The future of food security of the Philippines in the face of climate change and changing consumption

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Abstract

The objectives of this study are two-fold: (i) to foresight the future demand for food items in the Philippines by rural and urban households, and (ii) to simulate changes in food consumption under various climatic scenarios. I used uncompensated demand and income elasticities from Bairagi et al. (2022) to estimate the future food demands and develop a simulation-based rice market model to quantify changes in food demands in the next decade. The results reveal that temperature and precipitation negatively affect the rice yield in the Philippines, the primary cash crop and staple food, but the effects are insignificant (minimal). The rice productivity could decrease by 0.24-0.9%, resulting in an approximate 0.28-1.02% increase in rice prices in the next decade. Because of climate change (RCP 8.5: no climate mitigation target scenario), the per capita rice consumptions in Filipino rural and urban households are likely to decline by 0.60 kg and 0.74 kg per year, respectively. In terms of total demand, approximately 85 thousand metric tons (mt) of milled rice will be less demanded due to climate change. The total meat demand is likely to decline by 5.4 thousand mt, with a higher decline in urban areas. In contrast, approximately 1.2 thousand mt of fish consumption will increase by 2030. These findings indicate that climate change will reshape the future food basket in the Philippines.

Keywords: climate change; demand for food; food security; Philippines; simulation model.

JEL Codes:

1. Introduction

The global food system (production to processing to consumption) is under pressure from extreme weather events (e.g., floods and droughts) and non-climate stressors, such as population and income growth and increased demand for animal-sourced products (Godfray et al., 2010; Mbow et al., 2019). These supply and demand shifting factors are likely to adversely affect global food security and environmental sustainability (Wheeler & von Braun, 2013). For instance, agriculture contributes approximately one-fifth of the global share of greenhouse gas (CHG) emissions (IPCC, 2014). Noticeably, a few commodities with beef, dairy, and rice accounts for more than 80% of agricultural emissions (Figure 1; Laborde et al., 2021). However, the leading cash crop and staple food, rice, in the Philippines alone accounts for nearly two-thirds of agricultural emissions (Figure 1). From the agri-food system perspective, farmgate and pre- and post-production activities contribute one-fourth of the total emissions (Table 1).

The global food system emissions caused unembellished human health and biodiversity challenges and, importantly, brought extreme weather anomalies. For instance, more than half of the total floods, droughts, and storms that occurred during the last 120 years happened in the first two decades of the 21st century. Because of climate change and its impacts, the production of the global staple foods (wheat, maize, and rice) could shrink by 10.0-38.0% (Challinor et al., 2014; Deutsch et al., 2018; Müller & Robertson, 2014). Climatic change might also bring more insect pests and pathogens, resulting in additional crop production losses (Carraro, 2016; Savary et al., 2019). Therefore, meeting additional food demand due to income and population growth would be challenging (Bairagi et al., 2020, 2021). To fight against these challenges, it is urgent to transform the food supply system that can deliver better human and sustainable development outcomes. Regarding this, global leaders worldwide are already committed to adopting various mitigation and adaptation policy strategies. Specifically, two of the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, focused on “taking urgent action to combat climate change and its impacts (SDG 13)” and “ensuring sustainable consumption and production patterns (SDG 12).

Based on a global study, Challinor et al. (2014) found that the productivity gains of the global cereals (maize, wheat, and rice) could increase from 7% to 15% with various crop-level adaptations compared to without adaptation. However, adapting to a changing climate is site-specific, and thus specific adaptation and mitigation strategies are required (Aryal et al., 2018; Below et al., 2012; Deressa et al., 2009). For instance, since rice alone accounts for two-thirds of the agriculture emission in the Philippines, specific adaptation and mitigations policies targeting its rice sector are needed. However, knowledge regarding how climate change could reshape the Philippines’ food supply and demand system is limited. The contribution of this study is two-fold: (i) to foresight the future demand for food items in the Philippines by rural and urban households, and (ii) to simulate changes in food consumption under various climatic scenarios. I argue that findings from this study will help foresee the risk associated with climate change and guide policymakers in designing a sustainable food system that can provide adequate food and nutrition security in the future.

Following the introduction, the rest of the article consists of the following sections. Section 2 presents a partial equilibrium rice market model for the Philippines and data sources to develop the model. Section 3 discusses the main findings from the rice market model, whereas the conclusion and policy implications are presented in the final section.

