Effects of a tariff and a preference shift towards domestically produced maize in Kenya

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Executive summary

Against the background of the latest disruptions of international trade, policy makers may weigh cheap imports against independency from other trading partners. These considerations may appear especially relevant for staple foods, that are crucial for food security. In this study, we compare two instruments for substituting imported by domestically produced maize and their impact on the overall economy using a CGE-model. One scenario is a slight, but long-term increase of the import tariff for maize and the other is a preference shift among consumers and producers that use maize as an intermediate input away from imported towards domestically produced maize (e.g., following an awareness campaign) that leads to the same decrease in import quantities as the tariff increase.

- We find that a preference shift has less disruptive results on the overall Kenyan economy than an increase on maize import tariffs.
- Domestic maize production expands at the expense of the production of export goods like tea and other crops, e.g. fresh flowers, tobacco, cotton.
- In the tariff scenario, domestic consumption of all household groups decreases, except for the urban non-poor. In the preference scenario, the changes of household consumption were much smaller.
- In the preference scenario, the factor income for land owners increases more and the factor income for agricultural capital decreases more than in the tariff scenario. Income to labor decreases more in the tariff scenario.

Effets d'un tarif douanier et d'une mutation de préférence en faveur du maïs produit localement au Kenya

Résumé

Dans le contexte des dernières perturbations du commerce international, les décideurs politiques peuvent mettre en balance les importations bon marché et l'indépendance vis-à-vis de l'étranger. Ces considérations peuvent sembler particulièrement pertinentes pour les produits vivriers, qui sont cruciaux pour la sécurité alimentaire. Dans cette étude, nous comparons deux instruments de substitution du maïs importé par du maïs produit localement et leur impact sur l'économie du Kenya à l'aide d'un modèle d'équilibre général calculable (EGC). L'un des scénarii consiste en une augmentation légère, mais à long terme, des droits de douane sur les importations de maïs. L'autre scénario consiste en une mutation de préférence du maïs importé vers le maïs produit localement (par exemple, à la suite d'une campagne de sensibilisation), qui entraîne la même diminution des quantités importées que l'augmentation des droits de douane dans le premier scénario.

- Nous avons constaté qu'une mutation de préférence a moins d'effets perturbateurs sur l'ensemble de l'économie kenyane qu'une augmentation des droits de douane sur les importations de maïs.
- La production intérieure de maïs se développe au détriment de la production de produits d'exportation comme le thé et d'autres cultures, telles que les fleurs fraîches, le tabac et le coton.
- Dans le scénario de droit de douane, la consommation domestique de tous les groupes de ménages diminue, à l'exception des non-pauvres urbains. Dans le scénario des préférences, les variations de la consommation des ménages sont beaucoup plus faibles.
- Dans le scénario des préférences, le revenu du facteur terre augmente davantage et le revenu du facteur capital agricole diminue plus que dans le scénario de droit de douane. Le revenu de la main d'œuvre diminue davantage dans le scénario de droit de douane.

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1.   Background

Maize is a staple food in Kenya, with an estimated consumption of 3.6 billion tonnes per year. The country is termed as food insecure when the commodity is in short supply. However, production has drastically reduced by 17.5% between 2018 and 2021, and provisional data for 2022 shows that the country will produce only 2.7 billion tonnes, falling short of demand by 25% of total consumption.
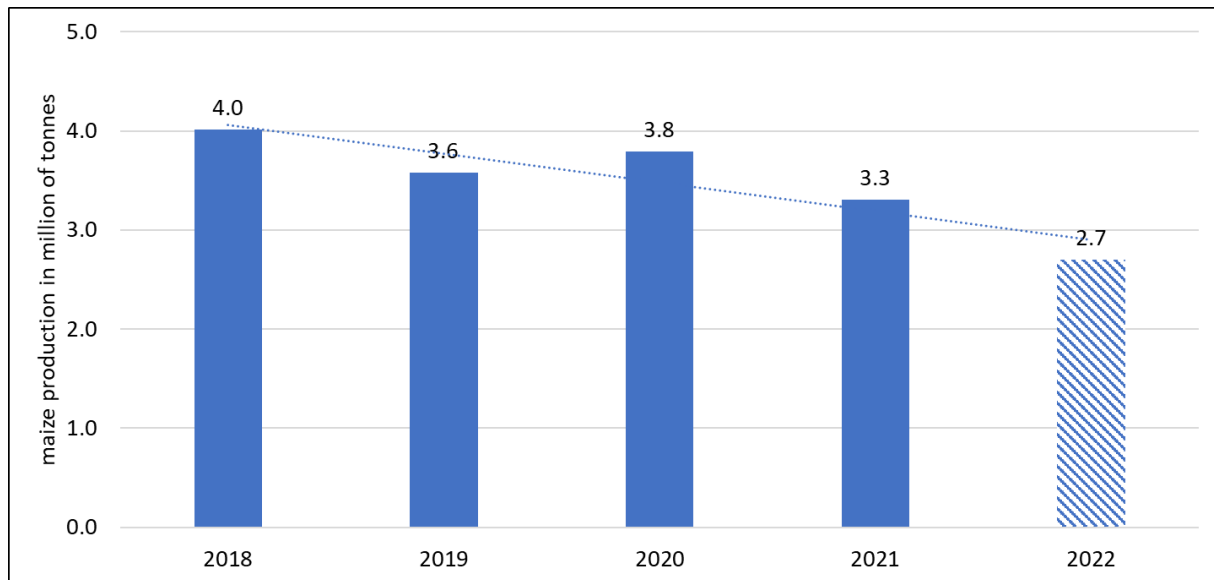
Figure 1: Production of maize between 2018 and 2021

Source: Authors' compilation based on FAOstat, 2023.

