gather a consensus of expert opinions through structured and anonymous group communication. In our study, the method was used to understand the extent to which poultry meat imports are perceived as a challenge. The Delphi study was composed of a heterogeneous group of experts, including researchers, poultry producers, policy makers, input suppliers, feed millers, owners of hatcheries, and slaughterhouses. The Delphi study was conducted from November to December 2020 in two rounds of emails. In the first round, a questionnaire, which was composed of two questions, was sent to the experts. The first question requested the experts to judge the importance of 14 challenges facing the value chain with the help of a five-point Likert scale. The initial 14 challenges had been identified by the researchers through an in-depth literature review.

The second question was an open question requesting the experts to identify and judge the importance of other challenges that were not included in the initial list. The first round of responses was then analyzed using the mean and standard deviation and fed back to the experts in round 2. In round 2, the experts had the option to repoll their responses based on the feedback received from other experts or they could repeat their previous responses. It was important to have a second round because it allowed all experts to rank the additional challenges that were identified in round 1 (question 2). The responses from the first and second rounds were then compared and a decision was made to end the study after two rounds as the results showed only minor changes.

4.2. MAGNET model

The MAGNET model is based on the GTAP database with a particular focus on the global agricultural sectors. Woltjer *et al.* (2014) provide a detailed description and assumptions of MAGNET. Apart from its flexibility, which allows users to apply for different extensions, a noted advantage over the standard GTAP model is that the MAGNET model accounts for the heterogeneity of the return to capital (i.e. wage) and land (i.e. rent) between agricultural and nonagricultural sectors. Thus, the factor transfer over these sectors is made sluggish (Sartori *et al.* 2019). In contrast to the standard GTAP models, which do not account for possible changes in the agricultural land use, land supply is assumed to be endogenous in MAGNET. This feature allows describing a supply curve between average real agricultural land rent and the land area in a region that is used for agriculture (Woltjer *et al.* 2014). In contrast to most of the general equilibrium models, MAGNET assumes differences in technological change across sectors (Woltjer *et al.* 2014). Moreover, for this analysis, the latest version of MAGNET is applied, which disaggregates the poultry sector from other livestock products. Given these advantages, this model has been widely applied by researchers and public institutes to assess the economic implications of agri-food trade policy scenarios (e.g. Boulanger and Philippidis 2015; Helming and Tabeau 2018).

As a first step, a comprehensive baseline is created that includes the phasing in of EU trade agreements between the years 2020 and 2030. The underlying trade policy and macroeconomic assumptions are documented by Hass *et al.* (2020) in more detail and updated for this analysis. The current version of the GTAP database does not include the CET by the ECOWAS and the Economic Partnership Agreement between Ghana and the EU. Thus, we included these assumptions in our baseline. As a result, the model approach includes tariff protection for all countries worldwide based on the 2017 protection structure, and by 2030 the data for the EU and ECOWAS countries have been adjusted according to the gradual implementation of trade agreements. For the update of the protection structure, we apply the TASTE program developed by Horridge and Laborde (2008) and updated by Pelikan *et al.* (2020). TASTE allows us to prepare tariff shock files at a detailed sectoral level (HS6). Building on the baseline, five scenarios regarding protection policies are created (see Fig. 5):

1. Decreasing the import tariff rate of maize (abbreviation: Maize Tariff_0%): The first scenario presents an expanding tariff wedge by abolishing 5 per cent import tariff rates of maize (i.e. livestock feeds).
2. Increasing the import tariff rate of poultry (abbreviation: Poultry Tariff_40%): This scenario is translated as an expanding tariff wedge by increasing import tariff rates of poultry meat (i.e. final product) from 35 per cent to 40 per cent.
3. Increasing the import tariff rate of poultry (abbreviation: Poultry Tariff_99%): This scenario presents an expanding tariff wedge by increasing import tariff rates of poultry meat from 35 per cent to 99 per cent (the maximum bound rate). This scenario is supported by WTO regulation that allows Ghana to increase the tariff rate to the maximum bound rate of 99 per cent.

