

FY 2016

World Food Supply and Demand Projection to 2026

-Results of the Projection Using the World Food Supply and Demand Model -



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I. Introduction

Since 2008, the Ministry of Agriculture, Forestry and Fisheries has developed world food supply and demand projection for the next 10 years using a model called the World Food Supply and Demand Model. This model reconstructs the models used by the Ministry in previous world food supply and demand projection estimates by fundamentally revising the equations and parameters in light of changes in the world food supply and demand environment. This model was used to project world food supply and demand to 2026.

II. Overview of the World Food Supply and Demand Model

1. Model structures

This model has been developed using the basic approach described below (Reference 1).

(A) Consumption volumes

The consumption volume (demand volume) of each item is determined by total population, real gross domestic product (GDP), real economic growth rate, and commodity prices

(B) Production volumes

a. The production volumes of crops are determined by the harvested land area and yield. Yield is determined by trends, and the harvested land area is determined by the real producer price (price that the producer receives in the market with financial and other direct or indirect assistance added) of the applicable commodity and competing commodities in the previous year.

b. The production volumes of livestock are determined by the per-head production volume and number of animals raised. Per-head production volume is determined by trends, and the number of animals raised is determined by previous year's number and the real producer price and feed cost for the applicable commodities and competing commodities.

(C) Prices

International commodity prices are determined at the point at which the demand and supply for each commodity coincide.

2. Commodities covered

The model covers a total of 20 commodities. There are six crops (wheat, corn, rice, other crops, soybeans, and other oilseeds), five meat/egg items (beef, pork, chicken, mutton, and eggs), four processed crops (soy meals, other oil meals, soybean oil, and other vegetable oils), and five milk/dairy products (raw milk, butter, powdered skim milk, cheese, and full-fat powdered milk).

3. Base and target year

As this is a projection of the next 10 years, it sets 2026 as the target year and 2014 as the base year. However, figures for the 2014 base year are averages for the three-year period from 2013 to 2015.

4. Projected items

The projected items are production volume, consumption volume, and net export volume (or net import volume) for each commodity/region, as well as the international prices (real and nominal) of each commodities.

5. Applicable scope and region classification

The projection applies to the entire world (all countries). There are eight region categories for the data used in the projection, determined geographically (the regions are subdivided into 31 countries/regions; Reference 2). The projection of supply and demand for each commodity is presented for these eight region categories. The main objective of the World Food Supply and Demand Model is to project trends in food supply and demand for the entire world. The projection of supply and demand for each commodity indicate the projection values for these eight region categories. In addition, this year's projection continues the method used the previous year and adds the results of the supply and demand projection for major producing/consuming countries for each commodity as reference values, making the change factors for the projected values clearer.

6. Population and economic growth rates

a) The global population in 2026 is estimated at 8.22 billion, based on the *World Population Prospects: The 2015 Revision* by the United Nations.

b) GDP (Real) data are estimated based on the *World Development Indicators 2016* by the World Bank, and real economic growth rates are estimated based on the *World Economic Outlook 2016* by the International Monetary Fund (IMF). Accordingly, the global average per capita GDP (real) is expected to rise 25.0% through 2026: from \$10,004 in the base year to \$12,502 in the target year.

III. Projection Results

1. Assumptions

Projection was conducted on the assumption that the current growth of the crop yield for cultivated crops will continue, and that there are no particular limitations on the expansion the existing area under cultivation. Furthermore, we endogenize the demand function for corn-based bioethanol and for biodiesel feedstock (it uses either soybean or one of the other vegetable oils) in our model. The model is set up in such a way that demand is determined by factors such as the price of crude oil, corn, soybean oil, and other vegetable oils. However, provisional calculations are made with the assumption that the consumption estimates mentioned in the biofuel policies of countries such as the USA and Brazil will be sustained in the future.

2. Projection results

Economic growth has slowed all over the world and continues at a sluggish pace in some developed and emerging nations such as China, Brazil, Russia, and India. Over the midterm, slow growth is anticipated to continue, leading to a slowdown in the growth of demand for agricultural products. Despite this, an increase in demand for agricultural products is expected due to the increase in demand for food and feed, primarily seen in emerging and developing countries as population continues to rise and income levels increase. Meanwhile, on the supply side, production of agricultural commodities is expected to rise primarily due to the increase in crop yield. Thus, it is predicted that the demand for grain will be satisfied with by its supply, and the international price of grain will continue to remain flat.

(A) Projections for production volume, consumption volume, and net imports/export volume by region

The production quantity, consumption quantity, and net imports/exports amount by region for each major commodity are shown below, both for a base year (the average of the values for 2013 and 2015) and for 2026. The figures for 2026 are based on projection results. Additionally, the projection identifies the country that is the primary producer and consumer of each commodity.

a) Wheat

Table 1 Projection results for wheat by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	728.1	840.5	704.5	840.5	0.0	0.0
North America	87.9	96.1	41.7	45.7	44.0	50.4
Latin America	25.3	30.0	38.0	44.1	-13.2	-14.1
Oceania	25.0	29.3	8.1	9.2	16.5	20.1
Asia	281.1	327.5	305.7	375.4	-38.5	-47.9
Middle East	39.6	49.0	59.9	74.6	-21.7	-25.6
Europe	243.5	273.9	179.0	196.0	61.1	77.9
Africa	25.7	34.6	71.7	95.0	-47.7	-60.4
(Reference)						
EU	153.8	168.2	123.4	137.1	27.7	31.1
Russia	57.4	67.7	35.6	38.0	21.4	29.6
Canada	31.5	36.7	9.0	10.8	22.7	25.9
US	56.4	59.4	32.6	35.0	21.4	24.5
Australia	24.6	28.9	7.1	8.1	17.0	20.8
Ukraine	24.8	29.6	12.0	12.3	12.6	17.3
China	128.4	131.2	115.3	133.6	-2.3	-2.4
India	92.0	115.6	91.9	116.1	3.3	-0.5