To address the current shortage, the government has decided to import 0.9 billion tonnes (10 million bags) duty-free as part of an agreement with several maize-producing countries. The Kenyan government has advised farmers to dispose of available maize stock within a month to cushion them from the expected low prices due to the imports and to free capacities in storage. This ad-hoc agreement will cover the shortage for 8 to 10 months. A short-term tariff decrease without such agreement would not have improved the situation as maize is currently scarcer than usually on the world market, also because of the Russian invasion in Ukraine.

A strong reliance on imports can have consequences. It can drain available foreign currency which may lead to devaluation of the local currency, with imports becoming more expensive. Foreign currency is spent on a staple food and is not available for other expenses. Also, high shares of imports may make the country vulnerable against disruptions of trade flows, especially if imports are sourced only from a few import partners.

Therefore, the duty-free imports offer a short-term relief of the maize shortage and the food insecurity associated with it. For a more long-term perspective, a decrease of imports and an increase of domestic production appears desirable to reduce import reliance. Several policies may be fit to achieve this goal:

1. Increasing domestic production of agricultural commodities by encouraging private-sector-led development or by subsidizing production factors, as the Kenyan government currently does through the distribution of fertilizers.

2. Import substitution by introducing import tariffs, indirect taxes and non-tariff barriers on the targeted agricultural commodities.

3. Import substitution by promotion of consumption of domestic products, for example like in the "Buy Kenya Build Kenya"-campaign.

4. Encouraging consumption of foods that are predominantly or exclusively produced domestically.

In this policy brief, the two interventions with the lowest costs for the government budget are examined, namely the increase of import tariffs and a shift in preferences towards domestically produced maize.

2. Methods

2.1 Database

A Social Accounting Matrix (SAM) for Kenya for the year 2019 has been designed at the International Agricultural Trade and Development Group at Humboldt-Universität zu Berlin based on Elnour et al. (2022) and extended with support from the staff of the Kenya National Bureau of Statistics.

The SAM identifies 46 activities producing 49 commodities, of which 20 are agricultural commodities. Additionally, the SAM includes eight production factors: two types of capital (agricultural and not), two land types (irrigated and not) and four labour categories. Labour is classified based on skill level (skilled and unskilled) and gender (male and female). Besides, households are categorised into four groups, depending on location (rural and urban) and income level (poor and non-poor).

2.2 Model and closure rules

We use the computable general equilibrium (CGE) model STAGE (McDonald and Thierfelder, 2015). A CGE model combines economic theory and numerical models to establish the impact of shocks in an economy. Real economic data is used to fit a set of equations that replicate the structure of the economy. From this framework, it is possible to simulate the effect of exogenous shocks, such as policy changes, including economy-wide interactions. The following presents a summary of the CGE model used:

- Production is structured by a three-level nest of Constant Elasticity of Substitution (CES) and Leontief production functions. At the top level, aggregate value-added, and intermediate inputs are combined using a CES function. Production factors are aggregated using CES functions at different levels, whereas the intermediate input component is aggregated using a Leontief production function (the second level). Aggregate primary factors (i.e., labor and land) are combined using CES functions (the third level).

- Producers sell their products either in the local or foreign markets, based on relative prices, as determined by a Constant Elasticity of Transformation (CET) function.

- Households supply production factors to productive activities through factor markets in exchange for wages that constitute a significant portion of their incomes. After paying taxes and making savings, households spend their income on purchasing

products. Households maximize their utility subject to Stone-Geary utility functions, selecting the optimal mix of commodities and services while considering purchase prices, preferences, and income constraints.

We assume that Kenya is a "small country" in the sense that it does not influence world market prices. The exchange rate is flexible. Further, we assume that government savings are constant and hence, that changes in government income e.g., from increases in tariff revenues are compensated for by adjusting household tax rates and that tax rates for all households are changed by the same percentages. Further, we assume that all factors are fully mobile (with the limitation that agricultural capital can only be employed by agricultural activities and non-agricultural capital only by non-agricultural ones.) and that all factors are fully employed.

2.3   Scenarios

The preference shift is implemented in a way that domestic consumers behave as if the domestic maize was 10% cheaper than it actually is. This is a rather small shock, because consumers' options to differentiate between domestic and imported maize are limited: Maize is a homogenous good and there are no perceivable quality differences between domestic and imported maize. As maize is a staple product, consumers are conscious about the price and will tend to buy the maize that is cheapest.

The import tariff is increased from 2.4% to 13.5% (4.68 times the original tariff). The numbers were chosen in a way that they lead to similar reductions in the imported quantities and hence make the scenarios comparable in their effects on other variables.

The method we use has limitations. There are several relevant aspects that cannot be examined with this model, for example:

1) Dynamic effects on domestic maize production caused by increased domestic demand, e.g. through investment in domestic production by farmers and the "good investment environment" that the government needs to provide in order for that to happen.

2) The welfare effects of resilience against short-term supply chain disruptions due to crises (Covid, Ukraine, etc.).

