Future changes in North American Trade agreements exacerbate climate impacts on food security in Mexico

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Climate change has direct and indirect impacts on many human activities, including public health and society at large. For this reason, it is necessary to analyze the available information to identify current trends and to design mitigation measures aimed at preventing and reducing the damage these changes may cause in the immediate future. The objective of this project is to provide strategic information to key stakeholders involved in the design and implementation of public policies in agriculture, health, economy, and governance sectors. This project is a collaboration between the National Institute of Public Health (INSP) of Mexico, Cornell University, and the International Maize and Wheat Improvement Center (CIMMYT)–CGIAR.

Acronyms

Wellcome Trust	The Wellcome Trust Foundation (https://wellcome.org/) is a global charitable foundation that funds high-impact research to improve health and save lives around the world, based on scientific principles.
INSP	Instituto Nacional de Salud Pública (National Institute of Public Health) (https://insp.mx/)
Cornell University	efers to the Department of Global Development within the College of Agriculture and Life Sciences at Cornell University (USA, https://cals.cornell.edu/).
CIMMYT	International Maize and Wheat Improvement Center (https://www.cimmyt.org/)
CGIAR	Consultative Group on International Agricultural Research (https://www.cgiar.org/)
WUR	Wageningen University & Research
AIM	Structural objective of the project.

Acknowledgment

The participants involved declare that they have no conflict of interest and that they did not receive any financial or non-financial benefits derived from the conducted research or the project. The information management protocol is governed by the principles of Human Subjects Research, as well as by the applicable legislation on the protection of personal data.

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Abstract

This study assesses how climate change and potential modifications to North American trade agreements jointly affect food security in Mexico, with a focus on maize and beans. Using the MAGNET computable general equilibrium model calibrated to the GTAP 11 database, we simulate scenarios combining climate impacts with trade policy changes, including a 10% tariff on basic grain imports from the United States. The baseline follows the SSP2 "middle-of-the-road" pathway, updated with national projections for Mexico. Results indicate that climate change will reduce domestic production of maize and beans by approximately 7% and 2%, respectively, by 2050, primarily driven by declines in labor productivity. These shocks are expected to increase producer prices by about 7% for maize and 4% for beans, while deepening Mexico's dependence on imports, particularly for animal feed. Trade restrictions on basic grains further exacerbate these effects, adding roughly one percentage point to price increases. Despite projected economic growth, Mexico remains structurally dependent on maize imports due to relatively low productivity gains compared to major trading partners. The findings suggest that trade protection measures, when combined with climate pressures, may undermine food affordability and increase fiscal pressure on agricultural support programs. Policy responses aimed at boosting productivity—such as expanding existing agricultural programs—could partially offset these adverse effects. Overall, the study highlights the importance of coordinated climate and trade policies to safeguard food security in Mexico over the coming decades.

Keywords

Climate change; Mexico; Maize; Beans; Trade policy; General equilibrium model

1. Introduction

There are growing concerns regarding the impact of climate change on crop productivity and prices (Li et al. 2022). Besides earth system dynamics, the magnitude and extent of future climate change impacts depend on socio-economic developments (e.g., population growth, economic development, technological change, trade policies) (van Vuuren et al., 2014). General equilibrium models are well-suited to capture such developments and to assess food security outcomes, as they link income changes and price feedback to food demand (van Meijl et al., 2020).

The current Mexican Government has placed a strong focus on supporting small farmers to produce priority crops such as maize and beans. This government strives to be self-sufficient on white maize production, while the country remains highly dependent on yellow maize imports (i.e., for animal feed). Currently, national household surveys reveal that the consumption of beans significantly declined over the past decades (Gutiérrez et al., 2012; Shamah et al., 2016). Maize and beans are a key component of sustainable healthy diets in the country, which if adopted, would help fighting the ongoing global syndemic of malnutrition and climate change (Swinburn et al., 2019; Unar-Munguía et al., 2024).

Trade restrictions could exacerbate climate impacts on food prices (Wiebe et al., 2015). The trade agreement between the United States, Mexico, and Canada (T-MEC) is subject to review in 2026 and is expected to expire in 2036. Its validity has the potential to be extended to 2042. At the same time, climate mitigation policies aligned with limiting warming to 1.5°C may also result in rising food prices (Sundiang et al., 2025). The Mexican Government faces continuous pressures from farmers to support the agricultural sector. Changes to T-MEC such as excluding basic grains (e.g., maize, beans, wheat, sorghum) have been proposed by farmer groups, which faces opposition as it may lead to higher food prices. Altogether, price variations have implications to national policies on agricultural support prices (e.g., "precios de garantia") of crops like maize.

This study aims to provide an integrated assessment of the impact of climate change on food security in Mexico in the following 25 years. For this purpose, we focus on the impact of climate change on the prices of maize and beans. The interactions with potential changes in trade policies resulting from the end of the T-MEC are also explored.

2. Methodology

2.1. Model version and developments

We employ a global macroeconomic model named MAGNET to examine a range of scenarios (Gatto et al., 2023; Kuiper and Cui, 2020; Woltjer et al., 2014). MAGNET (Modular Applied General Equilibrium Tool) is a neoclassical recursive dynamic, multi-regional, multi-commodity general equilibrium model build upon the GTAP model. For this research, MAGNET is calibrated to version 11c of the GTAP database with base year 2017 (Aguiar et al., 2022a).

The model version employed has 28 regions, where Mexico appears as an individual country (see Table A.1 in the Annex). It highlights separately top trade partners, such as the United States, the European Union (split in western and eastern parts), China, Japan and Canada. As Mexico strives to be in the top 10 of global economies, this regional aggregation includes countries competing with Mexico to be in that ranking, such as Brazil, South Korea, Russia, Turkey and Indonesia.

