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Impact of Changes in Agriculture Import Tariffs on Afghanistan's Food Availability and Macroeconomic Factors

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ABSTRACT

Afghanistan grappled with a severe food insecurity crisis, with two out of every five individuals experiencing acute food insecurity. The country heavily relied on imports, with cereals accounting for 66 percent of imports and wheat accounting for 73 percent of calories. This study scrutinized the influence of changing agricultural import tariffs on macroeconomic variables and food availability. The short-term impact of agricultural import tariffs was evaluated using GAMS software, utilizing a computable general equilibrium model and a social accounting matrix. Four diverse scenarios were investigated, focusing on changes in import tariffs for various agricultural products. The findings revealed that lower tariffs resulted in augmented imports and declined domestic output, whereas the opposite trend occurred with tariff upsurges. Scenario C analysed the effect of a 50 percent change on the agricultural import tariff rate of 6.12 percent. Wheat imports increased nearly 1 percent with a decline in tariffs, while they diminished by almost 22 percent with a surge in tariffs. All agricultural categories were affected, except for opium and forestry. The study volumes, lower labor and capital sharing rates, higher supply prices, and lower domestic output. To ensure food security, the government needed to advocate for scenarios that reduced tariffs, particularly through a comprehensive liberalization policy.

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INTRODUCTION

Afghanistan's agricultural economy is characterized by diversity, with a significant portion of rural residents engaged in subsistence farming. Major crops cultivated include wheat, rice, maize/millet, and various fruits and vegetables (FAO, 2021). Approximately 61.6% of Afghanistan's workforce is employed in agriculture, accounting for 23% of the country's GDP.

About 70% of Afghans reside in rural areas, where 61% of households derive their livelihood from agriculture (Worldbank, 2010). Private entities, including farmers, cooperatives, input suppliers, herders, agribusiness processors, and traders, predominantly manage the agricultural sector (Muradi, 2018). A substantial body of research exists, primarily focusing on the cereal trade due to its significant contribution to the global food supply.

Additionally, several studies consider agriculture as a proxy for food availability and Access (Wang & Dai, 2021; Dupas et al., 2019; Raj et al., 2022). Food availability and accessibility are vital aspects of attaining food security in developing countries (Muradi, 2018; Mateme-Maetz, 2013). The food trade plays a pivotal role in food security, with global trade integration increasing the variety of national food suppliesompared to production diversity since the mid-20th century (Aguiar et al., 2020; Hertel et al., 2021). The 2021 UN Food Systems Summit highlighted the significant role of trade in promoting food diversity as well (Hendriks et al., 2021). The varied food options often lead to increased reliance on imports for food security, but this is not problematic when there is adequate connectivity and redundancy in the system (Kummu et al., 2020).

Currently, the country faces a severe food insecurity crisis, with 44.6% of its population unable to access sufficient food (CSO, 2018; FAO, 2018). Two out of every five individuals in the nation suffer from high levels of acute food insecurity due to political, economic, and climatic shocks (FAO, 2023; IPC, 2023). Afghanistan ranks 109th out of 121 nations in terms of hunger (GHI, 2022). Despite agriculture's pivotal role in ensuring food availability in Afghanistan, its contribution to the country's GDP has declined from 44% to 23% since 2004 due to the absence of supportive government policies. Moreover, Afghanistan's hilly terrain and limited water resources make only 12% of the land suitable for agriculture, posing challenges for meeting the population's food needs.

As a result, Afghanistan heavily relies on imports from neighboring nations. In 2022, the World Bank and FAO reported that the agricultural sector accounted for 66% of all imports into the country, with cereals comprising 13% of all agricultural imports, followed by fruits, vegetables, and livestock products. Cereals, particularly wheat, serve as the staple food, accounting for 73% of calories consumed in Afghanistan. The country produces approximately 6.5 thousand tons of cereals, with wheat being the primary crop. Given that imports contribute nearly 40% to Afghanistan's GDP, this study aims to examine the effects of changing agricultural import tariffs on macroeconomic variables and food availability. Governments worldwide have implemented various measures, such as food reserves, agricultural subsidies, and price controls, to ensure food security in response to food crises (Fahad et al., 2023; Garrone et al., 2019). Afghanistan utilizes import tariffs as a policy tool to regulate imports of various goods, including food, textiles, heavy machinery, and automobiles. Import tariffs in Afghanistan vary, with automobiles and salt having the highest tariff rates, while furniture, fruits, nuts, processed marble, and carpets have lower rates set at 25% (Worldbank, 2012). The expanding import of food in Africa and other developing nations has led to the enactment of trade barriers and tariffs (Del Villar & Lancon, 2015). Afghanistan