3.   Results

The simulated preference changes have effects on all sectors and all actors in the economy. To structure the results we follow the shock through the economy according to Figure 2. We will commence with 3.1 the changes in imported quantities and domestic and imported prices, then examine the effects the simulations had on 3.2 the domestic production and on production factors. We will analyze the implications on factor demand and factor income. In section 3.3 we examine the implications for the households, focusing on their income, taxation and consumption. We conclude with the effects on 3.4 the macro-economic indicators.
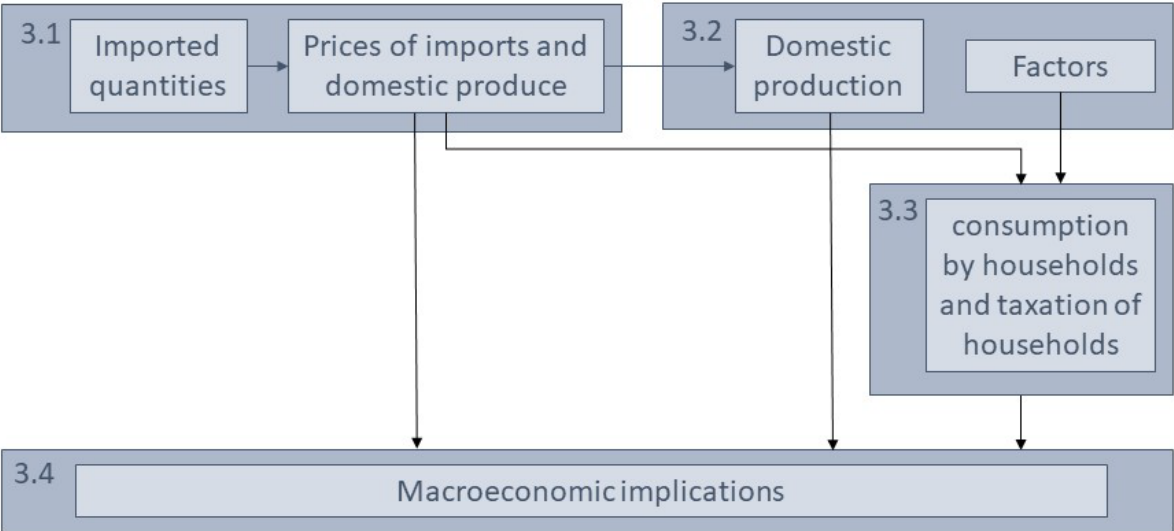
Figure 2: Mechanism of the effect of an import shock on the economy and structure for the results
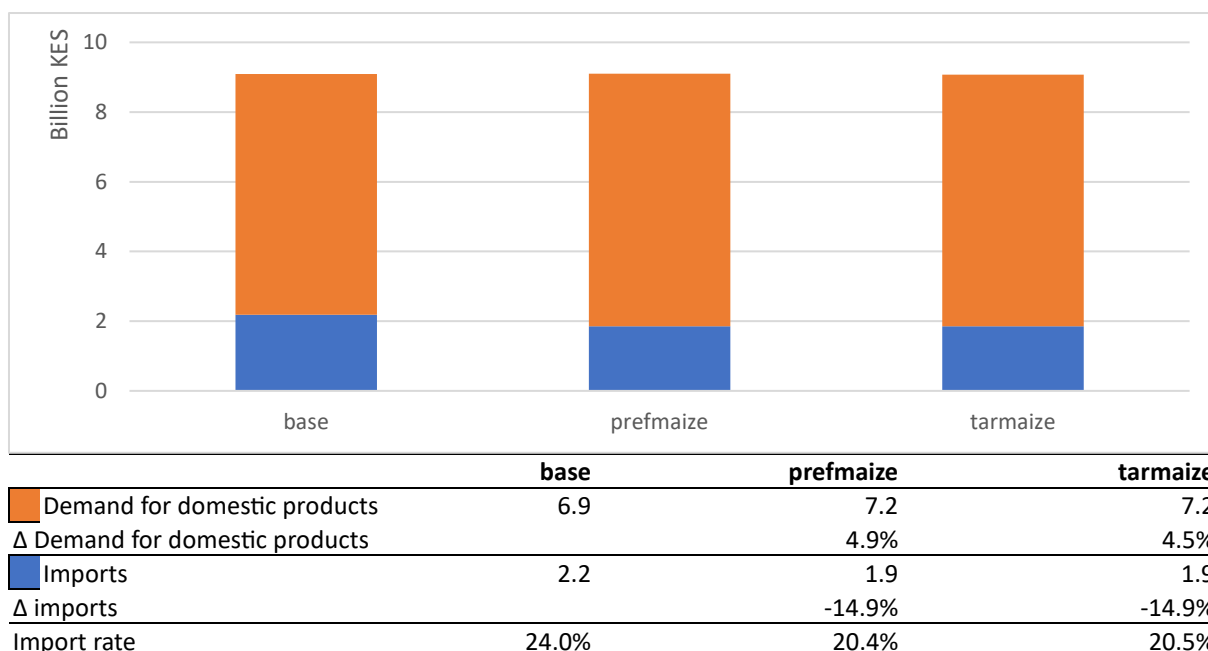
Source: Authors' compilation.

3.1 Imports and the effect on prices

The imported quantity of maize decreases by 14.9% for both scenarios (Figure 3). Hence, the effects of both shocks are very close in size and any differences in effects on other prices and quantities can be attributed to the differences between a preference and a tariff shock and not by the difference in the extent of the import decline.

The preference shock increases the demand for domestic products a little more than the tariff shock (4.9% vs. 4.5%). The import share decreases from 24% in the reference scenario to 20.4% in the prefmaize scenario and to 20.5% in the tariff scenario.

