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Wheat Value Chains: Global Analysis

EPAR Brief No. 199

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July 27, 2012

Executive Summary

Over the past 20 years, global wheat production and consumption have increased significantly.

- Production has increased 28% or about 1.3% annually.
- Consumption has increased about 24% or 1.1% annually.
- A small number of countries consistently account for over 90% of the export market.
- The import market is more diversified and involves many more countries.
- Wheat is primarily used for food, seed, and industry; only 20% of wheat production is used for animal feed.

The three countries analyzed in separate wheat value chain reports - Ethiopia, India, and Bangladesh - currently have a limited impact in the market. Projections of wheat production and demand, however, suggest that over the next 20 years demand in Bangladesh and Ethiopia will increasingly exceed supply, while India will become a net importer by 2030.

Overview of Data Discrepancies

Estimates of wheat production, area harvested, and therefore yields vary substantially across the USDA Foreign Agricultural Service (FAS), FAO, and various other sources. This variation likely results from the use of different methods for collecting and reporting data. The USDA FAS compiles projections for the current season in progress from multiple sources, including official government sources, and reports on a marketing year basis. While the USDA uses official statistics reported by countries when available, they also supplement from additional sources when needed. The FAO releases data after the season ends, uses member country statistics, which are collected from the relevant country's Ministry of Agriculture or Bureau of Statistics, and uses a calendar year.

- Australia, Pakistan, and India have the highest production growth rates.
 - India is the third largest producer of wheat, accounting for 12% of global production.

Global Wheat Production is Growing and Concentrated

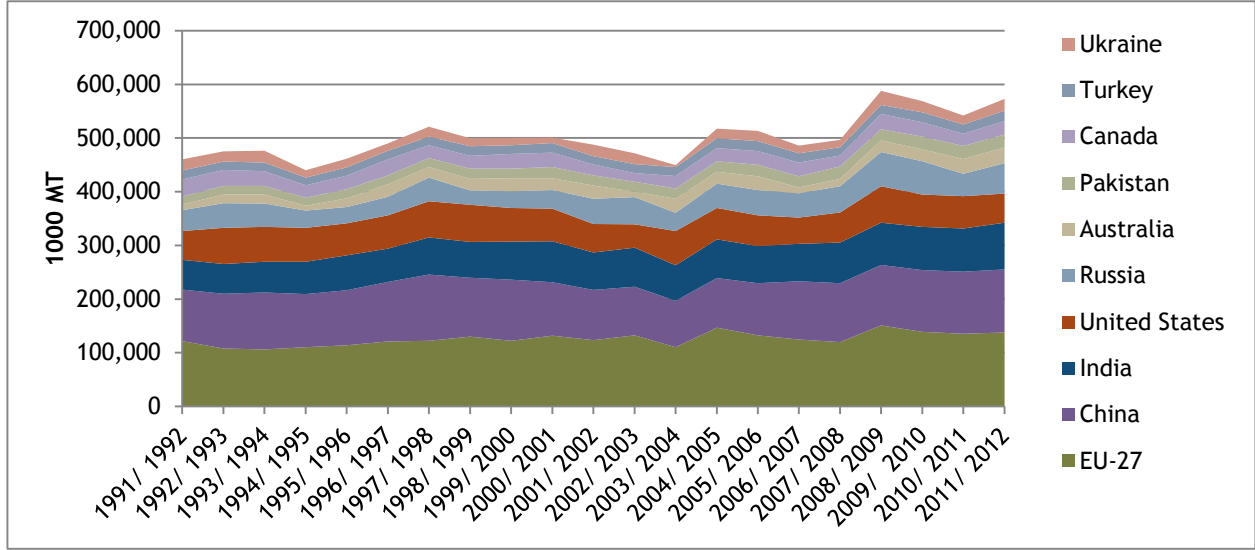
Over the past 20 years, global wheat production has increased over 150 million tons (from 543 million to 694 million). As **Figure 1** illustrates, production has been dominated by the same countries over this period. The top 10 producers account for between 82-85% of global production. Australia, Pakistan, and India had the highest growth rates and India, China, Australia, Russia, and EU-27^a all increased production by more

^a EU-27 aggregates data from current EU-27 members from 1991 on. Thus data from members who have only recently joined are still included in the EU-27 aggregate although they were not at that time members.

NOTE: The findings and conclusions contained within this material are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation.

than 15 million tons. U.S. production has remained flat and Canada’s has decreased. Among focus countries (Bangladesh, Ethiopia, and Bihar, India), India^b is the third largest producer accounting for 12%, while Ethiopia accounts for 0.4% of production in 2011/12 and Bangladesh accounts for 0.2%.

Figure 1: Top 10 Global Wheat Producers



Source: USDA FAS

The growth rate of wheat production in Australia, Pakistan, and India exceeded the population growth rate over the last two decades. Both Australia and India have witnessed significant increases in area cultivated (7 and 5 million hectare increases respectively) and yields (about 0.6 t/ha for both). Pakistan’s increase in area cultivated was not as large, however yields increased almost 0.9 t/ha. EU-27 production growth can be attributed to the increase in yields among individual states, particularly among new EU states. Both the U.S. and Canada lost around 5 million hectares of area cultivated in wheat, but yield gains during the period buffered some of the loss in production.^c

Growth in Global Wheat Production has Kept Pace with Global Consumption

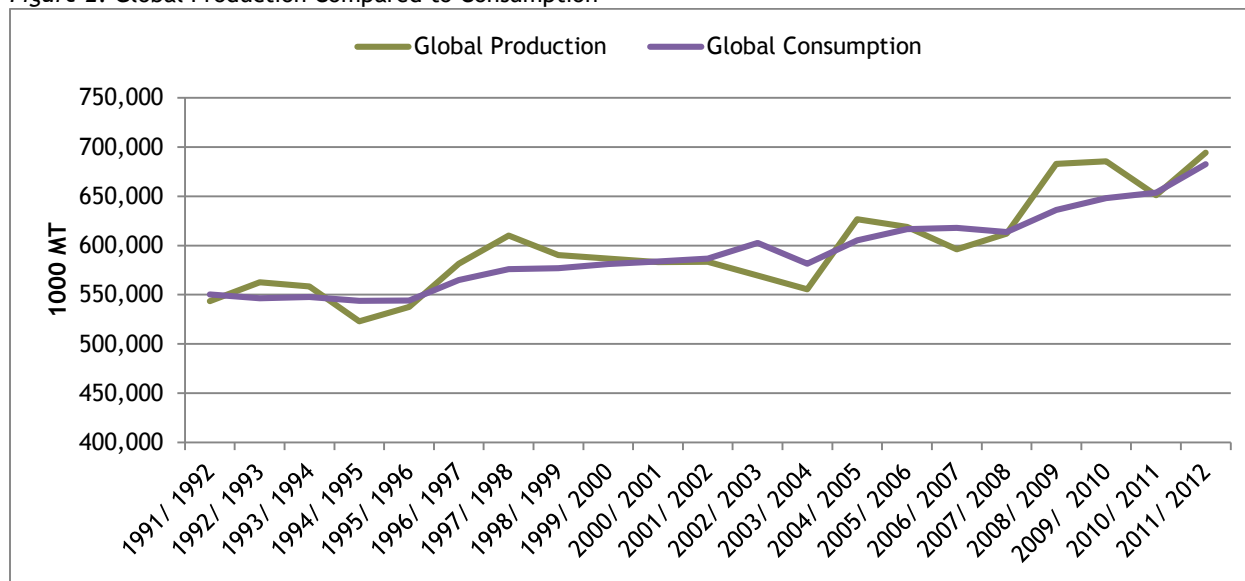
While consumption has grown by over 130 million tons (550 million to 682 million) over the past twenty years, since 2008 consumptions levels have mostly fallen below production levels (see *Figure 2*). The top 10 consumers accounted for 77% of total consumption at the beginning of the period, but this has fallen to 71% in 2011/12 suggesting new wheat consumption areas (*Figure 3*). Egypt, India, and Pakistan experienced the largest growth rate during the period, while EU-27 and India have seen the largest overall increases in consumption (28 and 25 million tons respectively). On the other hand, Russia and Ukraine have seen significant decreases in consumption levels (15 and 9 million tons respectively). Consumption trends in focus countries are similar to production trends: India is the third largest wheat consumer accounting for 12% of global consumption while Ethiopia and Bangladesh each account for 0.6% of global consumption.

