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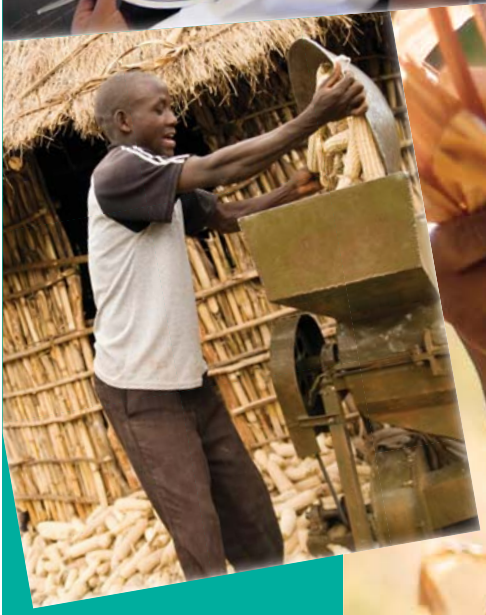
INTERNATIONAL FOOD SECURITY ASSESSMENT, 2011-21



Food security is projected to improve markedly in Asia, followed by Latin America and the Caribbean in the next decade.

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A Report from the Economic Research Service

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International Food Security Assessment, 2011-21

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Abstract

The number of food-insecure people in developing countries is estimated to decline by about 9 million, from 861 million in 2010 to 852 million in 2011 and the number is projected to decline by 16 percent, or nearly 140 million over the next decade. Food security in Asia and the Latin America and the Caribbean region is projected to improve, whereas food security in Sub-Saharan Africa is expected to deteriorate. Food-insecure people are defined as those consuming less than the nutritional target of roughly 2,100 calories per day per person.

Keywords: Food security, commodity prices, production, commercial imports, export earnings, food aid, calories, protein, energy, fat, sugar, diet, Sub-Saharan Africa, North Africa, Asia, Latin America and the Caribbean.

Preface

This report continues the series of food assessments in developing countries begun in the late 1970s. *Global Food Assessments* were done from 1990 to 1992, hence the GFA series. In 1993, the title was changed to *Food Aid Needs* Assessment to more accurately reflect the contents of the report, which focused on selected developing countries with past or continuing food deficits. In 1997, we widened our analysis beyond the assessment of aggregate food availability to include more aspects of food security. We therefore changed the title to *Food Security Assessment*. For this current report, the title has been changed to *International Food Security Assessment* to clarify that this is not an assessment of U.S. food security.

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Cover photos: Woman farmer-Malawi, United Nations, World Food Programme (WFP)/Charles Hatch-Barnwell; girls eating-Bolivia, WFP/Boris Heger; male farmer-Uganda, WFP/Vanessa Vick; family eating-Bangladesh, WFP/Shehzad Noorami; girl eating-Haiti, WFP/Tamara Kummer.

Approved by: USDA's World Agricultural Outlook Board.

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Summary

What Is the Issue?

The results in this report are based on projections of two key determinants of food security: Food production and import capacity of the countries. Domestic food production performance plays the most critical role in the food security of these countries, particularly for regions like Asia and Sub-Saharan Africa that depend on grain supplies. Conversely, imports play a significant role for regions like Latin America and North Africa that depend on positive trade terms. Since August 2009, prices of nonfood commodities (metals, agricultural, beverage, and industrial) have risen more than those for food. Therefore, for countries that export nonfood commodities and import food, food has become relatively cheaper. To understand how food production and import capacity impact food security, ERS researchers estimated and projected three measures of food security regionally and in each of the 77 developing countries for 2011-21. The estimates include the following:

- The number of food-insecure people in each country;
- The nutrition gap: The difference between projected food availability and the food needed to meet the average recommended nutritional target of roughly 2,100 calories per person per day; and
- The distribution gap: The difference between projected food availability and the food needed to increase consumption in food-deficit income groups within individual countries to meet the recommended nutritional target.

What Did the Study Find?

- Despite higher global food commodity prices, strong domestic food production coupled with low price transmission from global to domestic markets contributed to a decline in the number of food-insecure people from 861 million in 2010 to 852 million in 2011.
  - Asian countries are projected to see a decrease in food-insecure people of 6 percent, while the distribution food gap will decline by about 9 percent.
  - North African (NA) countries will see no change, assuming that the performance of their economies and food markets remains the same.
  - The Latin American and the Caribbean (LAC) region will see only a slight increase.
  - The number of food-insecure people in Sub-Saharan Africa (SSA) is estimated to increase by 17 million and the distribution gap to fall by 0.6 million tons.
- The number of food-insecure people is projected to decline by 16 percent, or nearly 140 million between 2011 and 2021.

- Asian and LAC countries will see a 33-percent decline in the number of food-insecure people.
- Sub-Saharan Africa (SSA) will see a 6-percent increase in the number of food-insecure people.

- The distribution food gap is projected to decline by nearly 7 percent during the next decade.
  - SSA shows an increase in its food gap, up roughly 20 percent. This, coupled with a 6-percent increase in the number of food-insecure people, indicates an intensification of food insecurity among that region's poor.
  - The distribution food gap is projected to decline by half in Asia and by 35 percent in LAC. No distribution gap is projected for NA.

How Was the Study Conducted?

All historical and projected data were updated relative to the *Food Security Assessment, 2010-20* report. Food production estimates for 2010 were based on data from the United Nations' Food and Agriculture Organization (FAO) as of February 2011. Historical production data came from FAO and food aid data came from the World Food Programme (WFP). Financial and macroeconomic data were based on the latest World Bank data as of February 2011. Projected macroeconomic variables were either based on calculated growth rates for the 1990s through the late-2000s or came from International Monetary Fund (IMF) and World Bank projections. Projections of food availability include food aid, with the assumption that each country will receive the 2007-09 average level of food aid throughout the next decade.

Overview: Food Security Assessment in Lower Income Countries, 2011-21

Food security estimates for 2011 all point to a slight improvement between 2010 and 2011 for the 77 countries covered in this report (see box, "Key Changes in this Year's Report," and box, "How Food Security Is Assessed: Methods and Definitions"). The estimates include the following:

- The number of food-insecure people in each country,
- The nutritional gap: The difference between projected food availability and the food needed to meet the average recommended nutritional target,
- The distribution gap: The difference between projected food availability and the food needed to increase consumption in food-deficit income groups within individual countries to meet the recommended nutritional target.

The distribution gap, which takes into account unequal purchasing power within countries, is estimated at about 15 million tons for 2011, or a decline of 0.8 million tons from 2010 (table 1, fig. 1). The number of food-insecure people is estimated to decline by about 9 million, from 861 million in 2010 to 852 million in 2011 (fig. 2).[1]

Food security in Asian countries is expected to improve in 2011 from that of 2010 as the number of food-insecure people is projected to fall 6 percent and the food distribution gap will decline by about 9 percent. No change is expected in the food security of North African (NA) countries, assuming that their economies, including their food markets, do not change significantly. These estimates, however, are subject to change given the uncertain political environment of the region. In the Latin American and Caribbean (LAC) region, the number of food-insecure people and the food distribution gap are projected to increase, but only slightly. These projected increases are largely

[1]The estimated annual indicators reflect both emergency and chronic food security situation of countries.

Key Changes in This Year's Report

Two key changes were made in this year's estimates of the food security indicators relative to earlier USDA, Economic Research Service's *Food Security Assessment* reports. First, the country coverage has been expanded from 70 to 77 countries to include those with potential food security problems (e.g., Republic of Congo and Namibia in Sub-Saharan Africa; Cambodia, Laos, Moldova, Mongolia, and Yemen in Asia). Tables 3 and 4 include estimated food security indicators for the 70 countries covered in 2010 and the 77 countries in 2011. Criteria used in the selection of study countries include average caloric consumption, per capita income, food aid status, and data availability. All of the countries included in the study received food aid at some point in time.

Also, the food access methodology was revised to improve estimates of food security indicators. Previously, the estimates were based on income quintiles, but they are now based on income deciles in an effort to refine food access estimations (see "Appendix—Food Security Model: Definition and Methodology"). As a result, the estimated number of food-insecure people account for 10, 20, 30, etc. (increments of 10) percent of the population in each country.

How Food Security Is Assessed: Methods and Definitions

The Food Security Assessment model used in this report is based on 2010 data (updated in March 2011), and therefore does not reflect any subsequent changes that may have transpired related to the food security of these countries. This annual update includes revisions of historical data, as sometimes new information leads to changes in historical data series. Updates can therefore change food-security estimates for past years. Food-security indicators for 2010 and 2011 are estimates; subsequent years are projections. Commodities covered in this report include grains, root crops, and "other," where the latter represents the remainder of the diet. These three groups account for 100 percent of all calories consumed in the study countries and are expressed in grain equivalent. The conversion is based on calorie content. For example, grain has roughly 3.5 calories per gram and tubers have about 1 calorie per gram. One ton of tubers is, therefore, equivalent to 0.29 ton of grain (1 divided by 3.5), and 1 ton of vegetable oil (8 calories per gram) is equivalent to 2.29 tons of grain (8 divided by 3.5).

Food consumption and food access are projected for 77 lower income developing countries—39 in Sub-Saharan Africa, 4 in North Africa, 11 in Latin America and the Caribbean, and 23 in Asia. (See "Appendix—Food Security Model: Definition and Methodology" for a detailed description of the methodology and definitions of terms and appendix table 1 for a list of countries.) The 2010 estimates are based on FAO production and import assessments, and the longer term projections are based on 2007-09 production data and 2006-08 macroeconomic data from the IMF and World Bank. The periods covered include 2010, 2011 (estimate), and 2021 (10-year projection). The model analyzes the gap between projected food availability (production plus commercial and food aid imports minus nonfood use) and two alternative consumption standards. The nutritional standard is the per capita nutritional requirements (NR) of roughly 2,100 calories per capita per day, depending on the region. The average ***nutrition gap*** measures the gap between available food and food needed to support a per capita nutritional standard.

The estimated ***distribution gap*** measures the food needed to raise consumption in each income decile to the nutritional requirement. In many countries, consumption in the lower income deciles is significantly below average (per capita) consumption for the country as a whole. In these countries, the distribution gap provides a measure of the intensity of hunger—the extent to which the food security of already hungry people deteriorates as a result of income or economic conditions. When our estimates show no distribution gap for the poorest 10 percent of the population, however we consider the country food secure despite the fact that food insecurity may exist (but only for less than 10 percent of the population). Similarly, when our estimates show a distribution gap for all deciles, we consider 100 percent of the population to be food insecure despite the fact that less than 10 percent of the population may be food secure. Finally, based on total population data and the population share that consumes below nutritional requirements, the projected number of people who cannot meet their nutritional requirements is calculated.

The common terms used in this report are:

- ***Domestic food supply—***the sum of domestic production and commercial and food aid imports;
- ***Food availability—***supply minus nonfood use, such as feed and waste, and exports;
- ***Import dependency—***the ratio of food imports to food supply;
- ***Food consumption—***equal to food availability; and
- ***Food-insecure—***occurs when per capita food consumption for a country or income decile falls shorts of the nutritional target of 2,100 calories per person per day.

due to higher projected food prices; lower export earnings resulting from the weak export demand growth of their trading partners, particularly the United States; and continued political instability in Haiti.

In Sub-Saharan Africa (SSA), the deterioration of food security in 2011 relative to 2010 can be attributed mostly to a return to normal production levels in 2011, following a record 2010 crop. The number of food-insecure people is estimated to increase by 17 million, although the distribution gap is estimated to fall by 0.6 million tons, indicating that even as the number of vulnerable people increases, the intensity of food insecurity decreases in 2011 compared

Table 1

Food availability and food gaps for 77 lower income countries

Year	Grain production*	Root production *(grain equiv.)*	Commercial imports	Food aid receipts *(grain equiv.)*		Aggregate availability of all food
			1,000 tons			
2002	470,096	77,230	81,754	8,404		757,189
2003	512,219	79,658	74,894	8,345		783,050
2004	510,453	84,369	75,364	6,675		785,628
2005	534,702	87,987	87,115	7,997		804,045
2006	551,903	91,613	96,489	6,513		834,016
2007	570,737	89,382	97,231	5,661		858,987
2008	588,625	96,889	104,252	6,005		893,315
2009	598,037	98,817	100,294	5,295		912,701
2010(e)	618,413	92,922	99,172	5,366		925,552
				Food gap**		
Projections				NG	DG	
2011	622,773	94,452	95,870	***6,092***	***14,999***	935,670
2016	686,496	102,420	109,101	***6,765***	***13,998***	1,033,722
2021	754,466	110,940	119,155	***7,831***	***13,967***	1,134,064

(e) estimate.

*Grain production includes rice expressed in milled rice equivalent.

**NG stands for nutritional gap and describes the amount of grain equivalent needed to support nutritional standards on a national average level. DG stands for distributional gap and it describes that amount of grain equivalent needed to allow each income quintile to reach the nutritional requirement.

Sources: USDA, Economic Research Service, using data from FAOSTAT, UN Food and Agriculture Organization and World Food Program, Rome.

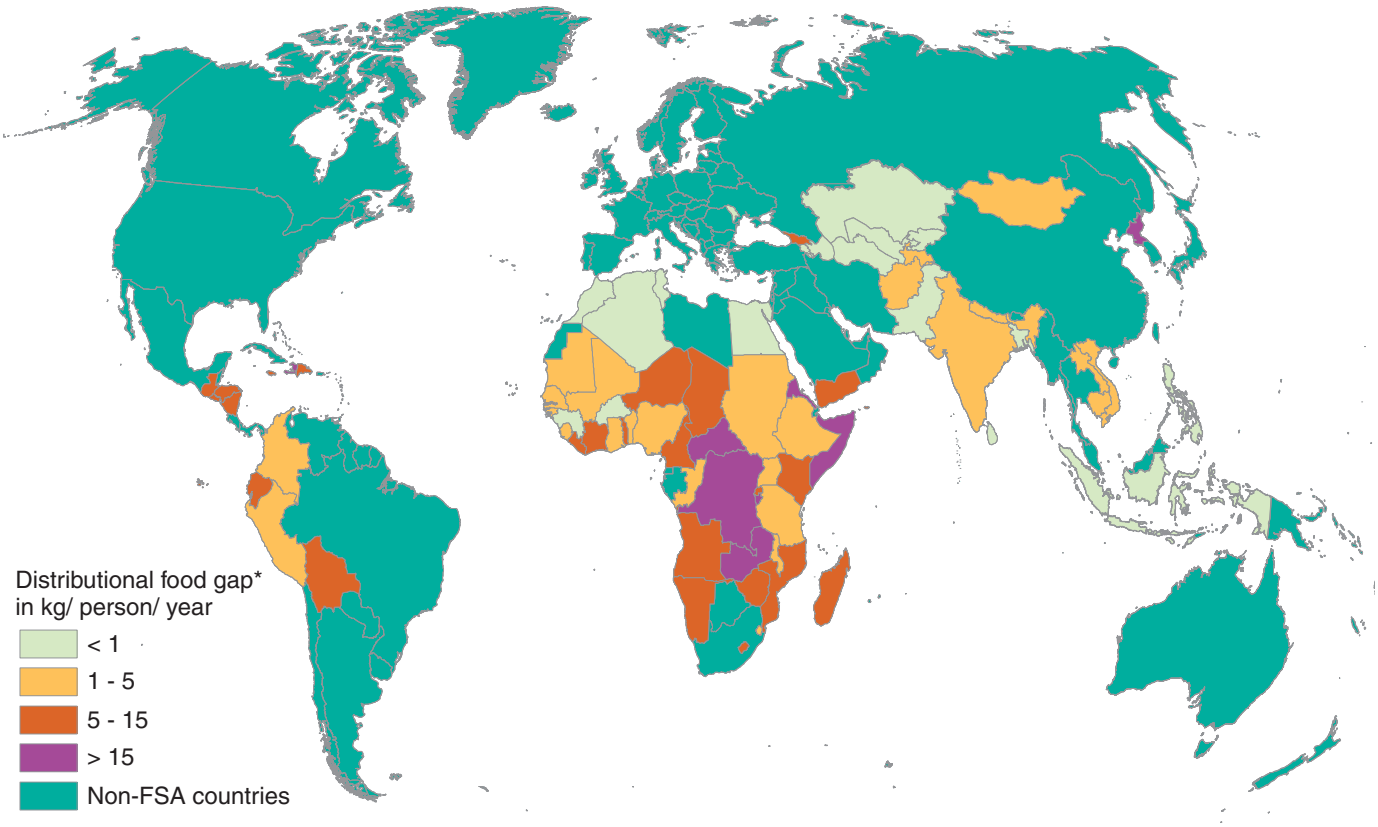
with 2010. This means that, on average, food-insecure people will be closer to meeting their nutritional target. Weather conditions in 2010 were highly favorable and, as a result, many countries experienced bumper crops. At the same time, the trend in the production of key staple foods in the region has been positive since the early 2000s. Despite this positive production trend, per capita food consumption has stagnated as the region's population growth is among the highest in the world—2.6 percent per year during the last decade compared with less than 2 percent in the other regions included in this study. Emergency food needs due to unresolved political instability in countries, such as the Democratic Republic of Congo and Somalia, negatively influence the region's food security indicators.

Production Variability Could Alter Projections

In July 2010, the USDA, Economic Research Service's *Food Security Assessment, 2010-20* report indicated an improvement in the food security of 70 developing countries surveyed. This improvement included a 7.5-percent decline in the number of food-insecure people and a negligible decline in the food distribution gap between 2009 and 2010, due partly to economic recovery in many of these countries. Another important factor leading to the positive assessment was an expected decline in food prices in 2010. With 2010 now complete, however, a range of unanticipated factors appear to have changed earlier price expectations for the second half of the calendar year.

Figure 1

The depth of food insecurity is most severe in Sub-Saharan Africa among all developing regions in 2011



*Measures the food needed to raise consumption of each income group to the nutritional target of roughly 2,100 calories per person per day.
Source: USDA, Economic Research Service.