imposed a 3.5% import tariff on wheat and flour in 2007, which was removed in 2009 due to price surges. Subsequently, a 10% tariff was imposed in 2010 to safeguard producers from falling prices, which was reduced to 5% in 2012 due to adverse growth conditions (Schulte, 2007; Ogama, 2013). Currently, short-term decisions in Afghanistan determine agricultural import tariffs rather than a long-term, sustainable strategy. This study aims to determine the appropriate level of import tariffs for agricultural products in Afghanistan using a computable general equilibrium (CGE) model, as no prior studies have employed this model in the agricultural sector of Afghanistan. The specific objectives of this study are:

1. Evaluate the impact of agricultural import tariffs on food availability in Afghanistan.
2. Assess macroeconomic factors affected by changes in import tariffs.
3. Recommend suitable tariff levels to enhance food security.

A recent strand of studies has explored the economic impact of trade policy on agriculture, utilizing CGE models to bolster agricultural output, enhance food security, and improve societal welfare. However, no domestic studies have applied the CGE model to agricultural trade in Afghanistan. The following section of this introduction reviews relevant international literature on the subject. (Mukhopadhyay et al, 2018) Conducted a study on China's food security in 2050 using the Global Trade Analysis Project's general equilibrium model framework. The results showed that a reduction in meat tariffs favorable to China impacted its food security, while agricultural land needs to be protected against urbanization and industrialization. (Arizne & Odior, 2023) assisted in a study on the impact of changes in import tariff rates on household welfare in Nigeria. They utilized a static CGE model to simulate four scenarios: 50% and 20% tariff rate reductions and 50% and 100% tariff rate rises from 2019 base year. The study found that a surge in import tariffs had an inverse relationship with household income and consumption volume. The research also revealed that an increase in tariffs would lead to higher prices overall. In the short term, both real income and consumption would benefit from tariff contractions. (Harold Glenn et al, 2023) exercised the shock of border tariffs on staple cereal prices in developing countries. They adopted the GTAP global economy-wide model to scrutinize 27 nations and 8 regions. They realized that while cereal costs may come down when border tariffs are lifted, the impact is more noticeable for wheat in Kenya and Japan, other cereal grains in South Korea, and all staples in Nepal. (Ramakrishna et al., 2023) delved into the brunt of a 95% deduction in import tariffs on macroeconomic variables in Ethiopia. The inquiry applied the Recursive Dynamic Computable General Equilibrium Model to gauge the long-term ramifications of key macroeconomic variables. The conclusion exhibited a negative repercussion on the main macroeconomic variables and long-term financial instability. (Adhikary et al., 2023) inspected the eventuality of the free trade agreement on Nepal's agriculture industry using a general equilibrium model. They revealed that abolishing 50% of non-tariff measures and 100% of tariffs led to a $28 million cutout in commodity imports and a $231 million hike in exports. (Elahi et al., 2020) established that the free trade agreement between Iran and Eurasia will boost trade, with the EAEU's exports to Iran benefiting more than the other partners. The

