The implications of the Russia-Ukraine war for the Ethiopia economy: a CGE Analysis

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Introduction

- The Russia-Ukraine war is triggering crises on global financial, food, and energy systems
    - **107** economies in the world, **1.7** billion people lives are exposed (UN, 2022a)
- The short – and long- term implications of the Ukraine-Russia war for African countries worrisome (UN, 2022b)

Introduction

AKADEMIYA2063 - Ukraine Crisis Brief Series

IFPRI - Impacts of the Ukraine and Global Crises on Poverty and Food Security (Country Briefs)

Introduction

- **The spillover effects on the Ethiopian economy are of particular interest, which is also dealing with other domestic issues**
  - COVID-19 pandemic
  - Drought
  - Armed conflicts

  } Soaring inflation, worsening trade & fiscal deficits, unemployment ….

- **Previous case studies, both applying a CGE model**
  - Diao et al. (2022) – could worsen **inequality** worsens
  - Tamiru & Gebrewolde (2022) – GDP which would **fall by ≈ 7.6%** as compared to the BAU

- **This study pursues a very similar approach, but**
  - A modified SAM – allows multiples energy fuels and fertilizer inputs (Yalew, nd)
  - Using **DEMETRA** model which allows much flexibility in production and utility nests (JRC, 2021)

Materials & Methods

- The 2015/16 Ethiopian SAM (Mengistu et al., 20219)
  - **205** accounts
- Modified 2015/16 Ethiopian SAM
  - **140** accounts: **71** activities + **50** commodities + **8** factors + **4** taxes + **2** households + **5** others
- Adjusted to fit for research on **energy** and **agriculture**

Materials & Methods

Growing **maize** activities in the SAM (billion ETB, 2015/16)

Inputs	Non-irrigated	Irrigated
Maize, seed	0.9763	0.0849
Inorganic fertilizers	2.4094	0.2095
Ogranic fertilizers, residues	0.0099	0.0009
Organic fertilizers, manure	0.2301	0.0200
Petroleum fuels	0.0243	0.0021
Electricity	-	0.0159
Rest of manufactured goods	2.9697	0.2582
Rest of services	0.0099	0.0009
Labor, unskilled	20.9954	1.8257
Labor, semi-skilled	1.9785	0.1720
Labor, skilled	0.1803	0.0157
Land, non-irrigated	18.230	-
Land, irrigated	-	1.5693
Capital (livestock)	5.4558	0.4744
Capital (farm machinery & equipment)	0.6062	0.0527
TOTAL	51.6661	4.4927

- Farm machinery, tools, and equipment separated from livestock draught power
- Irrigated and non-irrigated farming for crops
  - Irrigated farming uses electricity & irrigated land
- The use of organic fertilizers (manure & residues) is modified and improved

- **Improve the food-energy nexus representation**

Materials & Methods

Energy commodities in the SAM (billion ETB)

	Agriculture	Industry	Transport	Services	Households	Exports	TOTAL	Share (%)
Electricity	0.066	4.206	0.452	3.272	3.896	0.665	12.56	**7.40%**
Petroleum	0.261	22.246	37.095	7.735	4.920		72.26	**42.56%**
Fuelwood				1.495	77.104		78.6	**46.29%**
Resdiues	36.007	0.328			2.427		2.427	**1.43%**
Dung	2.5466				3.725		3.725	**2.19%**
Biogas					0.07		0.070	**0.04%**
Biofuels			0.097		0.048		0.145	**0.09%**
TOTAL	0.327	26.452	37.644	12.502	92.189	0.665	169.779	**100%**
Share (%)	**0.19%**	**15.58%**	**22.17%**	**7.36%**	**54.30%**	**0.39%**	**100%**	

Non-energy use of agricultural wastes is not used considered in calculating the energy shares

- Allow imperfect substitution between energy commodities – CES
- Capture the *fuel stacking* behavior of the households
- Capture the agriculture–energy nexus, i.e., agricultural wastes

Materials & Methods

Electricity activities in the SAM (billion ETB)

