Supplementary Information for

Impact of the conflict in Ukraine on global food security

Contents

Scenario set-up

We estimate the impacts of the Russian-Ukraine conflict on international food markets by incorporating assumptions into a scenario in which we match some already known consequences of the conflict such as trade restrictions and sanctions that were announced by the EU and US in March and April 2022. We build up the scenario in three blocks, in which we distinguish between 1) the effects of the conflict in Ukraine that arise from a trade stop between Ukraine on the one hand and Russia and Belarus on the other, extended with lower GDP and reduced agricultural production in Ukraine, and increasing trade cost for exports from the country 2) economic impacts of sanctions against Russia, resulting in lower GDP of and reduced trade by Russia in cereals and oilseeds, and 3) effects of a global energy price increase. In this way, it can be shown which part of the storyline will have the greatest impact on global food market prices and food security indicators. The three scenario building blocks are the following.

1. Impacts in Ukraine on GDP, agricultural production, and trade costs

1a Trade stop between Ukraine and Russia & Belarus

A starting point is the assumption that in the coming years there will be no or only very limited trade between Ukraine on the one hand, and Russia and Belarus on the other, due to current hostilities and the mutual animosity between the countries that may persist for years to come.

1b Production and GDP loss within Ukraine

The war in Ukraine displaced a third of the country's population from their homes, of which approximately 4m (around 10% of the total population) fled abroad. In addition, many buildings and an important part of the infrastructure were damaged. Economic activities continue to come to a standstill in large parts of the country due to the constant threat of war for the time being. This has major consequences for the country's output levels and income-generating opportunities. **We assume the direct economic impacts of the conflict are caused by a 30% decline in labour and capital endowments**, which results in a significant GDP fall.

Agricultural production in Ukraine suffers in the short term from the war situation due to insecurity in the countryside, lack of inputs and working capital, and a shortage of labour. By 1 April, analysts estimate the number of areas with spring-planted grains and oilseeds will be so much less than in 2021 that the estimated total production of grains and oilseeds in 2022 is expected to be 50% lower than the record level of the previous season (APK-Inform, 4248. April 1, 2022). Due to war damage and expected ongoing difficulties in obtaining sufficient inputs, it is likely that agricultural production will continue to be significantly less than in 'normal' years for the time being. **We simulate the agricultural production fall by assuming an overall 50% decrease in crop yields** (production/hectare) during the simulation period, which will reduce Ukraine's exportable grain and oilseeds surpluses.

1c Additional trade Cost Ukraine

Exports are further reduced by assumed **additional trade costs of 20%** due to infrastructural damages, harbour blockages and high-risk insurance costs of transported goods.

2. Impacts in Russia on GDP and agricultural exports

2a Russian trade sanctions

The EU, UK, USA, Canada and several other countries have denied Russia access to the international payment system SWIFT and international bank loans. Moreover, Russian banks' assets are being frozen in the US, UK, EU and Canada (BBC, 6 April 2022). These financial sanctions will affect the country's investments, exchange rate and, consequently, imports. In addition, restrictions on technology exports (particularly in the energy, telecom, aerospace, and defence industries) have been imposed by the EU, US and some other countries that have macroeconomic implications.

2b GDP reduction Russia

Following the expectations of various international organisations **we assume Russian GDP to fall by 10%.**[1]

2c Export reduction agricultural Russian exports

Russian agricultural production is assumed to be not directly affected by foreign sanctions related to the war with Ukraine, but restrictions on technology imports and services, in addition to financial restrictions and the withdrawal of Western-based multinationals active in the food industries in Russia can affect agricultural productivity. Lower productivity leads to less production and exportable surplus, which can affect international markets for agricultural commodities. In addition, news items in March indicate Russia considers export quota of grains and sunflower oil for 2022 to keep domestic prices stable. Moreover, there are signs that exports of wheat and oilseeds (meal and oil) face logistic problems and are paralysed due to high insurance risks and international payments restrictions (APK-Inform, 21 March 2022). We assume these factors will lead to a **reduced Russian export of wheat and oilseeds by 50% each.**

3. Impacts on global energy prices

Since Russia is a key player in the global energy market, the conflict and associated (threats of) sanctions may affect the energy markets significantly. The many market uncertainties make price projections extremely difficult – see Box 1 for some fossil fuel price developments in February and March 2022. We assume **international energy prices will increase by 20%**, caused by the disruption in the relationship with Russia, and the consequences of sanctions on technology exports and financial restrictions, which put pressure on security of supply on the medium-term (IEA, 2022).[2] The USA and the UK have announced a ban on importing Russian oil and gas to be implemented by the end of 2022. The EU relies on Russia for 40% of its gas and has not targeted Russian energy exports (yet).

Fertiliser prices are affected by energy prices and are endogenously determined by the model projection.[3]

Text box: Fossil fuel price developments

Oil prices (Brent futures prices, considered as benchmark for many other oil types and other [fossil] fuels and energy sources) have been stable at around USD 60 per barrel (Bbl) during the period 2017-early 2020. Prices fell to a record low in April 2020 (USD 21/Bbl, due to the Covid crisis) but since then an upward trend brought prices to USD 80/Bbl at the end of December 2021. Oil prices continued to increase in Jan-Feb 2022 to reach USD 100/Bbl on 25 February and have been volatile but went up to USD 127 on 8 March before tumbling more than 20% to touch below USD 100/Bbl on 16 March 16 and went up again to reach USD

[1] For instance, OECD Economic Outlook estimations of the impact of the war in Ukraine build on simulations that incorporate ex-ante domestic demand declines of 15% in Russia and 40% in Ukraine, leading to the expectation that GDP declines are likely in the same order of magnitude. Shocks that are assumed to last for at least one year (OECD, 2022). In their updated (in April) 2022 Outlooks, IMF and World Bank expect GDP to decline in both countries in the same range or even a bit stronger (IMF, 2022; World Bank, 2022).