2. Methodology and data

2.1 Rice market model for the Philippines

The following rice market model was developed, following the Arkansas Global Rice Model, to foresee the effects of climate change on future food demands. This structural model consists of a linear system of demand, supply, and price transmission equations:

Supply-side equations		
Yield (rough)	$Y_t = \alpha_0\, UP_t^{\alpha_1} \times PL_t^{\alpha_2} \times OF_t^{\alpha_3} \times R_t^{\alpha_4} \times T_t^{\alpha_5} \times Time^{\alpha_6}$	(1)
Area	$A_t = \beta_0 \times A_{t-1}^{\beta_1} \times PP_t^{\beta_2} \times SCP_t^{\beta_3}$	(2)
Total rice (milled) production	$TP_t = 0.63 \times Y_t \times A_t$	(3)
Demand-side equations		
Per capita consumption for urban areas	$PC_{ut} = \gamma_0 \times CP_{ut}^{\gamma_1} \times E_{ut}^{\gamma_2} \times CFP_{ut}^{\mu_1}$	(4)
Per capita consumption for rural areas	$PC_{rt} = \theta_0 \times CP_{rt}^{\theta_1} \times E_{rt}^{\theta_2} \times CFP_{rt}^{\mu_2}$	(5)
Total consumption	$TC_t = (PC_{ut} \times POP_{ut}) + (PC_{ut} \times POP_{ut})$	(6)
Net import demand (import – export)	$M_t = \delta_0 \times TP_t^{\delta_1} \times MP_t^{\delta_2}$	(7)
Price linkage or transmission equations		
Consumer price for urban areas	$CP_{rt} = \phi_0 \times PP_t^{\phi_1} \times B_u^{\phi_2} \times Time^{\phi_3}$	(8)
Consumer price for rural areas	$CP_{ut} = \vartheta_0 \times PP_t^{\vartheta_1} \times B_r^{\vartheta_2} \times Time^{\vartheta_3}$	(9)
Producer price	$PP_t = \omega_0 \times MP_t^{\omega_1} \times Y_t^{\omega_2} \times Time^{\omega_3}$	(10)
Import price	$MP_t = WP_t \times ER_t$	(11)
Market clearing condition		
Ending stocks (residuals)	$EST_t = TP_t + BST_t + M_t - TD_t$	(12)

where the subscripts u, r, and t are urban, rural, and year, respectively; Y_t = rice production per hectare (ha) in metric tons (mt); UP_t= the international urea price in USD/mt; PL_t= price of labor, PHP/person-days; OF = application of organic fertilizer (manure) in kg/ha; R= annual precipitation in millimeter; T= annual mean temperature in degree Celsius; $Time$ is an index, proxied as technological progress or changes over time; A_t and A_{t-1} are the current and lagged harvested areas, respectively, in thousands of hectares; PP_t= producer price in PHP/mt; SCP_t= producer price of alternative crops, corn (maize) is used in our case, in PHP/mt; CP = consumer price, proxied by Stone–Lewbel (SL) price indices from Bairagi et al. (2022); CFP= a vector of other food prices in Table 2; E = per capita food expenditure, PHP/year; POP = population; WP = international rice price, proxied by the Thai 5% broken price; PP = producer price, proxied by the wholesale price in PHP/mt; B = budget share, gathered from Bairagi et al. (2022); MP = import price in PHP/mt; BST = beginning stock, which is equivalent to EST_{t-1}; α, $\beta, \gamma, \theta, \phi, \mu, \gamma, \delta, \theta, \vartheta,$ and ω are supply, demand, and price transmission elasticities, either estimated or adopted from previous studies, such as (Le, 2016; Wailes & Chavez, 2011). However, parameters in equations 1, 4-5, 8-9, 10 are estimated. Table 1 presents the estimated parameters from equations 1 and 10. Equations 4-5 are fitted with own price and expenditure elasticities in

Tables 4-5. Finally, parameters in equations 8-9 were estimated with the multiple years of FIES data. The other data sources are the USDA PSD, FAOSTAT, and the World Bank.

2.2 Linking the rice market model with models for demand for other food items

As was presented in the above rice market model, prices of six food items, including rice price (CP and CFP variables in equation 4-5), are integrated into the structural model. The vector of food prices is also used to estimate the demand for other food items (equations 13-14) to observe a change in rice price because of the variability of climatic variables (temperature and precipitation) in equation 1. The parameters in Table 1 and elasticities in Tables 3-4 are used to fit these equations (for details, see the supplementary material).

$$OFC_{ut} = a_0 \times CP_{ut}^{a_1} \times CFP_{ut}^{b_1} \qquad (13)$$

$$OFC_{rt} = c_0 \times CP_{rt}^{c_1} \times CFP_{rt}^{d_1} \qquad (14)$$

where OFC is the other food items such as fish and meat; other variables are defined before.