main export benefits are expected from the textile, polymer manufacturing, metals, and agricultural food industries, particularly fruits and vegetables. (Nesongano & Talent, 2022) explored the implications of trade liberalization on the Zimbabwean economy. The findings demonstrate that trade liberalization shortens import prices. The market will have dwindled prices for consumers as a result of the tariffs on imported goods being lifted. (Akbulut & Egen, 2021) delved into the impact of trade reforms on Turkey's formal and informal labor markets. They put together a computable general equilibrium model. The findings demonstrate a negative correlation between tariff rates and informal labor employment, but an affirmative correlation exists between total formal labor employment and tariff rates. (Workneh & Tsehay, 2024) examine the consequences of import tariff shocks on the Ethiopian economy's fiscal policy. The study results exhibited that reducing tariffs by 50% augmented income and consumption expenditures for most households but cynically affected household welfare. Imports, exports, and investment increased in response to tariff cuts, but diminished tariffs depressingly affected household welfare, government consumption, private consumption, and GDP. (Dan & Claudius, 2010) highlight that Ethiopia's trade performance is hindered by high tariffs, which reduce trade's contribution to GDP and tax income. (Kebede et al., 2016) scrutinized the trade liberalization in Ethiopia. The results portray a short-term, unfavorable influence on real GDP. The study also scanned the relationship between trade liberalization, growth, income distribution, and poverty. However, the findings reveal conflicting evidence on the effects of trade liberalization on growth, income distribution, poverty, and welfare, with these sequels varying over time. (Annabi et al., 2005) utilized the CGE model to study the effect of trade liberalization on Senegal's growth and poverty. They discussed that tariff elimination led to amplified inequality and poverty decline, but over time, it improved welfare, reduced poverty, and improved capital accumulation.

METHOD AND MATERIAL

The International Food Policy Research Institute's standardized computable general equilibrium (CGE) model was utilized in the study (Lafgren et al., 2001) The computable general equilibrium model is a set of interconnected nonlinear equations and constraints that aims to understand the dynamics of prices, supply, and demand in the economy by examining market interactions. It is based on Walras' law, which states that at all prices, the value of surplus demand is zero. This model assumes perfect competition, full employment, and constant returns to scale in a small and open economy. However, it has drawbacks, including its limited scope, which only models one country, and its application to a specific time period. It also overlooks the advantages of savings, recreation, and public goods to families and society at large.

Additionally, it lacks capital and financial markets for the exchange of financial products. This model is further divided into static and dynamic models, with the role of capital being a key distinction. The study employs a static, computable general equilibrium model for Afghanistan due to data limitations. This model is widely used in policy analysis due to its adaptability to the features of emerging nations and is based on the Biruni Institute's Social

Accounting Matrix (SAM). The Afghanistan SAM was created using data from sources like the National Statistics and Information Authority's Input-Output Table 2018, the Afghanistan Living Conditions Survey, and the Ministry of Finance Fiscal Bulletins. The SAM's calibration process used elasticity values from the literature to estimate the shift and share parameters of the constant elasticity of substitution and the constant elasticity of transformation functions. Assuredly, Armington elasticities with varying rates were estimated for various items (Kafaei & Amiri, 2011), while transfer elasticities for cereals, fruits, vegetables, livestock, forestry, and opium were estimated at 0.9 (Saeednia et al., 2020).

Model Equations

Producers aim to maximize profits based on available technology. The producing function is a two-step procedure. At the lowest level, Cobb-Douglas production technology is used to presume that the combination of labor and capital yields value added (Equation 1).

$$\boldsymbol{VA_j = b_i \prod_f FD_{fi}^{\beta_{fj}}} \quad (1)$$

In the higher stage, the Leontif production function is used to combine intermediate inputs and added value to produce the final goods.

$$Y_j = min\left(\frac{Xji}{ax_{ji}}, \frac{VAj}{ay_i}\right)$$

By using the previously indicated techniques, all producers maximize their profit relative to their production, leading to the determination of the following formulas:

$$Xji = ax_{ji}.ax_{ji} \quad \forall j \quad (2)$$

$$VA_j = ay_i \,.Y_j \quad \forall i \quad (3)$$

$$FD_{fi} = VAj \,.\frac{\beta_{fj} \,.PNj}{Wf} \quad (4)$$

$$PS_i = ay_i \,.PNj + \sum_j ax_{ji} \,.PQj \quad \forall i \quad (5)$$

In this case, the household budget will determine how to maximize the utility function. Equation (6) will be obtained as a result.

$$C_j \, PQ_i = \delta_{Cj}(\sum_f Wf \,.FS_f - TAX_{dir} - SAV_h) \quad \forall j \quad (6)$$

It is a given that taxes are how the government makes money. The money received by the government will go toward savings and operating costs.

$$TAX_{ind.i} = tx_i \,.PS_i.Y_i \quad (7)$$

$$TAX_{dir} = td \,.\sum_f Wf \,.FS_f \quad (8)$$

$$TARIFF_i = tm_i \, PM_i \, M_i \quad (9)$$

The entire investment is the same as the total savings from all sources combined—private, public, and international. It is considered that foreign savings determine the currency rate and trade balance as an exogenous variable.

