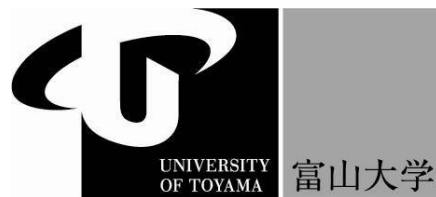# Dynamics of Production and Trade of Flower Bulbs in the Netherlands, China and Japan

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Dynamics of Production and Trade of Flower Bulbs in the Netherlands, China and Japan

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Abstract:

In Japan, the flower industry has stagnated since the late 1990s. The production of tulip bulb, especially, has greatly decreased in Toyama, the largest growing area in Japan. The peak of production was 1993, when the volume was 61 million bulbs. By 2015, volume was 17 million bulbs (28% of 1993's volume). One of the reasons for the reduction is the competition from cheaper Dutch bulbs. Tulip imports from the Netherlands, however, have decreased too. This paper aims to investigate the situation of the world bulb market and the true reason for the decline in the industry as seen in Japan. In this paper we discuss features of production and trade in the Netherlands, China, and Japan from 2000 to 2015. The Netherlands is a dominant country in the global flower industry. It has the largest production and trade of flower bulbs. China is a growing economy and the bulb industry there is growing and young; it is increasing its production and imports. Japan is also both a consumer and producer of bulbs; however, Japanese production and imports are decreasing. In this study, we compare the details of production and trade of the three countries and explore some economic factors of changes. We use an elementary economics model of demand and supply, analyse the dynamics of price and quantity on production, export, import and consumption of tulip bulbs and show some implications for Japan.

Keywords: flower bulb, production, trade, supply and demand, price, consumption

1. Introduction

In Japan, the flower industry has stagnated since the late 1990s. The production of tulip bulb, especially, has greatly decreased in Toyama, the largest growing area in Japan. The peak of production was 1993, when the volume was 61 million bulbs, grown by 358 farmers on 252 ha. By 2015, volume was 17 million bulbs (28% of 1993's volume), with 85 farmers (24%) and 77 ha (31%). One of the reasons for the reduction is the competition from cheaper Dutch bulbs. Tulip imports from the Netherlands, however, have decreased too. This paper aims to investigate the situation of the world bulb market and the true reason for the decline in the industry as seen in Japan.

This paper discusses features of production and trade in the Netherlands, China, and Japan from 2000 to 2015. The Netherlands is a dominant country in the global flower industry. It has the largest production and trade of flower bulbs. China is a growing economy and the bulb industry there is growing and young; it is increasing its production and imports. Japan is also both a consumer and producer of bulbs; however, Japanese production and imports are decreasing. In this study, we compare the details of production and trade of the three countries and explore some economic factors of changes. We use an elementary economics model of demand and supply, analyse the dynamics of price and quantity on production, export, import and consumption of tulip bulbs and show some implications for Japan.

Previous studies of the world flower bulb industry have been conducted by De Groot (1999), Buschman (2005); Ohkawa (2005); Niisato (2009); Benschman, Kamenetsky, LeNard, Okubo, and DeHertoug, (2010); and Niisato and Takeda (2016). For China, Zhou, W.Z., Xu and Zhou, Z.C. (2016) have studied recent Chinese flower tourism. These studies mostly described the situation of production of the flower and bulb. But this paper makes economic analysis of the industry.

2. Trend of Consumption and Production

2.1 Spring Tulip Festivals

In spring, many bulbs such as tulips, daffodils, gladioli and crocuses are in bloom and flower festivals are held all over the world. The Keukenhof Festival in the Netherlands is the most famous festival in the world. The Tonami Tulip Faire in Toyama Prefecture is also very well known.

In 2017, Keukenhof was open for eight weeks from 23 March to 21 May and 1.4 million people visited. Visitors came from 100 different countries: 20% of visitors were from the Netherlands, 40% from the surrounding countries. Of the remaining visitors, 120,000 were Americans, 90,000 were Chinese along with visitors from Eastern Europe, Russia and South America. In 2007, the Tonami Tulip Fair was open for two weeks from 21 April to 5 May and 0.32 million people visited. Of them, about 10,200 people came from nearby countries: Taiwan, Indonesian, Hong Kong, Thailand, Vietnam and China.

In a sense, flower festivals reflect consumers' consumption attitude toward flowers

and bulbs. As Figure 1 shows, during the 1980s and 1990s, the number of visitors had stagnated in the Keukenhof. In the mid-2000s, however, it recovered and in the 2010s, attendance increased again. Figure 1 also shows the trend in visitors to the Tonami Tulip Fair. Visitors peaked in the early 1990s and during 2000s and 2010s, the number of visitors stagnated. Recently, attendance has increased a little.

Figure 1

2.2 Global Production Area of Flower Bulbs

Table 1 shows the trend in the production area of flower bulbs in the main growing countries in the world. In 2015, the total area was 37 thousands ha. The Netherlands was the biggest producer of flower bulbs with about a 55% share of the world production area. The second was the UK with 17% and the third was China with 16%. The fourth was the United States with 7%. France was the fifth with 3% and Japan was the sixth, with only 1%.

From 2000 to 2010 the world production area decreased about 8% and from 2010 to 2015 it increased about 16%. From 2000 to 2015, the Netherlands's growing area did not change much. China's area rapidly grew by five times: from 1,300 ha (2000) to 6,000 ha (2015). The US decreased by 30%: from 3,600 ha (2000) to 2,500 ha (2012[1]), whilst Japan greatly declined by 64%: from 1,000 ha (2000) to 360 ha (2015).

In this paper, we focus on the Netherlands as the biggest producer of bulbs, China as a growing producer and Japan as a diminishing bulb production country.

3. Models
3.1 Small Country Model

We use a standard international model to analyse the dynamics of the flower bulb industry in the world. A small country model in a single commodity market is applied to China and Japan. A large country model is applied to the Netherlands.

We assume a domestic demand function for flower bulbs is as follows:

$$X = D(P_b, P_i, P_j, P_c, NI, D_s) \qquad (1)$$

$$D_{P_b} < 0, D_{P_i} > 0, D_{P_j} < 0. D_{P_c} > 0, D_{NI} > 0, D_{D_s} > 0,$$

where X: domestic demand for bulbs, P_b: price of bulbs, P_i: price of substitutes for bulbs (cut flowers and potted plants), P_j: price of complements for bulbs (gardening goods), P_c: prices of consumer goods, NI: nominal national income, and D_s: demand shock (change in expected income, population and preference of flowers, such as a gardening boom).

We assume the domestic supply function is:

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[1] The figure in 2015 could not be got. That in 2012 is the latest data.

$$Y = S(P_b, P_r, P_s, P_f, K, S_s) \qquad (2)$$

$$S_{P_b} > 0, S_{P_r} > 0, S_{P_s} < 0, S_{P_f} < 0, S_K > 0, S_S > 0,$$

where Y: domestic supply of bulbs, P_r: price of complementary crops in production (rotation crops, e.g. rice in the case of Japan. see Niisato (2009)), P_s: price of substitute crops(vegetables), P_f: price of production factors (material inputs, labour and land), K: capital equipment of the total farmers who decide their investment and quit, considering future expected profits and interest cost. S_s: supply shock (e.g. technological innovation, management innovation, improvement of market system and weather)

Import Z is the difference between domestic demand and supply.

$$Z = X - Y. \qquad (3)$$

Even a small country has some import costs such as shipping, customs and distribution. Therefore, we assume following import supply function:

$$Z = S_Z(P_b, eP_b^w, Z_S) \qquad (4)$$

$$\frac{\partial S_z}{\partial P_b} > 0, \frac{\partial S_z}{\partial (eP_b^w)} < 0, \frac{\partial S_Z}{\partial Z_s} > 0, 0 = S_Z(P_b, P_b, Z_S),$$

where e: foreign exchange rate. In the world flower industry, a basic currency is the euro. Therefore, P_b^w is the price of bulbs in terms of the euro in the world market. Z_s: import shock (e.g. innovations in transportation, political risk reduction). If the word bulb price, in terms of a country's own currency, is equal to the domestic price, then there is no import. If the former is lower than the latter, then bulb import increases. Therefore, the import supply is a right upward curve.