The model incorporates 95 commodities being produced, with a good split in the food systems (see Table A.2 in the Annex). The MAGNET database has been extended to include maize and beans as separate commodities. The latter task entailed splitting the commodity groups Other Grains and Pulses to disaggregate data for Maize and Beans, respectively. Demand and trade data were split with the RAS procedure (Aguiar et al., 2022b) based on data from Chepeliev et al. (2021). To obtain consistent production data, cost structures from the original sectors (i.e., Other grains, Pulses) were replicated to the new sectors. This procedures yield a new balanced SAM that incorporates Maize and Beans.

2.2. Scenario development

Initially simulations will run until 2050. The baseline scenario is based on the shared socioeconomic pathways database (SSPs), (O'Neill et al., 2017; Van Vuuren et al., 2012). For this scenario, we adopt the SSP2 variant, often referred to as the "middle of the road" scenario (Fricko et al., 2017). For consistency, we replaced the SSP values for Mexico with historical data (2017-2024) and projections for GDP and population, based on national sources (e.g., INEGI, CONAPO). For the GDP projections in the period 2025-2027, we update the SSPs with projections from the OECD Economic Outlook (December 2025), then for 2028-2040, we use data from the Aglink-Cosimo model developed by the OECD and the FAO. For 2040-2050, the GDP projections remain as specified in the SSP2 variant. The baseline also incorporates calibrations in terms of land and feed efficiency in the livestock sector based on the IMAGE model (Stehfest et al., 2014). Relevant changes in taxes (e.g., unhealthy foods) and tariffs (i.e., T-MEC) occurred since the base year 2017 to date, which are under an ongoing update based on a recent release of data by the GTAP Center for the year 2023.

The impacts of climate change on crop yields are based on selected Representative Concentration Pathways (RCPs) (van Vuuren et al., 2011) with data from Jägermeyr et al. (2021). Initial shock data is based on three global circulation models: gfdl_esm4, ipsl_cm6a_lr and mri_esm2_0. Climate impacts on livestock and agricultural labour productivity are based on Thornton et al. (2022) and Nelson et al. (2024), respectively.

Changes in T-MEC are modelled here, with a particular focus on basic grains. For this purpose, we assume a 10% tariff on imports of maize, beans, wheat and other grains from the United States to Mexico. This value is around the average value that Mexico imposes to other trading partners. This is imposed in the 2025-2030 period.

3. Results

As part of our projections, we expect that real income in Mexico would grow by 81% in the period 20117-2050 (Fig. 1). Compared with countries with similar economic size, Mexico would experience one of the lowest growth rates in the analysed period. Land productivity (production/land demand) of maize would barely grow by mid-century (Fig. 2, Panel I). Under this context, as the main source of maize import in Mexico, the United States has a substantially larger land productivity than Mexico and other countries with high participation in maize imports from Mexico. In the case of beans, Mexico has a larger land productivity than the countries of origin of most of its imports, which would keep growing (Fig. 2, Panel II).

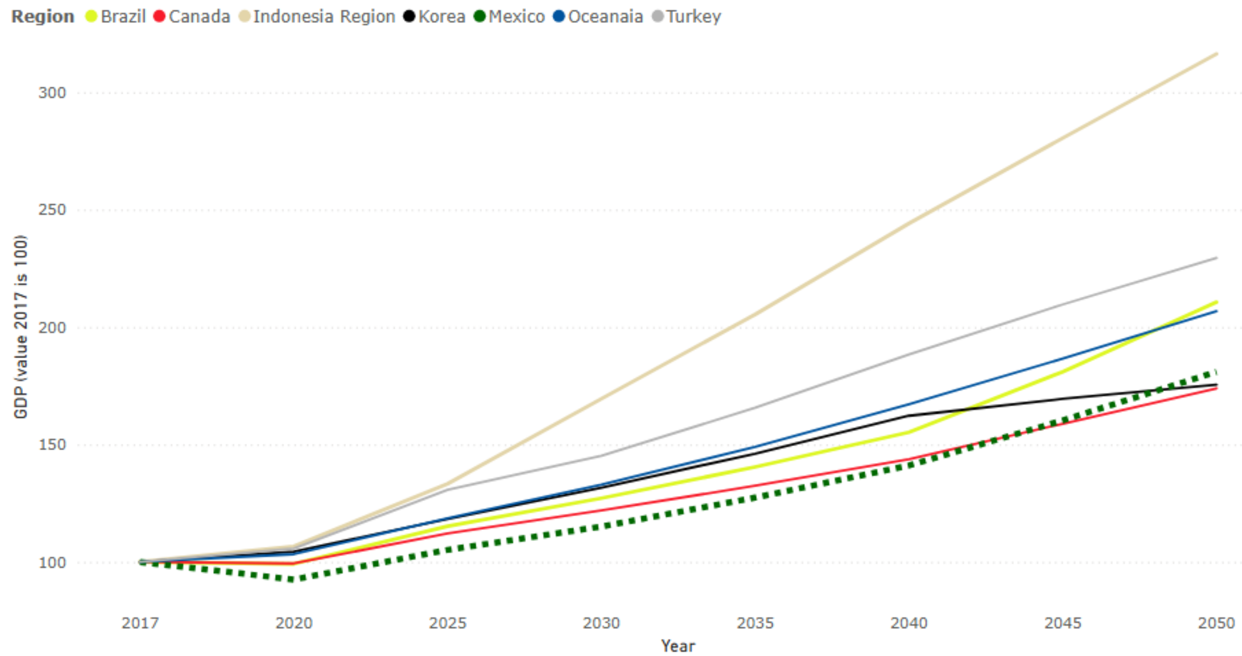
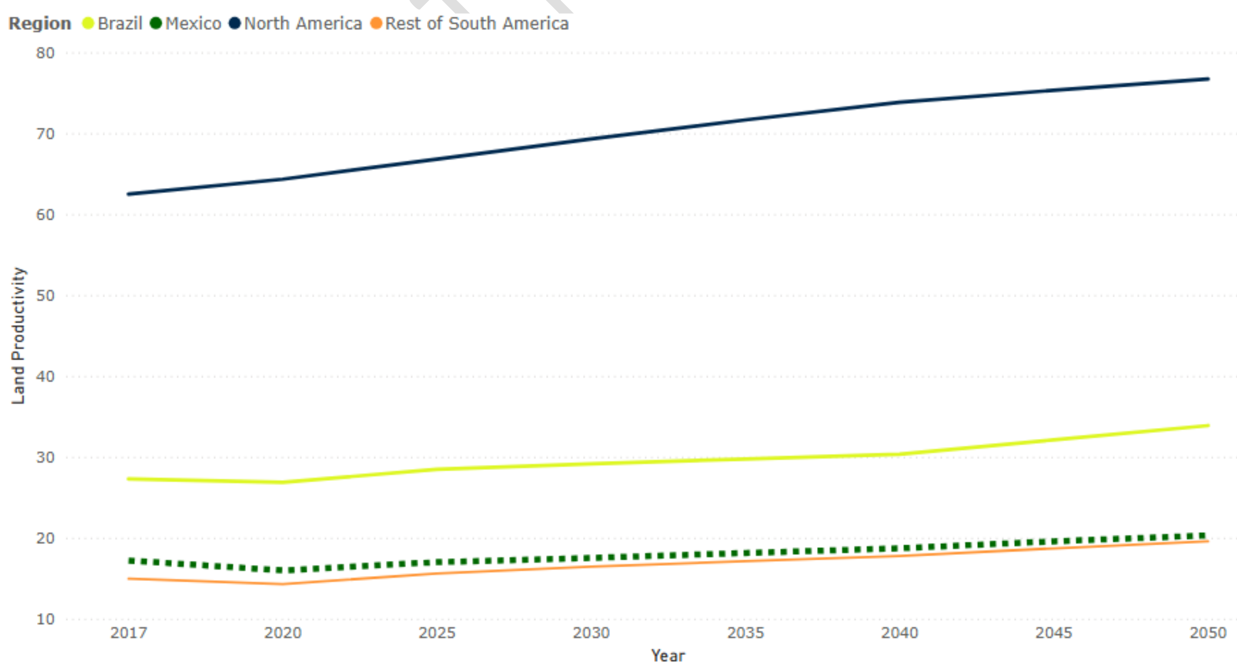