- Egypt, India, and Pakistan have the highest consumption growth rates.
- India is the third largest consumer of wheat, accounting for 12% of global consumption.

^b This paper will focus on aggregate India indicators. For reference, Bihar wheat production accounts for approximately 8% of national production.

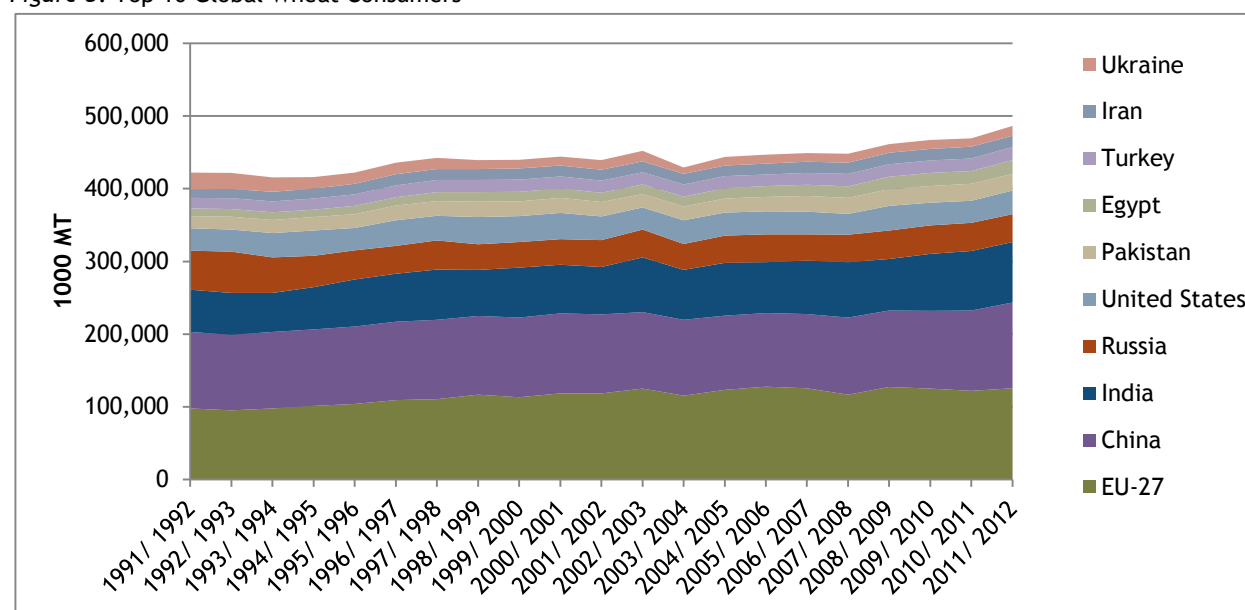
^c In Canada, the ratio of soybeans and canola relative to cereals has increased sharply from .11 in 1990 to .44 in 2007 (Baldwin & Macdonald, 2012). At the same time, crop receipts have significantly decreased for wheat while increasing for canola and other crops (Veeman & Gray, 2010).

Figure 2: Global Production Compared to Consumption



Source: USDA FAS

Figure 3: Top 10 Global Wheat Consumers



Source: USDA FAS

The literature suggests that as Asian countries experience economic growth and urbanization, wheat consumption may increase as it becomes the preferred staple.^{1,2,3} This may explain in part increasing wheat consumption in India and China.

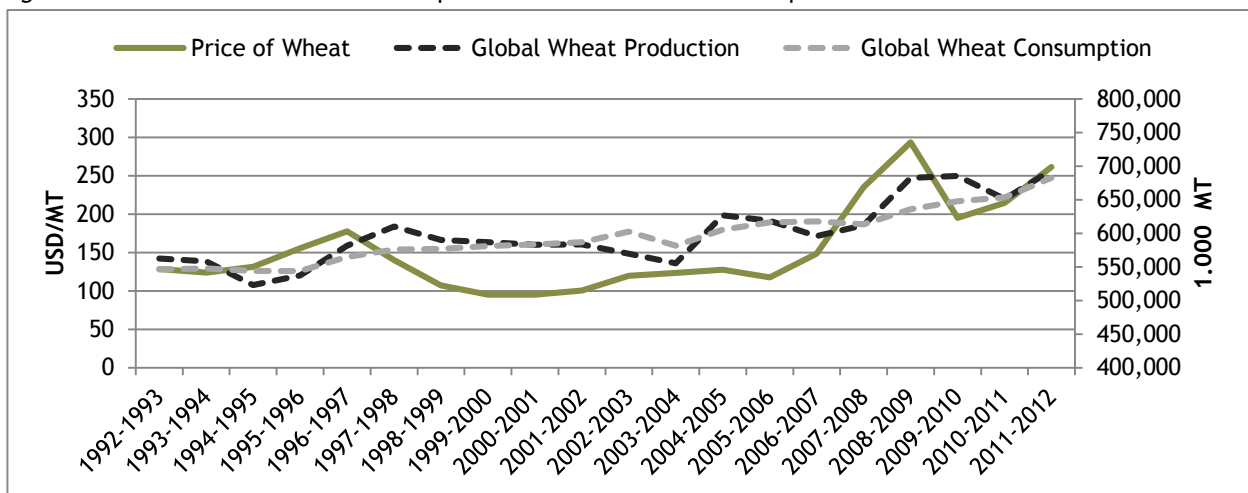
In contrast to most Asian countries, wheat is a staple crop in both Pakistan and Egypt. While growth in Pakistan's wheat consumption has been high, it is lower than the population growth rate as consumer preference has shifted from whole grain flour to lower extraction flour.⁴ Egypt's rate of consumption far exceeds the population growth rate, possibly due to the large subsidies placed on bread that make wheat products the cheapest available food.⁵ Consumption in the former Soviet Union has fallen dramatically responding to market forces transitioning away from livestock intensive production that required significant grain feeds.⁶

Global Wheat Price Have Increased Significantly Over the Past 5 Years

As Figure 4 indicates, the price of generic wheat futures increased by 84% over the past 20 years, from roughly \$129 per ton in 1992 to \$237 per ton in 2012.^d There were two notable price spikes during this period. From 1994-1996, wheat prices surged due to increased wheat demand from developing Asia and poor wheat harvests in major wheat supplying nations, causing prices to increase by 18% from 1994-1995, and 14% from 1996-1997.^e The second major price spike occurred during 2007-2008 in the midst of a global food crisis. During this period grain prices reached the highest levels in the last twenty years, with wheat reaching a high of roughly \$330 per ton. The spike in grain prices was likely caused in part by unexpected reductions in wheat supply, due to increased demand for grain as a component in biofuel production and as livestock feed in India and China.^{7,8} Over the past three years, wheat prices have remained high, but have not reached the levels seen during 2008.

- Wheat prices increased 84% in the past 20 years.
- Two major price spikes occurred in the 1994-1997 time period and the 2007-2008 time period.