Bulb price is determined by market equilibrium. From (1) to (4), we get that

$$D(P_b; \dots\dots) = S(P_b; \dots\dots) + S_Z(P_b; \dots). \qquad (5)$$

Equation (5) determines bulb price, P_b, as illustrated in Figure 2. In Figure 2, we can divide the causes into demand and supply sides and recognise the causes of changes in price and quantity.

Figure 2

3.2 Large Country Model

We assume two countries: The Netherlands(= a large country) and the US(=the rest of the world). We assume the demand function of each country as:

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$$X^i = D^i\left(P^i_b, P^i_i, P^i_j, P^i_c, NI^i, D^i_S\right), \tag{6}$$

where the upper suffix i = 1, and 2 indicates country. The supply function of each party is assumed as follows.

$$Y^i = S^i\left(P^i_b, P^i_r, P^i_S, P^I_f, K^i, S^i_S\right), \tag{7}$$

We assume Country 1 is the Netherlands, the exporter of flower bulbs, and Country 2 is the US, the importer of flower bulbs. The world market equilibrium condition can be written as follows.

$$X^1 + X^2 = Y^1 + Y^2$$

or

$$X^2 - Y^2 = Y^1 - X^2, \tag{8}$$

and

$$P^2_b = eP^1_b. \tag{9}$$

Equation (8) means world import is equal to world export. Inserting Equations (6) and (7) into Equation (9) and using (9), then:

$$D^2(eP^1_b; \dots) - S^2(eP^1_b; \dots) = S^1(P^1_b; \dots) - D^1(P^2_b; \dots). \tag{10}$$

Equation (10)[2] determines the world bulb price, P^1_b, as illustrated in Figure 3.

Figure 3

4. Economic Indicators of the Netherlands, China and Japan

Next, we look at some economic indicators of the three countries. Figure 4 shows economic growth rates from 2000 to 2015. In every country, the growth rate dropped in 2009 after the Lehman shock of 2008. As a whole, China saw rapid growth that gradually slowed down during the 2010s. Japan fluctuated around zero growth and suffered great damage from the shock. The Netherlands followed the general world growth at a slightly slow pace.

Figure 4

Figure 5 shows the trends of foreign exchange rates in terms of the euro. The US

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[2] The relationship between a small and large country models is the following. In a small country model the world price p^w_b $(= p^1_b)$ is given and the domestic price and the import volume are determined. Total summation of imports from the all countries but the Netherlands (i=2....n) is the world import demand. Therefore the left term of equation (10) can be written as follows.

$$Z(p^w_b) = \sum_{i=2}^{n} Z_i(e_i\, p^w_b) = \sum_{i=2}^{n} (D^i\,(e p^w_b) - S^i(e p^w_b))$$

dollar moved weakly from 2000 to 2008. After that, it was stronger and fluctuated. The Chinese Yuan moved weakly until 2007. After then it was strong to 2015. The Japanese Yen moved weakly until 2007, went up until 2012 and after that it moved weakly.

Figure 5

5. The Netherlands
5.1 Production

Table 2 shows the production area, holdings (firms or farmers) and production of bulbs in the Netherlands. Roughly speaking, the production area decreased from 2000 to 2010 and it increased from then to 2015. In 2015, it was at almost at the same level as in 2000. By species, tulips occupy about half of the total area and lilies and narcissi tended to decrease over the time period.

Table 2

The trend in the numbers of holdings is shown in Table 2. In 2000, the number was around 30,000; by 2015, it was about half (53%). In the Netherlands, a net–production system, in which the planting and harvesting of tulip bulbs are accomplished with large machines and mesh nets, became popular in areas with clay soil. Large farms of 100 ha appeared in the north and many small farms disappeared in the south and traditional growing areas. As a result, the average area per farm doubled, from 7.2 to 19 ha.

The production value in euros decreased from 2000 to 2010 as shown Figure 6. However, the real production increased steadily, except in 2009. Real production is calculated in how nominal production is deflated by the price index (export unit price) on the base year of 2010. From 2000 to 2008, it grew 20%. From 2008 to 2009 it fell 7.5%. From 2009 to 2015, it grew 61.2%. As a result, it grew 64.1% during the 15-year period. Indeed, the average growth rate, g, was 3.4% per year, which is higher than the average growth rate in the Netherlands shown in Figure 4. It is the same as the growth rate of land productivity, because production was almost the same in 2000 and 2015. This efficient growth of the industry was caused by the following factors: technical innovation of breeding, large-scale and production system, management innovation such as joint-companies, IT, internet sales, foreign workers and efficient distribution, as well as the so-called "golden triangle" among industry, academic and public sectors.

Figure 6

5.2 Trade

Table 3 shows a detail of the Netherlands's bulb exports and imports in 2015. The total export value was around 700 million euros. The import was around 40 million euros,

only 6% of the export. In exports, 30% of the export went to the EU, 27% went to Asia (China 11.0%, Japan 6.3% and Taiwan 2.5%), 21% went to North America (US 16.4% and Canada 11.0%). Compared to 2013, the EU had a decline, Asia increased and North America did not change. In the world trade, the Netherlands's share in exports was 80% to 90%.
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Table 3

The trend in exports since 2000 is shown in Table 4. The export volume in kg increased each year, except in 2009. In 2009, it declined 11.8%. The figure in 2015 was 2.14 times that of 2000. Therefore, the average growth rate was 5.2% per year. It was greater than the growth rate of the domestic production of bulbs. In addition, export price decreased almost continually.

Table 4

5.3 Analysis

We analyse the export supply and import demand for Dutch bulbs from the view of a large country model. In Figure 7, we plot the export quantities on the horizontal axis and prices on the vertical axis, showing quantities in every year. When connecting the points, the connected trend line starts at 2000 and ends at 2015. We presume that the point for each year is determined by the demand and supply force and the equilibrium point is the intersection between the demand and supply curve. We draw the demand curve D_1 and the supply curve S_1 at the year 2000 point. Shifts in demand and supply curve make a new equilibrium point in the next year. Roughly, from 2000 to 2008, the world economic growth pushed the bulb consumption demand in spite of a stronger trend in Europe. The demand curve for import moved to the right, illustrated by demand curve D_2. On the other hand, innovation progressed continually and the supply curve moved to the right, to supply curve S_2. In 2009, the export quantity decreased and the price increased. Owing to the Lehman shock, the import demand curve moved to the right. Then, because farmers had unfavourable economic conditions in the Lehman shock, the supply curve moved to the right. Later, the export quantity increased and prices decreased. The world economy recovered and innovation restarted. Therefore, in 2015, the demand cure moved to D_4 and the supply curve to S_4.

Fihure7

6. China
6.1 Production

Data of the flower bulb industry in China from 2000 to 2015 is shown in Table 5. The bulb production area grew rapidly with some ups and downs, as shown in Figure 8-1. In 2015, it was about five times of that in 2000. As shown in Figure 8-2, the production quantity

and value have an upward trend with some ups and downs. The domestic price (unit price of production) has fluctuated as shown in Figure 8-3. It increased from 2003 to 2007, decreased to 2010, increased in 2011, decreased to 2013, increased greatly in 2014 and decreased a little in 2015.

Table 5
Figure 8-1, Figure 8-2, Figure 8-3

6.2 Trade
The trend of China's bulb imports and exports is seen in Figure 9-1. The import grew at constant rate except in 2006 and 2014. Exports have been one-tenth of imports. In 2015, production was 644 million bulbs, import was 478 million bulbs, and export was 48 million bulbs. Therefore the consumption (=production + import- export) was 1.074 billion bulbs and the self-sufficiency rate (production / consumption) was 60%. The self-sufficiency rate has decreased since 2003. As shown in Figure 9-2, most of the imports come from the Netherlands, 90%, and the volume has increased rapidly.

Figure 9-1, Figure 9-2 Figure 9-3

China's trend of import prices is shown in Figure 9-3. Until 2006, the price increased, then it decreased to 2009, increased in 2010, decreased until 2013 and increased in 2014, and decreased in 2015. It has the same trend as the domestic price, but the import price seems to be higher than the domestic one. This may be because imported Dutch bulbs maybe have higher quality, or have the reputation of higher quality. In general, both import and domestic price have decreased since 2010, because of increasing imports. One of the reasons for the increasing imports is that the prices of Chinese bulbs are higher than the world prices, which have decreased continuously.