Fig. 1. Real GDP projections for selected countries, 2017-2050
Note: Values are shown as an index 2017=100.

Panel I: Maize



Panel II: Beans

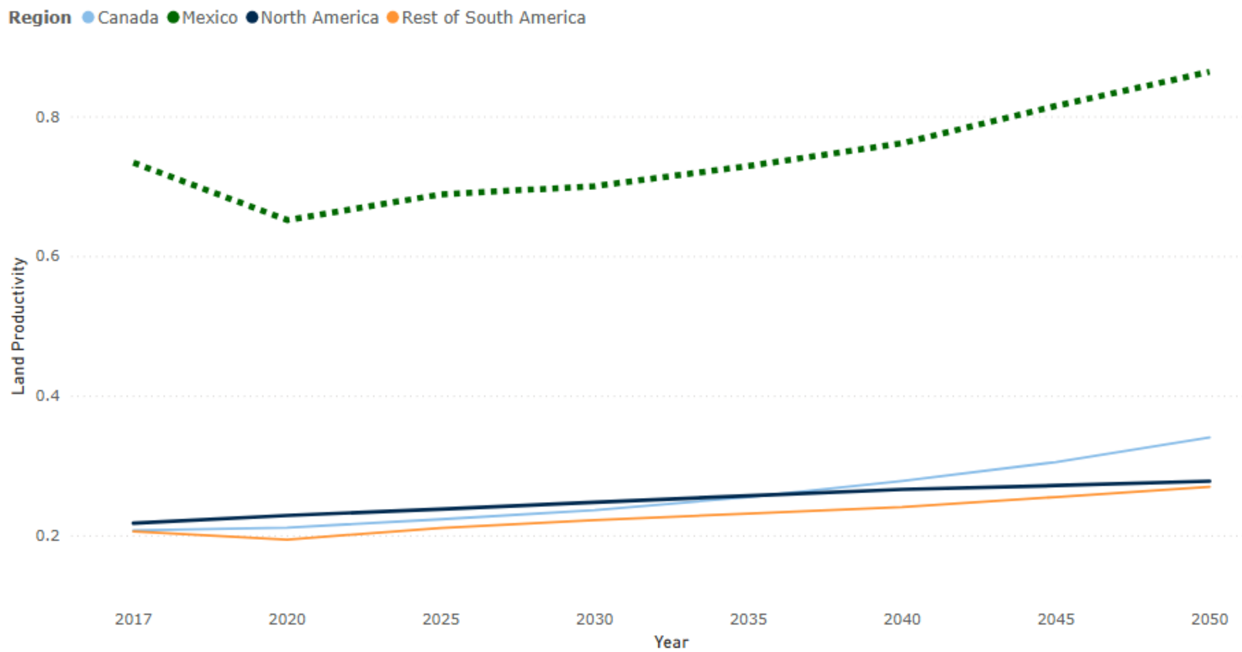


Fig. 2. Land productivity for selected countries, maize and beans, 2017-2050

The production of maize in Mexico would reach 33M tonnes by 2050 (Fig. 3). Trade flows would keep expanding, while the nation would preserve a large trade deficit of around USD 2.9B in this commodity. Beans production would reach 1.4M tonnes by mid-century (Fig. 4). Again, the country would preserve a trade deficit in this commodity during the same period.