	Off, DSL	Off, REN	HP, ABB	HP, OMB	HP, AWB	HP, TKB	HP, WSB	HP, ROB	RP, WND	RP, GEO	RP, SLR	RP, MSW	NP, DSL	T&D
	aogelecd	**aogelecr**	**ahpabb**	**ahpomb**	**ahpawb**	**ahptkb**	**ahpwsb**	**ahprob**	**arpwnd**	**arpgeo**	**arpslr**	**arpmsw**	**anpdsl**	**aeeu**
ccons														0.003
cwater												0.007		0.005
coilptrl	0.034		0.191	0.630	0.029	0.076	0.039	0.003	0.083	0.002	0.001	0.005	0.094	0.790
celect														0.050
cwoodp			0.003	0.010	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.012
crmnfg	0.005	0.013	0.282	0.887	0.041	0.108	0.055	0.004	0.116	0.003	0.003	0.007	0.032	1.050
crserv	0.009	0.013	0.439	1.400	0.064	0.170	0.086	0.006	0.183	0.004	0.001	0.003	0.002	1.761
ctrans														0.032
cheal														0.001
flbu	0.005	0.006												0.209
flbs	0.005	0.006	0.015	0.049	0.002	0.006	0.003	0.000	0.006	0.000	0.000	0.000	0.002	0.480
flbt	0.005	0.006	0.053	0.169	0.008	0.021	0.010	0.001	0.022	0.000	0.001	0.001	0.008	0.688
fkna	0.018	0.019	0.954	3.053	0.140	0.370	0.189	0.013	0.400	0.009	0.012	0.011	0.022	4.197
ptax			-0.857	-2.741	-0.126	-0.332	-0.169	-0.011	-0.359	-0.008				-3.069
total	0.080	0.063	1.081	3.457	0.159	0.419	0.214	0.014	0.453	0.010	0.018	0.035	0.161	6.207

CGE model

- Applied the **DEMETRA** model (JRC, 2021; Aragie et al., 2016)

- The overall framework is similar to other common single country CGE models (Lofgren et al., 2002; Decaluwé et al., 2013; McDonald et al., 2015)

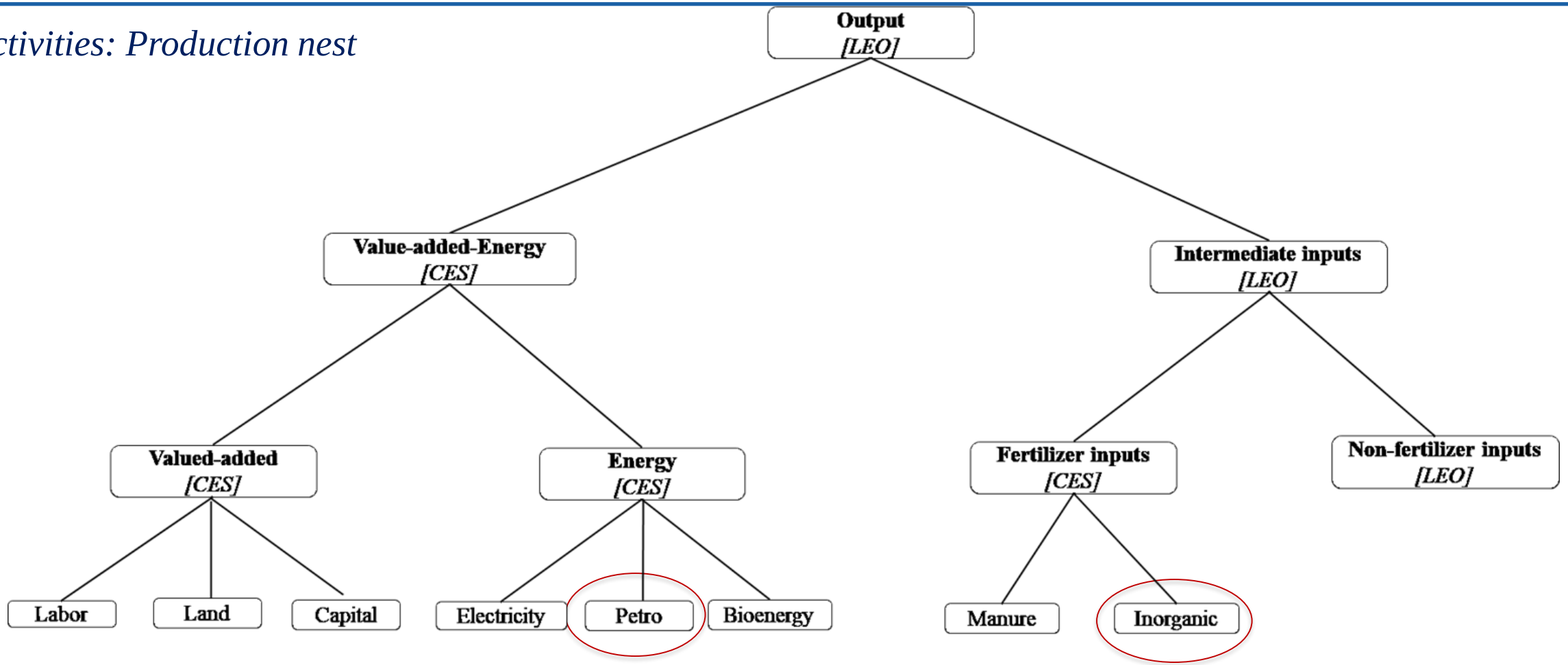
- Some features
  - Flexible CES nesting of production functions
  - Flexible CES-LES nesting of household demand systems