6.3 Analysis
Table 6 shows a time series of consumption quantity and price of bulbs in China. From the view of the small country model, we analyse the dynamics of consumption by demand and supply in Figure 10.

Table 6
Figure 10

The consumption quantity in 2015 was 4.33 times that of 2000. The average growth rate was 10.3% per year, which exceeds the average growth rate of the Chinese economy. In 2000, for example, the consumption point is where the demand curve D_1 meets the supply curve S_1 meet. The rapid growth of China's economy pushed demand for bulbs and demand

curve moved to D_2 in 2003. The great increase in production enlarged the potential output and the import of bulbs increased. The supply curve moved to S_2 in 2003; the price was constant and the quantity increased. The equilibrium point in 2003 is the point of the intersection of D_2 and S_2. The demand curve moved to the right; however, the movement of supply curve stopped because of decreasing production. The price increased and the quantity did not increase from 2003 to 2005. In 2006, the demand and supply curves moved back to the left; consumption decreased and price increased. The consumption point in 2006 is shown. In fact, both production and imports decreased in 2006. The reason is not clear but the following facts may be relevant: the world price increased from 2004 to 2006 and the Chinese Yuan–Euro exchange rate reduced China's buying power. Therefore, import prices increased and the import supply curve shifted to the right.

After 2006, both the demand and supply curve moved to the right. The supply curve moved faster than the demand curve and the price decreased to the point shown for 2013. The import supply increased constantly; whereas, the domestic supply moved up and down. From 2013 to 2015, the price increased and consumption decreased. The equilibrium point moved to the point shown for 2005. For China, it is presumed that the flower bulb industry is a young industry[3]. In the country, the technology is not well developed and the distribution system is not complete. Broadly speaking, in China, the demand and supply curve moved to the right with some oscillations for 15 years in China.

7. Japan
7.1 Production

Table 7 shows the trend of production area and number of farmers of flower bulbs in Japan. The production area decreased continuously from 2000 to 2015. By 2015, the area was 40% of that in 2000. The main crops were tulips, lilies and gladioli,[4] and production of all decreased. The number of farmers decreased, as well. In 2006, bulb farmers were half the number in 2000. The data for all Japan after 2007 are not available, so the table shows the number of farmers of tulip bulb production in Toyama prefecture[5]. By 2015, the number of farmers was 35% of that in 2000.[6] As a result, the average area per farmer remained almost constant, about 1 ha of Toyama tulips and around 0.3 ha of all bulbs in Japan.

This indicates that many farmers have quit bulb production and have not made progressive innovation in producing. In contrast, in the Netherlands over the study period, the number of farmers in 2015 was 50%, but the production area was almost stable. Therefore, the area per farmer was twice as large.

As shown in Figure 11-1, production quantity decreased continuously from 300

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[3] for example, a stem of tulip is more expensive than a rose in China

[4] In 2006, the share in total area is: tulips 45%, lilies 17% and gladioli 6%.

[5] Toyama is one of two main production areas and produces half of the Japanese output of tulip bulbs.

[6] The degree of decrease in bulb farmers is very serious. The total number of farmers in Japan in 2015 was 70% of that in 2000. It was 60% in the case of selling farmers. See Japan MAFF http://www.maff.go.jp/j/tokei/sihyo/data/07.html.

million bulbs in 2000 to 100 million bulbs in 2015, except in 2007 and 2009. The diminishing scale was one-third (33%) in the same of area and farmers during the 15-year period. At the same time, the production value decreased continuously from 5,300 million yen in 2000 to 2,700 million in 2015, except in 2007, 2010 and 2015, as shown in Figure 11-2. Overall, it diminished 50%. As shown in Figure 12, the unit price (average price) of production was almost constant until 2006, increased in 2007, decreased in 2009 and increased continuously thereafter. The area lost to flowers was not unutilised; instead it was shifted to growing vegetables and housing.

Figure 11-1, Figure 11-2

7.2 Trade

As shown in Figure 11-1, in Japan, the import quantity decreased from 650 million bulbs in 2000 to 360 million bulbs in 2015, except in 2002, 2004 and 2012. It diminished to 55% over the 15-year period. As shown in Figure 11-2, the import value decreased with some fluctuation from 12,000 million yen to 7,500 million yen, although some increases were seen in in 2001, 2006, 2007, 2013 and 2014. Over the 15 years, it diminished to 62%. The trend of unit price of imports is shown in Figure 12. It moved up and down, partly due to world bulb prices as shown in Figure 6 and the yen–euro exchange rate shown in Figure 5.

  Exports were very small. In 2015, the export quantity was one million bulbs, only 0.3% of import and export value was 1,232 million yen, only 0.2% of imports. The consumption quantity decreased from 958 million bulbs in 2000 to 460 million bulbs in 2015, declining 48%. The self-sufficiency rate in quantity was 32% in 2000 and 22% in 2015. The consumption value decreased from 17,200 in 2000 to 10,100 in 2015, to a 45% level. The self-sufficiency rate in value was 30% in 2000 and 26% in 2015. The movements of the production, trade and consumption price are shown in Figure 12.

Figure 12

7.3 Analysis

Table 8 shows the time series of consumption quantity and price. Figure 13 shows the configuration. In 2000, the demand curve D_1 and supply curve S_1 meet at the equilibrium point shown for 2000. Broadly speaking, consumption decreased and price increased until 2007. The demand curve moved continuously to the left because of the long-run depression of the Japanese economy, its decreasing population[7], changes in consumers' preference (e g. young persons' dislike for home gardening) and a decrease in forced bulb demand from the cut flower industry. The supply curve also moved continuously to the left. This is due to

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[7] The Japanese population peaked in 2010 with 128,057,000 people. By2015 it was 127,095,000 -0.8% in 5 years. See Statistics Japan http://www.stat.go.jp/english/index.htm and
http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001039703&cycode=0

firstly, the upward trend of world bulb price in terms of yen and secondly, the domestic supply was shifted by the decreasing number of bulb farmers who grew older and whose successors had poor expectations for the future of farming bulbs, as well as the complementary crop of rice. Therefore, the supply curve moved faster than the demand curve. Quantity decreased and prices went up.

From 2007 to 2012, prices fell because the demand curve moved faster to the left than the supply curve. The 2012 equilibrium point is shown. During that period, the import price fell because of a decrease in world prices, shown in Figure 6, and a cheaper euro, shown in Figure 5. The domestic export price was stable, owing to the farmers' domestic supply curve moving to the left. During this time, the Dutch bulb exporters may have shifted their bulbs from Japan to China where they had expectations of a good business. In addition, demand may have been affected by the Lehman shock in 2008 and the great earthquake in Japan in 2011. Since 2012, because of the relatively cheap Japanese Yen, import prices and consumption prices have increased and import and consumption have decreased. The demand curve moved to D_4 and the supply curve moved to S_4, as shown. The Japanese bulb industry was a diminishing industry from both the demand side and the supply side.

8. Conclusion

In this article, we discussed dynamics of production and trade of flower bulbs in the Netherlands, China and Japan from 2000 to 2015 by an analysis of the changes in the demand and supply curve.

In the Netherlands, the production area of flower bulbs has been stable. The Netherlands exports flower bulbs all over the world and global demand for Dutch flower bulbs has increased steadily. Although demand did drop in 2009 after the Lehman shock, it recovered soon after. Overall, world prices of flower bulbs have tended to decline. Increased innovation (technological and management innovation, scale economy, cost reduction, efficient logistics, foreign workers and the golden triangle) has caused a continuous decrease in prices.

In China, the area and volume of bulb production has grown rapidly. Imports of bulbs have grown even more. However, the supply chain conditions seem unstable in China because of insufficient technology in production and distribution. The rapid development of the Chinese economy pushed the demand for flowers and bulbs and the rapid growth of imports resulted in a decrease in bulb prices.

In Japan, the bulb prices were stable. The domestic production and the imports decreased, however. In looking at the demand side, long-run economic stagnation, a decrease in expected future income and a decline in the population and changes in consumers' preference caused a continuous decline in bulb demand. On the supply side, a continuous decline in number of the bulb farmers, who have pessimistic future expectation of flower bulbs cultivation as well as rice padding and unenthusiastic successors, moved the supply

curve to the left, indicating a decrease in supply. The supply curve was also moved to the left by the decrease in imports to Japan. This is because Japanese Yen has been devaluated since 2012 and because Dutch exporters have become pessimistic toward the Japanese market and shifted their attention to the growing Chinese market.