The difference in the effect on demand for domestic products can be explained by the different effect on the prices that the two scenarios have. For the explanation of the price effect it is important to note that we assume that Kenya is a "small country" in the sense that a change in import demand of Kenya does not affect the world market price and that the exchange rate for Kenya is flexible. A decrease in the import demand results in an appreciation of the domestic currency. We only directly reduce the import demand for maize, however, this results in overall import demand decreasing, though only slightly. But this leads to the different price developments for the import price. For prefmaize, the exchange rate decreases slightly so that all import prices decrease by 0.001%. Under the tariff scenario, the import price for maize by increases by 10.9%, which is mostly attributed to the increased tariff which is 11.1 percentage points. The effect of a decreased exchange rate is larger in the tariff scenario and import prices for all products other than maize decrease by -0.03%, resulting in slightly more consumption of alternative imports and slightly less demand for domestic maize.

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	base	prefmaize	tarmaize
Demand for domestic products	6.9	7.2	7.2
Δ Demand for domestic products		4.9%	4.5%
Imports	2.2	1.9	1.9
Δ imports		-14.9%	-14.9%
Import rate	24.0%	20.4%	20.5%

Figure 3: Composition of maize in the baseline, preference and tariff scenarios (Billion KES)

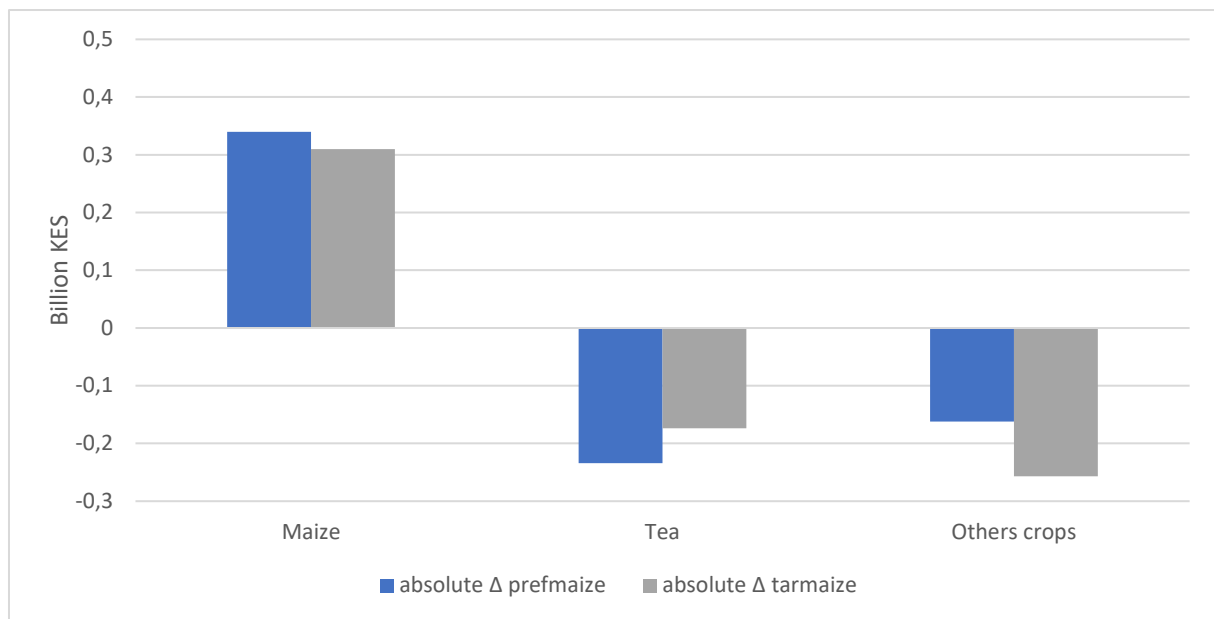Source: Authors' calculations based on simulation results.

3.2   Domestic production and production factors

Increasing demand for domestic products almost matches decreasing imports when compared in absolute terms. The decrease of 0.325 billion KES in import quantities is even a little bit overcompensated by the increase of 0.339 billion KES in domestic production in the preference scenario (Figure 4). In the tariff scenario the increase of domestic production is with 0.310 close to matching the decrease in import quantities, but leaves a little gap. Hence, in the preference scenario, the overall available quantity of maize in Kenya increases a little while it decreases a little in the preference scenario.

Increasing domestic production and re-allocation of formerly exported quantities into domestic consumption are two options to fulfil the increasing demand for domestic products. In our scenarios, the former is driving the effect. Domestic production of maize increases by 4.9% in the preference scenario and 4.5% in the tariff scenario and therefore matches the increase in the demand for domestic products almost perfectly.

This increase in domestic production means that more factors (land, labor and capital) are needed in maize production. As we assume full factor employment, they are fully drawn from other activities. This applies especially for tea which is like maize grown on rain-fed, non-irrigated land. Hence, the observation that maize production decreased in recent years and was replaced by tea production could be reversed by a preference shift or tariff increase. The same applies for "other crops", which consist mainly of flower production. Apart from tea and other crops, other activities are hardly affected at all.

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Figure 4: Absolute changes in domestic production (Billion KES)

Source: Authors' calculations based on simulation results.

When interpreting the decreases in tea production, it is important to note that these are long-term scenarios. Tea is a perennial crop and tea producers will only be willing to sacrifice their tea plants to make space for maize productions if profits from maize production are expected to be higher than from tea production for a long period.

A change in production implies a change in the use of production factors (Figure 5). It is noteworthy, that the proportion between the factors utilized in the production of maize, tea and other crops stays almost the same (Table A.1 in the Annex). The demand for each labor group, for non-irrigated land and for agricultural capital increases by around 5%. Only the demand for irrigated land is smaller (3.7% in prefmaize, 3.5% in tarmaize), implying a small shift in relative factor use. The use of irrigated land was already very small in the baseline for maize and zero for tea and other crops. Irrigated land is also drawn from all other crops using it.

