Conceptual Overview
Food Security and Climate Change

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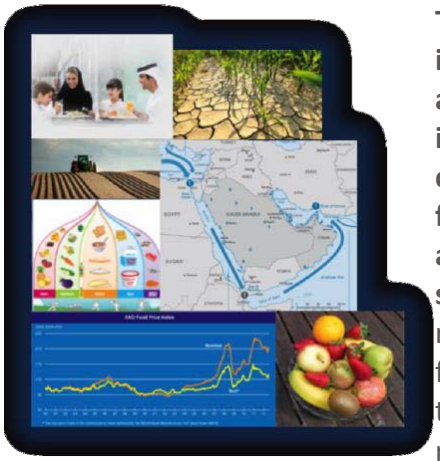

The UAE is a country that is heavily dependent on food imports and may be vulnerable to food supply constraints and associated price shocks associated with climate change impacts in food-exporting countries. The combination of climate change-induced declining agricultural productivity in food-exporting countries, tightening of world food markets, and price speculation pressures could lead to several adverse circumstances in the UAE. These may include recurrent retail food price spikes and/or a need for substantial food subsidies. Households throughout the seven emirates that have annual incomes at the lower end of the national range could find themselves in a position where they would be subject to spending a growing share of limited household budgets for food.

This study focused on the potential risks to the UAE's long-term food security under the adverse impacts of climate change. The recent global food crisis of 2008, with its price spikes and subsequent social unrest in several countries, represents an important challenge to the development of food security plans capable of producing human well-being and social harmony. Even without the additional threat posed by climate change, the global food crisis exposed interlinked vulnerabilities associated with agricultural productivity, international food trade markets, and food commodity prices. With climate change, current challenges of soil destruction, inadequate water supply, and stagnant mono-cultured crop yields will likely be seriously exacerbated, leading to reduced crop productivity in food-exporting countries, steady increases in food prices, and increased food insecurity around the world.

The overall goal of this study was to quantify the impact of climate change on long-term food security in the UAE on two levels. First, the study focused on the "Macro" or national level. This portion of the assessment addressed the interconnected issues of international food trade flows/constraints, and climate change impacts on agricultural productivity of food exporting countries. Second, the study focused on the "Micro" or household level. This portion of the assessment addressed the economic vulnerability of UAE households to food price volatility resulting from the impact of macro-level considerations.

The analytical framework for the macro- and micro-level assessments were codified into a

food security risk software program. This was done in order to make accessible both the actual results of food security analysis, as well as offer the capability to interested stakeholders to conduct subsequent analyses. To this end, a model was developed – the Food Security and Climate Change Inspector – incorporating all the data assumptions, modeling techniques, and vulnerability index calculations. The tool is a macro-driven Graphical User Interface (GUI) built in Excel software that implements the sequence of analytical steps in the modeling framework. The tool also offers users a way to visualize results and explore alternative scenarios of food supply and household vulnerability to food price impacts.

At the macro level, a Food Insecurity Index was calculated for each imported food item to the UAE, as well as for each major food exporter country to the UAE. The index accounts for a broad range of potential climate change scenarios that could affect global food trade flows. The basis for constructing the food insecurity index for food items and major exporter countries is the cumulative food import gap projected under conditions of climate change. The Index ranges from 1 to 10, with 1 representing strongly secure and 10 representing strongly insecure. Table 1 provides a summary of results. Green- shaded rows indicate high food import security under climate change (Index =1 to 2). Light red-shaded rows indicate increasing levels of food import insecurity under climate change countries (Index = 5 to 10, where 10 indicates the highest level of food import insecurity). Light brown-shaded rows indicate the middle range of food import insecurity (Index =3 to 4).