2.3 Simulation strategy

Two climatic scenarios (RCP8.5 and RCP6.0) are used to examine the impact of climate change on rice prices. The RCP8.5 is a high emission or no climate mitigation impact scenario, whereas the RCP6.0 is a medium-high emissions scenario (baseline scenario). The variability of temperature and precipitation under these two climate scenarios is illustrated in Figure 1. Under the RCP8.5 emissions pathway, average temperatures are predicted to rise more than half a degree Celsius in the next decade (2021-2030) compared to the past decade (2020-2011). On the other hand, the mean precipitations are projected to decline nearly by 7.0% in the next decade.

3. Results and discussion

3.1 Effects of climate change on rice yields and prices

Table 5 presents the effects of climate change on rice yield and farm prices in the Philippines. The results reveal that temperature and precipitation are negatively associated with rice yield. The coefficient related to mean temperature is -0.90, implying that a 1% increase in temperature (^{0}C) will reduce rice production by 1%. This effect is minimal or insignificant. However, it is consistent with a recent study that noted that the variability in temperature is currently not the biggest threat for rice productivity variability in the Philippines (Stuecker et al., 2018). Similarly, Peng et al. (2004) found an insignificant effect of maximum temperature on rice yield based on a field experiment in the Philippines. However, the authors found that each degree increase in growing-season minimum temperature might decline grain yield by 10%. Also, based on the household-level panel data, Wang et al. (2021) observed that an increase in minimum temperature is negatively and significantly associated with rice yields, but no significant effect of higher temperature was found. The reason could be the breeding efforts to develop abiotic stress-tolerant rice varieties (Wang et al., 2021). Regarding precipitation, the effect size is also negative, -0.02, but is insignificant. The input prices (urea fertilizer and labor) are negatively and significantly correlated with rice yields. The positive coefficient of time trend indicates technological progress in the rice sector over the years. Finally, the second column of Table 5 presents the results from the price equation, which implies that any disruption in the international market passes fairly quickly. The rice production is negatively associated with farm price, indicating consistency with the theory of supply.

Based on these parameters in Table 5 and the two climate pathways (RCP8.5 and RCP6.0), the rice yields and prices are forecasted from 2021 to 2030. The projected rice yields and prices are illustrated in Figure 2, which reveals that the rice productivity could decline by 0.24-0.90%, resulting in an approximate 0.28-1.02% increase in rice prices in the next decade. The price effects are comparatively lower than what was observed in rice prices in Vietnam due to climate change (Le, 2016).

<Insert Table 5 here>

3.2 Future food demands

The demands for six food items are predicted with the uncompensated price and expenditure (income) elasticities from Bairagi et al. (2022) and the projected Stone–Lewbel (SL) consumer price indices with multiple years of FIES. The uncompensated own-price elasticity assumes that a price change will change demand, holding the budget constant. Table 3 reveals that own-price elasticities for all food items are negative, meaning food demands will decline with a rise in price, which is consistent with the demand theory. Own-price elasticities for rural and urban households vary moderately, ranging from –0.726 to –3.151 and from –0.760 to –3.390, respectively. Among all of the food items, the lowest and highest own-price elasticity (absolute) are found for other cereals and dairy products, respectively. For rice, the compensated own-price elasticities are –0.903 and –0.915 for rural and urban households, respectively. This suggests that a 1.0% increase in rice price will reduce rice consumption by nearly 1.0% in the Philippines. An important note from the cross-price elasticities is that rice and cereals are substitutes and all other food items are complements, indicating that an increase in rice price will also affect other food consumptions. The expenditure elasticities in Table 4 illustrate rice and other cereals are necessary, and animal protein sources (meat, fish, and dairy products) are luxury foods.

The top sections of Tables 6 and 7 present the per capita consumption of six food items from 2021 to 2030, which we call BAU (baseline or business-as-usual) scenario. Several important insights stand out from these Tables. First, the per capita rice consumption in both urban and rural households will decline by 15% in 2030 compared to the current level (2018). However, due to the population growth, total demand for rice will increase, irrespective of urbanity (about 4.0% and 7% increase for urban and rural households, respectively). On the other hand, by 2030, the per capita demand for meat will increase by 36% and 38%, respectively, for urban and rural households. Rural households will demand other cereals (such as maize and flours) less than the current level but will be demanded more by urban households. These findings imply a reorientation of the food basket in the future. Finally, a slight increase in fish and dairy products demand is also observed among Filipino households in 2030.