Some reflections on the Japanese flower bulb industry are displayed the following chart.

The causes of the diminishing industry are divided to the demand side and the supply side.

(1) demand: stagnated economy and preference change,

(2) domestic production: no innovation because of fewer prospects for agriculture

(3) import supply: cheap yen and shift of the Netherlands to the growing Chinese market.

What we can learn from the Netherlands:

(1) technical and management innovation,

(2) optimal land use,

(3) capitalisation on the golden triangle,

These are all potentially available in Japan.

What we know from China:

(1) The Chinese bulb industry is growing and young. Japan could help to grow the industry in breeding, production and marketing.

(2) Chinese consumers want to purchase better and more favoured bulbs. Japan could export them to China.

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Tables and Figures
Table 1. Flower bulb production area in the world

	ha	year	ha	year	relative to 2000	ha	year	share in 2015	relative to 2010	relative to 2000
Belgium	224	1999	211	2010	94.2%	109	2015	0.3%	51.7%	49%
Finland	8	1999								
France	1,368	2003	1,115	2010	81.5%	1,112	2015	3.0%	99.7%	81%
Germany	115	2004	230	2008	200.0%	270	2013	0.7%	117.4%	235%
Ireland	81	2001	81							
Netherlands	20,849	2000	17,809	2010	85.4%	20,386	2015/16p	54.9%	114.5%	98%
UK	6,293	2000	4,690	2011	74.5%	6,182	2015	16.7%	131.8%	98%
Turkey	54	2004	54		100.0%	61	2015	0.2%	113.0%	113%
China	1,281	2000	4,794	2010	374.2%	6,070	2015	16.4%	126.6%	474%
Japan	995	2000	538	2010	54.1%	364	2015	1.0%	67.7%	37%
Korea	68	2000	45	2010	66.2%	29	2015	0.1%	64.4%	43%
Taiwan	14	2003	5	2010	35.7%	1	2014	0.0%	20.0%	7%
USA	3,611	2001	2,472	2007	68.5%	2,521	2012	6.8%	102.0%	70%
total	34,961		32,044		91.7%	37,105		100.0%	115.8%	106%

Source : AIPH, International Statistics Flowers and Plants 2001, 04, 07, 14, 16.

Japan MAFF, Statistics of Flower production http//www.e-stat.go,jp.

Korea MAFF, Flower Production, 2015.

UK DAEF, Basic Horticultural Statistics 2014, including cut flower production in the open.

China State Forestry Administration, China Flower Association http://hhxh.forestry.gov.cn/.

Table 2 Production area, firms and production, the Netherlands

	ha	no.	million eur	2010=100	base 2010
	area	holdings (firms)	production value	price index	real production
2000	20,849	2,709	603	137.8	438
2001	20,602	2,505	601	134.8	446
2002	21,319	2,574	611	125.4	487
2003	20,803	2,486	580	118.2	491
2004	19,388	2357	561	109.4	513
2005	19,119	2,176	560	110.5	507
2006	19,585	2,137	585	117.9	496
2007	19,794	2,047	607	115.0	528
2008	19,338	1,972	550	103.8	530
2009	18,412	1,790	516	105.2	490
2010	17,809	1,687	550	100.0	550
2011	19,207	1,662	575	90.7	634
2012	18,768	1,551	570	90.3	631
2013	18,528	1,531	575.7	94.4	610
2014	18,619	1,516	642.0	92.7	692
2015	20,386	1,551	667.3	92.8	719

Source: AIPH. International Statistics Flowers and Plants, 2001-2016.

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http://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2280&indicatorID=2087.

Table 3. Bulb trade of the Netherlands 2015

	Export			Import
	1000EUR	%		1000EUR
Austria	4,329	0.7		
Belgium/Luxembg	5,215	0.8		143
Czech Reblic	1,614	0.2		63
Germany	44,188	6.6		314
Genmark	6,857	1.0		
Spain	5,391	0.8		
Finland	9,431	1.4		
France	22,551	3.4		23
Hangary	3,206	0.5		
Italy	14,045	2.1		
Poland	8,198	1.2		113
Sweden	10,003	1.5		15
UK	47,522	7.2		230
EU,others	12,219	1.8		
EU,total	**194,767**	**29.3**		901
Australia	12,694	1.9	Brazil	6,018
Brazil	6,080	0.9	Chile	6,274
Canada	27,290	4.1	China	1,051
China	**72,785**	**11.0**	Ecuador	430
Taiwan	16,347	2.5		
Colombia	7,788	1.2	India	570
Costa Rica	7,455	1.1	Indonesia	697
Japan	**42,008**	**6.3**	Israel	1,414
Mexico	27,375	4.1	Japan	365
Norway	9,049	1.4	Morocco	544
Russian Federation	23,546	3.5	New Zealand	4,979
Swizerland	10,929	1.6		
Turky	7,924	1.2	Peru	3,052
UAS	109,160	16.4	South Africa	3,588
Vietnam	33,797	5.1	Thailand	216
			Turkey	1,239
<Korea>			USA	2,861
<Ukraine>			<Guma>	-
Europe, EU excluded	51,466	7.7		25
Africa	5,888	0.9		5,123
Asia,excl.Mid.East	178,595	**26.9**		3,137
Midle East	19,937	3.0		2,653
North America	136,450	**20.5**		2,884
Latin America	61,011	9.2		15,780
Australia, Oceania	16,369	2.5		5,051
Other Countries	55,528	8.4		1,354
World	664,521	100.0		35,553

Source: AIPH. International Statistics Flowers and Plants, 2016.

Table4. Export and price, the Netherlands

	milloin kg	EUR/kg
2000	146.9	3.87
2001	158.2	3.79
2002	175.9	3.52
2003	195.4	3.32
2004	190.9	3.08
2005	206.5	3.11
2006	223.2	3.31
2007	233.4	3.23
2008	247.5	2.92
2009	218.3	2.96
2010	242.1	2.81
2011	303.6	2.55
2012	304.2	2.54
2013	294.4	2.65
2014	329.5	2.61
2015	313.7	2.61

Source：calculated from Table 2 and UN Comtrade database(https://comtrade.un.org/), HS 060110.

Table 5. Production area, production and trade, China

	arae(ha)	productin (1,000bulbs)	production value (1,000RMB)	import (1,000bulbs)	export (1,000bulbs)	import value (1,000 dollar)	export value (1,000 dollar)
2000	1,281.4	173,931	122,552	80,120	6,092	6,731	875
2001	2,847.6	236,834	158,510	110,731	6,338	8,377	591
2002	2,684.6	216,597	143,442	143,114	6,604	14,746	1,093
2003	3,936.2	867,972	523,774	161,092	21,052	21,874	1,400
2004	3,685.1	842,963	685,547	176,395	15,855	25,683	849
2005	4,609.0	920,741	939,563	207,162	26,324	36,421	1,609
2006	3,404.3	587,271	590,505	156,725	8,671	32,829	1,376
2007	3,897.2	694,078	838,059	179,147	11,146	36,887	2,141
2008	4,680.0	647,531	775,939	191,147	10,670	38,394	2,462
2009	4,131.8	747,942	773,355	217,189	6,523	41,454	1,512
2010	4,793.9	1,237,703	820,946	225,295	5,981	53,495	1,133
2011	4,514.3	755,748	755,748	274,206	13,411	68,635	1,409
2012	4,470.6	949,924	833,506	301,137	6,053	71,392	1,492
2013	4,173.6	1,181,525.4	668,586.8	378,889	39,596	80,631	2,595
2014	5,657.8	723,421.7	895,450	356,576	31,786	82,604	2,092
2015	6,069.9	644,421.8	752,873	478,298	47,904	91,343	2,235

Source: China State Forestry Administration, China Flower Association
(http://hhxh.forestry.gov.cn/). UN Comtrade database (https://comtrade.un.org/), HS060110.