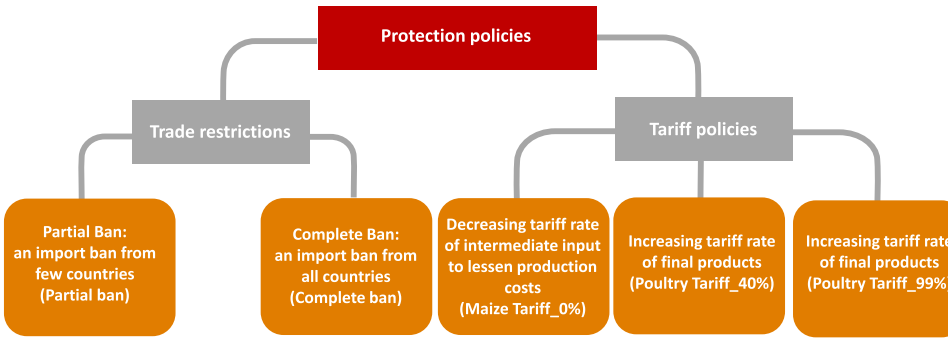

Figure 5. Scenario structure.
Source: Own presentation.

4. Partial ban: an import ban for poultry products from the Netherlands, Germany, Russia, and the UK.[3] This scenario reflects the recent partial ban by Ghana and it is formulated according to an official document. Although we have no information on the ban termination, we assume that the partial ban will be maintained for the period 2020–30.
5. Complete ban: the last scenario reflects an import ban for different poultry products from all trading partners for the period 2020–30. As mentioned above, this scenario is supported by poultry stakeholders according to our interview in Ghana.

In the context of CGE models, the import ban scenarios have been implemented in different ways. In the traditional approach, the ban is defined by increasing tariff rates to prohibitively high levels, which in turn causes the reduction in imports (Anderson *et al.* 2005; Henseler *et al.* 2013). Alternatively, Philippidis (2010) and Boulanger *et al.* (2016) formulate the base scenario by reducing domestic demand for imports. These analyses apply the same technique for implementing a ban with a different interpretation. In Philippidis (2010), reducing consumer consumption is rationalized by reduced confidence in the quality of the imported product, while in Boulanger *et al.* (2016), utility reduction implies that consumers are being denied access to their preferred set of imported products. We implement the import ban with the help of the import-augmenting technical change variable 'ams_{irs}', which can be used to lower effective prices of imported products. Equation 1 presents the effect mechanism of ams_{irs} on trade flows (Corong *et al.* 2017):

$$qxs_{irs} = -ams_{irs} + qim_{irs} - \varepsilon_i [pms_{irs} - ams_{irs} - pim_{is}] \quad (1)$$

where qxs_{irs}, qim_{irs}, and pms_{irs} respectively denote the percentage change in the exports (qxs) and imports (qim) of commodity i from country r (source) to country s (destination). pim_{is} presents the market price of an import into the country of destination. ε_i is the elasticity of substitution among imports in the Armington (1969) structure. To implement the ban, we change the closure of the model. qxs is changed to an exogenous variable and ams to an endogenous variable. In this way, we can reduce exports to Ghana by 100 per cent by implementing a shock on qxs.

4.3. Typical farm approach

The typical farm approach was used to construct empirically grounded farm data sets by using interviews with farmers, focus groups, and an in-depth literature review. The farm interviews and focus groups were conducted in February and March 2020. The constructed 'typical farms' were then used to analyze the economic performance of broiler chicken farms in Ghana. The results from the typical farm approach were not linked to the MAGNET

simulation results. However, we used the results from the typical farm approach to better interpret the results of MAGNET on the farm level. As stipulated by Chibanda *et al.* (2020), we applied the typical farm approach in a series of the following steps:

5. Step 1: the most important broiler production regions and most prevalent broiler production systems in Ghana were identified through an in-depth literature review and consultation of local experts. The most common broiler production systems identified include small-scale, medium-scale, and large-scale integrated commercial production systems.
5. Step 2: broiler farms with characteristics representing the identified typical broiler production systems were selected and visited. Data were collected from the farms through semistructured interviews. A standard questionnaire was used to conduct the semistructured interviews. The questionnaire was divided into two main parts, including the whole farm level part and the broiler production part. The farm observations were used to gain a deeper understanding of the characteristics of each production system.
5. Step 3: focus groups were used to typify the individual farm data collected in step 2 and to construct typical farms through recalibrating the farm data. A total of three focus groups were held, one for each production system. Each focus group was composed of ten participants, including five poultry producers, three local experts (extension or veterinary officers), and two local researchers. Chibanda *et al.* (2020) define the typical farms we constructed in step 3 as 'virtual' farms representing the most common farm types within specific production systems and regions. A total of three focus groups were held, one for each identified production system. Each focus group was composed of ten participants that included five producers, three extension officers, and two local researchers.
5. Step 4: the Technology Impact Policy Impact Calculations (TIPI-CAL) model was used to analyze typical farm data. TIPI-CAL is a computer-based policy impact assessment tool used in farm economic analysis as it allows a detailed analysis of farm-level variables (Kress and Verhaagh 2019). Chibanda *et al.* (2020) provide an in-depth explanation of the different farm economic analyses that can be performed with TIPI-CAL.

5. Results

Fig. 6 presents the key challenges facing the Ghanaian poultry meat sector. The challenges were identified and ranked through a Delphi study. The results show that frozen chicken imports and high feed costs are perceived to be the most important challenges facing the sector. Furthermore, most of the poultry industry experts interviewed indicated that poultry imports are hindering the development of the sector. The experts suggested that a complete ban on imports would be beneficial for the sector and the wider economy. Therefore, these findings formed the basis for us to run the complete ban scenario in the next step. Alternatively, we analyze the effects of increasing the tariff rate of poultry meat and decreasing the tariff rate of feed products as an instrument to reduce feed costs.

In the CGE model framework, we implemented the ban scenarios on imports of poultry meat, live poultry, eggs, and breeding animals' subsectors. According to the UN Comtrade data set (2019), there are few imports of breeding animals to Ghana. Thus, the egg and breeding animals' subsector mainly shows the changes in egg imports, of which, according to industry experts, the majority of the imported eggs are hatching eggs.

The effects on Ghanaian imports resulting from the partial and complete bans as well as tariff policy scenarios are displayed in Fig. 7. While the partial ban only results in small changes in total imports, the complete ban scenario will also affect other sectors. Here, crops (containing seeds for fodder plants) and maize imports increase when a complete ban on

