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**How did external pressures change Japan's protectionist farm policies from the  
Uruguay Round to TPP?: A Surplus Transformation Curve (STC) analysis**

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## **Abstract**

Japan's seemingly monolithic protectionist farm policies were often easily moderated by external pressures. This study analyzes the change of the degree and the methods of protectionist farm policies, focusing on Japan's most important crop, rice. It calculates consumer surplus, producer surplus and government spending in the past fifty years and integrates these figures into one diagram utilizing the STC (surplus transformation curve) analysis, developed by Bruce Gardner in 1983.

The result of the analyses suggests that external pressures have a considerable impact on domestic protectionist farm policies. For example, in 1986 when the demand by the RMA (Rice Milling Association) in the U.S. that Japan should open its rice market was issued, the STC diagram clearly shows that the level of protection estimated from the international market price diminished. Nevertheless, at that time the level of protection estimated from the domestic equilibrium did not fall. This implies that the government successfully pretended to resist external pressure, but in reality reduced the level of protection, considering the US demands. Furthermore, in 1994 when the Uruguay Round agreement was finalized, the STC diagram also shows that Japan's acceptance reduced its level of protection. The level of protection estimated from the domestic equilibrium was also reduced at the same time. These two observations suggest that external pressures distinctly affect the degree of protectionist farm policies, while the method of protection depends on domestic political conditions.

JEL classification: Q18, Q11

Key words: Surplus Transformation Curve, Japan's rice policy, acreage control, external pressure

## **Introduction**

Japan's seemingly monolithic protectionist farm policies were often easily moderated by external pressures. In fact, in 1986, the demands from the RMA (Rice Milling Association) in the U.S. that Japan should open its rice market had a strong impact on the public opinions concerning protectionist farm policies, entailing several reforms in protectionist farm policies, even though the request was eventually withdrawn by the US government. In 1993, the Blair-house Agreement (1992) between the U.S. and the EU urged Japan to accept the final resolution of the GATT. This acceptance entailed not only increasing rice importation as minimum access but also affecting several domestic policies, which ended up diminishing the level of protection.

This study analyzes the change of the degree and the methods of protectionist farm policies, focusing on Japan's most important crop, rice. It calculates consumer surplus, producer surplus and government spending in the past fifty years and integrates these figures into one diagram utilizing the STC (surplus transformation curve) analysis, developed by Bruce Gardner in 1983.

The direct purpose of this study is to examine how external pressures affect protectionist farm policies. The indirect objective is to consider the prospect of Japan's participation in TPP (Trans-Pacific Partnership), one of the key issues of which is how to deal with damage to the agricultural sector, especially the rice industry, if trade barriers are completely removed. Whether Japan makes a decision to participate in TPP heavily depends upon the implications for farm policies.

## **Theoretical framework**

*Significance of applying the STC analysis to Japan's rice policy*

The STC analysis, having been pioneered by Gardner (1983) during the 1980's US farm policy, is well suited to a comparison between acreage control and government payments. Although it may be considered quite old-fashioned in a discussion of contemporary US farm policies, it is expected to be an effective analytical tool for the present state of Japan's rice policy.

Japan's rice production has been under acreage control for the last 40 years. In addition to that, the method of acreage control was recently changed from the European-style mandate to the American-style voluntary method, in which farmers can select whether to participate in the program or not, considering the level of compensation payment to participant farmers. Nevertheless, in spite of this reform slightly loosening the regulation from a mandated to a voluntary system, farmers have been fed up with this long-lasting, insufferable government regulation. The opinion that such a program should be completely eliminated is mounting not only among farmers but also in business circles, in which leaders in many industries expect that the abolition of this program would result in reducing the rice price.

It is of urgent necessity for Japanese government and economists to consider the advantages and disadvantages of maintaining the status quo, that is, continuing the acreage control program, or alternatively of introducing drastic reform such as direct payments or other subsidy measures instead. In this context, the STC analysis is expected to wield clear analytical power for a comparison of these options in Japan's rice policy.

*Modifications for applying the STC to Japan's rice policy*

Although the STC analysis is expected to be an effective analytical tool for the present situation of Japan's rice policy, it is necessary to make several modifications in order to improve the method's suitability for some unique characteristics of Japan's rice policy. Mainly, there are two points which require modification.