Figure 4: International Wheat Price Compared to Production and Consumption



Source: Bloomberg, Chicago Board of Trade (CBOT), generic wheat futures contract W 1

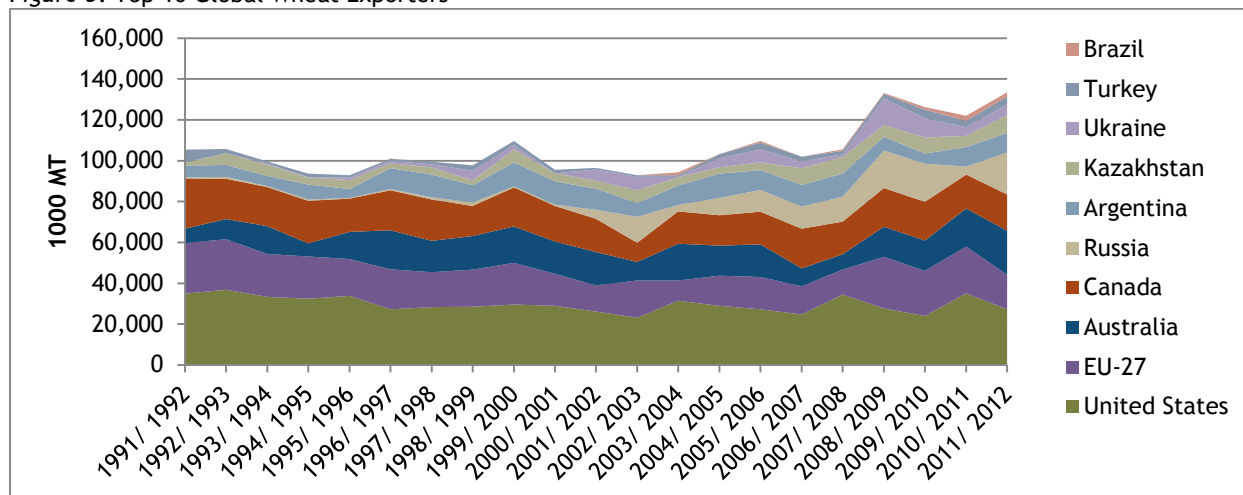
Global Wheat Exports are Dominated by a Few Countries

Global exports have steadily increased over the past 20 years from about 110 million tons to almost 144 million tons. Wheat exports are heavily dominated by a relatively few large exporters: the top 10 exporters accounted for 93% of exports in 2011/12. As Figure 5 indicates, North America, Europe, and former Soviet Union countries are the major exporters, with the former Soviet Union countries increasingly active in the market. Russia and Australia have seen significant export increases, while exports from the U.S., EU-27, and Canada have each fallen around 7 million tons. Top producers such as China, India, and Pakistan are not significant exporters because of their large internal demand. None of the three focus countries are involved in exporting. For a cartographic representation of trends in net trade, see Appendix 1.

A few large exporters - primarily North American, European, and former Soviet countries - dominate the wheat export market.

^d Calculated based on nominal, monthly generic wheat futures prices from 1992-2012. Source Bloomberg
^e IFPRI reported increases of 15% from 1994-1995 and 11% in 1995-1996, based on World Bank Pink Sheet data and using constant 1990 real dollars. (<http://www.ifpri.org/sites/default/files/publications/tmdp16.pdf>)

Figure 5: Top 10 Global Wheat Exporters



Source: USDA FAS

Russia's increase in exports exceeded their increase in production probably in response to the diminishing internal demand for wheat as livestock feed and a slightly negative population growth rate over the period. Australia's rate of increase in exports essentially matched their rate of increase in production and consumption. The large decreases from the beginning to the end of the period for U.S., Canada, and EU-27 are likely more indicative of aberrant years as both 2011/12 exports are near the average for the period and these countries have recently had record export years.

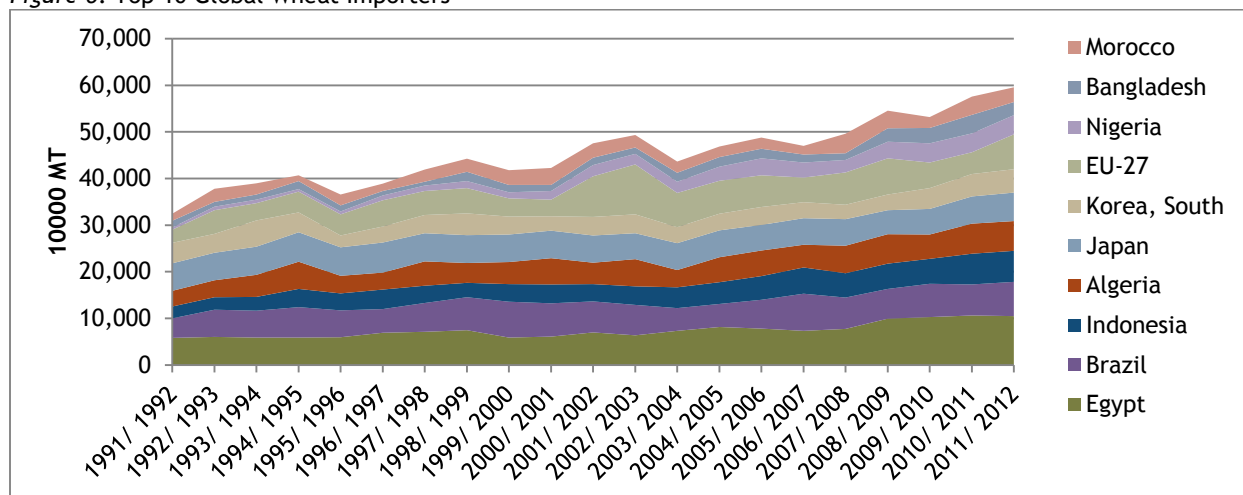
Global Wheat Imports are Growing in Asia and Africa

- The wheat import market is less concentrated than the export market.
- Wheat imports are particularly important in North Africa and Asia.

Global wheat imports have increased at a slightly slower rate than exports (from 108 million to about 140 million) over the past 20 years. The import market is less concentrated than the export market with the top 10 importers only accounting for 43% of total exports in 2011/12. Wheat imports are particularly important in North Africa and Asia as Figure 6 suggests. Imports have increased among all of the top

10 importers, with a growth rate over 80% for all but Japan and South Korea. Nonetheless, no one group of countries dominates imports: Bangladesh falls in the top 10 importing countries, but only accounted for 2% of global imports in 2011/12. Ethiopia accounted for 0.6% in the same period.

Figure 6: Top 10 Global Wheat Importers



Source: USDA FAS

While Egypt’s wheat production has been steadily growing, production growth in Algeria and Morocco has varied. Demand in these North African countries, however, appears to be steadily rising. Increases in wheat imports reflect a 20% increase in per capita consumption over the past 10 years -- the highest in the world.⁹ This rise may be partly due to food subsidies in the region.¹⁰ Imports in Nigeria have grown the fastest during this period, attributed to the lifting of the wheat ban in 1992 and changing consumption patterns among the growing middle class.¹¹ EU-27 is a top importer despite its large production because of its deficit in production of high-protein wheat.¹² Wheat imports have increased significantly in Bangladesh, likely due to growing per capita income and urbanization.^{13,14,15}