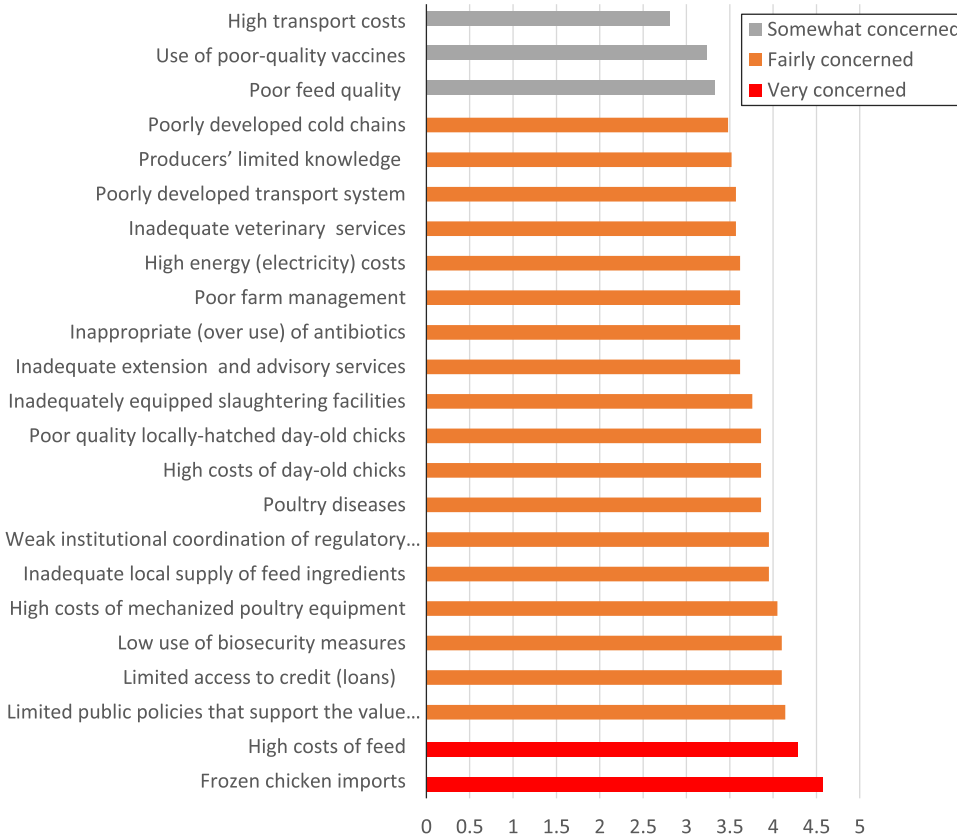

Figure 6. Ranking of key challenges facing the poultry meat sector.
Source: Own calculations based on the Delphi study.
Note: The mean values were interpreted following the guidelines developed by the Australian government for internal purposes (Wrench, 2013). 2.61–3.40 somewhat concerned (grey), 3.41–4.20 fairly concerned (orange), 4.21–5.00 very concerned (red).

poultry products is enforced. These products are used as inputs into poultry production. Through the typical farm approach, we calculated the proportions of key poultry feed ingredients used by typical broiler farms in Ghana. The feed used by these farms is composed of maize (57–60 per cent), soy meal (20–24 per cent), wheat bran (7–12 per cent), fish meal (2–5 per cent), broiler concentrate (5 per cent), and palm kernel cake (2.5 per cent). Additionally, the imports of beef and dairy subsectors increase after the complete ban. This is explained by lower domestic production of these products due to higher feed costs (i.e. maize and fodder plants), as the demand of the poultry sector for feed increases substantially.

As expected, poultry meat imports decrease substantially in response to the higher tariff rate. However, increasing the tariff rate from 35 per cent to 40 per cent has a significantly less pronounced protection effect compared with the maximum bound rate of poultry meat in Ghana, i.e. 99 per cent. This policy intervention results in an increase in live poultry (day-old chicks) imports, which in turn can be used in the domestic production process. As the current import duty of maize is already low (i.e. 5 per cent), we may not expect a significant change due to the import liberalization of maize. Additionally, Fig. 7 reveals that import demand shifts to other animal products like dairy and beef. Since the initial value of these imports is low, the additional quantities that cross the borders are also not high.[4]

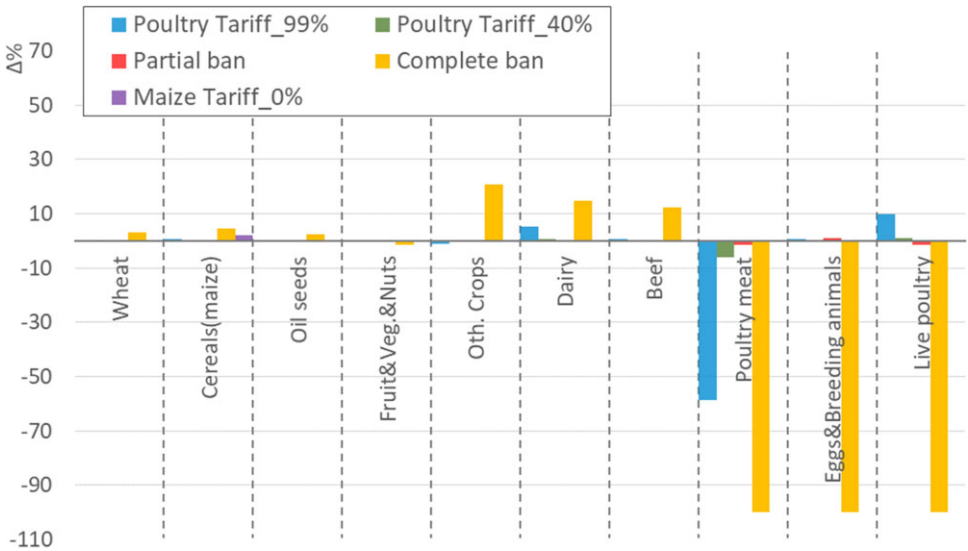

Figure 7. Change in import values relative to the baseline in the year 2030.
Source: Own calculations with MAGNET.