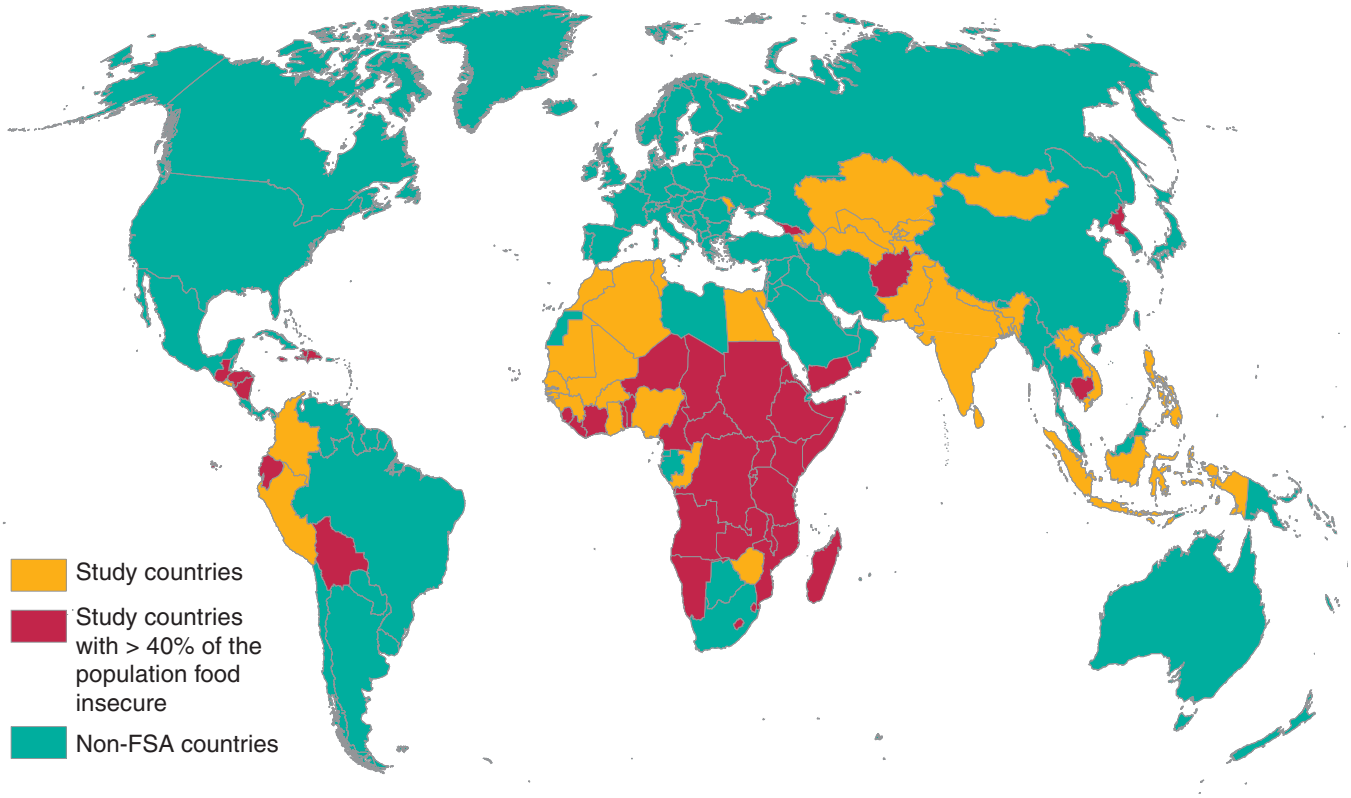
The United Nation's Food and Agriculture Organization's (FAO) food price index for December 2010 exceeded the peak reached in 2008. With actual 2010 data available on all the key variables used in the ERS food security assessment model, ERS updated its earlier assessment based on estimated values (Rosen et al., 2011).

In addition to higher prices, we now have actual 2010 production data and updated export earnings growth. Improvements in production performance in many of the study countries dampened the impact of food price increases in 2010. For example, Ethiopia's (SSA's second largest grain producer) production was 11.5 percent higher than the estimated level.

The updated analysis shows an overall improvement in food security compared with that of early 2010. The number of food-insecure people is estimated to decline 9 percent, while the food distribution gap is estimated to decline 1.7 percent. Results vary significantly by region. For example, in Asia, the number of food-insecure people declined more than 9 percent, but the region's food distribution gap grew by 25 percent which means that, while fewer people in the region were estimated to be food insecure, food insecurity intensified for those who were food insecure. Overall, Asia's estimated and actual production showed little difference, but for some countries the differences were significant. North Korea, Pakistan, and the Philippines had the

Figure 2

In 42 (out of 77) lower-income countries, over 40 percent of the population is estimated to be food insecure[1] in 2011



[1]Defined as consumption below the nutritional target of roughly 2,100 calories per person per day.

Source: USDA, Economic Research Service.

largest differences in terms of percentage increase in food distribution gaps. In each of these countries, actual production was significantly below the original estimate.

Food Security in 2011: Factors Behind the Estimates

Estimated food security indicators for 2011 show overall improvement since 2010. Results for 2011 are based on projections of two key food security determinants—food production and import capacity of the countries.

Domestic Food Production

Domestic food production performance plays the most critical role in the food security of many countries. In this assessment, we expected a slight increase in food production in 2011, mostly due to anticipated increases in Asia, principally India and Pakistan. In SSA, food security depends on the performance of domestic food production since it is the main source of food consumption. Grain production in the region is expected to decline from the 2010 bumper crop, but remain higher than the recent average. Production had increased more than 14 percent between 2009 and 2010. Grain production is projected to decline negligibly in the NA countries in 2011, but should not lead to increased food insecurity because the region's import capacity is projected to meet its food import needs.

In Asia, including Central Asian countries, food production is expected to grow by about 2 percent. The region's food production growth is constrained by the sheer size of the region's population, which places continued pressure on its limited resource base. Nevertheless, Asia's food production growth exceeds its population growth rate. In LAC countries, food production is projected to grow nearly 6 percent, marking a rebound from the 2010 decline. Despite this increase, results indicate some deterioration in food security for the region since imports play such a critical role in food availability in these study countries, generally accounting for more than 40 percent of their staple food consumption.

Given increasing global food commodity prices, farmers should respond by increasing their production. Research shows, however, that domestic prices for commodities in many countries are not highly correlated with world prices. Imperfect price transmission means that either changes in domestic prices lag behind changes in world prices or that domestic prices never completely adjust to changes in international prices. The rate of price transmission to domestic markets depends on the level of market infrastructure development and the extent of Government interventions through subsidies, exchange rate policies, tax policies and trade restrictions or preferences.

While complete information on price transmission is lacking, the available information suggests that through the end of February 2011, domestic prices had not increased in many of the 77 countries covered in the ERS assessment. According to the U.S. Agency for International Development's Famine Early Warning Systems Network (FEWS NET), prices in many of the markets in developing countries had not increased at the pace of global prices. In much of SSA, grain supplies had been adequate following good harvests, resulting in relatively low prices. More recently, however, prices have begun to increase, following their typical seasonal pattern. Central America has seen some increases in corn prices, but not as great as those at the international level (FEWS NET, 2011).

A recent study by the International Food Policy Research Institute (IFPRI, 2010) on price transmission in SSA (9 countries, 62 staple commodities) showed that domestic and international prices had a statistically significant long-term relationship for only 13 commodities, with the highest percentage being less than 40 percent. The study also showed that for commodities like rice, where imports contribute to a larger share of consumption, the rate of long-term price transmission is higher than commodities like corn, where the share of imports is low. FAO conducted a 16-country study that found similar results—higher price transmission for wheat relative to corn and sorghum in SSA. The FAO report also indicated that long-term price transmission was lowest in SSA, followed by LAC and Asia (Conforti, 2004).

The issue of price transmission during a time of rising prices is critical, particularly for SSA and Asian countries that rely on domestic production for most of their consumption. Historically, slow food production growth was explained by low incentives to producers due to declining global prices. Research now shows, however, low to no price transmission between international and domestic prices due to internal policies and poor market infrastructure in many food-insecure countries. In general, although Governments show strong commitment to increasing agricultural investment when drafting their food

strategies, most actions focus on appeasing consumers through low or stable food prices (UN FAO, 2011). Such policies include export bans/controls, food tax reductions/elimination, and consumer subsidies. Several countries have adopted producer subsidies, particularly for fertilizers, to boost food production, but how cost-effective these policies are in the long run is not clear. Abbott (2009) argues that to achieve both short- and long-term goals:

> "A more consistent policy environment must set appropriate incentives to agriculture, cognizant of effects on the vulnerable and consumers more broadly. A better balance needs to be achieved between short and long run outcomes, reflecting shared priorities of donors and national governments." (Abbott, 2009)

In practical terms, however, how to balance these policies based on the complexity of the issue and how it varies by country is not clear.

Food Imports Depend on Foreign Exchange Earnings

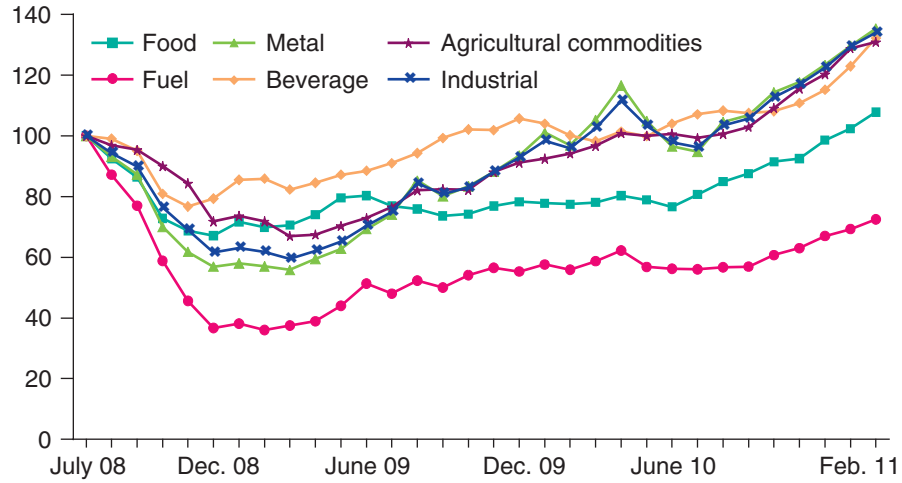
Based on International Monetary Fund (IMF) projections, we assumed positive export growth for all regions. Political changes in NA, however, create significant uncertainty and downward risk for export earnings. For trade-dependent countries, trade stability can be seen in the comparison of global food prices with prices of other commodities during 2010 and 2011 (fig. 3).

As figure 3 illustrates, relative to food prices, the prices of most commodities began to stabilize toward the end of 2009, meaning that the purchasing power of food-importing countries did not deteriorate. The prices of nonfood commodities (metals, agricultural, beverage, and industrial) have risen faster than food prices since August 2009. The only exception to this trend is fuel prices, which declined more than food prices after the peak in July 2008. Since June 2009, fuel prices have remained 20-40 percent lower than food prices. In the short-term, food imports have been relatively more expensive for countries that export fuel since the height of the 2008 price crisis. For

Figure 3

Rising export commodity prices mitigate impact of higher food prices

Commodity price indices, July 2008 = 100



Source: International Monetary Fund.

countries that export other commodities (metal, industrial, high-value agricultural products, etc.) and import food, however, food has been relatively less expensive—terms of trade are in their favor with respect to food. Given the tension that developed in the Middle East in 2011, rising fuel prices could cause terms of trade to deteriorate and increase pressure on the import capacity of the oil-importing countries. The political instability in the region could also impact remittances as workers are forced to leave several of the NA countries. Remittances from the Middle East are important sources of foreign exchange earnings for many countries in Asia and SSA.

According to the IMF monthly food price index, global food prices (in nominal terms) were stable during the first half of 2010, but increased steadily in the second half of 2010 through the first 3 months of 2011. A combination of weather-related food production declines in major exporting countries and strong food demand in emerging countries contributed to increasing food prices. Higher fuel prices also amplified the rise in food prices. As a result, FAO estimates that the global cost of food imports exceeded $1 trillion in 2010, marking a 15-percent increase from 2009 (Blas, 2011).

Although uncertainty persists, our analysis was based on *USDA Agricultural Projections to 2020* which show a 15-percent increase in grain prices between 2010 and 2011. This increase, in turn, leads to price increases for other commodities, such as feed and meat. In contrast, World Bank grain prices and aggregate food price projections for 2011 show a decline of about 4 percent from 2010 (table 2). Both USDA and the World Bank, however, project declining prices through 2020.

IMF analysts argue that as consumption of high-protein foods increases in the emerging countries, a downturn in food prices is unlikely (IMF Finance and Development, March 2011). Trostle (2011) reviews the factors behind the price surge and indicates that the long-term trends in agricultural production and consumption that contributed to 2002-08 price increases, such as growth in global population and income, rising demand for energy (including biofuels), and increasing food demand (meat in particular), will continue to impact the trend toward higher food prices at least in the midterm. Prices also could spike in the short term due to weather-related production shortfalls

Table 2
Key nominal commodity price indices (actual and forecast, 2000=100), 2005-12

	Actual						Projection	
	2005	2006	2007	2008	2009	2010	2011	2012
Energy	188	221	245	342	215	271	293	277
Nonenergy	149	192	225	272	213	267	270	258
Agriculture	133	150	180	229	198	228	213	205
Food	134	147	185	247	205	221	208	204
Beverages	137	145	170	210	220	250	225	210
Raw materials	131	160	175	196	169	232	219	206
Metals and minerals	179	280	314	326	236	348	386	367
Fertilizers	163	169	240	567	293	278	255	249

Source: World Bank, *Global Economic Prospects: Navigating Strong Currents*, 2011, http://siteresources.worldbank.org/INTGEP/Resources/335315-1294842452675/GEPJanuary2011FullReport.pdf.

in an environment of relatively low global commodity stocks. Government policy options, such as expediting imports as opposed to imposing export restrictions, could reduce the degree of these price increases, especially for such commodities as rice, where the trade market is thin.

The 2010 IMF projections for NA countries indicated faster export earnings growth in 2010 and 2011 than in 2009 in nearly all countries, ranging from 5 to 6 percent (IMF, 2010a). Political instability within the North Africa/ Middle East region could have negative implications for these countries, altering current positive projections.

In SSA, where chronic food insecurity persists, trade prospects are projected to improve from 2010 (IMF, October 2010a). Economic growth for the region is projected to improve modestly to 5.5 percent from 5 percent in 2010. Trade is a critical factor for projected growth and depends on the strength of demand of trading partners. According to the latest World Bank data, SSA's trade with developing countries, particularly Latin America and Asia has increased substantially. China's share of SSA's trade increased from 3.4 percent in 2000 to 13.9 percent in 2009 (World Bank). The most significant exports to these regions include oil, iron ore, diamonds, copper, and cobalt.

Within the LAC region, mineral commodity-exporting countries, particularly Peru, are projected to have the strongest trade performance (IMF, October 2010b). Of the study countries in 2010, Peru had the highest export growth in the region of about 8 percent. Export growth in Central American countries, such as Honduras, Guatemala, and Nicaragua, is projected at 4-5 percent. The financial performance of Central American countries depends heavily on the state of the U.S. economy, particularly in terms of exports and remittances. Slow economic growth in the United States can mean few gains for remittances and export earnings. While these countries have benefitted from the global commodity price boom, they also depend highly on imports of both oil and food. Therefore, a slow U.S. economic recovery and higher food and/or crude oil prices could increase pressure on their import capacity.

Of all regions included in this study, Asia shows the strongest and most sustainable export growth. Most countries in the region have diversified economies, and both production and exports benefit from growing investment in the region (IMF, April 2010). Projected export growth is the strongest for India and Indonesia. However, the lower income countries in the region like Bangladesh, Cambodia, and Vietnam benefit from strong external demand for commodities (e.g., textiles) and People's Democratic Republic of Laos and Mongolia will gain from brisk demand for minerals.

Projections for 2021: Asian Countries Will Lead Food Security Improvement

Long-term projections of food security indicators are made assuming a continuation of current trends in several key factors—agricultural productivity, foreign exchange availability, and population growth. According to ERS estimates, significant improvement in food security in terms of access to adequate calories is eminent. The number of food-insecure people at the aggregate level is projected to decline by 16 percent, or nearly 140 million between 2011 and 2021. Food security is projected to improve remarkably in Asia and LAC, but we project a slight deterioration in SSA. The number of food-insecure people is expected to decline 33 percent in Asian and LAC countries. The expectations for SSA, however, are not positive, pointing to a 6-percent increase in the number of food-insecure people (table 3). Note, however, that the region's population growth rate—about 26 percent through the next decade—far outstrips the increase in food-insecure people. Therefore, food security will improve per capita. In other words, the share of the population that is undernourished will decline from 44 percent in 2011 to 37 percent in 2021.

The distribution food gap is projected to decline by nearly 7 percent during the next decade. The projected less-than-proportional decline in the food gap relative to the number of food-insecure people means that food-insecure people, on average, will slip further below their nutritional requirement. Among the regions evaluated, only SSA shows an increase in its food gap, up roughly 20 percent. This, coupled with a 6-percent increase in the number of food-insecure people, indicates that food insecurity among that region's poor is intensifying. In these cases, food aid can play a critical role in enhancing food security (see box, "Trends in Food Aid and Official Development Assistance"). The distributional food gap is projected to decline by half in Asia and by 31 percent in LAC (table 4). No distribution gap is projected for NA.

According to our projections, per capita food consumption (in grain equivalent) is expected to increase through 2021. Growth will be highest in the

Table 3
Estimates and projections of food-insecure people

	Region				
	Total	Asia	LAC	NA	SSA
			Millions		
70 countries					
2010	837	437	56	0	345
2011	825	406	58	0	360
77 countries					
2010	861	459	56	0	346
2011	852	431	58	0	363
2021	714	290	39	0	358

LAC=Latin America and the Caribbean.
NA=North Africa.
SSA=Sub-Saharan Africa.

Source: USDA, Economic Research Service.