[2] IEA reports that Russian oil continues to flow to Europe, which is mostly governed by term deals and being delivered by trade agreements made before the invasion. But the agency states that 'new business has all but dried up. Buyers are avoiding Russian crude because of concerns about shipping safety, insurance and sanctions. Urals crude from Russia is being offered at record discounts, but uptake is limited so far, with Asian oil importers for the most part sticking to traditional suppliers in the Middle East, Latin America and Africa'. Moreover, the organisation claims that 'The prospect of large-scale disruptions to Russian oil production is threatening to create a global oil supply shock. We estimate that from April, 3 mb/d of Russian oil output could be shut in as sanctions take hold and buyers shun exports. OPEC+ is, for now, sticking to its agreement to increase supply by modest monthly amounts. Only Saudi Arabia and the UAE hold substantial spare capacity that could immediately help to offset a Russian shortfall' (https://www.iea.org/reports/oil-market-report-march-2022)

[3] There are also indications that Russia considers a ban on the export of fertilisers: early February Russia announced a temporarily restriction on export ammonium nitrate, for two months, to 1 April 2022 (https://www.agroberichtenbuitenland.nl/actueel/nieuws/2022/02/09/export-of-ammonium-nitrate-from-russia-is-restricted). RF exports about 4m tonnes of ammonium nitrate, which is about 40% of the world's ammonium nitrate exports. Russia also accounts for 14% of the global urea market and 21% of the potash market. Russia is considering more trade bans such as restrictions on Russian exports of telecoms, medical, vehicle, agricultural, and electrical equipment, as well as some forestry products such as timber to 'unfriendly countries' among which are the EU and the US (Russia hits back at Western sanctions with export bans - BBC News). Our scenarios do not include Russian export and/or import bans.

120/Bbl on 23-25 March. Energy prices are determined by both market developments and political decisions (e.g. OPEC). Volatile fossil fuel prices make forecasts very uncertain.[4]

All the scenarios build upon each other, by including all elements of the previous scenario and at the end representing the whole impact. In this way we can assess the contribution of the various assumptions on the world markets and prices. The four scenarios, their components, their description, and implementation are given in Table 3.1.

Table S.1 *Scenario description, assumptions, and implementation*

Scenario	Description of scenario	Shocks and assumptions
Ukraine impacts (Scen 1)	1a: Ukraine's trade halt with Russia and Belarus	Tariffs rise to reduce trade with 90% for all commodities
	1b: 1a + Ukraine's loss in production and GDP	Labour and capital fall 30%, land yields fall 50%, population falls 10%
	1c: 1b + Ukraine's additional transport cost with rest of world	Transport costs between Ukraine and rest of world rise 20%
Ukraine and Russia impacts (Scen 2)	2a: Scen 1 + US & EU trade sanctions against Russia.	US and EU tariffs rise 90% (or a converted %) for Russia for finance, aviation, water transport, energy, telecom, defence, iron & steel, high-end vehicle, fashion & art; in US for finance, fish & seafood, alcoholic beverage, non-industrial diamond, coal, oil, LNG; in EU for finance only.
	2b: 2a + Russia's loss in GDP	Real GDP in Russia falls 10%
	2c: 2b + Russia's reduced exports on grains and oilseeds.	Tariffs rise to reduce exports from Russia with 50% for wheat, other grains and oilseeds
Ukraine, Russia, energy price impacts (Scen 3)	Scen 2 + world energy prices rise	Prices rise 20% in the world for coal, oil, and gas

Model definition

We used the Modular Applied General Equilibrium Tool (MAGNET) for our analysis. MAGNET is a multi-regional, multi-sectoral applied computable general equilibrium (CGE) model. It is an advanced recursive dynamic version of the Global Trade Analysis Project (GTAP) model (Corong et al., 2017) which has been extended to allow integrated assessments focussing mainly on food and biomass production. As a CGE model, MAGNET solves through adjusting prices such that all markets for factors (land, labour, capital, natural resources) and commodities (good and services) simultaneously clear. Producers (one for each sector-region combination) respond to changing prices for inputs (factors and intermediates) based on profit maximization. With constant returns to scale production producers operate under zero-profit conditions. Representative private households (one for each region) respond to changing incomes earned with factor sales and changing prices of commodities for consumption based on utility maximization limited by the household's income constraint.

[4] For instance, the US Energy Information Agency projects a decline of Brent oil prices up to USD 89/Bbl in 2023, based on the expectation that global oil inventories will build at an average rate of 0.5m Bbl/d from 2Q22 through the end of 2023, despite an expected reduction of Russia's oil production. The agency stresses its price forecast is highly uncertain. (https://www.eia.gov/outlooks/steo/)

International trade flows are modelled bilaterally between all regions with regional sourcing of imports governed by the Armington assumption which allows two-way trade flows. Figure S1 outlines the structure of MAGNET with the interactions between production, trade, and consumption.