Factor demand for maize production increases most for land and much less for labor and capital. The factor wages are reflecting the relative changes in demand for the single factors (Figure A.1 in the Annex). So even though, there is also higher demand for labor, the wages for labor decrease. Factor wages decrease for labor and capital but increase for land. Hence, land owners benefit, but owners of capital and labor lose. For the latter, skilled labor loses more than unskilled labor. However, the households owning unskilled labor are usually poorer and even though decreases in factor income may be smaller in percentage and absolute terms per capita than for the skilled labor, they can lead to larger economic problems for the households.

As the preference scenario draws more factors from tea, the tariff scenario draws more factors from other crops and as both products use factors in different proportions, the effects for factor prices differ in size, but not in sign. Factor income decreases for labor (more for tarmaize), for land it increases (more for prefmaize) and it decreases for capital (more for prefmaize in the case of agricultural capital, more for tarmaize in the case of non-agricultural capital).

Figure 5: Absolute changes in factor demand (Billion KES)

Source: Authors' calculations based on simulation results.

3.3   Households: Income, taxation and consumption

The changes in the relative demand for factors affect their prices and hence the incomes of those who own them. As the ownership of the factors is unequally distributed between the genders, between young and old, the poor and the non-poor, the rural and the urban population, these scenarios have implications for the distribution of income between all these groups. An increase of rents for land and capital means a redistribution in the favor of the male and older population as they own a larger share of land and capital than women and youths. Household income decreases for all, except for rural poor in the preference scenario.

The household income of the rural poor increases ever so slightly even though the wages for unskilled labor decrease, because they could profit from the increased wages for land as they are also land owners. In the tariff scenario the drop in the wages for unskilled labor is higher than in the preference scenario and the increase in the land rents are smaller, hence the overall effect in the tariff scenario is negative for the rural poor. For the non-poor households, the overall change in household income is negative despite this, because the wage of the prevalent labor they own (skilled) decreases more than for unskilled. Related to that, urban households lose most because they do not own land, the only factor for which wages increase. In general, the changes in household income are more negative under the tariff scenario than under the preference scenario and even turned from positive to negative for the rural poor.

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	Rural poor	Rural non-poor	Urban poor	Urban non-poor
■ prefmaize	0,00%	0,00%	-0,01%	-0,01%
■ tarmaize	-0,02%	-0,03%	-0,04%	-0,03%

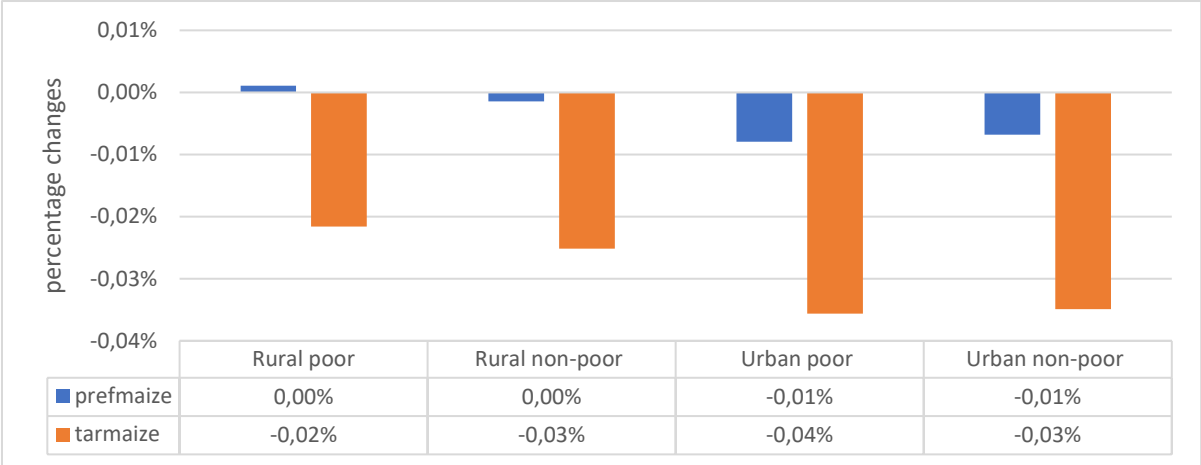_y-axis: percentage changes (from 0,01% to -0,04%)_

Figure 6: Effects on household income, % change compared to the reference scenario

Source: Authors' calculations based on simulation results.

With decreased household incomes, also household consumption decreases (Figure A.2 in the Annex). Again, the effect is larger (i.e. more negative) for the tariff scenario than for the preference shift. The consumption decrease is larger for maize, than for other foods as not only household income is decreasing, but also the increase of the relative price for maize plays a role. Linked to the smaller decrease in household income, the decreases in consumption are smaller in the preference scenario than in the tariff scenario.

It is interesting to note that in the tariff scenario the urban non-poor households consume more of some goods and services, especially those related to transportation, communication, finance, estate, health, education and other services, whereas both the urban and the rural poor show the largest decreases of their consumption in the goods and services. This can be explained by the fact that even though they lose less of their income in both absolute and percentage terms, their budget is overall tighter: they do decrease consumption of food and other necessities but still need to give up more of other expenses to allocate a higher proportion of their income to these necessities to fulfil their minimum needs.

This is not the case in the preference scenario. The reason for that is the assumptions we made for the government behavior. As the government earns net additional income through the increase in the import tariff for maize in the tariff scenario and budget savings are supposed to be constant, the government decreases household taxes. It decreases them for all household groups by the same percentage (0.45%) (not percentage points!) of the original tariff rate. In terms of percentage points change this is a larger tax reduction for the non-poor households as their tax rate was higher to begin with. In contrast, in the preference scenario the government budget slightly decreases due to the appreciation of the domestic currency, hence the income tax slightly increases[1]. Again, this affects non-poor households more and their tax payments increase more when considering the share of income they pay. This way, both scenarios had an additional distribution effect: the preference shift pro-poor, the tariff scenario pro-non-poor.