Trends in Food Aid and Official Development Assistance

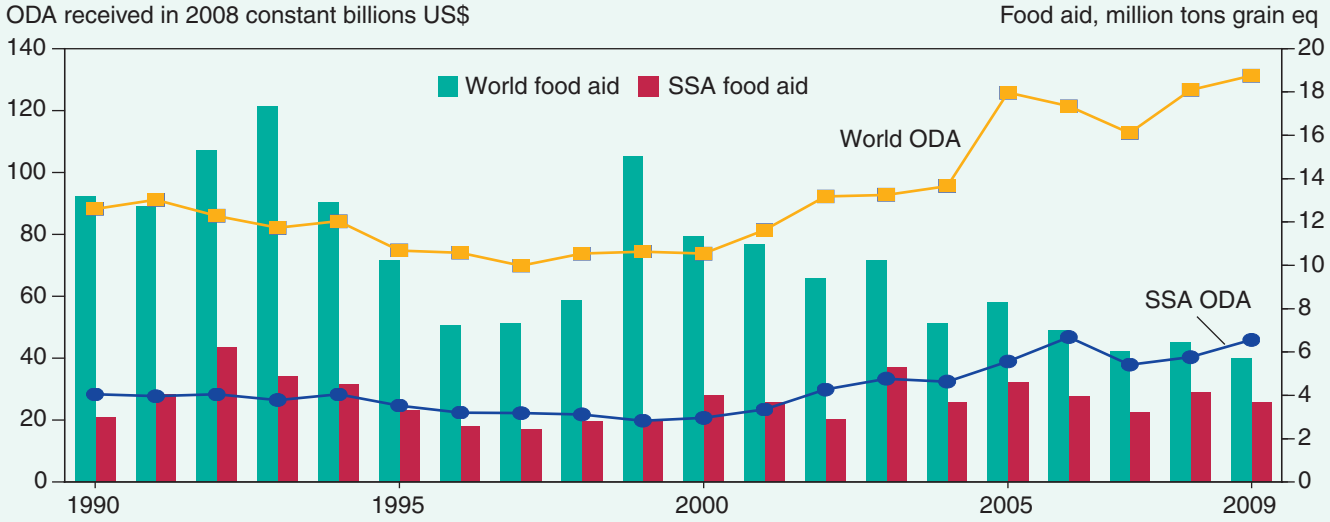
Food aid continues to be an important resource to combat food insecurity, particularly during emergency situations. The quantity of food aid, however, continues to decline. Food aid shipments averaged about 15 million tons (in grain equivalent) in the early 1990s but then declined steadily, reaching its lowest level of 5.8 million tons in 2009. Despite this declining trend, targeting of food aid to needy countries appears to have improved. The clear case in point is the increase in share of global food aid to SSA, the region most vulnerable to food insecurity. During 1990-94, SSA's share of total food aid was in the range of 23 to 40 percent. During 2006-09, this share increased to a range of 53 to 64 percent. In absolute terms, however, the quantity of food aid the region received declined, albeit not at as rapid a pace as the decline in global food aid—a decline of 17 percent versus 57 percent (box figure).

In 2009, the top 5 food aid recipient countries were Ethiopia, Sudan, Somalia, DR Congo, and Kenya. The United States remains by far the largest food aid contributor, with a share of 51 percent in 2009, followed by the EU at 17 percent. The shares of other donors were in the single-digit range, including large grain exporters Canada (4 percent) and Australia (1.7 percent).

In terms of food aid distribution management, 66 percent of food aid was channeled through the World Food Programme (WFP) in 2009. The remainder was either distributed directly by donors or by non-government organizations. Since 2008, the WFP has adopted a new strategy to move from food aid distributer to a food assistance agency. This means complementing their direct food aid distribution activities with safety net and development projects. It is too soon to evaluate to the impacts of their strategy change on food security and it is unclear how such activities complement nonfood development assistance.

Official development assistance (ODA), similar to food aid, declined during the 1990s. However, ODA has increased significantly since 2000 (constant 2008 US$). From 2000 to 2009, ODA increased by 87 percent, compared with a 16-percent decline during 1990-2000. So far, international efforts to reduce food insecurity and global poverty remain high on the development agenda. In terms of ODA targeting, the SSA share increased from 32 percent in 1990 to 35 percent in 2009. In absolute terms, however, its value increased by 62 percent. With the development of agriculture sectors being a priority for donors, significant improvements in the global food security situation may have a greater possibility during the upcoming decade.

SSA food aid share is increasing



ODA = Official Development Assistance.
SSA = Sub-Saharan Africa.

Source: World Food Programme.

Table 4
Estimates and projections of food distribution gaps

	Region				
	Total	Asia	LAC	NA	SSA
			Million tons		
70 countries					
2010	15.5	4.8	1.2	0	9.4
2011	14.7	4.5	1.3	0	8.9
77 countries					
2010	15.8	5.1	1.2	0	9.5
2011	15.0	4.7	1.3	0	8.9
2021	14.0	2.4	0.9	0	10.7

LAC=Latin America and the Caribbean.
NA=North Africa.
SSA=Sub-Saharan Africa.

Source: USDA, Economic Research Service.

Asian countries and lowest in SSA. Projected improvement in food availability is synonymous with a changing, more diversified diet. Per capita calorie consumption in the study countries (excluding Central Asian countries since they were not independent in 1985) increased by 11 percent between 1985 and 2007 (table 5). Asia saw the largest increase at 13 percent, followed by NA at 11 percent, LAC at 9 percent, and SSA at 8 percent.

Increased consumption of key dietary components generally was stronger than the increase in overall calorie consumption (table 5). During 1985-2007, per capita consumption of protein and sugar increased by 14 percent in all countries. LAC had the greatest increase in protein consumption at 18 percent, while Asia had the greatest increase in sugar consumption at 31 percent. Fat consumption increased at a faster rate (26 percent) than consumption for other key dietary components and was particularly high in Asia and LAC (36 and 30 percent, respectively).

Higher-than-recommended average consumption levels for certain dietary components, however, mask disparities in consumption by different segments of the population within the countries. In all study countries, income growth is projected to be positive and the income elasticity for protein, fat, and sugar remains positive (i.e., as incomes rise, the role and contribution of these macronutrients and food groups in the diet increases). Greater consumption of fats and sugar is of particular concern because of their likely adverse effects on not just weight and obesity, but also on health and health care costs.

Research shows that obesity is more common among higher income groups in low-income countries (World Health Organization, 2002). In contrast, obesity is more common among lower income groups in high-income countries. Results from this study indicate that consumption in the highest income deciles exceeds 2,500 calories per person per day in 57 of the 77 study countries in 2011. In 15 countries, consumption exceeds the upper range of the dietary requirement for a moderately active adult at 2,700 calories. In fact, consumption for the highest income quintile in NA was estimated at nearly 3,500 calories per day.

Table 5

Change in diet composition and ratios to recommended nutritional requirement

	Consumption per capita per day[1]				Ratio to requirement (per capita daily)			
	Energy	Protein	Fat	Sugar	Energy	Protein	Fat[2]	Sugar[2]
	kcal	g	g	g	2,100 cal	67 g	56 g	26 g
1985								
All countries	**2,108**	**53**	**41**	**52**	**1.00**	**0.78**	**0.74**	**2.01**
SSA	2,094	53	41	37	1.00	0.78	0.73	1.43
Asia	2,084	52	36	57	0.99	0.78	0.64	2.20
LAC	2,184	53	48	99	1.04	0.78	0.87	3.80
NA	2,897	78	64	98	1.38	1.16	1.15	3.78
2007								
All countries	**2,339**	**60**	**52**	**59**	**1.11**	**0.89**	**0.93**	**2.25**
SSA	2,262	56	48	42	1.08	0.84	0.86	1.63
Asia	2,347	60	49	75	1.12	0.89	0.87	2.88
LAC	2,391	62	63	95	1.14	0.93	1.12	3.67
NA	3,228	90	69	120	1.54	1.34	1.24	4.62

SSA=Sub-Saharan Africa.
LAC=Latin American and the Caribbean.
NA=North Africa.
[1]Calculated based on Food and Agriculture Organization (FAO) Food Balance Sheet.
[2]Based on American Heart Association.
http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Frequently-Asked-Questions-About-Fats_UCM_306069_Article.jsp.

Source: USDA, Economic Research Service calculations based on FAO Food Balance Sheet Data.

Overweight populations in developing countries could increase because of the rising number of overweight children. According to the World Health Organization study, 8-9 percent of children younger than age 5 in Egypt and Algeria were overweight; close to 10 percent of children younger than age 5 are estimated to be overweight in the United States (World Health Organization, 2002). The study also indicates that overweight and obesity represent a rapidly growing health threat to an increasing number of developed and developing countries. In some developing countries, overweight and obesity are replacing more traditional public health concerns, such as undernutrition and infectious diseases.

In most developing countries, human capital is a major resource and public health is key to economic progress. Obesity reduces a person's productivity. Moreover, the health costs associated with obesity and its related diseases could overwhelm a developing countries' fragile health care system. According to current World Bank data, per capita health expenditures in developing countries are less than 10 percent of developed countries' expenditures, while for least-developed countries this share is less than 1 percent.

Conclusions

International food security 2011 is projected to improve slightly. International food security for 2021 is projected to improve because food nutrition and distribution gaps and the number of food-insecure populations are projected to decline. The number of food-insecure people will rise only in SSA, but will decline as a share of the region's total population. These projections seem optimistic as a result of high food prices that have energized Governments, donors, and the private sector to focus on food security and increased investment in agricultural production, particularly for food.

If historical trends continue, growth in food availability will be accompanied by changes in the food baskets these countries consume. Consumption of protein, fat, and sugar are expected to grow. Protein consumption in all regions (except NA) was less than the nutritional requirement. Sugar consumption, however, was much higher than the maximum recommended level. As the rate of fat and sugar consumption increases, the number of overweight and obese people with potentially serious health complications will also increase.

The current high food prices could slow the pace of excess food consumption, but income growth will continue to boost food consumption. According to Prentice (2006), reducing obesity rates in low-income countries within the foreseeable future would be difficult because these populations have been fighting to escape hunger and frugal diets for generations. The challenge for the global community is to overcome food insecurity of the poorest people in the poorest countries in the world. Even for countries with adequate resources, lower income groups often remain vulnerable. However, several food security initiatives, if well-targeted, could alter the situation. Obesity is a new issue for these populations, but if ignored, the trend could mirror that of Western countries, leading to high health costs.

Food Security: Regional[2] and Country Perspectives

The food security situation of all regions covered in this study (except for SSA) will improve over the next decade. For Asian and LAC countries, a significant decline of 33 and 21 percent, respectively, in the number of food-insecure people is projected. Prospects for food security in NA remain favorable as food availability in the region is projected to increase 24 percent during the next decade. For SSA, we estimate a 6-percent increase in the number of food-insecure people over the next decade. Given the region's high population growth rate, however, the number of food-insecure people will decline as a share of the total population, from 44 percent in 2011 to 37 percent in 2021.

North Africa

The North Africa (NA) region—Algeria, Egypt, Morocco, and Tunisia—is projected to remain the most food secure among the regions included in this analysis (table 6). The region's average consumption of calories and macronutrients exceeds recommended nutritional targets as a result of their relatively high per capita gross domestic product (GDP) and Government food safety net programs. In 2007, NA's per capita caloric availability exceeded 3,200 kilocalories (kcal) per day, 54 percent higher than recommended energy requirements and comparable with consumption in developed economies. The region's per capita consumption of the macronutrients protein and fat also exceeded recommended nutritional targets by 34 and 24 percent, respectively.

Energy/caloric intake was fairly even across countries covered in the study, exceeding the recommended target (2,100 kcal per capita per day) by 50-58 percent. In both Tunisia and Algeria, fat consumption exceeded the regional average and exceeded recommended nutritional levels. In 2007, Tunisia's per capita consumption of fat was 56 percent above recommended rates, while Algeria's per capita consumption exceeded dietary guidelines by 25 percent. The overall level of caloric intake and fat consumption suggests that countries in this region may soon be facing escalating health problems associated with overconsumption and obesity—issues frequently associated with developed and highly industrialized countries.

Despite recent international food price increases and political instabilities, the short-term food security situation in the region remains positive. For 2011, the proportion of food-insecure people in the study countries will remain below 10 percent of the population. Their good performance is partly due to these countries being largely unaffected by the financial crisis and global recession. Their economies continued to grow, albeit at slower rates. In fact, in most NA countries, their economic growth rates have already returned to their long-term trend. Egypt experienced the biggest slowdown as economic growth dropped from 7.2 percent in 2008 to 4.7 percent in 2009. IMF (2011) projects Egypt's economic growth to continue to increase through the next 4 years, reaching 6.5 percent by 2015.

Strong economic growth boosts the region's commercial import capacity, particularly at times when domestic production is low, as in 2010.

[2]For our purposes, Asia, SSA, NA, and LAC refer only to the study countries and not the regions in their entirety.

Agricultural production in the region (except for Egypt) fluctuates widely because of its dependence on highly variable rainfall. Despite this variability, their Government's commitments to food supply stability remained strong, allowing food imports to adjust with production variation.

Commercial imports in 2011 are expected to fall below 2010 levels as international prices are projected to increase. As a result, food availability in the region in 2011 is projected to decline from the previous year's total. Nonetheless, total food supplies will be large enough to meet the nutritional needs of those populations.

The recent rise in international food prices has generated concerns about whether the region's poor can meet their nutritional needs. NA has a long history of consumer subsidy programs to keep food prices low, however. In response to recent price increases, several Governments took additional steps to further protect their consumers. In 2010, Egypt banned rice exports to stabilize domestic prices and Algeria reduced its taxes and tariffs on sugar imports (FAO, 2010).

As of early 2011, these policies had prevented the spike in international food prices from being transmitted to local markets (FAO, 2011). In Tunisia and Morocco, the yearly food price inflation rates remained below 5 percent at the end of 2010. For Algeria, yearly inflation rates for food and grain prices were only about 2.5 and 2.4 percent, respectively. In Egypt, yearly food price inflation rates were somewhat higher than in other countries in the region, increasing by 17.2 percent. Still, this increase is significantly less than that for international food prices over the same period (FAO, 2011).

NA countries' continued reliance on subsidies and broad-based food distribution/safety net programs to reduce their populations' food security vulnerability will continue to put pressure on Government budgets. These market interventions could be inefficient and fiscally difficult to sustain in the long run (Abbott, 2011). They are also often in conflict with countries' efforts to increase their investment in agriculture because many policies that reduce the impact of higher prices on consumers often reduce incentives to encourage investment in future agricultural production.

Long-term prospects for food security in the region remain favorable. Per capita food availability is expected to remain steady over the next decade, with food availability in the region projected to increase to 77 million tons by 2021, 24 percent higher than in 2011. The estimated increase in food availability in the region will be satisfied through increased domestic production and commercial imports. Grain production in the region is expected to increase to nearly 40 million tons in 2021, up 18 percent. The region will continue to depend highly on food imports to meet food needs as its commercial grain imports are estimated to provide 46 percent of the total available food supply in 2021.

The region's ability to maintain food imports over the long term will depend on its ability to increase export earnings and capital inflows. Higher international prices for crude oil and other export commodities will boost the import capacity of Egypt, Morocco, Tunisia and oil-exporting Algeria. IMF also projects that all the study countries' current account balances will improve

Table 6

Food availability and food gaps for North Africa

Year	Grain production	Root production *(grain equiv.)*	Commercial imports *(grains)*	Food aid receipts *(grain equivalent)*	Aggregate availability of all food
			1,000 tons		
2002	25,945	1,302	27,540	82	55,265
2003	33,174	1,503	20,889	35	56,056
2004	33,495	1,656	19,947	67	56,529
2005	30,302	1,873	26,704	56	57,832
2006	35,147	1,722	23,468	60	58,926
2007	27,387	1,620	27,215	31	60,504
2008	29,898	1,999	32,624	44	64,290
2009	39,168	2,225	29,257	26	65,313
2010(e)	33,791	1,824	32,581	34	67,075
Projections				Food gap*	
				NG DG	
2011	33,720	1,857	28,366	***0*** ***0***	62,626
2016	36,806	2,032	32,038	***0*** ***0***	70,095
2021	39,859	2,216	35,559	***0*** ***0***	77,387

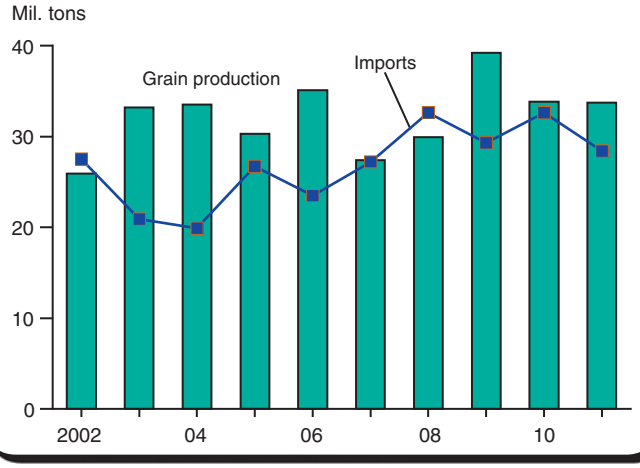
*See table 1.

North Africa
(165 mllion people in 2011)

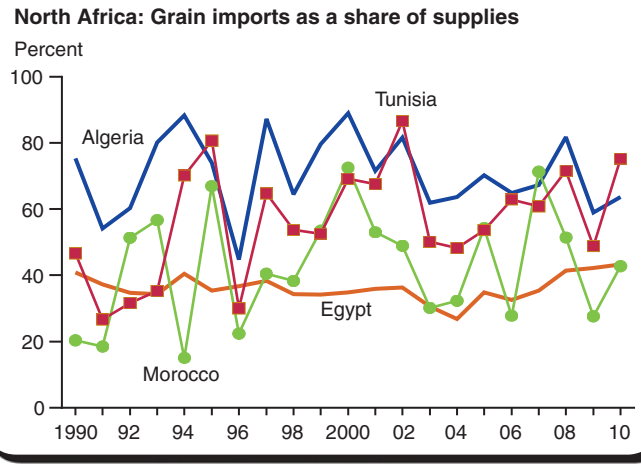
Despite recent increases in international food prices and political instabilities, North Africa's food security situation remains favorable. The region imports a large share of its food supplies because domestic production relies on variable weather and is constrained by a limited resource-base. Global economic recovery and the region's strong macro-economic health boost its import capacity which is helpful at times of low production.

However, recent civil unrests and political changes in NA will continue to pose downward risks to its food security outlook.

North Africia: Grain production and commercial imports



North Africa: Grain imports as a share of supplies



North Africa: Nutritional indicators of selected countries, 2007

	Share of available food for consumption					Percent of recommended nutritional target met		
	Grains	Roots and tubers	Vegetable oil	Sugar and sweeteners	Sum	Energy	Protein	Fat
			Percent				*Percent*	
Egypt	63	2	4	8	77	152	138	98
Morocco	60	2	9	12	83	154	129	115
Tunisia	51	2	13	10	76	158	142	156
NA	57	2	9	10	79	154	134	124

Source: USDA, Economic Research Service, Food and Agriculture Organization Food Balance Sheet, World Food Programme.

through 2015 and beyond as their economies grow, further enhancing their financial capacity to import. Financial stability is important because, while recent international price increases did not lead to higher domestic food prices, they increased the food import bill of all countries in the region.

Still, future risks to food insecurity remain a concern for these NA countries. Projected estimates show no significant change in food security for the region, but several factors could alter the situation. The recent civil unrest in several countries in the region raises fears about food security vulnerability as political uncertainties in NA may lead to:

- Economic instability,
- A growing number of internally displaced people (IDPs),
- An influx of refugees as some countries provide haven to people from neighboring countries (i.e., Libya),
- Possible disruptions in agricultural production, commercial, and other economic activities.

Moreover, income distribution in these countries is highly skewed: the richest 10 percent of the population earns about 30 percent of the total income, while the poorest 10 percent earns only about 3 percent, on average. As a result, a portion of the population, when confronted by a decline in purchasing power, would face increased susceptibility to food insecurity (World Bank, 2011). For example, in Tunisia, the poorest 10 percent of its population are projected, on average, to consume about 7 percent above the recommended nutritional target. As such, a significant decline in income or a prolonged increase in domestic food prices will put pressure on household budgets, potentially dropping consumption below recommended levels.