First, the STC analysis was originally intended to compare single policy measures, that is, the acreage control and the production subsidy. However, in this paper, it is modified to compare not single measures but several policy mixes. For instance, from 1970 to 1994, the adopted policy was a policy mix of a two-tier price system and an acreage control program. From 1996 to 2003, the adopted policy was a mix of an acreage control program and a subsidy for production. Originally, it was presumed that each single policy measure has a unique line in a STC diagram. Yet here, it will be assumed that a policy mix consisting of several policy measures has an individual line in a STC diagram.

Secondly, the STC analysis was originally intended to trace a series of consequences when the degree of a certain protective policy measure was enhanced. However, in the present study, it is modified to trace the time-series shifts of various policy mixes. Such an analysis not only examines the degree of protectionist farm policy in each year but also the features of various policy mixes. For instance, the comparison between 1969 and 1970 simultaneously means the comparison between the two-tier price system alone and the two-tier price system with acreage control.

## **Model and Methodology**

### *Framework*

Under a partial equilibrium framework, consumer surplus, producer surplus and

government spending on the rice market was calculated.

In order to estimate these figures, simple formulas for a demand function and a supply function are derived as follows:

$$Q_d = A \cdot P^{\varepsilon_d} \quad Q_s = B \cdot P^{\varepsilon_s}$$

The levels of elasticity of these two functions were given by a priori information based on previous studies as follows<sup>1</sup>:

$$\varepsilon_d = -0.2899, \quad \varepsilon_s = 0.4405$$

The other parameters, A and B, were calculated by substituting each year's observed amounts and prices for P and Q.

In the process of this calculation, it is crucial to accurately estimate the amount of supply (potential production) under the current price because it is not directly observed. The gap between the real amount of production and the potential production cannot be estimated from the nominal reduction rate of rice production in each year released by the government. A considerable amount of land that might be expected to potentially produce rice has already become worn out because of lack of care to preserve fertility. Consequently, such land should not be counted as potentially productive. Specific surveys were conducted in 41 prefectures and the substantial production potential was carefully estimated<sup>2</sup>.

The point of intersection of the two function curves in each year marks the

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<sup>1</sup> According to Kusakari (1998), the price elasticity of the rice demand function at the retail market was estimated as -0.3349. We scrutinized the data related to the retail and wholesale markets and converted it to -0.2899 as the elasticity at the wholesale market. According to Fujiki (1998), the price elasticity of the rice supply function at the farm gate stage was estimated as 0.45. We examined the data related to the production and wholesale stages and converted it to 0.4405 as the elasticity at the wholesale market.

<sup>2</sup> The author visited main rice production areas for field surveys and interviewed competent local officials in charge of rice production. The ratio of the number of prefectures visited in these surveys to total prefectures in Japan is 41/47. However, the ratio of the covered paddies or the covered amount of production is no less than 98%.

domestic market equilibrium. The equilibrium price and the equilibrium amount can be calculated by solving simultaneous equations derived from the functions above. The real market price and the real farmer's revenue received per unit are different from the equilibrium price. By estimating the gap between the equilibrium price and the real prices that a farmer receives or a consumer spends, the amounts of consumer surplus and producer surplus in each year measured by the domestic equilibrium were calculated. Similarly, by estimating the gap between the international market price and the real prices observed in the market distorted by government intervention, the amount of those surpluses measured by the international market price were calculated.

*Model and estimation of the surplus*

In this paper, four types of model were built according to the period in which different policy mixes were employed to protect farmers.

First, the policy mix adopted during the periods 1970-1973, and 1978-2007 is represented as Model A, explained as follows:

(The formulas shown here are those estimated from the domestic equilibrium. It can easily be changed to those estimated from the international market price by substituting  $P_w$  for  $P_e$ .)

The amount of the reduction of the consumer surplus:

$$-\Delta CS = -\int_{P_e}^{P_c} Q_d(P) dP$$

The amount of the increase of the producer surplus:

$$+\Delta PS = -\left\{ \int_{P_c}^{P_e} Q_s(P) dP - (P_e - P_c) \times Q_a \right\} + (P_s - P_e) \times Q_a$$

Government spending:



$$-\Delta GS = -(P_s - P_c) \times Q_a$$

This amount of consumer surplus is represented using a primitive function as follows:

$$\int Q_d(P) dP = F(P);$$

$$-\Delta CS = -\{[F(P)]^{P_c} - [F(P)]^{P_e}\}$$

Similarly, the amount of producer surplus is represented using a primitive function as follows:

$$\int Q_s(P) dP = G(P);$$

$$+\Delta PS = -\{[G(P)]^{P_e} - [G(P)]^{M_c} - (P_e - M_c) \times Q_a\} + (P_s - P_e) \times Q_a$$

Each primitive function is calculated as follows:

$$F(P) = 1/(\alpha + 1) \times A \times P^{\alpha+1}$$

$$G(P) = 1/(\beta + 1) \times B \times P^{\beta+1}$$

The situation of policy mix during the period 1974-1977 can be appropriately represented by Model B. During this period, the acreage control program was conducted as in other years. Nonetheless, the cutback of the production was so moderate that the reduced amount was still larger than the equilibrium amount. Principally, the formula to calculate Model B is similar to that of Model A, except for one major difference, depicted in Figure 1B.