Why is the effect of a partial ban so small? Although the imports from the Netherlands, Germany, UK, and Russia to Ghana become zero, the total imports remain relatively constant. As shown in Fig. 8, the market shortage in the Ghanaian poultry market due to the partial ban is mainly compensated for by imports from Brazil and the USA. Thus, the shares of these countries increase after the partial ban. Additionally, our findings display a similar pattern for the egg market. However, the partial ban causes the share of African, Asian, and other European countries to rise significantly in regard to the total import of egg products. Although the import of maize does not change significantly in total, this policy causes the share of the US and other African countries to increase in the Ghanaian maize market. The results from the model are consistent with the findings from the semistructured interviews. According to hatchery managers who were interviewed, the partial ban will most likely increase the number of imports of hatching eggs from nonbanned countries like Belgium, Turkey, Egypt, Ivory Coast, South Africa, and Brazil.

Fig. 9 presents the change in production based on historical data and supplements this with the results of the simulations. According to UN Comtrade data, poultry production in Ghana increased by 164 per cent from 2000 to 2010. In the next decade, the increase is 59 per cent. In our simulation, we focus on the period between 2020 and 2030. Although we consider GDP growth rates and population growth in our baseline, we project an increase until 2030 by only 20 per cent. Growing demand in Ghana is mainly met by additional imports. Increasing the tariff rate to a level of 99 per cent has a significant effect on the domestic production of poultry meat; however, the reduced cost of poultry production due to the maize market liberalization is not significant enough to be passed on to the final product. The current tariff rate of maize imports is only 5 per cent, which may not change the price of the final product significantly. Moreover, a partial ban resulting from avian influenza would increase production by 5.4 per cent in 2030 relative to the baseline. However, if a total import ban as suggested by the experts is implemented, then production could increase in a range of 231–254 per cent[5] relative to the baseline. Is a production increase of this magnitude possible? Which producers will benefit the most from this? An answer to these questions is provided by the analysis of typical farms. According to Amanor-Boadu *et al.* (2016), broiler farms that are fully operational in Ghana can run up to 6.5 production cycles

