FY 2015

World Food Supply and Demand Projection to 2025

-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 2025.

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 price of the item and competing items.

(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 item and competing items 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 item and competing items.

(C) Prices

International prices are determined at the point at which the demand and supply for each item 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 2025 as the target year and 2013 as the base year. However, figures for the 2013 base year are averages for the three-year period from 2012 to 2014.

4. Projected items
The projected items are production volume, consumption volume, and net export volume (or net import volume) for each item/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 item 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 item 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 2025 is estimated at 8.14 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 2015* by the World Bank, and real economic growth rates are estimated based on the *World Economic Outlook 2015* by the International Monetary Fund (IMF). Accordingly, the global average per capita GDP (real) is expected to rise 24.7% through 2025: from $7,896 in the base year to $9,848 in the target year.

III. Projection Results

1. Assumptions

Crop projections were made under the assumptions that the current growth in unit yield will continue and that there will be no restrictions on expansion of harvested land area (total land area).

The demand functions for the demand for corn for bioethanol production and demand for soybean oil and other vegetable oils for biodiesel production were incorporated into the model to determine the demand using parameters such as prices of corn, soybean oil, and other vegetable oils. Estimates were made under the assumption that target usage volumes in biofuel policies of countries such as the US and Brazil will remain unchanged in future.

2. Projection results

Global economic growth will slow down and become stagnant in some of the developed and emerging countries such as China, Brazil, Russia, and India; however, there is an expectation of continued moderate growth over the medium term. Therefore, although the growth rate of crop demand will slow down, demand growth is still expected. There will be an increase in food/feed demand, mainly in the emerging and developing countries due to ongoing total population growth and improving income levels. There is also support for the moderately growing demand for biofuel feedstocks. On the supply side, the production of grains and oilseeds are expected to grow, mainly through yield growth; however, demand will continue to slightly exceed supply, and international prices of food are expected to remain nearly unchanged, with a moderate rise.

(A) Projections of production volumes, consumption volumes, and net import/export volumes by region

The tables below show the projection results for the production volume, consumption volume, and net import/export volume for each major commodity for the base year (average of 2012–2014) and 2025. Projection results for major production/consumption countries are also presented as reference values for each item.

a) Wheat

Table 1 Projection results for wheat by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	702.9	828.1	693.1	828.6	0	0
North America	89.5	99.6	44.6	48.9	45.1	50.8
Latin America	24.1	29.4	37.4	43.9	−14.4	−14.5
Oceania	24.4	29.3	7.9	9	17.4	20.4
Asia	279	328.6	302.2	369.1	−32.3	−40.3
Middle East	37.9	47.5	58	72.6	−22.3	−25.1
Europe	222.7	258.9	173.8	191.2	49.9	67.8
Africa	25.3	34.8	68.7	93.4	−43.1	−58.6
(Reference)						
US	58.2	62.4	34.5	36.9	23.6	25.5
Canada	31.3	37.2	10.1	12	21.5	25.2
Australia	23.9	28.9	7	7.9	17.9	21
China	126	132.6	117.7	135.9	−2.7	−3.2
India	94.7	117.1	90.3	113.4	5.4	3.7
EU	144.9	162.6	119.9	134.5	24.7	28.2
Russia	49.6	63	34.4	36.7	16.6	26.3
Ukraine	20.9	25.2	11.6	11.7	9.4	13.4

i) In the base year, North America, Oceania, and Europe were net exporter regions and Latin America, Asia, the Middle East, and Africa were net importer regions.

ii) The production volumes of Latin America, the Middle East, and Africa will show growth of over 20% relative to the base year, but the consumption volumes will grow at a higher rate, resulting in higher net import volumes for these regions in 2025. The Middle East's net import volume will grow to 25.05 million tons in 2025. Africa's net import volume will grow, along with a rise in total population in both North Africa and the Sub-Sahara region. In 2025, the volume is expected to reach 58.63 million tons for the Africa region and 40.25 million tons for the Asia region, as the net import volumes of many countries increase slightly. China's net import volume is expected to be 3.25 million tons, but this volume is small compared to the country's domestic production volume of 132.56 million tons. India will have net export volume of 3.68 million tons in 2025, although the figure will depend on policy measures such as price supports.

iii) In North America and Europe, growth in yields will cause the production volume growth rate to exceed the consumption volume growth rate, so the net export volumes of both regions will grow by 2025. Led by Australia, Oceania will have high net export volume growth, with the region's net export volume expected to be 20.36 million tons in 2025. Although the production volume of the US will grow, the growth rate will be slower than in the previous ten years, resulting in only a slight growth of the net export volume. In Europe, the slowing economic growth in Russia and Ukraine has resulted in lower consumption volume projections, although the potential production volume is high despite uncertainties such as weather. Continued growth in the net export volume is expected. The total net export volume for the two countries is expected to be 39.71 million tons in 2025, far surpassing the figure for the US. The EU's production volume is expected to exceed its consumption volume, resulting in slight net export volume growth.