Climate change would impact the production of maize and beans, with reduction of 7% and 2% relative to baseline conditions, respectively. Exports of both commodities would decline, whereas Mexico would increase its maize imports and reduce its beans imports. Altogether climate change would result in around a 7% and 4% rise in maize and beans producer prices, respectively. Impacts of this shock would be mainly driven by the impacts on labour productivity (around 2.4%).

As a result of climate change, Mexico would need to import more animal feed in the future (Fig.6). This result would be mainly driven by the impacts of this shock on the livestock sector. The exclusion of basic grains such as maize and beans would lead to around 1 p.p. increase in the prices of these commodities.

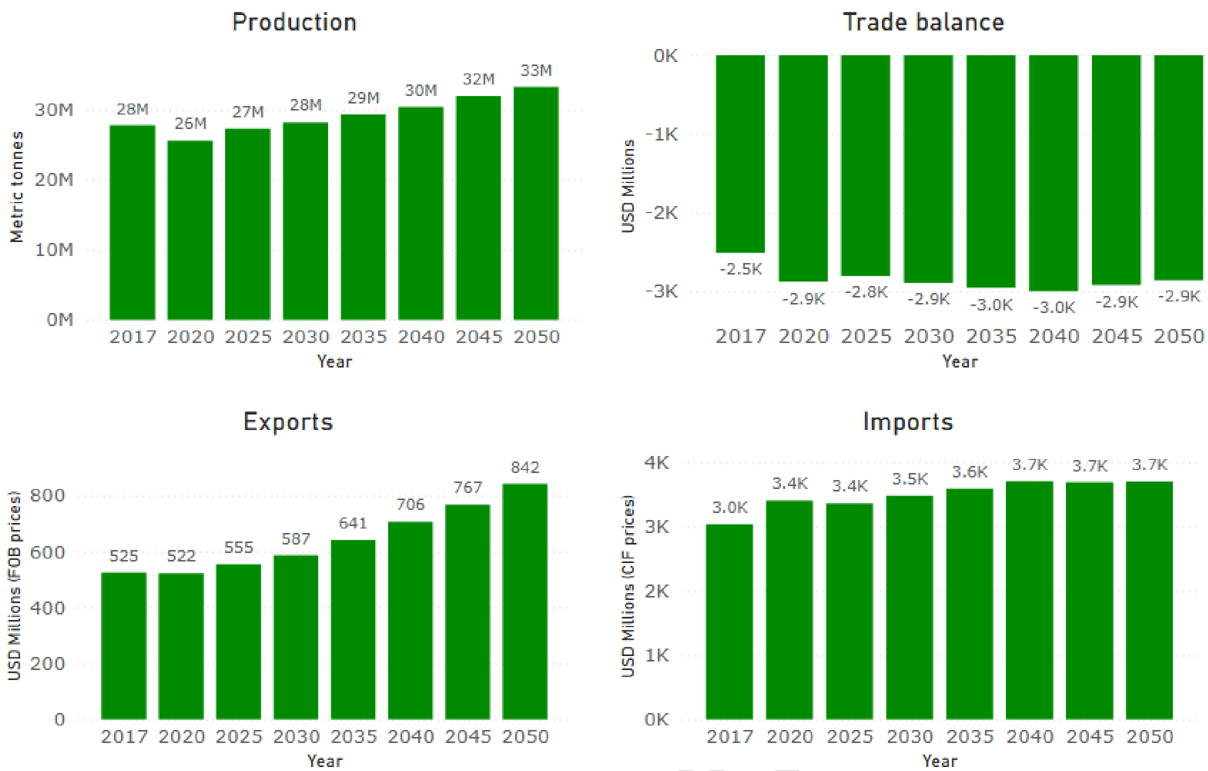


Fig. 3. Production and trade in the maize sector of Mexico, 2017-2050

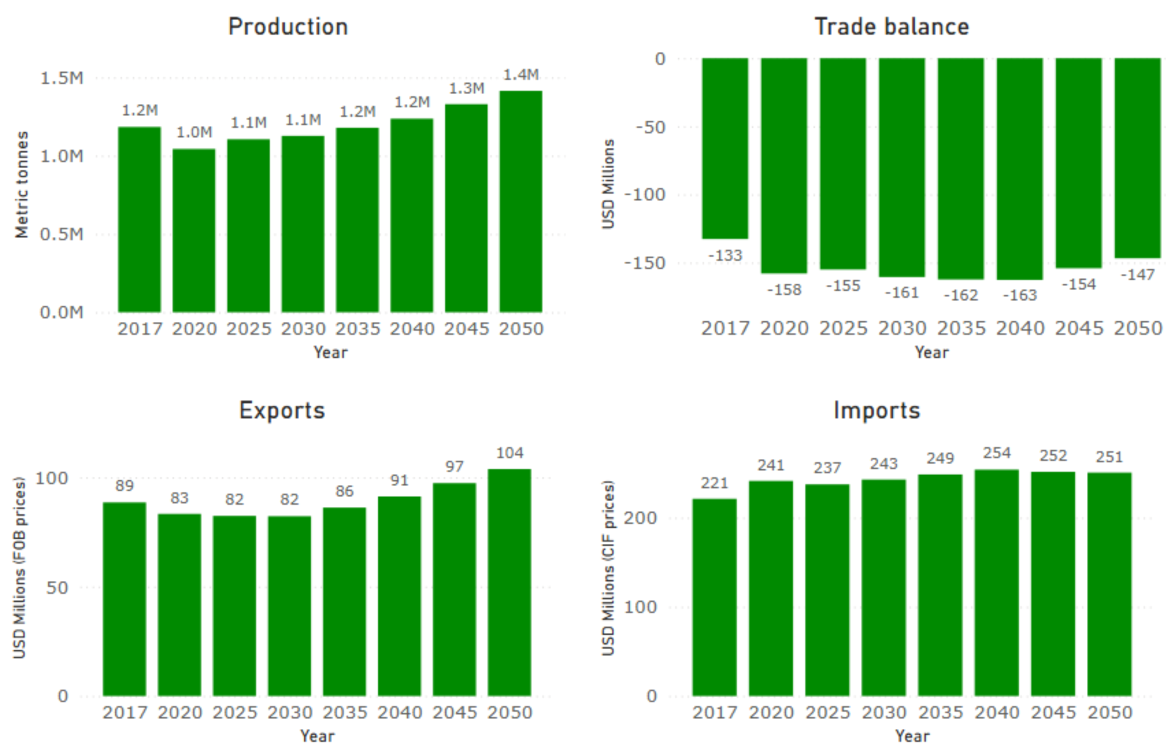


Fig. 4. Production and trade in the beans sector of Mexico, 2017-2050

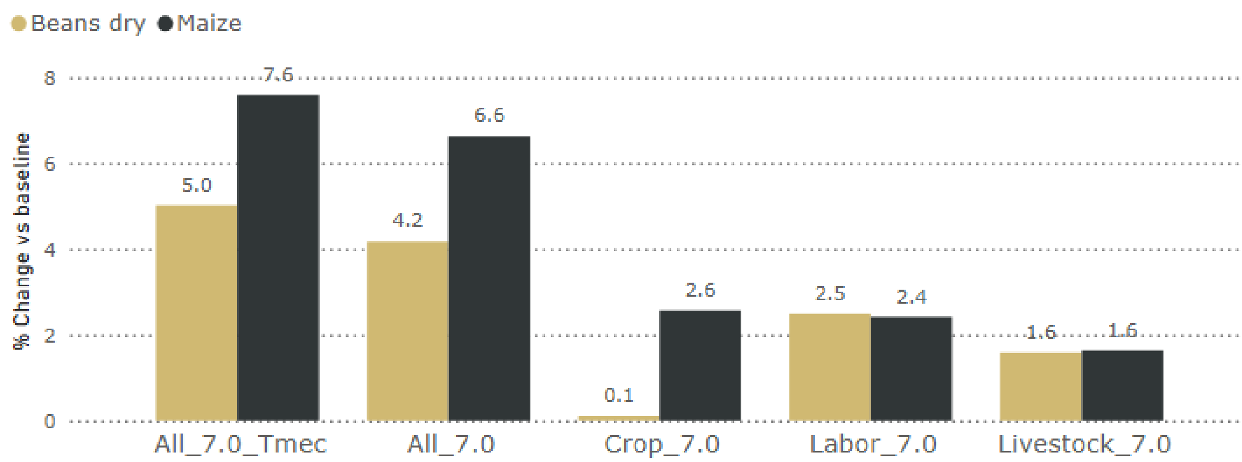


Fig. 5. Impact of climate change on maize and beans producer prices, % change vs baseline in 2050. Notes: Scenario All_7.0_Tmec includes exogenous imposition of 10% tariff on imports of basic grains from the United Stes to Mexico.

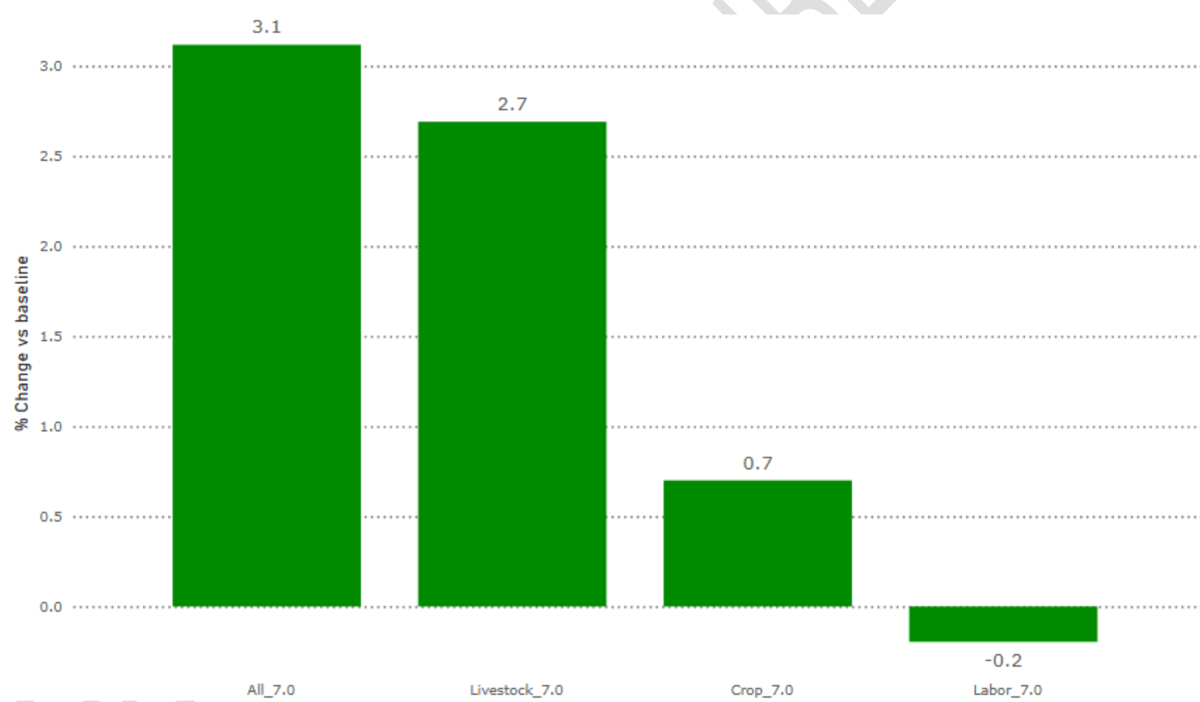


Fig. 6. Impact of climate change on animal feed imports, % change vs baseline in 2050.