Table 6. Consumption quantity and price, China

	consumption (million bulbs)	unit consumption price (RMB)
2000	248	0.69
2001	341	0.65
2002	353	0.73
2003	1,008	0.69
2004	1,004	0.89
2005	1,102	1.11
2006	735	1.14
2007	862	1.28
2008	828	1.24
2009	959	1.09
2010	1,457	0.81
2011	1,017	1.17
2012	1,245	1.02
2013	1,560	0.76
2014	1,048	1.33
2015	1,075	1.22

Source: calculated from Table 5 with China- EUR exchange rate.

Table 7. Production area farmers of bulbs and Toyama tulips, Japan

	area (ha)	farmers	area per famer (ha)	tulip bulb area (Toyama)	tulip famers (Toyama)	erea per famer (ha)Toyama
2000	995	3010	0.33	219	239	0.92
2001	883	2840	0.31	203	215	0.94
2002	778	2300	0.34	181	190	0.95
2003	703	2070	0.34	169	174	0.97
2004	636	1820	0.35	150	162	0.92
2005	597	1660	0.36	137	150	0.92
2006	575	1580	0.36	124	137	0.91
2007	564			118	130	0.91
2008	567			113	118	0.96
2009	538			106	112	0.95
2010	505			104	107	0.97
2011	478			100	106	0.94
2012	472			95.7	102	0.94
2013	414			85.5	90	0.95
2014	379			79.5	87	0.91
2015	364			77.1	85	0.91

Source: Japan Flower Promotion Center, Flower Data book (2009-10), and Toyama prefecture. Horticulture in Toyama (2016), Ministry of finance Trade Statistics of Japan. http://www.customs.go.jp/toukei/ HS(060110-060120).

Table 8. Consumption and price, Japan

	comsumption	price
2000	957.7	18.0
2001	903.8	19.6
2002	918.4	18.3
2003	752.8	21.1
2004	763.2	18.6
2005	705.1	19.0
2006	675.9	21.4
2007	663.2	23.3
2008	600.3	21.4
2009	608.0	16.7
2010	562.0	17.5
2011	546.4	17.6
2012	540.1	16.6
2013	496.4	19.8
2014	472.8	21.4
2015	458.9	22.0

Source: same as Figure 11.

Figures
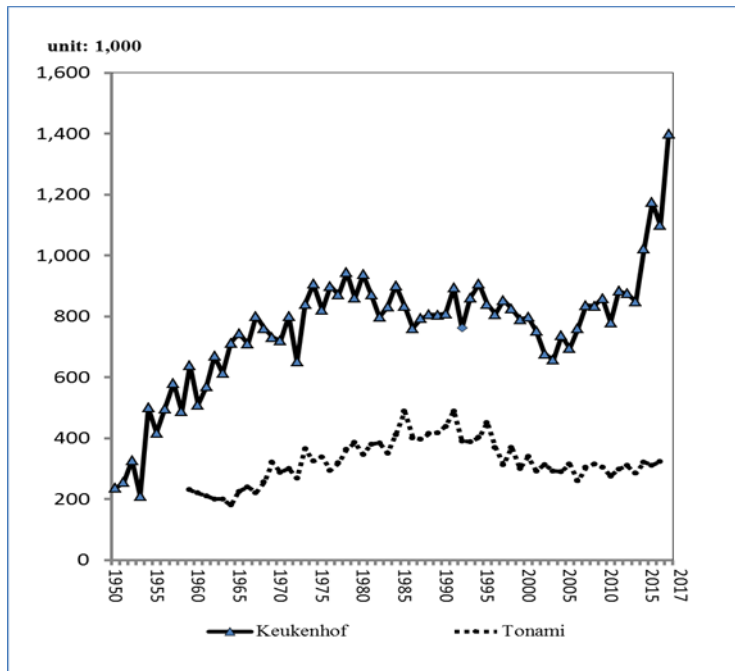
Source: Arie in't Veld(1999): 50 jaa Keukenhof1949-1999, p.103 for 1950-88 and Keukenhof office for 1989-2007. Tonami(2001):Tonami Tulip Fair 50 years, for 1960-2000 and Tulip gallery office for 2001-2007.

Figure 1. Visitors of Keukenhof and Tonami Tulip Fair
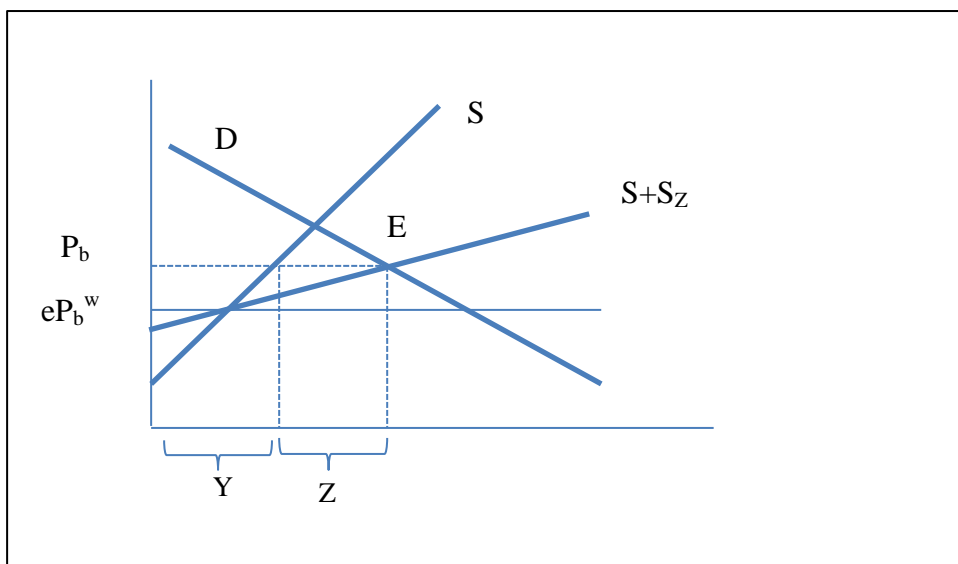
Figure 2. Determination of bulb price in a small country
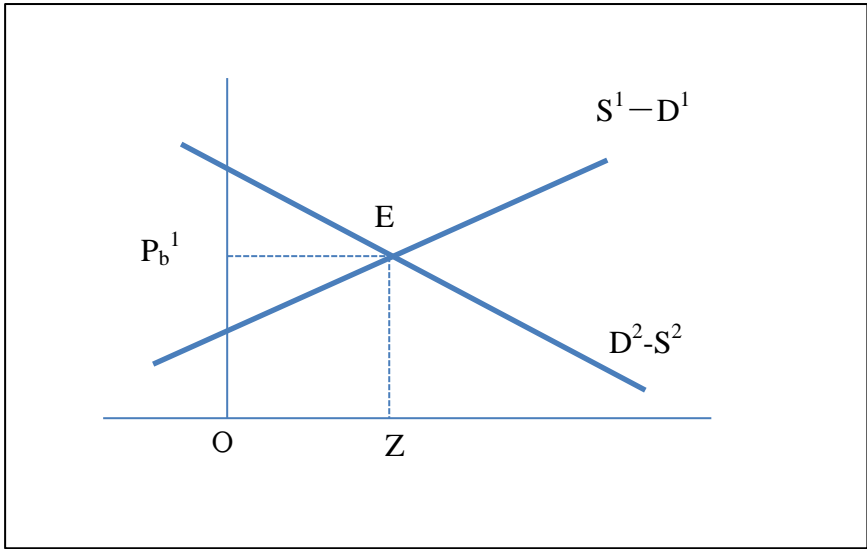
Figure 3. Determination of bulb price in a large country
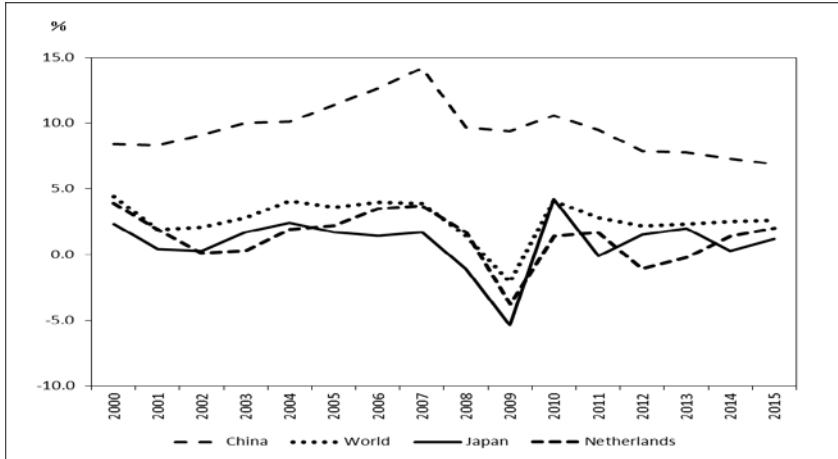
Source: Ministry of International Affairs and Communications Japan, Statistical Bureau.
World Statistics.