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[1]   The effect of the decreasing exchange rate on the government budget is also present in the tariff scenario, but is much smaller than the effect of the tariff increase which goes in the other direction.

3.4   Macroeconomic indicators

The decreases in consumption imply that GDP and absorption decrease slightly, more for the tariff scenario than for the preference shift. This could be remedied by improved, cheaper domestic production, which may come either through increased production (economies of scale) or need public investments in infrastructure and the provision of public services such as extension and education or private investments in improved production technology.

4.   Conclusion

We found that a preference shift has smaller impacts results on the overall Kenyan economy than an increase on maize import tariffs. In the tariff scenario, domestic consumption of all household groups decreases, except for the urban non-poor. In the preference scenario, the changes on household consumption are much smaller. In the preference scenario, the factor income for land owners increases more and the factor income for agricultural capital decreases more than in the tariff scenario. Laborers' factor income decreases more in the tariff scenario. All in all, the preference scenario appears to come at lower costs than the tariff scenario.

The effect on other crops and on external trade differed in detail, but lead to the same main conclusions. Domestic maize production expands in both scenarios at the expense of the production of tea and other crops. As tea is an important export crop, this has implications for international trade. Whereas both instruments lead to a decrease in imports of maize, they lead also to a decrease of tea exports. Also, the imports of other products increase slightly and the exports of other products decreased slightly (especially for the tariff scenario).

We must conclude that both instruments are successful in decreasing import dependency in maize, hence can improve self-sufficiency in food. However, both instruments decrease exports of tea and other products. Hence, the net inflow of foreign currency does not increase.[2]

5.   Policy implications and recommendations

Our analysis leads us to conclude that both interventions, i.e. the preference shift and the tariff increase, result in import substitution. Both instruments would lead to a decrease in imported quantities and to an increase in domestic production, with the preference shift being slightly more efficient in increasing domestic production. The preference shift appears to be the overall more favorable alternative of the two instruments, especially as it leads to less negative impacts esp. for household income and household consumption.

While our analysis accounts for the additional tariff income coming from an increase in tariff rates, it does not account for costs of a campaign promoting domestic products. For campaigns of this sort, there are a multitude of ways for designing them, linked to different costs and efficacy.

We can therefore conclude that both instruments are fit for decreasing imports and increasing domestic production of the targeted product but they both come at costs to the economy and various actors. Such costs may comprise

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[2]   In our model we assume a flexible exchange rate and a fixed external balance, hence foreign currency savings cannot change.

i)   decrease in household income, increase of domestic prices and therefore decrease in households' purchasing power,

ii)   decrease of domestic production of other products and

iii)   decrease of exports, as well as

iv)   a decrease in GDP.

Policy-makers need to be aware of all the related costs and must decide on this basis whether the political goal of lower import dependency for the products in question is worth it.

We therefore recommend a precise cost-benefit analysis for the specific instruments and campaigns before implementation. For a campaign promoting domestic products, this would include the costs of the separate components of the campaign and the expected size of the effect it would have on local consumers and producers demanding the products in question as intermediate goods. The analysis should also include a CGE-analysis on what these sought-after preference changes mean for the overall economy, especially if preference changes in several products are targeted. Also, a campaign does not necessarily need to target only preference shifts from an imported commodity to its domestically grown counterpart, but could also target shifting from a predominantly imported crop to another predominantly domestically grown crop (e.g., cassava, millet or sorghum). The cost-efficiency of the tariff and the campaign should then also be compared to those of other instruments, e.g. supporting domestic production directly by improving productivity through extension services, irrigation, soil conservation, control of pest and diseases, improved seeds or a targeted subsidy for small farmers etc.

Such cost-benefit analyses need high-quality and up to date data. Central to CGE analyses is the social accounting matrix. Funding Kenyan researchers to update the SAM and include data at the necessary regional or social level is therefore a good investment in better policy making.

References

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Appendices

		maize		tea		other crops	
		prefmaize	tarmaize	prefmaize	tarmaize	prefmaize	tarmaize
Aggregate labor	abs. Δ	0.02	0.02	-0.01	-0.01	-0.02	-0.03
	perc. Δ	5%	5%	0%	0%	0%	-1%
Aggregate skilled labor	abs. Δ	0.00	0.00	-0.01	0.00	-0.01	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Skilled labor - male	abs. Δ	0.00	0.00	0.00	0.00	0.00	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Skilled labor - female	abs. Δ	0.00	0.00	0.00	0.00	0.00	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Aggregate unskilled labor	abs. Δ	0.02	0.02	-0.01	-0.01	-0.01	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Unskilled labor - male	abs. Δ	0.01	0.01	0.00	0.00	0.00	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Unskilled labor - female	abs. Δ	0.01	0.01	-0.01	0.00	0.00	-0.01
	perc. Δ	5%	5%	0%	0%	0%	-1%
Aggregate land	abs. Δ	0.22	0.20	-0.15	-0.11	-0.05	-0.07
	perc. Δ	5%	4%	0%	0%	0%	-1%
Irrigated land	abs. Δ	0.02	0.02	0.00	0.00	0.00	0.00
	perc. Δ	4%	3%	0%	0%	0%	0%
Non-irrigated land	abs. Δ	0.20	0.18	-0.15	-0.11	-0.05	-0.07
	perc. Δ	5%	5%	0%	0%	0%	-1%
Agricultural capital	abs. Δ	0.03	0.03	-0.02	-0.02	-0.03	-0.05
	perc. Δ	5%	5%	0%	0%	0%	-1%

Appendix A: Effects on real factor demand, absolute change compared to the reference scenario (Billion KES)

Source: Authors' calculations based on simulation results.