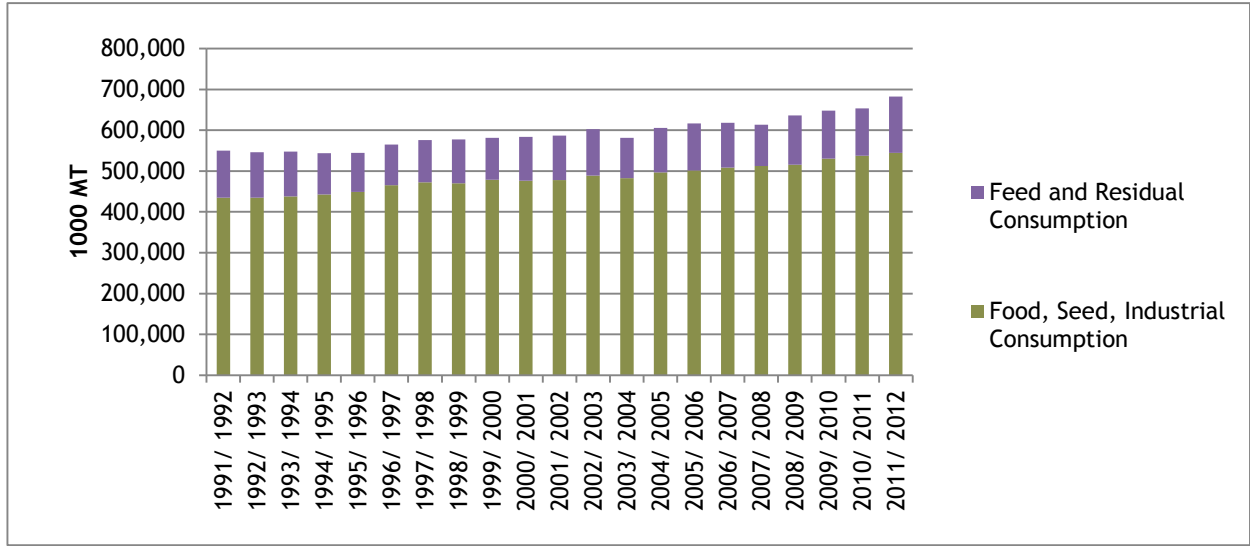
Wheat Consumption is Dominated by Food, Seed, and Industrial uses

- Eighty percent of wheat consumption is food, seed, or industrial consumption with the remaining 20% used for feed and residual.
- Ethiopia and Bangladesh use wheat primarily for food, seed and industrial, while India uses a small fraction for feed usage.

While overall consumption has increased, the pattern of wheat consumption uses has remained relatively consistent (see *Figure 7*). Close to 20% of wheat is used for feed^f and residual and around 80% of consumption goes towards food, seed, and industrial consumption. Within the food, seed, and industrial category, patterns of usage have also remained fairly consistent with food usage hovering around 70% and industrial use at 10%.¹⁶ Among top 10 importers, Ethiopia and Bangladesh have tended to use wheat exclusively for food, seed, and industrial over this

period, while India uses a small fraction for feed usage.

Figure 7: Wheat Consumption Trends by Type of Consumption



Source: USDA FAS

Global demand for wheat for human consumption is expected to grow 2.6% per annum from 2009-2020 while demand for animal feed wheat is predicted to grow at 5% per annum. Wheat in some countries of Europe is likely to be increasingly used for biofuel production (currently maize accounts for the bulk of biofuel production). Animal feed use is expected to be a increasingly significant portion of wheat usage in developed countries.¹⁷

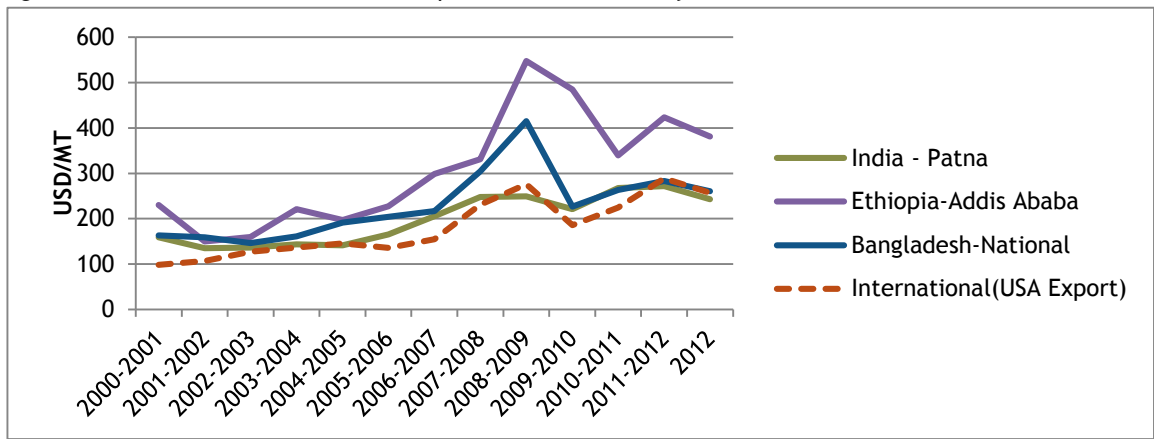
^f Feed usage refers to livestock feed.

Wheat Prices in Focus Countries

Over the past twelve years, wheat price trends in the focus countries have generally mirrored the trends in the international market (see *Figure 8*). However, nominal domestic prices for wheat in Ethiopia and Bangladesh have been consistently higher than the nominal international export price.⁸

Wheat prices in Ethiopia and Bangladesh have been consistently higher than international prices, while prices in India are consistent with international prices.

Figure 8: International Wheat Price Compared to Focus Country Market Prices



Source: FAO GIEWS Price Tool

Domestic Wheat Prices in Ethiopia are Increasingly Higher than International Prices

Over the past twelve years, nominal (unadjusted for inflation) wheat prices in Ethiopia have been on average 70% higher than international prices. In 2009-2010, the disparity reached a peak, with the price of wheat equaling almost 160% of the international price. Over the past three years, Ethiopian wheat prices have been between 47% and 50% greater than the international price.

A number of factors may have contributed to the disparity between local and international prices, including government economic and monetary policies. In 2009, the Ethiopian government devalued its currency, implying that in the preceding years the real gap between international and local prices was smaller than the nominal gap.^{18,19} Inflation also likely played a role, as Ethiopia's money supply grew by a greater percentage than the overall economy from 2004-2006.²⁰ In 2008, the government imposed a foreign currency rationing, which curtailed wheat imports, reducing local wheat supply and raising prices.^{21,22}

Domestic Wheat Prices in Bangladesh Have Converged Towards International Prices

Wheat prices in Bangladesh have been on average 30% greater than the international price over the past twelve years. During 2008-2009, wheat prices in Bangladesh were 50% higher than the international price. However, the difference between international and domestic prices has been decreasing over the last three years, averaging 7%, and the domestic price fell below the international price during 2011.

One factor driving the price discrepancy is demand for commodities in emerging Asian markets, leading to higher prices for many base commodities.^{23, 24} Inflation has also likely played a role. From 2004-2009, food price inflation was consistently higher than the general inflation rate, which may have contributed to higher nominal wheat prices.^{25, 26}

Prices in India Trend Closely with International Prices

⁸ Unless otherwise noted, all prices are nominal.

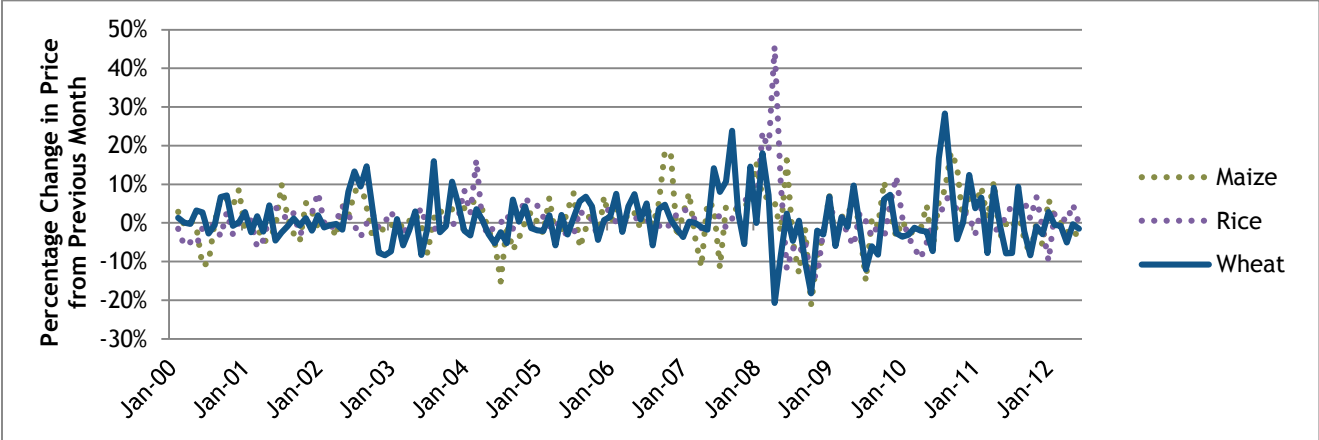
Wheat prices in India-Patna have been relatively close to international wheat prices from 2000-2012. The average price difference between domestic and international prices over this period was 17%. Although prices in India were generally higher than the international price, for a few years the domestic price fell slightly below the international price. In 2008-2009 during the food crisis, and from 2011 through the first quarter of 2012, the domestic price was slightly lower (1%) than the international price.