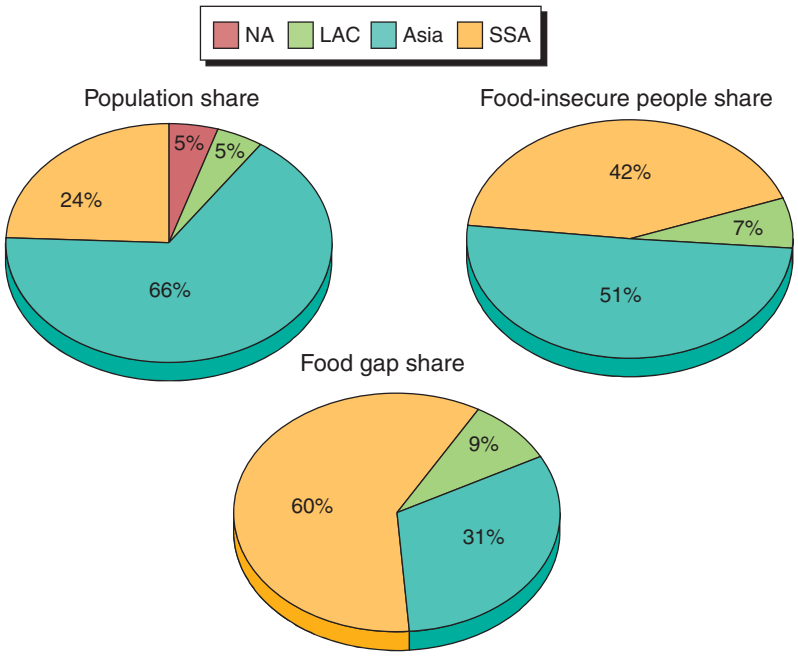
A region's prospects are primarily constrained by continued population growth, urbanization, unpredictable weather, and a limited resource base, particularly arable land and water. Thus, future domestic production growth must come primarily from increased input use and higher yields, which would require continued investment in the agricultural sector. Many countries in the region already offer such agricultural support and incentives. Algeria, Morocco, and Tunisia provide subsidies for fertilizer and improved seed varieties. They have also increased farmer's access to credit. In Tunisia, the Government recently expanded its seed distribution program and restructured the debt of farmers affected by poor harvests. Still, achieving a balanced mix of food policies to support consumers and aid the poor with agricultural policies to increase food production is a challenge faced not by just these NA countries, but by most developing economies.

Sub-Saharan Africa (SSA)

Sub-Saharan Africa (SSA) is the world's most vulnerable region regarding food security (table 7). Forty-four percent of the region's population is estimated to be food insecure in 2011. While it accounts for 24 percent of the population of the 77 countries included in the report, SSA is estimated to account for more than 42 percent of the food-insecure population and more than 59 percent of the distribution gaps of these countries (fig. 4). Domestic

Figure 4

Total and food-insecure population share and food gap share by region, 2011



Source: USDA, Economic Research Service and UN FAOSTAT.

production continues to be the key determinant of food security in the region in the short term (e.g., in 2010, a bumper grain crop in many countries led to a significant improvement in the region's food security over that of 2009).

Some SSA countries saw record crops in 2010, including Burkina Faso, Chad, Gambia, Guinea-Bissau, Mali, Niger, Senegal, Ethiopia, Kenya, Uganda, and Malawi. Nigeria reported a very good harvest as well. While output for 2011 is expected to be above the recent average, it is estimated to be 4 percent below last year's crop. This decline, coupled with higher global grain prices that constrain the region's import capacity, will result in an almost 5-percent increase in the number of food-insecure people between 2010 and 2011—to 363 million—in the 39 SSA countries included in this analysis. Another indicator of food security—the region's distribution food gap—is estimated, however, to decline more than 6 percent to less than 9 million tons in 2011. This gap, which measures the food needed to raise consumption in each income decile to the nutritional requirement of approximately 2,100 calories per day per person, provides a measure of the intensity of hunger—the extent to which the food security of already hungry people deteriorates or improves as a result of income or economic conditions. Given these results, the region's food security is estimated to spread, rather than intensify, in 2011.

Global food commodity prices increased sharply at the end of 2010 and have continued into early 2011. These prices, for the most part, however, have not been transmitted to local markets because of policy intervention and weak market infrastructure. Therefore, retail prices most often reflect local production levels. If the crop is produced domestically and output is good, prices have remained stable. For example, prices of millet and sorghum in Niger,

Table 7

Food availability and food gaps for Sub-Saharan Africa

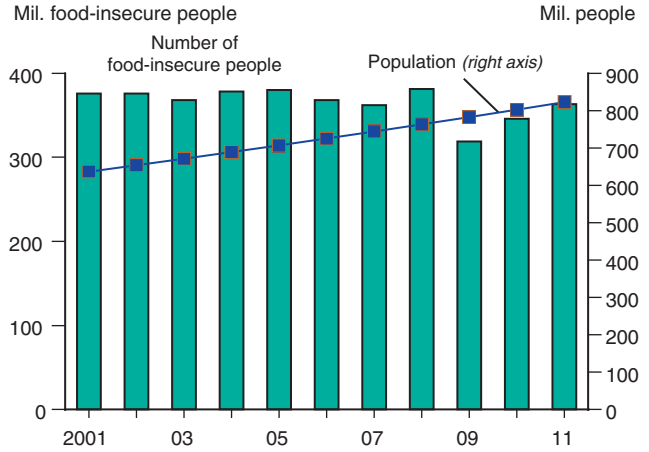
Year	Grain production	Root production *(grain equiv.)*	Commercial imports *(grains)*	Food aid receipts *(grain equivalent)*	Aggregate availability of all food
			1,000 tons		
2002	73,848	52,944	17,152	2,839	164,005
2003	81,279	54,500	16,708	5,249	169,399
2004	81,169	57,429	18,189	3,576	174,818
2005	89,887	59,693	20,440	4,575	182,246
2006	97,013	62,056	21,213	3,939	189,591
2007	93,577	59,444	19,742	3,195	196,290
2008	97,247	63,180	23,501	4,114	204,236
2009	99,154	64,532	23,181	3,610	210,681
2010(e)	113,326	62,713	20,296	3,352	214,650
Projections				Food gap* NG / DG	(w/o food aid)
2011	108,796	63,813	21,145	***5,032*** / ***8,934***	217,944
2016	125,975	69,559	24,391	***5,870*** / ***9,580***	248,227
2021	144,774	75,735	26,794	***6,809*** / ***10,681***	279,101

*See table 1.

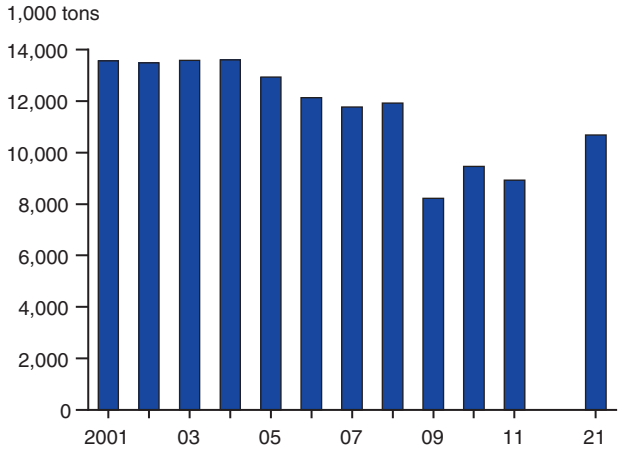
Sub-Saharan Africa
(823 million people in 2011)

The number of food-insecure people in the region is projected to increase 6 percent in the next decade. The region's population growth, among the highest in the world, is projected at 26 percent during that time. Therefore, SSA's per capita food security situation is actually projected to improve during the next decade. This is reflected in the decline in the food-insecure population from 44 percent in 2011 to 37 percent in 2021.

SSA: Trend in number of food-insecure people vs. population



SSA: Distribution gaps



Sub-Saharan Africa: Nutritional indicators of selected countries, 2007

	Share of available food for consumption					Percent of recommended nutritional target met		
	Grains	Roots and tubers	Vegetable oil	Sugar and sweeteners	Sum	Energy	Protein	Fat
			Percent				*Percent*	
Kenya	48	6	8	9	70	99	89	88
Madagascar	59	18	5	3	85	103	74	57
Nigeria	46	19	13	3	81	131	95	119
Uganda	23	23	8	4	57	105	73	76
Zambia	62	14	6	6	89	89	70	61
SSA	48	16	8	6	78	108	84	86

Source: USDA, Economic Research Service, Food and Agriculture Organization Food Balance Sheet, World Food Programme.

Mali, and Burkina Faso have shown some seasonal increases, but (as of April 2011) were below last year's levels due to bumper crops. In Nigeria, prices (as of April 2011) of corn and sorghum were lower than those of the prior year, again due to good harvests. Malawi's corn prices were lower in early 2011 versus the same period in 2010, owing to adequate availability and good prospects for the upcoming crop. In cases where the capital cities relied on certain imports—such as rice in Dakar, Senegal, and Maputo, Mozambique, and wheat in Nouakchott, Mauritania, and Khartoum, Sudan—early 2011 prices were higher than those in 2010. Prices also rose in February and March in some countries, such as Ethiopia and Kenya, due to poor secondary crops. Uganda has probably seen the largest price hikes in the staple crops—plantains and beans—due to drought-reduced harvests.

On an absolute level, the region's food security situation is projected to deteriorate over the next decade. The number of food-insecure people is projected to increase 6 percent to 385 million in 2021. The region's distribution gap is projected to rise even faster at 20 percent. Both of these indicators, however, will increase at a slower rate than the population. The region's population growth is among the highest in the world, projected at roughly 2.6 percent per year through 2021. Therefore, SSA's per capita food security situation is actually projected to improve during the next decade, according to the USDA-ERS indicators, and is reflected in the decline in the food-insecure population from 44 percent in 2011 to 37 percent in 2021.

The Democratic Republic of Congo, Burundi, Eritrea, and Somalia are among the most food-insecure countries in the region. The common trait among these countries is their involvement in civil conflict, either current or recent past, which generally results in the displacement of rural populations and the disruption of agricultural and other economic activities. Population growth in these countries remains high, around 3 percent, putting tremendous pressure on their resources. According to World Bank estimates, these countries also have high poverty levels. While data on the food security of these countries are weak, FAO indicates that the average calorie consumption in these regions is much lower than the 2,100 calorie target. As a result, these countries are high on the agenda of relief agencies.

The economies and/or agricultural sectors of several SSA countries (Ghana, Guinea, Mali, Mauritania, and Nigeria), in contrast to the countries mentioned previously, have improved significantly, which has boosted their food security situations in recent years. Results indicate that roughly 90 percent of the population of these countries is estimated to be food secure in 2011, with the lone exception of Mali at 80 percent. In Nigeria and Mauritania, increased food availability was primarily driven by the doubling of grain imports during the 2000s. In Ghana and Guinea, increased availability was due to gains in both domestic production and imports. In these cases, the import growth was supported by strong gains in the export sector. In Mali, the increase can be attributed to a doubling of grain area during the decade. Moreover, except for Mauritania, these countries benefitted from a population growth rate that was slower than the regional average.

Kenya and Ethiopia are projected to make some of the greatest strides in the region related to longer term improvements in food security. The number of food-insecure people in Kenya is projected to be cut in half over the next

decade. Our results indicate that in 2021, roughly 20 percent of the population will be food insecure. This improvement can be attributed to the slowdown in the country's population growth. Kenya's population growth rate was among the highest in the region—averaging over 3 percent per year in the 1990s. This growth slowed to roughly 2.7 percent per year in the 2000s and is expected to continue to slow over the next decade to about 2.1 percent in 2021. In addition, Kenya's imports have grown steadily, and this trend is projected to continue through the next decade. Imports have been supported by significant growth in export earnings as well as remittances, which are now greater than any other traditional foreign exchange earner (tea, tourism, horticulture). Near-term economic growth is favorable due to increased intra-regional trade and investment in infrastructure. Further trade and growth could be facilitated by the East Africa Common Market Protocol, which became effective in July 2010. This agreement allows for the free movement of goods, services, capital, and labor among the signatory countries of Burundi, Kenya, Tanzania, Uganda, and Rwanda.

Ethiopia is estimated to be the second fastest growing economy in the region (after Ghana) in 2011, up 8.5 percent in real terms. According to the IMF, growth will continue near this rate through 2016. This economic growth is being spurred by the agricultural sector, which has benefitted from investment in roads and power projects. Also, large commercial producers have gained from investments in agro-processing. These factors are projected to benefit the sector through the next decade. Grain production jumped nearly 8 percent per year in the 2000s and while production is projected to slow a bit through 2021, it will outpace the population growth of about 2.4 percent per year. In 2021, about 20 percent of the population is projected to be food-insecure, as compared with roughly 90 percent in the mid-2000s.

Global Factors Influencing Future Food Security Developments in SSA

According to the IMF, real GDP growth in SSA (including South Africa) was 5 percent in 2010. The increase was spurred by rising export volumes, commodity prices, foreign direct investment (FDI), and tourism. Export volumes increased the most for metals and minerals—nearly 35 percent—and the volume of oil exports was up more than 18 percent. Given that most of the economies in the region are agricultural, favorable weather conditions in Eastern and Southern Africa boosted household incomes in 2010.

Growth for 2011 is projected at 5.5 percent and for 2012 is projected at 5.9 percent, making SSA one of the fastest growing developing regions. The highest growth within the region is projected for oil exporters and low-income countries (Ethiopia, Nigeria, Kenya, Democratic Republic of the Congo, and Tanzania). The low-income country growth stems from Government investment and support for social programs and growing trade ties with China and other developing countries in Asia and Latin America. China's share of SSA trade has grown dramatically in the last decade. In 2000, China's share of SSA exports was 3.3 percent; by 2009, this share increased nearly fourfold to 12.6 percent. China's share of the region's imports increased at an even faster pace, from 3.5 percent to 14.5 percent. The IMF projects China's growth to remain strong at around 9.5 percent in the near term, while growth in India, which is also increasing trade and investment in the region, will be roughly 8 percent.

Europe remains SSA's largest trading partner, and growth in that region is projected to remain low. The IMF projects Euro area growth of 1.6 percent in 2011 and 1.8 percent in 2012.

Commodity prices on imports and exports will also play a key role in the region's food security outlook. The World Bank is projecting that global food prices will decline about 6 percent between 2010 and 2011 and then continue to decline slightly in 2012. Beverages prices, which many SSA countries export, are projected to rise about 10 percent in 2011. These prices are far above those seen in the mid-2000s. Prices for metals and minerals, which SSA countries also export, will remain high, increasing 10 percent in 2011 based on strong demand from China and other fast-growing developing countries. China accounts for more than 40 percent of the consumption of refined global metal (aluminum, copper, lead, nickel, and zinc), more than all Organisation for Economic Co-operation and Development countries combined. Upward pressure on prices could continue as a result of global demand as well as declining ore grades, land rehabilitation, and higher prices for energy and labor.

Foreign Direct Investment (FDI) is the largest source of private capital flows into the region. FDI has increased in most years during the last decade, reflecting global investment interest in the region. Net FDI inflows to the region (including South Africa) increased from roughly $13 billion in 2003 to an estimated $32 billion in 2010. FDI to the region as a percentage of GDP actually rose in 2010, unlike that for most developing regions. The World Bank forecasts net FDI to the region at nearly $52 billion by 2012. The United Nations Conference on Trade and Development (UNCTAD) estimates that FDI's rate of return in Africa is the highest in the world. While this investment is not spread equally among the countries in the region, more than half goes to smaller economies, such as Congo, Ghana, Mozambique, Zambia, Niger, Liberia, Sierra Leone, and Guinea. Most of the investment is geared toward the extractive industries sector, largely because of the recent rise in metal and oil prices. Forty percent of the region's FDI goes to the three largest economies—South Africa, Angola, and Nigeria.

Remittances are an important source of earnings for many households in the region. In Lesotho, this revenue equals about 20 percent of GDP and, although a lower share at about 10 percent, they are also important in Cape Verde, Senegal, and Togo. Due to slow economic recovery in the United States, North Africa, the Middle East, and parts of Europe, remittances increased slightly in 2010 to $21 billion.

To address long-term lagging production growth and rising food insecurity in the region, local Governments and donors have returned their focus to the agricultural sector. One example of this policy shift is the Comprehensive Africa Agriculture Development Programme (CAADP). CAADP works to eliminate hunger, reduce poverty, and boost economic growth through agriculture-led development. This initiative, which began in 2003, is led by the African Union's New Partnership for Africa's Development (NEPAD) and is supported by the donor community.

CAADP sets a policy framework with priorities and targets in its four pillar areas—land and water management, market access, food security and hunger,

and agricultural research. These plans are then developed and adopted by each country. Twenty-five SSA countries have signed CAADP contracts and are at different stages of implementation. The goal of the program is to raise agricultural productivity by at least 6 percent per year and increase public investment in agriculture to 10 percent of national budgets per year.

The relatively positive outlook for the region's economy and food security is predicated on continuation of the factors noted throughout this report—positive policy development, political stability, economic growth for trading partners, continued high prices for export commodities, and stabilization of prices for imported commodities. If the global economy should slip back into recession, this likely will have an adverse impact on these countries. As noted earlier, Europe remains the region's largest trading partner, and growth in that region is expected to be rather slow. However, China has become an important investor and trader for the region, and that country's growth prospects are very strong. Agriculture remains the dominant component of the region's economy, so growth in that sector is important but also highly dependent on weather conditions. Commodity prices remain important—rice, sugar, and vegetable oil are largely imported—so an increase in prices will reduce household food access. Political stability is another critical issue, and presidential and/or legislative elections are scheduled for a third of the countries in the region in 2011. In many cases, power has transitioned smoothly and it is important that this trend continue for sustained economic growth. Unrest in countries, such as Cote d'Ivoire, Madagascar, Guinea, and Nigeria, however, may impede growth and investment.

Asia

The overall food security situation in the Asian countries included in this analysis are projected to improve over the next decade, with the number of food-insecure people declining by almost 33 percent, from 431 million in 2011 to 290 million in 2021 (table 8). Strong economic growth contributes to Asia's success in improving food security. As the global economy continues to recover from the recent recession, Asia leads the economic upturn as its current and projected economic growth remains the highest among the different regional economies. According to the IMF, the developing Asia region is expected to grow 8.4 percent in 2011 compared with 5.5 and 4.7 percent in SSA and LAC, respectively (IMF, April 2011).