b) Corn

Table 2 Projection results for corn by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	960.4	1112.2	930.9	1113	0	0
North America	341.4	385	298.1	329.1	36.7	56
Latin America	145.5	186.2	123.6	156.7	18.1	29.6
Oceania	0.6	0.7	0.6	0.7	0	0
Asia	284.6	317.5	305.8	368.8	−38.2	−50.9
Middle East	7.8	10	20.6	25.9	−13.6	−15.9
Europe	112.3	133.4	99.6	120.3	11.7	13.1
Africa	68	79.4	82.7	111.5	−14.8	−32
(Reference)						
US	328.5	370.1	285.7	314.7	36.1	55.6
China	219.7	242.4	208.1	248.8	−4	−6
EU	66.2	77.6	75	92.9	−9.5	−15.2
Ukraine	26.8	31.4	9.5	10.6	16.9	20.8
Argentina	26	30.7	8.7	10.5	17.1	20.2
Brazil	81.2	108.4	54.9	76.1	23.1	32.4

i) In the base year, North America led the net exporter regions, followed by Latin America and Europe. Asia, the Middle East, and Africa were net importer regions.

ii) In the net importer regions of Asia and Africa, production volumes will grow, but this growth is expected to be surpassed by consumption volume growth caused by feed corn and other demands, resulting in higher net import volumes in 2025. In Asia, China has become a net importer in recent years; however, due to a slowdown in economic growth that has been called the “new normal,” its net import volume is expected to be only 60.4 million tons in 2025. The net import volume of the entire Asia region is expected to be 50.93 million tons. In Europe, the EU’s net import volume will grow by 2025, and the net export volume growth of countries such as Ukraine is expected to result in net export volume growth for the entire Europe region in 2025.

iii) In North America, the demand will fall due to factors such as the problem of bioethanol content in gasoline reaching its upper limit (the “blend wall”); therefore, the ongoing demand growth rate for bioethanol made from corn is expected to slow down. The rate of increase in harvested land area for corn will slow down, but the yield will rise, resulting in both production volume exceeding consumption volume and the US net export volume reaching 55.61 million tons in 2025. In Latin America, Brazil and Argentina will increase production volumes through measures such as second-corn crops, and these production volumes will greatly exceed the growth of domestic consumption volumes from sources such as feed demand. In 2025, the net export volume is expected to grow to 32.38 million tons in Brazil and 20.24 million tons in Argentina, reaching a total of 52.62 million tons for both countries.

c) Rice

Table 3 Projection results for rice by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	476.5	558.6	479.6	558.6	0	0
North America	6.5	7.5	4.4	5	2.1	2.6
Latin America	18.2	23.1	18.9	22.2	−0.8	0.9
Oceania	0.6	0.7	0.4	0.5	0.2	0.2
Asia	427.6	496.4	410.9	470.4	20.1	26
Middle East	2.4	2.8	9.3	11.4	−7	−8.6
Europe	2.7	3.4	4.4	4.6	−1.7	−1.2
Africa	18.5	24.5	31.2	44.4	−12.8	−19.8
(Reference)						
China	144.2	148.2	148.2	152.5	−4.2	−4.3
Thailand	19.8	22.2	11.1	11.9	8.8	10.3
Vietnam	27.9	35.7	21.9	26.3	6.3	9.5
Indonesia	36.4	45.5	38.5	48.3	−1.1	−2.8
India	104.8	129.1	97.5	119.6	10.4	9.5
Bangladesh	34.2	43.5	34.9	43.8	−0.7	−0.3

i) In the base year, Asia (accounting for about 90% of the production volume and over 80% of the consumption volume) and North America (despite its low production volume) were net exporter regions. Latin America, the Middle East, Europe, and Africa were net importer regions.

ii) In Asia, the production volume will increase steadily and food demand will increase along with the growing population, but the net export volume is expected to reach 26.03 million tons in 2025. Both Thailand (subject to policy) and Vietnam are expected to increase their net export volume. India’s net export volume will depend on minimum price supports and stocks (which are affected by weather and policy), but it is expected to decline slightly to 9.53 million tons in 2025. The net export volumes of Thailand and Vietnam are expected to grow to 10.30 million tons and 9.45 million tons, respectively, in 2025. China is expected to have somewhat of a net import volume surplus, with a figure of 4.28 million tons. Bangladesh’s production volume growth rate will exceed its consumption volume growth rate, resulting in a slight decrease in its net import volume. Indonesia’s consumption volume will grow along with its population, and its net import volume is expected to grow to 2.84 million tons in 2025.

iii) In the Middle East and Africa, the population growth rate is showing a trend of slowing down, but it is still higher than the growth rate of other regions. The consumption volume will grow along with total population, resulting in growth of net import volumes for both regions. In 2025, the net import volume is expected to grow to 8.61 million tons for the Middle East and 19.85 million tons for Africa. The trend of rice trading, consisting of export from Asia and import by the Middle East and Africa, will continue to expand. In contrast, there will be no major change in Europe, but its net import volume is expected to decrease slightly.

d) Other grains (such as oats, rye, and sorghum)

Table 4 Projection results for other grains by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	251.4	303.4	251.1	303.4	0	0
North America	26.1	30.6	19.6	23	6.6	7.5
Latin America	22.3	25.3	20.1	25.5	2	−0.1
Oceania	11.6	14.7	5.3	6.1	6.4	8.6
Asia	30.7	36.9	43.3	50.5	−12.5	−13.6
Middle East	11.2	13.7	23.9	30	−12.8	−16.3
Europe	101.6	120.2	88.5	99.2	12.9	21
Africa	47.9	61.9	50.4	69.1	−2.5	−7.1
(Reference)						
US	14.5	16.8	11	12.6	3.4	4.2
India	18.2	22.5	17.8	22.5	0.5	0
EU	67	78.4	60.3	68.9	6.6	9.5
Russia	21.6	25.4	18.2	19.8	3.2	5.6
Ukraine	8.9	11.4	5.6	5.9	3.3	5.5
Nigeria	11.3	15.2	11.3	15.5	0.1	−0.4

i) In the base year, North America, Oceania, Europe, and Latin America were net exporter regions, while Asia, the Middle East, and Africa were net importer regions.