Table 1: Food Insecurity Index results

a) By food item

Food item	Food import status	Food Security index
BEEF (i.e., Bovine Meat)	UNCONSTRAINED	1
CASS (i.e., Cassava and	CONSTRAINED	6
CHKP (i.e., Pulses, and	PARTIALLY CONSTRAINED	3
EGGS (i.e., Eggs)	PARTIALLY CONSTRAINED	2
GRND (i.e., Groundnuts	CONSTRAINED	6
LAMB (i.e., Mutton & Goat	UNCONSTRAINED	1
MAIZ (i.e., Maize and	UNCONSTRAINED	1
MILK (i.e., Milk - Excluding	PARTIALLY CONSTRAINED	3
MILL (i.e., Millet and	CONSTRAINED	6
OGRN (i.e., Barley and	CONSTRAINED	6
PKOL (i.e., Oil - Palm and	PARTIALLY CONSTRAINED	3
PORK (i.e., Pigmeat)	CONSTRAINED	6
POTA (i.e., Potatoes and	PARTIALLY CONSTRAINED	5
POUL (i.e., Poultry Meat)	PARTIALLY CONSTRAINED	3
RICE (i.e., Rice (Milled	CONSTRAINED	10
RPOL (i.e., Rape and	CONSTRAINED	6
RPSD (i.e., Rape and	CONSTRAINED	6
SBOL (i.e., Soyabean Oil)	CONSTRAINED	6
SFOL (i.e., Sunflowerseed	CONSTRAINED	6
SNFL (i.e., Sunflower seed)	CONSTRAINED	6
SOYB (i.e., Soybeans)	CONSTRAINED	7
SUBF (i.e., Fruit -	CONSTRAINED	8
SUGC (i.e., Sugar (raw))	PARTIALLY CONSTRAINED	2
SUGR (i.e., Sugar (Refined))	CONSTRAINED	7
SWPY (i.e., Sweet potatoes)	CONSTRAINED	6
TEMF (i.e., Fruit -	CONSTRAINED	7
TOOL (i.e., Oil - Other)	CONSTRAINED	4
VEGE (i.e., Vegetables - All)	CONSTRAINED	8
WHEA (i.e., Wheat and	CONSTRAINED	10

b) by country

Country name	Criterion		Food Security index
	Share of Imports	Climate change impact	
Argentina	4	2	3
Australia	4	2	3
Brazil	7	3	5
Canada	2	1	2
China	2	3	3
Egypt	1	3	2
Ethiopia	1	2	2
France	1	3	2
Germany	2	5	4
Gulf countries	2	2	2
India	9	3	6
Indonesia	1	4	3
Iran (Islamic Republic of)	3	8	6
Jordan	2	2	2
Lebanon	1	2	2
Malaysia	2	4	3
Netherlands	2	2	2
New Zealand	1	2	2
Pakistan	3	4	4
Paraguay	2	3	3
Philippines	2	5	4
South Africa	2	10	6
Spain	1	2	2
Thailand	2	4	3
Ukraine	2	2	2
United States of America	2	4	3
All other countries	10	3	7

In short, most food imports to the UAE will be constrained under climate change. Rice and wheat are strongly insecure food items for the UAE under climate change. On the other hand, beef, lamb meat, and maize are strongly food secure items suggesting that current food

trade flows will not be adversely affected in the future. Regarding exporting countries, imports from Brazil, India, Iran, and South Africa are projected to be constrained with climate change. On the other hand, tradition exports such as Pakistan, Germany, and Thailand are strongly food secure countries suggesting that current food trade flows from these countries will not be adversely affected in the future.

At the micro-level, a Food Insecurity Index was calculated for each household decile for the range of scenarios. The basis for constructing the micro-level food insecurity index was the extent to which the share of household food expenditures exceed a certain level considered to be a plausible characterization of a food secure situation at the household level. In this study, 17% was assumed to be the expenditure share that separated food secure households from those that are less secure. The impact of climate change on household food security is illustrated in Figure 2. This figure shows that climate change will lead to serious shifts in food spending patterns. In particular, introducing climate change increases the number of the most vulnerable households (i.e., red bars) from 685 thousand to 1.2 million (i.e., 75% increase) in a low real food price scenario and to 1.4 million (i.e., 100% increase) in a high real food price scenario.

Table 2: Change in the total number of UAE households classified by the Micro Index, all scenarios