Government policy explains some of the discrepancy between international and domestic wheat prices. To encourage domestic grain production, the Indian government offers a minimum support price (MSP) to wheat producers, leading to a price distortion and higher domestic prices.^{27,28}

Comparing Global Export Prices for Wheat, Maize and Rice: Wheat and Maize Track More Closely than Rice

Figure 5 shows a comparison of monthly international export prices for wheat, maize and rice from 2000-2012. Over the past twelve years, wheat prices have more closely mirrored maize prices patterns. For the months between January 2000 and June 2012, monthly wheat and maize price changes moved in the same direction 68% of the time. During this same period monthly wheat and rice prices moved in the same direction only 48% of the time. Prices were more volatile for wheat, maize and rice from 2006-2012 than from 2000-2005. From 2000 to 2005, the average monthly price change was 4% for wheat and maize and 2% for rice. Form 2006-2012, the average monthly price change was 6% for wheat and maize, and 5% for rice.

Figure 5: Comparison of Month-to-Month Changes in International Export Prices for Wheat, Maize, and Rice



Source: FAO GIEWS: International Export Prices (Maize (NO. 2 Yellow) USA: Gulf, Wheat(No.2 Hard Red Winter) USA: Gulf, Rice(25% Broken) Thailand: Bangkok)

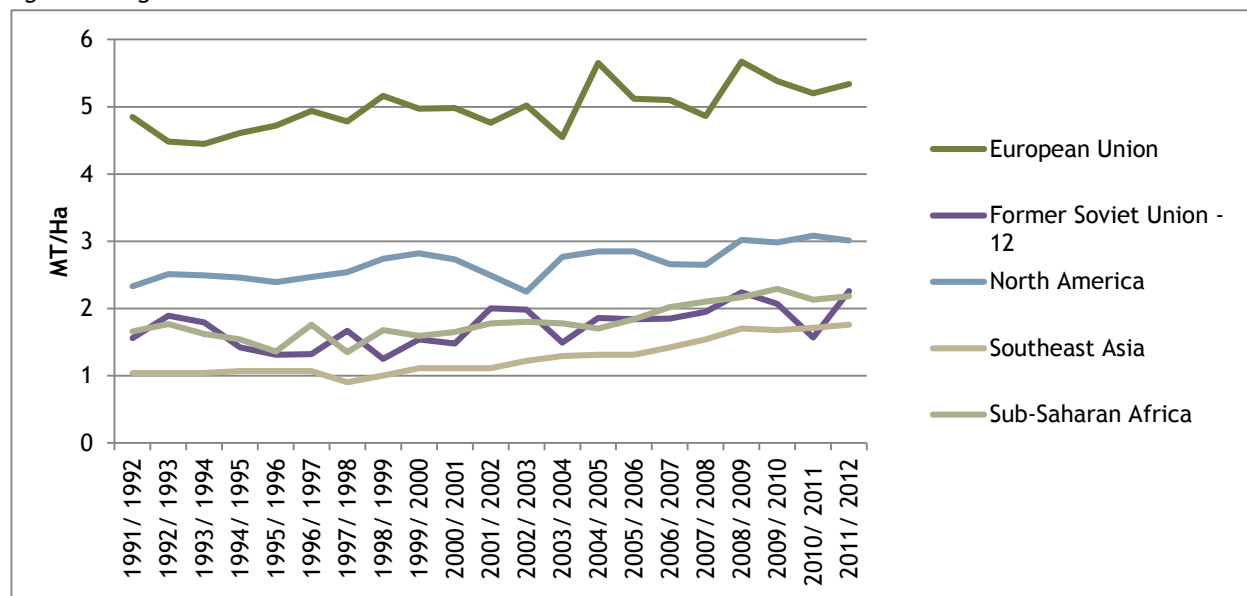
Global Wheat Yields Have Risen Slowly

Globally, yields have increased slightly from 1991-2012 even in less developed regions like Southeast Asia and Sub-Saharan Africa (see *Figure 6*). The European Union has had significantly higher yields than any other region, while Southeast Asia has consistently had the lowest yields.

Figure 7 shows that yields in focus countries have lagged below the global average. Yields in Bangladesh have performed better than the Southeast Asia average, while yields in Ethiopia have been lower than the Sub-Saharan Africa average.

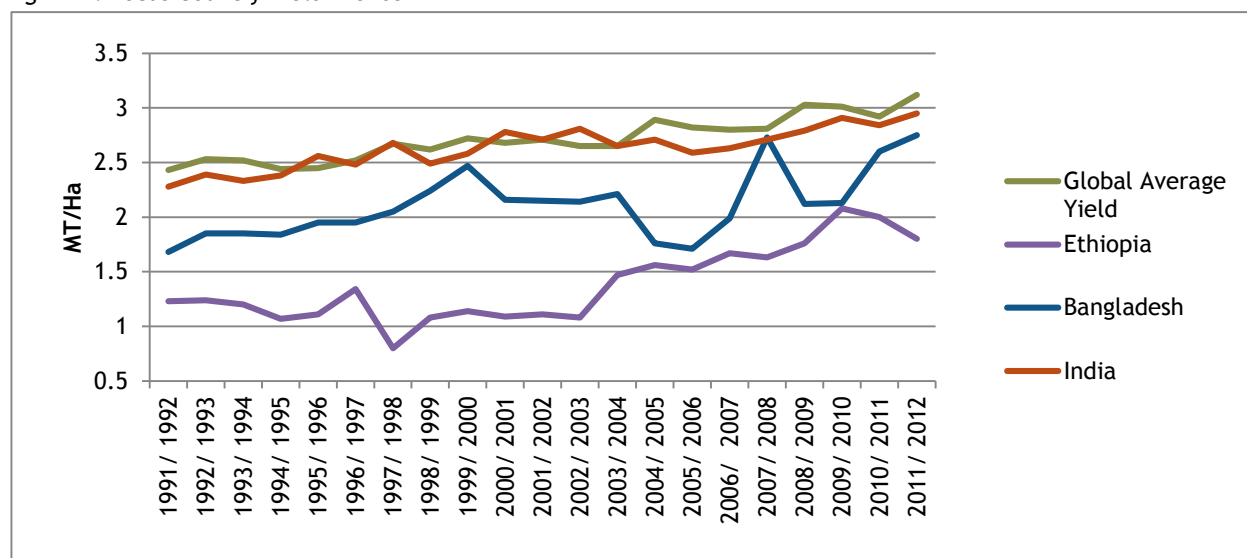
- Yields have increased globally over the last 20 years, although gains have been significantly higher in the European Union and lower in Southeast Asia.
- Yields in Ethiopia and Bangladesh have been below global averages, while in India yields have kept up with global trends.