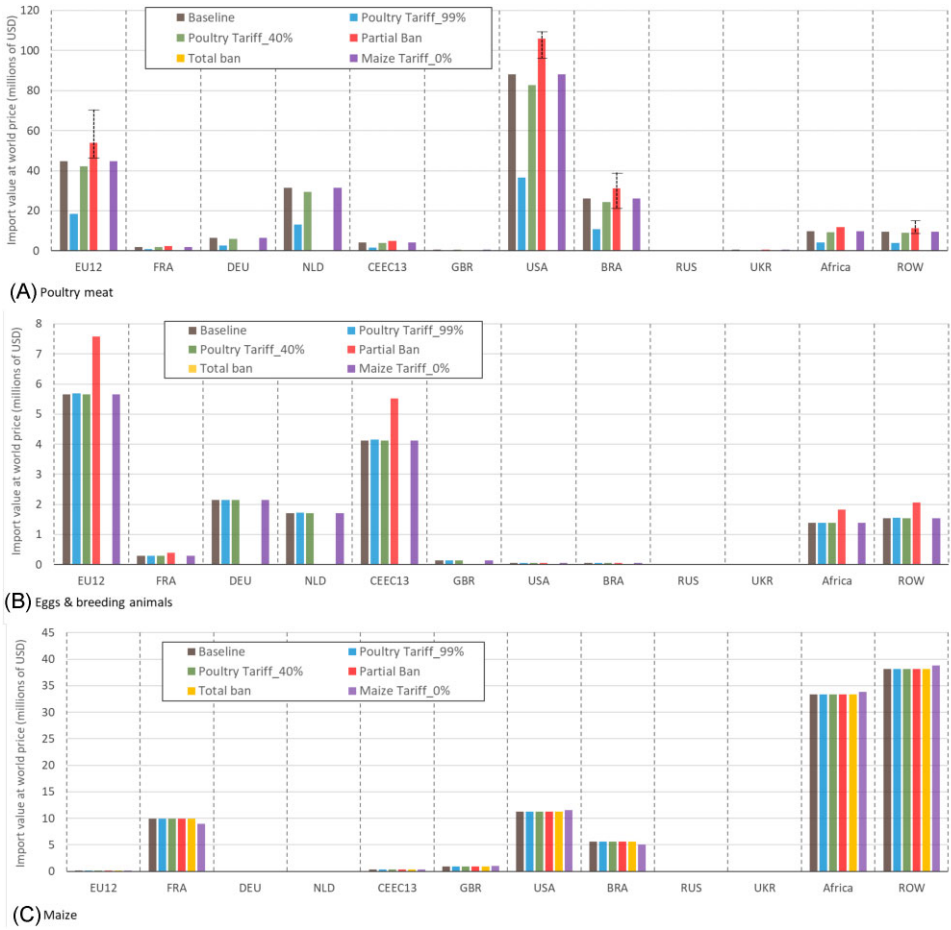

Figure 8. Import value to Ghana from different countries/regions (millions of USD).
Source: Own calculations with MAGNET.
Note: Intervals in partial ban scenario—to ensure that our findings are not driven by parametric uncertainty, we provide a sensitivity analysis by changing importers' substitution elasticities of poultry meat in the Armington aggregation structure. Thus, we decrease and increase the elasticities of substitution among imports from different destinations by 50 per cent. The import value changes over the intervals indicated in the graph.

per year. However, Table 1 shows that all three typical broiler farms run only around three production cycles per year. Producers who participated in the typical farm focus groups revealed that due to the low-priced frozen chicken imports, locally produced broiler meat is only marketable during peak demand periods[6] (i.e. Christmas, Easter, and Eid Al-Fitr). These findings are in line with the studies conducted by Amanor-Boadu *et al.* (2016) and the Netherlands Enterprise Agency (2019), which conclude that the Ghanaian broiler market is seasonal as production takes place mainly for the festive holidays. Therefore, a complete ban on imports would result in current producers easily increasing their production by 117 per cent by running 6.5 cycles per year. The rest of the increase could be accounted for by new producers attracted to poultry production or an increase in the number of birds per cycle by current producers.

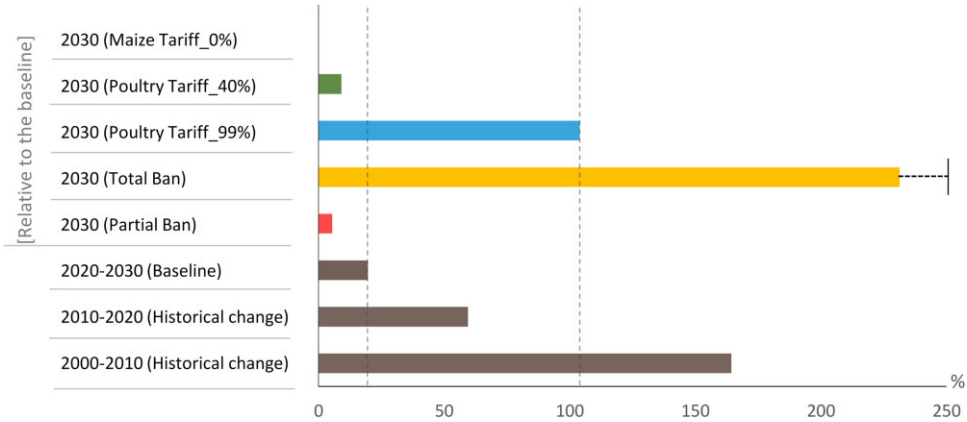

Figure 9. Percentage changes in the production of poultry meat in Ghana.
Source: Data set 2000–20, USDA (2019); Baseline and Scenarios, own calculations with MAGNET.
Note: Intervals in total ban scenario—we provide a sensitivity analysis by varying importers' substitution elasticities of poultry meat for Ghana by 20 per cent. The intervals show the range in which domestic production may change. The percentage changes 2020–30 (baseline), 2010–2020 (historical change), and 2000–10 (historical change) are relative to the years 2020, 2010, and 2000, respectively. The scenario results are the changes in 2030 relative to the baseline (2020–30) of our model.

Table 1. Characteristics of typical broiler production systems in Ghana.