<Insert Tables 6-7 here>

3.3 Climate-induced price effects on food demands

The effects of climate change on future food consumption in Filipino urban and rural households are reported in the bottom Tables 6 and 7, respectively. The findings reveal that, because of climate change (RCP8.5: no climate mitigation target scenario), the rice consumptions per capita for Filipino rural and urban households are likely to decline by 0.60 kg and 0.74 kg per year respectively. In terms of total demand, the country will demand approximately 85 thousand metric tons (mt) of milled rice less under climate change scenarios, which is equivalent to a 0.72% reduction. This estimate is consistent with a study in Vietnam that estimated a 1.86% increase in farm and wholesale rice prices due to climate change, causing domestic demand to fall by 0.28% (Le, 2016).

The results further reveal that the total meat demand is likely to decline by 5.4 thousand mt, with a higher decline in urban areas. In contrast, approximately 1.2 thousand mt of fish consumption will increase by 2030. Regarding percentage changes, the highest reduction is noted for rice consumption (0.73% and 72% reduction for urban and rural households, respectively) (Figure 3). Within animal protein demand, the effects of climate change are complex. For instance, the demand for meat will decline 0.11% for rural and 0.15% for urban households, whereas fish and dairy products demand will increase slightly by 2030. Finally, the demand for fruits and vegetables is likely to increase under the climate change scenario than BAU. These findings indicate that climate change will reshape the future food basket in the Philippines. Thus, policy should be focused on designing a sustainable food system.

<Insert Figure 3 here>

4. Conclusion

Future food supply systems are likely to be affected by both demand-side (such as rapid income and population growth and urbanization) and supply-side factors (e.g., climate change and scare of natural resources). Therefore, the food and nutrition security status of many developing countries is likely to hamper seriously. In the face of climate change, the present study foresees the future demand for food items in the Philippines by rural and urban households. The price and income elasticities from Bairagi et al. (2022) are used to estimate the future demand for six food items and develop a simulation-based rice market model to quantify changes in food demands due to climate change in the next decade.

The results show that temperature and precipitation negatively affect rice yield, the Philippines' primary cash crop and staple food, but the effects are insignificant (minimal). For example, the rice productivity could decrease by 0.24-0.90% under the climate change scenario, resulting in an approximate 0.28-1.02% increase in rice prices in the next decade. The business-as-usual scenario suggests that the per capita consumption of the leading staple food, rice, will decline by both urban and rural areas, almost at the same rate. On the other hand, the demand for meat (beef, chicken, and pork) will increase by about 36% and 38% for Filipino urban and rural households in 2030 compared to the current period (2020). Because of climate change (RCP 8.5: no climate mitigation target scenario), the per capita rice consumptions by rural and urban households are likely to decline by 0.60 kg and 0.74 kg per year, respectively. In other words, the country will demand approximately 85 thousand metric tons (mt) of milled rice less under climate change compared to the business-as-usual scenario (equivalent to a 0.72% reduction in total rice consumption).

The findings further reveal that the total meat demand is likely to decline by 5.4 thousand mt, with a higher decline by urban households. In contrast, about 1.2 thousand mt of fish consumption will increase by 2030 under the climate change scenario. Concerning percentage changes, the highest reduction is noted for rice consumption (0.73% and 72% reduction for urban and rural households, respectively). Within animal protein demand, per capita meat consumption will decline by 0.11%

for rural and 0.15% for urban households, whereas fish and dairy products demand will increase slightly by 2030. Finally, the demand for fruits and vegetables is likely to increase under the climate change scenario than BAU. These findings indicate that climate change is likely to reshape the future food basket in the Philippines. Thus, policy should be focused on designing a sustainable food system. Findings from this study will help foresee the risk associated with climate change and guide policymakers in designing an adequate food security and nutrition policy.