ii) The production volumes of the Middle East and Africa will grow, and the consumption volumes of these regions will grow mainly due to increasing feed demand in the Middle East and food demand in Africa, continuing the trend of production volumes being surpassed by consumption volumes. The net import volumes will, therefore, increase by 2025. In Africa, the increase in the total population of the Sub-Sahara region will result in an increase in food consumption of coarse grains used as traditional foodstuffs, causing the net import volume to increase to 7.12 million tons in 2025. In the Middle East, food consumption will only account for about 10% of the total consumption volume. The remainder will be feed demand, which will grow by 26.3%, and the net import volume is expected to reach 16.31 million tons. In the Asia region, the consumption volume is expected to surpass the production volume, and the net import volume is expected to grow. India’s net export volume is expected to decrease slightly due to growth of the demand volume slightly exceeding growth of the production volume (depending on policy).

iii) If the weather remains normal in Oceania and Europe, the production volumes will increase steadily and net export volumes will grow to 8.61 and 21.05 million tons, respectively, in 2025. In the Europe region, Russia and Ukraine are particularly susceptible to the effects of adverse weather, but they have high potential production volumes. As with wheat, net export volumes are expected to grow. The expected volumes for 2025 are 5.60 and 5.53 million tons for Russia and Ukraine, respectively. In Latin America, feed demand (which accounts for about 80% of all consumption volume) is expected to grow, making the region no longer a net exporter.

e) Soybeans

Table 5 Projection results for soybeans by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	290.2	359.3	281.1	359.7	0	0
North America	99.6	122.3	53.3	77.2	45.3	45.2
Latin America	156.9	196.9	92.2	109.6	55.9	87.7
Oceania	0.1	0.1	0.1	0.1	0	0
Asia	24.6	29	108.3	137.1	−83.3	−108
Middle East	0.3	0.4	2.7	2.7	−2.4	−2.3
Europe	6.7	8.3	20.4	28.7	−13.5	−20.5
Africa	2	2.2	4.1	4.3	−2.1	−2
(Reference)						
US	94.1	116.2	51.2	74.5	42.1	41.8
China	12.5	14.9	83	107.5	−70	−92.6
India	10.5	12.2	10.3	12.2	0.2	−0.1
EU	1.3	1.5	14.6	22.3	−13.1	−20.8
Argentina	54.3	70.5	40.3	42.9	7.9	27.8
Brazil	87.7	107.8	40.2	51.1	44.7	56.8

i) In the base year, North America and Latin America were net exporter regions, while Asia, Europe, the Middle East, and Africa were net importer regions.

ii) Production volumes of the Middle East and Africa are expected to be limited, and although structural reliance on imports will continue, the consumption levels will be lower than other regions. Production volumes of Asia and Europe are expected to be relatively low, with consumption volumes over three times greater than the production volumes, so import surpluses will continue and net import volumes will grow further by 2025. In the Europe region, the EU is expected to increase its net import volume, as is China in the Asia region. By 2025, the net import volume is expected to reach 20.77 million tons for the EU and 92.62 million tons for China. The net import volume of the Asia region is expected to grow to 108.04 million tons by 2025, with China accounting for 86% of this volume.

iii) The net export volume of North America is expected to be nearly unchanged, with the US accounting for over 90% of the volume. Latin America is expected to rapidly increase its production volume and to have a rapid rise in net export volume by 2025. It is expected to cover the increase in the net import volumes of Asia and Europe. Brazil is a major exporter in Latin America and has room to increase its arable land area without developing the Amazon region; therefore, by increasing both yields and harvested land area, it is expected to reach a production volume of about 107.79 million tons in 2025. As a result, Brazil's net export volume will reach 56.80 million tons in 2025. Partly due to the limited size of its domestic market, Argentina is expected to rapidly increase its net export volume of soybeans to 27.77 million tons in 2025, while still satisfying the soybean oil extraction demand (an export item). The growth in the net import volumes of Asia and Europe will be satisfied by the growth in the net export volumes of Brazil and Argentina.

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

Table 6 Projection results for vegetable oils by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	86.5	107.8	86.4	107.8	0	0
North America	13.3	18.2	11.6	12.6	1.7	5.6
Latin America	17.9	21.3	13.2	14.5	4.8	6.7
Oceania	0.3	0.4	0.4	0.4	0	0
Asia	27.4	32.9	34.6	50.1	−7.7	−17.2
Middle East	1.5	1.6	3.1	4.1	−1.6	−2.5
Europe	25.1	32.4	19.7	21	5.4	11.4
Africa	1	1.1	3.8	5.2	−2.7	−4.1
(Reference)						
US	9.9	14.2	10.7	11.6	−0.6	2.6
China	19.4	24.2	21.7	32.7	−2.9	−8.5
EU	15.5	21.6	15.5	16.7	−0.1	4.9
India	4.1	4.6	7.7	11	−3.5	−6.3
Russia	4.5	5.2	2.6	2.6	1.9	2.6
Ukraine	4.4	4.9	0.6	0.7	3.9	4.2
Argentina	7.9	8.6	3.3	3.8	4.6	4.7
Brazil	7.1	9.1	5.8	6.2	1.3	2.8

i) In the base year, North America, Latin America, and Europe were net exporter regions, while Asia, the Middle East, and Africa were net importer regions.