- i) In the base year, North America, Oceania, and Europe were net exporting regions, while Central and South America, Asia, the Middle East, and Africa were net importers.
- ii) Although the quantity produced in Central and South America, the Middle East, and Africa is expected to increase, compared with the base year, it is predicted that the growth in the quantity consumption will exceed this and the net imports will increase in 2026. The net import by the Middle East are predicted to rise to 25.6 million tons in 2026, and the net imports are expected to increase in not only North Africa but also sub-Saharan Africa due to the growth in total population, reaching 60.4 million tons for Africa as a whole. The 2026 projection for Asia is that the net imports in most countries will increase and the region will import 47.9 million tons. China's net wheat imports are expected to remain nearly flat, compared with the base year, and will be 2.4 million tons.
- iii) In North America and Europe, the rate of increase of production will exceed the rate of increase of consumption as crop yield improves, and the net exports for both regions will increase in 2026. Oceania shows strong growth in its net exports, driven by Australia's performance, and its net exports in 2026 are predicted to total 20.1 million tons. Although the United States' production is anticipated to increase, net exports will rise only slightly because the rate of increase will be slower than that witnessed in the past 10 years. In Europe, although the projected consumption amount has decreased due to the slowing of economic growth in Russia and Ukraine, the production potential is high despite uncertainty over the climate, and the net exports of the two countries in 2026 are expected to total 46.9 million tons, far exceeding that of the United States. In the EU, the net exports are predicted to increase slightly because production exceeds consumption.

b) Corn

Table 2 Projection results for corn by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	988.6	1,143.1	969.9	1,142.1	0.0	0.0
North America	365.7	402.6	311.1	338.4	47.1	63.8
Latin America	146.3	191.5	129.6	163.5	16.4	27.8
Oceania	0.7	0.8	0.7	0.8	-0.1	-0.1
Asia	285.8	321.7	320.3	382.9	-43.9	-61.6
Middle East	8.4	10.8	21.8	27.1	-14.4	-16.4
Europe	115.8	138.9	101.4	118.9	14.0	20.0
Africa	66.0	77.0	85.0	110.5	-19.2	-33.6
(Reference)						
US	352.6	387.6	298.1	323.2	47.0	64.1
Brazil	78.3	108.5	55.9	77.4	23.8	31.1
Argentina	27.6	33.4	9.1	10.8	18.3	22.5
Ukraine	27.6	32.5	9.2	10.4	18.5	22.1
EU	66.2	78.6	76.1	89.5	-10.2	-11.0
China	219.9	245.4	215.6	253.2	-4.0	-8.1

- i) In the base year, North America stood out as the top net exporter, followed by Central and South America and Europe. Asia, the Middle East, and Africa were net importing regions.
- ii) Although the production quantity is expected to increase in the net importing regions of Asia and Africa, it is predicted that the increase in consumption will exceed that in production and that the net imports by each region in 2026 will increase. In Asia, the net imports are expected to rise, particularly in China, reach 61.7 million tons. Although the EU is expected to increase its net imports slightly in 2026, it is predicted that an expansion in production in Ukraine and surrounding areas will increase European net exports in 2026.
- iii) In North America, demand is suppressed by the effects of the "blend wall," which refers to the problem of the limit imposed on bioethanol production by stipulating an upper limit for the bioethanol gasoline blend ratio to gasoline. Thus, it is anticipated that the continued growth in demand for bioethanol, which is made from corn, will slow. Although growth in the area under corn cultivation is expected to slow, increases in crop yield will keep the production quantity above the quantity consumed, and the net exports by the United States in 2026 are estimated to reach 64.1 million tons. In Central and South America, production will rise in Brazil and Argentina due to the growing of corn as a secondary crop, and the rise in these countries will far outstrip the increase in domestic consumption demand for corn used as feed and other purposes. The net exports by Brazil and Argentina in 2026 are estimated to increase to 31.1 million tons and 22.5 million tons respectively.

c) Rice

Table 3 Projection results for rice by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	476.7	555.8	477.8	556.0	0.0	0.0
North America	6.4	7.8	4.4	4.9	2.0	2.9
Latin America	17.8	22.8	19.0	21.9	-1.1	0.9
Oceania	0.4	0.5	0.4	0.5	0.1	0.0
Asia	427.9	492.9	408.5	468.5	20.2	24.5
Middle East	2.4	2.9	9.6	11.7	-6.9	-8.8
Europe	2.7	3.5	4.5	4.7	-1.8	-1.2
Africa	19.0	25.5	31.3	43.8	-12.4	-18.3
(Reference)						
Thailand	18.3	22.0	10.7	11.4	9.9	10.6
Vietnam	28.1	33.9	22.0	26.1	6.2	7.8
India	105.2	126.6	98.4	120.0	10.7	6.6
China	145.1	146.0	144.5	151.1	-4.8	-5.0
Indonesia	35.7	46.6	38.4	47.9	-1.6	-1.2
Bangladesh	34.5	42.5	35.1	43.6	-0.8	-1.0

- i) In the base year, net exporting regions included Asia, which accounts for approximately 90% of the total production and over 80% of the consumption, and North America. However, the quantity produced by the latter region was small.
- ii) Meanwhile, Central and South America, the Middle East, Europe, and Africa were all net importing regions.
- iii) In Asia, although demand for rice as food will rise as the population increases, production will also increase satisfactorily, and the net exports in 2026 are predicted to reach 24.6 million tons. In particular, Thailand is expected to increase its net export volume—although this will depend on the country's policies—and Vietnam is also expected to raise its net export volume, with estimated net export volumes in these countries increasing to 10.6 million tons and 7.8 million tons, respectively. In 2026, India's net exports are expected to fall to 6.7 million tons, although this will depend on the country's reserves and the minimum support price, which is influenced by both climate and government policies. Meanwhile, in China, the country's slight trade deficit will continue and net imports are expected to be 5.0 million tons. Indonesia's net imports are expected to fall to 1.2 million tons due to the increase in production outpacing the increases in consumption. In Bangladesh, the increase in demand will outpace the increase in production, and its 2026 net imports are expected to rise to 1.1 million tons.
- iv) Despite the trend of slowing population growth in the Middle East and Africa, the relatively higher population growth than other regions is likely to increase consumption and net imports in both areas. Net imports in 2026 are expected to be 8.8 million tons in the Middle East and 18.3 million tons in Africa. It is predicted that the increase in net imports by the Middle East and Africa will be met by the increase in net exports from Asia. Although no major changes are anticipated in Europe, the net import quantity is expected to decrease slightly.

d) Other grains (barley, rye, sorghum, etc.)