Figure 4. Economic growth rate
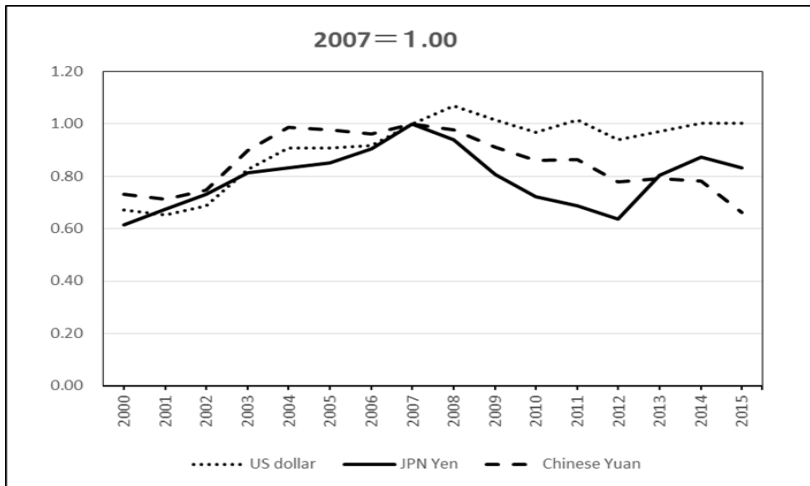
Source: Ministry of International Affairs and Communications Japan, Statistical Bureau.
World Statistics.

Figure 5. Foreign Exchange rate in terms of EUR
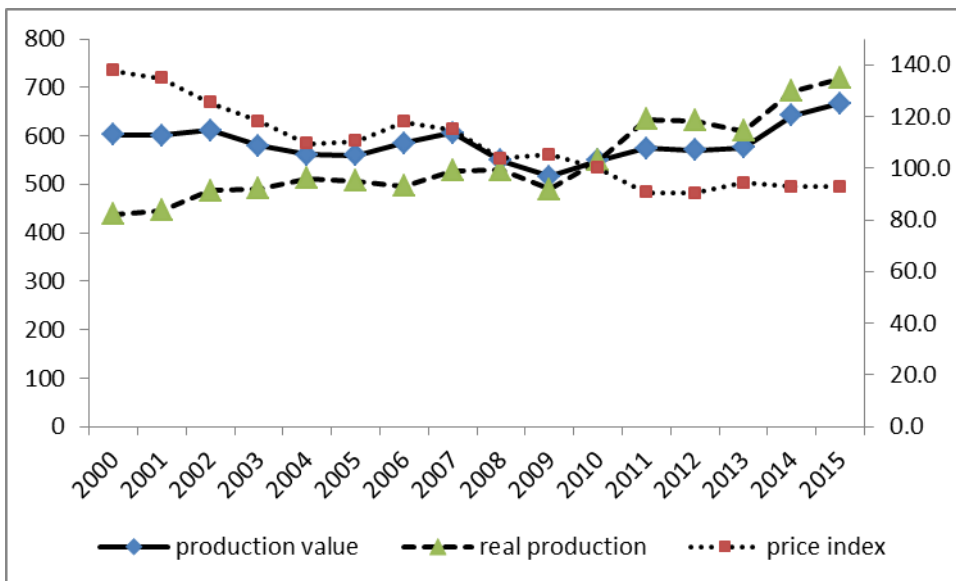
Source: see Table 2.

Figure 6. Production value, real production and price index, the Netherlands
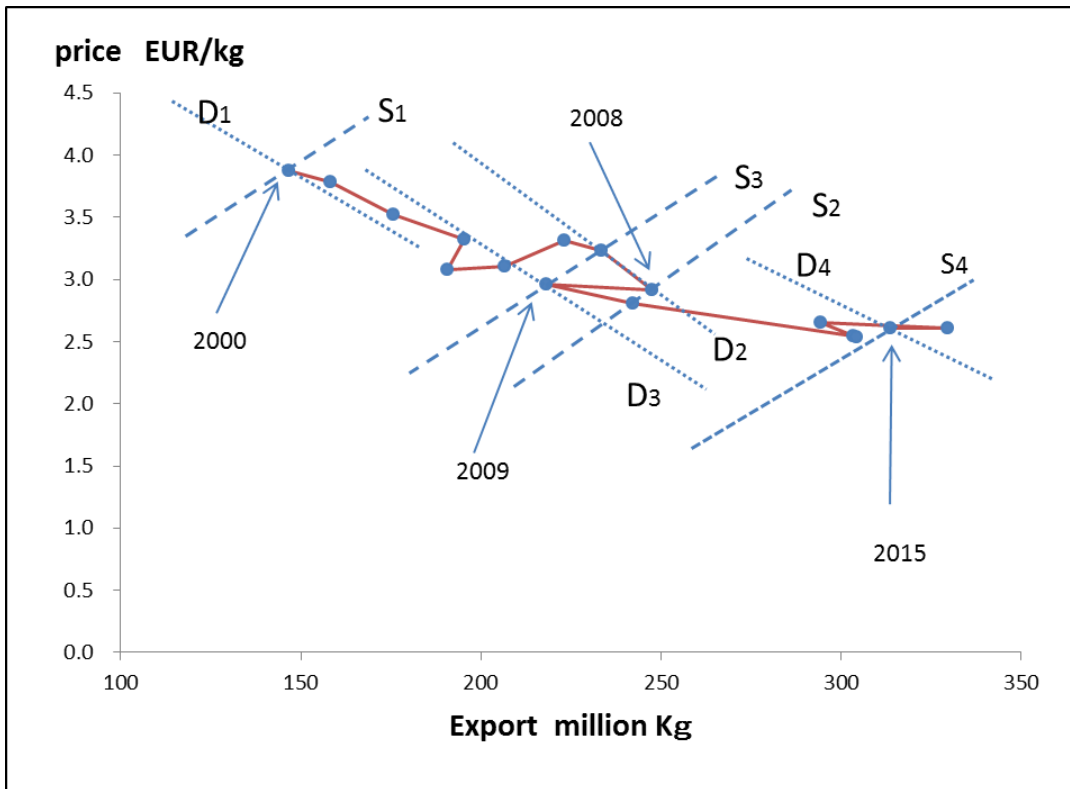
Source: same in Table 4.

Figure 7. Dynamics of export and price by demand and supply, the Netherlands
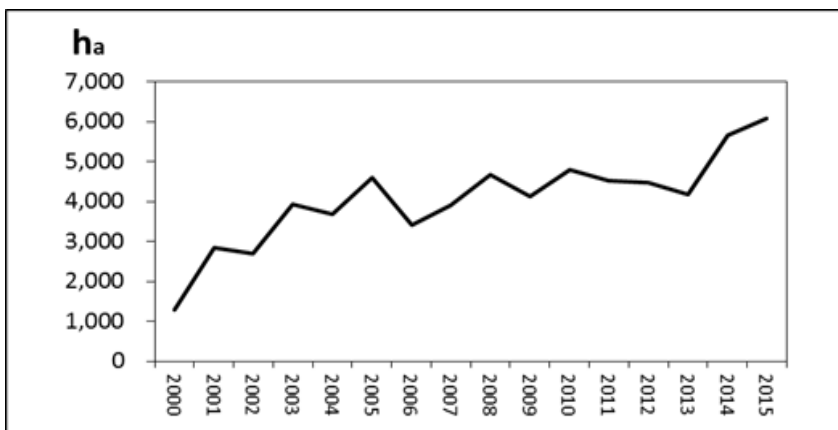
Source: see Table 5.