4. Conclusion

An initial assessment of the impact of climate change in Mexico revealed a sizeable increase of maize and beans prices in Mexico. This negative consequence would be exacerbated if Mexico excludes basic grains from the T-MEC. These foods are a key component of Mexican diets, especially of those living in low-income areas. This results in negative implications for this population groups in terms of consumption, but also regarding nutrition outcomes.

Alternative strategies should be added to compensate for this economic impact. This developments would result in increased budget pressures in Mexico to counteract the impacts of this shock. Currently, the Mexican Government deploys a program tailored to boost agricultural productivity. It has been estimated that such programs increase yields by 25%. Such programs may aid to bridge the gap with larger producers of Maize, for instance. An expansion of such policies is warranted in the context of trade and climate pressures.

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Annex

Table A.1. Region aggregation

Code	Region	Group	Group description
aus	Australia	OCE	Oceania
nzl	New Zealand	OCE	Oceania
xoc	Rest of Oceania	IDN	Indonesia Region
chn	China	CHR	China Region
hkg	Hong Kong	CHR	China Region
jpn	Japan	JAP	Japan
kor	Korea	KOR	Korea
mng	Mongolia	CHR	China Region
twn	Taiwan	CHR	China Region
xea	Rest of East Asia	KOR	Korea
brn	Brunei Darussalam	SEA	Southern Asia
khm	Cambodia	SEA	Southern Asia
idn	Indonesia	IDN	Indonesia Region
lao	Lao People's Democratic Republic	SEA	Southern Asia
mys	Malaysia	SEA	Southern Asia
phl	Philippines	SEA	Southern Asia

sgp	Singapore	SEA	Southern Asia
tha	Thailand	SEA	Southern Asia
vnm	Viet Nam	SEA	Southern Asia
xse	Rest of Southeast Asia	SEA	Southern Asia
afg	Afghanistan	RSA	Rest of South Asia
bgd	Bangladesh	RSA	Rest of South Asia
ind	India	IND	India
npl	Nepal	RSA	Rest of South Asia
pak	Pakistan	RSA	Rest of South Asia
lka	Sri Lanka	RSA	Rest of South Asia
xsa	Rest of South Asia	RSA	Rest of South Asia
can	Canada	CAN	Canada
usa	United States of America	USA	North America
mex	Mexico	MEX	Mexico
xna	Rest of North America	USA	North America
arg	Argentina	RSM	Rest of South America
bol	Bolivia	RSM	Rest of South America
bra	Brazil	BRA	Brazil
chl	Chile	RSM	Rest of South America
col	Colombia	RSM	Rest of South America
ecu	Ecuador	RSM	Rest of South America
pry	Paraguay	RSM	Rest of South America
per	Peru	RSM	Rest of South America
ury	Uruguay	RSM	Rest of South America
ven	Venezuela	RSM	Rest of South America
xsm	Rest of South America	RSM	Rest of South America
cri	Costa Rica	CAM	Central America
gtm	Guatemala	CAM	Central America
hnd	Honduras	CAM	Central America
nic	Nicaragua	CAM	Central America
pan	Panama	CAM	Central America
slv	El Salvador	CAM	Central America
xca	Rest of Central America	CAM	Central America
dom	Dominican Republic	CAM	Central America
hti	Haiti	CAM	Central America
jam	Jamaica	CAM	Central America
pri	Puerto Rico	CAM	Central America
tto	Trinidad and Tobago	CAM	Central America
xcb	Caribbean	CAM	Central America
aut	Austria	EU15	Western EU
bel	Belgium	EU15	Western EU
bgr	Bulgaria	EU12	Eastern EU
hrv	Croatia	EU12	Eastern EU
cyp	Cyprus	EU12	Eastern EU
cze	Czech Republic	EU12	Eastern EU
dnk	Denmark	EU15	Western EU
est	Estonia	EU12	Eastern EU
fin	Finland	EU15	Western EU
fra	France	EU15	Western EU
deu	Germany	EU15	Western EU
grc	Greece	EU15	Western EU
hun	Hungary	EU12	Eastern EU
irl	Ireland	EU15	Western EU
ita	Italy	EU15	Western EU
lva	Latvia	EU12	Eastern EU
ltu	Lithuania	EU12	Eastern EU

