

World Corn Market Supply-Demand Trends

Daniel O'Brien – Extension Agricultural Economist

K-State Research and Extension

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The world corn market has many participants, but a small number of larger corn producers and exporters have a dominating influence on global corn supply-demand balances. Major exporting countries such as the United States, Argentina, Brazil, and the Ukraine, and leading importers such as Japan, Mexico, South Korea, Egypt, Taiwan, Columbia and Iran impact world corn market prices through the leading roles they play in world corn trade. Other countries are heavily involved in corn production and use, but have not consistently been important participants in world corn trade, such as China, the European Union, India and South Africa.

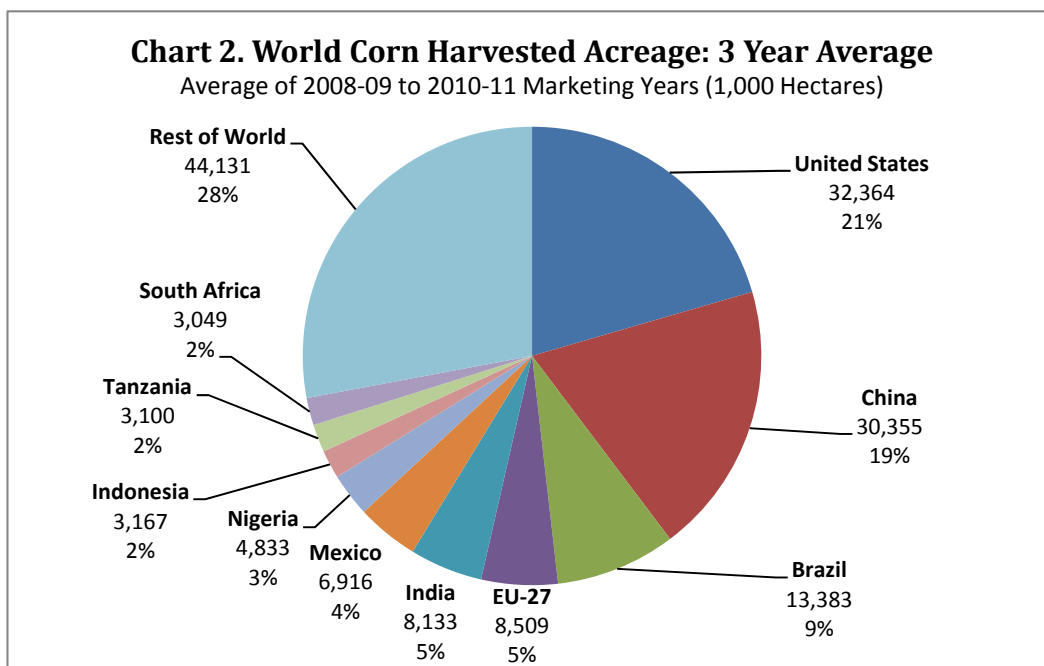
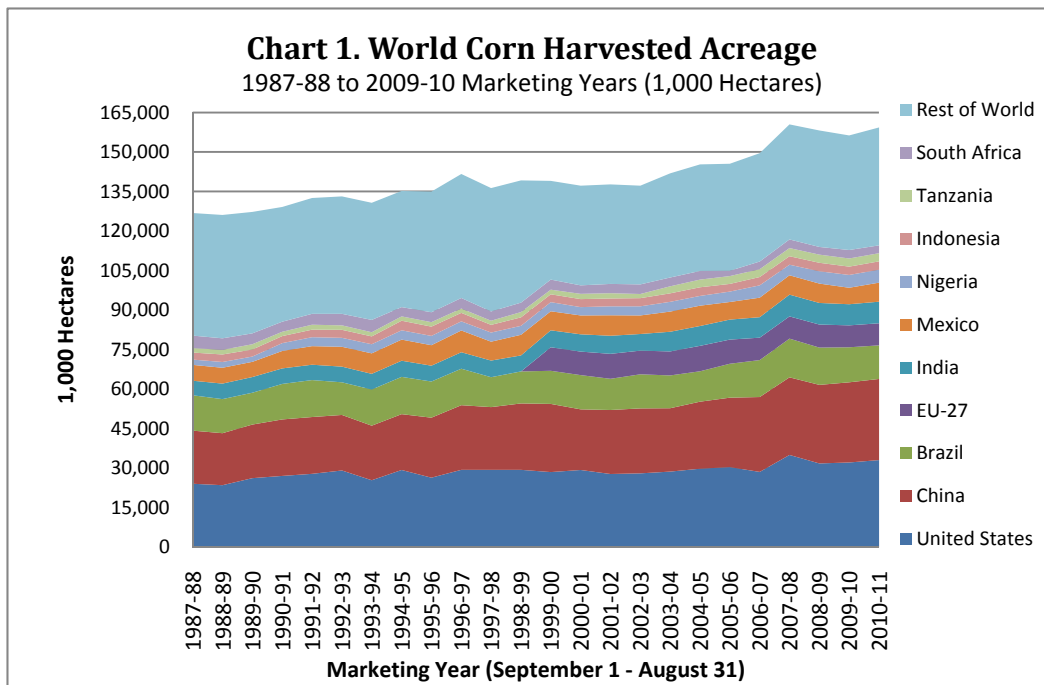
The United States and China are key participants in the world corn market, but for different reasons. The United States is the world's largest producer of corn, supplying an average of 40% of the world corn crop over the last 3 marketing years (MYs). The U.S. also is the world's largest corn exporter (57% 3 MY average), and the largest user of corn for all purposes – using 34% of all corn used on average since MY 2008-09. The U.S. has accounted for 44% of world corn for food, seed and industrial use and 28% of world corn livestock feed use over the same time period. Since MY 2008-09, the U.S. has held on average 30% of world corn ending stocks, 2nd behind China. Over the same time period, China has been the 2nd largest producer of corn (20% of world corn production), the 2nd largest user of corn for all purposes (19%), the 2nd largest user of corn for food, seed and industrial uses (15%), and the 2nd largest user of corn for livestock feeding (22%). China has ranked 1st globally in terms corn ending stocks, holding an average of 37% of world corn ending stocks since MY 2008-09 – more than the 30% held by the United States.

This article examines world corn supply-demand trends for MY 1987-88 through MY 2010-11 on a country by country basis. All world corn supply-demand estimates were obtained via custom queries on Production, Supply and Demand Online (PS&DOnline) through the USDA Foreign Agricultural Service (<http://www.fas.usda.gov/psdonline/psdQuery.aspx>). Projections from the May 11, 2010 World Agricultural Supply-Demand Estimates (WASDE) from the USDA World Agricultural Outlook Board (<http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1194>) are included in this report. Projected corn supply-demand balances for MY 2010/11 are examined relative to historical average levels and trends through time. The variability of these World corn supply-demand measures in recent history is also examined, providing some measure of the primary sources of risk and uncertainty in world corn markets in recent history.

World Corn Harvested Area

Total world corn harvested acreage in MY 2010-11 is estimated to be 159,320,000 hectares (393,520,000 acres)(Chart 1). World corn harvested acreage has increased from the range of 126,108,000 – 126, 860,000 in MY 1987-88 and MY 1988-89 to the range of 156,311,000 – 160,534,000 since MY 2007-08, with average annual trend increases of 1,353,000 hectares (3,343,263 acres per year).