Figure 6: Regional Wheat Yield Trends



Source: USDA FAS

Figure 7: Focus Country Yield Trends



Source: USDA FAS

The 0.6 mt/ha increase in global average yields is attributed to a number of factors including improved varieties, increased inputs, improved management practices, and improved marketing. However, the rate of yield growth over the past 20 years has decreased from earlier in the 20th century stemming in some part from a decreasing rate of investment in research and increasingly frequent droughts.²⁹

IMPACT Model Projections

Model Description

The IFPRI IMPACT model is designed to examine alternative future scenarios for global food supply, demand, trade, prices, and food security. IMPACT covers 30 commodities, which accounts for virtually all of world food production and consumption, including cereals, soybeans, roots and tubers, meats, milk, eggs, oils, meals, vegetables, fruits, sugar and sweeteners, and fish. It is specified as a partial equilibrium framework of 115 country-level supply and demand equations

where each country model is linked to the rest of the world through trade. Input data used in the projection model is FAO data from the year 2000. While precise predictions are unlikely, the general trends predicted by the IMPACT model can be helpful for policy analysis.^h The following analysis of future supply, demand, and prices is based on the model using the baseline, or median, scenario for population growth.

Projected Global Supply and Demand Increases 26%

- Top five wheat producing nations in 2030 are projected to be China, India, the United States, Russia, and France.
- China, India, the United States, Russia, and Pakistan are projected to have the highest demand.

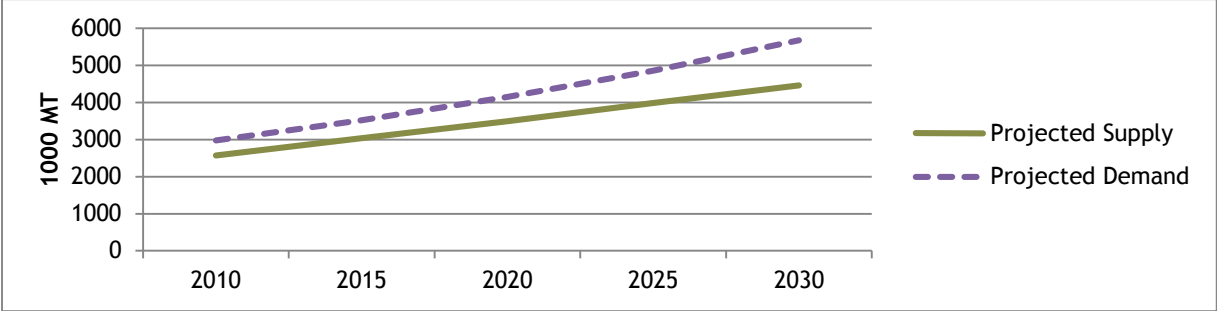
From 2010-2030, global supply and demand for wheat is expected to increase by 26%, from 650 million tons to 820 million tons. The current major wheat producing and consuming nations will continue to occupy a prominent place in the global wheat market. The top five wheat producing nations in 2030 are projected to be China, India, United States, Russia and France, together accounting for 49% of total wheat production. China, India, United States, Russia and Pakistan are projected to have the highest demand, together accounting for 43% of total wheat demand.

Projected Wheat Supply and Demand in Focus Countries

Ethiopia Faces a Growing Supply Deficit

As **Figure 8** illustrates, domestic supply and demand for wheat in Ethiopia are expected to increase significantly from 2010-2030, with demand outstripping supply. Supply is expected to increase by 73%, from 2.6 million tons in 2010 to 4.5 million tons in 2030. Demand is expected to increase by 91%, from 3 million tons to 5.7 million tons. Demand for wheat is projected to continually exceed supply from 2010-2030 and the gap will grow slightly more pronounced moving toward 2030. In 2015, the gap between expected supply and demand is expected to be over 400 thousand tons. By 2030, the demand-supply difference is expected to exceed one million tons.

Figure 8: Projected Supply and Demand in Ethiopia through 2030



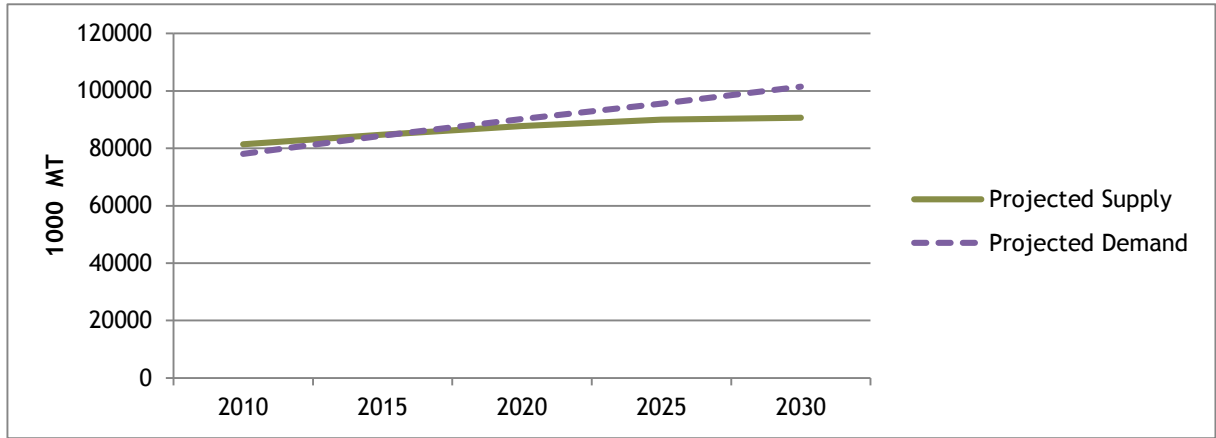
Source: IFPRI IMPACT Projections

India’s Demand is Expected to Outpace Supply

Over the next twenty years, Indian demand for wheat is projected to exceed domestic supply, with the gap between supply and demand becoming more pronounced toward 2030 (see **Figure 9**). From 2010-2020, wheat supply in India is expected to grow by 11%, from roughly 81 million metric tons to 90 million metric tons. Over the same period, wheat demand in India is projected to grow by 30%, from 78 tons to 100 million tons. Between 2015 and 2020, domestic demand for wheat will exceed domestic supply, perhaps necessitating an increase in wheat imports. By the year 2030, domestic wheat demand is expected to exceed supply by over 10 million tons. Over the entire twenty year period, India is expected to be one of the highest wheat demanding and supplying nations in the world, second only to China.

^h For more information on model methodology see <http://www.ifpri.org/book-751/ourwork/program/impact-model>

Figure 9: Projected Supply and Demand in India through 2030

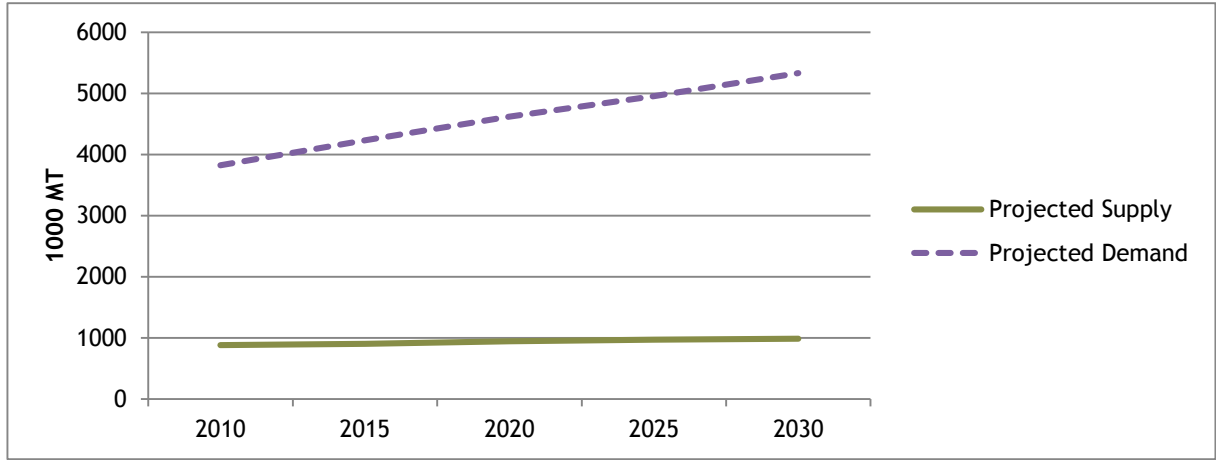


Source: IFPRI IMPACT Projections

Bangladesh Projects a Wide and Growing Wheat Deficit

Current demand for wheat in Bangladesh far exceeds domestic supply and the gap is expected to become more severe moving toward 2030 (see *Figure 10*). From 2010-2030, wheat demand in Bangladesh is expected to grow by 39%, from 3.8 million tons to 5.3 million tons. Over the same period, wheat supply is expected to grow by only 12%, from roughly 880 thousand tons to 980 thousand tons. In the year 2015, the projected gap between supply and demand is expected to be over 3 million tons. By 2030, the gap is projected to grow to over 4 million tons.