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|	Skilled labor - male	Unskilled labor - male	Skilled labor - female	Unskilled labor - female	Irrigated land	Non-irrigated land	Agricultural capital	Non-agricultural capital
■ prefmaize	-0.02%	-0.01%	-0.02%	-0.01%	0.14%	0.11%	-0.08%	-0.01%
■ tarmaize	-0.05%	-0.04%	-0.05%	-0.04%	0.06%	0.03%	-0.01%	-0.04%
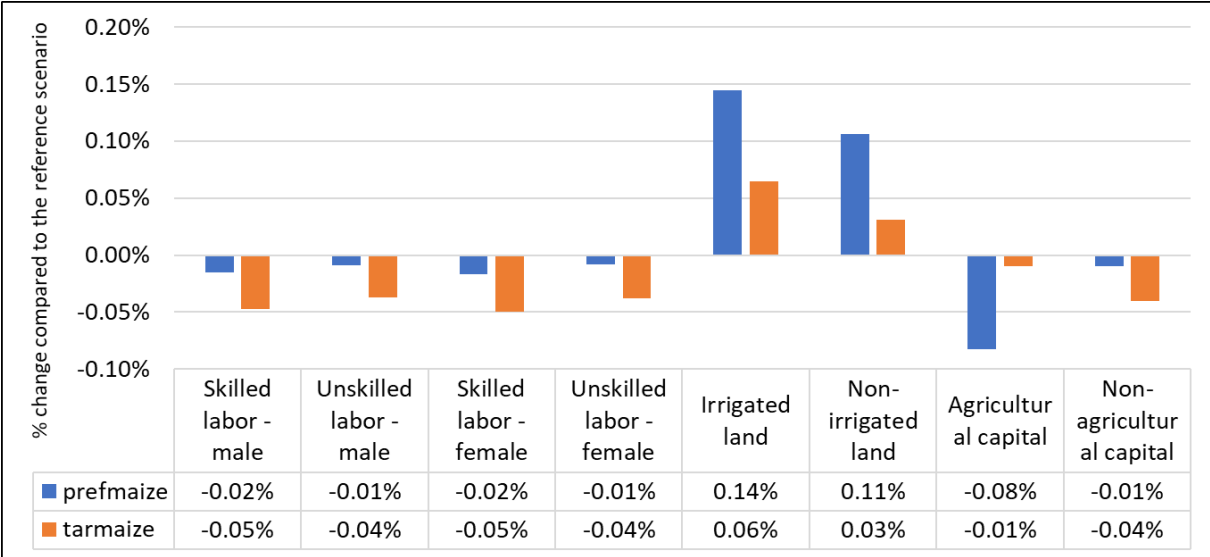
Appendix B: Effects on factor income, % change compared to the reference scenario

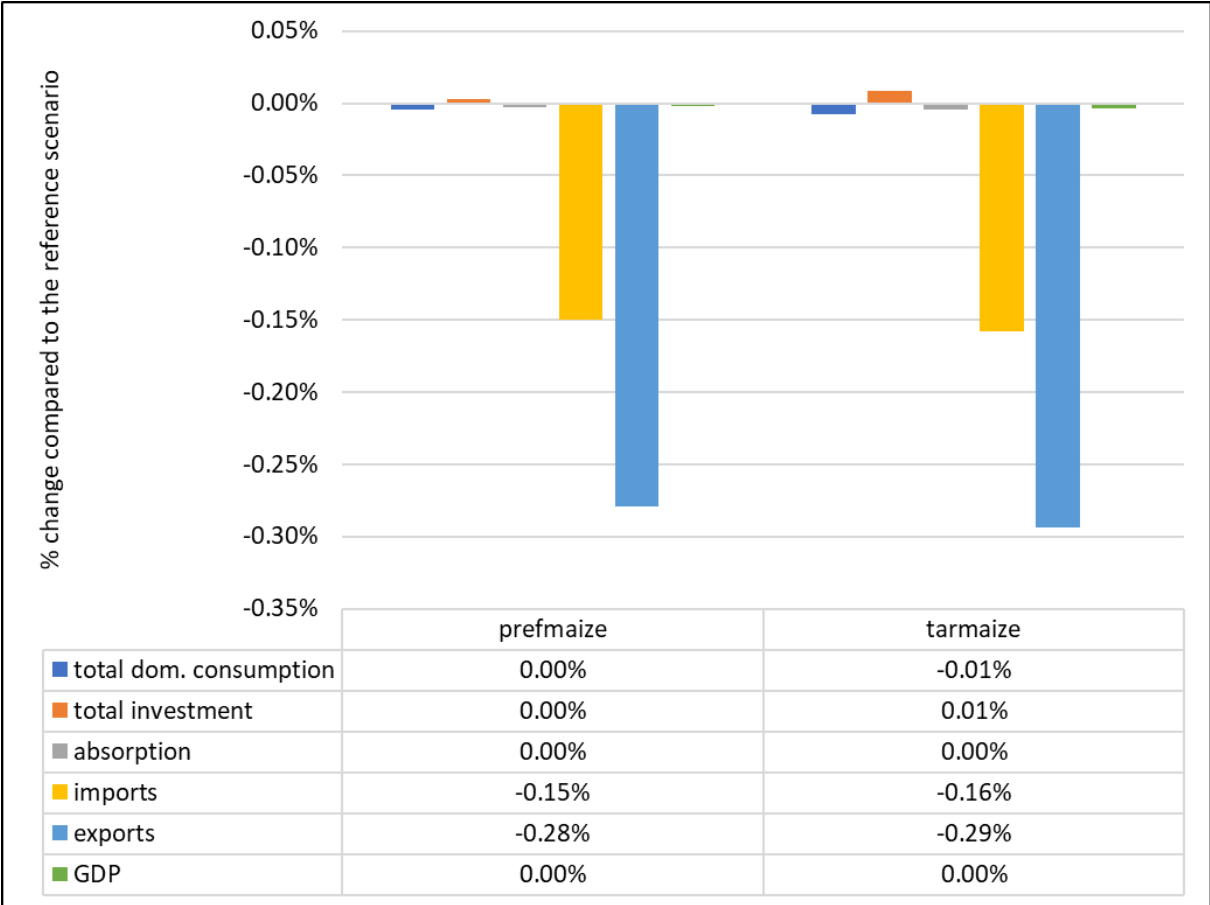Source: Authors' calculations based on simulation results.