During the MY 1987-88 to MY 2010-11 period, the top 10 countries in terms of corn producing area accounted for an average of 72% of world corn harvested acreage. Since MY 2008-09 the 5 largest nations in terms of average world corn harvested acreage are the United States (32.4 million hectares or mh), China (30.4 mh), Brazil (13.4 mh), the European Union (8.5 mh) and India (8.1 mh) (Chart 2). These corn area statistics indicate the leading positions of the United States and China in world corn production, as well as the importance of Brazilian productive land capacity in regards to corn and other competitive crops.



Since MY 2001-02, Tanzania, Nigeria and South Africa have the largest historic variability in corn area harvested relative to their average harvested area among the top 10 nations in terms of corn area. This measure of relative variability can be analyzed in terms of the “coefficient of variation” or “cv” of harvested corn acreage. (see http://en.wikipedia.org/wiki/Coefficient_of_variation). A coefficient of variation of 1.00 indicates that a measure of the variability of a variable (defined as the standard deviation) is equal to the average value of the variable. When the cv value is less than 1, it means that the standard deviation is less than the average value of the variable. Lower values of cv are indicative of less relative variability for a particular variable (or in this case, a measure of world corn supply-demand) than do higher cv values. The cv values for harvested corn acreage in Tanzania, Nigeria and South Africa over the last decade range from 0.143 and 0.192.

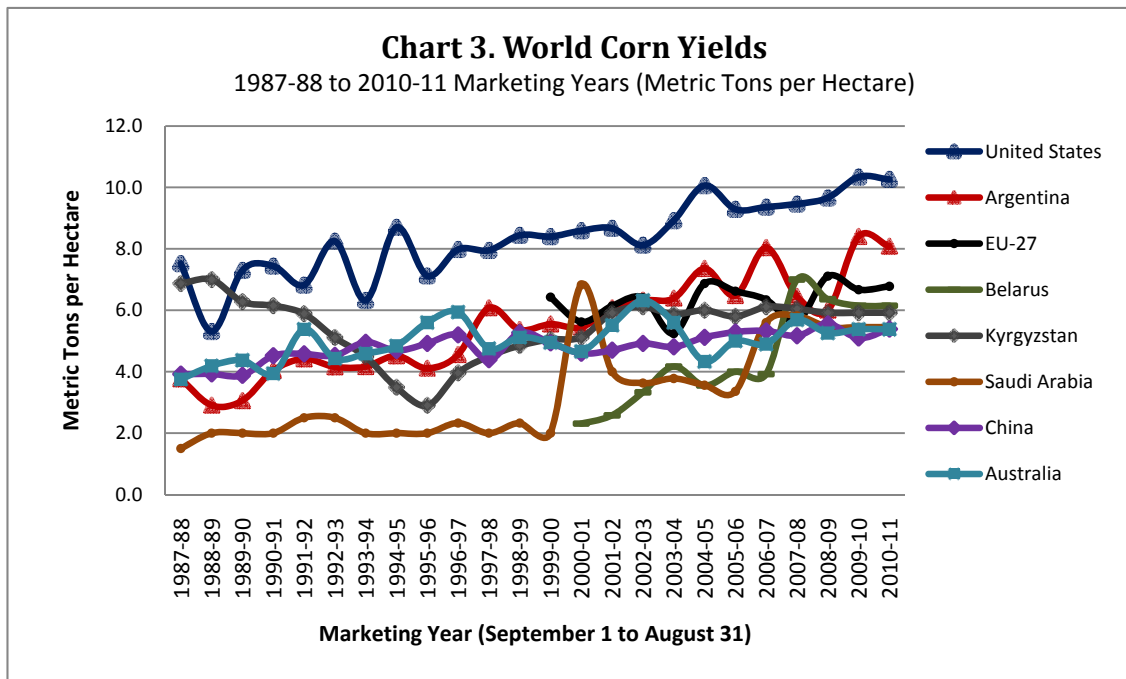
The United States ($cv = 0.08$) has had lower relative variation in harvested corn area of corn since MY 2001-02 than the 3 countries mentioned above as well as China ($cv = 0.10$). The U.S. has equal relative variability in harvested corn acreage to India, but greater variability than Indonesia ($cv = 0.04$), the European Union ($cv = 0.05$) and Mexico ($cv = 0.07$). In comparison, aggregate world corn harvested acreage has a relatively low level of relative variability ($cv = 0.06$) since MY 2001-02. World corn harvested area has been growing at a fairly consistent rate since MY 1987-88.

These results also show that in the 3 most recent corn marketing year, the United States and China have combined for 40% of World harvested corn area. Together with Brazil, the European Union and India, the top 5 countries in terms of harvested corn acreage have accounted for 59% of global harvested corn area. The world corn market is marginally more “concentrated” in terms of harvested acreage than is the world wheat market, where the top 5 countries account for 56% of world wheat harvested acreage.

World Corn Yields

Average World corn yields in the 2010-11 marketing year are estimated to be 5.24 metric tons per hectare (mt/ha) (equivalent to 83.6 bushels per acre). World corn yields have increased from 3.18 mt/ha (50.7 bu/ac) in MY 1988-89 to over 5.0 mt/ha since MY 2008-09, with average annual trend increases of 0.07 mt/ha (1.12 bu/ac) for since MY 1987-88.

Among the 10 largest corn producing countries in the World, the highest average corn yields over the most recent 10 year period (MY 2001-02 to MY 2010-11) were produced in the United States (9.41 mt/ha or 150.1 bu/ac), with yields trending upwards at 0.19 mt/ha (3.0 bu/ac) per year (Chart 3). The second highest yields since MY 2001-02 were produced in Argentina at 6.96 mt/ha or 111.0 bu/ac, with yields trending upwards at 0.18 mt/ha (2.9 bu/ac) annually. During the same period, corn yields in the European Union averaged 6.38 mt/ha (101.7bu/ac), increasing at a rate of 0.08 mt/ha (1.3 bu/ac) annually.



Belarus and Saudi Arabia have the largest historic relative variability in corn yields since 2001-02, with cv measures of 0.44 and 0.26, respectively. The United States ($cv = 0.19$) has had nearly equal yield variability with Vietnam, Argentina and Uzbekistan, but greater relative yield variability than China ($cv = 0.07$), and the European Union ($cv = 0.08$). In comparison, aggregate world corn yields since the 2001-02 marketing year have a relatively

low level of relative variability ($cv = 0.07$). These world versus nation cv measures indicate that annual yield increases and declines in individual countries may tend to offset themselves over time.

World Corn Production

World corn production in the 2010-11 marketing year is projected to be 835,033,000 metric tons (32,864,513,000 bushels). Note that 1 metric ton equals 2,204 pounds or 39.36 bushels of corn. World corn production has increased from 400,413,000 mt (15,759,112,000 bu.) in MY 1988-89 to the projected level in MY 2010-11 indicated above, with average annual trend increases of 16,002,000 mt (993,736,000 bu.) since MY 1987-88. World corn production is projected to have grown 109% since MY 1988-89.

The 10 largest countries produced an average of 85.4% of world corn over the MY 1987-88 to MY 2010-11 period (Chart 4). Since MY 2008-09, the 7 largest countries in terms of average world corn production were the United States (326.6 mmt, 40% of world corn production), China (162.3 mmt, 20% of world corn production), the European Union (58.4 mmt), Brazil (51.8 mmt), Mexico (23.2 mmt), India and Argentina (both with 19.0 mmt) (Chart 5). These levels of corn production support the idea that China and particularly the United States play key leadership roles in determination of world corn production and supplies.