$$SAV_h = S_h \sum_f Wf \,.\, FS_f \tag{10}$$

$$SAV_g = S_g \left(\sum_j TAX_{ind,j} + \sum_j TARIFF + TAX_{dir} \right) \tag{11}$$

$$SAVING = (SAV_h + SAV_{gow} + SAV_{fr}) \tag{12}$$

$$SAVING = INVESTMENT \tag{13}$$

$$ID_j \,.\, PQ_j = \mu_j \,.\, INVESTMENT \tag{14}$$

It is believed that there is a small country in the realm of foreign trade. Therefore, global import and export prices are constant.

$$PE_j = pwe_j \,.\, EXR \tag{15}$$

$$PM_j = pwm_j \,.\, EXR \tag{16}$$

It is assumed that imports are imperfect substitutes for domestic products. They show the relationship between imports and domestic production as a function of the constant elasticity of substitution (CES), which is known as Armington's hypothesis.

$$Q_j = \gamma_j \, (\alpha_{mj} \, M_j^{\rho_{mj}} + \alpha_{dj} \, D_j^{\rho_{mJ}})^{\frac{1}{\rho_{mj}}} \tag{17}$$

The demand functions for imports and domestic production will be obtained from the maximization problem in the form of equations (18) and (19).

$$M_j = \left(\frac{\gamma_j^{\rho_{mj}} \,.\, \alpha_{mj} \,.\, PQ_j}{(1 + tm_j)\, PM_j}\right)^{\frac{1}{1-\rho_{mj}}} \,.\, Q_j \qquad \forall j \tag{18}$$

$$D_j = \left(\frac{\gamma_j^{\rho_{mj}} \,.\, \alpha_{dj} \,.\, PQ_j}{PD_j}\right)^{\frac{1}{1-\rho_{mj}}} \,.\, Q_j \qquad \forall j \tag{19}$$

It is also assumed that export is an imperfect substitute for domestic production. The relationship between exports and domestic production is also expressed based on a constant elasticity of the transmission function (CET).

$$\boldsymbol{Y_j = \theta_J \, (\beta_{cj} \, E_j^{\rho_{mj}} + \beta_{dj} \, D_j^{\rho_{mj}})^{\frac{1}{\rho_{mj}}}} \tag{20}$$

The supply functions of exports and domestic goods will be obtained from the maximization problem in the form of relations (21) and (22), respectively:

$$\boldsymbol{E_j = \left(\frac{\theta_j^{\rho_{mj}} \,.\, \beta_{cj} \, (tx_j + PS_j)}{PE_j}\right)^{\frac{1}{1-\rho_{mj}}} \,.\, Y_j} \qquad \forall j \tag{21}$$

$$\boldsymbol{D_j = \left(\frac{\theta_j^{\rho_{mj}} \,.\, \beta_{dj} \, (tx_j + PS_j)}{PD_j}\right)^{\frac{1}{1-\rho_{mj}}} \,.\, Y_j} \qquad \forall i \tag{22}$$

The relevant prices can be used as an adjusting factor to equalize supply and demand in the labor force, capital, composite goods, and foreign exchange. The adjusting factors are the wage rate, interest rate, price of composite goods, and exchange rate, respectively.

$$\sum_i FD_{fi} = FS_f \qquad \forall_f \qquad (23)$$

$$Q_j = C_j + G_j + \sum_j X_{ji} \qquad \forall j \qquad (24)$$

$$\sum_j pwe_j \; E_J + SAV_{fr} = \sum_j pwm_j \; M_j \qquad (25)$$

In order to reach equilibrium, the price normalization equation is used. In this equation, the price index is fixed, and the changes in other prices are measured relative to this price.

$$PINDEX = \sum_j \omega_j \, PQ_j \qquad (26)$$

The New Classic model, a closed-loop system, applies an exogenous shock related to foreign remittances through the tariff variable in equation (9), assuming full employment and investment equal savings in all markets. The model was solved, and the scenarios were executed using the GAMS software. Appendix 1 contains the indices, variables, and parameters associated with the model equations.