Prior to the start of the acreage control program, the protectionist farm policy depended alone upon the two-tier price system. In this period, even consumers as well as producers were protected by the government spending. Under this two-tier price system, Model C, surpluses were calculated as follows:

$$+\Delta CS = \int_{P_e}^{P_c} Q_d(P) dP$$

$$+\Delta PS = \int_{P_e}^{P_s} Q_s(P) dP$$

$$-\Delta GS = -(P_s - P_c) \times Q_s$$

During the period 1965-1969, the policy measures differed from those during the period 1955-1964. Although the two-tier price system was employed in the same way, the supply apparently exceeded the demand. As a result, the government stockpile of rice had been accumulated year by year. Thus, Model D is modified from the Model C, only revising the formula of the government spending as follows<sup>3</sup>:

$$-\Delta GS = -(P_s - P_c) \times Q_d - (P_s - P_w) \times (Q_s - Q_d)$$

Thus, four types of model were built in order to appropriately illustrate the policy mixes implemented in each period. Figure 1 depicts those situations.

### *Other methodologies*

#### *(1) Division of the observation period*

Throughout the observation period, policy mixes frequently changed. For the purpose of lucidly examining the change of policy mix, it is useful to divide the observation period into several phases.

Phase 1 (1955-1964): two-tier price system alone without overproduction

Phase 2 (1965-1969): two-tier price system alone with overproduction

Phase 3 (1970-1977): two-tier price system with acreage control; “unstable stage”

Phase 4 (1978-1986): two-tier price system with acreage control; “stable stage”

Phase 5 (1987-1995): two-tier price system with acreage control; “transitional

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<sup>3</sup> A large amount of budget for disposing of an excess government stock was needed during this period.

stage”

Phase 6 (1996-2003): acreage control with a slight subsidy for production

Phase 7 (2004-present): acreage control without subsidy

Note: Phase 3 includes two types of model. From 1970 to 1973, Model A was adopted while from 1974 to 1977, Model B was adopted. In spite of difference with regard to the model type, these years have been combined and integrated into one phase, because this period has a common characteristic of institutional instability.

## *(2) Dealing with losses due to payment of taxes*

With regard to how to deal with subsidies or other government payments in the calculation of STC, whether losses due to payment of taxes should be considered or not is crucial in determining advantages and disadvantages of various policy measures. Generally, consumer-burden type policy measures such as price support are inefficient because of large dead weight loss, while taxpayer-burden type policy measures such as direct payments are efficient if a simple calculation without a consideration of that loss is adopted. Nonetheless, if the tax losses were taken into consideration, the efficiency of taxpayer-burden type policy measures would suffer more seriously, while consumer-burden type policy measures would be little affected.

Considering these prospects, in this paper, calculations for both cases were conducted.

Gardner (1983) pointed out the problem of the loss due to payment of taxes and argued that such a loss should be taken into consideration as a social opportunity cost, though he did not mention a concrete figure for the ratio of such a loss. Alston and Hurd (1990) also addressed the importance of this loss and closely examine the features of

each STC line's locus for various policy measures by taking the loss into consideration, though they also did not mention a concrete figure. Alston and James (2002) developed this close examination further and arrived at several concrete figures related to this loss based on previous studies, from around 10% to 25%.

Gardner (2002) reviewed previous studies highlighting the estimation of Fullerton (1991). Gardner evaluated Fullerton's estimation, 25%, as "reasonable." In this paper, we followed Gardner's evaluation and adopted "25%" as the ratio of the loss due to payment of taxes.

### *(3) Depicting STC lines*

The original STC is illustrated in Figure 2. The horizontal axis represents the amount of total consumer surplus above the international market price minus government spending. The vertical axis represents the amount of total producer surplus above the international market price. The detailed inset is shown in the right-hand upper corner of the chart in order to easily distinguish the changes of surplus. The equilibrium point, *e*, is moved on the horizontal axis in order to show the amount of the change of surplus from the equilibrium, not the amount of total surplus<sup>4</sup>.