The Ukraine and South Africa have the largest historic relative variability in corn production since MY 2001-02, with cv measures of 0.36 and 0.23, respectively. The United States ($cv = 0.14$) has had less production variability than India, Argentina and Brazil ($cv = 0.17 - 0.18$); equal production variability with China; and more production variability than Mexico, Canada, and the European Union ($cv = 0.08 - 0.11$). In comparison, aggregate World corn production has a cv value of $= 0.12$ since the 2001-02 marketing year. Because the U.S. and China together account for 60% of world corn production is reasonable to have world historic corn production variability ($cv = 0.12$) approximately equal to that of these two lead corn producing countries.

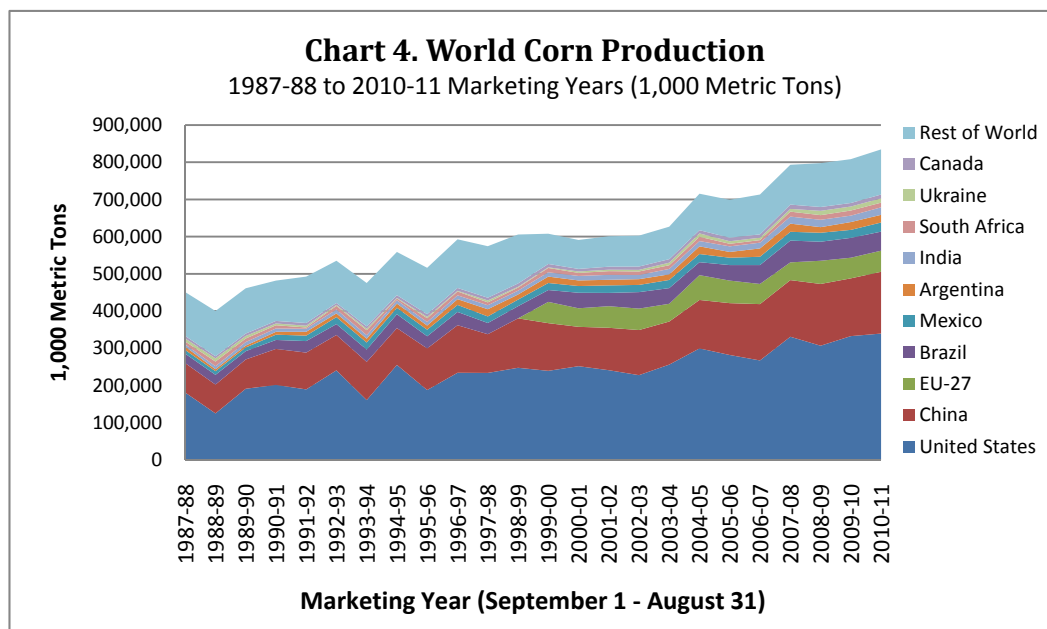
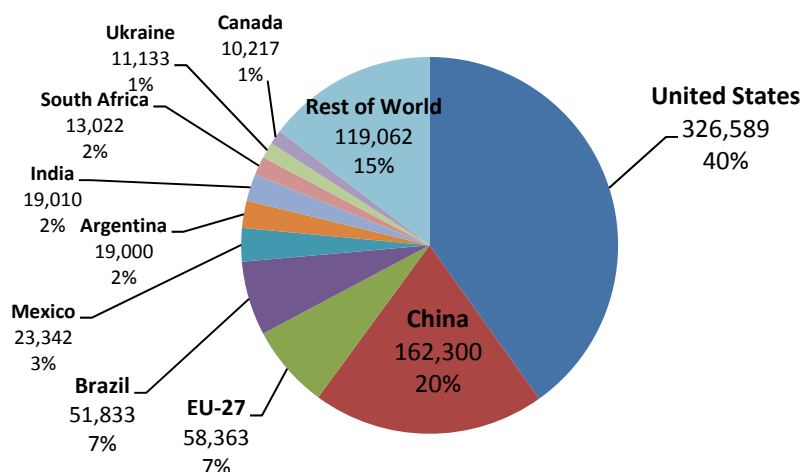


Chart 5. World Corn Production: 3 Year Average

Average 2008-09 to 2010-11 Marketing Years (1,000 metric tons)



World Corn Exports

World corn exports in MY 2010-11 are projected to be 88,527,000 mt. World corn exports have increased from 59,128,000 mt in MY 1987-88 to as high as 98,614,000 mt in MY 2006-07, with average annual trend increases of 1,225,000 mt since MY 1987-88.

The 10 largest nations shipped an average of 95.6% of World corn exports over the MY 1987-88 to MY 2010-11 period (Chart 6). Since MY 2008-09, the 5 largest countries in terms of average world corn exports were the United States (49.2 mmt or 57% of all World corn exports), Argentina (11.8 mmt, 14% of total), Brazil (7.2 mmt, 8% of total), the Ukraine (5.2 mmt) and South Africa (2.3 mmt) (Chart 7). The United States has a dominant market leadership position in world corn exports, with the next largest exporter shipping only 25% of the amount that the U.S. does.

Among the world's major exporters of corn, Serbia and India have the largest historic relative variability in corn exports since 2001-02, with cv measures of 1.33 and 1.01, respectively. Other countries with relatively high relative variability in annual corn exports during the last decade include the Ukraine (cv = 0.74), Paraguay (cv = 0.61), Thailand (cv = 0.59), South Africa (cv = 0.54), Brazil (cv = 0.53), and the European Union (cv = 0.48). The United States (cv = 0.12) has the lowest corn export variability among the top corn exporters in the last decade, with Argentina (cv = 0.17) also being relatively low compared to other World corn exporters. In comparison, aggregate World corn exports have a cv value of = 0.10 since the 2001-02 marketing year, indicating that the large market share of the U.S. together with Argentina, combined with their comparatively low annual export variability and somewhat offsetting supply availability among other corn exporting countries all works together to reduce overall annual variability in world corn exports.

Chart 6. World Corn Exports

1987-88 to 2010-11 Marketing Years (1,000 Metric Tons)