Model Calibration

Table 1 lists the model parameters and calibrated values. This table shows that, for all agriculture categories, the export substitution elasticity in the transformation function is elastic, but the import substitution elasticity in the Armington function is inelastic. For every subsector of agriculture, there are variations in the share and transfer parameters in the Armington and transformation functions. Except for the elasticity parameter in the transformation function, all other parameters of this product are projected to be zero because the import and export of opium are not legally relevant issues.

Table 1. *Calibrated values and model parameters*

Parameter and Elasticity	Cereals	Fruits	Vegetables	Livestock	Forestry	Opium
Share parameters of imported goods in the CES function	0.4	0.5	0.5	0.1	0.2	0.0
Share parameter of domestic goods in the CES function	0.6	0.5	0.5	0.9	0.6	0.0
Transfer parameter in the CES function	1.9	2.0	2.2	1.6	1.6	0.0
Share parameter of export goods in the CET function	0.9	0.8	0.7	1.0	0.0	0.0
Share parameter of domestic goods in the CET function	0.1	0.2	0.3	0.0	0.0	0.0
Transfer parameter in the CET function	3.2	2.6	2.1	6.6	0.0	0.0
Armington elasticity substitution parameters	0.5	0.9	0.9	-0.7	0.5	0.0
Elasticity parameter in the CET function	2.1	2.1	2.1	2.1	1.5	2.1

Source: Author estimation

Definition of Policy Simulation Experiments

This research scrutinizes the implications of four distinct scenarios: A, B, C, and D. The scenarios are based on percentage changes in import tariff rates. The baseline scenario, which allows a 0% decrease or increase in the 2018 import tariff rate, is used to compare the

actual values of Afghanistan's import tariff rate. The study applies the Afghanistan tariff rate of 6.12% to all agricultural categories in 2018, aiming to determine the short-term effects on macroeconomic variables after calibrating the benchmark equilibrium parameters.

Table 2. *Import Tariff Rate Changes*

Scenarios	Base Year Tariff rate (%)	Tariff rate (%) change	Index	Adjustment Tariff rate (%)
Baseline	6.12	Benchmark equilibrium	Normalized index price =1.00	6.12
Scenario A	6.12	50% Reduction	50% below the base year tariff = 0.50	3.06
Scenario B	6.12	100% Reduction	100% below the base year tariff =	0.00
Scenario C	6.12	50% Increase	50% above the base year tariff = 1.50	9.18
Scenario D	6.12	100% Increase	100% above the base year tariff =	12.24

Source: Author estimation.

The details of the diverse scenarios delved into the percentages at which import tariffs will be changed for several agricultural categories.

- In scenario A, the study examines the impact of a 50% reduction in the 2018 import tariff rate. It applies a 3.06% tariff rate.
- In scenario B, the research scrutinizes the consequences of a 100% reduction in the 2018 import tariff rate. A complete removal (100%) of tariffs (full liberalization) is implemented.
- In scenario C, the study investigates the shocks of a 50% increase in the 2018 import tariff rate. The 9.18% tariff rate is utilized to compare the percentage change to the base-year value.
- In scenario D, the research trials the effects of a 100% increase in the 2018 import tariff rate (6.12 + 6.12 = 12.24%) to compare the percentage change to the base year values.

FINDINGS AND DISCUSSION

The study reveals a correlation between import tariff rates in the agricultural sector and macroeconomic variables. Reducing tariff rates leads to lower domestic production and higher imports, but this reverses when tariffs increase. Household demand for cereals increases, but domestic output declines and imports surge. Scenarios C and D analyze the effects of a 50% and 100% expansion on the agricultural import tariff rate of 6.12%. Household consumption increases with a decline in tariffs, while it diminutions by over 5% with a surge in tariffs. Raising tariffs results in a lower labor and capital share rate, with scenarios C and D resulting in a 29% capital share downturn and over a 12% labor share fall. The study's results align with previous research suggesting that additional policy measures are necessary to boost domestic food demand amidst the rise in import tariffs (Olabisi et al., 2021; Tian & Lin, 2023). As well, rising tariff policies may mitigate imports, boost domestic production, and potentially affect food security, according to preceding studies (Hertel et al., 2010). The rising scenario results are confirmed by (Arizne & Odior, 2023), who state that a surge in import tariffs has an inverse relationship with household consumption volume.