CGE model

- Ethiopia is a small-open economy
  - World prices for exports and imports are exogenous
- Macro closures
  - Savings driven investment, fixed foreign savings/flexible exchange rate
- The elasticities, which are from the literature (e.g., Hertel and van der Mensbrugghe, 2019; Diao et al., 2012), capture the imperfect substitutions between commodities, factors, …

CGE model

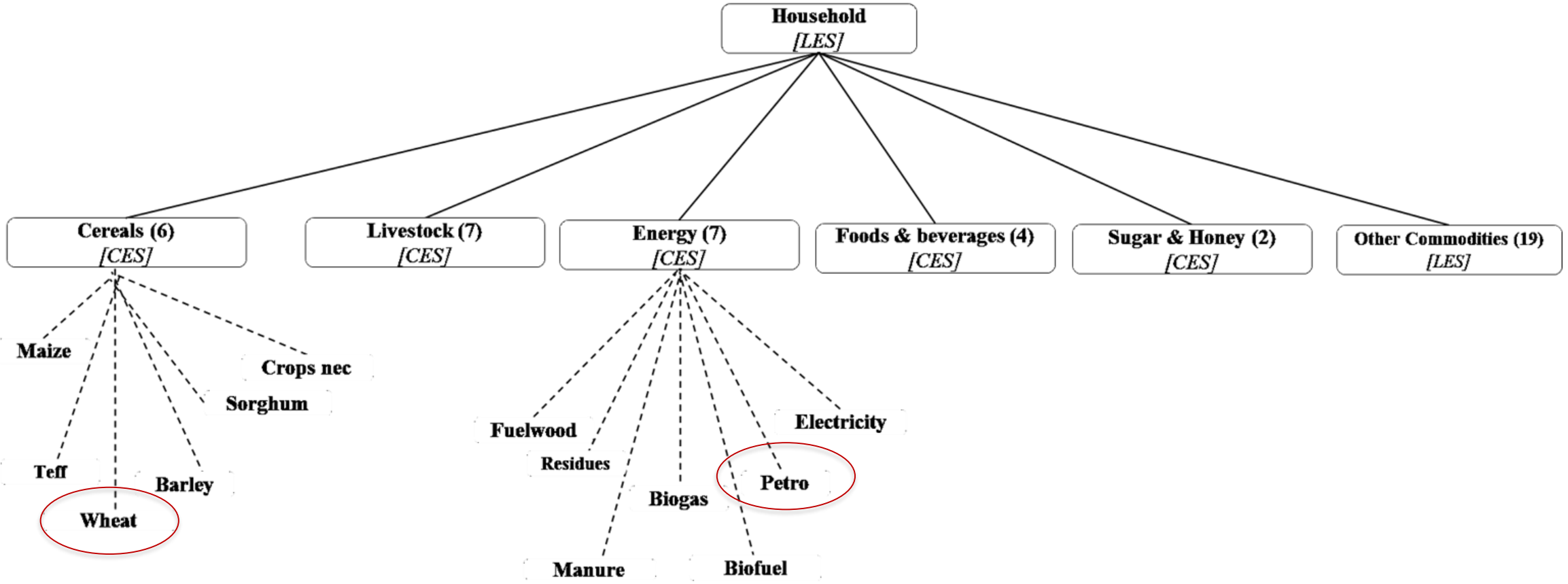
Activities: Production nest



- Allows the use (and imperfect substitution) of organic & inorganic fertilizers for growing crops

CGE model

Households: Utility nest



- Capture households' "fuel stacking" behavior

Simulation scenarios

- **Base scenario**
  - Calibrated to a modified 2015/16 SAM and updated to 2022
  - Economic growth rates (IMF, 2022), and population growth rates (UN, 2022)
  - The projected economic growth rates considered the effects of other recent crises affecting the economy

- **Experiment (shock) scenarios**
  - World import price changes for three important commodities to the Ethiopian economy
  - Wheat (+40%), fertilizers (+70%), and petroleum fuels (+50%) (World Bank, 2022)
  - More than 25% of total spending for merchandise imports (NBE, 2022)

- **Comparative static analysis**
  - The economy with world price changes compared to the base economy as of 2022