ii) The per capita consumption volume will grow, mainly due to population growth in Africa and economic growth in Asia and the Middle East. Production volume growth will be extremely limited in both the Middle East and Africa, and growth sufficient to meet the consumption volume growth will become difficult in Asia. The net import volume will grow in all these regions by 2025. Africa's consumption volume is expected to be only about 5% of the world's vegetable oil consumption volume. In Asia, the growth of China's per capita consumption volume will continue despite signs of economic slowdown, and the net import volume is expected to rise greatly. Consumption volume growth is expected in other countries in the Asia region besides China, and the region's net import volume will reach 17.19 million tons in 2025.

iii) In Europe, the production volume of vegetable oils such as canola is expected to rise in the EU, Ukraine, and Russia, along with the net export volume. In Latin America and North America, production volume growth will exceed domestic demand volume growth, resulting in each region's net export volume to grow by 2025. Soybean oil will have the largest net export volume among vegetable oils in the Latin America region in 2025. At 4.74 million tons, Argentina's net export volume of vegetable oils will grow somewhat by 2025, despite growth in domestic demand and net soybean export volume. In Brazil, there will be limited growth in domestic demand, such as demand for soybean oil for biodiesel production. Although there will be growth in the net export volume of soybeans, the net export volume of vegetable oils is expected to rise to 2.82 million tons in 2025.

g) Beef

Table 7 Projection results for beef by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	60.5	72.1	60.5	72.1	0	0
North America	12.6	14.6	12.9	14	−0.2	0.6
Latin America	17.2	20.4	15.2	17.9	2	2.5
Oceania	3	3.7	0.9	1.1	2.1	2.6
Asia	15.7	19.7	16.8	22.9	−1.2	−3.2
Middle East	0.5	0.5	1.2	1.6	−0.7	−1
Europe	9.7	11.1	11	11.2	−1.3	−0.1
Africa	1.8	2.2	2.5	3.5	−0.7	−1.3
(Reference)						
US	11.6	13.3	11.8	12.9	−0.2	0.5
Australia	2.4	2.9	0.8	0.9	1.6	1.9
China	6.7	8.5	7.1	9.6	−0.3	−1.1
India	3.8	4.7	2.1	3	1.8	1.7
Argentina	2.7	3.4	2.5	2.7	0.2	0.7
Brazil	9.6	11.7	7.9	9	1.7	2.7

i) In the base year, Latin America and Oceania were net exporter regions, while Asia, Europe, the Middle East, and Africa were net importer regions. Supply and demand were roughly balanced in North America.

ii) The Middle East's production level will be relatively low. The trend of consumption growth will continue due to improving incomes, and the net import volume is expected to grow to 1.05 million tons in 2025. In Africa, North Africa is expected to lead the growth in consumption, and the Africa region's net import volume is expected to grow. In Asia, the trend of production volume growth for water buffalo and other beef will continue, and India will maintain a high net export level. Improving incomes will result in diets improving throughout Asia. There will be growth in the region's per capita consumption volume, which has been low. China's net import volume will grow, reaching 1.08 million tons in 2025. The consumption volumes of other Asian countries will also grow, and the entire region's net import volume is expected to grow to 3.22 million tons in 2025. In contrast, the net import volume of the entire Europe region is expected to decline due to factors such as a slight reduction in Russia's net import volume, as consumption volume growth slows amid a slowing economic outlook. The US will increase its production volume by increasing per-head productivity. Its exports will improve slightly by exceeding consumption volume growth, and North America is expected to be a net exporter region.

iii) Oceania (which includes Australia) has high per capita consumption volume, but since the market within the region is small, the consumption volume growth will be limited while the production volume will grow steadily and the net export volume growth trend will continue. As a result, the region is expected to have a net export volume of 2.59 million tons in 2025, making it the world's largest net exporter region. In Latin America, economic growth will result in the growth of net import volumes of countries such as Mexico. However, the net export volume of the Latin America region is expected to grow due to growth in the net export volumes of Brazil and Argentina. The combined net export volume of the two countries is expected to be 3.36 million tons.

h) Pork

Table 8 Projection results for pork by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	111.2	133	111.2	133	0	0
North America	12.3	14.6	9.5	10.2	2.9	4.4
Latin America	6.5	8.4	6.8	8.1	−0.3	0.3
Oceania	0.4	0.4	0.6	0.7	−0.2	−0.3
Asia	64.8	80.3	67.8	85.5	−3.1	−5.2
Middle East	0	0	0	0	0	0
Europe	26.6	28.6	25.7	27.3	1	1.2
Africa	0.6	0.8	0.8	1.2	−0.2	−0.4
(Reference)						
US	10.5	12.2	8.6	9.3	1.9	2.8
Canada	1.8	2.4	0.8	0.9	1	1.5
China	55	68.6	55.5	69.9	−0.6	−1.3
EU	22.4	23.8	20.3	21.7	2.2	2.2
Brazil	3.3	4.3	2.7	3.1	0.6	1.2

i) In the base year, North America and Europe were net exporter regions; Asia was a net importer region; and Latin America, Oceania, and Africa were net importer regions. As the Middle East is an Islamic region, its supply and demand volumes for pork are extremely low.

ii) Asia accounts for about 60% of the world's total supply and demand for pork. As the Asia region's production volume will continue to grow steadily, its consumption volume will also grow along with economic growth. As there is high consumption among Southeast Asian countries such as the Philippines and Vietnam, the region's net import volume is expected to reach 5.20 million tons in 2025. China accounts for over 80% of the Asia region's consumption volume. China's consumption volume will continue to grow, and the country's net import volume is expected to reach 1.28 million tons in 2025.

