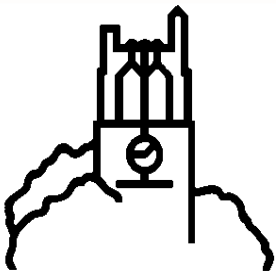
# MSU International Development Working Paper

**Wheat Consumption in Sub-Saharan Africa: Trends, Drivers, and Policy Implications**

**by**

**Nicole M. Mason, T.S. Jayne, and Bekele Shiferaw**



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# WHEAT CONSUMPTION IN SUB-SAHARAN AFRICA: TRENDS, DRIVERS, AND POLICY IMPLICATIONS

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**Nicole M. Mason, T.S. Jayne, and Bekele Shiferaw**

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## EXECUTIVE SUMMARY

Wheat consumption in Sub-Saharan Africa (SSA) is increasing rapidly, faster than any other major food grain. Between 2000 and 2009, per capita wheat consumption in SSA increased at a rate of 0.35 kilogram (kg)/year, outpacing maize and rice. Total wheat consumption increased by nearly 650,000 Metric tons (MT)/year. Staple grain consumption in Sub-Saharan Africa is rising at the same time that the region is becoming more dependent on imported staples. Wheat consumed in SSA is increasingly coming from imports from non-SSA countries as wheat production in SSA has failed to keep up with growing demand. Africa's growing reliance on imported staples including wheat received a great deal of attention in the 1980s and 1990s, yet there has been relatively little research on this issue in recent years. This paper takes stock of trends in wheat consumption and net imports in SSA since 1980, and identifies the drivers of growing demand for wheat at country-level in SSA. It also discusses the potential dilemmas posed by SSA's increasing reliance on imported staples, and examines the pros and cons of various options for African countries to meet their staple grain needs.

Results suggest that the key drivers of rising wheat consumption in Sub-Saharan Africa are rising incomes, growing populations, women's participation in the labor force increasing at a faster rate than men's, and wheat food aid. Given population projections alone, wheat consumption in Sub-Saharan Africa is expected to increase at an even faster rate in the coming decades: 670,000 MT to 1.12 million MT per year between 2010 and 2020, and 770,000 MT to 1.28 million MT per year between 2020 and 2030. Rising incomes and women's rising participation in the labor force are likely to boost wheat consumption even further. The econometric results do not point to urbanization as a statistically significant determinant of country-level wheat consumption. However, measurement error in the urbanization variable may be biasing this estimate downward. In most of SSA, wheat consumption and expenditure shares are systematically higher in urban than in rural areas, so urbanization, which is occurring rapidly in the region, would seemingly be an important driver of wheat demand. In countries such as Kenya and Nigeria, another important driver of increasing demand is the declining price of wheat relative to other staples (e.g., maize and rice). Following global trends, the price of wheat relative to maize and other staples has declined recently in several wheat consuming countries in SSA, making wheat relatively more affordable to local consumers.

Sub-Saharan Africa's growing dependence upon imported staple food grains poses at least two major dilemmas. First, SSA is becoming increasingly reliant on imported staples at a time when world prices for these commodities are rising and when prices and supplies are likely to become more variable as a result of climate change. Second, wheat consumption in SSA is generally higher in urban areas than in rural areas, and at present most of the urban demand for wheat in SSA is being met by imports or domestic production on large-scale commercial farms. Outside of Ethiopia, smallholders produce very little of the wheat demanded in SSA. Rising wheat demand therefore entails few urban-rural synergies and minimal prospects to contribute to broad-based economic development through the structural transformation process.

African policymakers have a number of potential policy options at their disposal to meet their countries' staple grain needs. Some are more likely than others to stimulate broad-based economic development. The 'best' option or combination of options will be country-specific.

However, investments in rural infrastructure, irrigation, agricultural research, development, and extension, and market information systems are likely to be core elements of successful strategies to promote increased staple grain production and productivity as well as economic development and poverty reduction.

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## ACRONYMS

| | |
|---|---|
| CIMMYT | International Maize and Wheat Improvement Center |
| CPI | Consumer price index |
| DRC | Democratic Republic of Congo |
| EGTE | Ethiopia Grain Trade Enterprise |
| EIU | Economist Intelligence Unit |
| FAOSTAT | Food and Agriculture Organization of the United Nations Statistical database |
| FEWSNET | Famine Early Warning Systems Network |
| g | gram |
| GDP | Gross domestic product |
| GIEWS | Global Information and Early Warning System |
| IAPRI | Indaba Agricultural Policy Research Institute |
| IMF | International Monetary Fund |
| kg | kilogram |
| KNBS | Kenya National Bureau of Statistics |
| LCU | Local currency unit |
| MSU | Michigan State University |
| MT | Metric ton |
| RSA | Republic of South Africa |
| SSA | Sub-Saharan Africa |
| UN | United Nations |
| UNPD | United Nations Population Division |
| USAID | United States Agency for International Development |
| USDA | United States Department of Agriculture |
| WFP | World Food Programme |

## 1. INTRODUCTION

Wheat consumption in Sub-Saharan Africa (SSA) is increasing rapidly, faster than any other major food grain. Between 2000 and 2009 (the most recent year for which consumption data are available), total wheat consumption in SSA grew by nearly 650,000 MT per year (Figure 1).[1] Over the same period, growth in per capita consumption of wheat outpaced that of maize and rice, the two other main staple grains in SSA. While per capita maize consumption has been roughly constant between 1990 and 2010, wheat consumption increased by an average of 0.35 kg per year, while rice consumption grew at 0.32 kg per year (Figure 2). And although maize remains the dominant staple in SSA in per capita consumption terms, the gap between maize and wheat consumption is shrinking. In the early 1990s, per capita maize consumption was 2.5 times greater than wheat; by the late 2000s, this difference has declined to 1.7 times.

Meanwhile, wheat production in Sub-Saharan Africa is failing to keep pace with growing demand. Although wheat produced in SSA accounted for roughly 54% of all wheat consumed there during the 1980s, that percentage fell to 34% during the 2000s (Figure 1). In 2010 alone, SSA countries imported a total of 18.2 million MT of wheat, valued at nearly US$5.1 billion (FAOSTAT).[2] The rise in wheat consumption and imports comes as Africa faces a deepening structural deficit for rice, and was deficit in maize in every year but one between 1997 and 2010 (Figure 3). SSA is therefore becoming increasingly dependent upon imports for all three staple grains, but especially wheat, and at a time when grain prices in world markets (and thus import bills) are on the rise (Figure 4).

The rising importance of wheat in Sub-Saharan Africa's staple food diets presents a possible dilemma. A major pathway for broad-based economic growth is the structural transformation process, a key part of which is rural-urban synergies whereby urban populations create a market for rural producers, while the income received from agriculture is used to meet the demand for goods and services produced by urbanites (Johnston and Mellor 1961; Johnston and Kilby 1975; Mellor 1976). At present in SSA outside of Ethiopia, wheat is produced almost exclusively by large-scale commercial farmers, not by smallholders. To the extent that urban consumers increasingly rely on staple foods produced only by large-scale farmers or procured in international markets, these synergistic growth processes between smallholder farmers and urban consumers may be mitigated, with potentially adverse implications for economic development. However, the growth in maize (and rice) consumption may also present opportunities to the extent that African farmers can exploit the potential to expand production of these crops.

Increased consumption in Sub-Saharan Africa of imported staple grains including wheat received a great deal of attention in the 1980s and 1990s (see, for example, Delgado and Miller 1985; Shah et al. 1985; Byerlee 1987; Morris and Byerlee 1993; Reardon 1993; and Kennedy and Reardon 1994). Wheat's importance in SSA diets has continued to increase since then but there has been relatively little research on this issue in recent years. Key exceptions include Mason et al. (2009) and Jayne et al. (2010); however, these studies focused only on East and Southern Africa and did not delve deeply into what is driving the

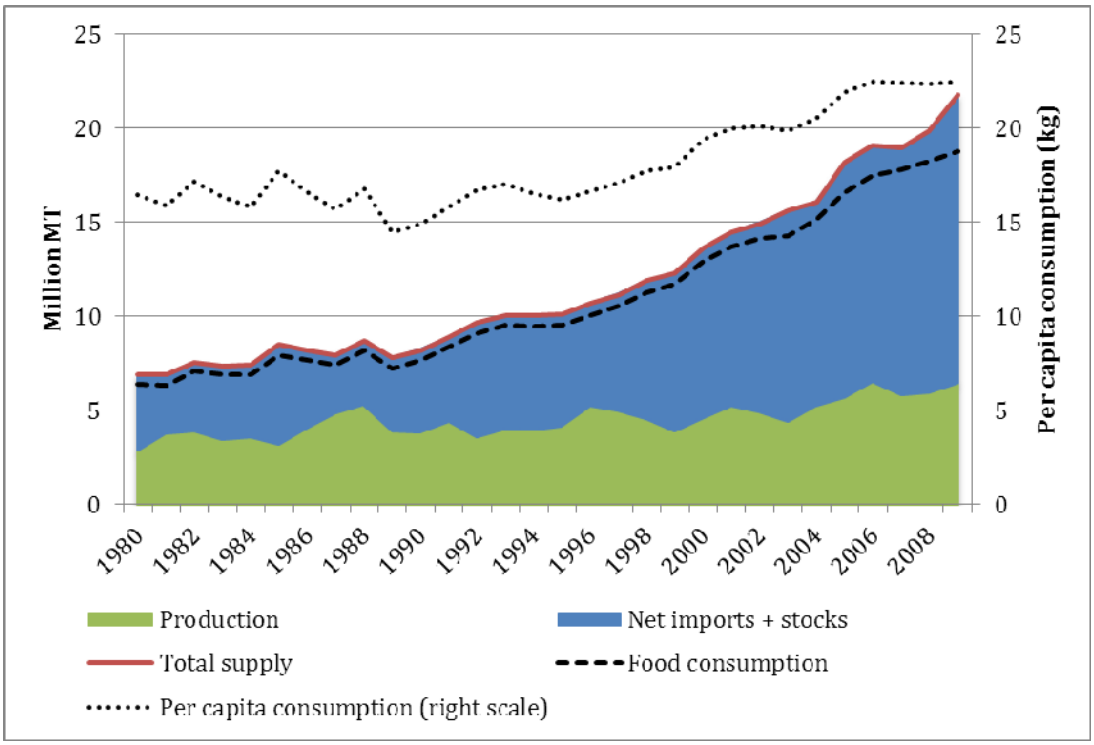
[1] Throughout the remainder of the paper, unless otherwise stated, *consumption* refers to direct human consumption and is estimated via the disappearance method (production + imports + stocks – exports – feed – seed – processing – other uses – waste) using data from FAOSTAT's Commodity Balances database. Over the 1980-2009 period, 93% of the wheat used in SSA was for human consumption.

[2] This figure is for wheat grain + wheat flour imports in wheat grain equivalent MT.

rising demand for wheat. Further analysis is needed to update our understanding of wheat consumption patterns throughout SSA, to uncover the factors that are driving rising wheat demand in the region, and to explore the implications for economic development. Given these knowledge gaps, this paper has three objectives. The first is to take stock of trends in wheat consumption and net imports in SSA since 1980, and to compare these to trends in consumption and net imports of maize and rice. The second objective is to identify the drivers of growing demand for wheat at country-level in SSA. The third and final objective is to discuss the policy implications of the region's rapidly rising wheat consumption, particularly in light of increasing staple grain prices in international markets.

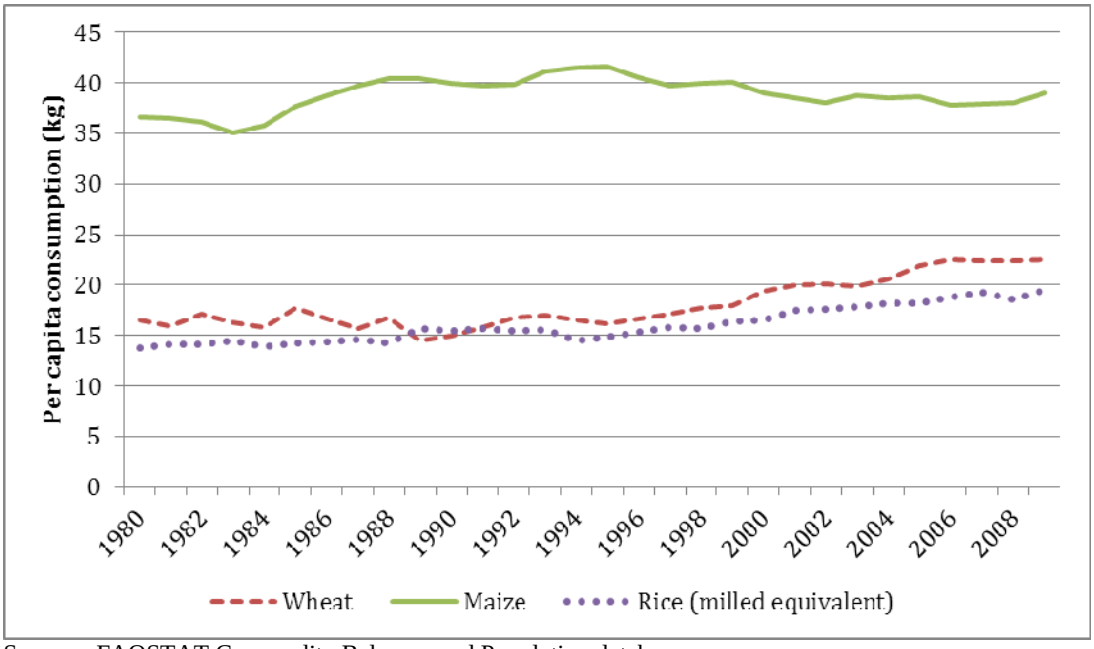
The remainder of the paper is organized as follows. Section 2 describes the data and methods used in the analysis. Section 3 reviews trends in wheat, maize, and rice consumption and net imports in Sub-Saharan Africa. Section 4 examines the potential drivers of rising wheat consumption. And Section 5 discusses the conclusions and their policy implications.

**Figure 1. Wheat Consumption, Production, and Net Imports in Sub-Saharan Africa, 1980-2009**



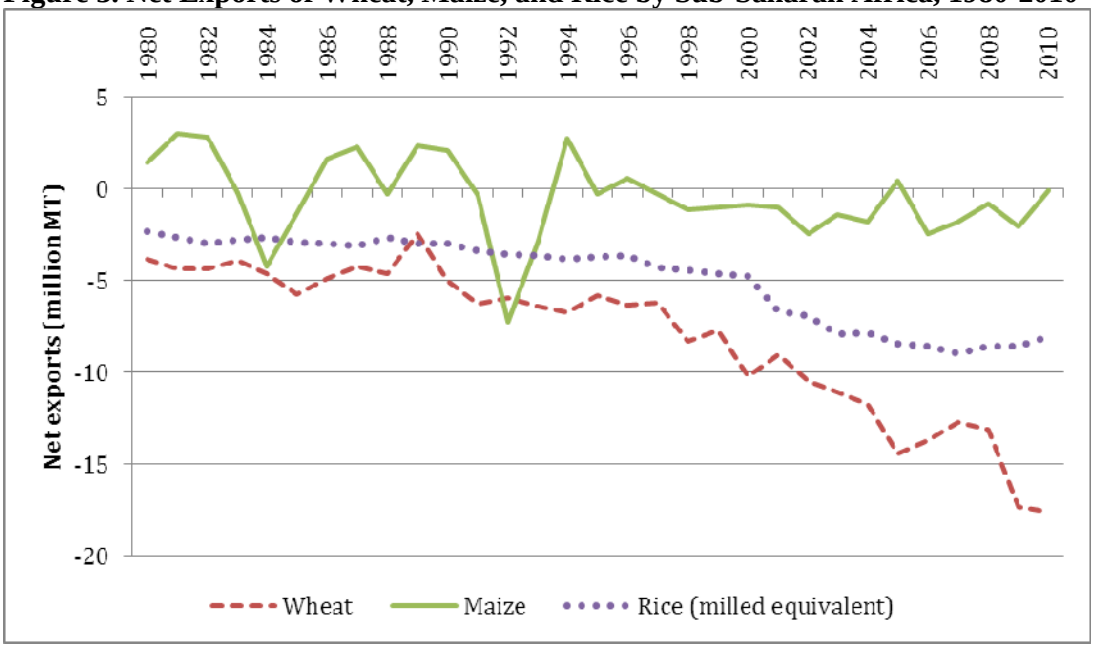

Sources: FAOSTAT Commodity Balances and Population databases.

**Figure 2. Per Capita Wheat, Maize, and Rice Consumption in Sub-Saharan Africa, 1980-2009**



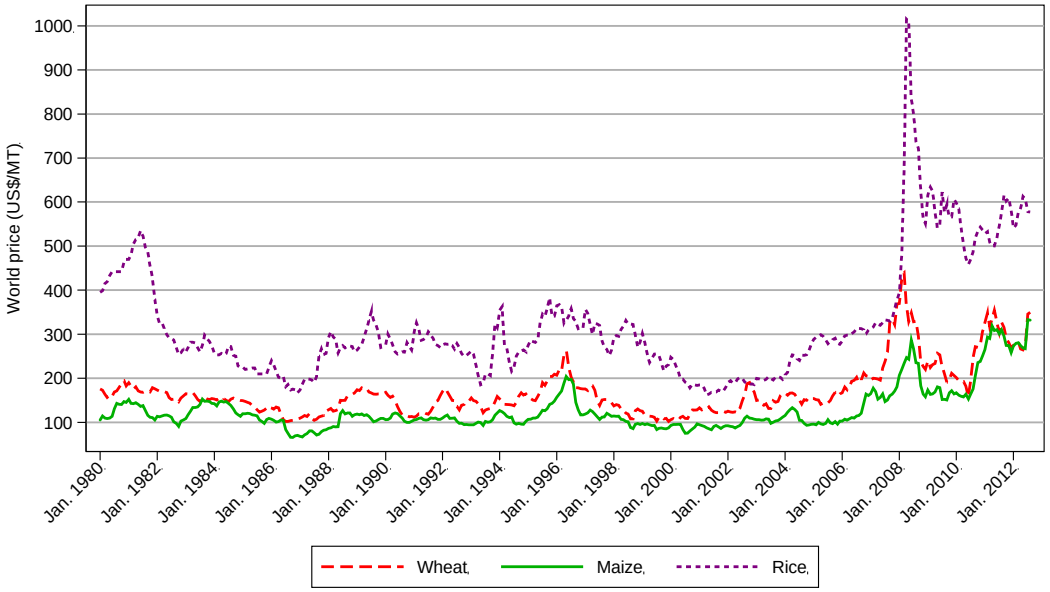

Sources: FAOSTAT Commodity Balances and Population databases.

**Figure 3. Net Exports of Wheat, Maize, and Rice by Sub-Saharan Africa, 1980-2010**




Source: FAOSTAT Trade database.

**Figure 4. Nominal World Prices of Wheat, Maize, and Rice, January 1980-August 2012**




Source: IMF Primary Commodity Prices database.
Notes: World prices for wheat, maize, and rice refer to the following: wheat, No.1 Hard Red Winter, ordinary protein, FOB Gulf of Mexico; maize, U.S. No.2 Yellow, FOB Gulf of Mexico; and rice, 5% broken milled white, Thailand nominal price quote.

## 2. DATA AND METHODS

The data used in Section 3 of the paper (trends in wheat, maize, and rice consumption and net imports in Sub-Saharan Africa) are drawn from various databases within the Food and Agriculture Organization of the United Nations Statistical database (FAOSTAT): Trade (quantities imported and exported), Commodity Balances (production, domestic supply, food supply, stock, seed, feed, processing, other use, and waste quantities), and Population (total population for per capita consumption calculations). Comparable, direct data on consumption are not available for all SSA countries so we rely on the disappearance method to estimate direct human consumption as described in footnote 1. We analyze trends in consumption and net imports for SSA overall and by region (West, Central, East, and Southern Africa excluding the Republic of South Africa (RSA), and RSA).[3] Although North Africa is not the focus of the paper, for comparison's sake we include results for North Africa in some of the main tables as well as in Appendix A. We complement the analysis of the FAOSTAT data with a review of expenditure shares for wheat, maize, rice and other key staples in select countries based on published studies, most of which draw on household survey data. The methods in this section are mainly descriptive in nature.

Section 4 of the paper investigates the likely drivers of rising wheat consumption in SSA. Economic theory would suggest that consumer demand for wheat is influenced by, among other things, its own retail price, the retail prices of related staples, and income levels. Aggregate demand at country level is in part determined by population size, with potentially differential responses to changes in the size of urban versus rural populations. Indeed, rapid urbanization is often cited as a key driver of increasing wheat consumption in Sub-Saharan Africa (see Morris and Byerlee 1993, and references therein). Another driver may be the convenience and reduced preparation time associated with bread, pasta, and other wheat products relative to maize and rice (Senauer, Sahn, and Alderman et al. 1986; Byerlee 1987; Morris and Byerlee 1993; Kennedy and Reardon 1994; Boughton and Reardon 1997). Furthermore, given that women are traditionally responsible for meal preparation throughout SSA, as women become more employed outside of the home and/or as the opportunity cost of time rises, families may seek ways of reducing cooking time, potentially through 'convenience' foods such as bread and other wheat products (ibid). Lastly, as discussed in Byerlee (1987) and Morris and Byerlee (1993), the current level of commercial imports of wheat (and, presumably, wheat consumption) may be positively correlated with the quantity of wheat received as food aid in the past.[4]

Section 4 explores each of these potential drivers of wheat consumption during the period 1980-2009. We begin by analyzing changes over time in the relative prices of wheat, maize, and rice products in international markets and in select retail markets in nine African countries.[5] A declining ratio of the wheat price relative to these other prices would suggest

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[3] West Africa includes Benin, Burkina Faso, Cote d'Ivoire, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Central Africa includes Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, and Sao Tome and Principe. East Africa includes Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan (former), Uganda, and Tanzania. Southern Africa excluding RSA is Angola, Botswana, Comoros, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Zambia, and Zimbabwe.