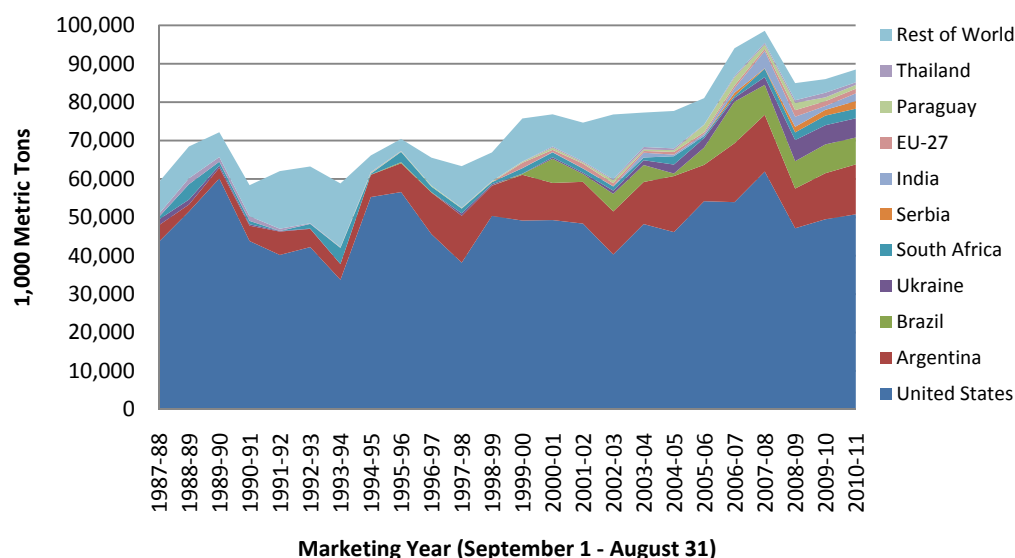
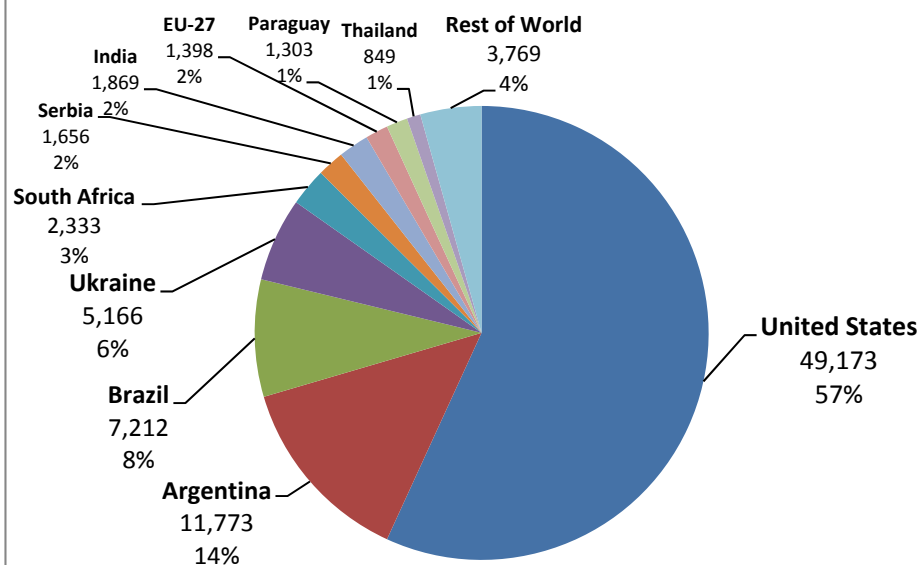


Chart 7. World Corn Exports: 3 Year Average

Average of 2008-09 to 2010-11 Marketing Years (1,000 Metric Tons)



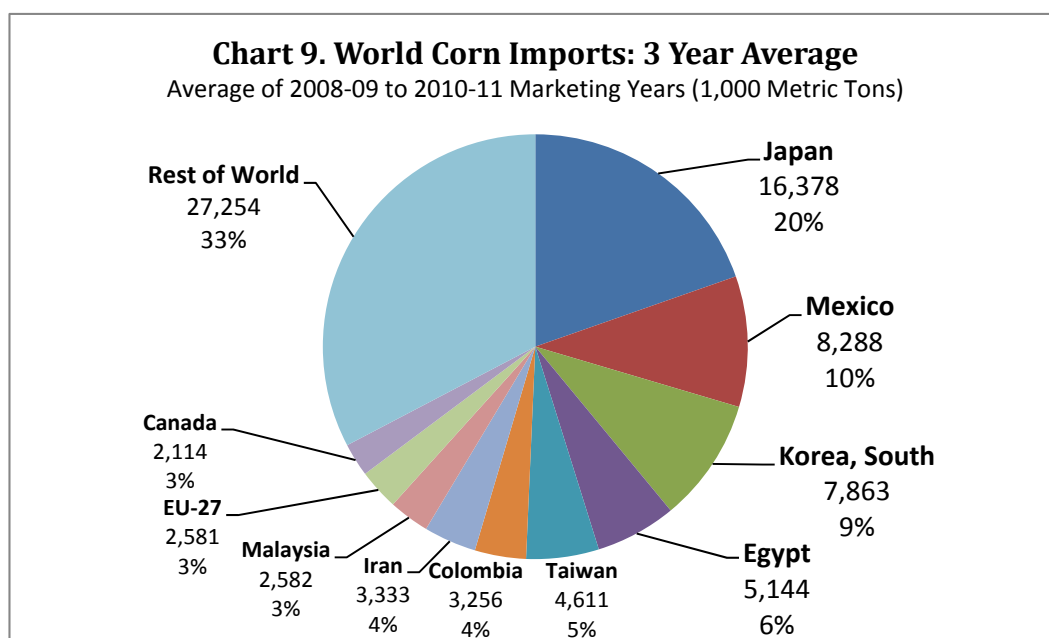
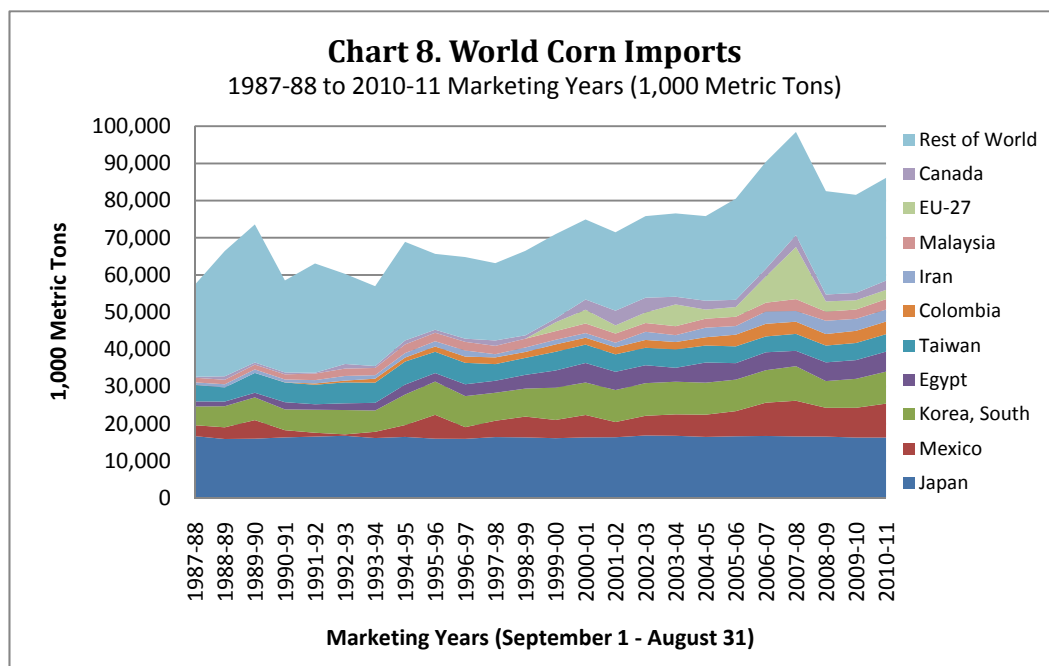
World Corn Imports

World corn imports in the 2010-11 marketing year are estimated to be 86,120,000 metric tons. World corn imports have increased from 57,323,000 mt in MY 1987-88 to as high as 98,489,000 mt in MY 2006-07, with average annual trend increases of 1,200,000 mt since MY 1987-88.