iii) In North America, the per capita consumption volume of the US and Canada will not grow, while the production volume will grow due to productivity improvements. As a result, the region's net export volume is expected to grow. In Latin America, Brazil's production volume and net export volume are expected to grow, making the region somewhat of a net exporter in 2025. In Europe, net import volumes are showing a downward trend due to economic slowdown, such as in Russia and other countries. The EU's production volume is expected to grow, while its growth in per capita consumption volume will be limited. As a result, the net export volume of the Europe region is expected to be 1.25 million tons in 2025. The growth in net export volumes of the North America region, the Europe region, and Brazil will cover the rise in the net import volume of the Asia region.

i) Chicken

Table 9 Projection results for chicken by region

(Unit: Million tons)

	Production volume		Consumption volume		Net export (import) volume	
	2012–14	2025	2012–14	2025	2012–14	2025
World total	88.4	113.1	88.4	113.1	0	0
North America	18	20.7	14.8	16.7	3.2	3.9
Latin America	20.4	27.4	18.2	20.5	2.2	6.9
Oceania	1.2	1.4	1.2	1.5	0	−0.1
Asia	27.2	36.1	28.8	42.3	−1.6	−6.2
Middle East	3.9	5.5	6	8.5	−2.1	−3.1
Europe	14.2	17	14.4	15.6	−0.3	1.3
Africa	3.7	5.1	5.1	8	−1.4	−2.9
(Reference)						
US	17	19.5	13.7	15.6	3.3	4
China	13.4	17.5	13.3	18.7	0.1	−1.3
EU	9.9	11.7	9.6	10.5	0.3	1.2
Brazil	12.5	18	9	10	3.5	8
Thailand	1.5	2.2	1	1.1	0.5	1.1

i) In the base year, North America and Latin America were net exporter regions, while Asia, the Middle East, Europe, and Africa were net importer regions. Supply and demand were roughly balanced in Oceania.

ii) Among the meats, the consumption volume of chicken has increased among both developed and emerging/developing countries due to increasing health concerns and a lack of religious prohibition of chicken. In the Middle East and Africa, there will be consumption volume growth along with economic growth, and the net import volumes are expected to be 3.06 and 2.85 million tons, respectively, in 2025. In the Africa region, there will be a trend of consumption volume growth led by North Africa, but consumption will also grow in other parts of Africa. Asia's consumption volume growth trend will continue, and the region's net import volume is expected to reach 6.16 million tons in 2025. China's consumption volume will also grow, with its net import volume reaching 1.29 million tons. However, the country's net import volume can also decline, since chicken has a shorter production period than red meats, making it relatively easy to expand production through measures such as integration to unified production processes. The consumption volumes of all other Asian countries will increase, and their net import volumes are expected to grow due to rising food demand amid economic growth.

iii) The per capita consumption volumes of North America and Latin America are already relatively high, so consumption volume growth will be relatively limited. The trend of production volumes exceeding consumption volumes will continue, and the net export volumes of the regions are expected to be 3.91 and 6.93 million tons, respectively, in 2025. Brazil and the US are major exporting countries that have a highly competitive advantage in the international chicken market. Their net export volumes are expected to grow by 2025, reaching 7.99 and 3.96 million tons, respectively. The future structure will consist of the Latin America region (led by Brazil) and North America region (led by the US) growing their net export volumes and supporting Asia's growth in consumption.

(B) Projections of per capita consumption volumes
The tables below show the per capita consumption volumes of grains, vegetable oils, and meats in the base year (average of 2012–2014), along with projection results for 2025. Projection results for the major emerging countries (China, India, Russia, and Brazil) are also presented for reference, since these countries are considered likely to have a major impact on world food supply and demand as their economies grow in the coming years.

a) Grains (total consumption volume including grains for feed and other uses)

Table 10 Per capita grain consumption volume projection results

	Base year (2012–14)		Target year (2025)	
	Value	Index	Value	Index
	kg		kg	
World total	328.2	100	344.8	105
North America	1,042.40	100	1,058.30	102
Latin America	322.8	100	357.8	111
Oceania	518.2	100	513	99
Asia	266.1	100	286.1	108
Middle East	364.8	100	380.8	104
Europe	494.3	100	560.2	113
Africa	207.1	100	212	102
(Reference)				
China	361.1	100	394	109
India	176	100	191.9	109
Russia	423.6	100	466	110
Brazil	377.2	100	457.8	121

i) The figures for the per capita consumption volume of grains in 2025 indicate the total consumption volumes including grains used for feed and biofuel. All the regions except Oceania show a growth trend compared to the base year.

ii) Latin America (including the emerging nation Brazil) is expected to have grain consumption growth, and Europe (including an emerging country such as Russia) is expected to have a relatively high growth rate. Latin America (including Brazil and other countries) is a net exporter region of livestock products; therefore, it will have high feed consumption volume. Europe will also continue to increase its feed consumption volume for production of livestock products, and its total population growth will be flat. Thus, both the Latin America and Europe regions will have high growth rates.