***Table 3**. Impact of the cereal import tariff changes on macroeconomics indicators.*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	118465.50	0.999516	44001.34	53869.61	36813.11	36924.12	13882.75
Scenario A	-2.33	-0.13	-2.59	-2.10	0.51	0.89	-3.17
Scenario B	-3.71	-0.21	-4.14	-3.37	0.82	1.41	-5.08
Scenario C	-21.76	-1.45	-12.13	-28.75	-5.56	-21.96	-30.16
Scenario D	-21.75	-1.46	-12.11	-28.73	-5.57	-21.75	-30.18

Source: Author estimation.

Discrete scenarios of changing import tariffs on fruits are shown in Table 4. Dropped import tariffs on fruits have led to a rise in the volume of imports, as seen in scenarios A and B. Although scenarios C and D recorded a slump of over 32% and 49%, respectively, household consumption also rose when import tariffs were diminished. However, it fell by more than 5% when import tariffs were upraised. The table also portrays that the rate of decline in exports, labor and capital shares, supply prices, and domestic production is higher when the tariff is raised than when it is lowered. Scholars suggest that the Special Safeguard Mechanism (The Special Safeguard Mechanism of the World Trade Organization provides a safeguard for developing nations, enabling them to raise tariffs on harmful agricultural imports) could curtail imports, boost domestic production, and potentially impact food security due to increased food prices in Special Safeguard Mechanism regions (Hertel et al., 2010).

***Table 4**. Impact of the fruit import tariff changes on macroeconomics indicators*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	88604.93	0.999817	36728.7	44966.39	57296.4	14496.22	16492.5
Scenario A	-4.86	-0.04	-5.12	-4.65	0.47	24.77	-4.99
Scenario B	-8.13	-0.06	-8.54	-7.80	0.78	41.69	-8.35
Scenario C	-22.28	-1.63	-12.71	-29.22	-5.54	-32.67	-27.59
Scenario D	-19.11	-1.63	-9.15	-26.33	-5.87	-49.00	-24.64

Source: Author estimation.

The study found that lowering vegetable import tariffs significantly increased vegetable imports through scenarios A and B, with imports rising by 127.32% in scenario B and 79.42% in scenario A. Lower tariffs were associated with more imports and less domestic production. In contrast, higher tariffs were linked with scarce imports and high domestic production. However, scenarios C and D exhibited a downward trend, with lower tariffs resulting in a decline in vegetable exports and higher tariffs leading to an increase in exports. The labor force and capital employment levels dropped by about 50% compared to the base year. However, they expanded dramatically through scenario D. The findings align with previous investigations that indicated that reduced tariff rates have significantly increased vegetable consumption (Tian & Lin, 2023). In addition, Odior & Arzine (2023) attest to the opposing relationship between expanding scenarios and rising agricultural commodity prices, leading

to falling scenarios. The study confirms (Akbulut & Egen, 2021) research's findings that informal labor share positively correlates with the increase and decrease of import tariffs for vegetables in agricultural categories.

***Table 5**. Impact of vegetable import tariff changes on macroeconomic indicators*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	24660.65	0.999522	9522.515	11657.34	20801.3	8754.356	8023.493
Scenario A	-42.66	-0.15	-42.81	-42.53	4.47	79.42	-42.82
Scenario B	-65.20	-0.26	-65.34	-65.05	8.47	127.32	-65.35
Scenario C	7.48	-1.51	20.72	-2.11	-7.19	-57.35	4.33
Scenario D	20.65	-1.51	35.51	9.88	-8.04	-78.02	17.12

Source: Author estimation.

Table 6 depicts that the shocks of reducing import tariffs on livestock have a downward trend, like dropping tariffs on cereals, fruits, and vegetables. Furthermore, scenarios A and B display livestock imports that are higher than the SAM value by 12.63% and 20.98%, respectively. In contrast, scenario C portrays a value of (-21.92%) and scenario D a value of (-48.95%). As well, more household consumption is linked to lower import tariffs, while household consumption is inversely correlated with higher import tariffs. It is imperative to bear in mind, however, that from scenario A to scenario D, there has been a progressive decline in the volume of domestic production, exports, and capital employment. The previous study (Tian & Lin, 2023) also supports the conclusion that reduced tariff rates have significantly increased the consumption of livestock.