[4] For example, wheat food aid exposes consumers to wheat and may encourage their development of a preference for wheat over locally-produced staples. Furthermore, receipt of wheat food aid in grain form incentivizes the development of domestic wheat processing facilities (Byerlee 1987; Morris and Byerlee 1993).

[5] These countries are Ethiopia, South Africa, Nigeria, Kenya, Democratic Republic of Congo, Mozambique, Mauritania, Cameroon, and Zambia.

that wheat is becoming relatively more affordable. Next, we investigate changes over time in consumers' purchasing power for wheat products in these countries as measured by the ratio of per capita gross domestic product (GDP) to the wheat product price.[6] If incomes (as proxied by per capita GDP) rise more rapidly than wheat prices, then consumers' wheat purchasing power increases. For both the relative price and purchasing power analyses, in additional to visually inspecting graphs, we also regress the indicators on a constant and time trend to determine if observed trends are statistically difference from zero.[7] Section 4 concludes with an econometric analysis of the determinants of national-level wheat consumption in SSA countries.

The dependent variable in the econometric model is the metric tons of wheat consumed in country *i* (*i*=1, …, 45) in year *t* (*t*=1980, …, 2009).[8] Explanatory variables include the nominal world price of wheat in US$/MT; the ratios of the world wheat price to the world maize and rice prices;[9] the world crude oil price in US$/barrel to partially control for transport costs associated with importing grain; the consumer price index (CPI, 2005=100) to control for the prices of *all other goods*; the exchange rate in local currency units (LCU) per US$; GDP; total population and the percent of total population residing in urban areas, or urban population and rural population; wheat food aid receipts in past years; and the ratio of the female labor force participation rate to the male labor force participation rate.[10] See Table B1 in Appendix B for summary statistics.

Data sources for the econometric analysis are as follows. Consumption data are from the FAOSTAT Commodity Balances database. World prices are from the International Monetary Fund (IMF) Primary Commodity Prices database. Population data are from the FAOSTAT Population database. Wheat food aid receipts (1988-2009 only) are from the World Food Programme Food Aid Information System, and data on all other explanatory variables are from the World Bank World Development Indicators database.

The data cover 45 countries over the period 1980-2009 and can be thought of as a country-level panel. We take advantage of the panel nature of the data and estimate the models via fixed effects, which controls for time-invariant unobserved country-level effects.[11] These include differences in dietary preferences across countries, to the extent that they are time-constant. We compute heteroskedasticity- and serial correlation-robust standard errors clustered at the country level.

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[6] Mason et al. (2011) analyze trends in staple food purchasing power using this and several other measures (e.g., based on wages in various sectors in the formal economy and value-added in the services sector) and find them all to be highly positively correlated. Of these measures, per capita GDP is the most readily available for all countries in SSA, so we prefer to use it for the purchasing power analysis in the current paper. An important drawback of using aggregate income measures as an indicator of consumer purchasing power is that it does not account for the distribution of income within the population.

[7] Time trend regressions are estimated via ordinary least squares with Newey-West heteroskedasticity- and serial correlation-robust standard errors.

[8] Wheat consumption data are not available from FAOSTAT for DRC, Equatorial Guinea, or Somalia. For the 45 SSA countries included in the model, data are missing for some countries in some years for some variables. The total number of observations used is 1,086, or approximately 24 years of data for each of the 45 countries.

[9] Ideally, domestic retail prices for wheat, maize, and rice would have been included in the model. However, such price data are only available for a subset of countries and are for different products (e.g., bread in some countries, wheat grain or wheat flour in others), and so could not be included.

[10] We also estimated models with the female labor force participation rate in levels but the variable was not statistically different from zero at the 10% level. Furthermore, economic theory suggests that in models of aggregate demand, the *distribution* of income (and not just total income) is important. Unfortunately, data on the Gini coefficient of income were not available for a sufficient number of years for the variable to be included in the model. We encountered similar problems with data on poverty rates.

[11] See Wooldridge (2010) for details on the assumptions required for the fixed effects estimator to be consistent.

## 3. TRENDS IN WHEAT, MAIZE, AND RICE NET IMPORTS AND CONSUMPTION IN SUB-SAHARAN AFRICA SINCE 1980

Sub-Saharan Africa is becoming increasingly structurally deficit in the major staple food grains – maize, wheat, and rice. As noted in the Introduction and shown in Figure 3, the region's overall grain deficit is being increasingly filled by wheat and rice imports; the region is only marginally deficit in maize in most years. These patterns of trade increasingly reflect the demand patterns of the region's urban areas. Rural surveys consistently indicate that most of the region's rural areas are either surplus producers of food grains, or marginally deficit (Jayne et al. 2010). Therefore, the region's growing structural deficit in wheat and rice are a consequence and reflection of the food consumption preferences of urban consumers, whose populations are growing at a rate of 3.61% per year, compared to 1.76% per year for rural populations (UNPD 2012).

These SSA-level trends mask more nuanced trends in the various regions. Figure 5 shows trends in net exports for wheat, maize, and rice by region. While the wheat and rice deficits are similar in West Africa and South Africa, the wheat deficit swamps that for rice in Central, East, and Southern Africa excluding South Africa. In East Africa and Southern Africa, where maize is the dominant staple food, wheat net imports have increased markedly since the region became consistently maize deficit in the early 1990s. Wheat appears to be filling some of the maize gap in East and Southern Africa (Jayne et al. 2010). In late 2012, for the first time in many years, world maize prices are moving above those for wheat. This trend is likely to continue as maize is diverted for bio-ethanol production and maize is likely to be more vulnerable to climate change than other cereals. Maize production is rainfed in much of the world and suffered the most from the recent drought and heat wave in the U.S. For maize importing African countries, this may encourage a further shift towards wheat as the relative prices favor wheat.

Of the five regions, the largest wheat net importers in absolute terms are West Africa (driven mainly by Nigeria) and East Africa (driven by Ethiopia, Sudan, and Kenya). In fact, along with South Africa, these four countries accounted for 53.4% of all wheat net imports in SSA on average during the period 2000-2009 (Table 1). As shown in Table 1, the *big 5* (South Africa, Nigeria, Ethiopia, Sudan, and Kenya), as we will refer to them collectively throughout the rest of the paper, accounted for an even greater share of total wheat consumption in SSA: 63.8%. (These five countries accounted for an average of 44.4% of SSA's total population during the period 2000-2009 (FAOSTAT).) As the big 5 account for the lion's share of wheat imports and consumption in SSA, future analyses should delve more deeply into the drivers of wheat demand in these countries in particular.

From which countries are the big 5 importing their wheat? Table 2 shows the major sources of wheat grain imports for the big 5 for the period 2000-2010. (Wheat flour imports are minimal as most wheat is imported as grain and milled in-country.) Although sources vary somewhat across countries, the U.S. was the single largest source of wheat imports by the big 5 collectively, accounting for 1/3 of total imports. Argentina was the second largest source of imports at 15% overall. As one of the worst droughts in U.S. history ravages large swathes of the prime maize producing parts of the country in 2012, world maize prices are rising and are putting upward pressure on wheat prices (see Figure 4). A dry 2012 summer in eastern Europe including the Russian Federation and Ukraine (important sources of wheat imports for Kenya), is negatively affecting wheat production there (World Bank 2012). Australia, which is Sudan's major source of imported wheat, has also been stricken by drought in recent years.

**Table 1. Average Annual Wheat Net Imports, Total Consumption, Per Capita Consumption, and Share of Domestic Production in Total Consumption, 2000-2009, by SSA Country**

| | Net imports | | | Total consumption | | | | Per capita consumption | |
|---|---|---|---|---|---|---|---|---|---|
| Rank | Country | '000 MT | % of total SSA | Country | '000 MT | % of total SSA | % from domestic production | Country | kg |
| 1 | Nigeria | 2,846.7 | 23.0% | South Africa | 2,830.2 | 17.8% | 73.2% | Mauritania | 106.92 |
| 2 | Sudan | 1,318.8 | 10.7% | Nigeria | 2,773.9 | 17.4% | 2.1% | Mauritius | 101.95 |
| 3 | Ethiopia | 1,020.4 | 8.2% | Ethiopia | 2,487.2 | 15.6% | 83.0% | Djibouti | 93.04 |
| 4 | South Africa | 820.8 | 6.6% | Sudan | 1,175.6 | 7.4% | 38.3% | South Africa | 59.65 |
| 5 | Kenya | 609.9 | 4.9% | Kenya | 891.9 | 5.6% | 35.2% | Eritrea | 57.39 |
| 6 | Tanzania | 452.4 | 3.7% | Tanzania | 504.1 | 3.2% | 16.4% | Gabon | 55.18 |
| 7 | Angola | 439.4 | 3.6% | Angola | 487.5 | 3.1% | 0.9% | STP | 53.89 |
| 8 | DRC | 415.9 | 3.4% | Mozambique | 397.3 | 2.5% | 0.5% | Seychelles | 52.28 |
| 9 | Mozambique | 369.0 | 3.0% | Senegal | 333.7 | 2.1% | | Congo | 47.76 |
| 10 | Cote d'Ivoire | 337.2 | 2.7% | Ghana | 332.4 | 2.1% | | Namibia | 44.58 |
| 11 | Senegal | 335.4 | 2.7% | Mauritania | 321.8 | 2.0% | 0.4% | Lesotho | 41.47 |
| 12 | Cameroon | 314.5 | 2.5% | Cameroon | 300.7 | 1.9% | 0.2% | Swaziland | 40.25 |
| 13 | Ghana | 303.0 | 2.4% | Cote d'Ivoire | 295.8 | 1.9% | | Cape Verde | 39.17 |
| 14 | Mauritania | 290.6 | 2.3% | Zimbabwe | 285.5 | 1.8% | 65.9% | Ethiopia | 33.85 |
| 15 | Eritrea | 255.3 | 2.1% | Uganda | 251.5 | 1.6% | 8.9% | Botswana | 32.31 |
| 16 | Uganda | 245.7 | 2.0% | Eritrea | 246.5 | 1.5% | 7.6% | Senegal | 30.84 |
| 17 | Djibouti | 161.8 | 1.3% | Congo | 168.2 | 1.1% | | Sudan | 30.64 |
| 18 | Congo | 132.1 | 1.1% | Zambia | 154.4 | 1.0% | 70.9% | Angola | 29.72 |
| 19 | Somalia | 127.7 | 1.0% | Mauritius | 127.3 | 0.8% | | Gambia | 26.71 |
| 20 | Guinea | 121.1 | 1.0% | Madagascar | 123.1 | 0.8% | 8.5% | Liberia | 26.40 |
| 21 | Mauritius | 112.3 | 0.9% | Guinea | 115.6 | 0.7% | | Kenya | 25.36 |
| 22 | Madagascar | 107.7 | 0.9% | Mali | 103.3 | 0.6% | 8.4% | Zimbabwe | 22.78 |
| 23 | Mali | 99.2 | 0.8% | Namibia | 91.1 | 0.6% | 12.3% | Nigeria | 19.89 |
| 24 | Zimbabwe | 94.1 | 0.8% | Lesotho | 85.3 | 0.5% | 19.6% | Mozambique | 19.03 |
| 25 | Malawi | 93.0 | 0.8% | Liberia | 84.6 | 0.5% | | Cameroon | 17.24 |
| 26 | Lesotho | 77.3 | 0.6% | Burkina Faso | 84.2 | 0.5% | | Comoros | 16.69 |
| 27 | Gabon | 73.5 | 0.6% | Malawi | 82.7 | 0.5% | 2.6% | Cote d'Ivoire | 16.52 |
| 28 | Chad | 71.2 | 0.6% | Gabon | 75.1 | 0.5% | | Ghana | 15.36 |
| 29 | Burkina Faso | 69.9 | 0.6% | Djibouti | 75.0 | 0.5% | | Zambia | 13.59 |
| 30 | Botswana | 62.6 | 0.5% | Chad | 74.4 | 0.5% | 5.5% | Sierra Leone | 13.34 |
| 31 | Togo | 60.2 | 0.5% | Niger | 69.6 | 0.4% | 10.9% | Tanzania | 12.92 |
| 32 | Liberia | 60.2 | 0.5% | Togo | 68.0 | 0.4% | | Togo | 12.83 |
| 33 | Niger | 53.2 | 0.4% | Sierra Leone | 66.3 | 0.4% | | Guinea | 12.81 |
| 34 | Namibia | 52.8 | 0.4% | Botswana | 60.4 | 0.4% | 0.6% | Guinea-Bissau | 12.28 |
| 35 | Gambia | 49.2 | 0.4% | Benin | 55.4 | 0.3% | | Uganda | 8.68 |
| 36 | Sierra Leone | 46.2 | 0.4% | Rwanda | 50.2 | 0.3% | 47.5% | CAR | 8.02 |
| 37 | Zambia | 44.0 | 0.4% | Swaziland | 44.7 | 0.3% | 0.8% | Mali | 7.84 |
| 38 | Swaziland | 41.4 | 0.3% | Gambia | 40.0 | 0.3% | | Chad | 7.60 |
| 39 | Benin | 38.5 | 0.3% | CAR | 31.9 | 0.2% | | Benin | 7.32 |
| 40 | CAR | 32.0 | 0.3% | Cape Verde | 18.4 | 0.1% | | Madagascar | 6.96 |
| 41 | Rwanda | 27.9 | 0.2% | Guinea-Bissau | 16.7 | 0.1% | | Malawi | 6.48 |
| 42 | Cape Verde | 23.6 | 0.2% | Burundi | 16.1 | 0.1% | 57.9% | Burkina Faso | 5.92 |
| 43 | Equat. Guinea | 15.3 | 0.1% | Comoros | 10.7 | 0.1% | | Niger | 5.47 |
| 44 | Guinea-Bissau | 15.1 | 0.1% | STP | 8.2 | 0.1% | | Rwanda | 5.27 |
| 45 | Comoros | 9.7 | 0.1% | Seychelles | 4.3 | 0.0% | | Burundi | 2.23 |
| 46 | Burundi | 9.7 | 0.1% | DRC | -- [a] | | | DRC | -- [a] |
| 47 | STP | 7.6 | 0.1% | Equat. Guinea | -- [a] | | | Equat. Guinea | -- [a] |
| 48 | Seychelles | 5.7 | 0.0% | Somalia | -- [a] | | | Somalia | -- [a] |
| | **SSA** | **12,370.6** | **100.0%** | **SSA** | **15,920.9** | **100.0%** | **34.5%** | **SSA** | **21.2** |
| | **North Africa** | **17,399.5** | **N/A** | **North Africa** | **25,034.0** | **N/A** | **59.4%** | **North Africa** | **164.5** |

Sources: FAOSTAT Commodity Balances, Trade, and Population databases.

Notes: [a] Data not available. CAR = Central African Republic, DRC = Democratic Republic of Congo, STP = Sao Tome and Principe.

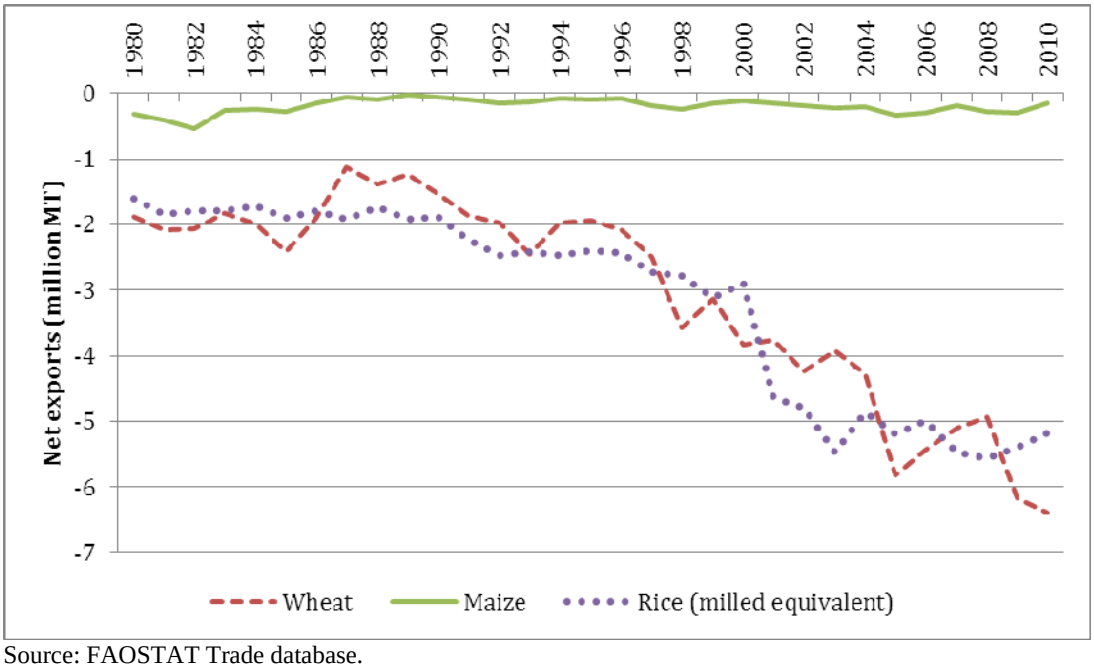
**Table 2. Major Sources of Wheat Grain Imports for the Top 5 Net Wheat Importers in SSA (Ethiopia, Kenya, Nigeria, South Africa, and Sudan), 2000-2010**

| | Importing country<br>Share of total imports from source country | | | | | |
|---|---|---|---|---|---|---|
| Source country | Ethiopia | Kenya | Nigeria | South Africa | Sudan | All 5 |
| Argentina | 0.0% | 22.3% | 8.9% | 31.2% | 5.4% | 15.0% |
| Australia | 1.0% | 6.6% | 0.7% | 9.1% | 44.6% | 7.8% |
| Belgium | 0.0% | 0.1% | 13.1% | 0.0% | 0.0% | 4.0% |
| Bulgaria | 8.2% | 0.2% | 0.0% | 0.0% | 0.0% | 1.5% |
| Canada | 2.3% | 2.4% | 1.3% | 8.0% | 25.7% | 5.5% |
| Germany | 0.7% | 2.5% | 0.3% | 22.0% | 0.0% | 6.4% |
| Italy | 20.1% | 0.0% | 0.0% | 0.0% | 0.8% | 3.8% |
| Pakistan | 0.0% | 6.1% | 0.0% | 0.0% | 2.6% | 1.2% |
| Russian Federation | 0.9% | 16.9% | 0.8% | 0.3% | 0.4% | 3.3% |
| Ukraine | 4.4% | 18.7% | 0.0% | 2.1% | 0.0% | 4.4% |
| USA | 48.9% | 7.7% | 57.9% | 20.6% | 6.0% | 33.8% |
| Other countries | 13.6% | 16.4% | 17.0% | 6.7% | 14.5% | 13.3% |
| TOTAL | 100% | 100% | 100% | 100% | 100% | 100% |

Source: FAOSTAT Trade database.