The growth rates of Asia, the Middle East, and Africa are lower than those of Europe and Latin American countries. In China (expected to have higher economic growth than other emerging nations) and India, increasingly diverse and improved diets will result in growing consumption volumes of vegetable oils and livestock products, with unchanging per capita consumption volumes of grains for food. As a result, the growth rate of per capita consumption volumes of grains in Asia is expected to be relatively low. In Africa, problems such as purchasing power will result in low consumption volume growth of grains for feed and consumption volume growth only for grains for food. As a result, the growth rate is expected to be only 2%.

iii) In North America, because of relatively high rate of population growth among the developed nations and slowing growth in demand for corn-produced bioethanol anticipated by government policy, the per capita consumption volume is expected to be nearly unchanged. Oceania's per capita consumption volume is also expected to be nearly unchanged.

b) Vegetable oils

Table 11 Per capita vegetable oil consumption volume projection results

	Base year (2012–14)		Target year (2025)	
	Value	Index	Value	Index
	kg		kg	
World total	12	100	13.3	110
North America	33	100	32.7	99
Latin America	21.2	100	20.9	99
Oceania	13.2	100	12.8	97
Asia	8.7	100	11.4	131
Middle East	10.3	100	11.2	109
Europe	26.6	100	28.3	107
Africa	3.4	100	3.5	103
(Reference)				
China	16	100	23.2	145
India	6	100	7.5	125
Russia	18.2	100	18.6	103
Brazil	28.5	100	28	98

i) At 32.7 kg, the developed region of North America will have somewhat of a decrease in the per capita consumption volume of vegetable oils in 2025. The figure for Oceania also shows a slight decreasing trend relative to the base year. However, the figure for Europe shows a growth trend, as the region includes an emerging country.

ii) The per capita consumption of Asia and the Middle East will show a growth trend as the economies of these regions will grow. The Asia region is expected to have a growth rate of 31%. The region includes China (with growth rate of 45%) and India (with growth rate of 25%), which will have high growth rates reflecting their relatively high economic growth rates. However, at 11.4 kg and 11.2 kg, respectively, the per capita consumption volumes of Asia and the Middle East in 2025 will only be about 50% of the volume for Latin America, leaving ample room for continued growth.

iii) Latin America's per capita consumption volume in 2025 will remain at roughly the same level and is expected to be about 60%–70% of the levels of North America and Europe. Brazil's per capita consumption volume in 2025 is expected to decrease slightly to 28.0 kg, reflecting factors such as slightly slowing economic growth. Africa region's per capita consumption volume in 2025 is expected to be 3.5 kg, which is extremely low compared to the other regions. Factors such as purchasing power issues will result in only a small increase in the per capita consumption volume of vegetable oils for the region as a whole. Although areas such as North Africa show a growth trend in per capita consumption volumes, the Africa region as a whole is not expected to have any major change in its per capita consumption volume of vegetable oils.

c) Meats

Table 12 Per capita meat consumption volume projection results

	Base year (2012–14)		Target year (2025)	
	Value	Index	Value	Index
	kg		kg	
World total	38.2	100	41.4	109
North America	106	100	107.4	101
Latin America	65.7	100	67.8	103
Oceania	112.7	100	117.7	104
Asia	30.1	100	36.4	121
Middle East	27.9	100	32.5	116
Europe	71	100	75.1	106
Africa	10	100	11.2	112
(Reference)				
China	58.9	100	73.6	125
India	5.3	100	7.9	150
Russia	67.2	100	69.8	104
Brazil	96.7	100	99.8	103

i) All the regions show a growth trend in per capita meat consumption volume in 2025 relative to the base year.

ii) With their relatively low per capita meat consumption volumes, Asia and the Middle East are expected to have high growth rates of 21% and 16%, respectively, through 2025. In the Asia region, high economic growth rates relative to the developed countries and elsewhere will result in growth rates of 25% for China and 50% for India through 2025. Although India's per capita consumption will grow (led by growth in chicken consumption), the volume will remain low, growing from 5.3 kg in the base year to 7.9 kg in 2025, which is lower than even Africa's base year figure. The Africa region will not have notable growth in per capita consumption volumes of grains or vegetable oils. Its per capita meat consumption volume will also remain the lowest of any of the regions; however, the consumption volume growth of North Africa, led by chicken consumption, is expected to contribute to the Africa region's per capita meat consumption to grow by 12% to 11.2 kg in 2025.

iii) North America, Oceania, and Europe already had high per capita consumption volumes in the base year. By 2025, the volumes of North America and Oceania will increase only slightly to 107.4 kg and 117.7 kg, respectively. With Russia's economy expected to become stagnant, its per capita consumption volume will show a growing trend and increase to 69.8 kg in 2025. The Latin America region will have per capita consumption volume of 67.8 kg in 2025, which represents a growth of just 3%, but that will bring it close to the level of Europe. Brazil's per capita consumption volume will grow to 99.8 kg in 2025. The Latin America region's growth in per capita consumption volume will be led by Argentina and Brazil.

(C) International price projections

The US and other developed countries will gradually move toward economic recovery, but their economic growth rates will vary, with slowdowns in some developed and emerging countries. The global economy will move toward recovery, and trade will recover and remain steady in the emerging and developing nations. However, the economic growth rates will be lower than before, and instability will remain. Over the medium term, the economic growth rates of emerging and developing countries are expected to be higher than those of developed nations.

Given these assumptions, the projections created using our World Food Supply and Demand Model indicate that the international commodity price will vary as described below, in line with each item's supply and demand conditions.

i) Grains/soybeans

In 2011, the price of corn temporarily exceeded the price of wheat, and in 2012, one of the worst droughts in history caused the prices of corn and soybeans in the Chicago market to reach record-setting highs. However, the surge in grain and soybean prices gave farmers a production incentive, and the cultivated land area increased. As a result, international prices showed a downward trend due to factors such increasing production volume in the US and South America from 2013 to 2014.