The 10 largest corn importing countries secured an average of 67.3% of world corn imports since MY 1987-88 (Chart 8). Since MY 2008-09, the 7 largest countries in terms of average world corn imports were Japan (16.4

mmt, 20% of total corn imports), Mexico (8.3 mmt, 10% of total), South Korea (7.9 mmt, 9% of total), Egypt (5.1 mmt), Taiwan (4.6 mmt), Columbia (3.3 mmt) and Iran (3.3 mmt) (Chart 9).

Among the World's major importers of corn, the European Union has the largest historic relative variability in corn imports since 2001-02, with $cv = 0.83$. Other countries with higher relative variability in annual corn imports since MY 2001-02 include Canada ($cv = 0.32$), Iran ($cv = 0.28$), Mexico ($cv = 0.26$), and Columbia ($cv = 0.23$). Egypt ($cv = 0.11$) and Malaysia ($cv = 0.10$) have somewhat lower annual import variability. The Asian countries of South Korea ($cv = 0.07$), Taiwan ($cv = 0.04$) and Japan ($cv = 0.01$) have the least amount of relative annual variability in world corn imports. On an aggregate basis, world corn imports have a cv value of $= 0.10$ since the 2001-02 marketing year. Extremely low annual corn import variability for South Korea, Taiwan and Japan is offset to some degree by the greater annual import variability in the European Union, Canada, Iran, Mexico, Columbia and elsewhere.

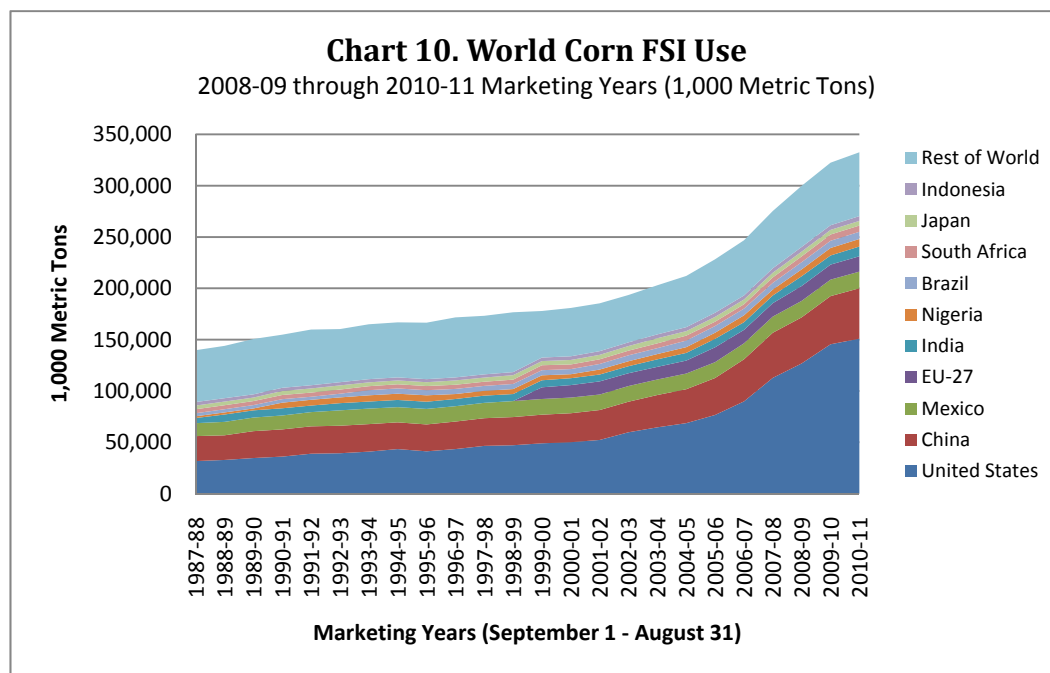


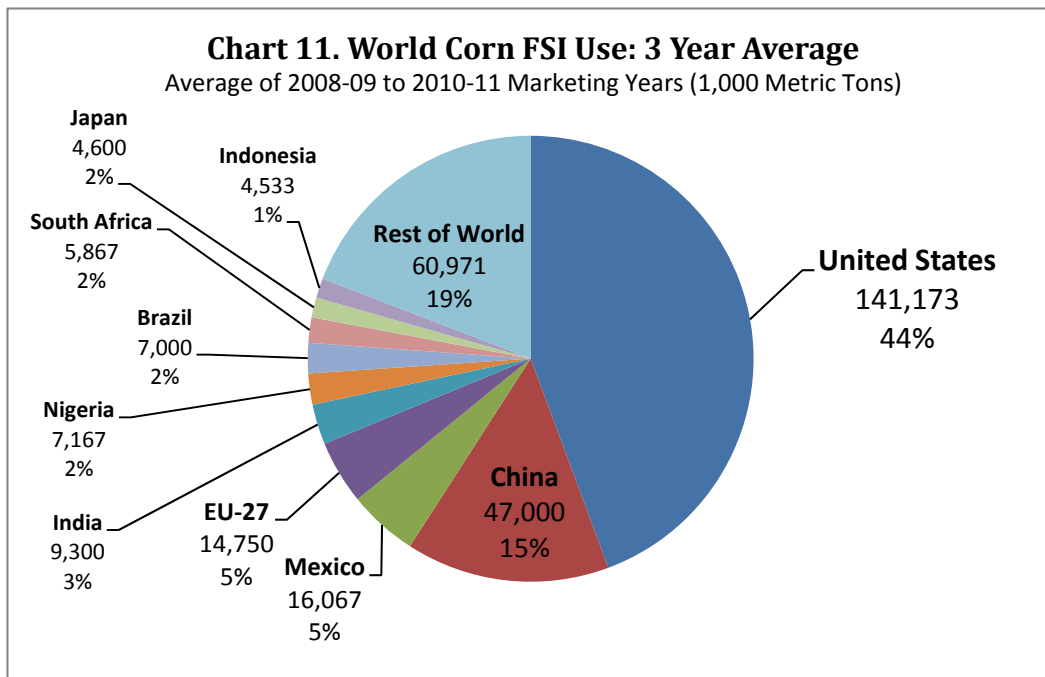
World Corn Food, Seed and Industrial Use

World corn food, seed and industrial (FSI) use (including ethanol production) in the 2010-11 marketing year is estimated to be 332,766,000 metric tons. World corn FSI use has increased from 139,837,000 mt in MY 1987-88 to a projected high in MY 2010-11 listed above, with average annual trend increases of 8,039,000 mt since MY 1987-88. World corn FSI is projected to have grown 138% since MY 1987-88.

The 10 largest countries accounted for an average of 80.8% of World corn FSI use over the MY 1987-88 to MY 2010-11 period (Chart 10). Since MY 2008-09, the 2 largest countries in terms of average world corn FSI use were the United States (141.2 mmt, 44% of all world corn FSI use) and China (47.0 mmt, 15% of total). Mexico (16.1 mmt), the European Union (14.8 mmt), and India (9.3 mmt) followed the U.S. and China (Chart 11). These figures indicate the strong impact that growth in feedgrain-based ethanol production has had on domestic corn supply-demand balances in the U.S. in recent years.