Table 4 Projection results for other grains by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	259.3	309.2	257.5	309.4	0.0	0.0
North America	29.5	34.2	19.9	23.4	8.8	10.8
Latin America	21.0	23.3	19.1	23.7	1.8	-0.4
Oceania	12.4	15.7	5.3	6.1	6.9	9.6
Asia	31.5	37.5	48.4	56.5	-17.0	-18.9
Middle East	12.2	14.7	25.2	31.4	-13.4	-16.7
Europe	105.8	124.2	89.5	100.9	16.3	23.4
Africa	46.9	59.7	50.1	67.4	-3.3	-7.7
(Reference)						
EU	69.3	80.5	60.8	69.6	8.4	11.0
US	17.6	20.2	11.3	12.9	5.7	7.3
Ukraine	9.5	12.1	5.5	5.8	3.9	6.3
Russia	22.9	26.7	18.9	20.7	4.0	6.1
India	18.2	22.3	17.8	22.7	0.4	-0.4

- i) In the base year, North America, Oceania, Europe, and Central and South America were net exporters, while Asia, the Middle East, and Africa were net importers.
- ii) Although production is expected to increase in the Middle East and Africa, consumption will also increase, primarily due to demand for other grains as feed in the Middle East and for food in Africa, and the quantity consumed will exceed what is produced. It is predicted that this trend will continue, leading to a rise in the net imports in 2026. In particular, food consumption of coarse grain, a traditional staple, is expected to increase along with the rise in total population in sub-Saharan Africa, and the net imports are estimated to reach 7.7 million tons in 2026. In the Middle East, it is anticipated that the net exports will reach 16.7 million tons due to increases in demand for feed, which makes up 90% of the total consumption amount. Meanwhile, in Asia, consumption is expected to surpass production, leading to a slight increase in the net imports.
- iii) In Oceania and Europe, production is predicted to rise steadily if the yearly averages for normal weather, with net exports in 2026 increasing to 9.6 million tons and 23.4 million tons, respectively. The European countries including Russia and Ukraine have the potential to raise production despite their being easily affected by poor weather conditions. The net exports in 2026 are expected to increase, reaching 6.1 million tons and 6.3 million tons in Russia and Ukraine, respectively. Meanwhile, Central and South America is expected to change from being a net exporter to a net importer due to increasing demand for feed, which accounts for 70% of all consumption of other grains.

e) Soybean

Table 5 Projection results for soybeans by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	305.2	375.0	299.6	375.5	0.0	0.0
North America	107.6	129.1	55.5	72.6	50.2	56.6
Latin America	165.1	206.9	99.5	122.1	63.0	85.3
Oceania	0.0	0.0	0.0	0.0	0.0	0.0
Asia	22.2	26.6	113.7	144.0	-92.5	-117.3
Middle East	0.3	0.4	4.7	4.8	-4.4	-4.4
Europe	7.9	9.7	21.5	27.0	-13.6	-17.4
Africa	2.0	2.2	4.8	5.0	-2.7	-2.8
(Reference)						
Brazil	93.5	116.8	42.3	51.5	51.1	65.4
US	101.7	122.7	53.2	69.5	46.7	53.2
Argentina	57.1	72.3	44.7	53.9	9.9	18.7
China	12.3	15.1	88.8	114.4	-77.8	-99.3
EU	1.7	2.0	15.1	19.6	-13.3	-17.6
India	8.4	9.6	8.6	10.7	0.2	-1.1

- i) In the base year, North America and Central and South America were net exporting regions, while Asia, Europe, the Middle East, and Africa were all net importers.
- ii) Although it is predicted that the Middle East and Africa will continue to have limited production and remain structurally dependent on imports, it is predicted that the level of consumption will be low compared with other regions. The trade deficit of Asia and Europe is likely to continue because of their low production levels, compared with the demand, and is predicted that the net imports will further increase in 2026. It is predicted that the net imports will increase for the EU countries in the European region and China in Asia, with the EU imports reaching 17.6 million tons and China's reaching 99.3 million tons in 2026. China alone accounts for 85% of the net imports by Asia, and the region's net soybean imports are expected to rise to 117.3 million tons in 2026.
- iii) North America's net exports are expected to increase to 56.6 million tons and more than 90% of this quantity will come from the United States. Meanwhile, it is predicted that Central and South America will rapidly ramp up production and that the 2026 net exports will also increase steeply, meeting the increase in net imports by North America, Asia, and Europe. In Central and South America, Brazil is the primary exporter and it has sufficient land to expand the area under cultivation without developing the *Amazon region*. Both crop yield per and harvest area are expected to increase and production in 2026 is estimated to reach 116.8 million tons. Based on these, Brazil's net exports are predicted to reach 65.4 million tons in 2026. Despite the limited size of the domestic market in Argentina, the 2026 demand for soybeans, used for extraction of soybean oil in countries to which it is exported, will be met. It is predicted that the country will rapidly increase its net exports of soybeans to 18.7 million tons. In the future, the increase in the net imports by Asia and Europe will be met by rising net exports from Brazil, the United States, and Argentina.

f) Vegetable oil (soybean oil, canola oil, and sunflower oil)