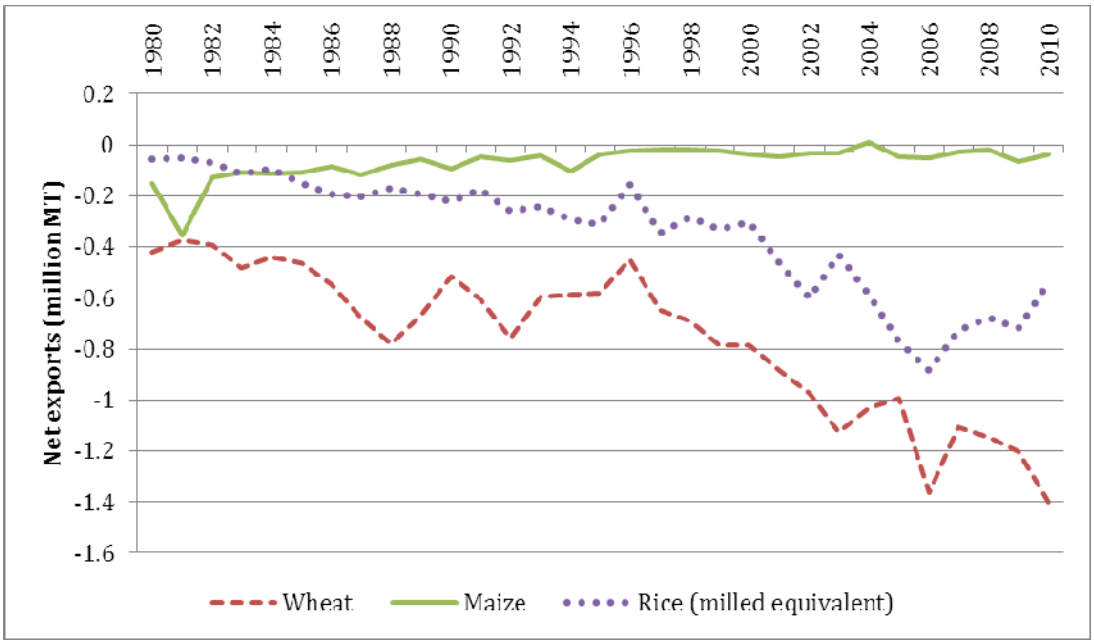
**Figure 5. Net Exports of Wheat, Maize, and Rice by Region, 1980-2010**

**5a. West Africa**



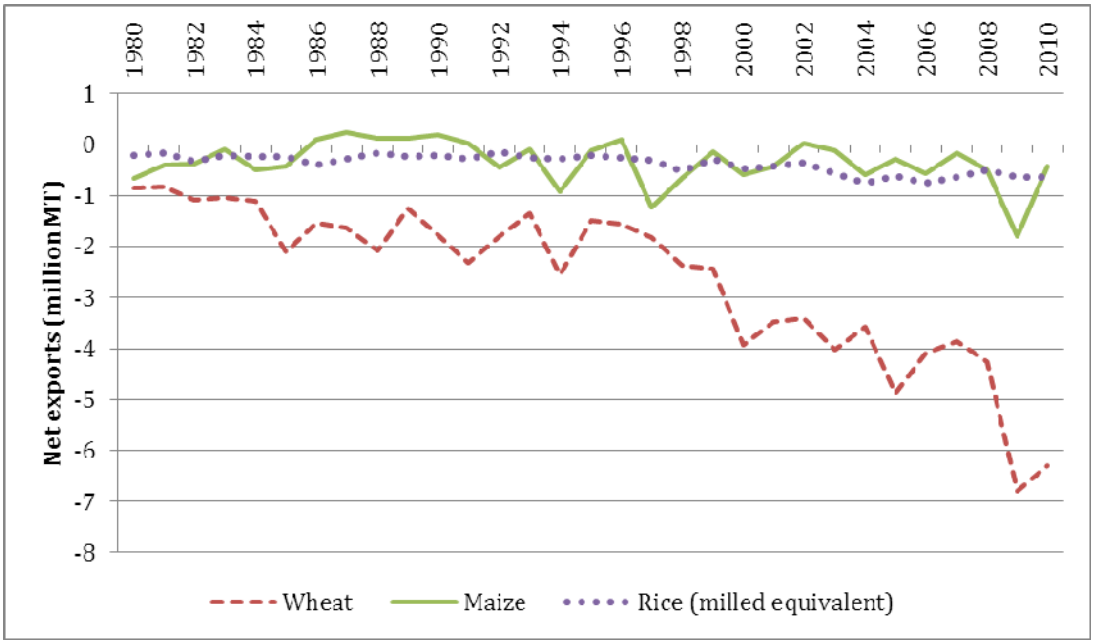

Source: FAOSTAT Trade database.

**5b. Central Africa**



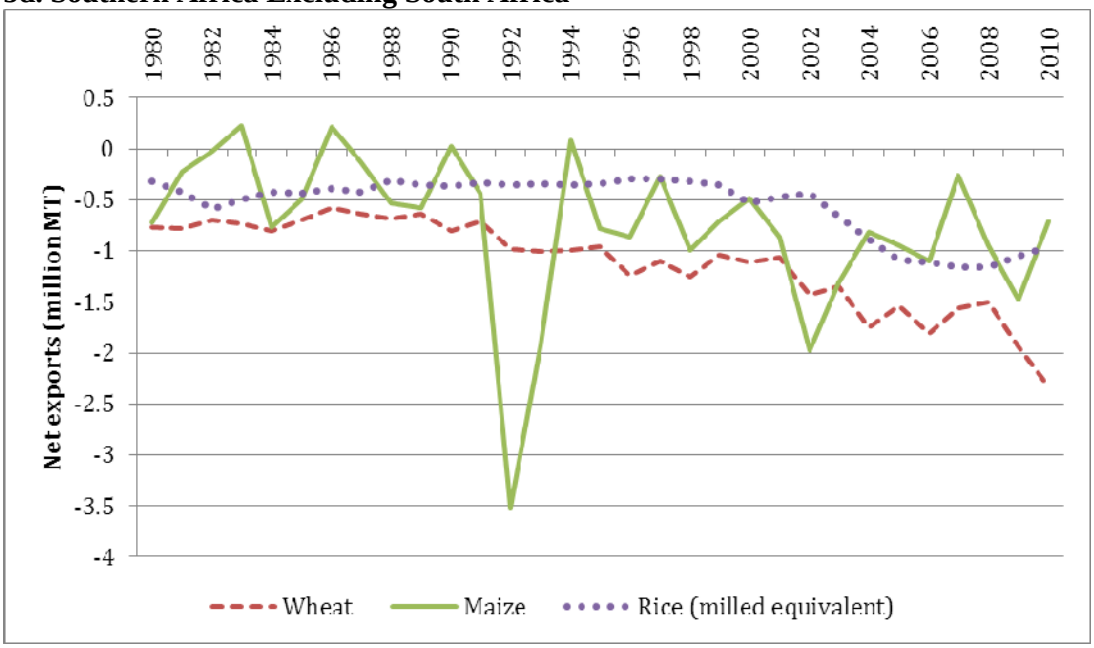

Source: FAOSTAT Trade database.

**5c. East Africa**



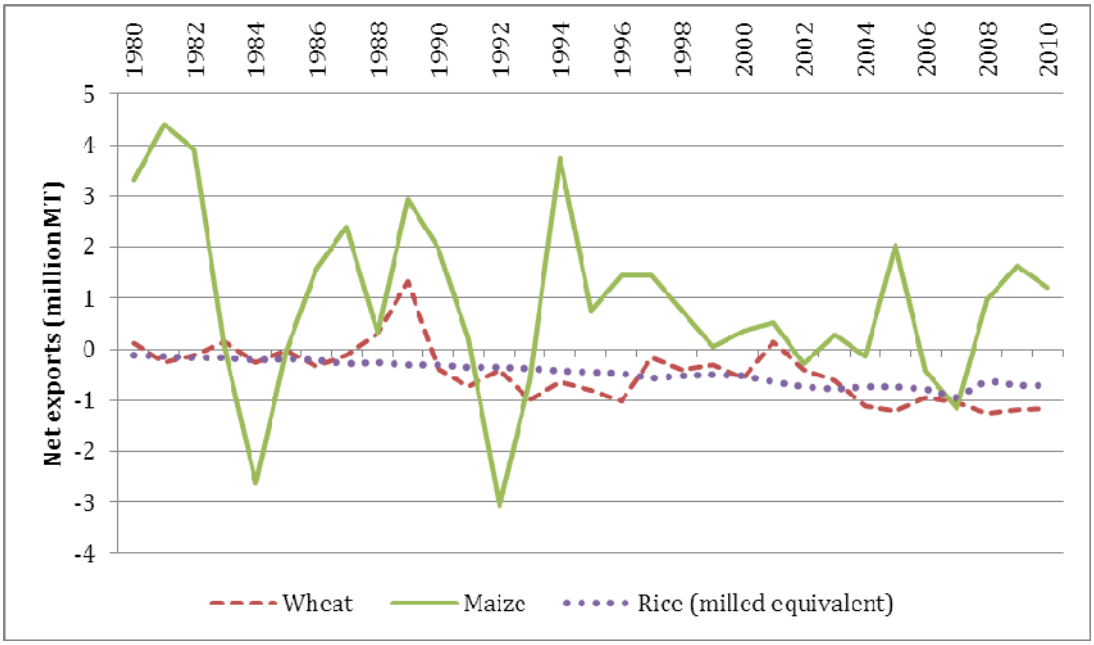

Source: FAOSTAT Trade database.

**5d. Southern Africa Excluding South Africa**




Source: FAOSTAT Trade database.

**5e. South Africa**




Source: FAOSTAT Trade database.

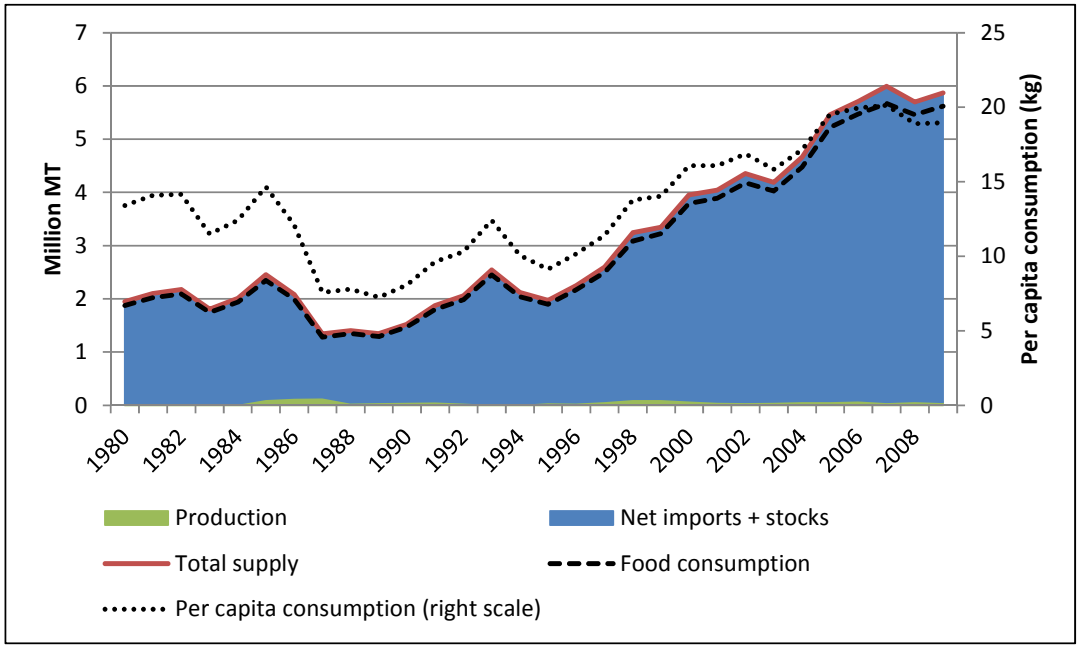
Climate change may make severe droughts more common in future years. Investment in domestic production of wheat in Sub-Saharan Africa (where agronomically viable and economically profitable) may be one option to reduce food import bills. Indeed, recent simulation analyses suggest that there may be potential for profitable, competitive, rainfed wheat production in several SSA countries (Shiferaw et al. 2012).

Just as net import trends for wheat vary across regions (and countries) in Sub-Saharan Africa, so do trends in wheat consumption in total and per capita terms, as well as the contribution of domestic production to total consumption (see Figures 6a through 6e, and summary Table B2 in Appendix B). Consider first the share of total consumption coming from domestic production. Wheat production is virtually zero in West and Central Africa. In contrast, in East Africa, growth in wheat production has nearly kept pace with growth in wheat consumption: domestic production accounted for 57.4% of total consumption in the 1980s and 52.1% during the 2000s.[12] In Southern Africa excluding RSA, Zambia has achieved wheat self-sufficiency but wheat production in the region as a whole has stagnated. And although RSA was a net exporter of wheat in several years during the 1980s, since then it has become increasingly reliant upon wheat imports as domestic production growth has stalled.

Total wheat consumption has increased over time in all regions of SSA since the mid-1990s but demand growth since that time has been most rapid in both total and per capita terms in West and Central Africa (Figures 6 and 7). Per capita wheat consumption in West Africa in 2007-2009 was nearly double average levels in 1994-1996, while per capita demand increased by over 70% in Central Africa during the same period. Over the full period, 1980-2009, demand expansion has been steadiest in East Africa, and among all regions excluding RSA, per capita wheat consumption is highest in East Africa (25.6 kg in 2009). But Southern Africa excluding RSA and West Africa are not far behind, with 2009 per capita wheat consumption rates of 21.4 kg and 19.0 kg, respectively.

**Figure 6. Wheat Consumption, Production, and Net Imports by Region, 1980-2009**

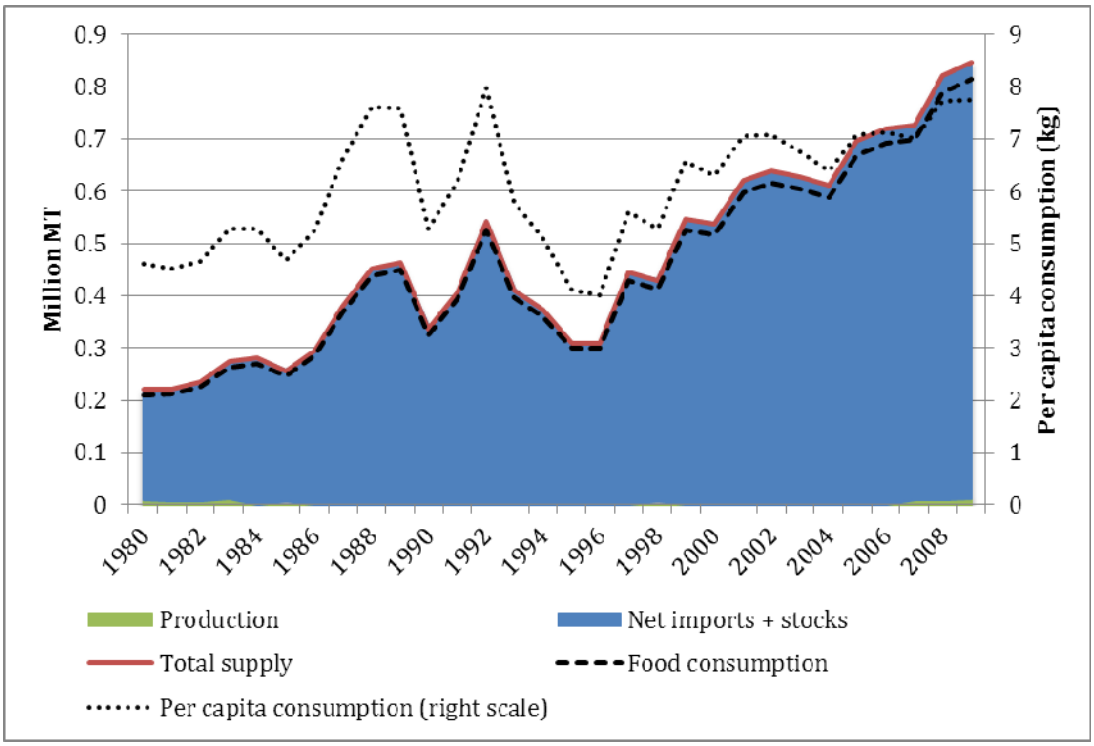
**6a. West Africa**




Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

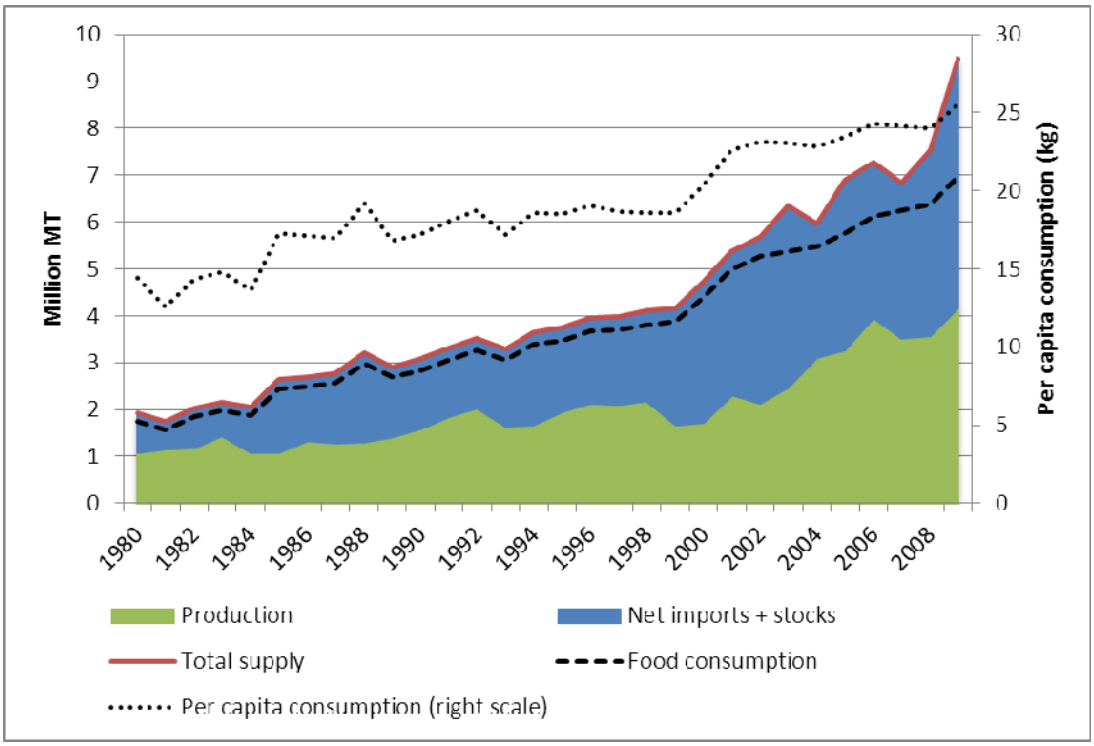
[12] In East Africa unlike in the other regions, there is a non-marginal difference between total supply and direct human consumption of wheat since the early 2000s (Figure 6c). Based on data from FAOSTAT's Commodity Balances database, over the period 2000-2009 the gap between total supply and direct human consumption is due to unspecified other uses of wheat (42.4% of the difference), waste (31.8%), seed (15.6%), feed (10.1%), and processing (0.1%).