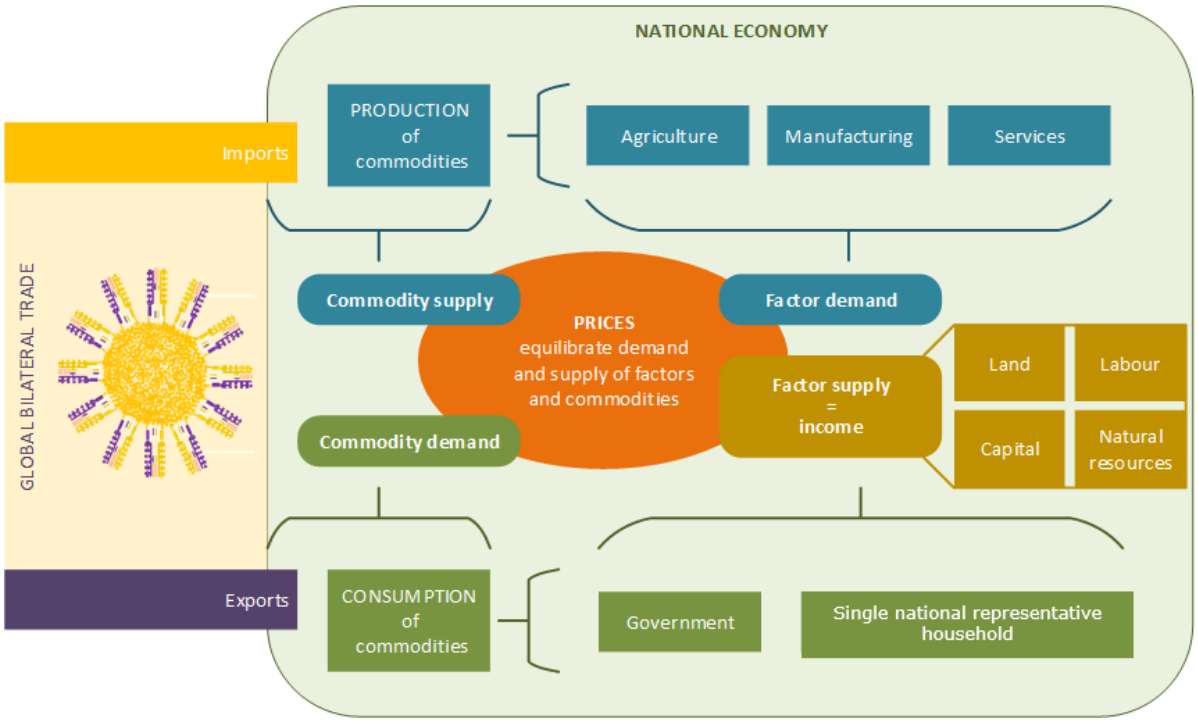

Figure S1 Schematic outline of the structure of MAGNET and the circular flow of money and commodities through the global economy.

A distinguishing feature of MAGNET is its modular structure, allowing the model to be easily tailored to specific research questions, regions, and products of interest. As a global CGE model MAGNET covers the entire global economy, with extensions adding detail on food and biomass production and use not available from other CGE models. Modules relevant for the current study are the flexible nested CES production trees (allowing for more substitution possibilities than in the standard GTAP model), endogenous land supply (allowing land areas to expand and contract depending on demand), flexible nested CET land allocation (governing the movement of sluggish land across sectors depending on the ease of switching between different types of land use), purchasing power adjusted CDE demand function (adjusting income elasticities in baseline projections to attain a more plausible pattern in food demand when incomes rise substantially), and segmented factor markets (capturing diverging labour and capital price developments in agricultural and non-agricultural sectors).

As the requested time frame is shorter than the normally considered adjustment period within this kind of analysis, the standard substitution elasticities between production factors are reduced by 50% relative to the level of the original GTAP and MAGNET elasticities.

Regional and sectoral aggregation used in MAGNET model simulation

Regional aggregation

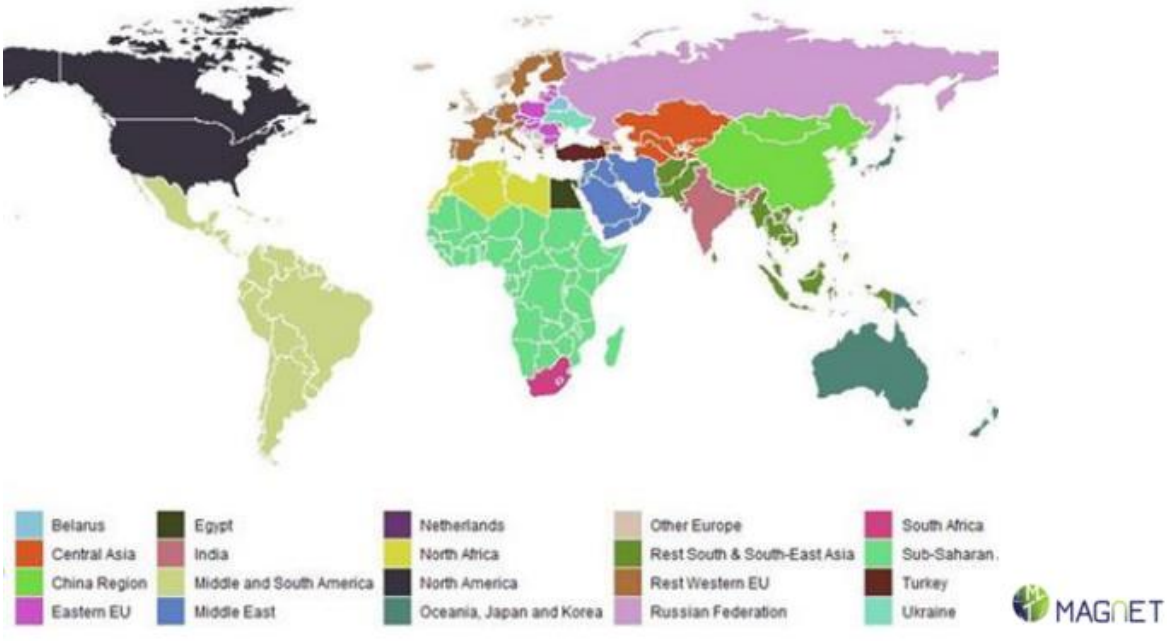

Figure S2 Regional aggregation of MAGNET model used within this study

Figure S2 Regional aggregation of MAGNET model used within this study Figure 2.1 shows the regional MAGNET aggregation used within this study (a more elaborated description is given in the Appendix). Twenty regions covering the whole world are distinguished with a focus on the Ukraine war impacts on food security. As key players Ukraine, Russia and Belarus are identified. Impacts are expected in neighbouring regions such as Eastern EU, Turkey, Middle East, Central Asia and in the China region. For food security reasons Turkey, Egypt, (rest of) North Africa, Middle East, Sub-Saharan Africa and Rest of South and South-east Asia are distinguished. Table S3 and Table S4 in the Appendix provide a detailed description of which countries belong to the regions specified above.