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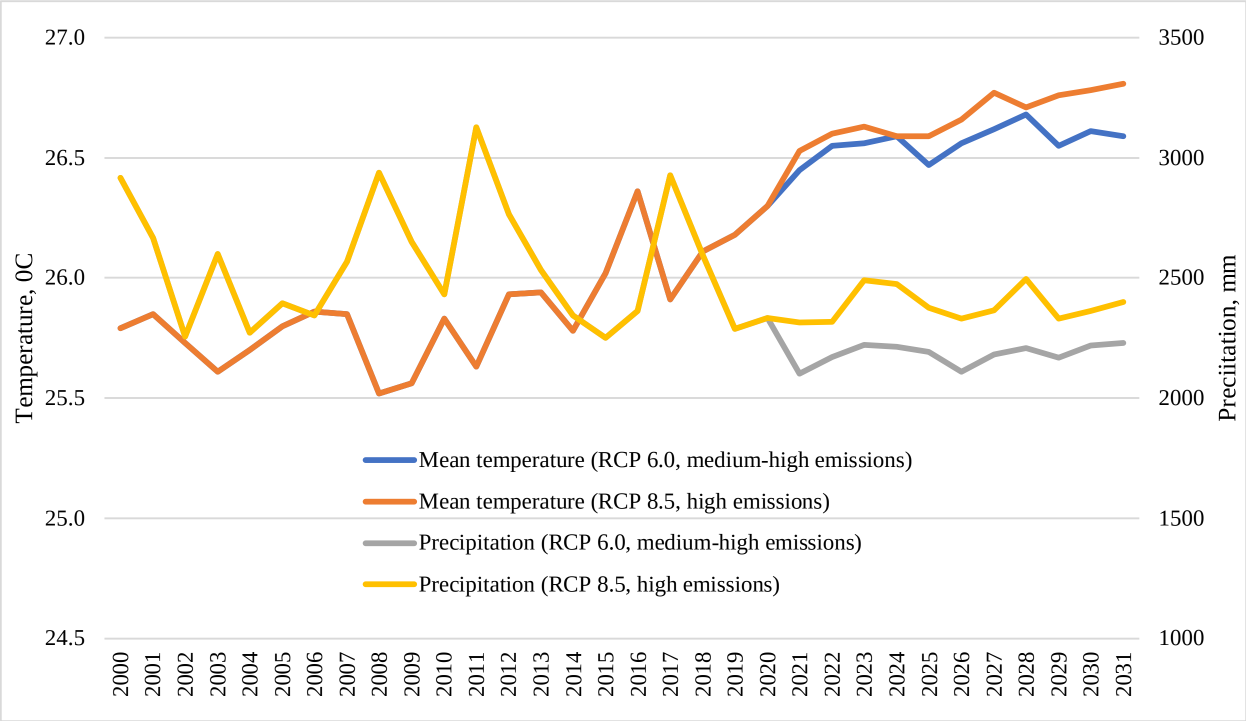
Figure 1. GHG emissions (in CO2 eq) from food commodities, 2017 (shares in percent).

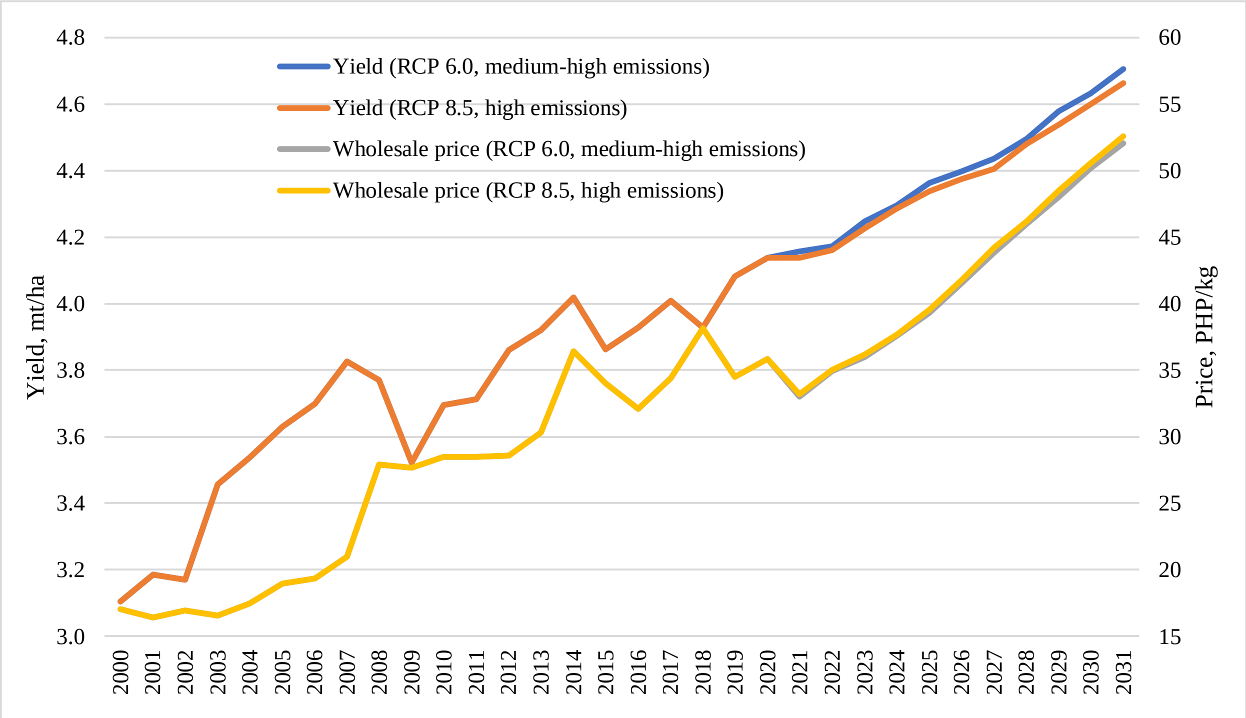
Source: Author's calculation from FAOSTAT, available at https://www.fao.org/faostat/en/#data/EI.