**6b. Central Africa**



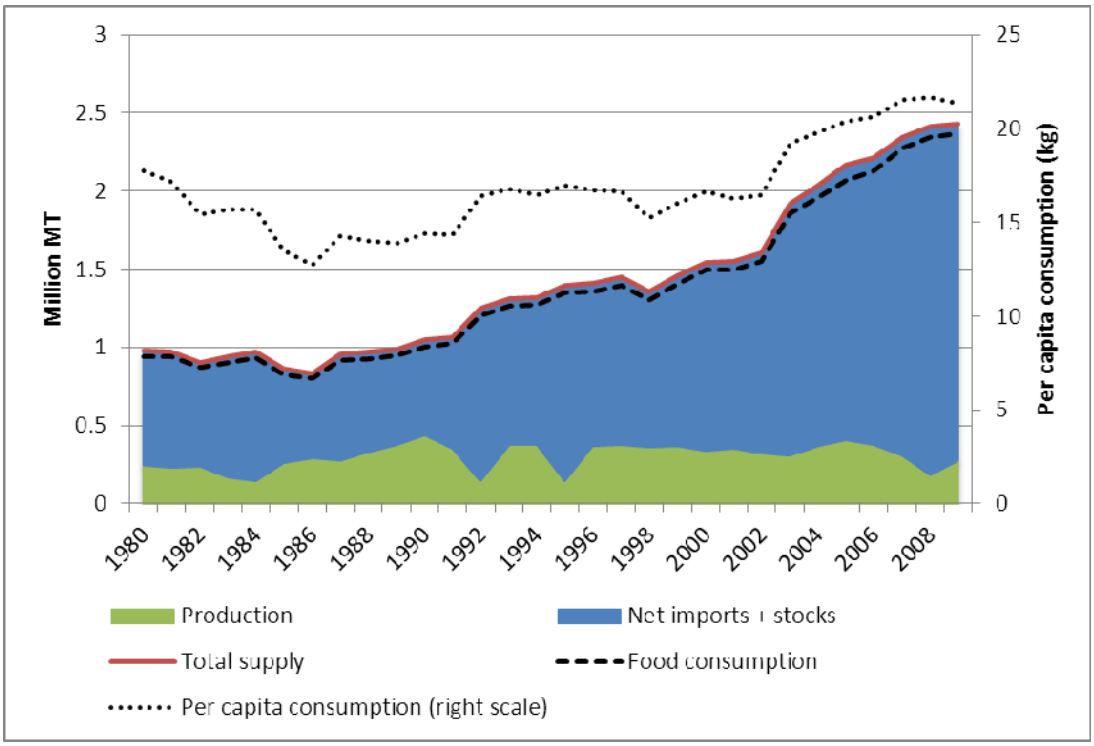

Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

**6c. East Africa**



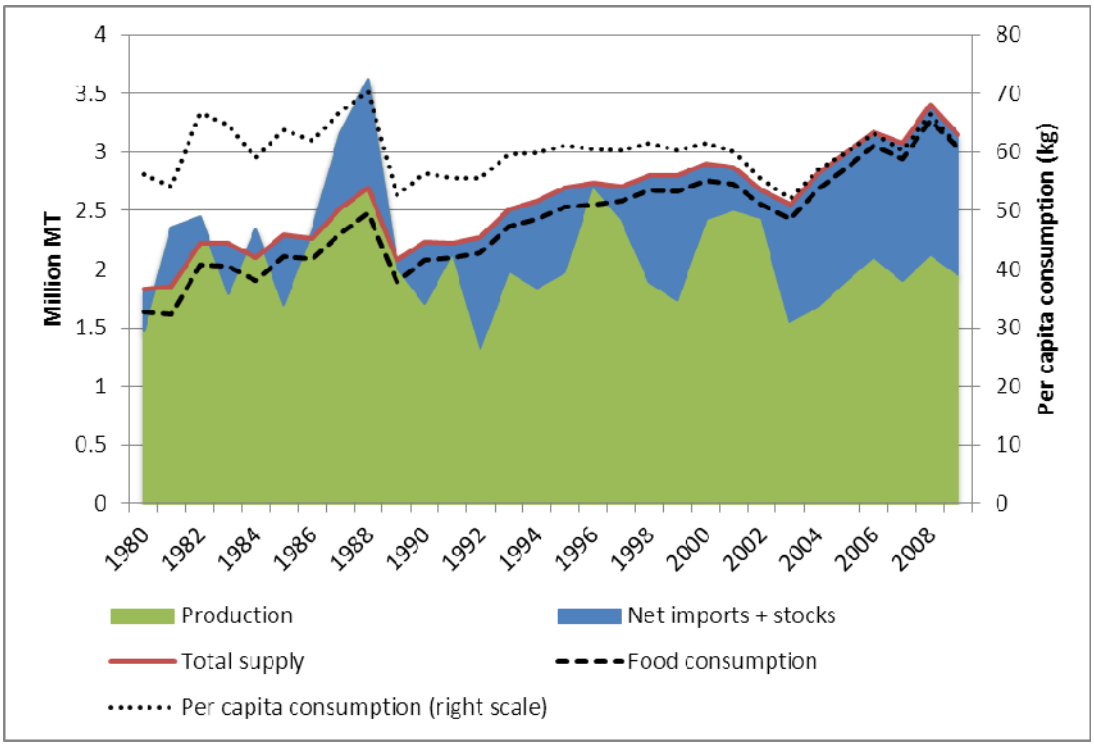

Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

**6d. Southern Africa Excluding South Africa**




Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

**6e. South Africa**




Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

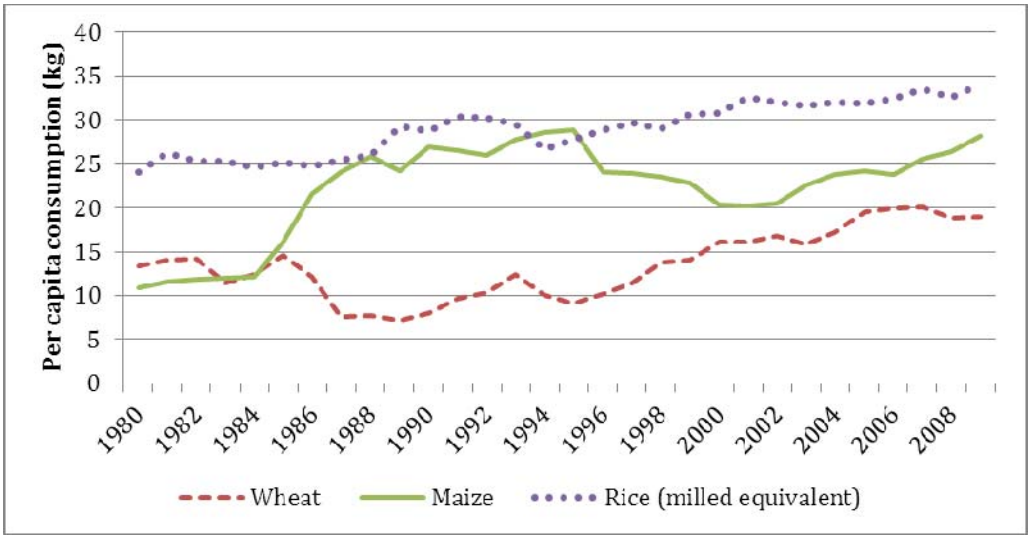
Looking across the regions, however, declines in per capita maize consumption have not been dramatic (Figure 7). And in West Africa, per capita maize consumption was actually on the rise in the mid- to late-2000s. Increases in wheat consumption have generally been mirrored by increases in rice consumption. These patterns paint a generally positive picture for food security in SSA, at least for the food *availability* dimension thereof: supplies of wheat, maize, and rice combined have grown more rapidly than population in SSA and its constituent regions, particularly since the early-1990s.

Although Figures 2 and 7 show that wheat is not yet the dominant staple grain in Sub-Saharan Africa (overall or in any of its regions), in some countries and for certain segments of the population, expenditures on wheat products do exceed those on maize, rice, and other important staple carbohydrates. Expenditures shares for wheat, maize, rice, and cassava in Kenya, Malawi, Mozambique, and Zambia are summarized in Table 3, and expenditure shares for wheat, maize, teff, and sorghum in Ethiopia are summarized in Table 4. In several cases, sufficient information is available to disaggregate households by income or total expenditure level. Gray-shaded cells indicate cases in which expenditures on wheat exceed expenditures on the other key staple foods.

Table 3 reveals that in the capital cities of Kenya and Zambia (Nairobi and Lusaka) and in Southern Mozambique (Maputo, Gaza, and Inhambane Provinces) expenditures on wheat exceed those on the other staples on average across *all* households, but especially among the wealthiest households. In Zambia, the dominance of wheat is not limited to Lusaka. In Kitwe, the second largest city in the country as of the 2010 census, wheat also dominates overall and among wealthy households. But even in much smaller provincial capitals (Mansa and Kasama), wheat is the dominant staple grain among the urban non-poor. In Mozambique, wheat also dominates among wealthy urban households in the Center of the country (Sofala, Manica, and Tete Provinces).

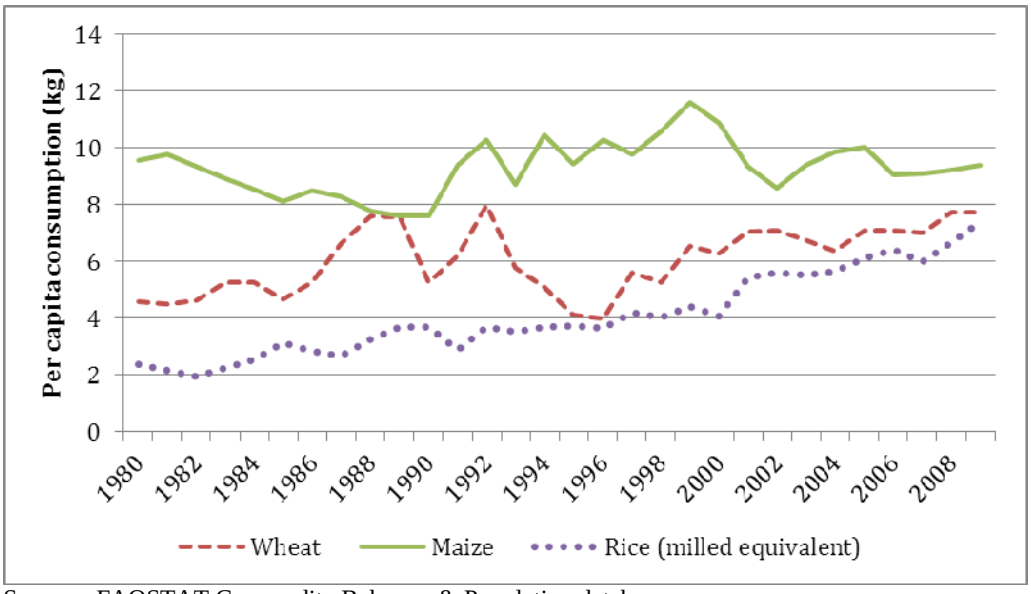
**Figure 7. Per Capita Consumption of Wheat, Maize, and Rice by Region**

**a. West Africa**



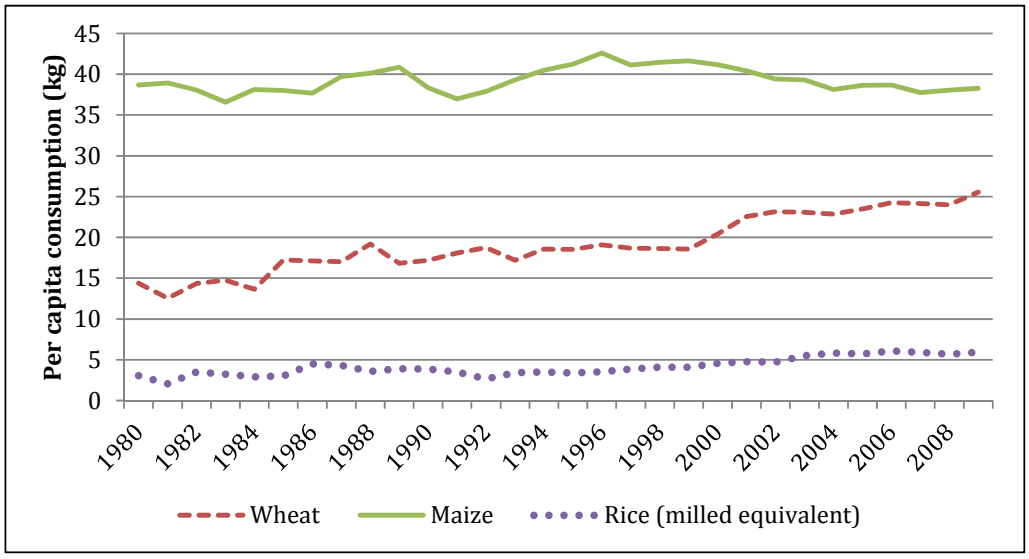

Sources: FAOSTAT Commodity Balances and Population Databases.

**7b. Central Africa**



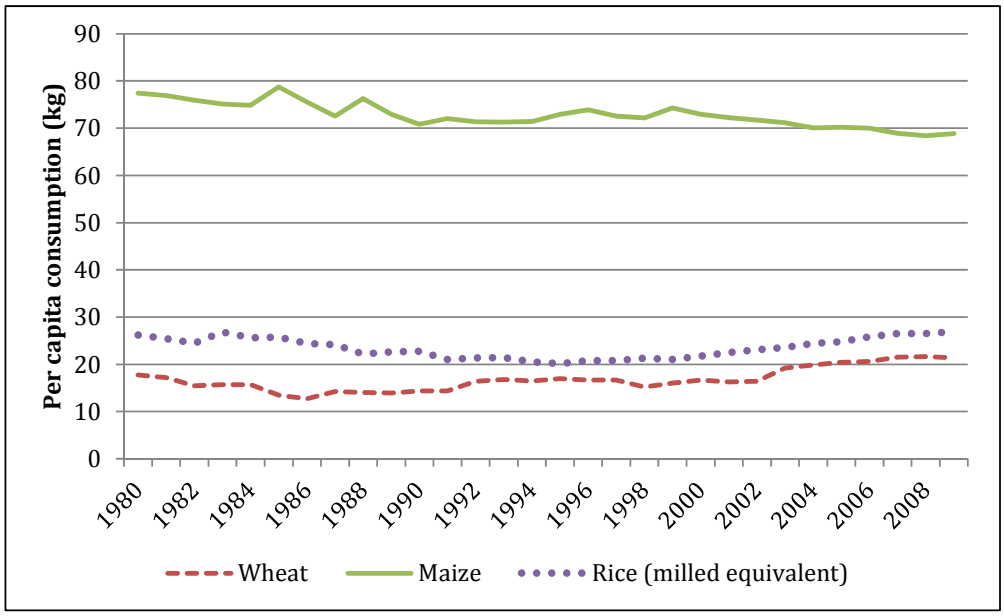

Sources: FAOSTAT Commodity Balances & Population databases.

**7c. East Africa**



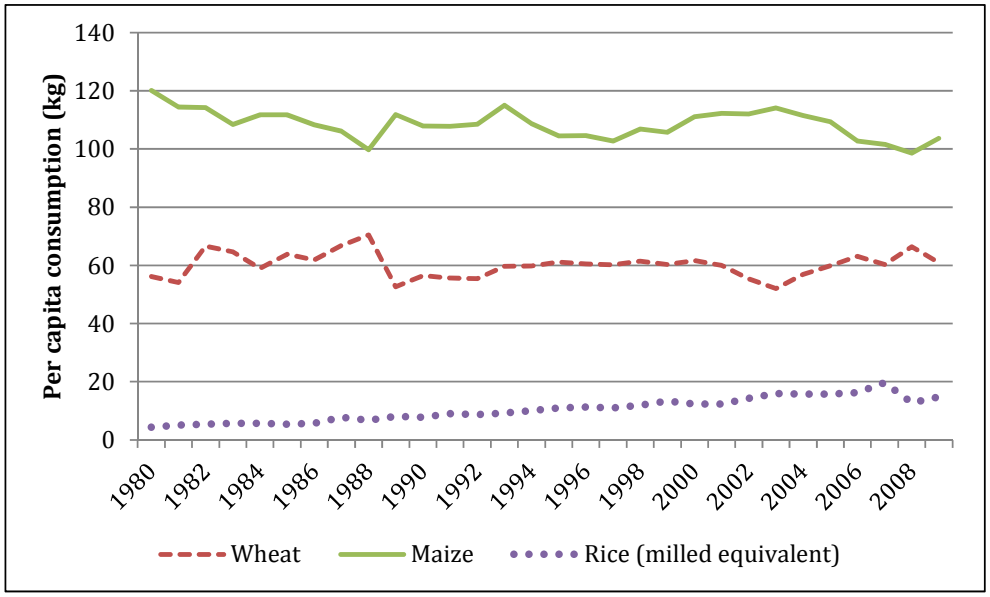

Sources: FAOSTAT Commodity Balances & Population databases.

**7d. Southern Africa Excluding South Africa**




Sources: FAOSTAT Commodity Balances & Population databases.

**7e. South Africa**




Sources: FAOSTAT Commodity Balances & Population databases.

Therefore, even though maize is the dominant staple in East and Southern Africa in per capita consumption terms in general (Figure 7), wheat dominates in expenditure terms in many urban centers in the regions. Wheat's dominance is greater among, but not limited to, relatively wealthy households in urban Kenya, Mozambique, and Zambia. Among the urban poor in these countries, maize still tends to dominate in terms of both consumption and expenditure shares.

The patterns in expenditure shares for wheat in Ethiopia are quite different. Unlike in urban Kenya, Mozambique, and Zambia, budget shares for wheat in Ethiopia are actually *lower* among the urban rich than among the urban poor (Table 4). Furthermore, although in Mozambique expenditure shares on wheat are systematically higher among urban households than among rural households, the opposite holds true in Ethiopia: rural budget shares for wheat exceed urban ones (Tables 3 and 4). These observations are important because they highlight that consumption patterns are heterogeneous across and within countries, and that wheat is not necessarily only a food for wealthy urbanites everywhere. A distinguishing feature of Ethiopia is that wheat is grown mainly by smallholder farm households. Elsewhere in SSA, wheat production is generally dominated by large-scale commercial farms. The fact that wheat is widely grown by Ethiopian smallholders may largely explain the divergent wheat expenditure share patterns in Ethiopia compared to those in Kenya, Mozambique, and Zambia.

## Table 3. Expenditure Shares on Wheat, Maize, Rice, and Cassava in Kenya, Malawi, Mozambique, and Zambia

| Location | Year Households: | % share of food group in total expenditures on wheat, maize, rice, & cassava | | | | | | | | | | | | % share of wheat, maize, rice, & cassava in total food expenditures | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wheat | | | Maize | | | Rice | | | Cassava | | | | | |
| | | *All* | *Poorest* | *Richest* | *All* | *Poorest* | *Richest* | *All* | *Poorest* | *Richest* | *All* | *Poorest* | *Richest* | *All* | *Poorest* | *Richest* |
| Kenya - Nairobi | 1995 | 35.3 | -- | -- | 42.4 | -- | -- | 22.4 | -- | -- | N/A | N/A | N/A | -- | -- | -- |
| | 2003 | 40.8 | 34.1 | 52.0 | 39.4 | 49.7 | 23.4 | 19.7 | 16.2 | 24.6 | N/A | N/A | N/A | 28.4 | 30.2 | 25.6 |
| Malawi (national) | 2004/05 | 5.5 | 1.0 | -- | 83.1 | 90.9 | -- | 5.0 | 1.5 | -- | 6.4 | 6.6 | -- | 42.1 | 51.8 | -- |
| Mozambique | | | | | | | | | | | | | | | | |
| Urban - North | 2008 | 10.5 | 2.8 | 24.5 | 43.5 | 36.4 | 39.9 | 17.9 | 11.1 | 25.8 | 28.1 | 49.7 | 9.8 | 43.0 | 46.7 | 32.6 |
| Urban - Center | 2008 | 22.3 | 15.4 | 44.4 | 55.5 | 58.2 | 34.5 | 21.2 | 24.6 | 20.3 | 1.0 | 1.8 | 0.8 | 39.1 | 32.5 | 35.4 |
| Urban - South | 2008 | 49.7 | 31.5 | 74.5 | 16.2 | 18.3 | 10.9 | 27.8 | 36.3 | 12.6 | 6.3 | 13.8 | 2.0 | 33.4 | 35.5 | 29.4 |
| Rural - North | 2008 | 1.4 | 0.4 | 3.4 | 43.9 | 32.2 | 58.7 | 11.6 | 9.1 | 13.6 | 43.1 | 58.4 | 24.4 | 51.0 | 53.8 | 47.2 |
| Rural - Center | 2008 | 1.7 | 3.0 | 2.0 | 91.2 | 75.6 | 91.6 | 6.0 | 16.3 | 5.5 | 1.1 | 5.2 | 0.8 | 46.6 | 13.5 | 59.7 |
| Rural - South | 2008 | 11.5 | 4.5 | 25.7 | 45.6 | 37.1 | 36.5 | 18.8 | 24.5 | 19.4 | 24.1 | 33.9 | 18.4 | 34.0 | 24.5 | 28.8 |
| Zambia | | | | | | | | | | | | | | | | |
| Urban | 1991 | 40.4 | -- | -- | 32.7 | -- | -- | 7.1 | -- | -- | 19.8 | -- | -- | 17.6 | -- | -- |
| Urban - Lusaka | 2007/08 | 49.2 | 33.5 | 59.0 | 39.0 | 59.9 | 26.6 | 10.8 | 6.3 | 13.7 | 1.0 | 0.4 | 0.7 | 19.5 | 26.9 | 13.9 |
| Urban - Kitwe | 2007/08 | 45.3 | 26.6 | 57.5 | 42.2 | 64.8 | 28.7 | 10.3 | 6.2 | 12.2 | 2.2 | 2.4 | 16.6 | 23.2 | 29.0 | 18.1 |
| Urban - Mansa | 2007/08 | 28.2 | 5.8 | 46.9 | 45.8 | 53.4 | 34.7 | 10.1 | 4.9 | 11.3 | 16.0 | 35.9 | 7.0 | 23.8 | 30.9 | 21.3 |
| Urban - Kasama | 2007/08 | 26.1 | 5.0 | 43.3 | 49.1 | 57.4 | 40.7 | 13.7 | 12.4 | 12.4 | 11.1 | 25.2 | 3.6 | 22.6 | 29.8 | 19.4 |

Sources: Ayieko, Tschirley, and Mathenge (2005); Mason and Jayne (2009); Mason et al. (2011); Stampley (1993); World Bank Mozambique 2008 Living Standards Measurement Study; Zanias and Gunjal (2007)

Notes: For Kenya and Zambia, poorest (richest) refers to households in the bottom (top) expenditure quintile. For Mozambique, poorest and richest refer to the bottom and top expenditure quintiles, respectively. For Malawi, poorest refers to households living on less than US$1 per day. For Mozambique, South refers to Maputo, Gaza, and Inhambane Provinces; the Center to Sofala, Manica, and Tete Provinces; and the North to Zambêzia, Nampula, Cabo Delgado, and Niassa Provinces.

## Table 4. Expenditure Shares on Wheat, Teff, Maize, and Sorghum, Ethiopia, 2004/05

| | % share of food group in total expenditures on wheat, teff, maize, & sorghum | | | | | | | | % share of wheat, teff, maize, & sorghum in total food expenditures | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | | Teff | | Maize | | Sorghum | | | |
| Income group: | Bottom 40% | Top 60% | Bottom 40% | Top 60% | Bottom 40% | Top 60% | Bottom 40% | Top 60% | Bottom 40% | Top 60% |
| Urban | 20.5 | 18.5 | 59.2 | 70.7 | 11.0 | 5.2 | 9.2 | 5.6 | 29.2 | 23.2 |
| Rural | 25.3 | 27.3 | 20.4 | 21.0 | 28.7 | 26.1 | 25.6 | 25.6 | 38.7 | 34.8 |

Source: Berhane et al. (2011)

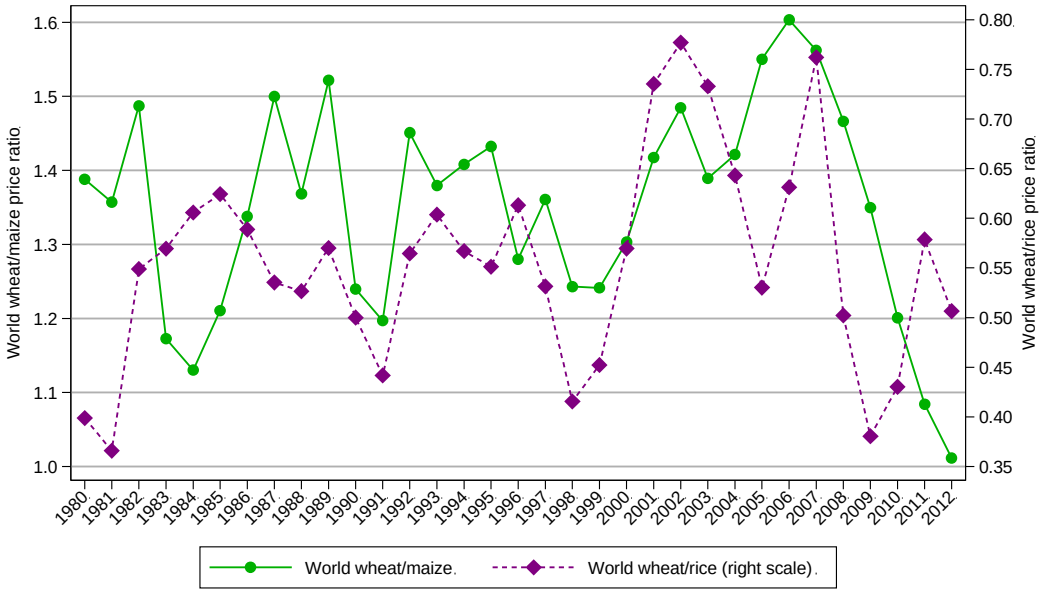
## 4. DRIVERS OF RISING WHEAT CONSUMPTION IN SUB-SAHARAN AFRICA

As demonstrated in the previous section, wheat consumption in Sub-Saharan Africa is increasing. What is driving rising demand for wheat? In Section 2, we outlined six potential drivers: (i) declining wheat product prices relative to the prices of other staple grains; (ii) rising incomes; (iii) population growth; (iv) urbanization; (v) rising opportunity cost of women's time associated with increased labor force participation by women; and (vi) wheat food aid. In this section, we explore each of these potential drivers in a bivariate and/or multivariate setting.