For explanatory convenience, some countries and regions presented in Figure S2 have been combined into more aggregated regions which are used to show the results in the graphs. The more aggregated regions and which MAGNET regions they contain are described in Table S2.

Table S2 Regional aggregation used in world market graphs

Aggregated regions	Model regions
Ukraine	Ukraine
Russia	Russia
EU	EU14, Eastern EU, Netherlands
Rest of Europe	Other Europe
Central Asia	Belarus, Central Asia, Turkey
North Africa	Egypt, Northern Africa
Rest Africa	Sub-Saharan Africa, South Africa
Rest South & South-East Asia	Rest South & South-East Asia
Asia & Oceania	Asia & Oceania
North America	North America
Middle and South America	Middle and South America
World	World

TableS3 ***Model*** *region mapping (MAGNET to GTAP)*

Regional Aggregation	Description	Mapped GTAP region
OCJK	Oceania, Japan and Korea	aus, nzl, xoc, jpn, kor, xtw
CHR	China Region	chn, hkg, mng, twn, xea
RSEA	Rest South & South-East Asia	brn, khm, idn, lao, mys, phl, sgp, tha, vnm, xse, bgd, npl, pak, lka, xsa
IND	India	Ind
NAM	North America	can, usa, xna
MSA	Middle and South America	mex, arg, bol, bra, chl, col, ecu, pry, per, ury, ven, xsm, cri, gtm, hnd, nic, pan, slv, xca, dom, jam, pri, tto, xcb
EU14	Rest Western EU	aut, bel, dnk, fin, fra, deu, grc, irl, ita, lux, mlt, prt, esp, swe
EU12	Eastern EU	bgr, hrv, cyp, cze, est, hun, lva, ltu, pol, rou, svk, svn
NLE	Netherlands	nld
REU	Other Europe	gbr, che, nor, xef, alb, xer
BLR	Belarus	blr
RUS	Russian Federation	rus
UKR	Ukraine	ukr
FSU	Central Asia	xee, kaz, kgz, tjk, xsu, arm, aze, geo
ME	Middle East	bhr, irn, isr, jor, kwt, omn, qat, sau, are, xws
TUR	Turkey	tur
EGY	Egypt	egy
NAF	North Africa	mar, tun, xnf
SSA	Sub-Saharan Africa	ben, bfa, cmr, civ, gha, gin, nga, sen, tgo, xwf, xcf, xac, eth, ken, mdg, mwi, mus, moz, rwa, tza, uga, zmb, zwe, xec, bwa, nam, xsc
ZAF	South Africa	zaf

Table S4 ***Model*** *region mapping (MAGNET to ISO)*

Regional Aggregation	Description	Mapped ISO region
OCJK	Oceania, Japan and Korea	AUS, CXR, CCK, HMD, NFK, NZL, ASM, COK, FJI, PYF, GUM, KIR, MHL, FSM, NRU, NCL, NIU, MNP, PLW, PNG, PCN, WSM, SLB, TKL, TON, TUV, UMI, VUT, WLF, JPN, KOR, BVT, ATA, IOT, ATF
CHR	China Region	CHN, HKG, MNG, TWN, PRK, MAC
RSEA	Rest South & South-East Asia	BRN, KHM, IDN, LAO, MYS, PHL, SGP, THA, VNM, MMR, TLS, BGD, NPL, PAK, LKA, AFG, BTN, MDV
IND	India	IND
NAM	North America	CAN, USA, BMU, GRL, SPM
MSA	Middle and South America	MEX, ARG, BOL, BRA, CHL, COL, ECU, PRY, PER, URY, VEN, FLK, GUF, SGS, SUR, GUY, CRI, GTM, HND, NIC, PAN, SLV, BLZ, DOM, JAM, PRI, TTO, AIA, ATG, ABW, BHS, BRB, CYM, CUB, DMA, GRD, HTI, MSR, ANT, KNA, LCA, VCT, TCA, VGB, VIR

EU14	Rest Western EU	AUT, BEL, DNK, ALA, FIN, FRA, GLP, MTQ, REU, DEU, GRC, IRL, ITA, LUX, MLT, PRT, ESP, SWE
EU12	Eastern EU	BGR, HRV, CYP, CZE, EST, HUN, LVA, LTU, POL, ROU, SVK, SVN
NLE	Netherlands	NLD
REU	Other Europe	GBR, CHE, NOR, SJM, ISL, LIE, ALB, AND, BIH, FRO, GIB, GGY, VAT, IMN, JEY, MKD, MCO, MNE, SMR, SRB
BLR	Belarus	BLR
RUS	Russian Federation	RUS
UKR	Ukraine	UKR
FSU	Central Asia	MDA, KAZ, KGZ, TJK, TKM, UZB, ARM, AZE, GEO
ME	Middle East	BHR, IRN, ISR, JOR, KWT, OMN, QAT, SAU, ARE, IRQ, LBN, PSE, SYR, YEM
TUR	Turkey	TUR
EGY	Egypt	EGY
NAF	North Africa	MAR, TUN, DZA, LBY, ESH
SSA	Sub-Saharan Africa	BEN, BFA, CMR, CIV, GHA, GIN, NGA, SEN, TGO, CPV, GMB, GNB, LBR, MLI, MRT, NER, SHN, SLE, CAF, TCD, COG, GNQ, GAB, STP, AGO, COD, ETH, KEN, MDG, MWI, MUS, MOZ, RWA, TZA, UGA, ZMB, ZWE, BDI, COM, DJI, ERI, MYT, SYC, SOM, SDN, SSD, BWA, NAM, LSO, SWZ
ZAF	South Africa	ZAF

Sectoral aggregation

The sectoral aggregation includes the key crops for Ukraine and Russia such as wheat, other cereal grains (includes maize) and oilseeds. Oilseeds includes all varieties of oilseeds and is therefore a mixture for products were Ukraine and Russia are important such as rape and sunflower seeds, and some where this is not the case (e.g. soybean). In addition to these key crops the aggregation includes rice, vegetables, sugar crops, rice, other crops. Cattle, pork, poultry and other cattle and related processed products are separated within the livestock sectors. Another 50 sectors cover the rest of the economy including the energy sectors (coal, gas, oil) and fertiliser sectors (N, P and K). A detailed description of all sectors is given in Table S5.