Among the top 10 countries using corn for FSI production, the United States has had the largest annual variability in FSI use (cv = 0.39), followed by China (cv = 0.20), Nigeria (cv = 0.16), South Africa (cv = 0.14), and India (cv = 0.13). Other countries have displayed less variability in annual FSI use – including Indonesia (cv = 0.09), Brazil (cv = 0.085), the European Union (cv = 0.078), Japan (cv = 0.04) and Mexico (cv = 0.024). Variability in FSI use in the United States since MY 2001-02 is attributable to the rapid expansion in U.S. grain-based ethanol production in accordance with U.S. environmental and energy policies. Taken together, world corn FSI use has a cv value of 0.22 since MY 2001-02, indicating that the largest source of variability in FSI use in the World corn market originates in the United States.





World Corn Feed & Residual Use

World corn feed and residual use in MY 2010-11 is estimated to be 492,698,000 metric tons. World corn feed and residual use has increased from 306,797,000 mt in MY 1988-89 to a high 496,838,000 mt in MY 2007-08, with average annual trend increases of 7,341,000 mt since MY 1987-88. World corn feed and residual use is projected to have grown 56% since MY 1987-88.

The 10 largest countries accounted for an average of 79.8% of world corn feed and residual use over the MY 1987-88 to MY 2010-11 period (Chart 12). Since MY 2008-09, the 2 largest countries in terms of average World corn feed and residual use were the United States (134.9 mmt, 28% of all world corn feed and residual use) and China (108.3 mmt, 22% of total). The European Union (44.8 mmt), Brazil (39.8 mmt), Mexico (15.6 mmt) and Japan (11.8 mmt) followed the U.S. and China in feed and residual use. (Chart 13). This information reinforces the leadership roles of the U.S. and China in both world feed and residual use and in livestock feeding industries.

Among the top 10 countries, Mexico has had the largest annual variability in corn feed and residual use ($cv = 0.21$), followed by India, Brazil, and Canada (cv range of 0.127 to 0.12). Other countries have displayed less variability in annual feed and residual use – including Egypt ($cv = 0.08$), the European Union ($cv = 0.062$), the United States ($cv = 0.057$), China ($cv = 0.055$), South Korea ($cv = 0.04$) and Japan ($cv = 0.02$). Taken together, world corn feed and residual use has a cv value of 0.05 since the 2001-02 marketing year, indicating that livestock feeding has been a relatively stable use for world corn in the last decade. The availability of feedgrain substitutes such as grain sorghum, barley, oats or distillers grains from ethanol production may also impact the degree to which corn versus competitive alternatives are used in livestock feed rations.

Chart 12. World Corn Feed & Residual Use

2008-09 through 2010-11 Marketing Years (1,000 Metric Tons)

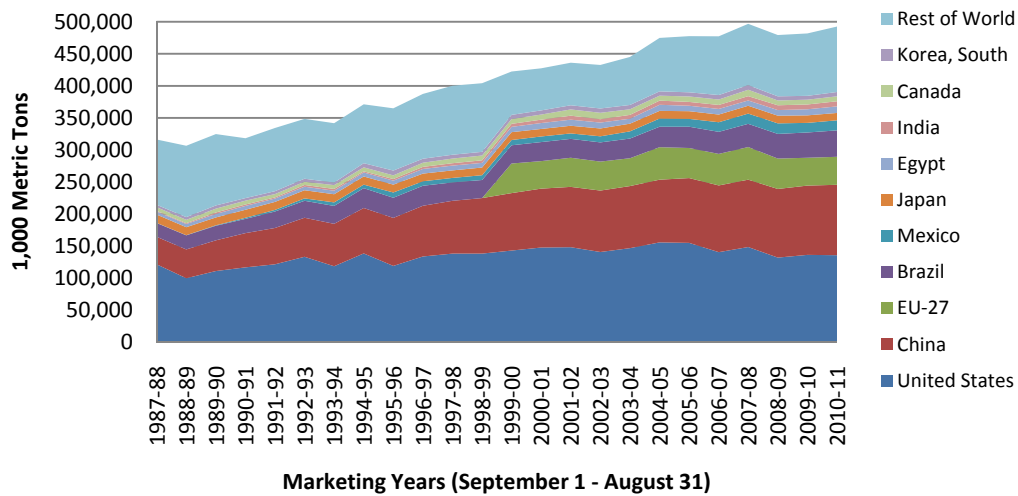
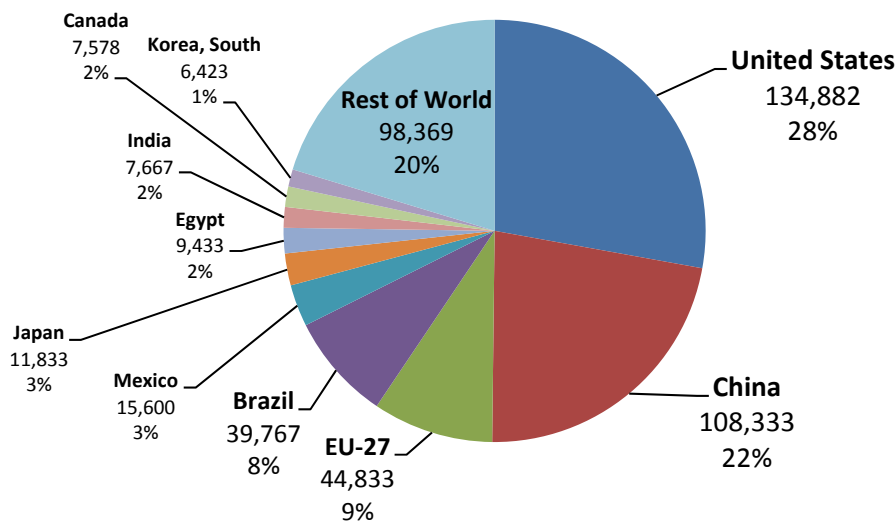


Chart 13. World Corn Feed & Residual Use: 3 Year Average

Average of 2008-09 to 2010-11 Marketing Years (1,000 Metric Tons)



World Total Domestic Use of Corn

Total domestic use of World corn in the 2010-11 marketing year is projected to be 825,464,000 metric tons. World corn total domestic use has increased from 450,832,000 mt in MY 1988-89 to a projected high in MY 2010-11 as indicated above, with average annual trend increases of 15,380,000 mt since MY 1987-88. World corn total use is projected to have grown 81% since MY 1987-88.

The 10 largest countries accounted for an average of 79.3% of world total corn domestic use over the MY 1987-88 to MY 2010-11 period (Chart 14). Since MY 2001-02, the 2 largest countries in terms of average total use of World corn were the United States (276.1 mmt, 34% of all world corn usage) and China (155.3 mmt, 19% of total). The European Union (59.6 mmt, 7% of total), Brazil (46.8 mmt), Mexico (31.7 mmt), India (17.0 mmt) and Japan (16.4

mmt) followed the U.S. and China in total use of corn (Chart 15). The strong market leadership positions of the U.S. and China in world corn markets are shown in their combined 53% of total corn use since MY 2008-09.