lux	Luxembourg	EU15	Western EU
mlt	Malta	EU15	Western EU
nld	Netherlands	EU15	Western EU
pol	Poland	EU12	Eastern EU
prt	Portugal	EU15	Western EU
rou	Romania	EU12	Eastern EU
svk	Slovakia	EU12	Eastern EU
svn	Slovenia	EU12	Eastern EU
esp	Spain	EU15	Western EU
swe	Sweden	EU15	Western EU
gbr	United Kingdom	RWE	Rest of Western Europe
che	Switzerland	RWE	Rest of Western Europe
nor	Norway	RWE	Rest of Western Europe
xef	Rest of EFTA	RWE	Rest of Western Europe
alb	Albania	RCE	Rest of Central Europe
srb	Serbia	RCE	Rest of Central Europe
blr	Belarus	UKR	Ukraine Region
rus	Russian Federation	RUR	Russia Region
ukr	Ukraine	UKR	Ukraine Region
xee	Rest of Eastern Europe	UKR	Ukraine Region
xer	Rest of Europe	RCE	Rest of Central Europe
kaz	Kazakhstan	CAS	Central Asia
kgz	Kyrgyztan	CAS	Central Asia
tjk	Tajikistan	CAS	Central Asia
uzb	Uzbekistan	CAS	Central Asia
xsu	Rest of Former Soviet Union	CAS	Central Asia
arm	Armenia	RUR	Russia Region
aze	Azerbaijan	RUR	Russia Region
geo	Georgia	RUR	Russia Region
bhr	Bahrain	ME	Middle East
irn	Iran Islamic Republic of	ME	Middle East
irq	Iraq	ME	Middle East
isr	Israel	ME	Middle East
jor	Jordan	ME	Middle East
kwt	Kuwait	ME	Middle East
lbn	Lebanon	ME	Middle East
omn	Oman	ME	Middle East
pse	State of Palestine	ME	Middle East
qat	Qatar	ME	Middle East
sau	Saudi Arabia	ME	Middle East
syr	Syria	ME	Middle East
tur	Turkey	TUR	Turkey
are	United Arab Emirates	ME	Middle East
xws	Rest of Western Asia	ME	Middle East
dza	Algeria	NAF	Northern Africa
egy	Egypt	NAF	Northern Africa
mar	Morocco	NAF	Northern Africa
tun	Tunisia	NAF	Northern Africa
xnf	Rest of North Africa	NAF	Northern Africa
ben	Benin	WAF	Western Africa
bfa	Burkina Faso	WAF	Western Africa
cmr	Cameroon	WAF	Western Africa
civ	Cote d'Ivoire	WAF	Western Africa
gha	Ghana	WAF	Western Africa
gin	Guinea	WAF	Western Africa
mli	Mali	WAF	Western Africa

ner	Niger	WAF	Western Africa
nga	Nigeria	WAF	Western Africa
sen	Senegal	WAF	Western Africa
tgo	Togo	WAF	Western Africa
xwf	Rest of Western Africa	WAF	Western Africa
caf	Central African Republic	WAF	Western Africa
tcd	Chad	WAF	Western Africa
cog	Congo	WAF	Western Africa
cod	Congo the Democratic Republic	WAF	Western Africa
gnq	Equatorial Guinea	WAF	Western Africa
gab	Gabon	WAF	Western Africa
xac	South Central Africa	RSF	Rest of Southern Africa
com	Comoros	EAF	Eastern Africa
eth	Ethiopia	EAF	Eastern Africa
ken	Kenya	EAF	Eastern Africa
mdg	Madagascar	EAF	Eastern Africa
mwi	Malawi	RSF	Rest of Southern Africa
mus	Mauritius	EAF	Eastern Africa
moz	Mozambique	RSF	Rest of Southern Africa
rwa	Rwanda	EAF	Eastern Africa
sdn	Sudan	EAF	Eastern Africa
tza	Tanzania	RSF	Rest of Southern Africa
uga	Uganda	EAF	Eastern Africa
zmb	Zambia	RSF	Rest of Southern Africa
zwe	Zimbabwe	RSF	Rest of Southern Africa
xec	Rest of Eastern Africa	EAF	Eastern Africa
bwa	Botswana	RSF	Rest of Southern Africa
swz	Eswatini	RSF	Rest of Southern Africa
nam	Namibia	RSF	Rest of Southern Africa
zaf	South Africa	ZAF	South Africa
xsc	Rest of South African Customs	RSF	Rest of Southern Africa
xtw	Rest of the World	OCE	Oceania

Table A.2. Commodity aggregation

Code	Commodity	Group	Group description
pdr	Paddy rice	pdr	Paddy and processed rice
wht	Wheat	wht	Wheat
maize	Maize	maize	Maize
gro	Cereal grains nec	grain	Cereal grains nec
v_f	Vegetables, fruit, nuts	veg	Vegatables
osd	Oil seeds	oils	Oil seeds
c_b	Sugar cane, sugar beet	sug	Sugar cane, sugar beet
pfb	Plant-based fibers	oagr	Other agriculture
ocr	Crops nec	crops	Crops nec
ctl	Bovine cattle, sheep and goats	othctl	sheep,goats,horses
oap	Animal products nec	pigpls	Pig and other animal product
rmk	Raw milk	milk	Raw milk
wol	Wool, silk-worm cocoons	wol	Wool, silk-worm cocoons
frs	Forestry	frs	Forestry
fsh	Fishing	wfish	Wild fish
coa	Coal	coa	Coal
oil	Oil	oil	Crude oil
gas	Gas	gas	Gas
oxt	Minerals nec	oxt	Minerals nec