Table 6 Projection results for vegetable oils by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	91.3	111.3	91.1	111.4	0.0	0.0
North America	14.0	18.0	12.1	13.6	1.6	4.4
Latin America	19.4	23.8	13.7	15.2	5.8	8.6
Oceania	0.3	0.4	0.3	0.4	0.0	0.0
Asia	28.5	34.8	37.5	50.9	-9.3	-16.0
Middle East	2.1	2.2	3.8	5.0	-1.7	-2.8
Europe	26.0	30.9	19.8	21.3	6.3	9.7
Africa	1.1	1.2	3.9	5.1	-2.8	-3.9
(Reference)						
Argentina	8.8	10.7	3.3	3.7	5.6	7.0
Ukraine	4.8	5.4	0.5	0.6	4.3	4.9
Russia	4.6	5.3	2.3	2.3	2.3	3.0
Brazil	7.5	9.2	6.2	6.8	1.4	2.4
US	10.4	13.6	11.2	12.6	-0.9	0.9
India	3.3	3.8	8.4	11.5	-5.0	-7.7
China	21.2	26.5	23.4	32.5	-2.5	-5.9

- i) In the base year, North America, Central and South America, and Europe were net exporting regions, while Asia, the Middle East, and Africa were net importers.
- ii) The per capita increase in consumption in Africa and the Middle East due to increase in population and in Asia due to economic growth, and are the primary causes of increased consumption overall. Meanwhile, the scope for growth in production is extremely limited in both Africa and the Middle East, and Asia is also expected to have difficulties to increasing production sufficiently to meet growing consumption demand. Thus, it is predicted that the net imports in 2026 will increase in all these regions. Africa will see little growth in consumption, and the net imports in 2026 are predicted to increase to 3.9 million tons. In Asia, the per capita consumption in China is expected to keep increasing despite the signs of an economic slowdown, and it is predicted that the net imports will increase manifold. It is predicted that consumption will also increase in Asian countries other than China, and the 2026 net imports by Asia are estimated to reach 16.0 million tons.
- iii) In Europe, the EU, Ukraine, and Russia are expected to increase the production of vegetable oils made from sunflower, rapeseed and other vegetable oils, thus increasing the net quantity exported. Central and South America and North America will both see increases in their 2026 net exports due to the increase in production outpacing the increase in domestic demand. The net exports by Central and South America in 2026 will primarily comprise soybean oil. The net exports of vegetable oil by Argentina and Brazil in 2026 are expected to increase to 7.0 million tons and 2.4 million ton respectively, even as these countries experience increased domestic demand and increase in the net export for soybeans.

g) Beef

Table 7 Projection results for beef by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	60.5	71.7	60.6	71.7	0.0	0.0
North America	12.3	14.1	12.8	13.9	-0.5	0.3
Latin America	17.3	20.4	15.2	17.6	2.1	2.7
Oceania	3.2	3.8	0.9	1.0	2.3	2.8
Asia	15.7	19.6	17.1	23.2	-1.4	-3.5
Middle East	0.5	0.5	1.2	1.5	-0.7	-1.0
Europe	9.7	11.0	10.9	11.1	-1.1	-0.1
Africa	1.9	2.2	2.6	3.4	-0.7	-1.1
(Reference)						
Brazil	9.6	11.6	7.9	8.8	1.7	2.9
Australia	2.5	3.0	0.8	0.9	1.8	2.0
India	4.0	4.9	2.1	3.2	1.9	1.7
Argentina	2.8	3.5	2.6	2.9	0.2	0.6
US	11.2	12.8	11.7	12.7	-0.5	0.1
China	6.8	8.6	7.4	9.8	-0.6	-1.2

- i) In the base year, Central and South America and Oceania were net exporting regions, while Asia, Europe, the Middle East, and Africa were net importers. Demand and supply were nearly equal in North America.
- ii) Although demand will increase in Asia, the upward trend in beef production, including water buffalo, will continue and India is expected to maintain its relatively high net export level. Across Asia, meat is becoming a part of the diet as incomes rise, and thus, the previously low level of per capita meat consumption is expected to rise. It is predicted that China's net imports will increase to 1.2 million tons in 2026. Consumption amounts will also increase in other Asian countries, and it is estimated that in 2026 the total imports by Asia will increase to 3.5 million tons. Production levels are relatively low in the Middle East, compared with the demand, but there is a pattern of consumption increasing due to rising income. Based on this, the 2026 net imports are expected to rise to 1.0 million tons. In Africa, consumption is expected to increase, particularly in northern Africa, and higher net imports are predicted for the entire region. In Europe, growth rate of consumption are slowing and due to the predictions of an economic slowdown in Russia, net imports are expected to decrease. Based on such factors, the net imports by Europe as a whole are expected to fall. The US is raising productivity per head of cattle to increase production and ensure that it exceeds the growth in the quantity consumed, thus creating more exports than imports, and North America is predicted to become a net exporter.
- iii) Although per capita consumption is high in Oceania, which includes Australia, an increase in consumption is limited by the size of the regional market. Meanwhile, production is steadily increasing and the trend of increasing net exports is expected to continue. The expected net exports in 2026 are 2.8 million tons, making Oceania the largest exporting region in the world. In South and Central America, the fact that the net exports are increasing in Brazil and Argentina leads experts to estimate that the net exports by the South and Central American region will increase. The net beef exports by traditional exporters Brazil and Argentina will increase, to 3.4 million tons in 2026.

h) Pork

Table 8 Projection results for pork by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	112.3	132.9	112.4	132.9	0.0	0.0
North America	12.5	15.0	9.8	10.4	2.7	4.6
Latin America	6.7	8.8	7.1	8.2	-0.4	0.6
Oceania	0.4	0.4	0.6	0.8	-0.2	-0.3
Asia	65.1	78.8	68.5	85.4	-3.4	-6.6
Middle East	0.0	0.0	0.0	0.0	0.0	0.0
Europe	27.0	29.2	25.6	27.1	1.4	2.1
Africa	0.6	0.8	0.8	1.1	-0.2	-0.3
(Reference)						
US	10.7	12.5	8.9	9.5	1.7	3.0
EU	22.8	24.4	20.5	21.7	2.2	2.7
Canada	1.8	2.5	0.8	0.9	1.0	1.6
Brazil	3.4	4.6	2.8	3.1	0.6	1.5
China	55.5	67.2	56.2	69.8	-0.7	-2.6