Asia's food security situation will improve in both absolute and relative terms. In 2011, at 2.2 billion people, the region will account for 66 percent of the total population included in the 77 countries and for almost 51 percent of the total number of food-insecure people. By 2021, Asia's projected population of 2.5 billion people will account for 64 percent of the total study population, while the number of food insecure will account for 41 percent.

In the short term, the region's food security will also improve as the number of food-insecure people declines by 6 percent from 459 million in 2010 to 431 million in 2011, the only region in the study showing a decline. Asia's expected impressive performance is supported by favorable crop production prospects in most of the region in 2011, strong economic recovery, increased investment, and high export earnings growth in line with the recent surge in export/international commodity prices.

Domestic production is the main source of food supply in the Asia region, where grain production, on average, accounts for over 85 percent of supplies.[3] Although import dependency is low in most study countries, it is an important coping strategy when food production declines, as transitory and emergency food shortages could be enormous given the scale of Asia's population size.

Strong macroeconomic fundamentals underpin Asia's financial capacity to import. Favorable international prices of export commodities also contribute to Asia's ability to finance food imports. Thus, recent increases in international prices of food and nonfood commodities have boosted the export earnings of many Asian countries, thereby increasing Government revenues. For instance, Mongolia's heavy reliance on rice and wheat imports is partly sustained by high demand for its copper, gold, and coal exports. High international commodity prices also help other exporting countries, including energy-exporting countries like Azerbaijan, Kazakhstan, Turkmenistan, Uzbekistan and Yemen; grain-other agricultural product-exporting countries like India, Pakistan, Cambodia, Vietnam, Bangladesh and Kazakhstan; and other mineral-exporting countries like the People's Democratic Republic of Laos.

An increasingly important concern about rising international prices, particularly staple food prices, is that it threatens the food security situation of the poor and most vulnerable segments of the population. Economists fear that increases in international food prices will translate to higher domestic prices, diminishing the already low purchasing power of the poor and intensifying the depth of food insecurity. So far, recent studies show low price transmission in many Asian countries with sometimes no significant domestic price increases compared with world levels (Dawe, 2008; Keats et al., 2010; Robles, 2011). FAO/GIEWS reported in early 2011 that, although domestic food prices in the Asian markets increased, they had not risen as much as global food prices.

Low price transmission is due partly to price stabilization policies and/or food safety net programs employed by Governments in the region to protect their consumers and support the poor and vulnerable. For example, Bangladesh controls rice prices by State sales at subsidized prices facilitated in 2011 by the doubling of rice import targets to augment stocks. Indonesia suspended rice import duties in early 2011 to reduce domestic rice prices. In Central Asia, a region that heavily depends on food imports, Kyrgyzstan and Tajikistan are releasing wheat and wheat flour from public stocks to stabilize flour and bread prices. Early in 2011, Armenia introduced a new policy that will set price ceilings for essential food products, including wheat flour and bread, in the event of a 30-percent price increase within a month. These price stabilization policies together with food safety net initiatives can put additional pressure on Government budgets as food import bills mount, calling into question their long-term viability. Additionally, these types of policies generally tend to provide a significant bias in favor of consumers while creating disincentives to domestic agricultural production.

Not all agricultural food policies are focused on consumers. Governments in the region use long-term policy measures to increase investment in the agricultural sector to encourage sustainable increases in productivity, promote food self-sufficiency, and provide broad-based economic opportunities for

[3]The average is calculated across countries over the last decade (2000-10), excluding Yemen, Mongolia, Armenia, Georgia, and Tajikistan, where imports account for 45-80 percent of grain supplies.

Table 8

Food availability and food gaps for Asia

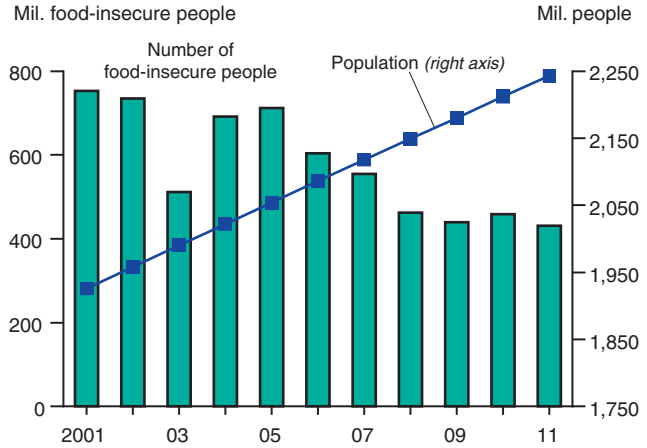
Year	Grain production	Root production *(grain equiv.)*	Commercial imports *(grains)*	Food aid receipts *(grain equiv.)*	Aggregate availability of all food
			1,000 tons		
2002	356,989	19,470	24,891	4,351	499,413
2003	383,723	20,110	24,894	2,623	518,943
2004	381,948	21,787	24,372	2,506	514,861
2005	400,188	22,894	25,634	2,742	523,811
2006	405,326	24,087	35,812	1,877	544,165
2007	434,313	24,379	33,789	2,084	560,170
2008	446,013	27,814	33,395	1,499	580,830
2009	443,465	27,992	32,358	1,402	592,061
2010(e)	455,436	24,538	30,635	1,661	599,030
Projections				Food gap*	
				NG / DG	
2011	463,300	24,888	31,426	***810*** / ***4,736***	610,233
2016	505,523	26,702	35,827	***668*** / ***3,410***	665,496
2021	550,420	28,615	38,753	***785*** / ***2,422***	723,239

*See table 1.

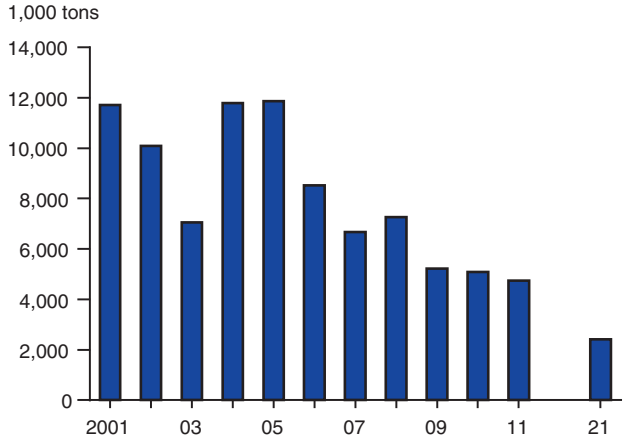
Asia
(2.2 billion people in 2011)

Food security will continue to improve in Asia over the next decade. Domestic production is the dominant source of food supplies in most countries. Chronic food insecurity exists in the region for the poor and the vulnerable who are constrained by inadequate purchasing power brought on by skewed income distribution. Income inequality leads to disparity not only in quantity, but also the quality of food use within and among countries. As a result, many Asian countries may increasingly deal with hunger and obesity-related problems at the same time.

Asia: Trend in number of food-insecure people vs. population



Asia: Distribution gaps



Asia: Nutritional indicators of selected countries, 2007

	Share of available food for consumption					Percent of recommended nutritional target met		
	Grains	Roots and tubers	Vegetable oil	Sugar and sweeteners	Sum	Energy	Protein	Fat
			Percent				*Percent*	
India	59	2	8	8	78	112	86	86
Indonesia	62	6	9	6	83	121	85	95
Pakistan	47	1	11	11	70	109	88	122
Philippines	57	3	4	9	72	122	90	89
Vietnam	65	1	3	4	73	134	110	109
ASIA	58	3	6	7	75	117	98	97

Source: USDA, Economic Research Service, Food and Agriculture Organization Food Balance Sheet, World Food Programme.

the poor. In 2010, Cambodia started a 2-year program to improve its rice irrigation systems to increase production and exports, as well as to provide additional employment opportunities. In the same year, the Philippines reiterated its food self-sufficiency objective by announcing a goal to increase domestic rice production and eliminate its imports by 2013. Pakistan provides credit and input subsidies to support farmers' use of fertilizer. Meanwhile, Afghanistan increased import duties on wheat and wheat flour to support domestic production.

Continued investment in agricultural research and development is important in Asia because the region must rely on gains in yields and intense cropping to increase production. Although Asia's population growth rate (1.5 percent) was lower than its production growth (about 2 percent) during the last decade, the long-term challenge of feeding the region's sizable population remains. The scale and density of the region's population will continue to put pressure on its resource base, particularly on its limited arable land. Given the healthy financial and economic outlook for most countries in the region, however, any additional growth in food import bills to make up for production shortfalls should not put undue pressure on Government budgets.

Significant progress in improving food security throughout the Asian region masks some of the vulnerabilities in individual countries and the variation in performance among countries. North Korea is Asia's most food-insecure country, followed by Afghanistan.

North Korea is expected to undergo food shortages in the next 10 years and is facing a dire situation in the short term as a convergence of recent events threatened its food security further. Even when experiencing normal weather conditions, North Korea currently produces less than half of the grain output seen in the early 1990s as a result of a lack of inputs, such as fertilizer and fuel, poor Government policies, and a stagnant macro economy. However, the country experienced temperatures far below normal during the winter of 2010/11, which may reduce the harvest by 25 percent compared with an average year (WFP, 2011). In addition, a recent foot-and-mouth disease (FMD) outbreak further threatens North Korea's food security as infected draft animals are unable to support land preparation, threatening agricultural production. If FMD spreads, livestock mortality rates may reduce meat and dairy production. The resulting production shortfalls will mean even higher import requirements at a time when increases in international food and fuel prices will reduce the import capacity of the country. To make matters worse, the country's Public Distribution System (PDS), which provides food rations to 70 percent of the population, is expected to run out of stocks by mid-2011. In the past, the PDS has been unable to satisfy its dependents' nutritional requirements, and its unavailability during lean times will only worsen the emergency food shortage North Korea faces and further exacerbate its chronic food insecurity problem.

Afghanistan's 2011 favorable crop production prospects and bumper crop harvests in the past 2 years have helped improve the food security outlook for the country. Insufficient food availability and lack of economic access to food, however, are projected to remain a problem partly because, on average, food production, which is highly variable due to weather, will not be able to keep pace with the country's annual population growth rate of over 3 percent,

the highest among the 23 Asian study countries. Continued conflicts and political instability will also compound food insecurity risks as they disrupt agricultural production and economic activities.

In 2007, Asia exceeded the recommended per capita daily energy requirement by 19 percent. All 23 Asian countries, except North Korea, Afghanistan, and Yemen, met caloric targets and, by 2008, Yemen had also met its caloric target. This shows that food availability in the region is not the major problem as there will be enough food for everyone if distributed equally throughout the population. Food insecurity exists in Asia mainly because of the lack of economic access to food by vulnerable segments of the population, who are constrained by inadequate purchasing power brought on by skewed income distribution. With the disparity in income within and among countries, the quantity and quality of food use also varies. As low purchasing power may lead to food insecurity among the poor, higher income segments of the population may face contradictory problems. As a result, countries may deal with hunger on one side (low-income groups) and obesity on the other side (high-income groups).

In fact, the Central Asia (CA) subregion exceeded recommended energy, protein, and fat dietary requirements by 29, 17, and 22 percent, respectively, in 2007. All of the CA countries met all three nutritional targets with only two exceptions: Azerbaijan met only 91 percent of the dietary target for fat, and Tajikistan met only 80 percent of the target for protein. All CA countries met almost all the recommended requirements and did so at a higher rate than rest of Asia (South and East/Southeast) because its average per capita gross national income is 47 percent higher than the rest of the Asia.

Indeed, as countries develop and their income increases, consumption patterns change. If we exclude CA from the rest of the Asian study countries, consumption patterns, on average, have changed between 1985 and 2007, showing that the share of grains in the diet declined by about 8 percent and the combined share of fat and sugar in the diet increased by 20 percent. Over the same period, average per capita food consumption in terms of kilocalories also increased by 13 percent. This means that fat and sugar consumption played a greater role in total per capita food consumption increases than grain consumption. In 2007, per capita energy consumption in these countries, on average, exceeded the recommended requirement by 12 percent, while protein and fat targets were not fully met at 89 and 87 percent, respectively. Furthermore, sugar consumption was higher than the recommended level by all Asian countries, except for North Korea.

Asian countries consume less from different food groups compared with Industrialized Western countries. Since the region has the highest per capita income growth and the largest number of people, increases in unhealthy food consumption could pose current and future health consequences. A study of the trends in underweight and overweight women in both rural and urban Bangladesh indicates the seriousness of the problem and the high cost of diet-related chronic diseases, such as type 2 diabetes, hypertension, cardiovascular diseases, and some types of cancer (Shafique et al., 2006). Moreover, the negative implications of high fat and sugar consumption may escalate in CA, especially for countries exceeding recommended fat intake guidelines (Kazakhstan, Uzbekistan and Turkmenistan) and for countries

exceeding recommended sugar intake at over 50 percent (Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Kazakhstan, and Moldova).

While poverty and hunger in Asia remain the biggest challenges, the emerging obesity problem poses another important challenge, requiring strategies aimed at mitigating rising diet-related diseases and problems associated with overnutrition and obesity.

Latin America and the Caribbean (LAC)

Compared with other regions, the Latin America and the Caribbean (LAC) region has ample resources to reduce poverty and produce enough food for its population for at least the next few decades (table 9). However, the region has chronic food insecurity that stems from highly skewed income distribution—the highest in the world. For the 11 countries from this region included in this study, the average income of the highest 10 percent of the population is about 30 times that of the poorest 10 percent. LAC's volatile weather situation disproportionally affects the livelihood of the poor in rural areas. In 2010, for example, a La Niña weather pattern brought heavy rains to Central America and Colombia, destroying crops and damaging agricultural infrastructure. With heavy La Niña rains expected to continue into 2011, food insecurity may intensify. In 1997-98, El Niño brought drought to Haiti and the Dominican Republic and heavy flooding to Ecuador and Peru. Hurricanes Georges and Mitch destroyed lives, crops, and infrastructure in many countries in fall 1998, resulting in a drop in food supplies and severely damaged internal distribution systems. Natural disasters and rising food prices have become major policy challenges for all countries in the region.

According to ERS estimates, 37 percent of the population in the selected LAC countries consumed below the caloric nutritional target in 2011, but estimates vary significantly among countries. For example, in Colombia, 20 percent of the population consumes below the target, whereas in Haiti, below-target consumption is at about 90 percent. The number of people consuming less than the requirement will increase by an estimated 4 percent to 58 million between 2010 and 2011. The food distribution gap will increase by 17 percent to 1.4 million tons. LAC's apparent deteriorating food security situation is a result of stagnant production of major staple foods during the last several years, mainly in Central American countries. Frequent natural disasters increase the risk of food insecurity and make domestic agriculture an unreliable source of food supplies, amplifying the importance of food imports at a time when food import prices are increasing.

Higher food import prices have a greater impact on these countries' trade balances than on internal market prices. Research shows that price transmission for basic staple commodities, such as corn, is low (Robles, 2011). For consumers who were poor at the outset, however, even a small increase in food prices could reduce food security. In Honduras, Bolivia, Guatemala, and Jamaica, food accounts for 50-83 percent of expenditures of the lowest income decile (Dupriez, 2007).

Since the 2008 food price spike, these countries have adopted an array of food security policies (table 10). Most of these policies are targeted at reducing financial pressures on consumers. Attention is also aimed at

Table 9

Food availability and food gaps for Latin America and the Caribbean

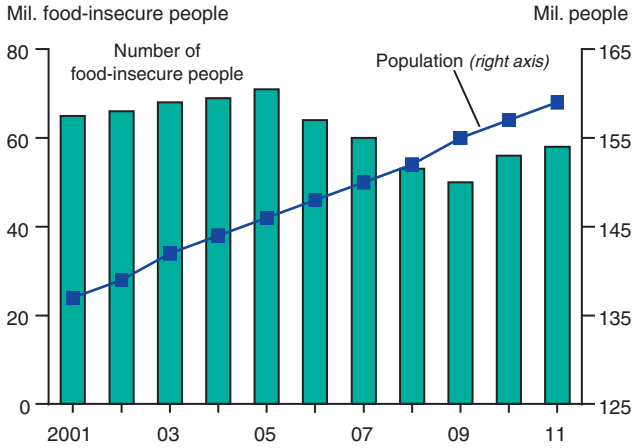
Year	Grain production	Root production *(grain equiv.)*	Commercial imports *(grains)*	Food aid receipts *(grain equiv.)*	Aggregate availability of all food
			1,000 tons		
2002	13,315	3,514	12,171	1,132	38,507
2003	14,043	3,545	12,404	438	38,652
2004	13,841	3,496	12,857	527	39,420
2005	14,326	3,527	14,338	625	40,156
2006	14,416	3,749	15,996	637	41,333
2007	15,460	3,939	16,485	351	42,023
2008	15,466	3,896	14,733	348	43,959
2009	16,250	4,069	15,498	257	44,646
2010(e)	15,860	3,848	15,660	319	44,797
Projections				Food gap*	
				NG / DG	
2011	16,957	3,893	14,933	*250* / *1,328*	44,867
2016	18,191	4,127	16,845	*227* / *1,007*	49,904
2021	19,413	4,373	18,049	*236* / *865*	54,337

*See table 1.

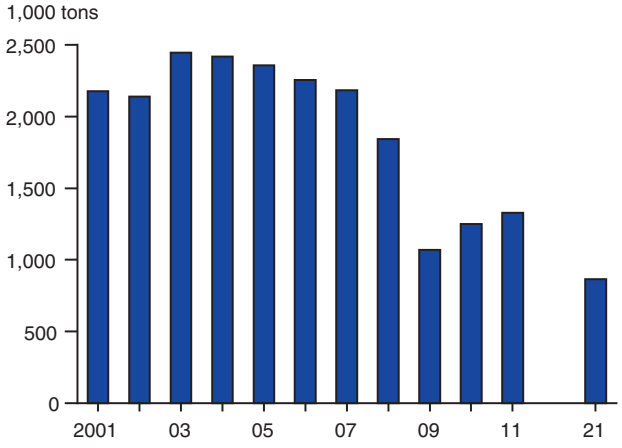
Latin America and the Caribbean (LAC) (159 million people in 2011)

The number of food-insecure people in the region is projected to decline by about 33 percent by 2021. The share of the population that is food insecure is projected to decline from 38 percent in 2011 to about 20 percent in 2021. However, performance among countries will vary significantly. Less than 10 percent each of Jamaica and Peru's populations are projected to be food insecure in 2011. In contrast, 90 percent of Haiti's population is projected to be food insecure.