Table S5 ***Commodity*** *mapping*

Commodity Aggregation	**Description**	**Disaggregated MAGNET sets**	**Mapped GTAP sets**
pdr	Paddy and processed rice	pdr	<-
wht	Wheat	wht	<-
grain	Cereal grains nec	gro	<-
veg	Vegetables	v_f, veg	<-
oils	Oil seeds	osd	<-
sug	Sugar cane, sugar beet	c_b	<-
oagr	Other agriculture	pfb	<-
crops	Crops nec	ocr	<-
othctl	sheep,goats,horses	ctl	<-
pigpls	Pig and other animal product	oap	<-
milk	Raw milk	rmk	<-
wol	Wool, silk-worm cocoons	wol	<-
frs	Forestry	frs	<-
wfish	Wild fish	fsh	<-
coa	Coal	coa	<-
c_oil	Crude oil	oil	<-

gas	Gas	gas	<-
manu	Manufacturing	oxt, nmm, i_s, nfm, fmp, ele, eeq, ome, mvh, otn, omf, cns	<-
othcmt	Meat: other cattle,sheep,goats,horse	cmt	<-
othmt	Other meat product nec	omt	<-
vol	Vegetable oils and fats	vol	<-
dairy	Dairy products	mil	<-
pcr	Processed rice	pcr	<-
sugar	Sugar and molasses	sgr, mola	sgr, sgr
ofd	Processed food	ofd, b_t	<-
othind	Other industry	tex, wap, lea, lum, ppp	<-
petro	Petroleum, coal products	p_c, aviaf, ftavia	p_c, p_c, p_c
chm	Chemical products	chm, bioch	chm, chm
bph	Basic pharmaceutical products	bph, bioph	bph, bph
rpp	Rubber and plastic products	rpp, lsug, pe, pla, bfchem, biopl	rpp, sgr, chm, chm, chm, rpp
ely	Electricity	ely, edt	ely, ely
gas_dist	Gas manufacture, distribution	gdt	<-
ser	Services	wtr, trd, cmn, ofi, ins, rsa, obs, osg, edu, dwe	<-
foodserv	Food services	afs, ros, hht	<-
trans	Transport sector	otp, wtp, atp, whs	<-
fruit	Fruit	fruit	<-
nuts	Nuts	nuts	<-
roots	Roots and tubers	roots	<-
pulses	Pulses	pulses	<-
feed	Animal feed	feed	ofd
cvol	Crude vegetable oil	cvol	vol
biog	Biogasoline	biog, bf_g, bf_s, bf_m	p_c, p_c, p_c, p_c
biod	Biodiesel	biod, bf_o	p_c, p_c
fert_n	fertilizer nutrient n	fert_n	chm
fert_p	fertilizer nutrient p	fert_p	chm
fert_k	fertilizer nutrient k	fert_k	chm
ftfuel	ftfuel 2nd gen biofuel	ftfuel	p_c
eth	ethanol 2nd gen biofuels	eth	p_c
ely_c	electricity from coal	ely_c	ely
ely_g	electricity from gas	ely_g	ely
ely_n	electricty from nuclear	ely_n	ely
ely_h	electricty from hydro	ely_h	ely
ely_w	electricty from wind and solar	ely_w	ely
bioe	bioelectricity 2nd gen	bioe	ely
res	residue sector	res	p_c
pel	pellet sector	pel	lum
plan	Plantation	plan	frs
pltry	poultry sector	pltry	oap
pulmt	poultry meat	poum	omt
cattle	cattle sector	bfctl	ctl
bfmt	beef meat	BFCMT	cmt
aqcltr	Aquaculture	Diad, Fresh, Crust, Marin, Molus	fsh, fsh, fsh, fsh, fsh
fishp	Fish processing	Fishp	ofd
heat	heat	heat	ely
bioh	bioheat	bioh	ely
ddgs	Biogasoline byproduct	ddgs	p_c

oilcake	Oil cake byproduct of cvol used as animal feed	oilcake	vol
r_pdr	residue pdr	r_pdr	pdr
r_wht	residue wheat	r_wht	wht
r_gro	residue gro	r_gro	gro
r_osd	residue osd	r_osd	osd
r_ocr	residue ocr	r_ocr	ocr
r_frs	residue frs	r_frs	frs
r_veg	residues vegetables	r_v_f, r_veg	v_f, veg
fishm	fish meal	fishm	ofd
r_frt	residue fruits	r_frt	fruit
r_nuts	residue nuts	r_nuts	nuts
r_root	residue roots	r_root	roots
r_puls	residue pulses	r_puls	pulses

Additional scenario results

GDP effects are presented in two panels in Figure S3 because country effects differ in scale. The top panel shows GDP effects in Ukraine and Russia. Ukraine's GDP decline (about 30%) is due to the (assumed) strong decline in the labour and capital endowments, which holds for all three scenarios. Russia's GDP decline (about 10%) is based on our interpretation of IMF expectations about the country's potential recession, emerging in scenario 2 and 3. Outside Ukraine and Russia, GDP impacts are limited, with strongest impacts on 'Central Asia' of -0.8%. The assumed increase of energy prices (Ukraine, Russia, energy prices impact, scenario 3) has a strong GDP impact in all regions. For example, for the EU GDP declines by 0.4% in the energy price scenario, whereas GDP effects are about 0.0% in scenario 1 (Ukraine impacts) and scenario 2 (Ukraine+Russia impacts).