Among the top 10 corn using nations, the United States has had the largest annual variability in total corn use (cv = 0.13), followed by India (cv = 0.12), Brazil (cv = 0.115), South Africa (cv = 0.112), and Mexico (cv = 0.10). In terms of annual variability in total use, these countries are followed by China (cv = 0.093), Egypt (cv = 0.086), Canada (cv = 0.082), the European Union (cv = 0.046), Japan (cv = 0.017). Taken together, world total domestic use of corn has a cv value of 0.10 since MY 2001-02, indicating relatively stable total domestic consumption of corn in the major corn using countries of the world. Slightly higher annual variability in total corn use in the U.S. can be attributed to the rapid expansion of ethanol-based corn use in conjunction with U.S. environmental and energy policies.

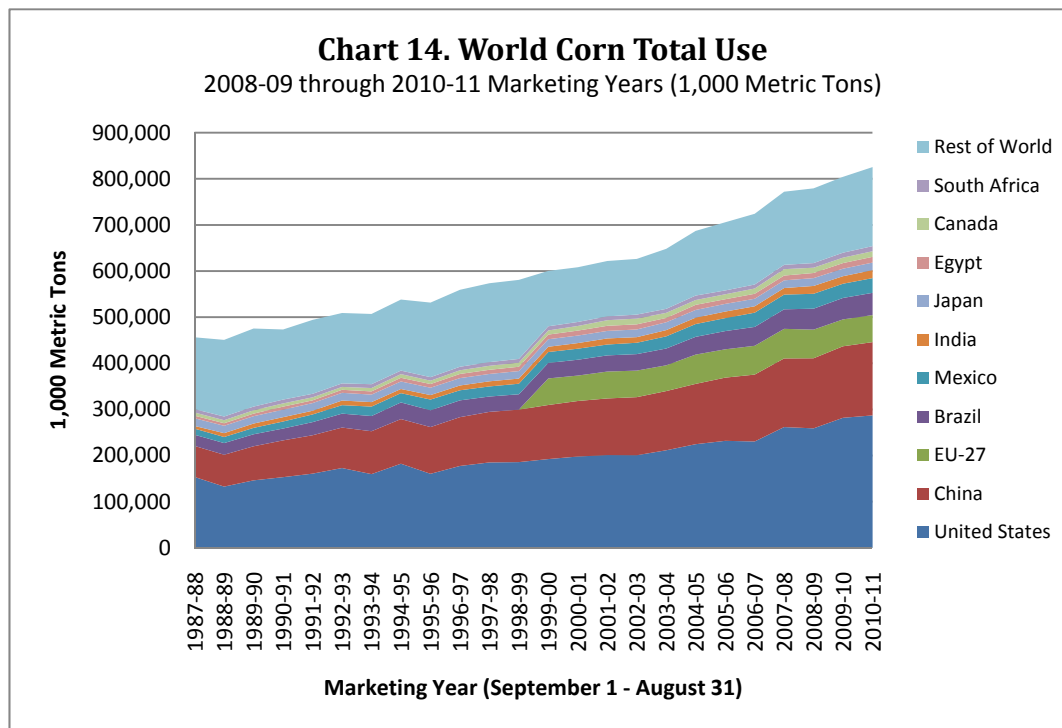
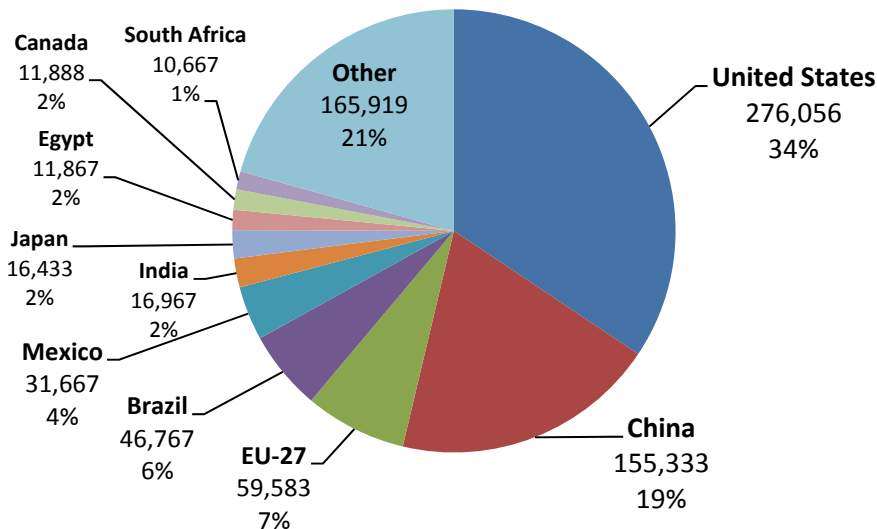


Chart 15. World Corn Total Use: 3 Year Average
Average of 2008-09 to 2010-11 Marketing Years (1,000 Metric Tons)



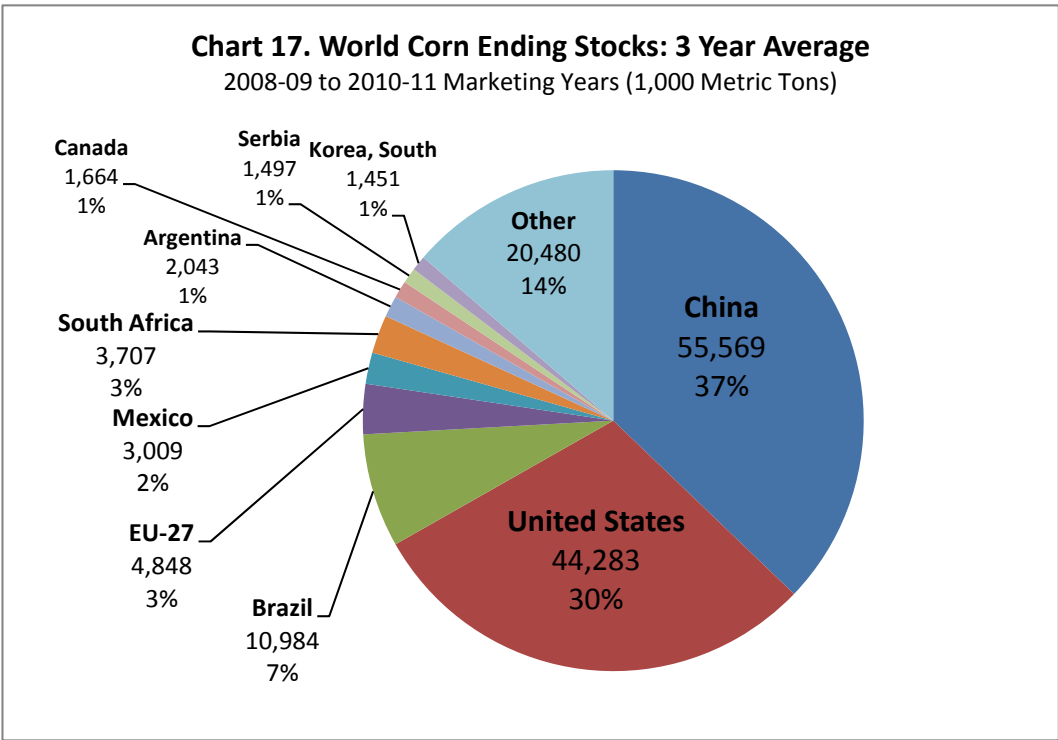
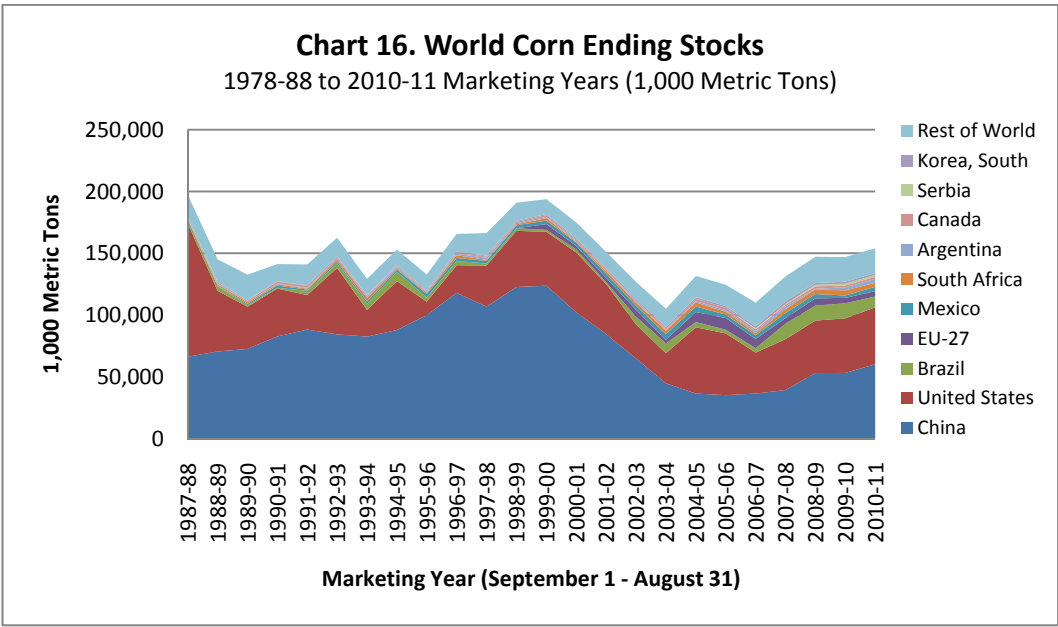
World Corn Ending Stocks