Figure 1. The variability in climatic variables in the Philippines



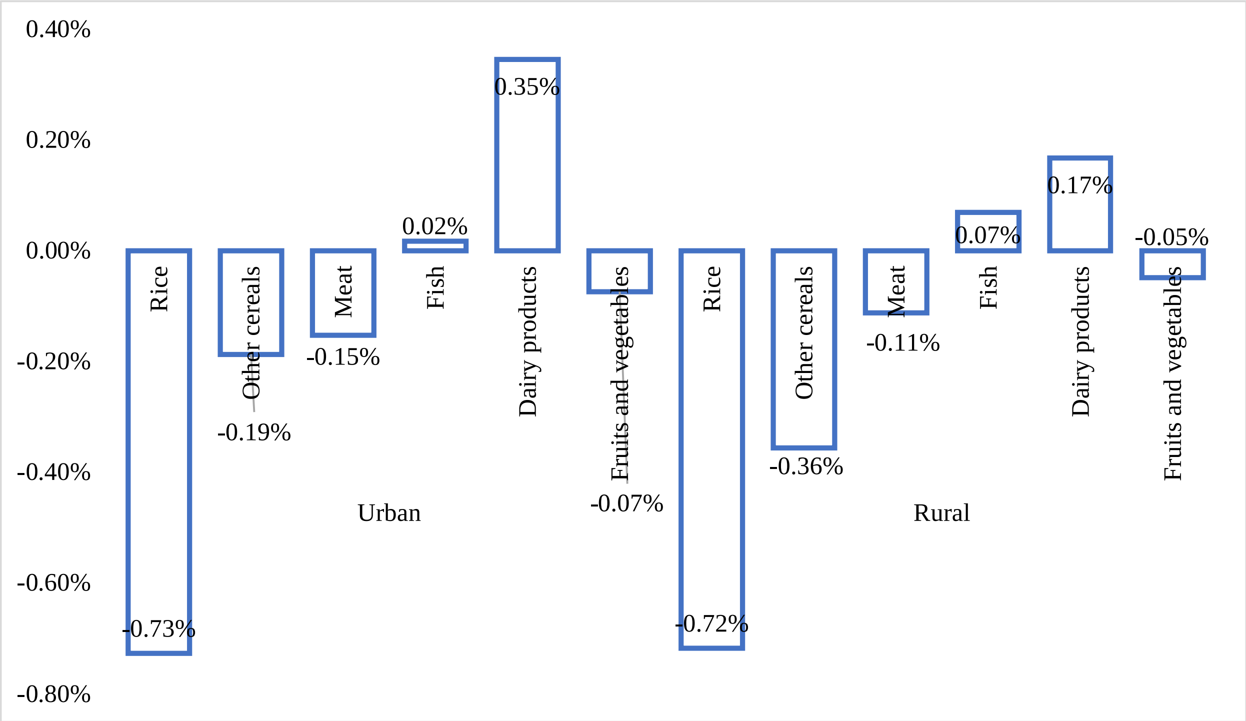
Notes: Data were gathered from the World Bank's climate change knowledge portal (https://climateknowledgeportal.worldbank.org/download-data). The data after 2020 are predicted under the CMIP-5 Projections.

Figure 2. The rice yields and prices under various scenarios



Source: USDA PSD Online (2000-2020) and author's estimation (2021-2031).

Figure 3. Effects of climate change on the Filipino food basket in 2030 (% change)



Source: Author’s calculation based on the Philippines’ rice market model.

Table 1. GHG emissions (in CO_2 eq) from food systems, (shares in percent).