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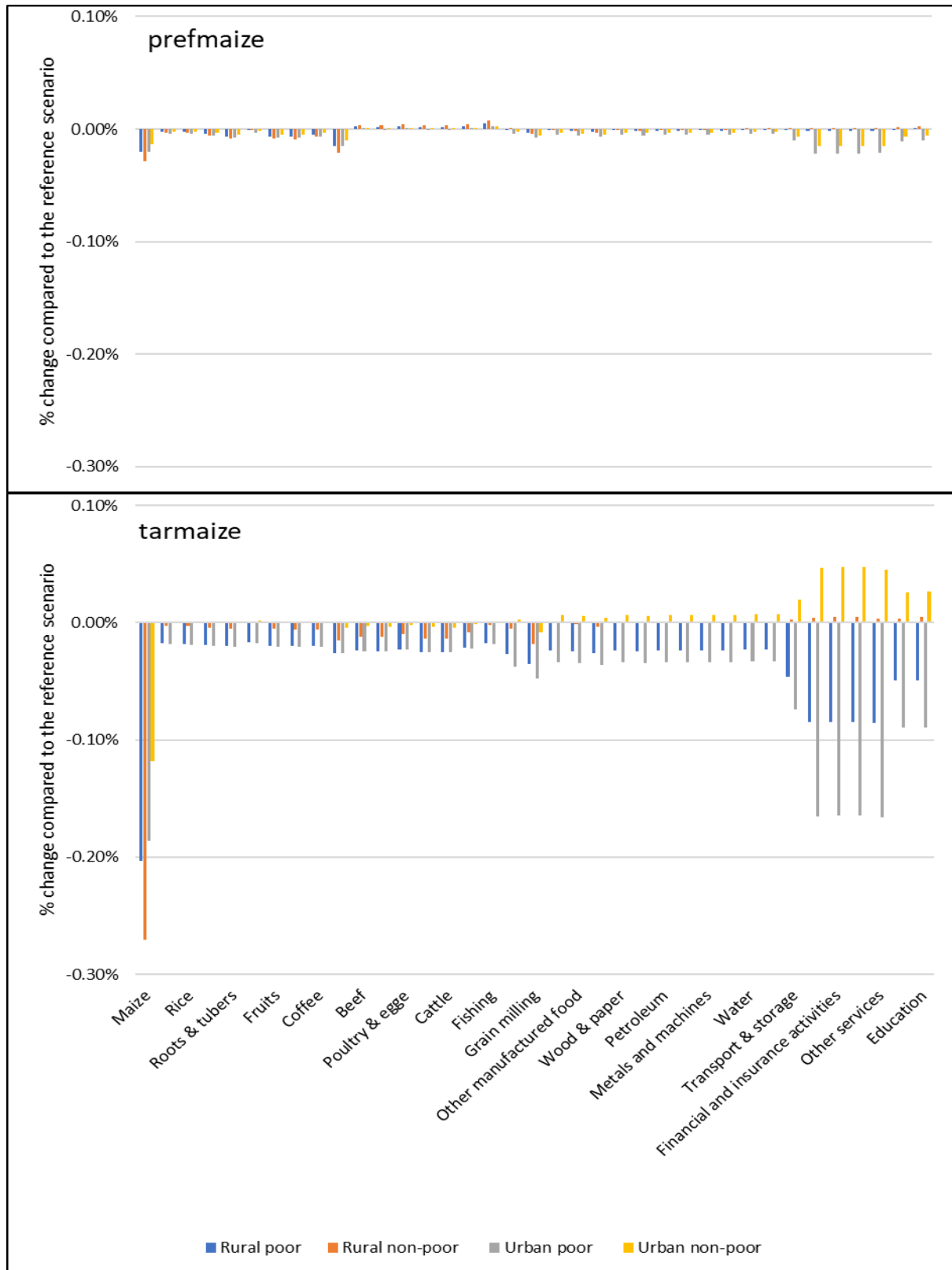
Appendix C: Effects on household consumption, % change compared to the reference scenario

Source: Authors' calculations based on simulation results.

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	prefmaize	tarmaize
■ total dom. consumption	0.00%	-0.01%
■ total investment	0.00%	0.01%
■ absorption	0.00%	0.00%
■ imports	-0.15%	-0.16%
■ exports	-0.28%	-0.29%
■ GDP	0.00%	0.00%

Appendix D: Effects on real macroeconomic indicators, % change compared to the reference scenario

Source: Authors' calculations based on simulation results.