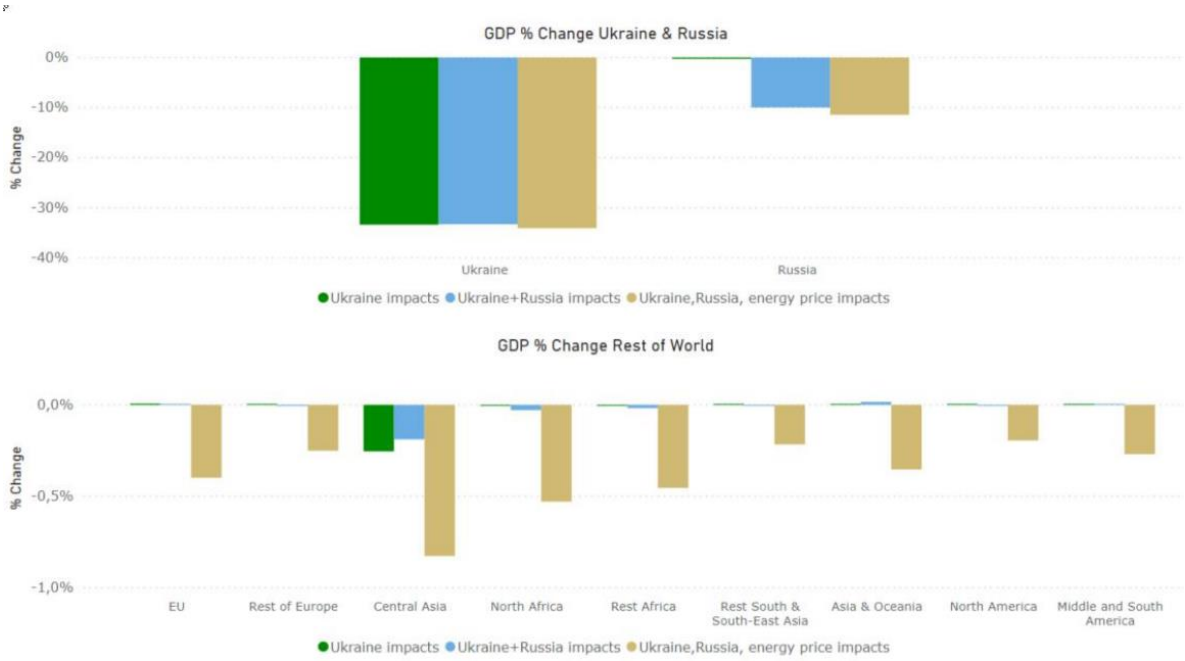

Figure S3 GDP developments (% change)

Production

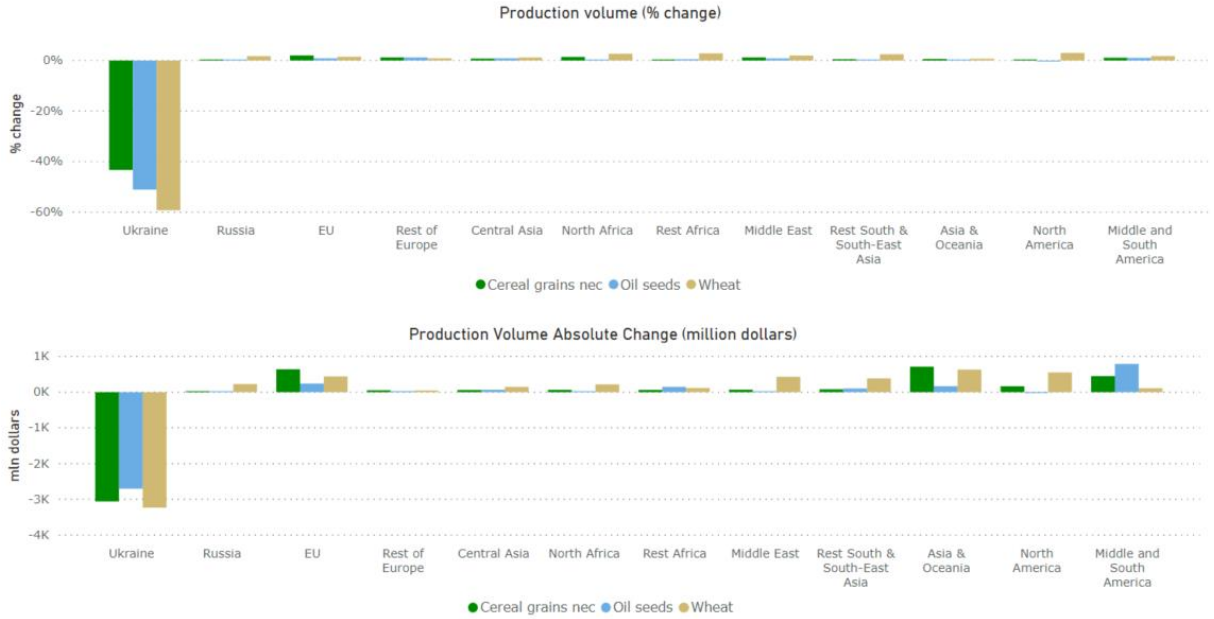

Figure S4 Production volume developments (% change in upper panel, absolute change (million US dollars) in lower panel)) for wheat, oilseeds, and other cereals in the Ukraine impacts scenario (scenario 1)

In the Figure above and below the production effects are also shown when only Ukraine impacts (scenario 1) and Ukraine-Russia impacts (scenario 2) are applied. If only Ukraine impacts (scenario 1) are applied, then Figure S4 shows that different regions slightly increase production. Wheat production is expanding in Asia and Oceania, North America, Rest of South, Europe, Middle East, Southeast Asia, and also a little in Russia. For other grains, production expands especially in Europe, Asia, and Oceania, and Middle and South America. Oilseed production expands especially in Middle and South America. Figure S5 (below) shows the impacts of the Ukraine-Russia scenario (scenario 2) in which wheat production in Russia in particular is negatively affected and production increases mainly in Central Asia and the regions that also do so in scenario 1. Some additional Figures on world price decomposition, trade and consumer prices impacts are provided below to provide additional information, although they are not referred to in the main text.