cmt	Bovine meat products	othcmt	Meat: other cattle,sheep,goats,horse
omt	Meat products nec	othmt	Other meat product nec
vol	Vegetable oils and fats	vol	Vegetable oils and fats
mil	Dairy products	dairy	Dairy products
pcr	Processed rice	pcr	Processed rice
sgr	Sugar	sugar	Sugar
ofd	Food products nec	ofd	Processed food
b_t	Beverages and tobacco products	b_t	Beverages and tobacco products
tex	Textiles	texplus	textiles, leather and wearing apparel
wap	Wearing apparel	texplus	textiles, leather and wearing apparel
lea	Leather products	texplus	textiles, leather and wearing apparel
lum	Wood products	wood	Wood products
ppp	Paper products, publishing	ppp	Paper products, publishing
p_c	Petroleum, coal products	p_c	Petroleum, coal products
chm	Chemical products	chm	Chemical products
bph	Basic pharmaceutical products	bph	Basic pharmaceutical products
rpp	Rubber and plastic products	rpp	Rubber and plastic products
nmm	Mineral products nec	nmm	Mineral products nec
i_s	Ferrous metals	manu	Manufacturing
nfm	Metals nec	manu	Manufacturing
fmp	Metal products	manu	Manufacturing
ele	Computer, electronic and optic	manu	Manufacturing
eeq	Electrical equipment	manu	Manufacturing
ome	Machinery and equipment nec	manu	Manufacturing
mvh	Motor vehicles and parts	manu	Manufacturing
otn	Transport equipment nec	manu	Manufacturing
omf	Manufactures nec	omf	Other Manufacturing, includes furniture
ely	Electricity	ely	Electricity
gdt	Gas manufacture, distribution	gas_dist	Gas manufacture, distribution
wtr	Water	ser	Services
cns	Construction	manu	Manufacturing
trd	Trade	ser	Services
afs	Accommodation, Food and servic	foodserv	Food services
otp	Transport nec	trans	Transport sector
wtp	Water transport	trans	Transport sector
atp	Air transport	trans	Transport sector
whs	Warehousing and support activi	ser	Services
cmn	Communication	ser	Services
ofi	Financial services nec	ser	Services
ins	Insurance	ser	Services
rsa	Real estate activities	ser	Services
obs	Business services nec	ser	Services
ros	Recreational and other service	foodserv	Food services
osg	Public Administration and defe	foodserv	Food services
edu	Education	edu	Education
hht	Human health and social work a	foodserv	Food services
dwe	Dwellings	ser	Services
veg	Vegetables	veg	Vegatables
fruit	Fruit	fruit	Fruit
nuts	Nuts	nuts	Nuts
roots	Roots and tubers	roots	Roots and tubers
pulses	Other pulses	pulses	Other pulses
beans	Beans	beans	Beans
feed	Animal feed	fdctl	feed cattle
cvol	Crude vegetable oil	cvol	Crude vegetable oil
biog	Biogasoline	biog	Biogasoline

biod	Biodiesel	biod	Biodiesel
fert_n	fertilizer nutrient n	fert_n	fertilizer nutrient n
fert_p	fertilizer nutrient p	fert_p	fertilizer nutrient p
fert_k	fertilizer nutrient k	fert_k	fertilizer nutrient k
bf_g	biofuel feedstock grains	biog	Biogasoline
bf_s	biofuel feedstock sugar	biog	Biogasoline
bf_m	biofuel feedstock molasse	biog	Biogasoline
bf_o	biofuel feedstock oils	biod	Biodiesel
ftfuel	ftfuel 2nd gen biofuel	bf2nd	2nd gen biofuel
eth	ethanol 2nd gen biofuels	bf2nd	2nd gen biofuel
lsug	ligno sugar	biopl	bio plastics
pe	pe biochemical	biopl	bio plastics
pla	pla biochemical	biopl	bio plastics
f_chem	mixed fossil biochemical sector	chm	Chemical products
ely_c	electricity from coal	ely_c	electricity from coal
ely_g	electricity from gas	ely_g	electricity from gas
ely_n	electricty from nuclear	ely_n	electricty from nuclear
ely_h	electricty from hydro	ely_h	electricty from hydro
ely_w	electricty from wind and solar	ely_w	electricty from wind and solar
bioe	bioelectricity 2nd gen	bioe	bioelectricity 2nd gen
res	residue sector	respel	residue and pellets sector
pel	pellet sector	respel	residue and pellets sector
plan	plantation	plan	Plantation
pltry	poultry live animals	pltry	poultry sector
poum	Poultry meat	pulmt	poultry meat
bfctl	beef	cattle	cattle sector
BFCMT	beaf meat	bfmt	beef meat
Diad	Diadromis fish	aqcltr	Aquaculture
Fresh	Fresh water fish	aqcltr	Aquaculture
Crust	Crustaceans	aqcltr	Aquaculture
Marin	Marin fish	aqcltr	Aquaculture
Molus	Molusks	aqcltr	Aquaculture
Fishp	Fish processing	fishp	Fish processing
bfchem	bioplastics	biopl	bio plastics
aviaf	fossil kerosine	p_c	Petroleum, coal products
ftavia	biokerosine	p_c	Petroleum, coal products
edt	electricty distribution	ely	Electricity
heat	heat	heat	heat
bioh	bioheat	bioh	bioheat
bioch	bio chemicals	bioch	bio chemicals
bioph	bio pharmaceuticals	bioph	bio pharmaceuticals
biopl	bio plastics	biopl	bio plastics
Bgas	Biogas	gas_dist	Gas manufacture, distribution
SugSc	Sugar syrup confec	sugar	Sugar
Swd	Seaweed	Swd	Seaweed
fdctl	feed cattle	fdctl	feed cattle
fdpig	feed pigs	fdpig	feed pigs
fdplt	feed poultry	fdplt	feed poultry
fdfsh	feed fish	fdfsh	feed fish
pest	pesticides	pest	pesticides
ddgs	Biogasoline byproduct	ddgs	Biogasoline byproduct
mola	Molasse	mola	Molasse
oilcake	Oil cake byproduct of cvol used as animal feed	oilcake	Oil cake byproduct of cvol used as animal feed
r_pdr	residue pdr	r_pdr	residue pdr
r_wht	residue wheat	wht	Wheat
r_gro	residue gro	r_gro	residue gro

r_osd	residue osd	r_osd	residue osd
r_ocr	residue ocr	crops	Crops nec
r_frs	residue frs	r_frs	residue frs
r_v_f	residue v_f	veg	Vegatables
fishm	Fish meal	fishm	fish meal
r_veg	residue vegetables	veg	Vegatables
r_frt	residue fruits	fruit	Fruit
r_nuts	residue nuts	nuts	Nuts
r_root	residue roots	roots	Roots and tubers
r_puls	residue pulses	pulses	Pulses
r_bean	Residue beans	beans	Beans
mnctl	manure cattle	mnctl	manure cattle
mnbctl	manure beef cattle	mnbctl	manure beef cattle
mnoap	manure other animals	mnoap	manure other animals
mnrmk	manure rawmilk	mnrmk	manure rawmilk
mnpltry	manure poultry	mnpltry	manure poultry

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