Food system	Philippines		World	
	2010	2019	2010	2019
Farm-gate emissions	34.34	25.40	14.27	13.36
Land use change	12.69	0.01	7.98	6.49
Pre- and post- production	11.79	10.51	10.24	10.79
Fertilizers Manufacturing	0.017	0.052	0.743	0.756
On-farm electricity use	0.416	0.462	0.694	0.918
Food Processing	1.815	1.640	0.913	0.944
Food Transport	1.342	1.254	0.925	0.983
Food Transport - International Bunkers			0.106	0.102
Food Retail	0.739	0.888	1.741	1.726
Food Waste Disposal	5.835	4.408	2.559	2.366
Food Household Consumption	1.548	1.701	1.981	2.424
Food Packaging	0.075	0.105	0.581	0.574

Source: FAOSTAT, available at https://www.fao.org/faostat/en/#data/EM.

Table 1. Effects of climate change on rice yield and farm price in the Philippines, 1975-2020

Independent variables	Log of rice yield, mt/ha	Log of wholesale rice price, PHP/mt
Log of urea price, $/mt	-0.0261**	
	(-2.36)	
Log of labor price, PHP/day	-0.346***	
	(-4.62)	
Log of annual precipitation, mm	-0.0214	
	(-0.35)	
Log of mean temperature, ^{0}C	-0.900	
	(-0.92)	
Log of manure application, kg/ha	-0.0739	
	(-0.93)	
Log of import price, $/mt		0.471***
		(4.16)
Log of rice yield, mt/ha		-1.138
		(-1.57)
Time trend	0.0197***	0.0478***
	(14.26)	(3.90)
Constant	5.943*	5.236***
	(1.69)	(5.45)
Observations	46	39

Source: Author's estimation.

Table 2. Parameters estimated from consumer price equations

Region	Independent variables	Dependent variable: Log price of					
		Rice	Other cereals	Meat	Fish	Dairy products	Fruits and vegetables
Urban	Constant	4.009	4.091	4.178	4.138	4.200	4.150
	Time index	0.399	0.333	0.289	0.381	0.317	0.454
Rural	Constant	3.985	4.083	4.041	4.147	4.177	4.093
	Time index	0.414	0.352	0.353	0.374	0.337	0.479

Source: Author's estimation based on multiple years (2006, 2009, 2012, 2015, and 2018) of the Philippines Family Income and Expenditure Survey (FIES).

Table 3. Predicted Stone–Lewbel (SL) consumer price indices

year	Rice	Other cereals	Meat	Fish	Dairy products	Fruits and vegetables
Urban						
2006	57	61	68	67	68	68
2009	72	78	82	81	82	83
2012	86	89	88	90	96	96
2015	96	96	94	98	104	110
2018	108	104	107	122	112	138
2019	114	111	109	121	119	138
2020	121	117	114	128	125	148
2021	128	122	118	135	130	157
2022	134	127	122	141	135	165
2023	140	131	126	147	140	173
2024	145	136	130	152	144	181
2025	150	140	133	157	148	188
2026	155	143	136	162	152	195
2027	160	147	139	167	156	202
2028	164	150	142	171	159	209
2029	168	154	144	176	162	215
2030	172	157	147	180	165	221
Rural						
2006	56	60	61	66	67	64
2009	72	78	74	82	81	81
2012	85	91	83	92	97	95
2015	96	98	92	102	105	110
2018	108	106	104	121	113	135
2019	115	114	108	123	121	138
2020	122	121	114	130	127	148
2021	129	126	119	137	133	158
2022	136	132	125	143	139	167
2023	142	137	129	148	144	176
2024	148	141	134	154	148	184
2025	153	146	138	159	153	192
2026	158	150	142	164	157	200
2027	163	154	146	168	161	207
2028	168	158	149	173	165	214
2029	172	161	153	177	168	221
2030	177	165	156	181	172	227

Notes: Price indices from 2006-2018 were gathered from (Bairagi et al., 2022), and the rest were predicted using parameters from Table 1.