Figure 10: Projected Supply and Demand in Bangladesh through 2030

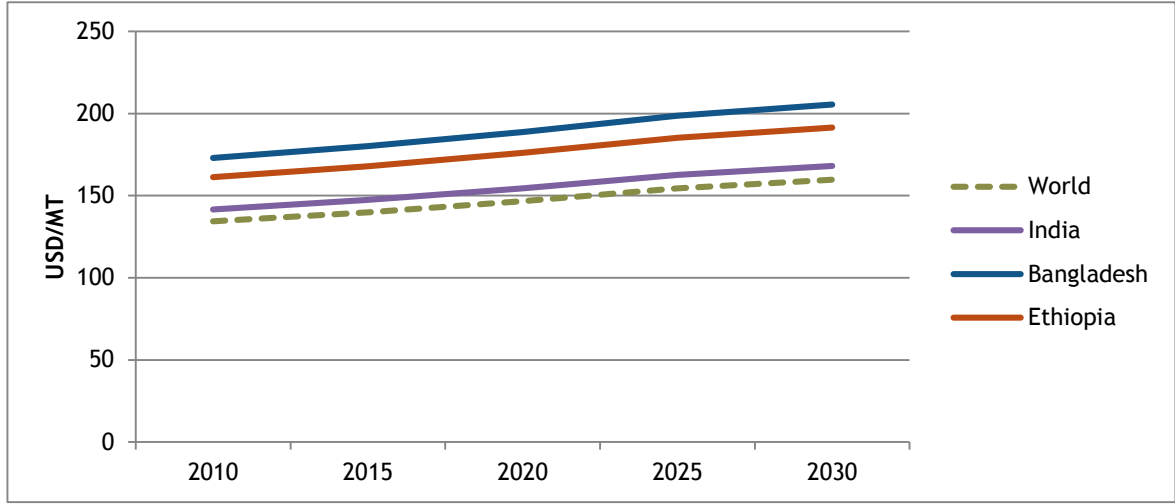


Source: IFPRI IMPACT Projections

Wheat Prices are Projected to Grow

Global wheat prices are expected to increase by 19% from 2010-2030, from \$134 per ton in 2010 to \$160 per ton by 2030 (see *Figure 11*). Wheat prices in all the focus countries are expected to be higher than the world price, though the gap varies. In India, the price of wheat is expected to exceed the world price by an average of \$7 per ton. In Ethiopia the price of wheat is predicted to exceed the world price by an average of \$30 per ton. While in Bangladesh, the domestic price is expected to exceed the world price by \$42 per ton.

Figure 11: Projected Global and Focus Country Prices

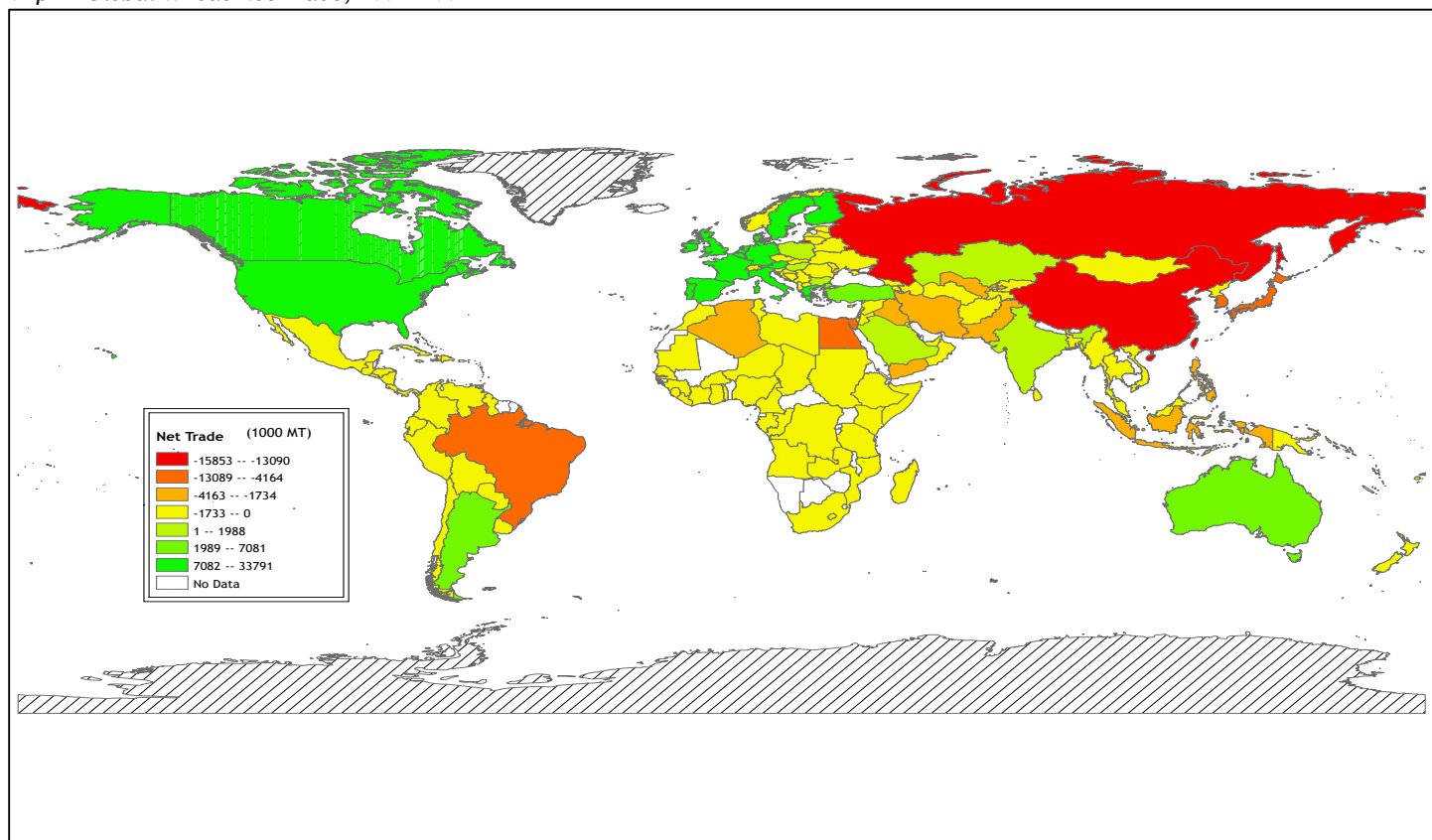


Source: IFPRI IMPACT Projections
Note: Domestic prices are the IMPACT consumer prices.

Please direct comments or questions about this research to Leigh Anderson and Mary Kay Gugerty, at eparx@u.washington.edu.