LAC: Trend in number of food-insecure people vs. population



LAC: Distribution gaps



Latin America and the Caribbean: Nutritional indicators of selected countries, 2007

	Share of available food for consumption					Percent of recommended nutritional target met		
	Grains	Roots and tubers	Vegetable oil	Sugar and sweeteners	Sum	Energy	Protein	Fat
			Percent				*Percent*	
Haiti	46	9	7	11	73	89	64	61
Honduras	43	1	9	17	69	125	102	122
Jamaica	32	5	12	16	64	136	120	158
Nicaragua	49	1	9	15	75	114	94	107
Peru	44	14	5	8	72	117	103	75
LAC	41	5	9	14	69	114	93	112

Source: USDA, Economic Research Service, Food and Agriculture Organization Food Balance Sheet, World Food Programme.

producers in terms of price supports and input subsidies. Policies geared toward boosting production require longer term support, not only with respect to direct farm support but also investment in the marketing and distribution system. Financial prospects for the region are strong, albeit with some variation depending on the country. For 2011, projected export earnings growth is highest for Peru, about 8 percent, supported by strong demand growth for minerals. Export growth for the remaining countries ranges between 3 and 5 percent. Except for Bolivia, all countries show a current account deficit. El Salvador, Honduras, Guatemala, and Nicaragua face additional financial uncertainly since they depend on food and fuel imports, prices of which have risen significantly in the last year. In addition, their foreign exchange earnings depend on economic recovery in the United States, a major trading partner.

Haiti, as one of the poorest countries in the world, remains vulnerable to food insecurity. Food insecurity issues have been compounded further by both natural disasters and political instability. Over the years, donors have embarked on several food and cash programs to improve food security, but given the unstable climate, the country continues to depend on short-term support.

The number of food-insecure people in the LAC region is projected to decline by about 33 percent by 2021. A decline is also projected for the food distribution gap, 35 percent by 2021. As a result, the intensity of food insecurity—the difference between food availability and nutritional requirement—will be much less than it is now. The share of the population that is food insecure is projected to decline from 38 percent in 2011 to about 20 percent in 2021. However, performance among countries will vary significantly. Less than 10 percent each of Jamaica and Peru's populations are projected to be food insecure in 2011. In contrast, 90 percent of Haiti's population is projected to be food insecure. In the remaining LAC countries, the share of the food-insecure population is projected to range from 20 to 30 percent. Note that there is high uncertainly about the economic progress in Haiti, and that is the driving force behind the high level of projected food insecurity. The recent peaceful elec-

Table 10
Policy measures, by country

Policy	Country
Food ration or food stamp program	Bolivia, Ecuador, El Salvador, Honduras, Peru
Conditional cash transfer program	Bolivia, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Peru
Consumer price subsidy	Bolivia, Ecuador, Jamaica, Nicaragua
Fertilizer subsidy	Bolivia, Guatemala, Haiti
Export ban on food staples	Bolivia, Ecuador
Easing restriction/tariff on imports	Bolivia, Ecuador, El Salvador, Honduras, Nicaragua
Food price control in selected markets	Bolivia, Honduras

Source: World Bank, *Price inflation and its effects on Latin America and the Caribbean*, 2009.

tion creates optimism, but it is too early to predict any significant positive change.

Overall, LAC countries have considerable potential to improve their food security. Almost all countries where food insecurity is high, such as Nicaragua, have ample resources, particularly land that could be brought into agricultural production. The historical growth in food production is significantly lower than the growth in agricultural exports, creating significant room for improvement in the performance of the food sector. Inequality in incomes—the major contributor to food insecurity in the region—could be reduced with improvement in food production performance. Unlike agricultural export commodities, staple foods are produced by the smallholders that are the poorest in the region. Any performance gains could increase their income and lessen income inequality.

Another argument can be made for increased investment aimed at raising productivity of smallholders. Many people from these countries leave seeking greater economic opportunities abroad. As a result, remittances have grown rapidly in the last couple of decades, particularly supporting economies of rural communities. With stronger immigration policies on the radar in many developed countries, however, the recent upward trend in remittances may not continue in the long term. Therefore, employment opportunities at home must expand. The success of investments in smallholder productivity, however, depends on other complementary investments. In most countries, export promotion, including agricultural exports, is viewed only as a source of foreign exchange earnings, not as a growth strategy. Therefore, complementary sectors, such as transportation and banking, have not been developed. For example, in Nicaragua the costs of moving domestic corn internally are higher than the combined costs of transporting the corn from the United States (to the port and then by ocean) and other logistical items—30 percent versus 18 percent (World Bank, 2011). A 2011 conference[4] in Brazil is focused on increasing investment in agriculture and, given the region's expertise in the area, the outlook is promising.

[4]The Agriculture Investment Summit, LatAm 2011, http://www.terrapinn.com/2011/agriculture-investment-summit-latam/.

The LAC region has adequate resources to meet its food needs. Recent attention toward increasing investment in food production could result in higher earnings in rural areas, where most of the poor reside. Focusing on rural areas could work to narrow income inequality, which, in turn, could improve access to food. In this analysis, we have projected that the region's per capita grain production would increase by 13 percent during the next decade. Food imports are projected to increase by 23 percent, significantly lower than the growth projected for export earnings at 30-40 percent, which are the key determinants of their import capacity.

Along with increasing food availability, the diet composition of LAC study countries is also expected to change. Per capita calorie consumption in the region increased 9 percent between 1985 and 2007, from 2,184 calories per day to nearly 2,400 calories. Calorie consumption varies by country: Colombia and Jamaica are ranked at the top, while Guatemala and Haiti are at the low end. Latin American countries, similar to other developing countries, are experiencing what is called a nutritional transition (or increased consumption of animal products and processed foods with a large share of sugar and fat). In terms of changes in the consumption of different food

groups, the region's per capita consumption of fat increased the most at 30 percent. Fat consumption exceeded the level recommended by the American Heart Association by 12 percent in 2007. Sugar consumption was more than three times the recommended level. Per capita consumption of both sugar and fat was among the highest in Jamaica, with fat consumption being about 60 percent of recommended levels and sugar nearly 5 times that of the recommended level.

The region is particularly influenced by the American diet because of their large number of people who travel back and forth. Research shows that this diet, despite the potential positive impact of introducing new food varieties, has contributed to increased obesity. If they continue, these dietary trends could have long-term health costs (Tucker, 2010).

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Special Article

The Composition of Calories Consumed: The Cases of Beijing and Delhi

Sharad Tandon, Fred Gale, Lisa Mancino, and Junfei Bai

Introduction

China and India are often paired as large, rapidly-growing developing countries. Together they account for 36 percent of the world's people. Both countries have historically dealt with chronic poverty and food insecurity, but both have also experienced marked economic growth over the last 20 years. The availability of food has increased much faster in China, however. Based on estimates from the Food and Agriculture Organization (FAO), the estimated size of the food-insecure population in India is significantly higher than in China.[1]

This report supplements aggregate estimates of food availability with estimates of calorie consumption, diet composition, and food expenditures using household consumption data. Analyzing food expenditures and nutritional outcomes at the household level enriches estimates of national food availability. Given data limitations, however, we must restrict the analysis to the capital cities of each country—Beijing and Delhi. The comparative analysis draws on a unique Chinese dataset presenting detailed consumption data for Beijing residents and a household survey conducted periodically by the Government of India. Although respondents from each of these cities might not be represent the rest of the country, their large populations make these estimates interesting in their own right.[2]

The average Beijing resident consumes more total calories than the average Delhi resident. Additionally, the composition of the calories consumed is different. Households in Delhi rely on a higher share of grains in their diet relative to the Beijing diet, which includes more calories from fruits, pulses, and meats. A number of studies have found that dietary diversity is associated with better general health outcomes (e.g., Drescher et al., 2007).

Delhi consumers spend approximately 13 rupees (or $0.29) per day, on average, on food consumption. To match the total number of calories consumed by Beijing consumers, based on the Delhi diet, expenditures would need to increase approximately 57 percent. To match both the calories consumed and the dietary composition of Beijing, where respondents consumed a higher share of more expensive calories, expenditures would need to increase approximately 141 percent.

Data

Both the Beijing and Delhi surveys report the quantity of a number of different food items consumed. To convert purchased quantities of food to calories, we utilized FAO's calorie information for the South Asian region and the East Asian region.[3] The food groups were then aggregated to calories

[1]Estimates of food availability were accessed at http://www.fao.org/economic/ess/ess-fs/ess-fs-country/en/on April 2011.

[2]Based on population estimates presented in the Central Intelligence Agency's factbook at https://www.cia.gov/library/publications/the-world-factbook/rankorder/2119rank.html?countryName=Angola&countryCode=ao&regionCode=af&rank=70#ao, Beijing's population is greater than the 53rd largest country in the world; Delhi's population is greater than the 71st largest country.

[3]These values are available online at http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368 and were accessed on January 2011.

contained in one of seven food groups: dairy, fruits, grains, meat, pulses, eggs, and vegetables.

The Chinese data came from a household survey on food consumption conducted in Beijing in 2007 by the Chinese Center for Agricultural Policy (CCAP). The survey's main objective was to ascertain amount and types of food consumed away from home in restaurants, cafeterias, food stalls, and banquets. These venues account for a growing share of food consumption in China, but except for the Beijing survey, annual household surveys on Chinese food consumption only contain commodity-level information for foods purchased for use at home. The Beijing sample represented residents of urban Beijing, and excluded residents of rural villages and migrants whose legally registered domicile was not in urban districts of Beijing.[4]

The strength of the Beijing survey lies in its careful coverage of food consumption both at home and away from home. Respondents were asked to keep a diary of all food consumed over a 7-day period, recording food consumed at home as well as all meals eaten outside the home by all family members. Researchers at the CCAP painstakingly consulted common recipes to estimate the amount of various food ingredients used in dozens of common dishes reported by the respondents.

Other consumption surveys, such as those conducted by China's National Bureau of Statistics (NBS), record total expenditures on food away from home but they do not record what foods are consumed away from home. Both the Beijing survey analyzed here and expenditure data from other sources indicate that away-from-home expenditures are an important component of food consumption among both rural and urban households (Gale et al., 2003; Gale and Huang, 2007).

The Indian consumption data were collected by India's National Sample Survey Organization (NSSO). The NSSO conducts annual surveys on a range of topics, and produces a more detailed survey of both expenditures and employment every 5 years. For the expenditure survey, approximately 125,000 households are surveyed in each round, and the data collected include quantity and value of purchases for approximately 152 separate food items, along with the sources of each food item (e.g., homemade, purchased, etc.). The survey also reports the number of meals consumed outside the household and the number of meals provided to nonhousehold members. In addition to reporting household consumption, the survey reports a range of household and individual characteristics, including the number of household members, where the household is located, and the education and age of household members. The 61st round of the NSSO consumer expenditure survey used in this article reports detailed expenditure data for 122,888 households collected during 2004-05.[5] Of these households, 1,111 resided in Delhi.

The NSSO consumer expenditure survey is not a random sample of Indian households. Rather, the sample is geographically dispersed and stratified into rural and urban portions, and further stratified based on measures of income. Portions of rural villages and urban towns are randomly sampled and, within these regions, households of particular income groups and sectors (e.g., rural or urban) are randomly sampled. Thus, the sample represents the entire

[4]This is a large and growing share of the total population (11 percent) that is likely poorer than average. Thus, it might be appropriate to compare the poorer Beijing respondents with slightly better off households in the Delhi survey, which includes all Delhi residents. Given this concern, we included a comparison of the poorest quintile of Beijing respondents to the richest quintile of Delhi residents when comparing calorie consumption, etc.

[5]Surveys for 124,624 households were reported, but only 124,536 were able to be matched to probability weights, which are needed to estimate purchases for the entire Indian population from the sample. Furthermore, 48 households were excluded when household size could not be calculated, and 1,600 households with visible recording mistakes were also excluded from the analysis.

country only when the data for survey households are properly weighted based on their prevalence in the entire country.[6]

While the surveys allow for a valid comparison of calorie consumption between the two countries, differences should be noted:

- The Beijing survey provides a calorie figure for food eaten outside the household, while the Indian dataset only gives the number of meals eaten outside the household and meals given to nonhousehold members. The Indian consumption figures are adjusted based on estimates of the number of calories consumed in these meals following Deaton and Subramanian (1996).
- The Indian data do not contain caloric and other nutritional information for a number of residual categories of food items (e.g., other dairy items) and some types of processed foods (e.g., salted refreshment), while the Chinese survey provides calorie information for these items.[7] The Indian consumption figures adjust for expenditure on these items and estimates the number of calories consumed from these food items using approach following Deaton and Subramanian (1996).
- The Beijing data do not include information on the amount of oils consumed, while the Indian dataset provide calorie figures for these food items. Estimates of the average oil consumption in China have been added to the consumption figures for each household in the Beijing sample.

Consumption in Beijing and Delhi

Figure A-1 presents the average number of calories consumed and the sources of those calories for both Beijing and Delhi.[8] Consistent with the FAO assessment of overall food availability in each country, households in Delhi consume fewer calories than households in Beijing.[9] Furthermore, despite consuming significantly more calories, the surveys also suggest that food costs as a share of household expenditure are lower in Beijing than in Delhi. On average, about 32 percent of total expenditure is devoted to food in Beijing households, compared with 49 percent in Delhi.

Figure A-1 also presents total consumption for the poorest and richest quintiles of both the Beijing and Delhi surveys. Consumption in Beijing does not vary much with income. Both the richest and poorest quintiles of respondents consume similar numbers of total calories.[10] However, consumption in Delhi households varies significantly based on income. The richest Delhi households consume approximately the same number of calories consumed by Beijing survey respondents. The poorest Delhi residents, however, consume significantly fewer calories.

In addition to total calorie consumption, the composition of calories consumed is also important to both the assessment of food security and overall health outcomes. Figure A-1 disaggregates consumption by food group and demonstrates that households in Delhi consume a much higher share of their total calories from grains than households in Beijing. Additionally, in each city, consumption of grains does not substantially

[6]Probability weights were calculated using the multipliers provided by the NSSO, which are the number of households in the entire population represented by the household in the sample. We first multiplied the multiplier by the size of the household, which gave us the number of people represented by the household members, and then divided by the total population to get the weights used in the calculations. Results were qualitatively identical if households are treated as the level of observation, with weights equal to the multiplier divided by the total number of Indian households estimated in the 2001 Census.

[7]The exact food items for which only expenditure is calculated are other rice products, other wheat products, other cereals, other pulse products, other milk products , other edible oils, others (birds, crab, oyster, tortoise, etc.), other vegetables, other fresh fruits, other dry fruits, cold beverages, fruit juice and shake, other beverages, biscuits, salted refreshment, prepared sweets, cake/ pastry, sauce, and, other processed food.

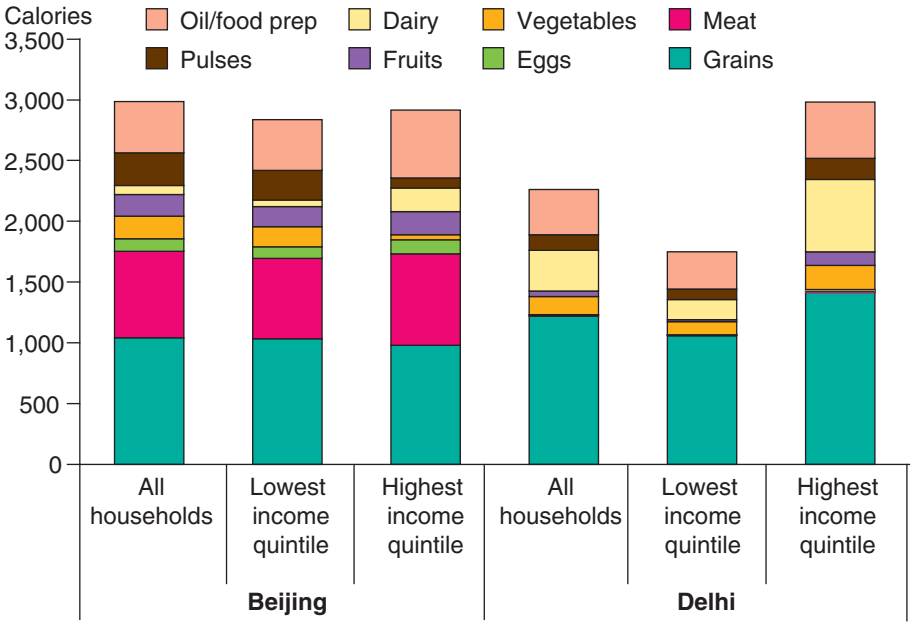
[8]Estimates for all of India are similar to estimates of Delhi.

[9]Estimates of food availability were accessed at http://www.fao.org/economic/ess/ess-fs/ess-fs-country/en/, April 2011.

[10]This could be the result of smaller variability of income in China relative to India. Summary statistics of the income distribution were accessed at http://data.worldbank.org/data-catalog/country-profiles in April 2011.

Figure A-1

Household calories consumed in Beijing and Delhi



Notes: Figure presents calorie consumption (by source) for households in Beijing and Delhi. All data for Delhi were obtained from the 61st round of the National Sample Survey Organisation consumer expenditure survey and all data for Beijing were obtained from the Chinese Center for Agricultural Policy survey. Figures for all respondents are included for each survey, as well as figures for the richest and poorest quintile of respondents in the survey.

Source: USDA, Economic Research Service.

change as income increases. The consumption of calories from all other sources, however, does increase with income.

Higher consumption of grains in Delhi may be due to the relative costs of food items. Using the expenditure on calories for each food group, we can calculate the number of calories a person could consume from each food group if they gave up 100 calories of consumption of grains (fig. A-2). Two patterns emerge from this analysis:

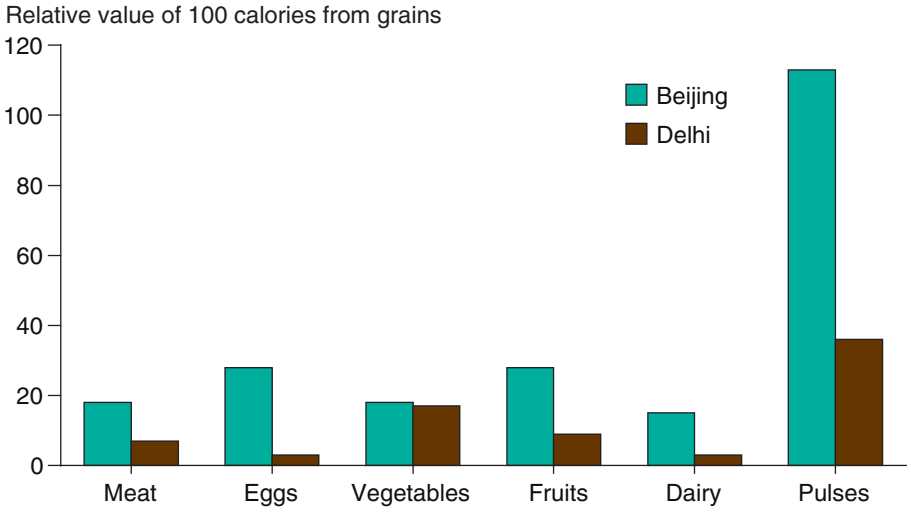
- Since most calorie figures for both Beijing and all from Delhi are lower than 100 calories, calories from grains are significantly cheaper than calories from most other food groups in both cities.
- Beijing residents can consume more calories from every other food group than households from Delhi for each calorie of grains foregone, suggesting that grains are relatively cheaper in Delhi than in Beijing.