Table 4. Uncompensated price elasticities of demand for various food items in the Philippines (2006-2018)

Food items	Rice	Other cereals	Meat	Fish	Dairy products	Fruits and vegetables
Urban						
Rice	-0.915	-0.020	0.176	0.144	0.249	0.070
Other cereals	-0.235	-0.760	0.049	0.023	0.001	0.202
Meat	-0.192	-0.080	-1.079	-0.228	0.032	-0.168
Fish	0.021	-0.006	-0.082	-1.416	0.259	0.048
Dairy products	0.432	-0.128	0.037	0.394	-3.390	-0.014
Fruits and vegetables	-0.093	0.134	-0.094	0.050	0.068	-1.075
Rural						
Rice	-0.903	-0.098	0.198	0.205	0.188	0.079
Other cereals	-0.447	-0.726	0.067	0.061	0.163	0.294
Meat	-0.141	-0.088	-1.050	-0.287	-0.027	-0.205
Fish	0.086	-0.020	-0.129	-1.595	0.257	0.084
Dairy products	0.209	0.063	-0.069	0.430	-3.151	0.111
Fruits and vegetables	-0.062	0.172	-0.106	0.132	0.143	-1.181

Source: Table 8, Bairagi et al. (2022).

Table 5. Expenditure (income) elasticities for food items by rural and urban households (2006-2018)

Food items	Urban	Rural
Rice	0.069	0.109
Other cereals	0.725	0.496
Meat	1.943	2.033
Fish	0.951	1.126
Dairy products	2.182	2.138
Fruits and vegetables	1.045	1.011

Source: Table 6 from (Bairagi et al., 2022).

Table 6. Effects of climate change on the future food consumption (kg/capita/year) in Filipino urban households

Food items	Actual	Predicted					% change (2030 vs 2018)
	2012	2015	2018	2020	2025	2030	
Business-as-usual scenario (RCP 6.0)							
Rice	111.47	102.34	95.99	90.01	84.40	81.27	-15.33%
Other cereals	7.07	9.55	11.51	10.18	11.01	12.05	4.70%
Meat	22.58	27.32	28.67	23.70	30.12	39.09	36.35%
Fish	20.09	22.38	25.86	23.97	24.53	26.22	1.41%
Dairy products	0.27	0.62	0.77	0.51	0.62	0.79	2.94%
Fruits and vegetables	55.62	57.25	57.79	51.87	54.09	58.82	1.78%
Climate change scenario (RCP 8.5)							
Rice	111.47	102.34	95.99	90.01	83.90	80.68	-15.95%
Other cereals	7.07	9.55	11.51	10.18	10.99	12.03	4.50%
Meat	22.58	27.32	28.67	23.70	30.08	39.03	36.14%
Fish	20.09	22.38	25.86	23.97	24.54	26.23	1.42%
Dairy products	0.27	0.62	0.77	0.51	0.62	0.79	3.30%
Fruits and vegetables	55.62	57.25	57.79	51.87	54.06	58.78	1.70%

Source: Author’s estimation.

Table 7. Effects of climate change on the future food consumption (kg/capita/year) in Filipino rural households

Food items	Actual	Predicted				% change
	2012	2015	2018	2020	2025	2030	(2030 vs 2018)
Business-as-usual scenario (RCP 6.0)							
Rice	117.60	113.00	122.08	113.26	107.01	103.77	-15.00%
Other cereals	17.63	25.03	28.74	25.79	26.72	28.10	-2.25%
Meat	13.54	15.91	16.64	13.64	17.47	22.90	37.68%
Fish	16.08	17.26	21.47	19.71	20.68	22.68	5.66%
Dairy products	0.09	0.11	0.11	0.08	0.10	0.13	11.98%
Fruits and vegetables	66.40	60.14	59.11	53.75	56.38	61.42	3.92%
Climate change scenario (RCP 8.5)							
Rice	117.60	113.00	122.08	113.26	106.38	103.02	-15.61%
Other cereals	17.63	25.03	28.74	25.79	26.65	28.00	-2.60%
Meat	13.54	15.91	16.64	13.64	17.46	22.88	37.52%
Fish	16.08	17.26	21.47	19.71	20.69	22.70	5.73%
Dairy products	0.09	0.11	0.11	0.08	0.10	0.13	12.17%
Fruits and vegetables	66.40	60.14	59.11	53.75	56.35	61.39	3.87%

Source: Author’s estimation.

Supplementary Material

SM Table 1. Enclosed data and estimation files

SL	File name	Description
1.	0_predict_food_prices_php.do	STATA do file for estimating yield and price equations
2.	"FIESDataQuaidsR1.dta"	Processed data matrix for regression analysis from multiple years of FIES data.
3.	40_climate_model_php_rcp8.5	Required data and results with RCP8.5 scenario
4.	41_climate_model_php_rcp6.0	Simulated results with RCP 6.0 scenario
5.	Table1_food_demand_2030	Effects of climate change on the future per capita food consumption in the Philippines (RCP 8.5 versus RCP 6.0 scenarios)