### 4.1. Trends in Wheat Prices Relative to Prices for Other Staple Grains

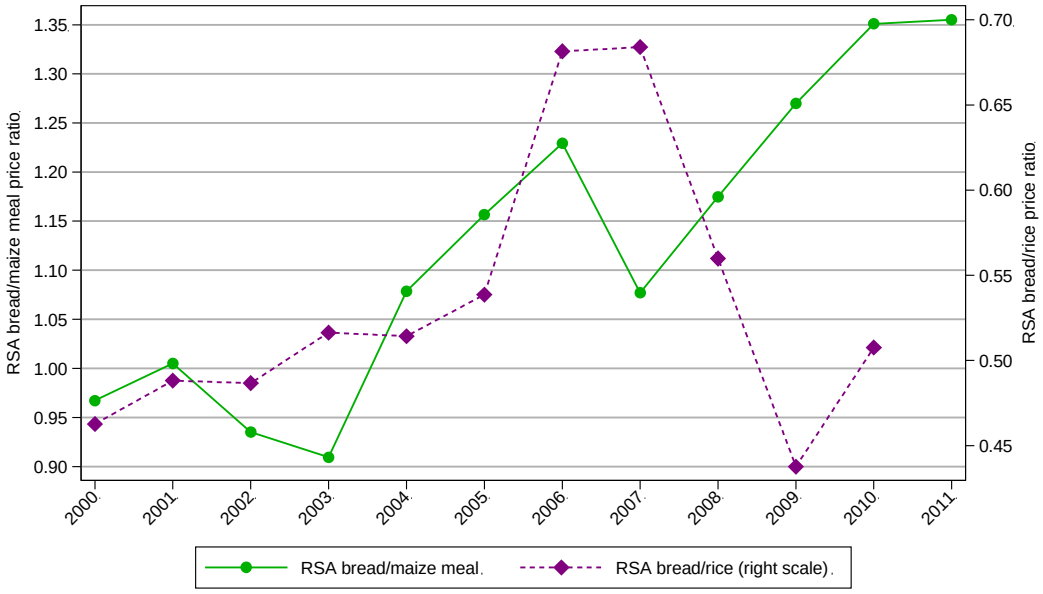
First consider changes in the price of wheat products relative to the prices of other staple grains. The prices that ultimately matter for consumers are retail prices; however, it is also instructive to examine trends in the relative prices for wheat, maize, and rice in world markets given that the majority of wheat consumed in Sub-Saharan Africa is imported from non-SSA countries. World price ratios are plotted in Figure 8. Although there is no significant trend in the world wheat/maize price ratio from 1980-2006, since 2006 wheat prices in world markets have risen less rapidly than maize prices (trend = -0.107/year, p=0.000). Similarly, since 2002, the world wheat/rice has trended downward (trend = -0.028/year, p=0.004). Thus, in recent years, wheat prices in world markets are declining relative to the prices of the two other main staple grains consumed in SSA – maize and rice. This would favor a shift toward wheat as relative prices favor wheat.

**Figure 8. Trends in World Wheat Prices Relative to World Maize and Rice Prices, 1980-2012**




Source: IMF Primary Commodity Prices database.
Notes: Data plotted are average price ratios for the calendar year. 2012 data are through August only. World prices are US$/MT for No.1 Hard Red Winter Wheat, ordinary protein, FOB Gulf of Mexico; U.S. No.2 Yellow Maize, FOB Gulf of Mexico; and 5% broken milled white rice, Thailand nominal price quote.

**Figure 9. Trends in Retail Bread Prices Relative to Retail Maize Meal and Rice Prices – South Africa, 2000-2011**




Source: AC Nielsen South Africa retail price database.
Notes: Data plotted are average price ratios for the calendar year. Prices are based on scanner data from supermarkets throughout South Africa. Bread price is for brown bread (700 g loaf); and rice and maize meal prices are per kg. (Correlation coefficient between prices for brown and white bread is 0.999.)

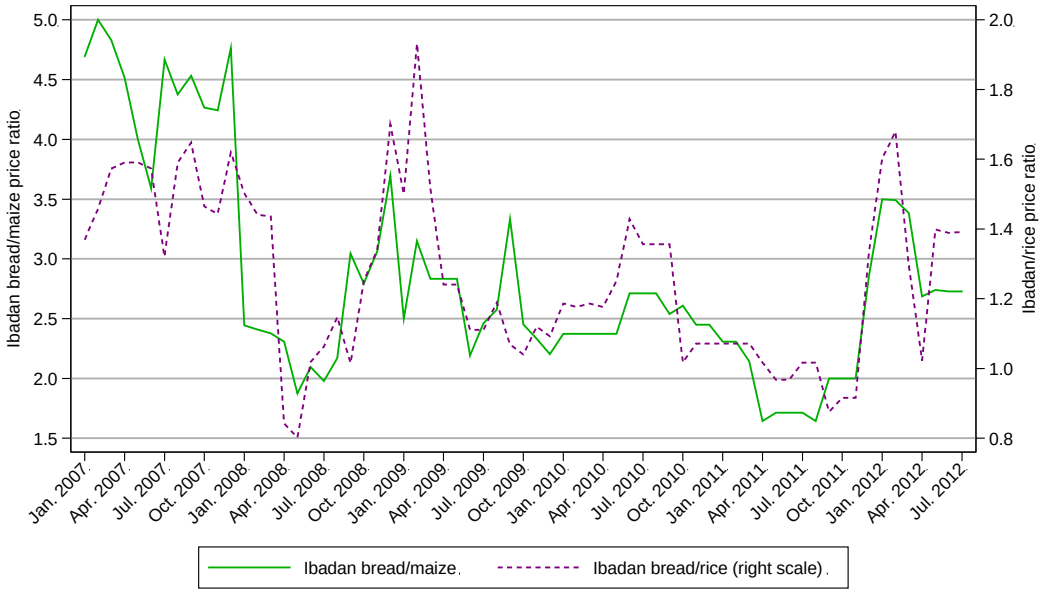
Of course, policies in some SSA countries may delink trends in domestic retail prices from trends in world prices. So what have been the trends in relative retail prices for wheat products relative to other staple grains in various countries? We examined these trends for nine countries: Ethiopia, South Africa, Nigeria, Kenya, Democratic Republic of Congo (DRC), Mozambique, Mauritania, Cameroon, and Zambia. There are no discernible trends in the price ratios for Mauritania, so we do not report those results here.

In South Africa, SSA's biggest consumer of wheat, bread prices have actually been rising relative to maize meal prices since the early 2000s (Figure 9). Bread prices also rose more rapidly than rice prices between 2000 and 2007. So it does not appear that declining relative prices for bread are likely to be driving increased wheat consumption in South Africa. There are currently no consumer subsidies for wheat products in South Africa but there is a duty on wheat grain imports when world wheat prices drop below a certain level (Marais 2011).[13] South African policy therefore generally favors wheat producers over wheat consumers.

Nigeria is Sub-Saharan Africa's second largest wheat consumer. In Ibadan (the country's third largest city and the city for which the most retail price data were available), both the bread/maize and bread/rice price ratios generally declined between 2007 and August 2011 (bread/maize trend = -0.043/month, bread/rice trend = -0.008/month, p=0.000 for both) (Figure 10). However, since late 2011, bread prices have been increasing more rapidly than maize and rice.

[13] As of July 2011, the duty was 140 rand (US$20.89) per MT when the Kansas City price for hard red winter wheat falls below US$215 (Marais 2011).

**Figure 10. Trends in Monthly Retail Bread Prices Relative to Retail Maize and Rice Prices – Ibadan, Nigeria, January 2007 – July 2012**




Source: FEWSNET Retail price database.
Notes: Bread price is per 500 g loaf. Maize and rice prices are per kg.

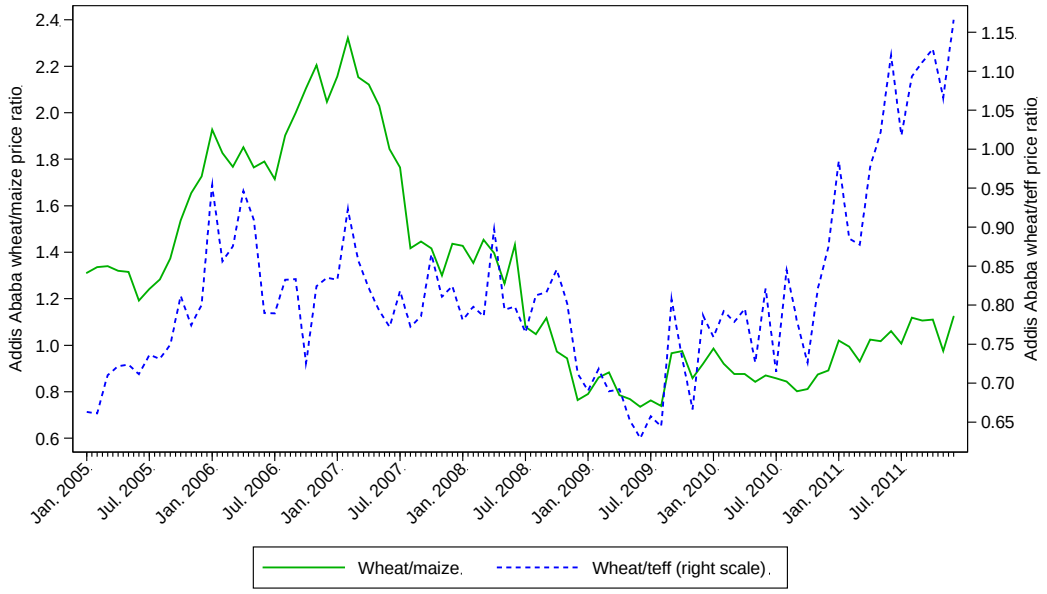
Thus, increasing relative affordability of bread in five of the last six years may have contributed to growing wheat consumption in Nigeria. Like South Africa, Nigeria also has a levy on wheat imports (15% on wheat grain and 65% on wheat flour as of July 2012) (USDA 2012).

In Ethiopia, SSA's third largest wheat consuming country, wheat prices have risen more quickly than prices of the main staple, teff, in Addis Ababa since mid-2009 (trend = 0.016, p=0.000) (Figure 11).[14] In contrast, wheat prices rose less rapidly than or at a similar rate as maize prices since January 2007 (trend = -0.0156, p=0.002). Since 2008, the Ethiopian government has arranged wheat imports and sold the wheat at subsidized prices mainly to millers and consumers through the parastatal Ethiopian Grain Trade Enterprise (Dorosh and Ahmed 2010; WFP 2012). However, it appears that this policy has failed to prevent retail wheat prices from rising more rapidly than retail teff prices.

No reliable retail wheat price data are available for Sudan, the fourth of Sub-Saharan Africa's wheat big 5, but in Kenya, the fifth of the big 5, bread/maize meal and bread/rice price ratios have both been declining in urban areas in recent years (Figure 12). The increasing affordability of bread may therefore be an important driver of rising wheat demand in Kenya. At present, there are no consumer or producer subsidies for wheat or wheat products in Kenya, nor are tariffs on wheat imports normally applied after all domestic wheat produced annually has been sold to millers (personal communications, F. Karin and M. Mathenge, Tegemeo Institute of Agricultural Policy and Development, 20 September 2012).

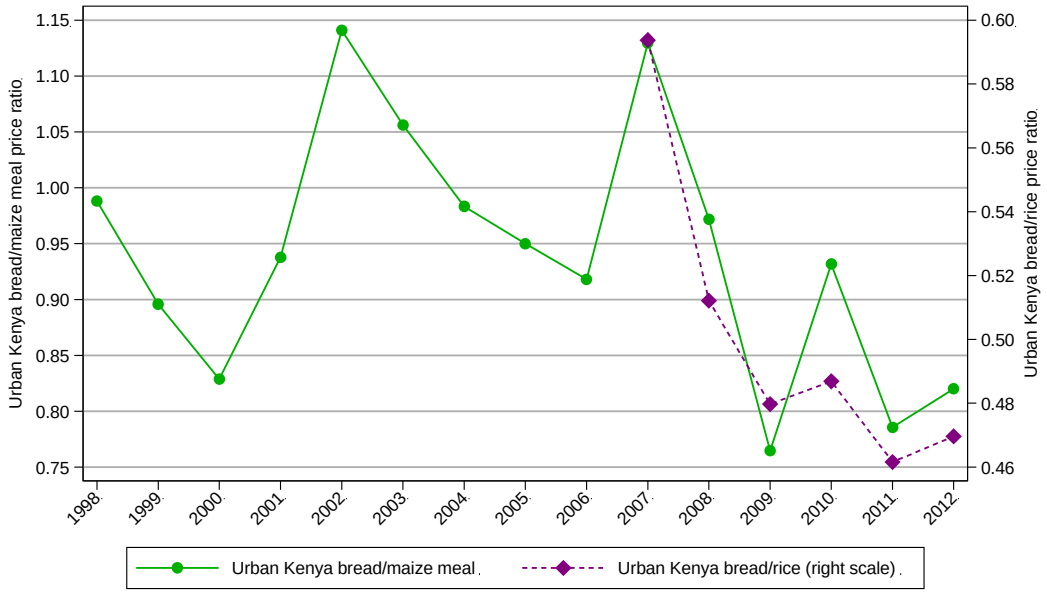
[14] Like the retail wheat:teff price ratio, the wholesale wheat:teff price ratio trended upward between mid-2009 and early 2011. However, unlike the retail price ratio, the wholesale price ratio trended downward after April 2011 and only exceeded one in April and May 2011.

**Figure 11. Trends in Retail Wheat Prices Relative Retail Teff and Maize Grain Prices – Addis Ababa, Ethiopia, January 2005 – December 2011**




Sources: Ethiopia Central Statistical Agency and Ethiopian Grain Trade Enterprise via FEWSNET Retail price database and the FAO Global Information and Early Warning System Food Price Data and Analysis Tool.
Notes: Prices are for Merkato, the main market in Addis Ababa. Wheat prices are for white wheat; maize prices are for white maize; teff prices are for mixed teff. All prices are per kg.

**Figure 12. Trends in Retail Bread Prices Relative to Retail Maize Meal and Rice Prices – Urban Kenya, 1998-2012**




Source: Kenya National Bureau of Statistics
Notes: Data plotted are average price ratios for the calendar year. 2012 data are through July only. Bread price is per 400 g loaf; maize meal price is per kg of sifted maize meal; rice price is per kg of Grade 2 rice.

In the DRC, a large importer of wheat in SSA but a country for which consumption data are not available (see Table 1), the price of wheat flour in Kinshasa has been increasing more rapidly than the price of maize grain in Lubumbashi since early 2010 (Figure 13).[15] Wheat flour/rice retail price ratios in Kinshasa were much more stable over that period, though also rose slightly. Conclusions about possible shifts in the wheat/maize price ratios over time are difficult to make given the very short price series available for DRC.

In Mozambique, the eighth largest consumer of wheat in Sub-Saharan Africa, the retail wheat flour/maize meal price ratio in Maputo declined between 1997 and 2006 (trend = -0.046, p=0.006) but has been on the rise since then (Figure 14). There is no statistically significant trend in the retail wheat flour/rice price ratio over the full the 1997-2011 period (p=0.843). Bread prices in Mozambique are set by the Ministry of Commerce and Tourism but wheat flour prices are not regulated.[16]

The last two countries for which we examine relative price trends for wheat and other staple grains are Cameroon and Zambia. As shown in Figure 15, wheat flour has become increasingly affordable relative to maize and rice for consumers in Cameroon's capital, Douala, since early 2008 (trend for wheat flour/maize = -0.015, trend for wheat flour/rice = -0.006; both are statistically significant at the 1% level). Finally, in Zambia, bread prices in Lusaka have been rising more rapidly than those for breakfast meal (refined maize meal) since 2002 (trend = 0.055, p=0.053) (Figure 16). In contrast, the retail bread/rice price ratio generally declined marginally over the full 1994-2012 period (trend = -0.007, p=0.063). Zambia has been self-sufficient in wheat since 2008 but is a relatively high-cost producer. Domestic wheat producers have been protected from international competition by import tariffs on wheat grain and flour imports, and, in recent years, wheat import bans.

To summarize, although world wheat/maize and wheat/rice price ratios have been trending downward in recent years, trends in the domestic retail price ratios are mixed in the countries examined here. In four of the eight countries (Nigeria, Kenya, Mozambique, and Cameroon), wheat products became relatively more affordable compared to maize and/or rice for much of the period for which data are available. But in the other four countries (South Africa, Ethiopia, DRC, and Zambia), wheat products became more expensive relative to the main staple food consumed in each country.

### 4.2. Trends in Wheat Purchasing Power

Rising incomes are another potential driver of growing demand for wheat in Sub-Saharan Africa. Are per capita incomes rising faster than wheat product prices in key wheat consuming countries? Figure 17 shows the number of 500g loaves of bread affordable per GDP per capita in South Africa, Nigeria, Kenya, and Zambia, and Figure 18 shows the kg of wheat or wheat flour affordable in Ethiopia, Mozambique, Mauritania, and Cameroon.[17] As shown in Figure 17, bread purchasing power increased over time in Nigeria, Kenya, and Zambia ($p<0.05$ for all trends), while there is no significant trend in bread purchasing power in South Africa. There are no significant trends in wheat grain/flour purchasing power in Ethiopia, Mozambique, Mauritania, or Cameroon (Figure 18).

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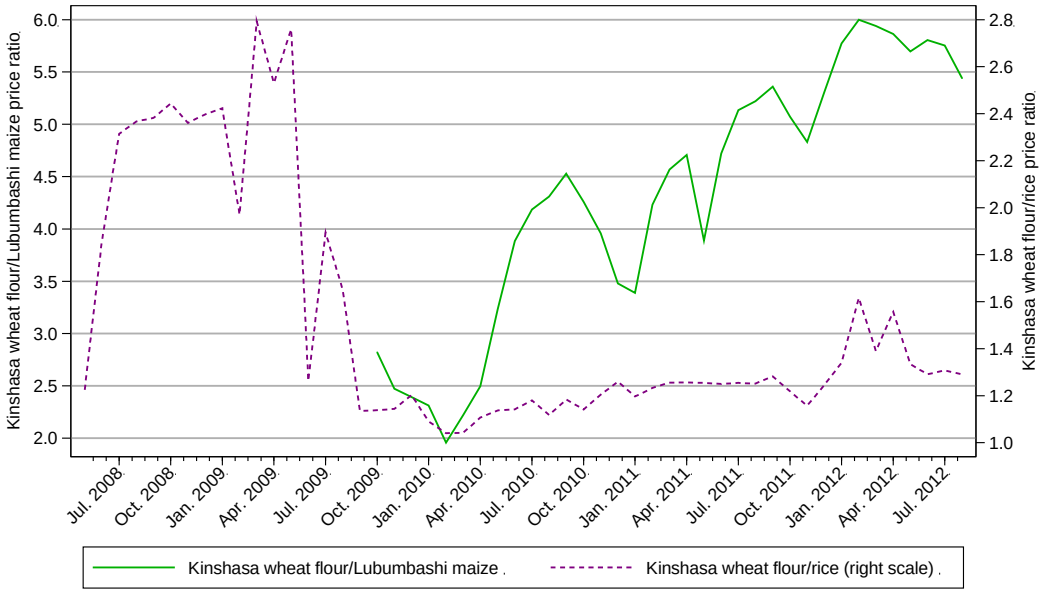
[15] No retail maize grain or maize meal price data are available for Kinshasa.

[16] Given administratively determined bread prices, bakeries often change the size of the loaf or the quality in response to changes in their input costs. Data on such changes are not available so we prefer to analyze changes in wheat flour affordability rather than bread affordability.