The differences in the relative price of grains between the two cities is difficult to explain fully, but the distribution of subsidized wheat and rice to poor consumers in Delhi is likely partially responsible. On the other hand, Gale and Henneberry (2009) demonstrated that when China eliminated grain subsidies in the early 1990s, the relative price of animal protein to grains was reduced.

In addition to presenting detailed consumption data, the surveys also demonstrate a large difference in the amount of food consumed away from home

Figure A-2

Calories consumed per 100 calories of grains foregone



Notes: This graph presents the number of calories found in each food group if individuals consumed 100 fewer calories of grains. All data for Delhi were obtained from the 61st round of the National Sample Survey Organisation consumer expenditure survey and all data for Beijing were obtained from the Chinese Center for Agricultural Policy survey. Figures for all respondents are included for each survey, as well as figures for the richest and poorest quintile of respondents in the survey.

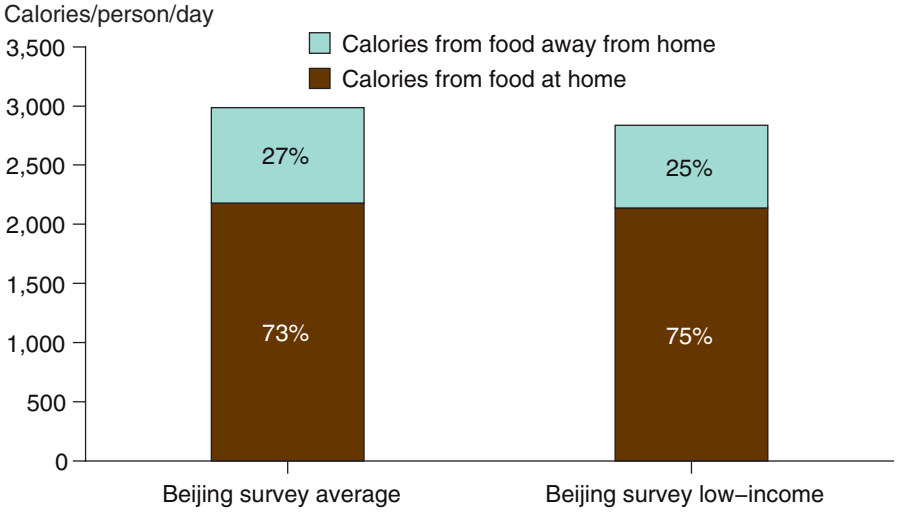
Source: USDA, Economic Research Service.

between residents of the two cities. This difference likely influences the types of foods that are eaten, and can potentially account for some of the observed differences in total calorie consumption and the composition of the household diet. Figure A-3 demonstrates that both the entire Beijing sample and the poorest quintile of residents consume approximately a quarter of their total calories away from home. Although the Indian survey only collects the number of meals eaten outside the household and does not collect any actual household consumption, the number of meals consumed per household member is likely too small to account for such a large share of consumption. The average individual consumed only .04 meals outside the household per day, and this figure only increased to .07 meals per day when restricting the sample to the richest quintile of respondents. Thus it appears that meals eaten outside the household account for a much larger portion of consumption in Beijing than in Delhi.

Given both the higher number of calories consumed in Beijing and the increased diet diversity, households in Delhi would have to substantially increase food expenditures substantially to match the Beijing diet. Based on the average calories received per rupee spent in Delhi over all food groups, Delhi residents would need to increase in food expenditures by 57 percent to reach the same number of daily calories as Beijing respondents. Based on the prices Delhi consumers pay for calories from particular food groups, however, the average Delhi household would need to increase food expenditures by 141 percent to match both the number of calories and the composition of the Beijing diet.

Figure A-3

Calories consumed away from home



Notes: Figure presents calorie consumption (by source) for households in Beijing. All data was obtained from the Chinese Center for Agricultural Policy survey. Figures for all respondents are included for each survey, as well as figures for the poorest quintile of respondents in the survey.

Source: USDA, Economic Research Service.

The data suggest that Beijing residents consume more total calories and a more diverse diet that is less reliant on grains than the diet of Delhi residents while spending a smaller share of total expenditures on food. These estimates are consistent with the higher income growth in Chinese relative to Indian cities. Although the data are estimated only for the two capital cities, these patterns are consistent with FAO estimates of food availability, as well as with World Health Organization estimates of malnutrition in the two countries.[11]

How Representative Are the Capital Cities of the Rest of the Country?

Note that Beijing and Delhi are special cases that cannot be easily generalized to the rest of the population. Beijing does not represent China as a whole since incomes in Beijing are relatively high and the city is the focus of a lot of investment and commercial activity. According to China's 2010 census, half of the country's population resides in rural areas. Rural diets include a much higher proportion of grains and fewer meals away from home than the Beijing diet. China's poor and food-insecure population is concentrated in rural areas where agricultural productivity is low. Gale et al. (2003) surmised that rural Chinese households relied on self-produced grain to conserve limited cash income for nonfood purchases, but they found rural diets were diversifying as cash income increased.

Furthermore, the Beijing survey excludes the growing stream of rural-urban migrants who work in cities but do not reside there permanently. The National Bureau of Statistics estimates these migrants comprise approximately 11 percent of China's total population. Surveys of migrants indicate

[11]Estimates of malnutrition are available at a World Health Organization database accessed at http://www.who.int/nutgrowthdb/database/ countries/en/, January 2011.

that their income and food expenditures are much lower than permanent residents of cities, and food consumption varies widely.

The consumption estimate of nearly 3,000 calories per day from the Beijing survey is significantly higher than previous estimates for the entire country (China's National Bureau of Statistics 2009; Ge et al., 2002). Most previous survey-based estimates of Chinese calorie consumption excluded food consumed away from home, and the Beijing survey suggests that this omission could understate calorie consumption by at least 25 percent. The Beijing calorie estimate, however, is nearly equal to the FAO estimate of per capita food availability for China at 2,970 calories per day.

The survey does allow for a direct comparison with the rest of the Indian population. The average daily consumption for rural and urban Indian population is approximately 2,361 and 2,199 calories per person per day, respectively. Thus, although the consumption of Delhi residents is slightly different than other areas in India, results suggest that, on average, estimates of consumption and food security are not substantially different in Delhi compared with urban areas in the rest of the country. This result is somewhat surprising given the large differences in household characteristics between Delhi residents and the rest of India.

Conclusions

A comparison of these surveys highlights a number of consumption patterns in both Beijing and Delhi regarding the number of calories consumed and the composition of those diets. These findings are corroborated by both FAO estimates of food availability and by much higher rates of malnutrition in India relative to China. These patterns further suggest that that both income and relative prices of food items have important implications for the number of calories consumed and the composition of the household diet.

Exactly why relative prices of food items might be different in the two cities is difficult to explain, however. The difference could be the result of varying cultures, tastes, and Government policies. On the other hand, the difference likely reflects income differences between residents of the two cities. As described previously, Beijing residents consume more expensive types of calories, such as fruits and meat. But even within these categories, Beijing residents are likely to consume higher quality products on average given their higher income. Thus, as incomes increase in Delhi, whether relative prices or the composition of diets in Delhi will follow the changes that have occurred in Beijing over the past few decades is difficult to predict.

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Appendix—Food Security Model: Definition and Methodology

The Food Security Assessment model used in this report was developed by USDA's Economic Research Service to project food consumption, food access, and food gaps (previously called food needs) in low-income countries through 2021. Food is divided into three groups: grains, root crops, and a category called "other," which includes all other commodities consumed, thus covering 100 percent of food consumption. All of these commodities are expressed in grain equivalent.

The food security of a country is evaluated based on the gap between projected domestic food consumption (domestic production plus imports minus nonfood uses and exports) and a consumption requirement. Like last year, we include total food aid data (cereal and noncereal food commodities) provided by the UN's World Food Programme (WFP). All food aid commodities were converted into grain equivalent based on calorie content to allow aggregation. For example, grain has roughly 3.5 calories per gram and tubers have about 1 calorie per gram. One ton of tubers is therefore equivalent to 0.29 ton of grain (1 divided by 3.5), and 1 ton of vegetable oil (8 calories per gram) is equivalent to 2.29 tons of grain (8 divided by 3.5).

While projection results provide a baseline for the food security situation in the study countries, the results depend on the specification of the model and the underlying assumptions. Since the model is based on historical data, it implicitly assumes that the historical trend in key variables will continue in the future.

Two kinds of food gaps are estimated and projected:

1) The national *average nutrition gap* measures the gap between per capita availability and the recommended caloric intake standards of about 2,100 calories per capita per day—depending on the region—recommended by the UN's Food and Agriculture Organization (FAO). The caloric requirements (based on total share of grains, root crops, and "other") used in this assessment are those necessary to sustain life with minimum food-gathering activities.

2) The *distribution gap* measures the gap between per capita availability in each income group and the recommended caloric standard. If food availability in a given income group is lower than minimum requirements, that difference is part of the distribution gap for this country.

Nutrition-based food gaps assist in comparisons of relative well-being. Large nutrition-based needs mean additional food must be provided if improving nutrition levels are the main objective. The national average nutritional gap approach, however, fails to address inequalities of food distribution within a country; those are addressed by the distribution gap.

Structural Framework for Estimating and Projecting Food Consumption in the Aggregate and by Income Group

Projection of food availability. The simulation framework used to project aggregate food availability is based on partial equilibrium recursive models of 77 lower income countries. The country models are synthetic, meaning that the parameters that are used are either cross-country estimates or are estimated by other studies. Each country model includes three commodity groups: grains, root crops, and "other." The production side of the grain and root crops are divided into yield and area response. Crop area is a function of 1-year lag returns (real price times yield) to crop production, lagged returns to substitute crops, and lagged crop area. Yield responds to input use. Commercial imports are assumed to be a function of domestic price, world commodity price, and foreign exchange availability. Food aid received by countries is assumed constant at the base level during the projection period. Foreign exchange availability is a key determinant of commercial food imports and is the sum of the value of export earnings and net flow of credit. Foreign exchange availability is assumed to be equal to foreign exchange use, meaning that foreign exchange reserves are assumed constant during the projection period. Countries are assumed to be price takers in the international market, meaning that world prices are exogenous in the model. However, producer prices are linked to the international market through food imports and their impact on domestic supply. The projection of consumption for the "other" commodities is simply based on a trend that follows the projected growth in food crops supply (grains plus root crops). Although this is a very simplistic approach, it represents an improvement from the previous approach, where the contribution of commodities, such as meat and dairy products, to the diet was overlooked. ERS plans to enhance this aspect of the model in the future.

Food consumption (*FC*) for grains and root crops (*c*) is defined as domestic supply (*DS*) minus nonfood use (*NF*), where *n* is a country index and t is a time index.

$$FC_{cnt} = DS_{cnt} - NF_{cnt} \quad (1)$$

Nonfood use is the sum of seed use (*SD*), feed use (*FD*), exports (*EX*), and other uses (*OU*).

$$NF_{cnt} = SD_{cnt} + FD_{cnt} + EX_{cnt} + OU_{cnt} \quad (2)$$

Domestic supply of a commodity group is the sum of domestic production (*PR*) plus commercial imports (*CI*), changes in stocks (*CSTK*), and food aid (*FA*).

$$DS_{cnt} = PR_{cnt} + CI_{cnt} + CSTK_{cnt} + FA_{cnt} \quad (3)$$

Production is generally determined by area and yield response functions:

$$PR_{cnt} = AR_{cnt} * YL_{cnt} \quad (4)$$

$$YL_{cnt} = f(LB_{cnt}, FR_{cnt}, K_{cnt}, T_{cnt}) \quad (5)$$

$$RPY_{cnt} = YL_{cnt} * DP_{cnt} \quad (6)$$

$$RNPY_{cnt} = NYL_{cnt} * NDP_{cnt} \quad (7)$$

$$AR_{cnt} = f(AR_{cnt-1}, RPY_{cnt-1}, RNPY_{cnt-1}, Z_{cnt}) \quad (8)$$

where *AR* is area, *YL* is yield, *LB* is rural labor, *FR* is fertilizer use, *K* is an indicator of capital use, *T* is the indicator of technology change, *DP* is real domestic price, *RPY* is yield times real price, *NDP* is real domestic substitute price, *NYL* is yield of substitute commodity, *RNPY* is yield of substitute commodity times substitute price, and *Z* represents exogenous policies.

The commercial import demand function is defined as:

$$CI_{cnt} = f(WPR_{ct}, NWPR_{ct}, FEX_{nt}, PR_{cnt}, M_{nt}) \quad (9)$$

where *WPR* is real world food price, *NWPR* is real world substitute price, *FEX* is real foreign exchange availability, and *M* is import restriction policies.

The real domestic price is defined as:

$$DP_{cnt} = f(DP_{cnt-1}, DS_{cnt}, NDS_{cnt}, GDP_{nt}, EXR_{nt}) \quad (10)$$

where *NDS* is supply of substitute commodity, *GDP* is real income, and *EXR* is real exchange rate.

Estimations/projections of food consumption by income group. Inadequate access to food is the most important cause of chronic food insecurity among developing countries and is related to income level. Estimates of food gaps at the aggregate or national level fail to take into account the distribution of food consumption among different income groups. Lack of consumption distribution data for the study countries is the key factor preventing estimation of food consumption by income group. An attempt was made to fill this information gap by using an indirect method of projecting calorie consumption by different income groups based on income distribution data.[1] Note that this approach ignores the consumption substitution of different food groups by income class. The procedure uses the income/consumption relationship to allocate the total projected amount of available food among different income groups in each country (income distributions are assumed constant during the projection period).

[1]The method is similar to that used by Shlomo Reutlinger and Marcelo Selowsky in "Malnutrition and Poverty," World Bank, 1978.

Assuming that consumption increases with income, but at a declining rate (semi log functional form) the income/consumption relationship was specified as shown below:

$$C = a + b \ln Y \quad (11)$$

$$C = C_o/P \quad (12)$$

$$P = P_1 + \ldots\ldots + P_i \quad (13)$$

$$Y = Y_o/P \quad (14)$$

where,

$i = 1$ *to* 10

C and Y are known average per capita food consumption (all commodities in grain equivalent) and per capita income (all quintiles), C_o is total food consumption, P is the total population, i is income deciles, a is the intercept, b is the consumption income propensity. A consumption-income elasticity, b/C, is calculated for individual countries. The parameter b was estimated based on cross-country (77 low-income countries) data for per capita calorie consumption and income. The parameter a is estimated for each country based on the known data for average per capita calorie consumption and per capita income.

Data

Historical supply and utilization data for 1990-2009 come from FAOSTAT Food Balance Sheets, FAO/GIEWS, and USDA as of March 2011. Food aid data are from the UN's World Food Programme (WFP) for 1988-2009, and financial data come from the International Monetary Fund and World Bank. The base year data used for projections are the average for 2007-09, except export earnings, which are 2006-08.

Endogenous projection variables:

Production, area, yield, commercial imports, domestic producer prices, and food consumption.

Exogenous projection variables:

Population—data are medium variant United Nations population projections as of 2009.

World price—data are USDA Long-Term Agricultural Projections.

Stocks—FAO data; assumed constant during the projection period.

Seed use—USDA data; projections are based on area projections using constant base seed/area ratio.

Food exports—FAOSTAT data, projections are either based on the population growth rate or extrapolation of historical trends.

Inputs—fertilizer and capital projections are, in general, extrapolations of historical growth data from FAO.

Agricultural labor—projections are based on United Nations population projections, accounting for urbanization growth.

Net foreign credit—is assumed constant during the projection period.

Value of exports—projections are based on World Bank (Global Economic Prospects and the Developing Countries, various issues), IMF (World Economic Outlook, various issues), or an extrapolation of historical growth when data are not available.

Export deflator or terms of trade—World Bank (Commodity Markets—Projection of Inflation Indices for Developed Countries).

Income—projections are based on World Bank report (Global Economic Prospects and the Developing Countries, various issues) or extrapolation of historical growth.

Income distribution—World Bank data; income distributions are assumed constant during the projection period.

Appendix table 1a

List of countries and their food gaps in 2011

	2011 food gaps			2011 food gaps	
	Nutrition[1]	Distribution[2]		Nutrition	Distribution
	---1,000 tons---			*---1,000 tons---*	
Cameroon	0	137	Algeria	0	0
CAR	45	88	Egypt	0	0
DRCongo	3,518	3,956	Morocco	0	0
Burundi	363	398	Tunisia	0	0
Eritrea	439	452	**North Africa**	0	0
Ethiopia	0	253			
Kenya	0	326			
Rwanda	0	117	Afghanistan	0	99
Somalia	582	608	Bangladesh	0	157
Sudan	0	202	India	0	2,781
Tanzania	0	230	Indonesia	0	185
Uganda	0	140	Korea, Dem. Rep.	810	943
Angola	0	227	Nepal	0	32
Lesotho	0	27	Pakistan	0	34
Madagascar	0	160	Philippines	0	95
Malawi	0	74	Sri Lanka	0	8
Mozambique	0	177	Vietnam	0	120
Swaziland	0	5	Cambodia	0	58
Zambia	18	233	Laos	0	18
Zimbabwe	0	73	Mongolia	0	5
Benin	0	36	Yemen	0	148
Burkina Faso	0	0	Armenia	0	0
Cape Verde	0	3	Azerbaijan	0	0
Chad	49	168	Georgia	0	32
Cote d'Ivoire	0	125	Kazakhstan	0	0
Gambia	0	16	Kyrgyzstan	0	0
Ghana	0	34	Tajikistan	0	23
Guinea	0	4	Turkmenistan	0	0
Guinea-Bissau	0	6	Uzbekistan	0	0
Liberia	18	59	Moldova	0	0
Mali	0	28	**Asia**	**810**	**4,736**
Mauritania	0	4			
Niger	0	121	Bolivia	0	151
Nigeria	0	290	Colombia	0	209
Senegal	0	44	Dominican Republic	0	55
Sierra Leone	0	27	Ecuador	0	98
Togo	0	45	El Salvador	0	38
Congo, Rep	0	16	Guatemala	0	113
Namibia	0	22	Haiti	250	393
Sub-Saharan Africa	**5,032**	**8,934**	Honduras	0	78
			Jamaica	0	14
			Nicaragua	0	33
			Peru	0	147
			Latin America and the Caribbean	**250**	**1,328**
			Grand total	**6,092**	**14,999**

[1]Nutrition gap: gap between available food and food needed to support a per capita nutritional standard.