Simulation scenarios

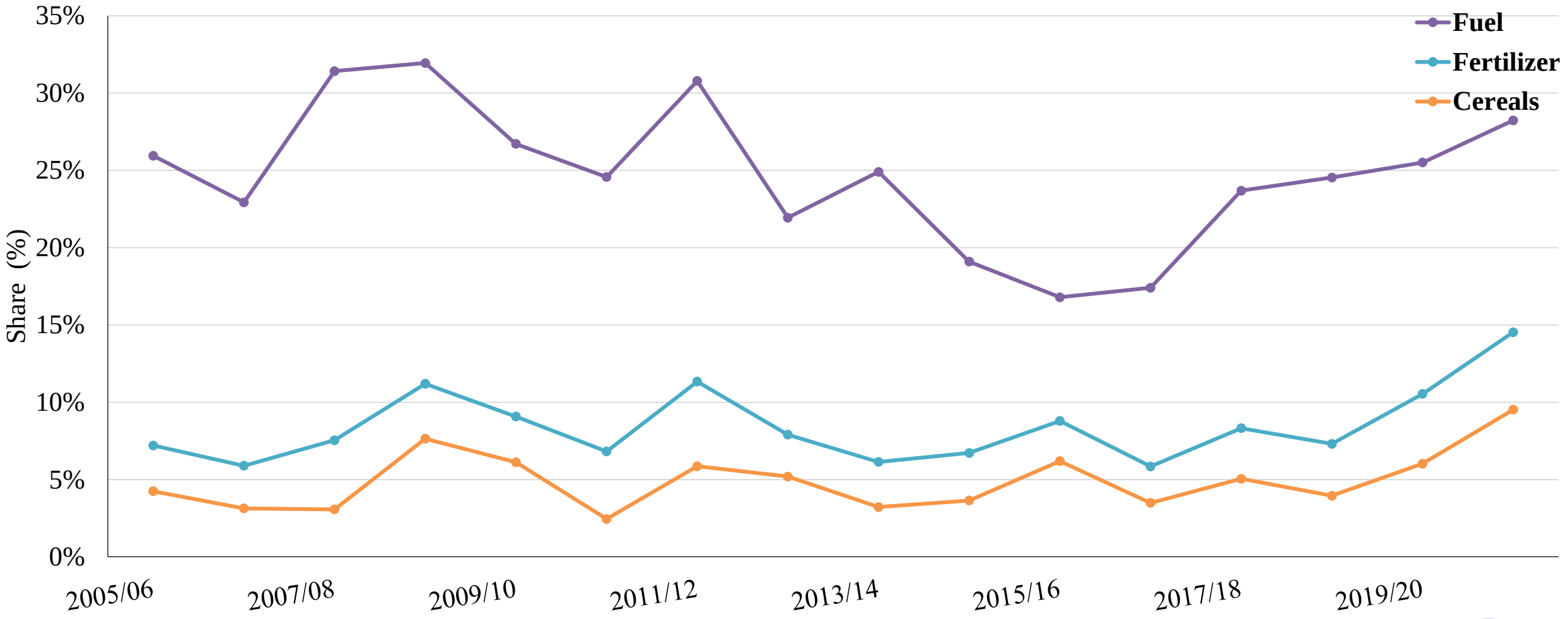
Impports	*World price changes in 2022 compared to 2021 (%)*				
	UKR_WHT	**UKR_FRT**	**UKR_FOD**	**UKR_ENG**	**UKR_FENG**
Wheat	**40**	**-**	**40**	**-**	**40**
Fertilizer	**-**	**70**	**70**	**-**	**70**
Petroluem	**-**	**-**	**-**	**50**	**50**

Source: World Bank (2022)