Appendix 1: Cartographic Representation of Net Trade Trends

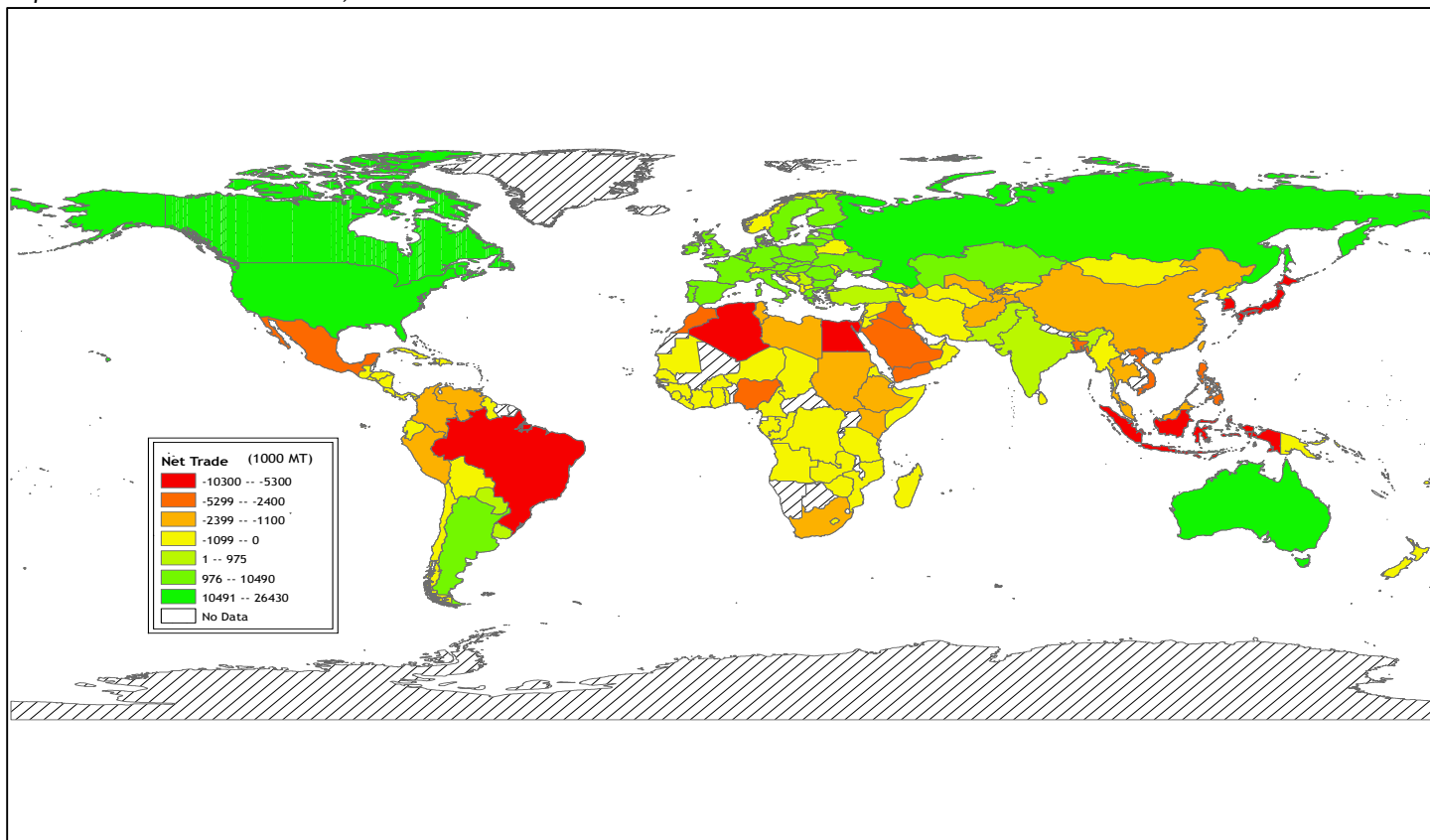
Map 1: Global Wheat Net Trade, 1991/1992



Source: USDA FAS, Wheat Export and Import Data 1991/92

Note: Negative numbers denote net importers and positive numbers net exporters.

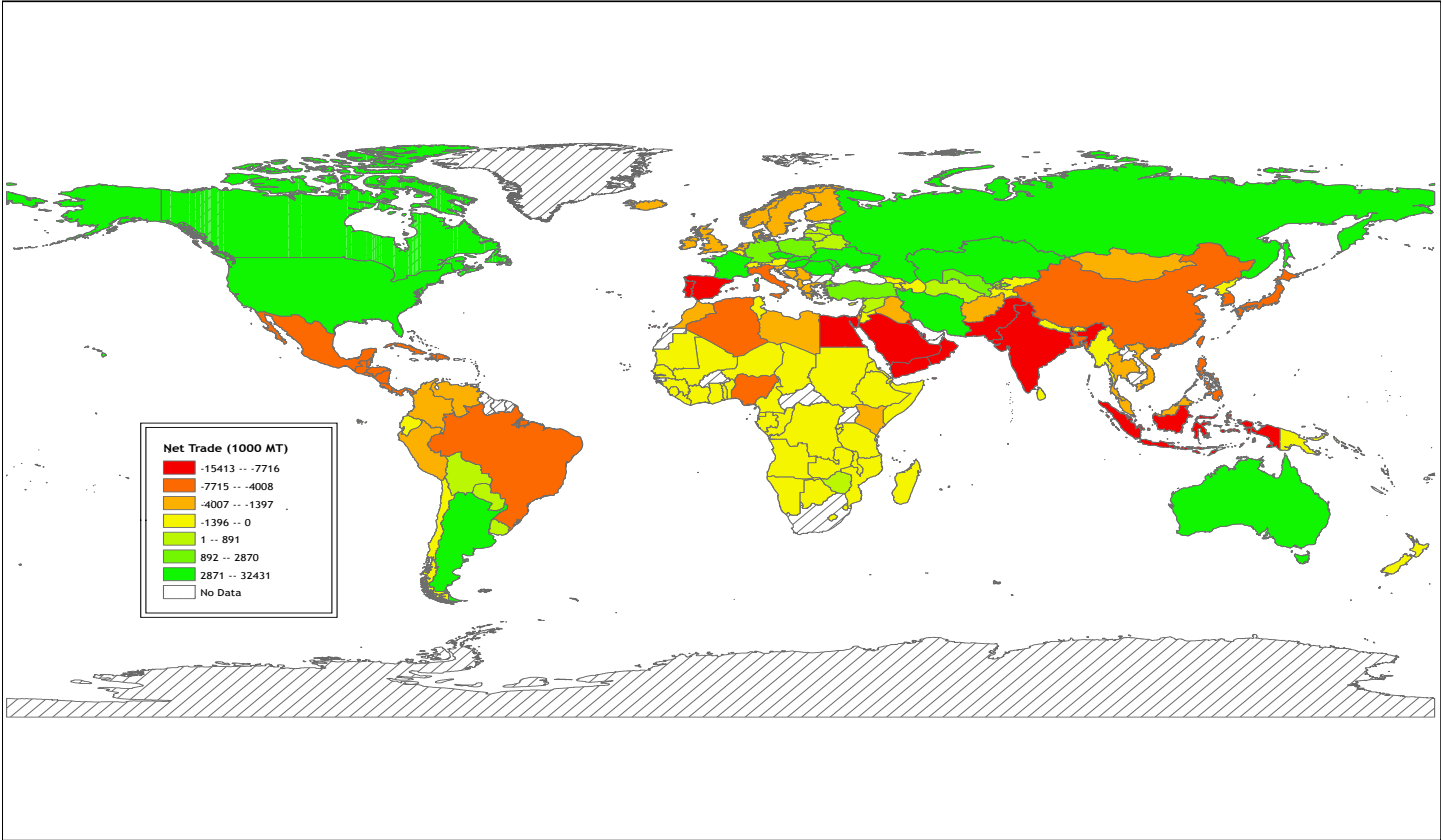
Map 2: Global Wheat Net Trade, 2011/2012



Source: USDA FAS, Wheat Import and Export Data 2011/12

Note: Negative numbers (Yellow, Orange and Red) denote net importers and positive numbers (Green) net exporters

Map 3: Global Wheat Net Trade Projections, 2030



Source: IFPRI IMPACT 2030 projections
Note: Negative numbers (Yellow, Orange and Red) denote net importers and positive numbers (Green) net exporters.

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