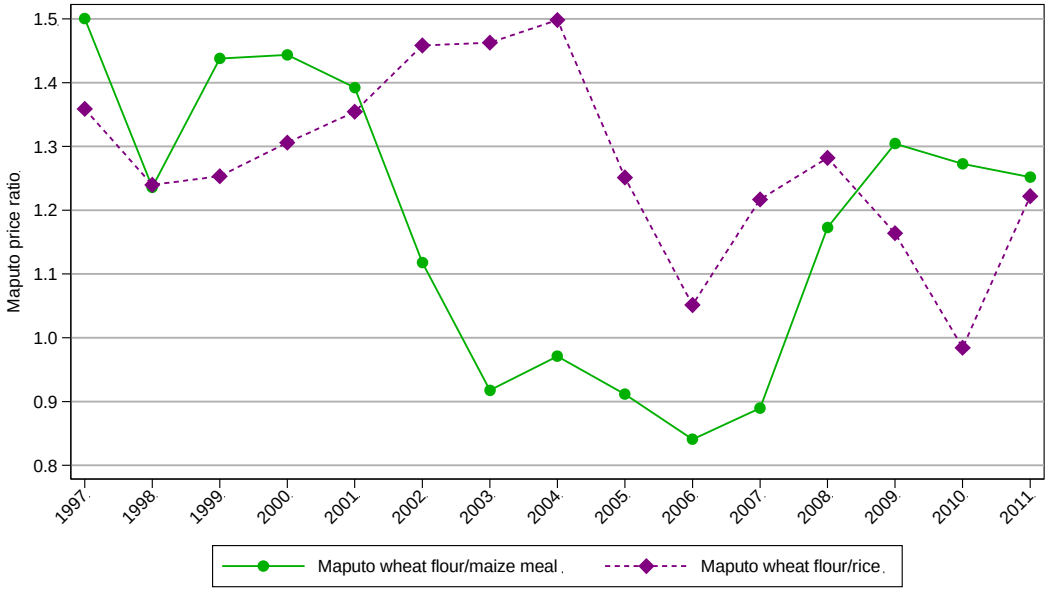
[17] We exclude DRC from this analysis because only four years of data are available.

**Figure 13. Trends in Monthly Retail Wheat Flour Prices Relative to Retail Maize and Rice Prices – Democratic Republic of Congo, May 2008 – August 2012**



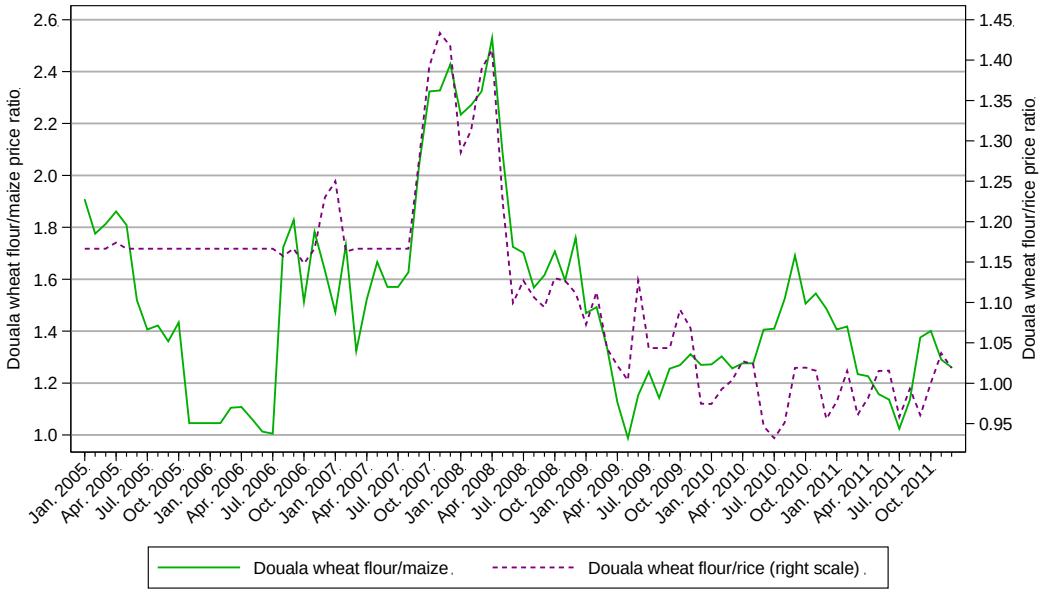

Source: FAO. Global Information and Early Warning System (GIEWS) Food Price Data and Analysis Tool.
Notes: All prices are per kg. Wheat flour and imported rice prices are for Kinshasa. Maize grain prices are for Lubumbashi.

**Figure 14. Trends in Retail Wheat Flour Prices Relative to Retail Maize Meal and Rice Prices – Maputo, Mozambique, 1997-2011**



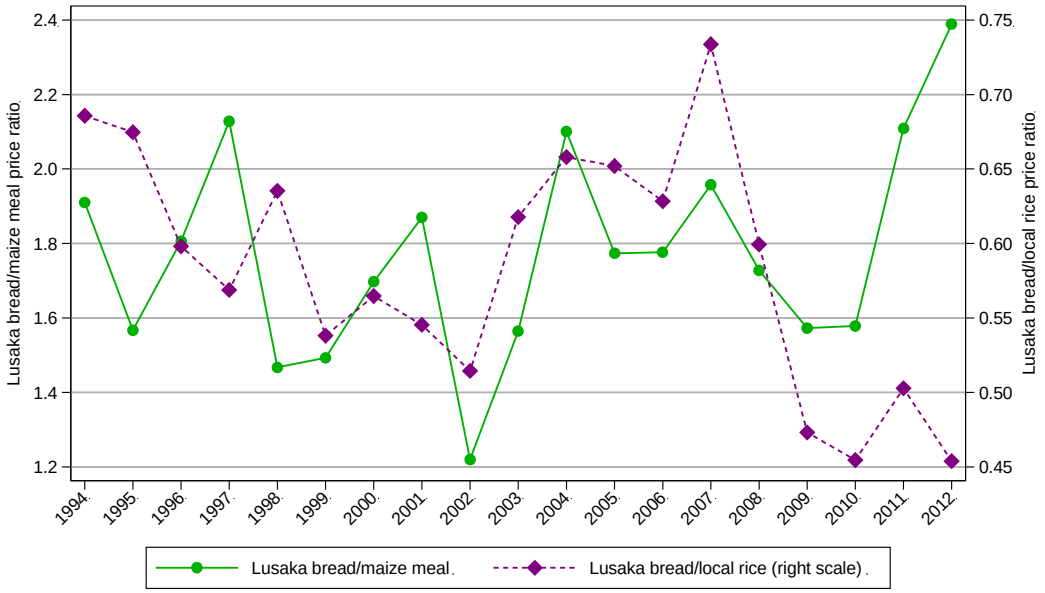

Source: Mozambique Agricultural Market Information System.
Notes: Data plotted are average price ratios for the calendar year. Maize meal price is per kg of roller meal. Wheat flour and rice prices are per kg.

**Figure 15. Trends in Monthly Retail Wheat Flour Prices Relative to Retail Maize and Rice Prices – Douala, Cameroon – January 2005-December 2011**



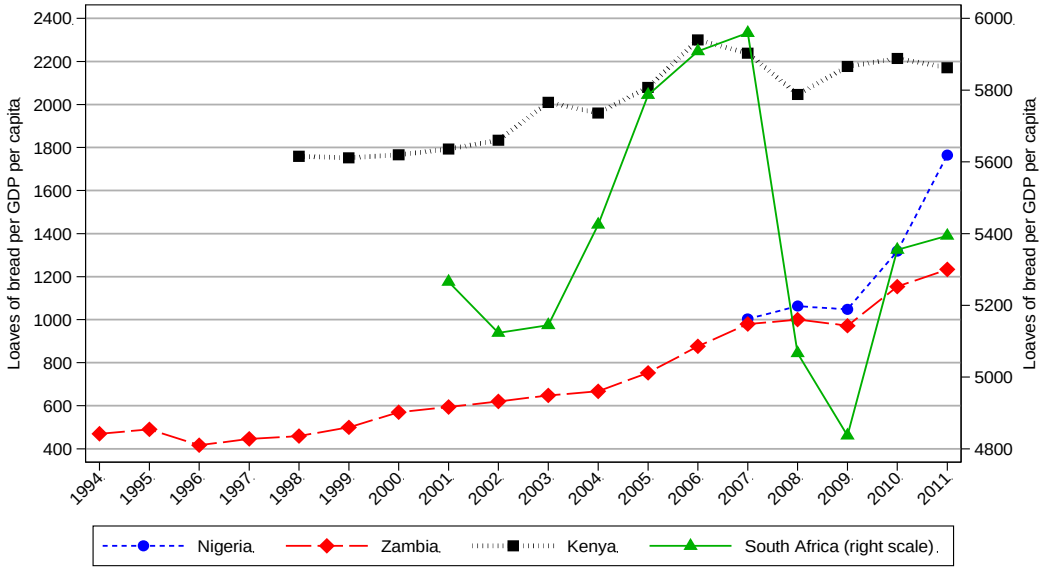

Source: FAO. Global Information and Early Warning System (GIEWS) Food Price Data and Analysis Tool.
Notes: Wheat flour, maize, and rice prices are per kg.

**Figure 16. Trends in Retail Bread Prices Relative to Retail Maize Meal and Rice Prices – Lusaka, Zambia, 1994-2012**



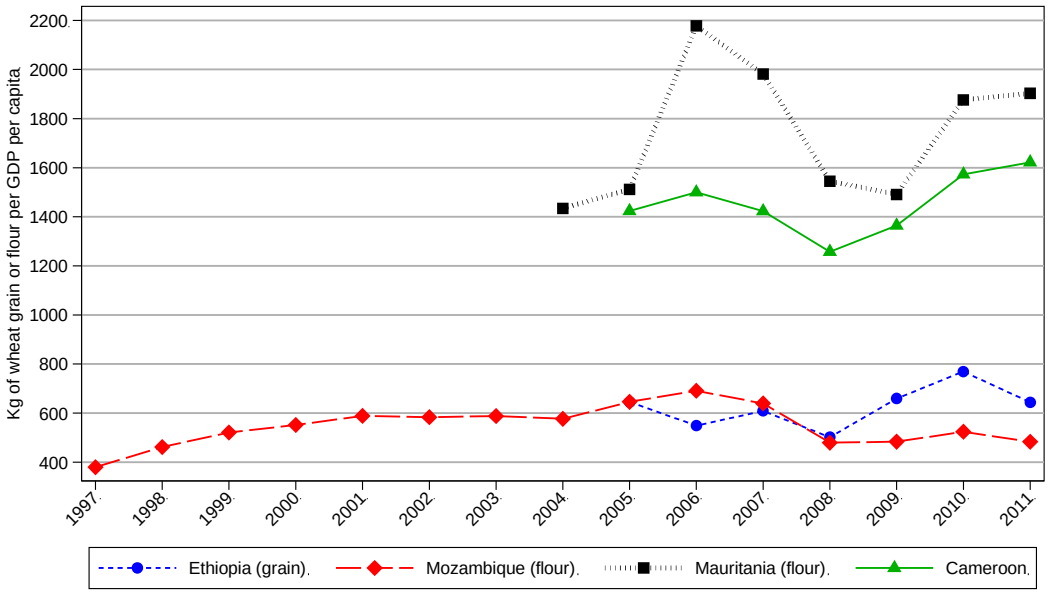

Source: Zambia Central Statistical Office
Notes: Data plotted are average price ratios for the calendar year. 2012 data are through July only. Bread price is per 700 g loaf; maize meal price is per kg of breakfast meal; rice price is per kg.

**Figure 17. Trends in Bread Purchasing Power in South Africa, Nigeria, Kenya, and Zambia**




Sources: World Bank World Development Indicators, FEWSNET Retail price database, Zambia Central Statistical Office (CSO), Kenya National Bureau of Statistics (KNBS), and AC Nielsen South Africa retail price database. Notes: Nigeria retail bread prices are for Ibadan. Zambia retail bread prices are for Lusaka. Kenya retail bread prices are average for urban Kenya. South Africa prices are average retail prices nationwide for brown bread. All prices have been normalized to be per 500g loaf.

**Figure 18. Trends in Wheat Purchasing Power in Ethiopia, Mozambique, Mauritania, and Cameroon**




Sources: World Bank World Development Indicators, Ethiopia Grain Trade Enterprise, Mozambique Agricultural Market Information System, Mauritania Office National de Statistique via GIEWS, and Cameroon National Office of Statistics via GIEWS.
Notes: Ethiopia retail wheat grain prices are for Addis Ababa (Merkato). Mozambique, Mauritania, and Cameroon retail wheat flour prices are for Maputo, Nouakchott, and Douala, respectively.

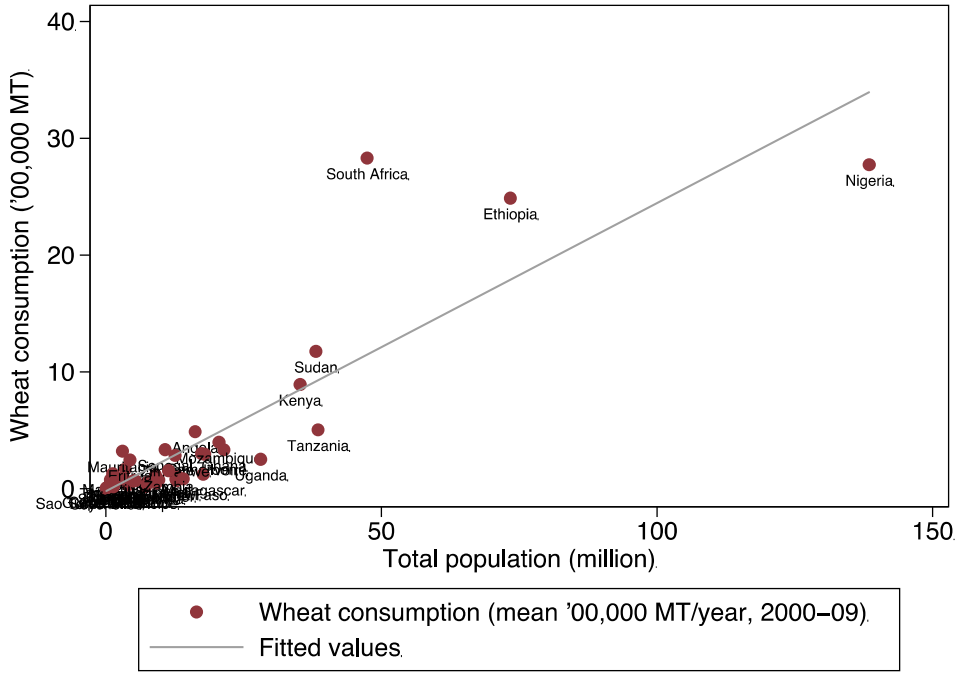
GDP per capita is a crude measure of per capita incomes. however, in at least some countries (Nigeria, Kenya, and Zambia), wheat purchasing power appears to be rising over time and may contribute to growing demand for wheat.

### 4.3. Bivariate Relationships between Total Wheat Consumption and Population, Urbanization, and GDP

Before turning to the multivariate regression results, we examine how Sub-Saharan African countries' total wheat consumption relates to three different potential drivers of demand growth without controlling for other factors: population, GDP as a proxy for income, and urbanization. Consider first the population-wheat consumption relationship. Figures 19a and 19b plot for each of 45 SSA countries average total wheat consumption over the period 2000-09 against average population size during that period.[18] The two figures are identical except that 19b excludes the *big 7* (South Africa, Nigeria, Ethiopia, Sudan, Kenya, Tanzania, and Angola) to enable us to more easily see patterns for the rest of the countries. Regardless of if we include the big 7, there is a clear, statistically significant positive relationship between population size and total wheat consumption (slope = 0.246 with the big 7 and 0.098 without; p=0.000 in both cases). As expected, countries with larger populations consume more wheat. As we will demonstrate in Section 4.5, this relationship holds after controlling for other factors.

**Figure 19. Average Total Wheat Consumption and Population Size, 2000-2009**

**a. All 45 countries**

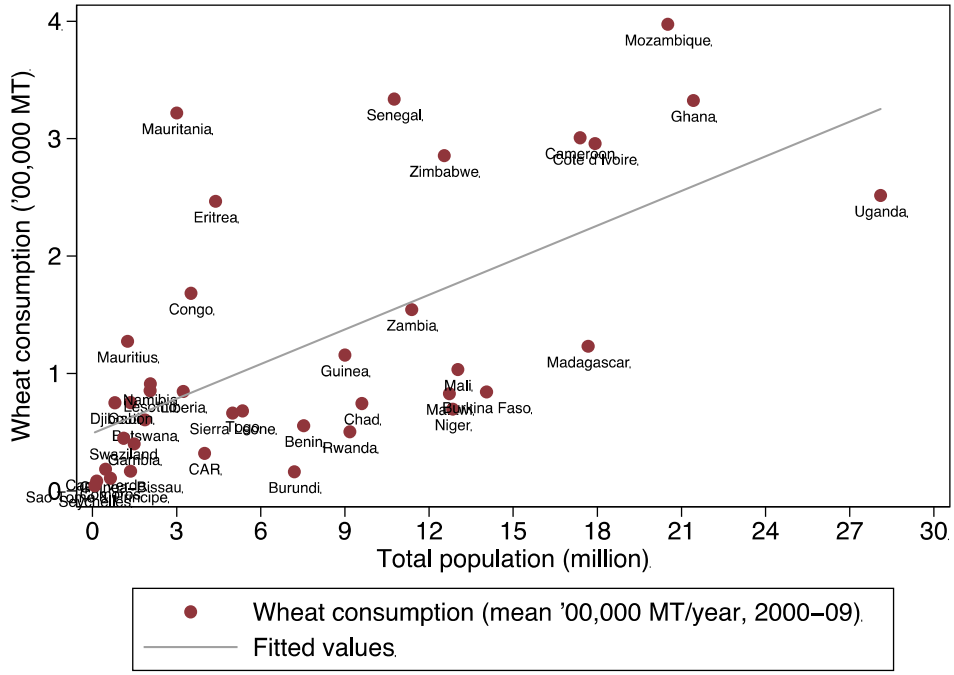



Note: Slope of fitted line = 0.247 (p=0.000)

[18] Again, no consumption data are available for DRC, Equatorial Guinea, or Somalia.

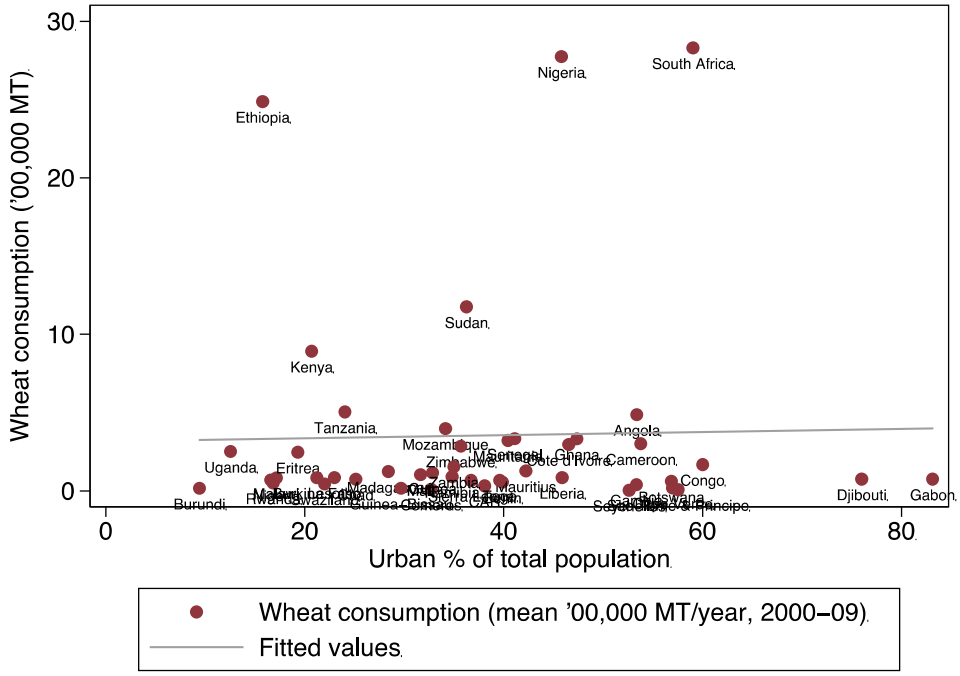
Figure 19. (cont.)