Figure 8-1. Bulb production area, China
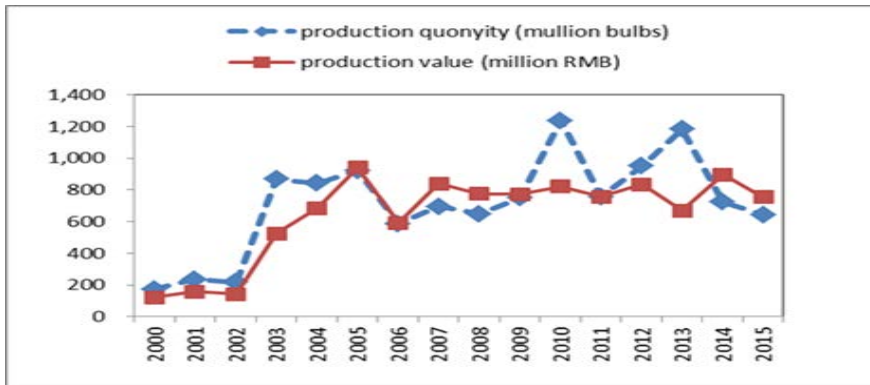
Source: see Table 5.

Figure 8-2. Production quantity and value, China
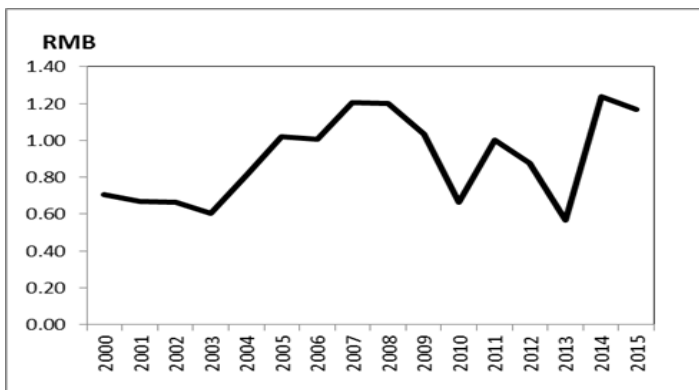
Source: calculated from Table 5.

Figure 8-3. Unit price of production, China
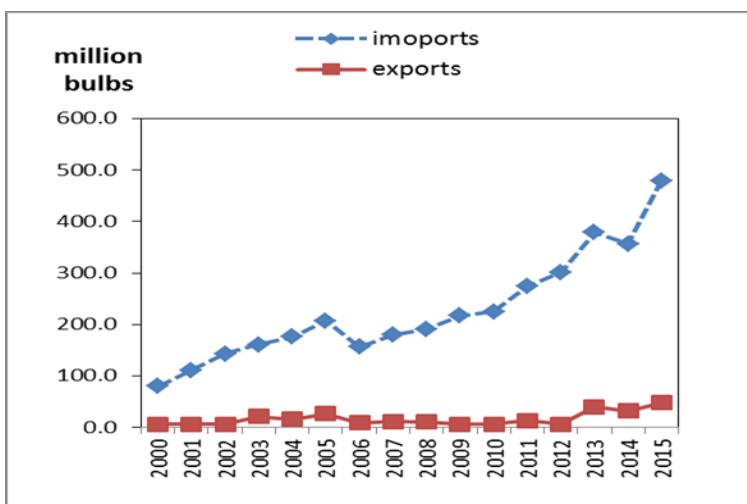
Source: UN Comtrade database (https://comtrade.un.org/), HS 060110.

Figure 9-1. Bulb import and export China
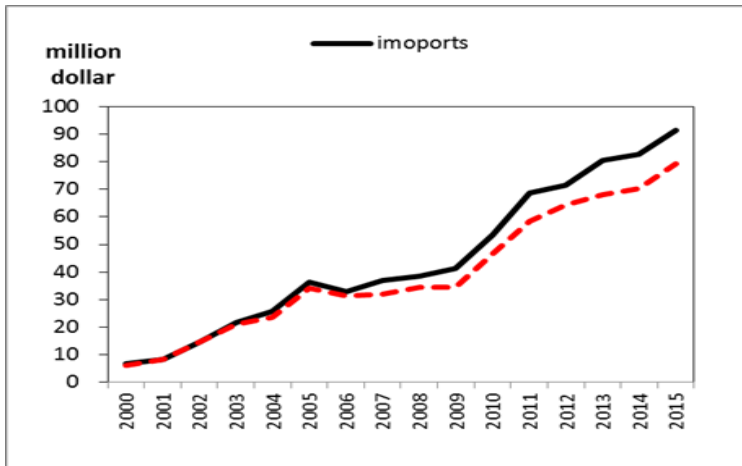
Source: UN Comtrade database (https://comtrade.un.org/), HS060110.
Figure 9-2. China imports of bulbs from the Netherlands in Dollar
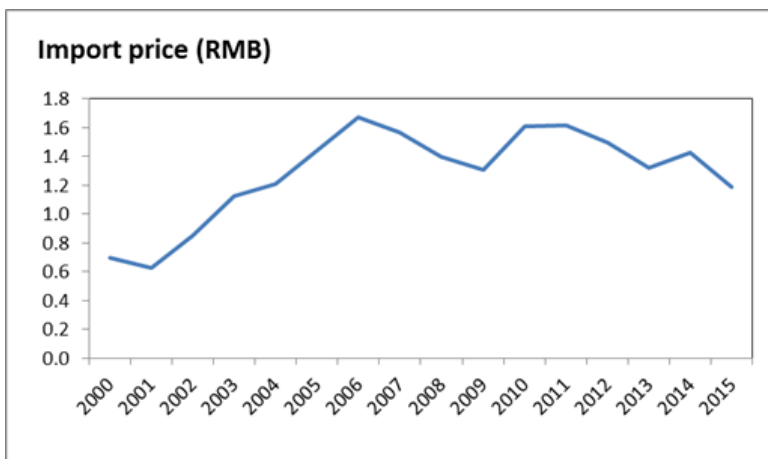
Source: calculated from Table 5 with China- dollar exchange rate.
**Figure 9-3. Unit import price in terms of RMB**
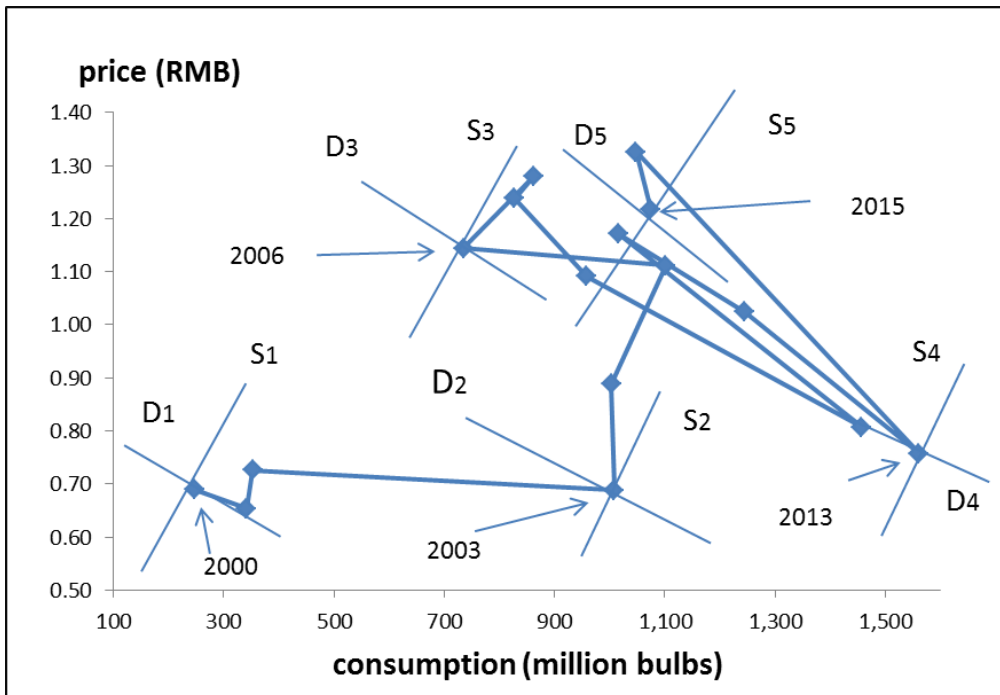
Source: see Table 6.