	Small-scale commercial	Medium-scale commercial	Large-scale integrated
Farm size	<5,000 birds per year	5,000–20,000 birds per year	>20,000 birds per year
Farm location	Urban and peri-urban areas	Urban and peri-urban areas	Urban and peri-urban areas
Feed source	Commercial feed mills	Commercial feed mills	Operate their own feed mills
Day-old chicks	Exotic breeds that are often imported	Exotic breeds that are often imported	Farms often own a hatchery and produce their own exotic breeds
Marketing	Live birds sold in local communities, live markets, and to small restaurants	Live chickens are sold in live markets and to traders	Chickens are often slaughtered on the farm, and sold to retailers and restaurants
Type of labor	Family labor; 1680 hours/year. Casual labor; 1440 hours/year	Family labor; 1,152 hours/year. Permanent labor; 6,720 hours/year	Permanent labor; 26,136 hours/year
Number of cycles per year	3.72	3.00	3.00
Average selling price of chickens (euro/kg live weight)	2.22	1.38	2.68

Source: Own calculations based on typical farm analysis.

Table 2. Changes in the Ghanaian GDP under different scenarios.

	GDP (millions of USD) in 2030	Percentage change (per cent)
Baseline	76,357	–
Scenarios:		
Partial ban	76,331	−0.03
Complete ban	76,356	−0.00
Poultry Tariff_40%	76,351	−0.01
Poultry Tariff_99%	76,273	−0.11
Maize Tariff_0%	76,351	−0.01

Source: Own calculations with MAGNET.

According to Asante-Addo and Weible (2020), besides the poultry meat imports being more affordable than local chickens, consumers in Ghana buy more chicken imports than local chickens because the imports are available in cut pieces or as dressed chickens, which make preparation more convenient. Table 1 presents the characteristics of typical broiler production systems that were identified. The results show that large-scale broiler farms are the most vertically integrated farm type as they operate their own hatcheries and slaughterhouses. Consequently, the large-scale farms are the only farm type that is selling slaughtered chickens. Therefore, the status quo of the different farm types suggests that, in the short term, large-scale farms are better positioned to take advantage of the complete ban and satisfy the demand for processed chickens. Similar to the experiences of Senegal (FAO, 2014) and Cameroon (GIZ, 2018), which placed poultry trade-restrictive measures, small- and medium-scale farms in Ghana are also expected to gradually increase their production. Moreover, an increase in poultry meat production will most likely lead to increased urban employment as the typical farm analysis shows that broiler farms in Ghana are more prevalent in urban and peri-urban areas. The typical farm analysis also shows that medium- and large-scale farms employ the highest number of people; therefore, such farm types are expected to boost urban employment if they increase production. Furthermore, an increase in local broiler production will most likely have positive knock-on effects on slaughterhouses. According to slaughterhouse managers who were interviewed, the few existing formal slaughterhouses are operating below their capacities (small-scale slaughterhouses are processing around 19 chickens/day, and large-scale slaughterhouses are processing around 100 chickens/day) because of the low quantities of chicken meat delivered for processing. Furthermore, the managers also underlined that the seasonality of domestic broiler production negatively affects slaughterhouses as they have an irregular supply of chickens to process.

Finally, it should be noted here that the focus of this analysis is on producers. In the overall economy, import bans are often associated with welfare losses. The decline in GDP as a result of the partial ban would be 26 million USD (Table 2). But, GDP would fall by 1 million USD as a result of a complete ban. Although GDP is not reduced that much at any point due to the increase in domestic production, the slight reduction in GDP (remaining 1 million USD) might be related to the reduction in government tariff revenue following the complete ban. We have not quantified the benefits of preventing avian influenza, as it is not explicitly captured by the model. However, it can be assumed that an outbreak can be prevented at relatively low costs if imports are banned only from specific countries. When interpreting the results of a complete ban, it should be kept in mind that, in reality, illegal imports are often carried out when a country imposes a ban. This would reduce the positive effects on producers and would have an additional negative effect on consumers, as cold chains are more frequently not adhered to in illegal trade. Although increasing the import duty of poultry meat results in a negative effect on the GDP, the reductions in the GDP increase at a diminishing growth as the tariff rates rise. Liberalization of the maize market

has the same negative effect of increasing 5 per cent tariff rate of poultry meat on GDP. As shown, both scenarios lead to 0.01 per cent reduction in GDP.