**b. Excluding the Big 7 (South Africa, Nigeria, Ethiopia, Sudan, Kenya, Tanzania, Angola)**




Note: Slope of fitted line = 0.098 (p=0.000)

**Figure 20. Average Total Wheat Consumption and % Urban in Total Population, 2000-2009**



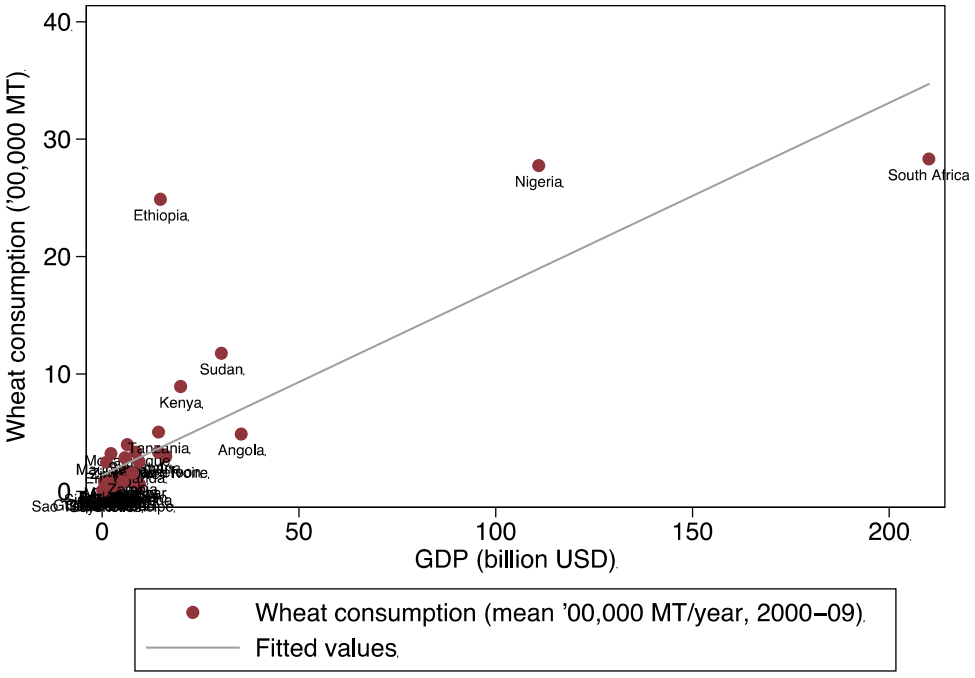

Note: Slope of fitted line = 0.010 (p=0.882). Without the big 7, slope = -0.0001 (p=0.986).

An important dimension of population growth in SSA is rapid urbanization. As of 2010, the percentage of all Sub-Saharan Africans residing in urban areas stood at 36.3% (UNPD 2012). Between 1980 and 2010, this percentage rose at a rate of about 2 percentage points every five years. By 2040, more than half of all Sub-Saharan Africans are expected to reside in urban areas (51%). What do the aggregate data suggest about the extent to which more urbanized SSA countries consume more wheat? Figure 20 plots average total wheat consumption in 2000-2009 against the average percentage of a country's population that is urban over the same period. At least at the aggregate level over the 2000-2009 period, there does not appear to be a statistically significant relationship between the share of the population that is urban and total wheat consumption. Regardless of whether we include the big 7, the linear regression line is far from significant (p>0.88). As we will show in Section 4.5, the share of the population that is urban does not affect total wheat consumption in a multivariate setting either.

What about the relationship between income levels (as proxied by GDP) and a country's total wheat consumption? Figures 21a and 21b plot average total wheat consumption in 2000-2009 against the average GDP over the same period (the big 7 are excluded from Fig. 21b). Whether or not we include the big 7, there is a positive, statistically significant relationship between total wheat consumption and GDP (slope = 0.159 with the big 7, slope = 0.169 without; p=0.000 in both cases). As expected, richer countries consume more wheat, and the regression results in Section 4.5 will show that this relationship holds even after we control for other factors.

**Figure 21. Average Total Wheat Consumption and GDP, 2000-2009**

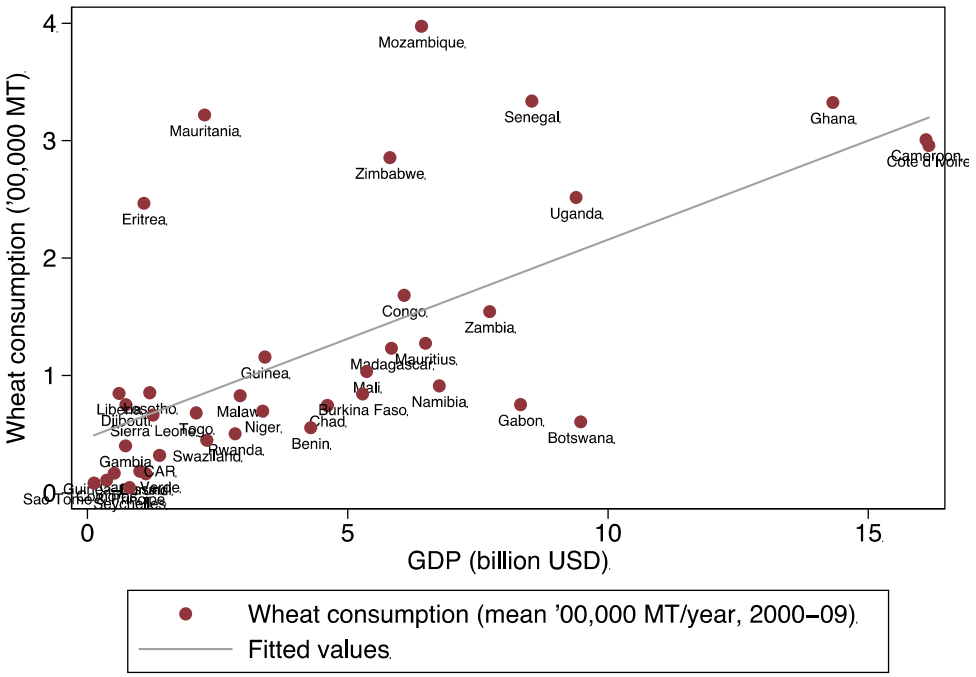
**a. All 45 countries**




Note: Slope of fitted line = 0.159 (p=0.000)

Figure 21 (cont.)

**b. Excluding the Big 7 (South Africa, Nigeria, Ethiopia, Sudan, Kenya, Tanzania, Angola)**




Note: Slope of fitted line = 0.169 (p=0.000)

### 4.4. The Role of Wheat in Food Aid to Sub-Saharan Africa, 1990-2011

As discussed in Section 2, the regression results, which we will present next, include as an explanatory variable wheat received as food aid in recent years. Byerlee (1987) noted 25 years ago that wheat food aid received in the past was an important driver of commercial wheat imports and wheat consumption in the present. To what extent are large quantities of wheat still flowing to Sub-Saharan African countries in the form of food aid? Table 5 shows the average annual MT of wheat, maize, and rice food aid delivered to SSA countries during three periods: 1990-99, 2000-09, and 2010-11.[19] Although the total amounts of maize and rice food aid to Africa have declined over time, wheat food aid volumes have held steady over the last two decades in the range of 1.27 million MT per year. Moreover, wheat's share of the total wheat, maize, and rice food aid calories delivered to SSA has risen over time from 43% in the 1990s to more than 56% in 2010-11. Thus, wheat food aid flows to Sub-Saharan Africa continue to be substantial, and are likely to be an important driver of wheat consumption there.

[19] Table 5 is based on data from the World Food Programme Food Aid Information System, which only reports food aid to SSA countries beginning in 1988.

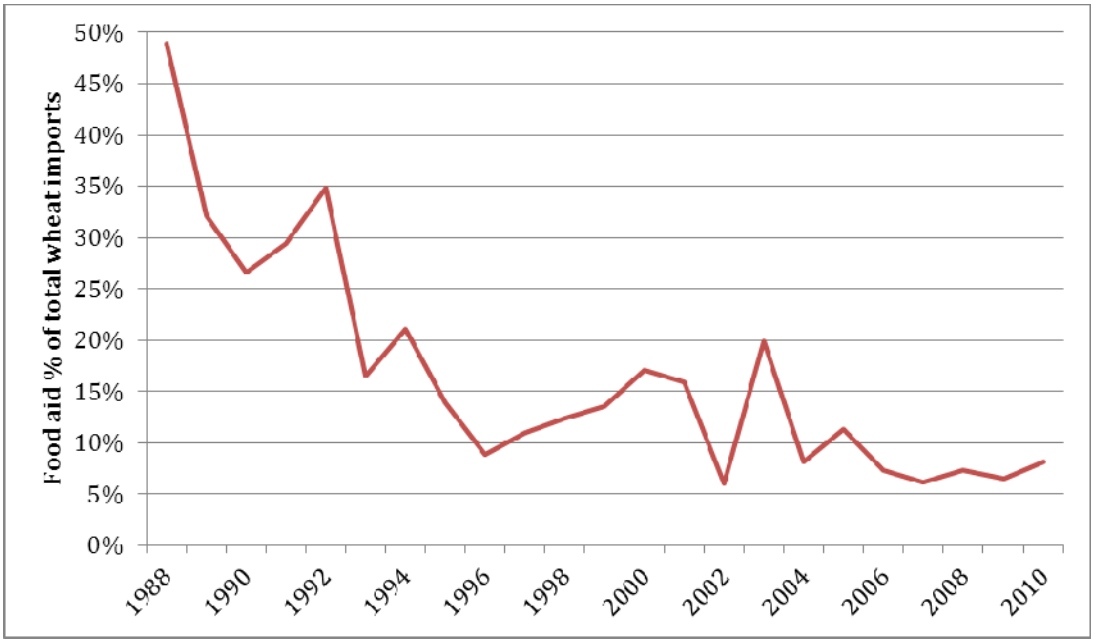
**Table 5. The Role of Wheat in Food Aid Deliveries of Wheat, Maize, and Rice to SSA Countries, 1990-2011**

| | Average annual food aid deliveries to SSA countries [a] | | | % of total (wheat+maize+rice) food aid calories delivered [b] | | |
|---|---|---|---|---|---|---|
| Years | Wheat grain + flour (mil MT, grain equivalent) | Maize grain + meal (mil MT, grain equivalent) | Rice (mil MT, milled equivalent) | Wheat grain + flour | Maize grain + meal | Rice |
| 1990-99 | 1.24 | 1.17 | 0.34 | 43.0% | 44.0% | 12.9% |
| 2000-09 | 1.29 | 0.90 | 0.28 | 50.0% | 38.2% | 11.9% |
| 2010-11 | 1.26 | 0.63 | 0.26 | 56.4% | 30.9% | 12.8% |
| 1990-2011 | 1.27 | 1.00 | 0.31 | 47.1% | 40.5% | 12.5% |

Source: World Food Programme (WFP) Food Aid Information System
Notes: [a] Excludes soya-fortified wheat flour, maize grain, and maize meal.
[b]Calorie content is per Wright (2011): 3,338 Kcal/kg for wheat; 3,650 Kcal/kg for maize; and 3,656 Kcal/kg for rice.
Columns sum to 100% +/- 0.1%.

However, although the total tonnage of wheat food aid delivered to SSA each year has not changed much over the last two decades, the relative importance of food aid in total wheat imports has declined markedly over time. Figure 22 shows the annual share of total wheat imports coming from food aid from 1988 and 2010. Food aid imports accounted for nearly 50% of total wheat imports by SSA in 1988. By the late 2000s, this share had dropped to 7% as commercial imports soared. Thus, although food aid may continue to be a driver of wheat consumption in SSA, factors affecting commercial imports of wheat are likely to be even more important drivers of demand.

**Figure 22. Food Aid's Share of Total Wheat Imports by SSA, 1988-2010**




Sources: World Food Programme Food Aid Information System and FAOSTAT Trade database.

### 4.5. Regression Results: The Determinants of Country-level Wheat Consumption in Sub-Saharan Africa

Thus far in the paper, our discussion of the potential drivers of rising wheat consumption in Sub-Saharan Africa has been based mainly on descriptive and/or bivariate results. But many of the potential drivers of wheat demand, such as growing populations, rising incomes (proxied by GDP), urbanization, and increasing participation of women in the labor force may be highly correlated, making it difficult to disentangle *ceteris paribus* effects using only bivariate techniques. We, therefore, estimate a multivariate econometric model using panel data from 45 SSA countries over the period 1980-2009. The dependent variable in the model is total wheat consumption (including food aid) in MT and the explanatory variables are intended to capture many of the likely drivers of growing wheat demand based on economic theory and previous research. [20]

Fixed effects estimation results are presented in Table 6. There are two broad sets of estimation results: specification A, which includes world prices of wheat and other commodities but no year dummies; and specifications B through F, which include year dummies but no world prices. It is not possible to include both year dummies and world prices in the same specification because the two are perfectly collinear: both variables change in the time dimension but do not vary in the cross-sectional (i.e., country) dimension.

We find that the world prices in specification A are neither individually significant nor jointly significant ($p>0.10$), indicating that world price levels are not a major determinant of national wheat consumption over time. However, the year dummies are jointly significant ($p<0.05$). The year dummies capture changes in world prices as well as changes in other Sub-Saharan Africa-wide and/or global conditions, although it is not possible to isolate these effects from each other. The remainder of the discussion focuses on the results from the year dummy specifications (B through F).

What are the drivers of wheat consumption in SSA as revealed by the econometric results? Two drivers are positive and statistically significant ($p<0.05$) in all specifications: GDP and population. Other factors constant, wealthier countries and more populous countries have higher demand for wheat. A US$1 million increase in a country's GDP raises its wheat consumption by 1.9 to 4.8 MT, *ceteris paribus*. Although highly statistically significant, the magnitude of the GDP effect is quite small: in elasticity terms it is only 0.09 to 0.22. The total population effect, on the other hand, is both statistically and economically significant. A 1,000-person increase in total population raises a country's wheat consumption by 30 to 50 MT, other factors constant. At these rates and given United Nations (UN) population forecasts for SSA, wheat demand there is expected to increase by 6.7-11.2 million MT (total) between 2010 and 2020, and by 7.7-12.8 million MT (total) between 2020 and 2030 (UNPD 2012 and authors' calculations). These are large increases given that total wheat consumption in Africa in 2009 stood at 18.8 million MT (FAOSTAT).

Interestingly (though not surprisingly given the bivariate results in Figure 20), changes in the percentage of the population living in urban areas do not have a statistically significant effect on total wheat consumption at country level in SSA. This finding is contrary to the conventional wisdom and our *a priori* expectations so we do a number of robustness checks to verify the result.

[20] We also estimated similar models in per capita consumption terms but the results were highly sensitive to model specification. We therefore focus on the total consumption results.

## Table 6. Regression Results – Determinants of Country-level Wheat Consumption (MT) in SSA

| | (A) | | (B) | | (C) | | (D) | | (E) | | (F) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Explanatory variables | Coef. | p-val. | Coef. | p-val. | Coef. | p-val. | Coef. | p-val. | Coef. | p-val. | Coef. | p-val. |
| **GDP (US$ million)** | **4.598** ** | **0.031** | **4.485** ** | **0.030** | **4.848** ** | **0.026** | **1.868** *** | **0.002** | **2.127** *** | **0.000** | **1.911** *** | **0.001** |
| **Total population ('000)** | **29.192** *** | **0.000** | **30.273** *** | **0.000** | | | **50.171** *** | **0.000** | **47.846** *** | **0.000** | **49.122** *** | **0.000** |
| **% urban in total population** | **-2.79E+03** * | **0.084** | **-7.275** | **0.996** | | | **305.036** | **0.931** | **836.105** | **0.800** | **3167.435** | **0.414** |
| Consumer price index (2005=100) | -5.484 | 0.905 | 75.544 | 0.267 | 76.959 | 0.237 | 21.159 | 0.634 | 67.202 | 0.119 | 42.370 | 0.152 |
| Official exchange rate (LCU per US$) | -28.576 * | 0.071 | -21.828 | 0.121 | -26.170 | 0.139 | -8.870 | 0.411 | -6.794 | 0.436 | -0.291 | 0.955 |
| World wheat price, US$/MT | -391.562 | 0.205 | | | | | | | | | | |
| World wheat: world maize price ratio | -1.56E+04 | 0.605 | | | | | | | | | | |
| World wheat: world rice price ratio | 4.93E+04 | 0.334 | | | | | | | | | | |
| World crude oil (petroleum) price, US$/barrel | 987.330 | 0.279 | | | | | | | | | | |
| **Urban population ('000)** | | | | | **25.577** *** | **0.001** | | | | | | |
| **Rural population ('000)** | | | | | **36.465** *** | **0.006** | | | | | | |
| **Ratio of female to male labor force participation rate (%)** | | | | | | | **5589.439** ** | **0.033** | **5084.700** * | **0.053** | **6178.415** * | **0.093** |
| **Wheat food aid received (MT, moving average of 1-3 years ago)** | | | | | | | | | **0.687** *** | **0.000** | | |
| Wheat food aid received (MT, moving average of 5-7 years ago) | | | | | | | | | | | -0.00277 | 0.993 |
| Constant | -3.83E+04 | 0.671 | -1.19E+05 * | 0.089 | -1.55E+05 * | 0.080 | -9.89E+05 *** | 0.000 | -9.49E+05 *** | 0.000 | -1.12E+06 *** | 0.008 |
| Year dummies | No | | Yes | | Yes | | Yes | | Yes | | Yes | |
| Observations | 1,086 | | 1,086 | | 1,086 | | 765 | | 727 | | 583 | |
| Number of countries | 45 | | 45 | | 45 | | 44 | | 44 | | 43 | |
| Years covered | 1980-2009 | | 1980-2009 | | 1980-2009 | | 1990-2009 | | 1990-2009 | | 1990-2009 | |
| Within R-squared | 0.759 | | 0.765 | | 0.767 | | 0.874 | | 0.875 | | 0.844 | |
| F-test: overall model | 221.11 *** | 0.000 | 2,905.40 *** | 0.000 | 9,951.31 *** | 0.000 | 2,420.26 *** | 0.000 | 1,589.24 *** | 0.000 | 834.57 *** | 0.000 |
| **F-test: Joint significance of world prices & price ratios** | **0.67** | **0.618** | | | | | | | | | | |
| **F-test: Joint significance of year dummies** | | | **3.23** *** | **0.000** | **2.86** *** | **0.001** | **2.45** *** | **0.008** | **2.06** ** | **0.027** | **2.10** ** | **0.032** |
| **F-test: coefficients on rural and urban populations are equal** | | | | | **0.34** | **0.562** | | | | | | |

Source: Authors' calculations.

Notes: Key results in **bold**. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Estimated via fixed effects with robust standard errors clustered at country level. No consumption data for DRC, Equatorial Guinea, or Somalia. Seychelles dropped from regressions (D) and (E) due to lack of data on female labor force participation. Ethiopia PDR dropped from regression (F) due insufficient observations after including 3-5 year moving average food aid variable.

First, we estimated specification C, where instead of including variables for total population and the percent urban in total population, we include the urban population and rural population as separate explanatory variables. An F-test reveals that the coefficients on the urban and rural population variables are not statistically different from each other. This suggests that it is an increase in a country's population that raises a nation's demand for wheat, regardless of if that increase is in urban or rural areas. Second, we estimated models including an interaction term between total population and the percent urban in total population (urbanization), an interaction term between urbanization and the year dummies, or an interaction term between urbanization and regional dummies. We also estimated models that used different definitions of urbanization, i.e., the urban population growth rate or the percentage of the urban population living in the largest city. However, none of these variables was statistically significant at the 10% level. Thus, regardless of the model specification, we find no statistically significant relationship between urbanization and country-level wheat demand, other factors constant.

Conventional wisdom suggests that urbanization is a key driver of rising wheat consumption in SSA, yet we find no empirical evidence to support this claim. What are some potential reasons for this? First, it may not be changes in the share of the population living in urban areas in and of itself that affects demand. As we discuss below, it may be the demographic and economic changes that often go hand-in-hand with urbanization that affect demand (e.g., rising opportunity cost of women's time, rising incomes, etc.). Second, there may be measurement error in the urbanization variables used in the analysis. Tiffen (2003) discusses the problems with population data for SSA countries, including infrequent censuses, late reporting of census results to UN or World Bank population databases, and differences in the definition of urban across countries and over time. Measurement error tends to lead to attenuation bias (Wooldridge 2010), which in this case would mean that the magnitude of the coefficient on urbanization in underestimated. A third possible reason for the finding of no statistically significant effect of urbanization on wheat demand may be omitted variable bias. Recall that domestic retail prices for wheat products and other staple foods are not included in the model due to lack of data. These variables are likely to be important determinants of wheat demand, and their omission may be biasing the parameter estimates for the variables included in the model.

Although we do not find empirical evidence that urbanization *per se* has a statistically significant effect on country-level wheat consumption, we do find evidence that demographic and economic changes associated with urbanization have important effects on wheat demand (Senauer, Sahn, and Alderman 1986; Byerlee 1987; Morris and Byerlee 1993; Kennedy and Reardon 1994). One such demographic change is an increase in women's participation in the labor force (ibid). While we do not find a statistically significant effect of women's labor force participation rate on wheat consumption, we do find that an increase in the *ratio* of women's to men's labor force participation rates does have a statistically significant effect. A one-percentage point increase in the ratio of women's to men's labor force participation rates raises wheat consumption by roughly 5,000-6,200 MT, other factors constant ($p<0.10$, specifications D through F). In other words, if women's labor force participation increases at a faster rate than that of men, wheat demand is expected to increase, *ceteris paribus*. This result is consistent with the findings of Kennedy and Reardon (1994), which indicate that increased work outside of the home by women (a proxy for an increase in the opportunity cost of women's time) has a positive effect on bread expenditures in Kenya.

The last two sets of results (E and F) examine the extent to which past food aid receipts affect current wheat consumption. The two different specifications of the food aid variable capture wheat food aid received one-to-three years ago (column E) and five-to-seven years ago

(column F). While wheat food aid received in the more recent past has a positive and statistically significant effect on current wheat consumption (p=0.000), wheat food aid received in the more distant past has no such effect (p=0.993). Current food aid receipts (which are included in the dependent variable, total consumption) are highly correlated with the quantity of food aid received one-to-three years ago (correlation coefficient = 0.804). Thus, the positive and statistically significant coefficient on food aid receipts one-to-three years ago is probably picking up on current consumption of food aid wheat, rather than capturing habits formed by lagged food aid. Byerlee (1987) and Morris and Byerlee (1993) argue that in the first decades after independence, wheat food aid exposed many African consumers to wheat, may have encouraged them to develop a preference for wheat over locally-produced staples, and encouraged the development of domestic wheat processing facilities. Our model is not able to capture these effects because the wheat food aid data used in the model only go back to 1988, well after these effects are likely to have occurred.