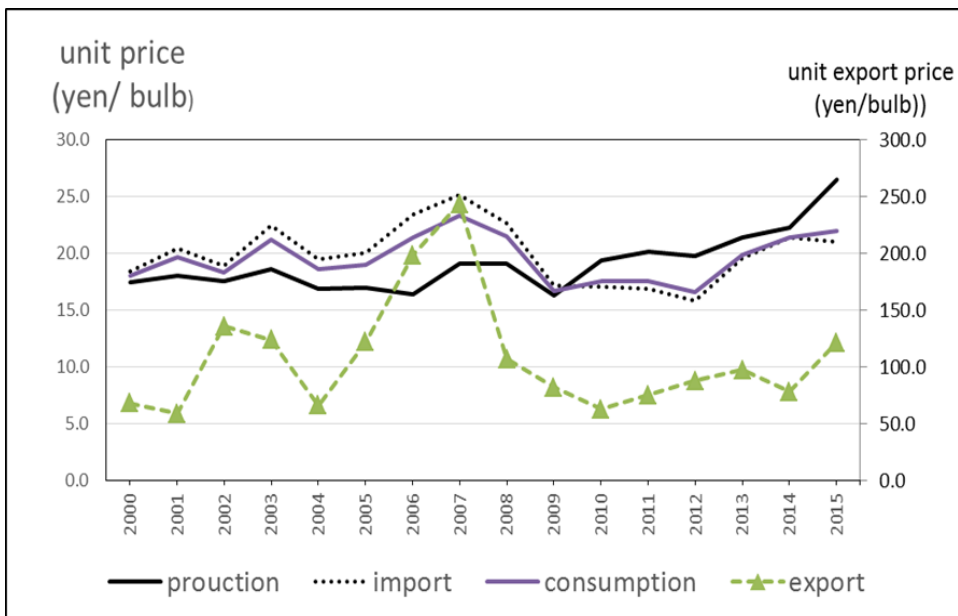**Figure 10. Consumption by demand and supply, China**
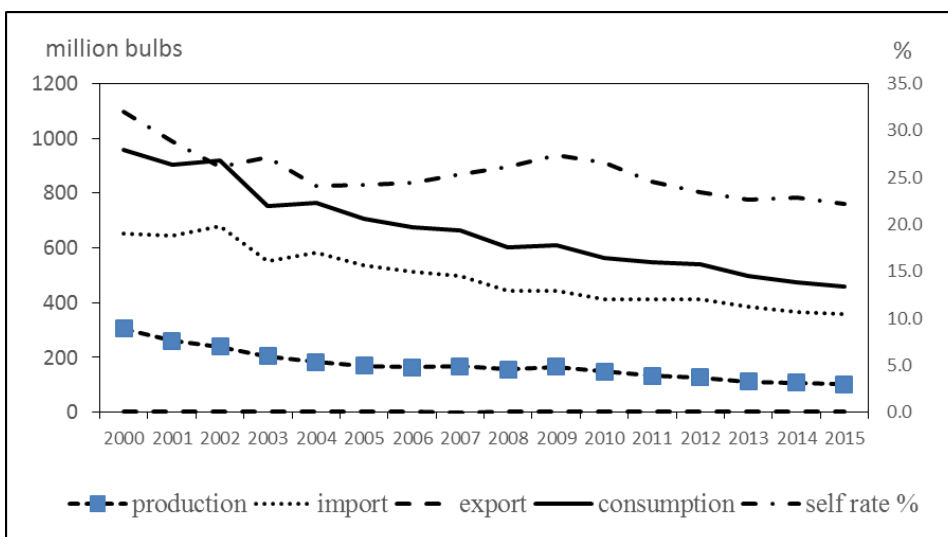
Source: Japan Flower Promotion Center. Flower Data book (2010-15), Japan MAFF. Flower production. http://www.maff.go.jp/j/tokei/kouhyou/hana_sangyo/, Ministry of finance Trade Statistics of Japan. http://www.customs.go.jp/toukei/ HS(060110-060120).

Figure11-1. Production, trade, consumption and self-sufficient rate in quantity, Japan
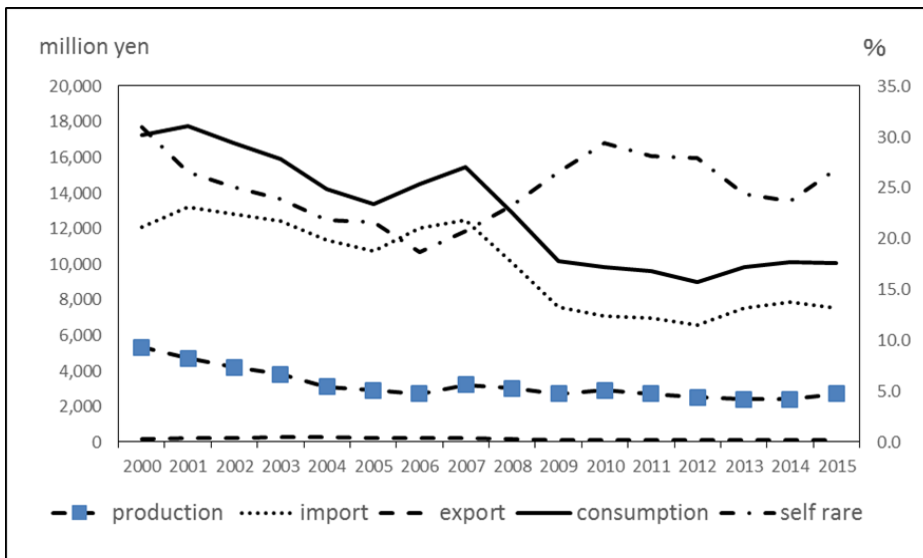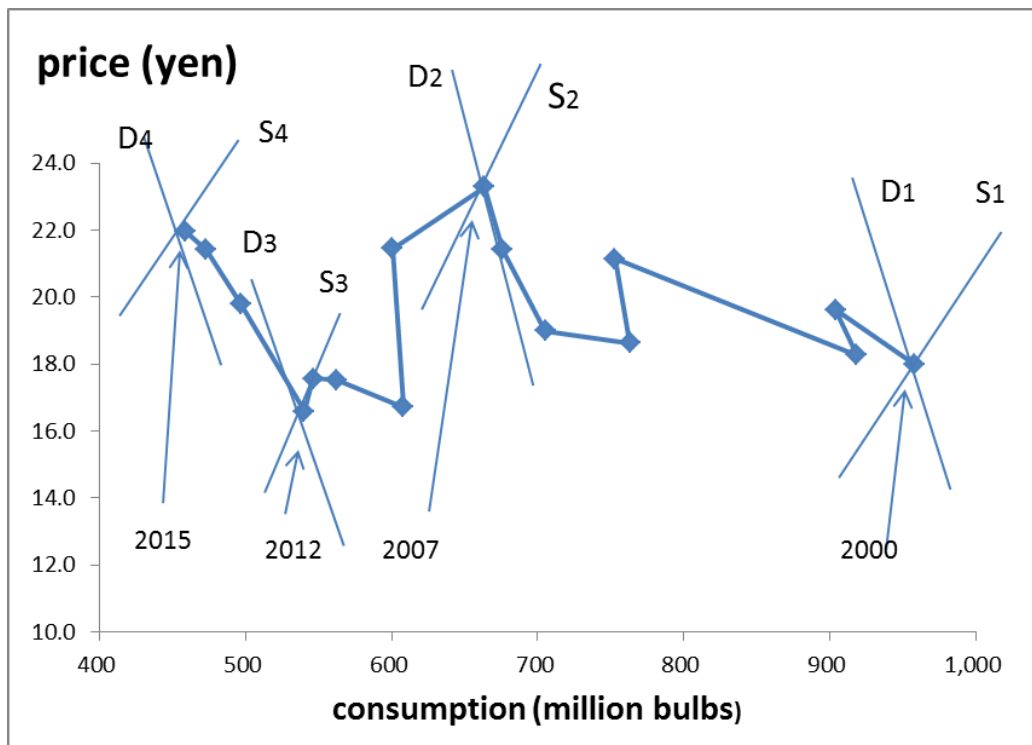
Source: same as Figure 11-1.

Figure 11-2. Production, trade, consumption and self-sufficient rate in value, Japan

Source: same as Figure 11.

Figure 12. Unit price of production, import, export and consumption, Japan

Source: see Table 8.

Figure 13. Consumption and price by demand and supply, Japan