Total world corn ending stocks in MY 2010-11 are projected to be 154,210,000 metric tons. World corn ending stocks-to-total use is projected to be 18.7% in MY 2010-11. Since MY 1987-88, world corn ending stocks have ranged from a low of 110,069,000 mt in MY 2006-07 to a high of 193,883,000 mt in MY 1999-00, with average annual trend decreases of 1,811,000 mt since MY 1987-88. Also since MY 1987-88, world corn ending stocks-to-total use has ranged from a low of 15.2% in MY 2006-07 to a high of 43.3% in MY 1987-88, with average annual trend decreases in world corn ending stocks-to-use of 1.0% since MY 1987-88. World corn ending stocks are projected to have declined 22% since MY 1987-88.

The 10 largest countries accounted for an average of 86.3% of total world corn ending stocks over the MY 1987-88 to MY 2010-11 period (Chart 16). Since MY 2001-02, the 2 largest countries in terms of average total ending stocks of world corn were China (55.6 mmt, 37% of all world corn ending stocks) and the United States (44.3 mmt, 30% of total). Brazil (11.0 mmt, 7% of total), the European Union (4.8 mmt, 3% of total), South Africa (3.7 mmt) and Mexico (3.0 mmt) followed China and the United States in terms of amount of corn remaining in ending stocks at the end of each marketing year (Chart 17). Clearly, there is a tendency for world ending stocks of corn to be owned by a relatively small numbers of countries, such as China, the U.S., Brazil and the European Union. However, although China is the largest holder of world corn stocks, that country tends to use its stocks to support domestic uses rather than to make them available to the world corn trade market. The supplies of world corn ending stocks that are likely to be made available for world trade are even smaller than the world ending stocks total (by at least 37%, the 3 year average proportion of world corn ending stocks held by China).

Among the top 10 World countries that hold corn ending stocks, Serbia (cv = 1.16), Argentina (cv = 0.64), and Brazil (cv = 0.57) have the largest annual variability in corn ending stocks levels, followed by the European Union (cv = 0.38), China (cv = 0.31), South Africa (cv = 0.27), Canada (cv = 0.24), the United States (cv = 0.23), and Mexico (cv = 0.23). South Korea has the lowest annual variability in corn ending stocks among this group of (cv = 0.18). Taken together, total world corn ending stocks has a cv value of 0.13 since MY 2001-02. This indicates that the aggregate annual amount of world corn ending stocks is less variable in relative terms than are the levels of corn ending stocks among the world's top 10 corn ending stocks holding nations. Restated, changes in nations in corn

ending stocks have tended to offset each other over time, making to overall aggregate world corn ending stocks level relatively more stable than the levels of corn ending stocks among major corn ending stock holding nations.



Summary and Conclusions

The world corn market tends to be dominated the United States and China in terms of production, supplies, use and ending stocks, with a number of other important corn exporting and importing countries also playing key roles in world corn supply-demand dynamics. Increasing grain-based ethanol production in the United States has

had an impact on the use of corn in world markets, especially in terms of food, seed and industrial use. Potential expansion of ethanol production beyond current levels holds could markedly affect world export markets, given that the United States is the predominant supplier of the world's corn exports.

China's role in world corn markets in most years is that of major, quasi-self sufficient supplier to its own domestic corn use needs. However, with a strong domestic feedgrain demand base, production shortfalls in China in any particular year hold potential to motivate the Chinese to obtain additional needed corn supplies via import channels. Current Chinese buying activity in world corn export markets is indicative of this very situation occurring in MY 2010-11.

The long term trend toward lower, tighter world corn ending stocks and world corn ending stocks-to-use has abated somewhat since MY 2006-07. Even with current reasonable expectations for increases in world corn yields and world corn production in the future, anticipated growth in the global usage of corn is likely to extend the long term trend towards lower world corn stocks (if not accelerate it). In addition, the full impacts of increased corn usage from U.S. ethanol production under increased ethanol blended fuel inclusion rate policies needs to be closely examined. All else being equal, increased use of corn for ethanol in the U.S. would likely cause even sharper price competition in the future between U.S. livestock feeders and foreign export buyers to obtain remaining U.S. corn supplies. Increased availability of distillers grains from ethanol production processes would help to abate this tightness in supplies and increased price competition to some degree. However, the question of how potentially large increases in use of U.S. corn for domestic ethanol production would affect world corn and coarse grain export markets and the viability of domestic and foreign livestock enterprises needs to be closely examined.

It is possible to conceive of a scenario in the future where corn prices increase markedly in an effort to ration limited corn supplies to meet continued growth in demand for corn use both domestically and abroad. Such potentially disproportional increases in corn prices and crop enterprise income prospects in the future could cause accelerated acreage shifts toward corn production (in the United States and elsewhere) and away from other less profitable crop enterprises. In this situation, competitive pressures would likely drive each country and/or regions within each country to produce crops that they have the greatest physical productivity and economic returns competitive advantages in. In the long term, competitive pressures such as this in the United States and elsewhere would likely lead to increased corn production at the expense of other crop enterprises.

A caveat to this line of thought is that it is possible that per acre productivity of corn and other crops may increase to such a degree that these anticipated competitive pressures on available U.S. corn supplies may be lessen (due to greater availability of corn supplies relative to demand). That said, if future corn yield increases are larger on a relative basis than for other competitive crops, the incentive to shift acreage toward corn production in the U.S. would be unchanged (if not even greater).