[2]Distribution gap: amount of food needed to raise consumption in each income quintile to the nutritional standard.

Source: USDA, Economic Research Service.

Appendix table 1b

List of countries and their food gaps in 2021

	2021 food gaps	
	Nutrition[1]	Distribution[2]
	---1,000 tons---	
Cameroon	0	99
CAR	71	119
DRCongo	5,019	5,575
Burundi	191	243
Eritrea	453	471
Ethiopia	0	105
Kenya	0	151
Rwanda	0	159
Somalia	1,045	1,075
Sudan	0	131
Tanzania	0	140
Uganda	0	315
Angola	0	346
Lesotho	0	16
Madagascar	0	154
Malawi	0	74
Mozambique	0	168
Swaziland	0	17
Zambia	0	127
Zimbabwe	0	37
Benin	0	46
Burkina Faso	0	14
Cape Verde	0	1
Chad	30	195
Cote d'Ivoire	0	158
Gambia	0	12
Ghana	0	45
Guinea	0	44
Guinea-Bissau	0	4
Liberia	0	43
Mali	0	49
Mauritania	0	29
Niger	0	190
Nigeria	0	137
Senegal	0	61
Sierra Leone	0	28
Togo	0	38
Congo, Rep	0	42
Namibia	0	26
Sub-Saharan Africa	**6,809**	**10,681**

	2021 food gaps	
	Nutrition	Distribution
	---1,000 tons---	
Algeria	0	0
Egypt	0	0
Morocco	0	0
Tunisia	0	0
North Africa	0	0
Afghanistan	264	473
Bangladesh	0	34
India	0	825
Indonesia	0	0
Korea, Dem. Rep.	521	675
Nepal	0	57
Pakistan	0	46
Philippines	0	27
Sri Lanka	0	4
Vietnam	0	187
Cambodia	0	2
Laos	0	2
Mongolia	0	0.3
Yemen	0	73
Armenia	0	0
Azerbaijan	0	0
Georgia	0	3
Kazakhstan	0	0
Kyrgyzstan	0	0
Tajikistan	0	15
Turkmenistan	0	0
Uzbekistan	0	0
Moldova	0	0
Asia	**785**	**2,422**
Bolivia	0	90
Colombia	0	125
Dominican Republic	0	33
Ecuador	0	19
El Salvador	0	16
Guatemala	0	89
Haiti	236	409
Honduras	0	67
Jamaica	0	0
Nicaragua	0	15
Peru	0	0
Latin America and the Caribbean	**236**	**865**
Grand total	**7,831**	**13,967**

[1]Nutrition gap: gap between available food and food needed to support a per capita nutritional standard.

[2]Distribution gap: amount of food needed to raise consumption in each income quintile to the nutritional standard.

Source: USDA, Economic Research Service.

Appendix table 2

Number of food-insecure people, 2011 and 2021

	2011	2021		2011	2021
		Million people			
Asia	**431**	**290**	**SSA**	**363**	**385**
Afghanistan	15	33	Cameroon	10	10
Bangladesh	33	19	CAR	4	5
India	246	138	DRCongo	68	88
Indonesia	23	0	Burundi	9	9
Korea	24	22	Eritrea	5	7
Nepal	6	7	Ethiopia	35	22
Pakistan	19	23	Kenya	21	11
Philippines	19	11	Rwanda	7	9
Sri Lanka	2	2	Somalia	10	13
Viet Nam	18	20	Sudan	18	16
Cambodia	6	2	Tanzania	23	18
Laos	2	1	Uganda	14	24
Mongolia	0.5	0.3	Angola	10	15
Yemen	12	10	Lesotho	1	1
Armenia	0	0	Madagascar	12	13
Azerbaijan	0	0	Malawi	6	8
Georgia	2	0.4	Mozambique	12	12
Kazakhstan	0	0	Swaziland	0.5	1
Kyrgyzstan	0	0	Zambia	10	7
Tajikistan	2	2	Zimbabwe	4	3
Turkmenistan	0	0	Benin	4	4
Uzbekistan	0	0	Burkina Faso	0	2
Moldova	0	0	Cape Verde	0	0
			Chad	8	11
LAC	**58**	**39**	Cote d'Ivoire	9	11
Bolivia	5	4	Gambia	1	1
Colombia	9	11	Ghana	2	3
Dominican R.	4	2	Guinea	1	4
El Salvador	2	1	Guinea-Bissau	0.5	0.4
Guatemala	7	6	Liberia	3	3
Haiti	9	11	Mali	3	5
Honduras	3	3	Mauritania	0	2
Jamaica	1	0.3	Niger	7	12
Nicaragua	2	1	Nigeria	32	20
Ecuador	6	2	Senegal	4	5
Peru	9	0	Sierra Leone	2	3
			Togo	3	3
North Africa	**0**	**0**	Congo, Rep	1	2
Algeria	0	0	Namibia	1	1
Egypt	0	0			
Morocco	0	0			
Tunisia	0	0			
			Grand total	**852**	**714**

Source: USDA, Economic Research Service.

Appendix table 3

Country indicators

Region and coutry	Population 2011	2011 Population annual growth rate	Grain production		Root production growth 1990-2009	Projected annual growth in supply 2010-2021
			Growth 1990-2010	Coefficient of variation 1990-2010		
	1,000		*Percent*			
North Africa:						
Algeria	35,954	1.5	3.9	46.9	5.3	1.4
Egypt	85,950	1.7	2.9	17.4	3.9	1.9
Morocco	32,771	1.2	1.7	47.8	2.9	1.0
Tunisia	10,476	1.0	0.1	39.9	3.4	2.6
Central Africa:						
Cameroon	20,398	2.2	3.3	21.8	3.1	2.4
Central African Rep.	4,590	1.9	5.2	31.0	1.2	1.8
Congo, Dem. Rep.	67,678	2.8	0.2	3.5	-1.5	2.5
Congo, Republic	3,843	2.2	7.5	42.4	2.3	1.0
West Africa:						
Benin	9,492	3.0	4.3	26.7	4.8	2.9
Burkina Faso	16,821	3.3	3.7	25.8	2.5	2.4
Cape Verde	520	1.4	-3.0	75.2	0.0	1.5
Chad	11,815	2.7	5.8	39.6	1.4	1.6
Côte d'Ivoire	22,079	2.4	0.7	6.0	3.7	2.1
Gambia	1,797	2.6	6.5	44.8	0.8	2.1
Ghana	24,838	2.1	3.2	22.0	5.0	1.8
Guinea	10,600	2.7	5.6	33.5	3.0	1.7
Guinea-Bissau	1,685	2.3	1.2	16.0	3.7	2.3
Liberia	4,231	3.1	5.3	46.6	4.8	3.0
Mali	13,644	2.4	4.4	32.1	15.0	1.7
Mauritania	3,440	2.2	1.2	29.5	1.6	1.5
Niger	16,507	3.9	4.4	33.8	1.4	2.5
Nigeria	161,796	2.2	1.9	13.2	4.6	2.2
Senegal	13,190	2.6	2.6	31.4	13.5	2.1
Sierra Leone	5,978	2.4	3.5	43.1	5.6	2.7
Togo	6,943	2.4	3.7	22.6	2.5	2.3
East Africa:						
Burundi	8,717	2.3	-0.02	7.5	1.0	3.1
Eritrea[1]	5,380	3.0	4.1	64.8	-1.4	3.8
Ethiopia[1]	87,165	2.6	6.5	36.3	3.7	2.3
Kenya	41,948	2.7	1.2	15.1	1.9	3.3
Rwanda	10,560	2.8	5.2	48.8	5.4	1.9
Somalia	9,605	2.6	-1.0	36.0	5.0	1.0
Sudan	44,104	2.1	2.6	29.7	3.1	1.7
Tanzania	46,386	3.0	2.9	23.5	0.4	3.2
Uganda	34,916	3.3	3.2	21.5	3.9	2.7

See footnotes at end of table.

Continued——

Appendix table 3

Country indicators—continued

Region and coutry	Macroeconomic indicators					
	Per capita GNI 2009	Per capita GDP growth 2009	GDP growth 2009	Export earnings growth 2009	Official development assistance as a share of GNI 2008	External debt present value as a share of GNI 2009
	U.S. dollars	*Percent*				
North Africa:						
Algeria	4,420	0.6	2.1	-3.0	0.2	3.2
Egypt	2,070	2.8	4.7	-14.5	0.8	16.5
Morocco	2,770	3.7	5.0	-13.1	1.4	23.4
Tunisia	3,720	2.1	3.1	-1.6	1.2	53.9
Central Africa:						
Cameroon	1,190	-0.3	2.0	-4.8	2.3	3.6
Central African Rep.	450	0.5	2.4	14.4 ('06)	13.1	11.8
Congo, Dem. Rep.	160	-0.1	2.7	5.4	15.9	23.8
Congo, Republic	2,080	5.6	7.6	--	6.1	20.3
West Africa:						
Benin	750	0.6	3.8	5 ('05)	9.6	11.8
Burkina Faso	510	0.1	3.5	24.4 ('06)	12.6	16.8
Cape Verde	3,010	`	2.8	11.9	14.7	26.7
Chad	540 ('08)	-4.2	-1.6	-3.2('06)	6.2	21.8
Côte d'Ivoire	1,070	1.2	3.6	9.3	2.8	46.1
Gambia	440	1.8	4.6	2.5	12.1	29.5
Ghana	1,190	2.5	4.7	12.6	7.9	27.3
Guinea	370	-2.6	-0.3	3.0	9.1	44.2
Guinea-Bissau	510	0.7	3.0	--	29.5	202.6
Liberia	160	0.3	4.6	--	185.9	316.0
Mali	680	1.9	4.3	3.4 ('07)	11.1	14.5
Mauritania	960	-3.4	-1.1	4.9 ('07)	8.7	83.3
Niger	340	-2.9	1.0	--	11.3	12.8
Nigeria	1,190	3.2	5.6	--	0.7	3.5
Senegal	1,040	-0.4	2.2	-8.8	8.0	20.0
Sierra Leone	340	1.5	4.0	--	19.2	20.3
Togo	440	0.0	2.5	7.5 ('05)	11.4	49.6
East Africa:						
Burundi	150	0.6	3.5	--	43.7	13.5
Eritrea[1]	270 ('08)	-13.9 ('08)	-11.29 ('08)	-2.2 ('07)	8.7	34.2
Ethiopia[1]	330	6.0	8.7	7.0	12.8	11.9
Kenya	760	-0.1	2.6	-7.0	4.5	19.4
Rwanda	460	2.4	5.3	--	21.1	8.3
Somalia	..	--	--	--	..	..
Sudan	1,220	2.2	4.5	23 ('08)	4.6	73.1
Tanzania	500	2.5	5.5	-0.2 ('06)	11.3	13.5
Uganda	460	3.6	7.1	16.2	11.7	8.2

See footnotes at end of table.

Continued——

Appendix table 3

Country indicators—continued

Region and coutry	Population 2011	2011 Population annual growth rate	Grain production Growth 1990-2010	Grain production Coefficient of variation 1990-2010	Root production growth 1990-2009	Projected annual growth in supply 2010-2021
	1,000			*Percent*		
Southern Africa:						
Angola	19,508	2.7	7.1	47.9	12.0	1.9
Lesotho	2,101	0.8	-2.0	41.2	3.5	1.5
Madagascar	20,675	2.6	3.4	26.2	0.7	2.3
Malawi	16,131	2.8	4.8	39.5	17.0	2.4
Mozambique	23,916	2.2	7.2	43.4	3.5	2.3
Namibia	2,252	1.8	2.8	31.2	3.0	1.4
Swaziland	1,219	1.4	-3.1	33.6	0.8	0.7
Zambia	13,585	2.5	3.2	41.1	2.3	2.5
Zimbabwe	12,834	1.5	-1.7	39.8	3.2	3.0
South Asia:						
Afghanistan	30,110	3.4	3.9	34.0	1.9	2.9
Bangladesh	166,616	1.3	3.4	22.1	8.4	1.4
India	1,230,792	1.3	1.5	9.8	3.6	1.6
Nepal	30,377	1.8	2.3	14.3	6.1	1.9
Pakistan	188,794	2.2	2.8	17.8	5.6	2.3
Sri Lanka	20,576	0.8	2.6	20.7	-2.3	0.7
Yemen	24,944	2.8	0.2	22.7	2.2	3.3
East/Southesat Asia:						
Cambodia	15,305	1.7	7.1	45.2	19.6	1.7
Indonesia	234,996	1.1	2.1	14.3	1.5	1.9
Korea, Dem. Rep.	24,074	0.3	-2.7	40.4	6.7	0.4
Laos	6,552	1.8	6.3	39.0	1.7	2.1
Philippines	95,248	1.7	2.8	19.3	-0.5	2.0
Vietnam	89,976	1.1	4.4	25.3	5.2	2.1
Mongolia	2,732	1.1	-5.4	64.2	2.4	1.7
Central Asia:[2]						
Armenia	3,099	0.3	2.0	23.0	3.1	1.8
Azerbaijan	9,035	1.1	5.3	32.5	15.1	1.1
Georgia	4,184	-0.8	-1.7	30.1	-0.9	1.1
Kazakhstan	15,868	0.7	1.0	32.9	1.7	0.3
Kyrgyzstan	5,617	1.2	1.2	14.9	9.8	1.4
Tajikistan	7,204	1.8	9.4	46.8	12.9	1.0
Turkmenistan	5,243	1.3	6.0	51.4	17.7	2.8
Uzbekistan	28,111	1.1	7.5	37.1	7.3	1.5
Moldova	3,549	-0.8	-0.6	26.5	-3.4	0.8
Latin America and the Caribbean:						
Bolivia	10,198	1.7	4.0	25.6	0.7	2.5
Colombia	46,933	1.4	1.2	14.6	-0.2	1.1
Dominican Republic	10,358	1.3	2.5	19.5	0.4	1.1
Ecuador	13,932	1.1	2.2	17.9	-1.8	1.6
El Salvador	6,227	0.5	1.1	13.9	2.0	1.5
Guatemala	14,736	2.5	-0.5	11.5	4.3	2.2
Haiti	10,343	1.5	0.8	12.5	1.0	1.7
Honduras	7,768	2.0	-0.9	11.6	4.1	0.9
Jamaica	2,741	0.4	-3.9	35.0	-3.6	0.1
Nicaragua	5,906	1.4	4.0	25.4	4.9	1.2
Peru	29,832	1.1	5.7	32.7	5.6	2.0

See footnotes at end of table.

Continued——

Appendix table 3

Country indicators—continued

Region and coutry	Per capita GNI 2009	Per capita GDP growth 2009	GDP growth 2009	Export earnings growth 2009	Official development assistance as a share of GNI 2008	External debt present value as a share of GNI 2009
	Macroeconomic indicators					
	U.S. dollars	*Percent*				
Southern Africa:						
Angola	3,750	-1.9	0.7	--	0.5	23.7
Lesotho	980	0.0	0.9	-17.2	7.0	18.6
Madagascar	420 ('08)	-2.2	0.4	10.4	8.9	17.4
Malawi	280	4.8	7.7	-5.4	22.7	16.2
Mozambique	440	4.0	6.3	2.4	21.6	18.1
Namibia	4,270	-2.7	-0.8	-14.0	2.4	..
Swaziland	2,470	-0.3	1.2	-6.1	2.4	13.3
Zambia	970	3.7	6.3	21.5	8.2	10.1
Zimbabwe	360 ('05)	-6.2 ('06)	-6.3 ('06)	-3.4 ('05)	11.6 ('05)	..
South Asia:						
Afghanistan	310 ('08)	37.1	40.8	31.4 ('05)	45.7	5.3
Bangladesh	580	4.3	5.7	0.0	2.4	17.0
India	1,180	6.2	7.7	-6.7	0.2	17.0
Nepal	440	2.8	4.7	38.4	5.6	22.8
Pakistan	1,000	1.4	3.6	-3.3	0.9	23.9
Sri Lanka	1,990	2.8	3.5	--	1.8	35.1
Yemen	1,060	0.8	3.8	--	1.2	17.4
East/Southesat Asia:						
Cambodia	610	-3.5	-1.9	-6.3	7.5	38.2
Indonesia	2,050	3.4	4.6	-9.7	0.3	29.5
Korea, Dem. Rep.	..	--	--	--	..	..
Laos	880	4.5	6.4	11.7 ('08)	9.4	78.1
Philippines	2,050	-0.7	1.1	-13.4	0.0	34.9
Vietnam	930	4.0	5.3	11.1	2.9	26.6
Mongolia	1,630	-2.7	-1.6	--	4.8	34.7
Central Asia:[2]						
Armenia	3,100	-14.6	-14.4	-32.8	2.4	35.6
Azerbaijan	4,840	8.0	9.3	2.9	0.6	10.2
Georgia	2,530	-4.0	-3.9	--	7.0	27.5
Kazakhstan	6,920	-0.2	1.2	-6.2	0.3	96.2
Kyrgyzstan	870	1.5	2.3	-7.0	7.2	35.8
Tajikistan	700	1.7	3.4	7.1	5.7	39.5
Turkmenistan	3,420	6.6	8.0	22.2	0.1	3.4
Uzbekistan	1,100	6.3	8.1	5.2 ('05)	0.7	12.0
Moldova	1,560	-6.4	-6.5	-7.8	4.5	54.9
Latin America and the Caribbean:						
Bolivia	1,630	1.6	3.4	-10.8	3.9	16.2
Colombia	4,990	-0.6	0.8	-2.8	0.4	20.4
Dominican Republic	4,550	2.0	3.5	-7.4	0.4	21.7
Ecuador	3,970	-0.7	0.4	-6.4	0.4	23.3
El Salvador	3,370	-4.0	-3.5	-16.4	1.1	49.1
Guatemala	2,650	-1.9	0.6	-6.3	1.4	33.5
Haiti	..	1.3	2.9	9.9	..	14.9
Honduras	1,800	-3.9	-1.9	-12.6	4.1	13.4
Jamaica	4,590	-3.5	-3.1	--	0.6	82.3
Nicaragua	1,000	-6.9	-5.6	1.1	11.9	35.9
Peru	4,200	-0.3	0.9	-2.5	0.4	23.3

[1]= data start in 1993. [2]= data start in 1992.

-- = data unavailable or not applicable due to inconsistent data set.

Source: Population = FAOSTAT, UN 2008 revision (medium variant), Macroeconomic indicators = World Development Indicators and Global Development Finance databases (last updated on 12/15/10) in World dataBank: http://databank.worldbank.org/