- i) In the base year, North America and Europe were net exporting regions; Asia was a net importing region; and Central and South America, Oceania, and Africa all showed net imports. As the Middle East region is predominantly Islamic, pork supply and demand is very limited.
- ii) Asia accounts for about 60% of the world's pork demand and supply. Although production in Asia will continue to rise steadily in the future, economic growth will cause a further increase in the quantity consumed. Consumption will be particularly strong in the southeast Asian countries such as the Philippines and Vietnam, and the net imports in 2026 are expected to reach 6.6 million tons. In particular, the consumption volume in China, which accounts for over 80% of consumption in Asia, will continue to grow in the future and its net imports in 2026 are expected to reach 2.5 million tons.
- iii) In North America, the net export volume is expected to increase to 4.6 million tons because the decrease in per capita consumption in the United States will be more than offset by the increase in production due to improvements in productivity. In South and Central America, the net exports will increase due to rising production in Brazil, and the net exports in 2026 are expected to increase to 1.5 million tons. European countries such as Russia, where there is a general sense of a slowing down of the economy, are displaying a tendency to decrease imports. It is predicted that the increase in per capita consumption in the EU is limited and production will increase. Therefore, the net exports by Europe region are expected to be 2.1 million tons in 2026. In the future, it is expected that the increase in Asia's net imports will be covered by the increase in net exports from North America, Europe, and Brazil.

i) Chicken

Table 9 Projection results for chicken by region

(Unit : Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2013-15	2026	2013-15	2026	2013-15	2026
World Total	90.3	114.5	90.3	114.5	0.0	0.0
North America	18.5	21.1	15.4	16.9	3.1	4.2
Latin America	20.7	27.5	18.5	20.8	2.2	6.6
Oceania	1.2	1.4	1.2	1.5	0.0	-0.1
Asia	27.6	36.4	29.3	43.4	-1.6	-7.0
Middle East	3.6	5.1	5.9	8.3	-2.2	-3.2
Europe	14.9	17.8	15.0	16.3	0.0	1.5
Africa	3.7	5.2	5.1	7.3	-1.4	-2.1
(Reference)						
Brazil	12.7	17.8	9.1	10.1	3.6	7.7
US	17.4	19.9	14.3	15.7	3.1	4.2
EU	10.3	12.2	10.0	10.9	0.3	1.3
Thailand	1.6	2.2	1.1	1.1	0.5	1.1
China	13.3	17.2	13.1	18.4	0.1	-1.2

i) In the base year, North America and Central and South America were net exporting regions; Asia, the Middle East, and Africa were net importing regions; in both Oceania and Europe, the demand and supply were met.

ii) As chicken: (i) is relatively inexpensive, when compared with other kinds of meat; (ii) fits in with the desire to eat healthier food; and (iii) is not avoided for religious reasons, its consumption is increasing all over the world. The consumption is increasing, keeping pace with the economic growth, in the Middle East and Africa as well, and the net import amount in 2026 is expected to be 3.2 million tons and 2.1 million tons, respectively. The trend of increase in consumption in Asia is expected to continue and the 2026 net imports are expected to reach 7.0 million tons. An increase in consumption is also expected in China, and it is predicted that the net imports will reach 1.2 million tons. However, as it is relatively easy to expand the production of chicken due to its short production cycle, when compared with red meat, and the integration possible in the production process, it is also possible that the net imports will decrease. Chicken is a food item that is consumed more as economic growth increases disposable incomes and its consumption is also increasing in other Asian countries. It is predicted that the rising demand in these countries will lead to an increase their net imports.

iii) Although per capita consumption is relatively high in North America, and particularly in the United States, the growth in consumption is comparatively small. Experts expect the trend of production outpacing the growth in consumption to continue, with the 2026 net export amount reaching 4.2 million tons. Brazil, the world's biggest exporter of chicken, is highly competitive in the international chicken market, and it is predicted that the country will increase its net exports in 2026 to 7.7 million tons. In the future, both Central and South America and North America will increase their net exports—the increase being driven by Brazil and the United States in the latter—and thereby meet the increase in consumption in Asia.

(B) Projections of per capita consumption volume

The forecast of per capita consumption amount in the base year (the average of 2013/2015) and in 2026 are given below for grain, vegetable oil, and chicken. Additionally, for the sake of reference, projection results for the major emerging countries—China, India, Russia, and Brazil—that are expected to have a major impact on the world's food supply and demand as future economic growth takes place, are also given.

a) Grain (total consumption quantity, including grain used for feed)

Table 10 Per capita grain consumption volume projection results

	Base year (2013-15)		Target yera (2026)	
	Value	Index	Value	Index
	kg		kg	
World Total	331.9	100	347.0	105
North America	1,064.2	100	1,068.8	100
Latin America	328.5	100	362.2	110
Oceania	517.4	100	513.2	99
Asia	268.6	100	289.8	108
Middle East	373.1	100	388.4	104
Europe	503.9	100	566.0	112
Africa	206.1	100	206.2	100
(Reference)				
China	364.1	100	398.0	109
India	177.2	100	194.3	110
Russia	440.4	100	488.2	111
Brazil	376.5	100	457.1	121

- i) The per capita consumption of grain in 2026 includes grain consumed for feed or producing biofuels, and all regions other than Oceania and Africa are predicted to see an upward trend in consumption, compared with the base year.
- ii) For emerging countries such as Brazil and Russia in Europe and Central and South America, respectively, grain consumption is expected to grow at a relatively high rate. In the livestock net exporting region of Central and South America, there is a very large consumption of grain as feed, while in Europe, the consumption of grain as feed for livestock production is increasing as the population growth stagnates. Therefore, the rate of increase for these two regions is high.