Since 2015, there has been ongoing demand for grains and soybeans used as feed amid an increase in livestock product consumption in emerging and developing nations. Although the population growth in Asia and Africa is gradually decreasing, the total population continues to grow. However, some bearish indicators have appeared. For example, in the US and elsewhere, policy-oriented consumption created by demand for biofuel materials is facing the problem of bioethanol content (the blend wall), limiting the potential growth of bioethanol demand; thus, the economic growth of some emerging countries will be minimal. As a result, the growth rates of international prices of grains and soybeans will decrease, and although prices will not return to the low pre-2006 levels seen before the surge in resource/grain prices, they are expected to remain nearly unchanged. The real international prices of wheat, corn, rice, and soybeans are expected to increase only by 1.0–3.9% in 2025.

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

Amid variation in economic growth rates, growth in demand for soybean oil/other vegetable oils for biodiesel production (the nonfood demand category) will slow down; however, the outlook for the international prices of vegetable oils is more bullish than that of grains/soybeans due to growth in vegetable oil consumption among the emerging countries of Asia and elsewhere and the ongoing growth of the total population led by Asia and Africa.

iii) Meats

With the growing total populations of regions such as Asia and Africa underpinning a trend of steady consumption of meats, the consumption volume of chicken will grow in emerging and developed nations due to rising health consciousness and lack of religious prohibition of chicken. In 2025, the real international price of chicken is expected to rise by a substantial 7.8%. The price of pork is expected to increase by 4.5% due to consumption growth led by Asia. The price of beef is expected to remain nearly unchanged, with a rise of just 3.0%. Variation in economic growth rates will result in differences in the price increase rates of livestock products. Meat consumption will increase due to changes in quality resulting from improving income levels. Although the international prices of corn and other feeds will rise slower than before, the prices of meats are expected to show a somewhat rising trend, due in part to the effect of their current levels being maintained.

ⅳ) Dairy products

Despite varying economic growth rates, the consumption volumes of dairy products, such as butter, powdered skim milk, and cheese, will gradually increase along with improvement in income levels in the emerging and developing nations, which have low per capita consumption levels. Although the population growth will gradually slow down, the total population will continue to grow, resulting in continued growth in demand, and the international prices of dairy products are expected to show a rising trend. However, since the production period for cheese is longer than for other dairy products in response to demand growth, the growth in demand from emerging countries in Asia and elsewhere will be lower for cheese than for products such as butter or powdered skim milk, and growth is expected to be slow.

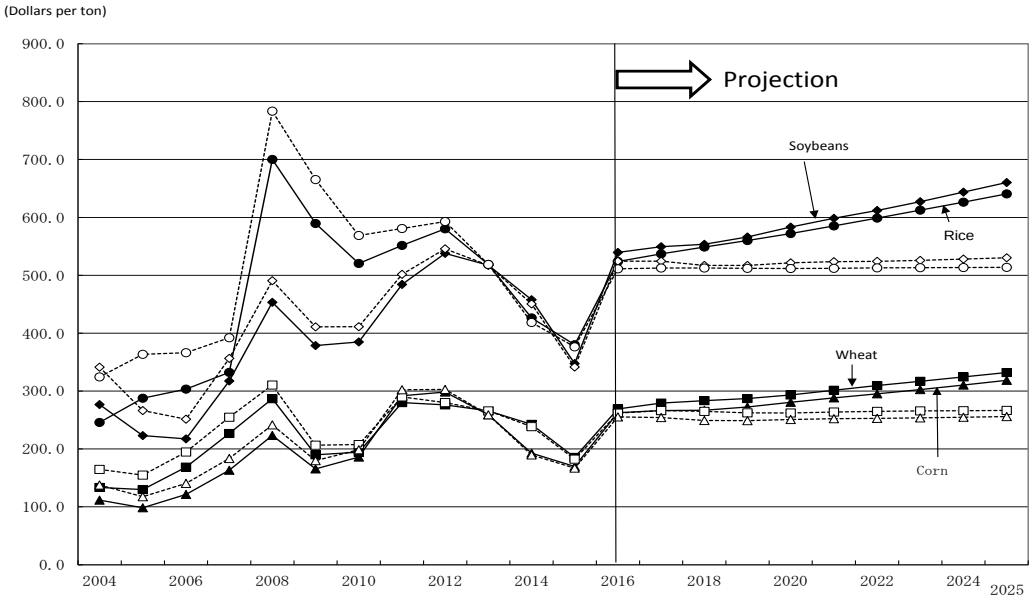


Figure 1 International price projections for grains and soybeans
(Solid lines: Nominal prices; Dotted lines: Real prices)

Notes

1. Prices till 2015 are actual prices. Prices for 2016–2025 are projections.
2. Past actual prices and future nominal prices use 2013 (average of three years from 2012 to 2014) 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 100 kg [livestock products])

Item	Base year (2012–14) price	2025 (Target year)			
		Real price		Nominal price	
			Rate of change (%)		Rate of change (%)
Wheat	261.5	266.7	2.0	332.2	27.0
Corn	250.1	255.9	2.3	318.6	27.4
Rice	508.5	513.7	1.0	640.5	26.0
Other grains	196.9	201.2	2.2	255.5	29.8
Soybeans	510.3	530.1	3.9	660.2	29.4
Vegetable oils	1,027.7	1,173.2	14.2	1,474.6	43.5
Beef	437.7	450.7	3.0	600.5	37.2
Pork	200.0	209.0	4.5	260.3	30.1
Chicken	226.5	244.1	7.8	304.0	34.2
Butter	392.7	541.0	37.8	666.2	69.7
Powdered skim milk	393.8	487.5	23.8	600.3	52.4
Cheese	436.9	454.5	4.0	559.7	28.1