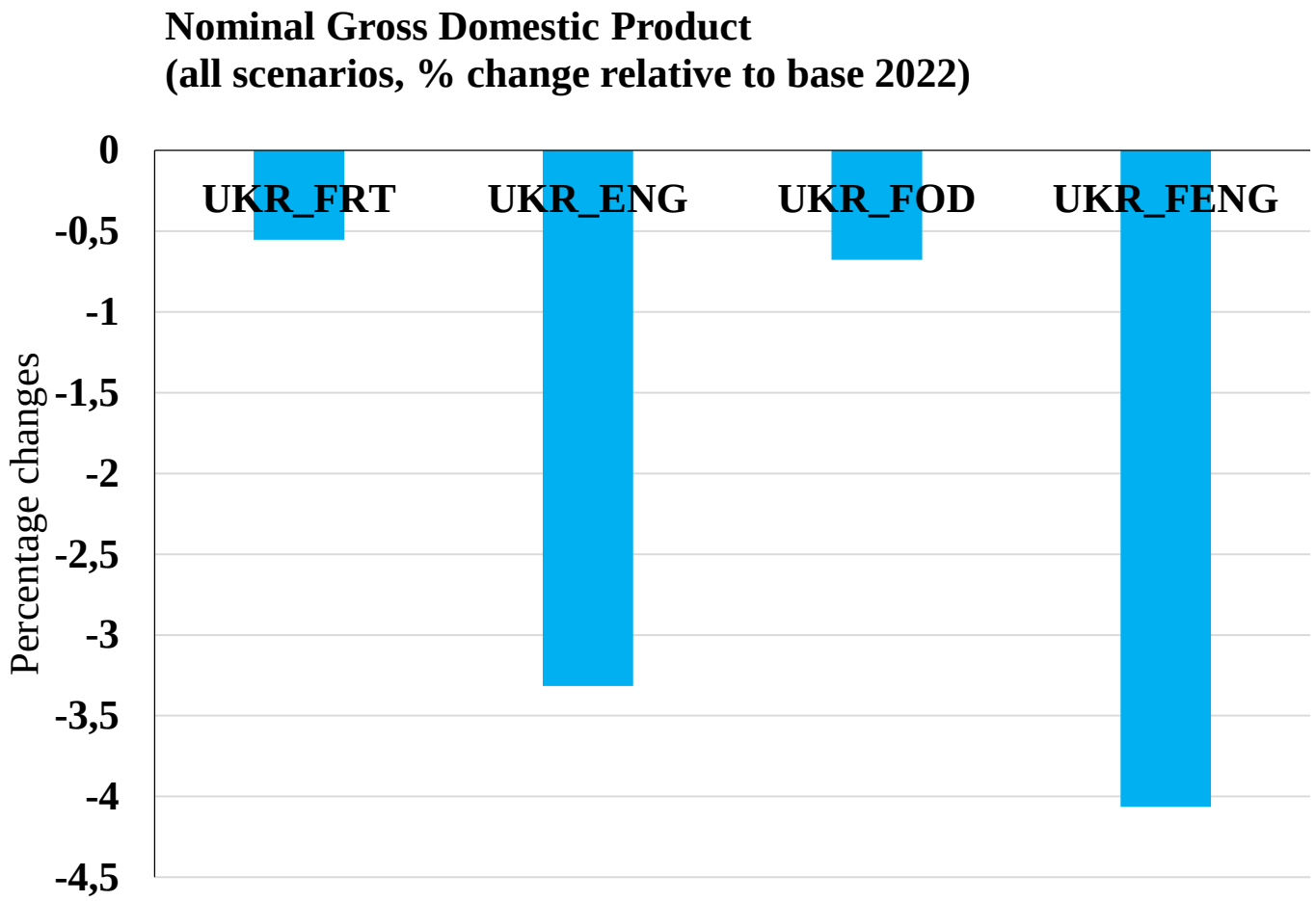
- **UKR** – Ukraine, **WHT** – Wheat, **FRT** – Fertilizers, **FOD** – Food sector (fertilizer & wheat), **ENG** – Energy (petroleum fuels), **FENG** – Food and energy items

Simulation scenarios

Share of cereals, fertilizer, and fuel imports in total merchandise imports ≈ 25 % (NBE, 2022)