Thus, to summarize, the key drivers of wheat consumption in Sub-Saharan Africa based on the econometric results are increases in: (i) GDP, (ii) total population, (iii) women's labor force participation rate relative to men's, and (iv) food aid receipts.

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

Wheat consumption is rising rapidly in Sub-Saharan Africa. Between 2000 and 2009, total wheat consumption in SSA increased at an average rate of 650,000 MT (or approximately 4.2%) per year. Econometric results suggest that the key drivers of rising wheat consumption in Sub-Saharan Africa are rising incomes (proxied by GDP), growing populations, women's participation in the labor force increasing at a faster rate than men's, and wheat food aid. Given population projections alone, wheat consumption in Sub-Saharan Africa is expected to increase at an even faster rate in the coming decades: 670,000 MT to 1.12 million MT per year between 2010 and 2020, and 770,000 MT to 1.28 million MT per year between 2020 and 2030. Rising incomes and women's rising participation in the labor force are likely to boost wheat consumption even further. The econometric results do not point to urbanization as a statistically significant determinant of country-level wheat consumption. However, measurement error in the urbanization variable may be biasing this estimate downward. In most of SSA, wheat consumption and expenditure shares are systematically higher in urban than in rural areas, so urbanization, which is occurring rapidly in the region, would seemingly be an important driver of wheat demand. The percentage of the population living in urban areas is projected to increase from 36% in 2010 to over 50% by 2040 (UNPD 2012). In countries such as Kenya and Nigeria, another important driver of increasing demand is the declining price of wheat relative to other staples (e.g., maize and rice). Following global trends, the price of wheat relative to maize and other staples has declined recently in several wheat consuming countries in SSA, making wheat relatively more affordable to local consumers.

Africa's wheat consumption is also rising in per capita terms. Between 2000 and 2009, per capita wheat consumption increased by an average of 0.35 kg/year. These increases have been coupled with rising rice consumption (yearly increases of 0.32 kg/capita) and stable per capita maize consumption. Together, these results suggest that per capita grain availability and consumption is improving in SSA. Although food availability is only one dimension of food security, rising grain consumption, with important contributions from wheat, bodes well for food security in the region.

Perhaps ironically, per capita staple grain consumption in Sub-Saharan Africa is rising at the same time that the region is becoming more dependent on imported staples. Wheat consumed in Sub-Saharan Africa is increasingly coming from imports from non-SSA countries as wheat production in SSA has failed to keep up with growing demand. While wheat produced in Sub-Saharan Africa accounted for more than half (53%) of total wheat consumption in the early 1980s, by the late 2000s, that percentage had dropped to 33%. Although it is one of the dominant imported staples, wheat is not the only staple grain for which SSA faces a deepening structural deficit. Wheat net imports are increasing at the fastest rate but the rice gap is also growing. Thus, Sub-Saharan Africa is becoming increasingly reliant upon cereal imports to feed itself.

World prices for all staple food grains have risen dramatically since the mid-2000s, and most projections indicate that these higher food prices are likely to persist for some time. Consequently, Sub-Saharan African countries' food grain import bills are likely to rise in the coming years. Between 2006 and early 2012, wheat prices in international markets generally rose less rapidly than the world prices of rice and maize, improving the relative affordability of wheat and favoring wheat imports. However, droughts in 2012 are putting upward pressure on wheat prices either directly by reducing wheat output levels (as in eastern Europe), or indirectly by reducing maize output levels (as in North America), which raises maize prices and puts upward pressure on the prices of wheat and other food grains. Climate change may

make severe droughts in these and other regions more common in the future. Furthermore, an El Niño is considered *likely* in late 2012, with potentially negative consequences for wheat production in another major exporter to Sub-Saharan Africa: Australia (World Bank 2012). Thus SSA is becoming increasingly reliant upon imported staple food grains at a time when world prices for these commodities are rising and when prices and supplies are likely to become more variable as a result of climate change.

Sub-Saharan Africa's rising demand for wheat points to another potential dilemma. In general, wheat consumption is higher in urban areas than in rural areas, and at present most of the urban demand for wheat in SSA is being met by imports or domestic production on large-scale commercial farms. Outside of Ethiopia, very little of the wheat demanded in SSA is produced by smallholders. Rising wheat demand therefore entails few urban-rural synergies and minimal prospects to contribute to broad-based economic development through the structural transformation process (Johnston and Mellor 1961; Johnston and Kilby 1975; Mellor 1976).

What, then, are some of the options available to policymakers, and what are the pros and cons of these options? One option is a neutral approach in which policymakers allow consumption patterns to evolve according to international market prices, consumer preferences, and the strategies of food milling and retailing companies. Under this approach, large imports of wheat (and rice) are likely to continue. On the positive side, food prices should be capped at import parity in an open trade environment. On the negative side, continued large-scale food grain imports would be a drain on foreign exchange and are likely to be a risky proposition under increasing price volatility in the face of climate variability and change. In addition, the urban-rural synergies of such an approach are likely to be minimal for the reasons outlined above.

A second option would be to actively use trade policy (e.g., tariffs, protection) and/or taxes to increase the prices of imported staples relative to the prices of staple food grains that are widely grown by smallholders. The goals of such an approach would be: (i) to shift consumption toward staples such as maize and cassava that are grown and sold widely by African farmers; (ii) to increase incentives for domestic production of those staples; and (iii) to stimulate rural/urban synergies and contribute to structural transformation and economic development. If such an approach succeeds at stimulating *both* increased production of staple food grains *and* increased demand for those domestically produced staples, then this approach may bring about the desired synergies. If tariffs and taxes are used, such an approach could also raise government revenues. The downsides of such an approach are that it requires more public sector technical skill to maintain food prices at import parity levels, and it would raise the food bills of consumers if they choose not alter their consumption patterns. However, the urban non-poor tend to spend more on wheat than the urban poor, so the higher imported staple food bills may be more of an issue for the non-poor than the poor. Furthermore, if the policies stimulate only a supply response with no increase in demand, or vice versa, there could be negative consequences for net buyers or net sellers of staple food grains. For example, an increase in domestic production of staple food grains but no increase in demand for these items would put downward pressure on staple food prices to the detriment of net sellers. On the other hand, if the policies succeed in shifting consumer demand toward domestically produced staples but there is no supply response, this would put upward pressure on staple food prices to the detriment of net buyers. In general, net sellers tend to be wealthier than net buyers, so the welfare effects of the latter scenario are likely to be more deleterious than the former. Even if there is a supply response, given the biological lags in production as well as adjustment costs and rigidities, the supply response will not be immediate. As a result, food prices would be likely to rise in the short-run under this policy approach.

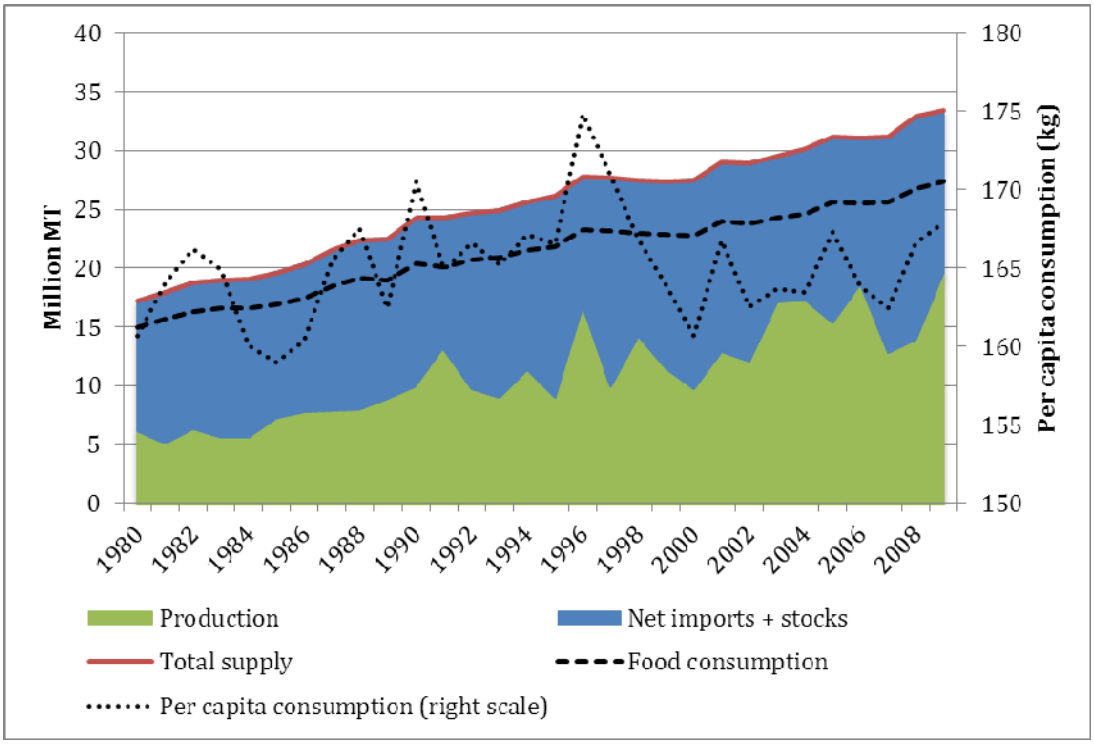
A third option would be to promote domestic production of wheat and other staple grains through non-distortionary measures such as investments in rural infrastructure, irrigation, agricultural research, development, extension, and market information systems. The goals of such an approach would be similar to option #2 but the means of achieving those goals would be different. The pros are similar to option #2 with a few exceptions. There would be no additional government revenue from tariffs or taxes but these types of rural/agricultural investments have been shown to promote *both* agricultural growth *and* poverty reduction (Fan, Gulati, and Thorat 2008; Economist Intelligence Unit 2008). Furthermore, because it does not entail taxes or tariffs to raise the prices of imported staples, option #3 does not have the downside of option #2 of raising food prices in the short-run. While it makes sense to expand wheat production in areas where it is more profitable for farmers to grow it and cheaper than imports for local consumers, this approach will require investments in research, extension, and value chain development for strengthening domestic production and marketing capacity. However, lags between investments to raise production and the supply response remain an issue, and as in option #2 there could be detrimental effects on net sellers if the supply response is not accompanied by increased demand for domestically produced staples.

A fourth option is the promotion of value addition and processing of the staples grown by smallholders in order to improve their convenience and reduce preparation time (Boughton and Reardon 1997). Recall that a key driver of rising demand for wheat is the rising opportunity cost of time, particularly for women, and the greater relative convenience of wheat products compared to coarse grains. A related strategy is the promotion of blending domestically produced staples with wheat flour. These strategies have the potential to increase rural/urban synergies and possibly employment. However, consumer demand for the processed coarse grains and blended flours may be uncertain. Furthermore, processing facilities may require significant capital investments and investors may not be willing to take the risk if demand is uncertain.

These four options are not necessarily mutually exclusive or exhaustive, and the ‘best’ option or combination of options is likely to be country-specific. Policymakers need to identify their objectives and weigh the pros and cons of the various options for different types of households (e.g., rural vs. urban, poor vs. non-poor, net-buyers vs. net-sellers, etc.). A major challenge in identifying the ‘best’ policy approach and in predicting how consumers and producers are likely to respond to changes in relative prices is a paucity of empirical evidence on consumer and producer price elasticities in many SSA countries (Delgado and Miller 1985; Nzuma and Sarker 2010). Thus, additional research is needed to support policymakers in the process of identifying how best to promote rural/urban synergies in the context of rising demand for wheat and other imported staple grains in SSA.

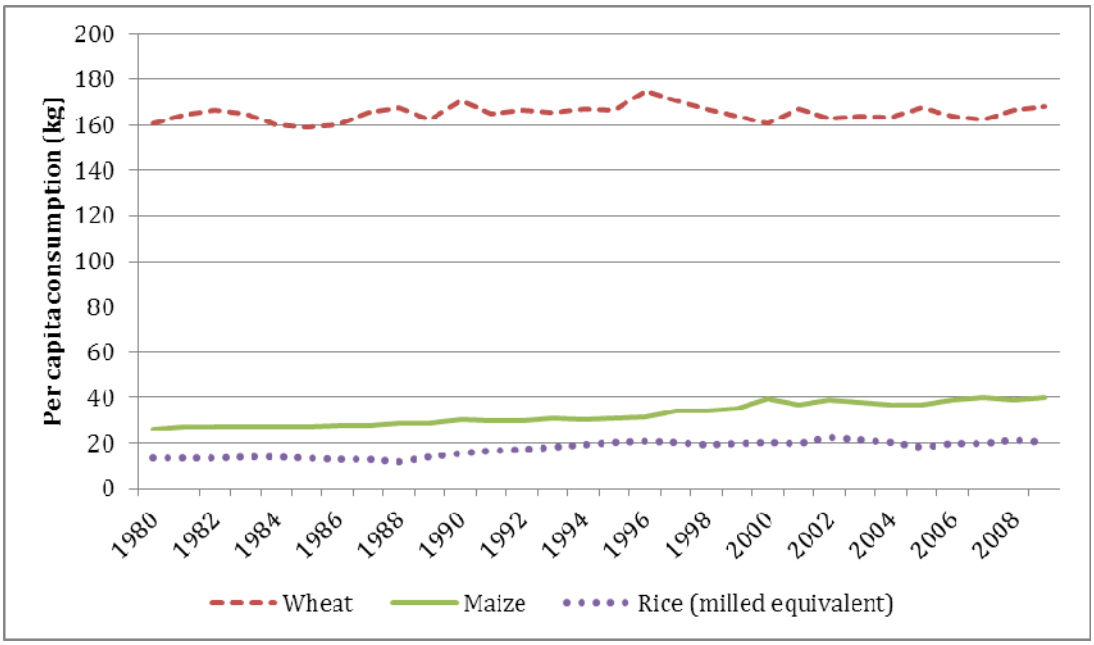
## APPENDIX A

**Figure A1. Wheat Consumption, Production, and Net Imports in North Africa, 1980-2009**



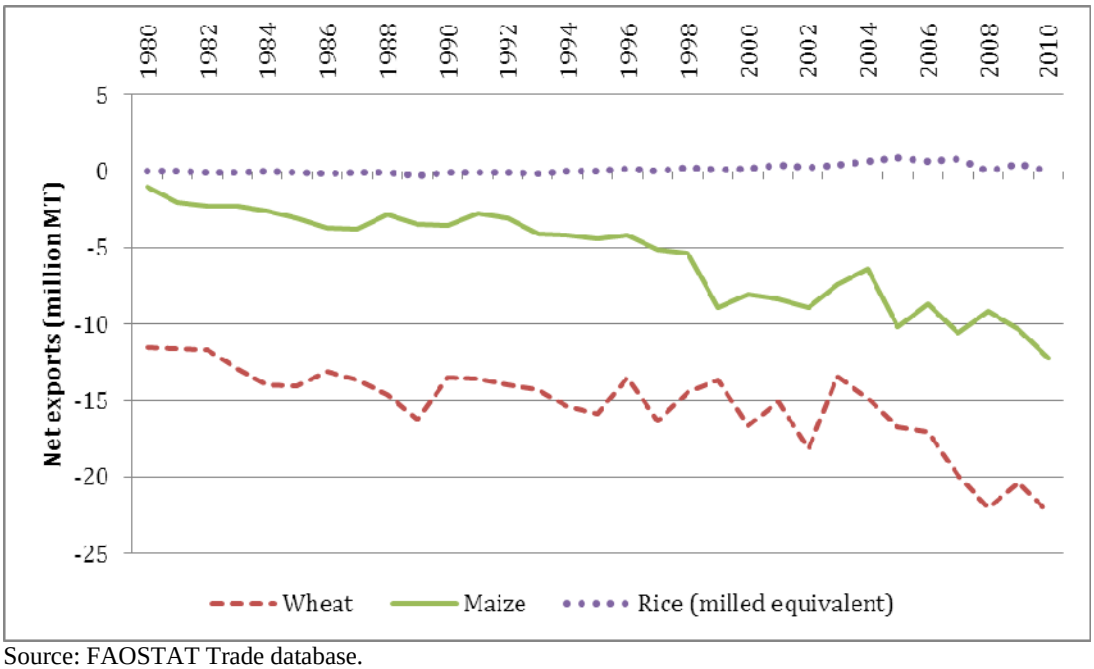

Source: FAOSTAT Commodity Balances and Population databases.
Notes: Total supply estimated as production + imports + stocks – exports.

**Figure A2. Per Capita Wheat, Maize, and Rice Consumption in North Africa, 1980-2009**




Sources: FAOSTAT Commodity Balances and Population databases.

**Figure A3. Net Exports of Wheat, Maize, and Rice by North Africa, 1980-2010**




Source: FAOSTAT Trade database.

## APPENDIX B

**Table B1. Summary Statistics for Variables Included in the Econometric Model**

| Variable | Obs. | Mean | Median | Std. dev. | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Wheat consumption (MT) | 1,337 | 245,870 | 72,575 | 518,275 | 1,230 | 3,379,353 |
| GDP (US$ million) | 1,356 | 8,795 | 2,613 | 25,828 | 76 | 286,172 |
| Total population ('000) | 1,427 | 12,433 | 6,420 | 19,619 | 63 | 154,488 |
| % urban in total population | 1,427 | 33.3 | 32.5 | 15.5 | 4.3 | 85.6 |
| Urban population ('000) | 1,427 | 3,864 | 1,487 | 7,639 | 31 | 75,826 |
| Rural population ('000) | 1,427 | 8,569 | 4,737 | 12,908 | 32 | 78,662 |
| Consumer price index (2005=100) | 1,162 | 62.850 | 61.996 | 52.895 | 7.01E-12 | 1,196.678 |
| Official exchange rate (LCU per US$) | 1,416 | 409.921 | 110.064 | 1,140.702 | 9.33E-12 | 16,208.450 |
| World wheat price, US$/MT | 1,440 | 160.807 | 151.747 | 44.334 | 112.0517 | 325.941 |
| World wheat: world maize price ratio | 1,440 | 1.368 | 1.374 | 0.121 | 1.122 | 1.577 |
| World wheat: world rice price ratio | 1,440 | 0.558 | 0.558 | 0.106 | 0.362 | 0.774 |
| World crude oil (petroleum) price, US$/barrel | 1,440 | 30.849 | 24.640 | 19.416 | 13.074 | 97.035 |
| Ratio of female to male labor force participation rate (%) | 940 | 76.712 | 82.360 | 19.838 | 23.810 | 108.085 |
| Wheat food aid received (MT, moving average of 1-3 years ago) | 909 | 24,880 | 1,771 | 93,966 | 0 | 980,049 |
| Wheat food aid received (MT, moving average of 5-7 years ago) | 715 | 22,762 | 2,149 | 84,769 | 0 | 939,359 |

Source: Authors' calculations. See Section 2 for specific data sources.

**Table B2. Wheat Net Imports and Consumption Trends in Africa by Region and Decade, 1980-2009**

| Region of SSA | Net imports (mean mil MT per year) | | | | Total food consumption [a, b] (mean mil MT per year) | | | Per capita food consumption [b] (mean kg per year) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1980-89 | 1990-99 | 2000-09 | 2010 | 1980-89 | 1990-99 | 2000-09 | 1980-89 | 1990-99 | 2000-09 |
| West | 1.79 | 2.30 | 4.75 | 6.39 | 1.79 (4.1%) | 2.26 (3.1%) | 4.78 (1.6%) | 11.50 | 10.89 | 17.94 |
| Central | 0.53 | 0.62 | 1.06 | 1.40 | 0.30 (1.8%) | 0.40 (0.9%) | 0.66 (0.7%) | 5.61 | 5.59 | 7.03 |
| East | 1.36 | 1.95 | 4.23 | 6.30 | 2.22 (57.4%) | 3.41 (55.3%) | 5.70 (52.1%) | 15.71 | 18.32 | 23.35 |
| Southern excl. RSA | 0.70 | 1.01 | 1.51 | 2.33 | 0.90 (28.6%) | 1.26 (26.9%) | 1.95 (17.3%) | 15.01 | 16.00 | 19.39 |
| RSA | -0.08 | 0.58 | 0.82 | 1.16 | 2.01 (114.9%) | 2.41 (82.0%) | 2.83 (73.2%) | 61.6 | 59.1 | 59.6 |
| **All SSA** | **4.29** | **6.46** | **12.37** | **17.57** | **7.21 (53.8%)** | **9.74 (44.1%)** | **15.92 (34.5%)** | **16.30** | **16.68** | **21.18** |
| North Africa | 13.33 | 14.44 | 17.40 | 22.34 | 17.10 (39.8%) | 21.76 (52.5%) | 25.03 (59.4%) | 163.07 | 167.73 | 164.53 |

Sources: FAOSTAT Commodity Balances, Population, and Trade Databases.

Notes: [a] Mean share of production in total food consumption in parentheses. [b] No data available for DRC or Equatorial Guinea (Central Africa) or Somalia (East Africa).

Total consumption and per capita consumption are of wheat consumed as food (i.e., netting out wheat used for seed, feed, processing, other uses, and waste).

Over the 1980-2009 period, 93% of the wheat used in SSA was for human consumption.

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