***Table 6.** Impact of livestock import tariff changes on macroeconomics indicators*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	55718.57	0.976558	22933.45	28076.09	60783.14	15612.07	1571.57
Scenario A	-2.58	-0.04	-2.85	-2.36	1.08	12.63	-3.70
Scenario B	-4.25	-0.07	-4.67	-3.91	1.79	20.98	-6.33
Scenario C	-13.88	-1.49	-3.27	-21.57	-6.03	-21.92	-100.00
Scenario D	-7.59	-1.49	3.80	-15.84	-8.53	-48.95	-100.00

Source: Author estimation.

Afghanistan's social accounting matrix includes forestry as a separate account. This category of the agricultural sector includes firewood, charcoal products, logging, and forestry. According to the results of the study, in scenarios A and B, lowering the import tariffs on forestry products results in a notable rise in their imports but a fall in household consumption. The prices of forest supply items have decreased in all cases, according to the outcomes of tariff change measures. The results are outlined in Table 7. Due to the data issues, the forestry product tariff increase is not shown in this table.

Table 7. *Impact of forestry import tariff reduction on macroeconomic indicators.*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	2.38E-06	0.999	0.000	0.000	16262.518	0.001	N/A
Scenario A	0.00	-0.03	0.00	0.00	-34.66	108.33	N/A
Scenario B	0.00	-0.05	0.00	0.00	-46.44	400.00	N/A

Source: Author estimation. (N/A) indicates unavailable data.

For several years, Afghanistan has been the top producer of opium worldwide. Even though Afghan academics believed that the production and consumption of this commodity violated Islamic Sharia law, the illicit trade and cultivation of this crop persisted throughout the nation due to internal turmoil and a lack of security. Table 8 demonstrates that all macroeconomic variables eventually decreased in each applicable scenario, except for household consumption. It is important to note that situations with higher import tariffs have a faster rate of change reduction than scenarios with lower import tariffs. The results of the current analysis are not supported by a study that claimed that the total elimination of tariffs resulted in a $28 million drop in commodity imports and a $231 million gain in exports (Adhikary et al., 2023).

Table 8. *Impact of opium import tariff changes on macroeconomics indicators*

Scenarios	Percentage change from the base value						
	Domestic Production	Supply price	Share of labor	Share of capital	Household consumption	Imports	Exports
Base value	160930	0.999472	38105.76	46652.12	9344.33	10568.9	104108.5
Scenario A	-1.00	-0.14	-1.28	-0.78	0.13	-0.65	-1.07
Scenario B	-1.60	-0.22	-2.04	-1.25	0.12	-1.06	-1.70
Scenario C	-12.49	-1.16	-1.72	-20.31	1.053	-11.09	-13.00
Scenario D	-14.04	-1.24	-3.45	-21.71	1.710	-11.34	-14.57

Source: Author estimation.

CONCLUSION

This study examines the impacts of altering agricultural tariffs on food availability and macroeconomic variables in Afghanistan. Utilizing the 2018 social accounting matrix and a computable general equilibrium model, four distinct scenarios were scrutinized, primarily focusing on changes in import tariffs across various agricultural categories, including cereals, fruits, vegetables, livestock, forestry, and opium. The study investigates the relationship between import tariff rates and food availability by analyzing the volume of imports and domestic production. The findings indicate that lower import tariffs lead to higher imports and lower domestic output, whereas higher tariffs have the opposite effect, impacting all agricultural categories except opium and forestry. Rising tariffs result in decreased domestic production, higher supply prices, lower labor and capital share rates, and reduced export volumes compared to lowering tariff rates. Scenarios involving reduced tariffs demonstrate a steady increase in household consumption of cereals, fruits, vegetables, and livestock, as well as imports. Increased imports and consumption are associated with decreased export

volumes, supplier pricing, and employment opportunities in production factors. Ultimately, reducing tariff rates leads to improved food availability, supply prices, and household consumption compared to scenarios with increasing tariffs. In addition, future research avenues could include incorporating time variables into the model, which would enable dynamic modeling and allow for the investigation of the effects of policy implementation on variable changes over time, particularly for programs like trade liberalization that may have prolonged effects. As well as splitting the labor force into groups based on income, skill level, or urban versus rural locations, to achieve more precise findings regarding labor dynamics and their impacts on the economy. Based on the study's findings, several policy suggestions are proposed:

- The government should prioritize scenarios that reduce tariffs, particularly through a comprehensive liberalization policy, as higher tariff rates lead to declines in various macroeconomic indicators, including domestic output, household consumption, labor and capital shares, imports, and exports.
- Instead of relying solely on reduced tariffs on agricultural products to promote food security, the government should encourage investment in rainfed and irrigated agriculture to enhance sustainable food production and ensure long-term food security.
- To ensure food security, emphasis should be placed on improving food availability through free trade, which can lead to increased imports, lower commodity prices, and higher household consumption. This approach should prioritize meeting food demands through imports rather than overemphasizing domestic production.
- Increased physical and financial Access to food can be achieved through food imports in scenarios with reduced tariffs. This surge in imports can drive the adoption of new agricultural technologies, further enhancing food access and availability. Therefore, trade liberalization should be a top priority for the government.

By addressing these recommendations and pursuing future research avenues, policymakers can gain a deeper understanding of and address the complex interactions between agricultural tariffs, food availability, and macroeconomic variables, thereby promoting sustainable economic development and food security in Afghanistan.

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AUTHORS' CONTRIBUTIONS

Ayaz Khan Naseri: Conceptualization; Methodology; Formal analysis; Writing – Original Draft; Review, Editing, and Finalization.
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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests, personal relationships, or any other conflicts of interest that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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APPENDICES

Appendix 1. *Definitions*

Symbol	Index, Parameter and Variables
i	Sector index
h	Index of primary factors of production (labor and capital)
VA	The added value of the i-th sector
FD	Demand for the f-th production factor by the i-th sector
b	Efficiency parameter in the production function
β_{fi}	The share parameter of production elasticity of the i-th sector with respect to the f-th input.
j	Sector index
Y_i	The gross output of the sector i
X_{ji}	The production of the j-th sector, which is consumed as an intermediate input by the i-th
Ax_{ji}	The coefficient of the minimum need for intermediate inputs of the j-th sector in order to
ayi	The coefficient is the minimum value added to produce a unit of gross output
PN_i	The value-added price of the i-th sector
W_f	Wages of production factors
PS_i	The supply price of the i-th sector
PQ_j	The price of the composite product is the j-th sector
C_j	Households' consumption of goods of the j-th sector
δ_{tj}	The share parameter in the utility function
FS_i	Supply amount of primary factor f-th (exogenous variable)
TAX_{dir}	Direct tax on household income
SAV_h	Household savings
$TAX_{ind,i}$	Indirect tax (sales tax)
Tx_i	Sales tax rate, td direct tax rate
$TARIFF_i$	Import Tariff
Tm_i	Import tariff rate
PM_i	Import price
M_i	Import amount
G_j	Government expenditure in the j-th sector
SAV	Government savings
λ_{gi}	The parameter of the share of government expenditure in each sector
S_h	Household saving
S_g	Government saving
SAV_{fr}	Foreign saving
$SANVING$	Total savings
$INVEST$	All investment
ID_j	The investment demand of the j-th sector
μ_j	The investment share parameter of the i-th sector
PE_j	Export price
Pwe_j	Global export price (exogenous variable)
Pwm_j	Global import price (exogenous variable)
EXR	Exchange rate
Q_j	Composite product
D_j	Domestic product
γ_j	Efficiency parameter in the production function of composite goods
, αm_j αd_j	Share parameters in the Armington function
ρ_{mi}	Power of the Armington function

η_i	Elasticity of Armington function
PD_i	The price of domestically produced goods
E_i	Export amount
θ_i	The efficiency parameter of the transfer function
β_{ej} و β_{dj}	Share parameters in the transfer function
ρ_{ei}	The power of the transfer function
σ_j	Transmission elasticity
$Ep(PQ_j, U)$	Cost function
C_j	J^{th} goods consumption
PQ_j	The price of goods
$U(C_j)$	Utility function (U is a certain utility level)