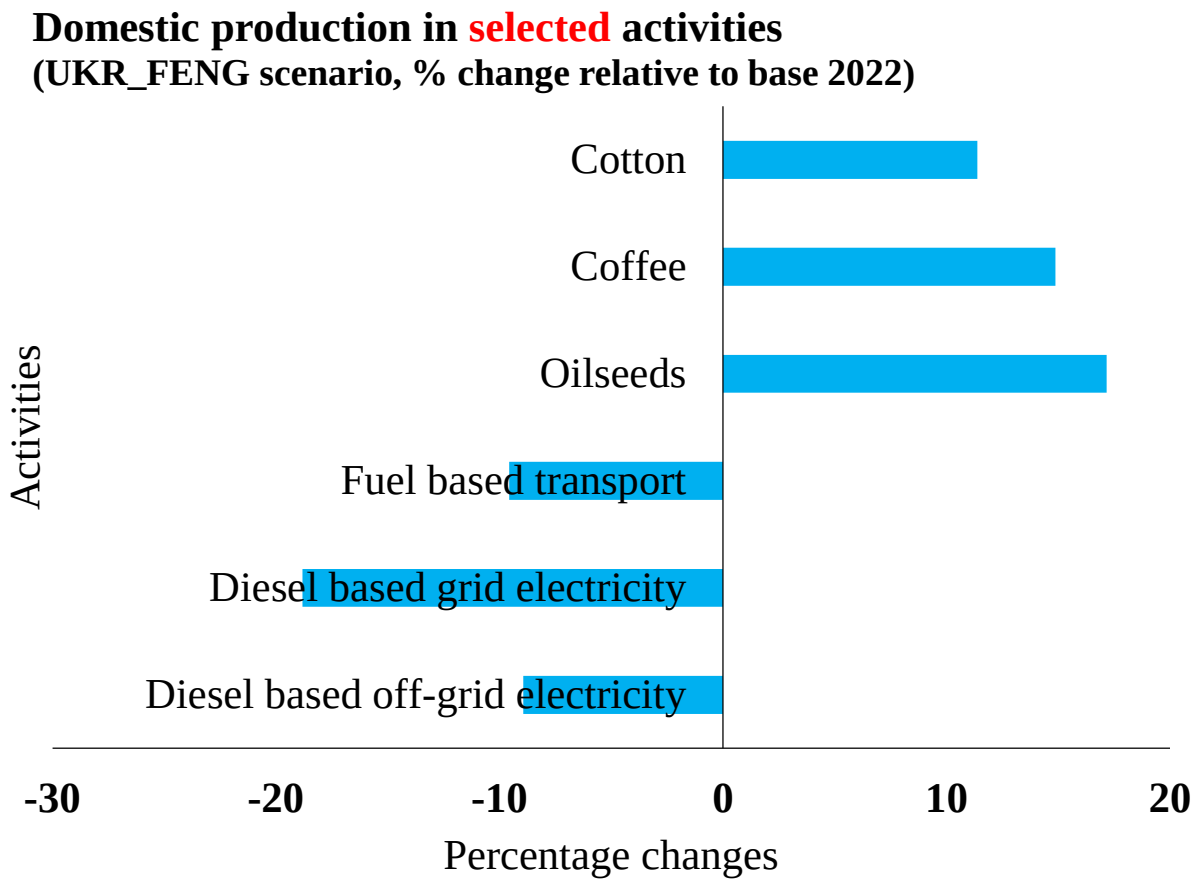


Preliminary results



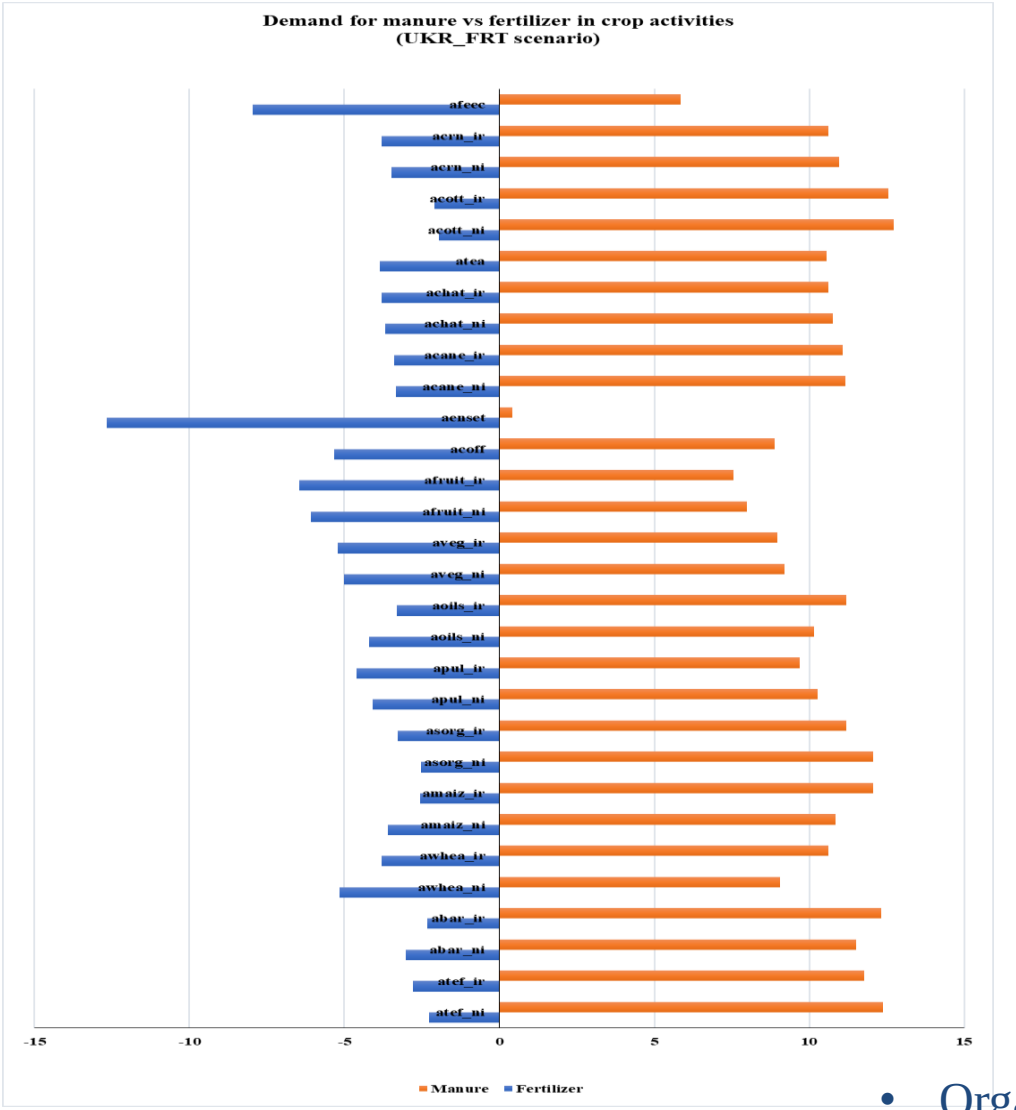
- Contracts Ethiopia's nominal GDP by about 4%
- The effect on real GDP barely -0.6%.
- The overall effects are influenced chiefly by the **fuel** price changes.