Figure S5 Production volume developments (% change in upper panel, absolute change (million USD) in lower panel)) for wheat, oilseeds, and other cereals in the Ukraine Russia impacts scenario (scenario 2)

World price decomposition

Figure S6 Decomposition: World price impact of agricultural commodities in each scenario (% change).

Trade in Ukraine impacts and Ukraine-Russia scenarios

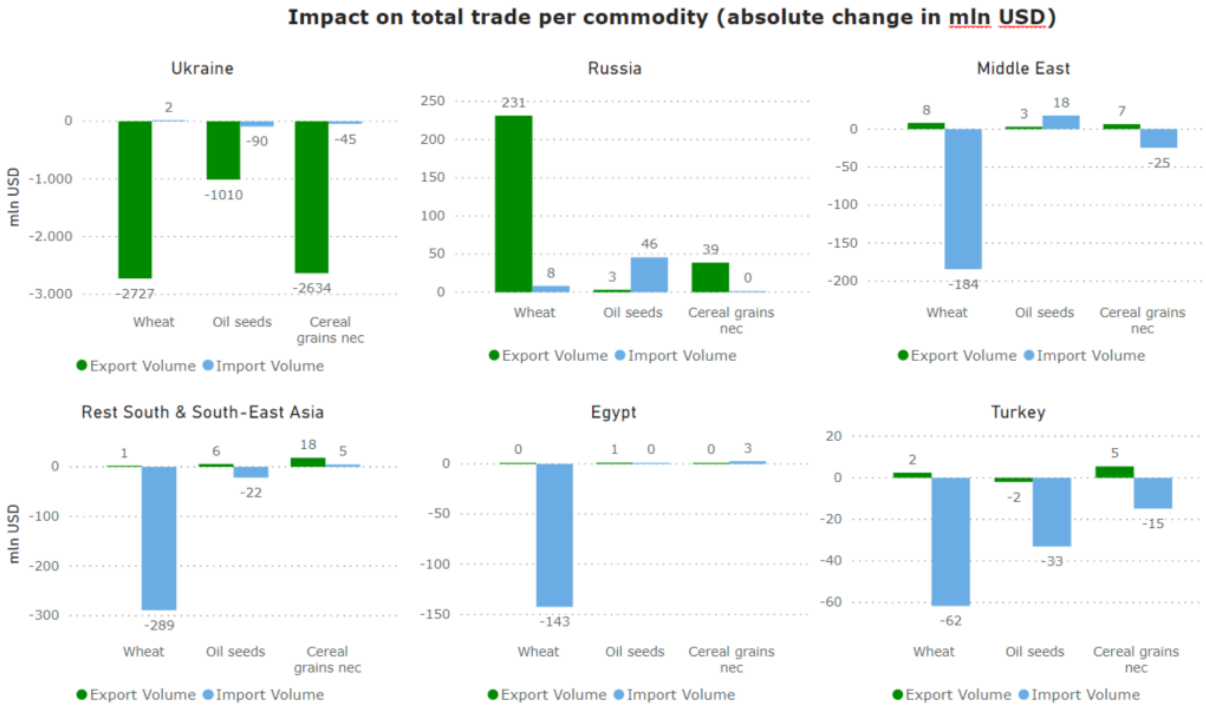

Figure S7 Changes in exports and import of wheat, other cereals and oilseeds, Ukraine impacts scenario (scenario 1, absolute change in million USD)

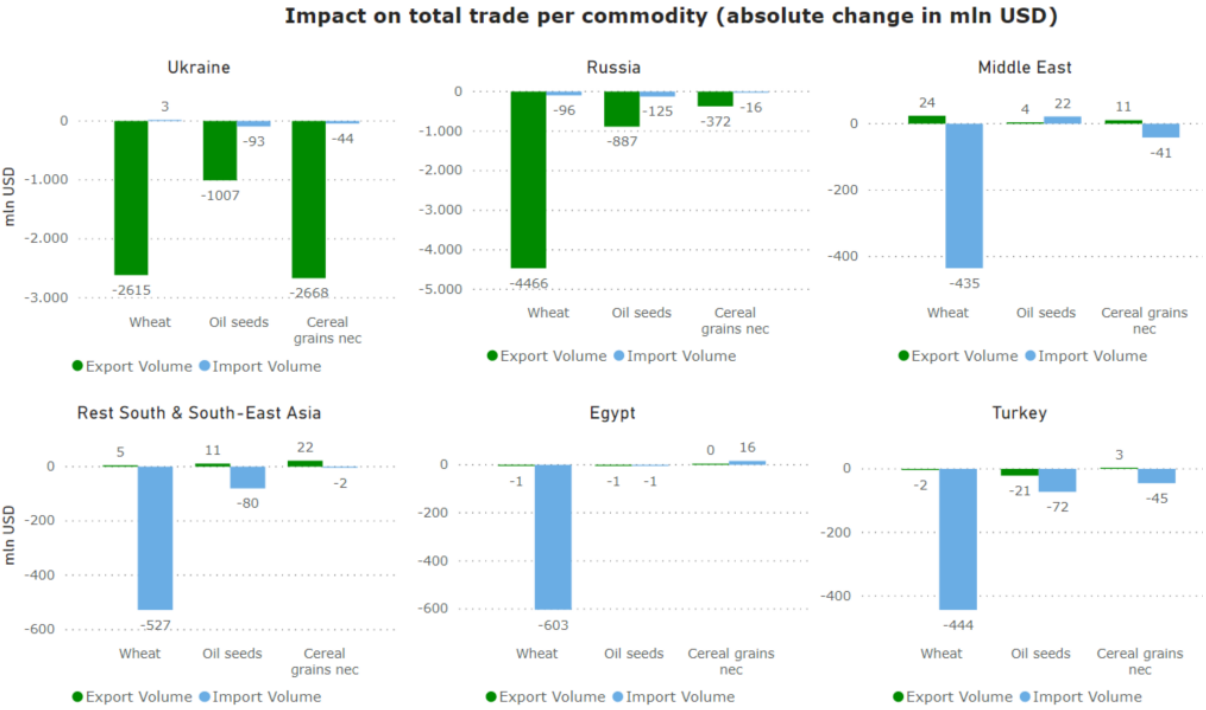

Figure S8 Changes in exports and import of wheat, other cereals and oilseeds, Ukraine+Russia impacts scenario (scenario 2, absolute change in mln USD)