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	Other grains	Soybeans
Base year (2012–14)	Production volume		703	960	477	251	290
	Consumption volume		693	931	480	251	281
		Food	557	246	478	112	217
		Feed	130	547	1	139	24
		Biofuels	6	138	-	-	40
	Ending stock volume		205	192	106	32	67
	International price (US dollars per ton)		262	250	509	197	510
2025	Production volume		828	1,112	559	303	359
	Consumption volume		829	1,113	559	303	360
		Food	662	286	558	135	283
		Feed	159	685	1	168	29
		Biofuels	8	142	-	-	47
	Ending stock volume		202	188	105	31	63
	International price (effective; US dollars per ton)		267	256	514	201	530
	International price (nominal; US dollars per ton)		332	319	640	256	660
Rate of change (%)	Production volume		18	16	17	21	24
	Consumption volume		20	20	16	21	28
		Food	19	17	17	21	30
		Feed	22	25	−9	21	20
		Biofuels	33	3	-	-	19
	Ending stock volume		−2	−2	−1	−2	−6
	International price (real; US dollars per ton)		2	2	1	2	4
	International price (nominal; US dollars per ton)		27	27	26	30	29

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.

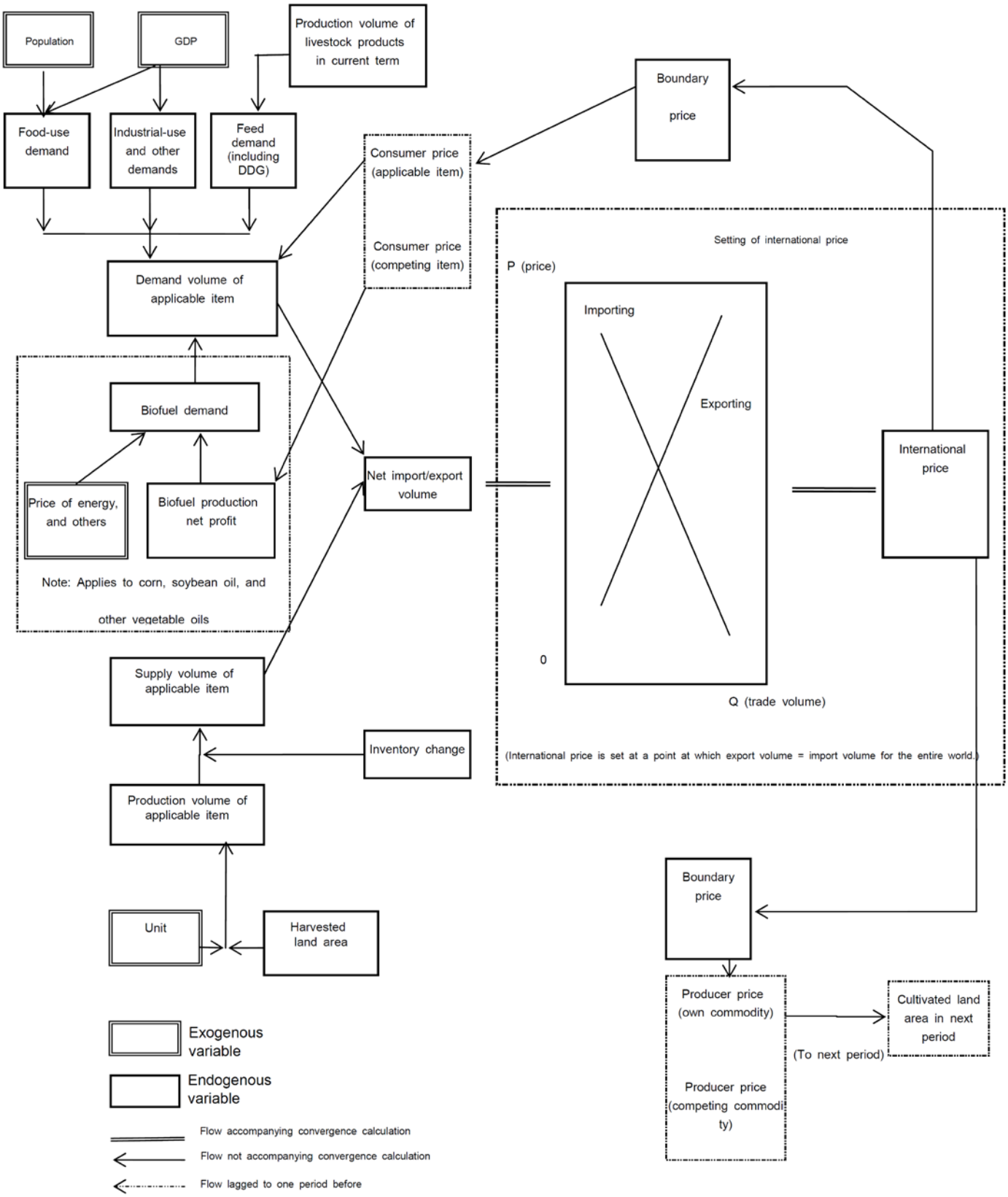
(B) Due to data limitations, the effects of stocks of beef, pork, chicken, mutton, eggs, milk, and processed livestock products on supply and demand are not considered.

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