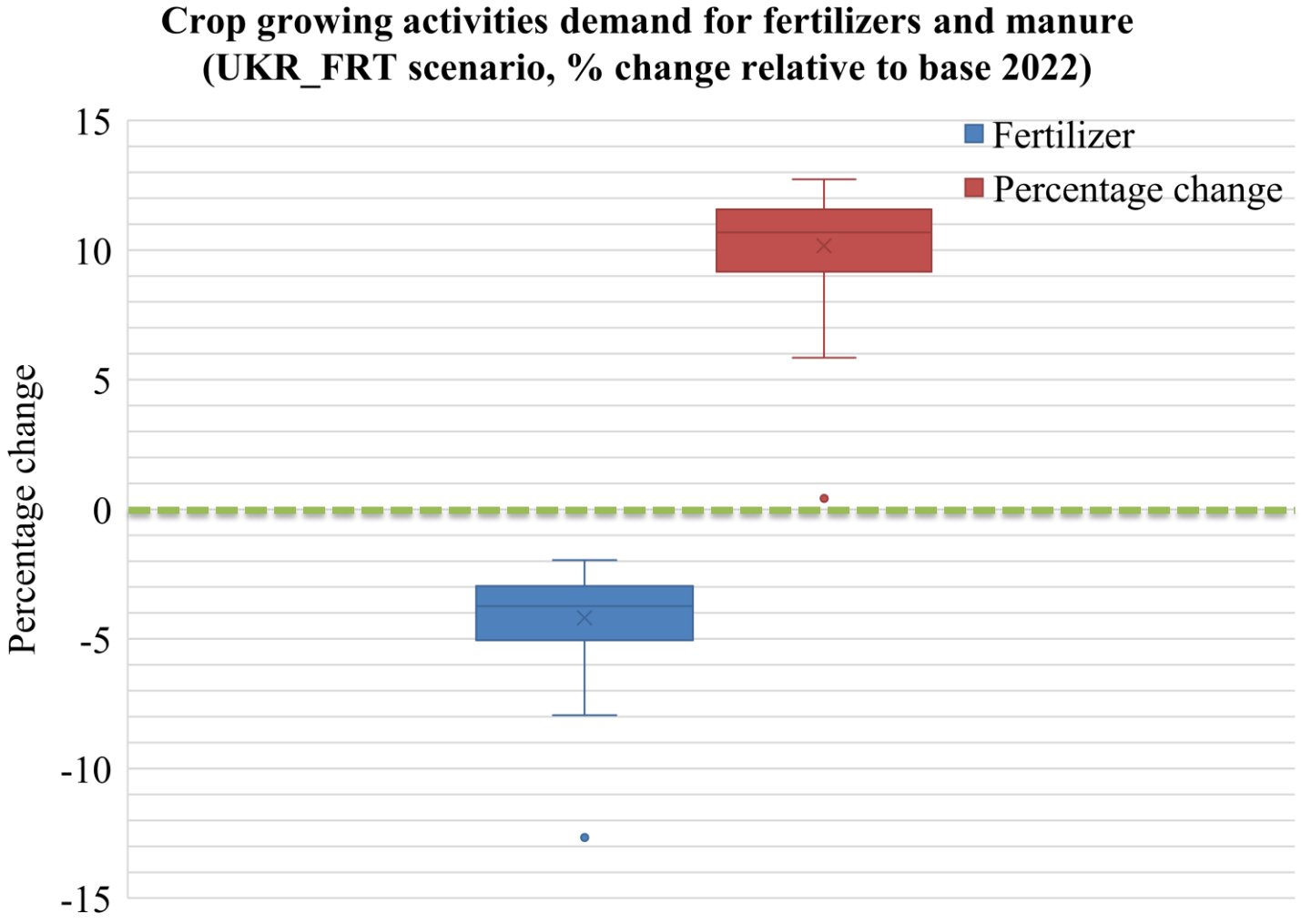
Preliminary results



- The effect on domestic production highly varies across activities – winners vs losers
- Fuel-dependent activities such as transport and electricity from diesel generators are severely affected
- Activities producing agricultural exports may increase to maintain the trade balance
- The effects through fuel price changes overweigh the effects through changes in wheat and fertilizer prices (UKR_FOD scenario)