Consumer price impacts

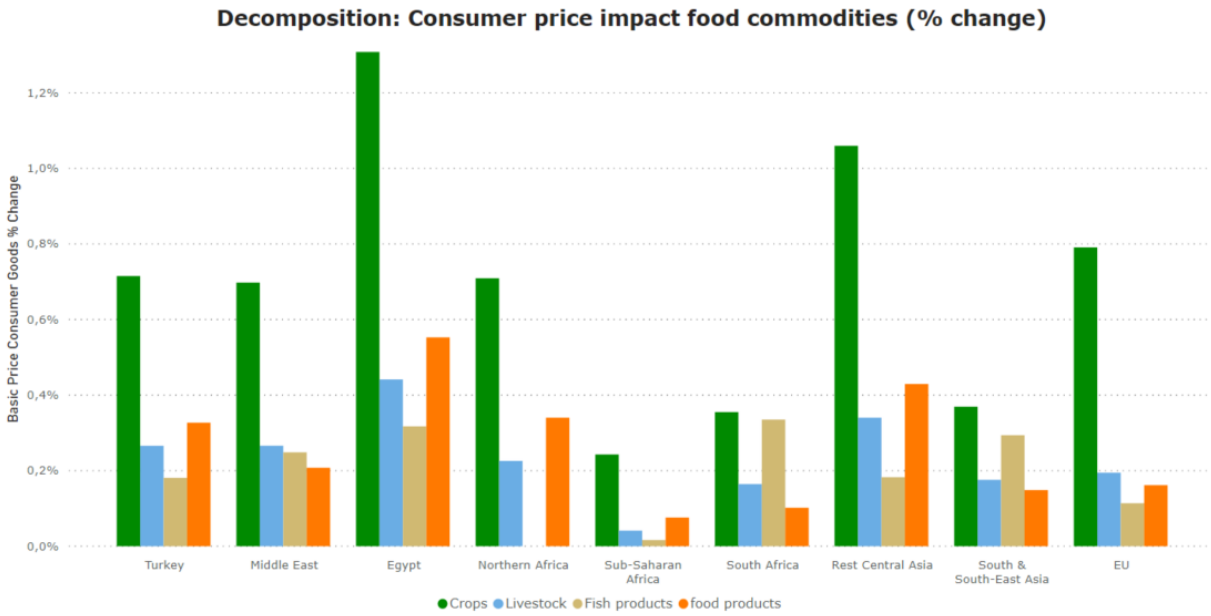

Figure S9 Basic consumer price impacts for different groups of agri-food products in Ukraine impact scenario 1 (% change)

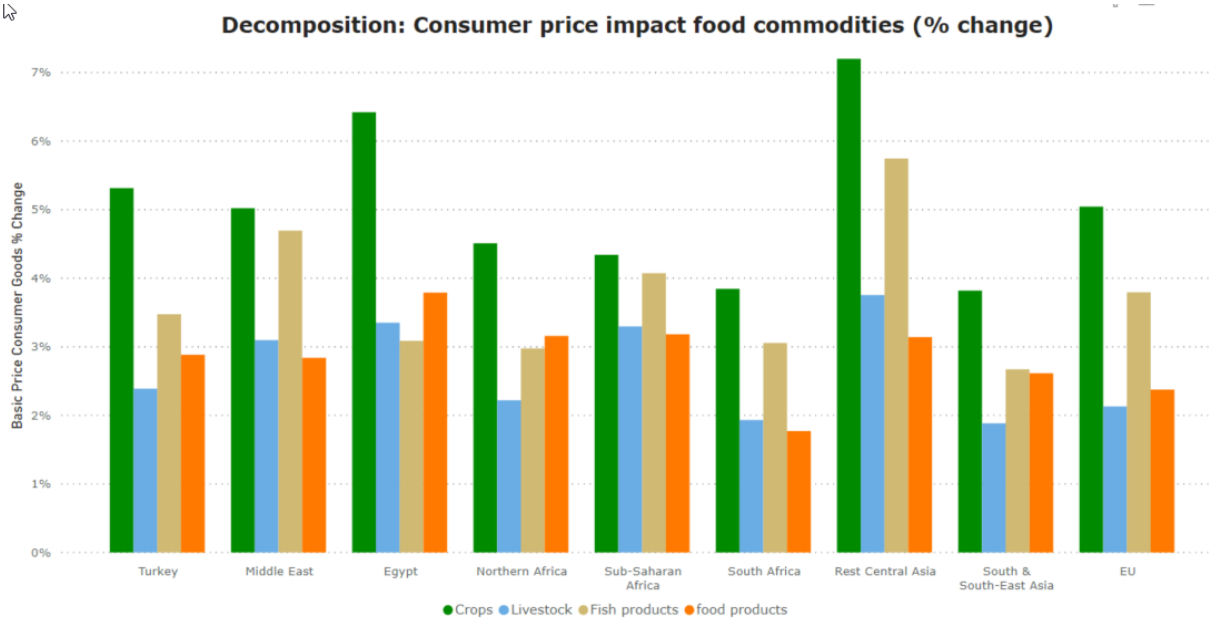

Figure S10 Basic consumer price impacts for different groups of agri-food products in Ukraine, Russia, energy prices impact scenario 3 (% change)

References

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