In Asia, although the diversification and improvement in diet in China and India is increasing the human consumption by humans of vegetable oil and livestock products, and the consumption of grain as feed, the per capita consumption of grain as staple food is predicted to stagnate. The rate of increase in the per capita consumption of grain in Asia, Middle East, and Africa is relatively low compared to the countries in Europe and Central and South America. It is predicted that the sluggish growth in consumption due to factors such as a lack of purchasing power will lead to insipid growth.

iii) Population growth in North America is high, compared to other regions with developed nations, and a slowdown in the growth in demand for corn-based bioethanol is expected because of the existing government policy, resulting in a nearly flat growth. Additionally, the per capita consumption in Oceania is predicted to be flat.

b) Vegetable oil

Table 11 Per capita vegetable oil consumption volume projection results

	Base year (2013-15)		Target yera (2026)	
	Value	Index	Value	Index
	kg		kg	
World Total	12.6	100	13.6	108
North America	34.1	100	35.2	103
Latin America	21.9	100	21.8	99
Oceania	12.2	100	12.0	99
Asia	9.3	100	11.5	124
Middle East	12.3	100	13.3	108
Europe	26.6	100	28.6	108
Africa	3.4	100	3.3	99
(Reference)				
China	17.2	100	23.0	134
India	6.5	100	7.8	120
Russia	16.0	100	16.6	104
Brazil	29.9	100	30.2	101

i) The per capita consumption of vegetable oil in 2026 is expected to rise slightly, compared to the base year, in North America, a developed region, and an upward trend in consumption is expected in Europe because it includes emerging countries.

ii) In Asia and the Middle East, the trend of increasing per capita consumption, is supported by the economic growth. The relatively high rate of economic growth is predicted to raise consumption in Asia by 24%, caused by a 34% increase in China and a 20% increase in India. However, the per capita consumption in Asia and the Middle East in 2026 is expected to stabilize at 11.5 kg and 13.3 kg, respectively. As these quantities are only about 50% of the per capita consumption in Central and South America, there is ample scope for future increases in consumption.

iii) It is predicted that the 2026 per capita consumption level in Central and South America will remain nearly flat, at about 60 to 70% of the levels in North America and Europe. Due to a slight slowdown in economic growth, Brazil's per capita consumption is expected to drop slightly and bottom out at 30.2 kg in 2026. The low purchasing power and consumption level in Africa mean that per capita consumption will not rise and it is estimated to be 3.3 kg in 2026.

c) Meat

Table 12 Per capita meat consumption volume projection results

	Base year (2013-15)		Target yera (2026)	
	Value	Index	Value	Index
	kg		kg	
World Total	38.1	100	41.1	108
North America	107.5	100	107.1	100
Latin America	65.9	100	67.5	102
Oceania	114.4	100	119.1	104
Asia	30.2	100	36.5	121
Middle East	27.0	100	31.5	117
Europe	71.0	100	75.3	106
Africa	9.8	100	10.1	103
(Reference)				
China	59.2	100	73.4	124
India	5.3	100	8.3	155
Russia	66.0	100	70.1	106
Brazil	96.6	100	98.9	102

- i) With the exception of North America, an upward trend in per capita consumption of meat until 2026 is anticipated, when compared with the base year.
- ii) Asia and the Middle East, where per capita consumption levels are relatively low, are expected to witness rates of growth of 21% and 17%, respectively, in 2026. The relatively high rate of economic growth in Asia, compared to developed countries, will see consumption grow by 24% in China and 55% in India. Although India will see an increase, particularly in chicken consumption, the base year figure of 5.3 kg will increase to a still relatively low 8.3 kg in 2026, and it is predicted that chicken consumption levels will not even reach the base year levels of Africa. In Africa, there was no marked increase in per capita consumption amount of grain or vegetable oil, and although Africa's consumption level is the lowest among the regions analyzed, it is predicted that it will increase by 3% to reach 10.1 kg in 2026, primarily due to the increase in consumption of chicken in north Africa.
- iii) The per capita consumption in North America, Oceania, and Europe was already high in the base year, and it is predicted that the consumption in 2026 will be a reach 107.1 kg in North America and increase slightly to 119.1 kg in Oceania. Amid predictions of economic stagnation in Russia, per capita consumption amount is expected to increase by 6% in 2026, primarily due to growing demand for chicken. Although the 2026 per capita consumption in Central and South America is predicted to grow by 2% and stabilize at 67.5 kg, which is close to the European consumption level.

(C) International price projections

i) Grain and soybean

In 2012, corn prices temporarily exceeded wheat prices and both corn and

soybean prices hit record high level on the Chicago market due to a severe drought in the United States. However, the price hike of grain and soybeans increased the incentive for farmers to grow them, leading to an increase in area under cultivation. Due to this, production in not only the United States but also South America increased in 2013 and 2014, leading to a downward trend in international prices.

From 2015 onwards, demand for grain and soybeans as livestock feed has remained high as emerging and developing countries continue to consume larger quantities of livestock products. While the total population continues to grow despite population growth slowing in regions like Asia and Africa, the consumption demand for biofuel feedstock propped up by government policies and the limit on the bioethanol blend ratio to gasoline (blend wall) means that there is limited room for bioethanol demand. Indications of a bearish market, such as slow economic growth in some emerging nations, are also evident. Although international prices for grain and soybeans are not expected to return to the low levels seen before 2006, it is predicted that they will remain flat. Additionally, the international prices for wheat, corn, rice, and soybeans in 2026 are expected to increase by 0.9 - 2.6% in real terms and remain stable.

ii) Vegetable oil (soybean oil and other vegetable oils)

Amid disparate levels of economic growth, and the slowing of the growth in demand for non-edible use of soybean or other vegetable oils, the consumption of vegetable oil is rising in emerging countries, particularly those in Asia, and the population continues to increase, especially in Asia and Africa. Given these factors, it is predicted that the international price of vegetable oil is expected to be higher than the price of wheat.

iii) Meat

The population increase in regions such as Asia and Africa ensures a steady consumption of meat. The consumption of chicken is increasing worldwide, helped by the growing desire to be healthy and the lack of religious proscription on its consumption. Chicken prices are expected to rise by 6.8% in real terms in 2026. Meanwhile, pork prices are expected to see a similar increase of 5.1% due to increased consumption, primarily in Asia. It is predicted that beef prices will be nearly flat, with a growth rate of 2.5%. Meat consumption is increasing because of the changes in diet quality that accompanies rising income levels. Meat prices are also affected by the fact that the current price levels for feed corn and grains are holding steady despite slowing growth, and it is predicted that the price of meat will trend slightly upward.

iv) Dairy products

Despite disparities in economic growth, the consumption of dairy products such as butter, powdered skim milk, and cheese is increasing gradually, with the rise in income levels in emerging and developing countries that have low per capita consumption. Despite the slowing of the rate of population growth, the increasing population will lift demand in the future. As such, international prices are expected to trend upward. However, cheese is different in that it takes time to process it and meet the demand. It is expected that the growth in demand for cheese in emerging economies, particularly those in Asia, will be lower than the demand for butter and powdered skim milk. Thus, a relatively slower growth is predicted for it.