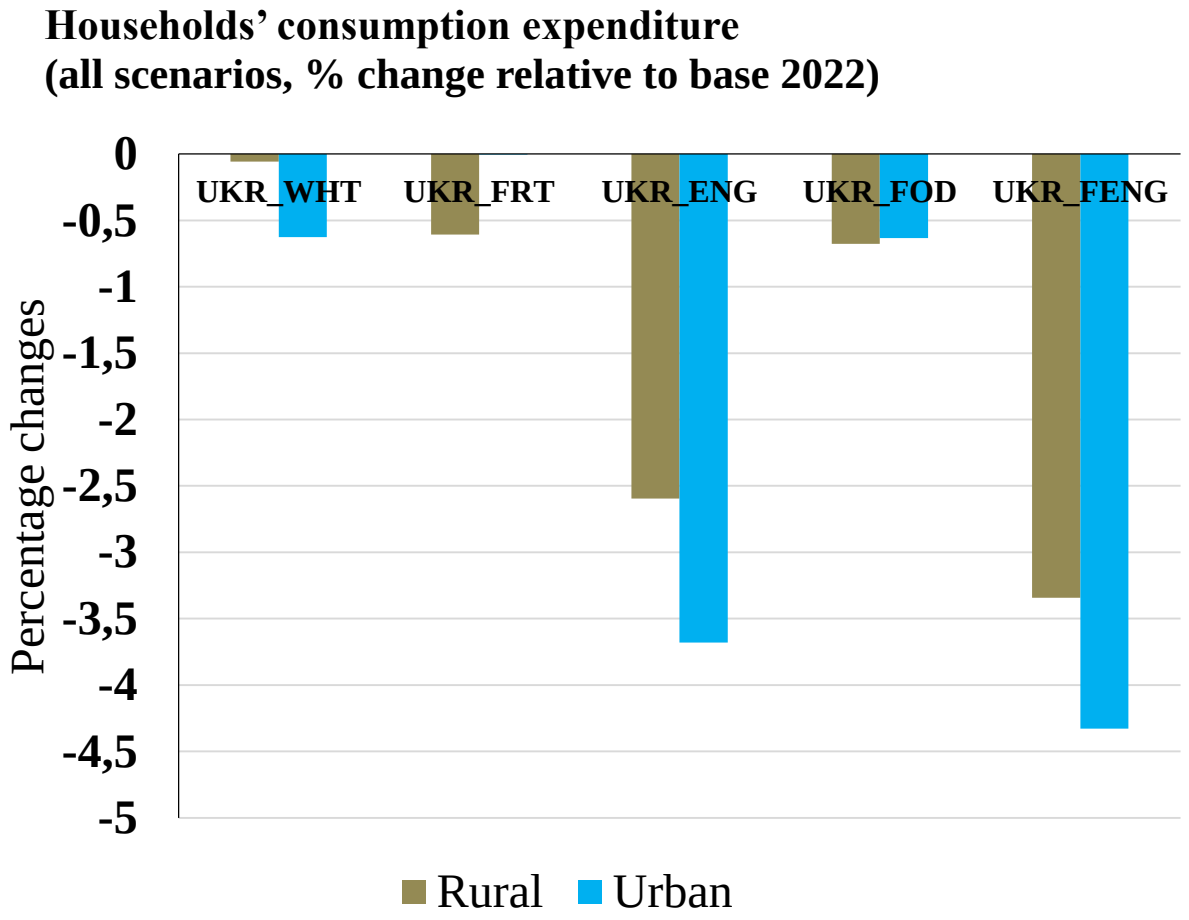
Preliminary results





- Organic fertilizer may help to dampen the adverse effects on crop activities

Preliminary results



- Households' consumption will be affected by rising prices as well as falling incomes (Diao et al., 2022)
- Labor factor incomes decline by around 4%
- The effects of wheat and fuel price changes are pronounced on urban households
- The reverse is true for the case of fertilizer price changes

Conclusions

- **Fuel price** changes represent the **dominant effects,** relatively, compared to fertilizer impacts in Diao et al. (2022)
  - Because two layers of effects (price + productivity losses from reduced fertilizer use)
- Impacts on **household** consumption are relatively worse for **urban** compared to rural in two previous studies
  - Could be due to the production and utility nests I applied, allowing more flexibility/substitutions
- Other differences
  - Higher number of commodities (Diao et al., 2022; Tamiru & Gebrewolde, 2022)
  - Size of shocks (Tamiru & Gebrewolde, 2022) & ways of modeling (Diao et al., 2022)
  - No information on the SAM used
  - DEMETRA flexibility on production & utility nests
    - e.g., manure as substitute for fertilizer (Tamiru & Gebrewolde, 2022)
- Agreements
  - Directions of impacts in many cases – GDP, employment, household consumption
  - Negligible effects due to wheat price changes

Conclusions

- **Limitations**
  - Price changes as of April 2022, latest projections might be available
  - Not weighted by the trade shares with Russia and Ukraine
  - No protective policy measures: due to other domestic economic issues
  - Missing: Other important commodities such as ***edible oils*** & ***metals***

- **Next steps**
  - Weighted by trade shares
  - Include **edible oils** & **metals**
  - Look into **nutrition** & **food security** outcomes

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Thank you

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