6. Conclusion

This study analyses the potential effects of alternative tariff policies and trade restrictions on the domestic production of poultry in Ghana. The scenarios for this study are based on the qualitative results of a Delphi study. To capture the spillover effects of these trade policies on different stakeholders, we apply a hybrid method that combines a CGE and the typical farm approach allowing us to project the results of alternative policies for different farm types.

Our findings imply that the potential effects of expanding the tariff wedge between final and feed products by 5 per cent, either through increasing the tariff rates on the final product or by abolishing the tariffs on feed products, is small. Due to the low tariff rate of maize, a reduction in production cost driven by market liberalization is not large enough to change the poultry meat production significantly.

Further, we simulated the effects of a partial import ban on poultry products from the Netherlands, Germany, Russia, and the UK. Our findings show that imports of corresponding products do not change significantly due to the partial ban. This pattern is driven by a 'cushioning' effect through trade diversion by increasing the import shares of other competitors to the food market of Ghana. The partial ban causes the export shares of US and Eastern European countries to increase in the sectors of 'poultry meat' and 'eggs & breeding animals' of Ghana, respectively. Our simulation suggests that the partial ban that protects the Ghanaian producers from an outbreak of avian influenza comes with relatively low costs for the domestic market. However, increasing the tariff rate on the final product to the maximum level of bound tariff (i.e. 99 per cent) and a complete ban have larger effects on the value chain and cause the domestic production to increase by 104 per cent and up to 254 per cent, respectively.

The study also reveals that in the short term, large-scale farms are better positioned to take advantage of the tariff increase or an import ban, while small and medium farm types are expected to gradually increase their production. The Ghanaian broiler market is seasonal, with peaks in the festive holidays. Therefore, by increasing the number of production cycles per year, output could be increased. Considering the potential capacity of domestic producers, a complete ban on imports would result in current producers increasing their production substantially, of which a rise in production will most likely result in increased employment in medium- and large-scale farm types located in urban and peri-urban areas.

Although the modeling results show that a complete ban will result in increased local production, there are several challenges that producers will have to overcome. In this regard, the Delphi study shows that a number of the issues directly affecting producers are related to high costs of production (i.e. high feed costs, high costs of machinery, high costs of chicks). Therefore, reducing production costs would most likely enable producers to produce more, encourage more producers to engage in broiler production, or might lead to lower consumer prices of locally produced chicken meat. Moreover, considering the significant level of cross-border trade in West Africa, the ban policy may increase the risk of illegal trade. However, we have no information on illegal trade to estimate the potential effects of the ban. Another limitation of our analysis goes back to the long-term structural effects of the protection initiatives. It might be difficult to relax a ban again after a long-term implementation as the producers may not be competitive on the world market anymore. Furthermore, the study does not analyze how consumers may be affected by the different policies. Even though the effect of the partial ban is minor overall, the tariff policy and the complete ban may increase the price of final products, which may be passed through to the final consumer and

in turn affect food security. Therefore, analyzing the long-term effects of protection policies on domestic consumers and food security might be a venue for future research.

End Notes

1. The self-sufficiency rate increased slightly from 2012 to 2015, which might be explained by two policy interventions to support domestic production. The government cut the tariff rate of poultry input in 2013 and later launched the Ghana Broiler Revitalization Project (GHABROP) in 2014 intending to reduce the cost of production (FAO 2015; Netherlands Enterprise Agency 2019).
2. Increasing a tariff wedge with the stage of processing is known as tariff escalation in the policy literature (Hwang *et al.* 2017).
3. According to the UN Comtrade, exports from Denmark to Ghana are minor. Thus, we have taken Denmark out of our analysis.
4. Our analysis does not show any change in the world market for poultry, as Ghana is not a large country (from an economic perspective).
5. We changed the standard GTAP Data Base to differentiate these elasticities (ESUBD) by product and by country and reduce the elasticity in a sensitivity analysis for Ghana by 20 per cent to receive that range. This is because studies such as those summarized in Asante-Addo *et al.* (2020) suggest that the substitutability of domestic and imported poultry in Ghana is not as high as in other countries.
6. According to FAO (2014), the price of frozen chicken imports is usually lower than locally produced chicken meat.

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Data availability

Data are available upon request.

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