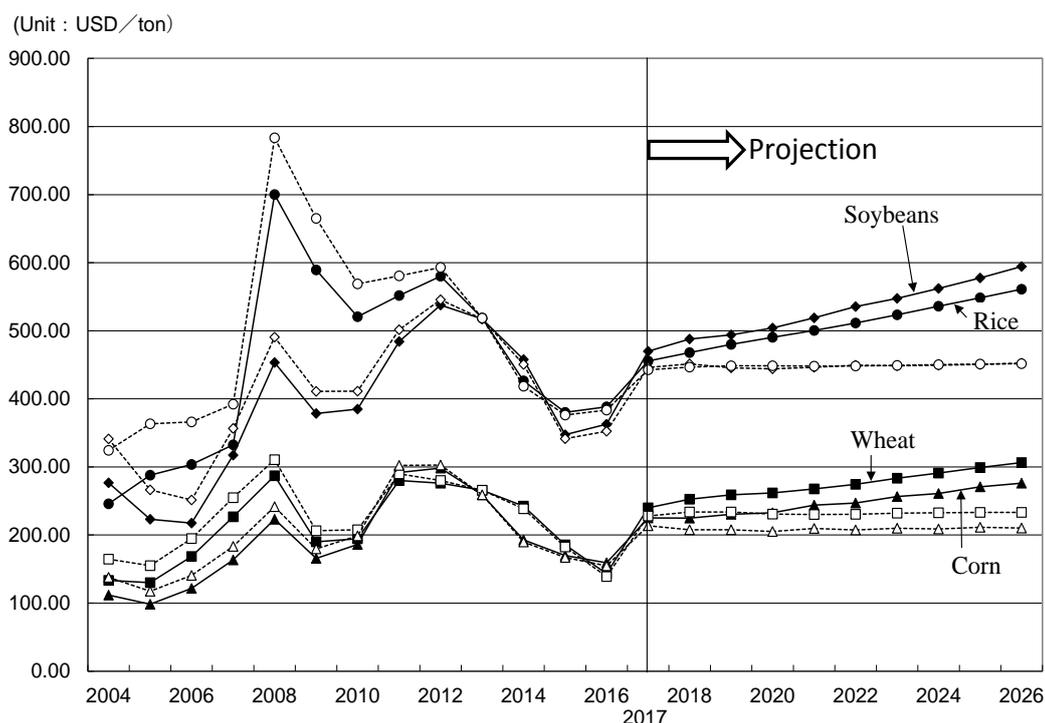


Figure 1 International price projections for grains and soybeans
(Solid lines: Nominal prices; Dotted lines: Real prices)

Notes

1. Prices until 2016 are actual prices. Prices for 2017–2026 are projections.
2. Actual prices and future nominal prices use 2014 (average of three years from 2013 to 2015) as the base year. Wheat, corn, and soybean prices were calculated using the US consumer price index (CPI), and rice prices were calculated using Thailand's CPI (all from IMF data).

Table 13 Base year and target year prices of major items

(Unit: US dollars per metric ton [crops] and US dollars per 100kg [livestock products])

Commodities	Base year price (2013-15)	2026 (Target year)			
		Real price	Nominal price		
			Changing rate (%)	Changing rate (%)	
Wheat	231	233	0.9	307	32.5
Corn	207	210	1.4	276	33.2
Rice	442	452	2.2	561	27.0
Other grains	160	162	1.1	207	29.4
Soybeans	441	452	2.6	594	34.9
Vegetable oils	869	1,002	15.4	1,300	49.7
Beef	447	458	2.5	615	37.6
Pork	189	199	5.1	261	38.0
Chicken	242	258	6.8	339	40.3
Butter	385	511	32.8	634	64.8
Powdered Slim milk	390	475	21.8	589	51.1
Cheese	428	443	3.7	550	28.7

Note: Among the target year nominal prices of wheat, corn, soybeans, and vegetable oils, the prices of soybean oil, pork, and chicken were calculated using the US CPI, the prices of other grains and other vegetable oils using Canada's CPI, the price of rice using Thailand's CPI, the price of beef using Australia's CPI, and the prices of dairy products using New Zealand's CPI (all from IMF data).

Appendix: List of Estimate Results for Major Grains

Table 14 Production volumes, consumption volumes, ending inventory volumes, and international prices of major grains

(Unit: Million tons)

		Wheat	Corn	Rice	Soybeans
Base year (2013-15)	Production volume	728	989	477	305
	Consumption Volume	705	970	478	300
		Food	574	395	477
	Feed	131	575	1	21
	Ending stock volume	234	205	118	71
	International price (US dollars per ton)	231	207	442	441
2026	Production volume	840	1,143	556	375
	Consumption Volume	840	1,142	556	375
		Food	681	428	555
	Feed	160	714	1	26
	Ending stock volume	233	202	115	68
	International price (Real: US dollars per ton)	233	210	452	452
International price (Nominal: US dollars per ton)	307	276	561	594	
Changin g rate (%)	Production volume	15	16	17	23
	Consumption Volume	19	18	16	25
		Food	19	8	16
	Feed	22	24	-8	22
	Ending stock volume	-1	-1	-2	-4
	International price (Real: US dollars per ton)	1	1	2	3
International price (Nominal: US dollars per ton)	33	33	27	35	

Note: Volumes for soybeans for food consumption include consumption volumes for oil extraction.

Commentary: World Food Supply and Demand Model

1. The World Food Supply and Demand Model was developed using a measurement model development system for food supply and demand that was developed by Keiji Ohga, University of Tokyo Professor Emeritus, and Gen Furuhashi, Senior Researcher at the Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries (PRIMAFF). A refined version of the model was developed at PRIMAFF in 2008. Subsequent refinements were made such as incorporation of equations of the World Biofuel Supply and Demand Projection Model developed by Senior Researcher, Tatsuji Koizumi.

The model is a simultaneous equation system supply-and-demand equilibrium model in which the supply and demand of each commodity are matched through the medium of price every year through the target year, with the entire world as the market, and under fixed assumptions about future population growth rates and economic growth rates. The model consists of about 6,000 equation systems.

2. Essentially, the supply and demand tables for each commodity conform to the approach used by the United States Department of Agriculture's food supply and demand tables. However, the following specific points should be noted for the items mentioned:

(A) The data for rice are for milled rice.

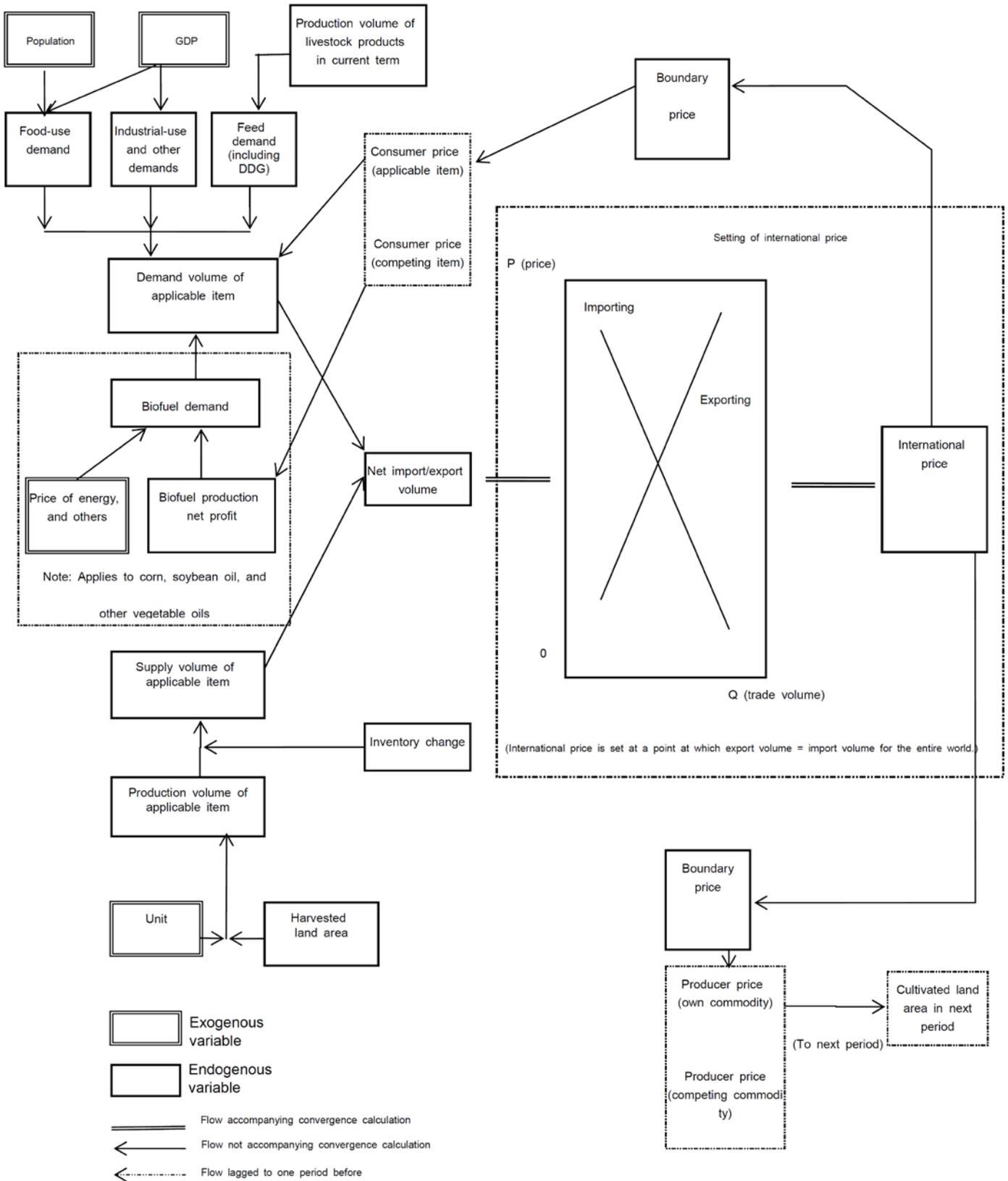
(B) Due to data limitations, the effects of stocks of beef, pork, chicken, mutton, eggs, milk, and processed livestock products on supply and demand are not considered.

3. For model projection purposes, the base year supply and demand volumes are adjusted as described below. Thus, they do not necessarily match the actual figures.

(A) The model assumes equilibrium supply and demand in a single year, so the volumes are adjusted to make the worldwide net import/export volume zero.

(B) To prevent discontinuous movements in international prices, the figures are adjusted to balance the worldwide production and consumption volumes of each commodity.

Reference 1: Conceptual Diagram of the World Food Supply and Demand Model



Reference 2: Applicable Countries and Region Categories

Applicable countries and region categories used in the model projections

Region category	Sub-category (country/region name)
North America	US and Canada
Latin America	Argentina, Brazil, Mexico, and other parts of Latin America
Oceania	Australia and New Zealand
Asia	Japan, China, Korea, Thailand, Vietnam, India, Indonesia, Pakistan, Bangladesh, Malaysia, Philippines, Taiwan, and other parts of Asia (including Central Asia)
Middle East	Middle East
Europe	EU (28 countries), Russia, Ukraine, and other parts of Europe
Africa	South Africa, Nigeria, North Africa, and other parts of Africa
Rest of world	Rest of the world
Total	31 countries/regions