### *(4) Decomposing the burden of protecting producers*

The advantage of the STC analysis is that the income transfer can be clearly depicted in one diagram by combining the burden of protection shouldered by several sources, such as consumer surplus reduction, government spending, and dead weight loss. However,

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<sup>4</sup> This method of representation was adopted in Kola (1993).

this combining process at the same time becomes a disadvantage. The STC analysis alone does not provide information related to the degree of burdens shouldered by each source.

In this paper, in order to compensate for this disadvantage of the STC analysis, a diagram showing the decomposition of the burden incurred by protecting producers is provided. In particular, the consumer surplus reduction is further decomposed into the reduction caused by trade barriers and the reduction caused by domestic policies.

## **Results**

### *STC analysis*

The results of the STC analysis are shown at Figures 3A, 3B, 4A and 4B. Two figures, 3A and 3B, represent the surpluses calculated from the international market price, while the other two figures, 4A and 4B, represent the surpluses calculated from the domestic equilibrium. Figures 3A and 4A illustrate the results without considering the loss due to payment of taxes, while Figures 3B and 4B show the results considering that loss.

To begin with, viewing a general tendency, the level of protection had increased from 1955 to 1969 and then acreage control was introduced in 1970. Whereas incorporating this policy measure into the two-tier price system improved the efficiency measured from the domestic market equilibrium, the efficiency measured from the international market price deteriorated. The level of protection was actually increased after acreage control was introduced, even though farmers had unabashedly shown strong disaffection toward this policy measure. In Phase 3, from 1970 to 1977, the level of protection had been unstable because of incidents such as the world food crisis in 1973. After Phase 4, from 1978, the level of protection had become relatively stable.

After the 1980s, the level of protection gradually decreased. Among various other factors, two shifts clearly accelerating this decrease can be observed in 1987 and 1994.

First, in 1986, a demand from the RMA (Rice Milling Association) in the U.S. that Japan should open the rice market had a strong impact on the public opinions concerning protectionist farm policies, entailing several reforms in protectionist farm policies, although the demand was eventually withdrawn by the US government. The STC diagram clearly shows that this demand diminished the level of protection from 1986 to 1987 when measured from the international market price. Nevertheless, the level of protection measured from the domestic equilibrium was not reduced at the same time. Usually, people are aware of a change of policy, especially the change of income redistribution or the change of protection level, through information transmitted through domestic market signals<sup>5</sup>. This implies that the government successfully pretended to resist external pressure, but in reality reduced the level of protection, considering the US demands.

In 1993, the Blair-house Agreement (1992) between the U.S. and the EU urged Japan to accept the final resolution of the GATT. This acceptance entailed not only increasing rice importation as minimum access but also modifying several domestic policies. The STC diagram shows that this acceptance reduced the level of protection estimated from the international market price. At the same time, the level of protection estimated from the domestic equilibrium was also reduced. In this case, unlike the case in 1986, the Japanese capitulation to external pressure was apparently recognized by the general people.

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<sup>5</sup> Besides this, if Japanese go abroad, they immediately notice the gap between the domestic price and the overseas price. However, few people travel frequently. Political movements and interest groups' pressure are heavily influenced not by the comparison in international markets, but by the change in domestic markets and government spending.

These two observations suggest that external pressures have a distinct impact on the degree of protectionist farm policies, while the methods of protection depend on domestic political conditions.

After 1995, the level of protection has continued to decrease. However, that level is still not fallen to the 1955 level, the year of the first observation. In addition, the problem is that the efficiency of the policy mix was deteriorated. This is shown by the distance from the 45 degree angled line. That distance in the 2000s is longer than that in the 1950s, even though the level of protection is almost the same.

#### *Detailed analysis of who should shoulder the burden of producer protection*

Figure 5 shows the detailed analysis of who should shoulder the burden of producer protection. Consumer surplus reduction measured from the international market price is divided into two parts, the reduction purely caused by trade barriers such as tariff and import quota and the reduction (or increase) caused by domestic market distortions such as the two-tier price system.

Figure 5 shows five lines. The relationship among them, the parts of the burden and the income transfer to producers, is as follows:

$$CS_{TB} + CS_{DP} + GS - DWL = PS$$

$CS_{TB}$ : amount of the reduction of consumer surplus brought about by trade barriers

$CS_{DP}$ : amount of the reduction (increase) of consumer surplus brought about by domestic policy

$GS$ : amount of government spending

$DWL$ : dead weight loss

$PS$ : amount of the increase of producer surplus

First, with regard to the trend of producer surplus, the diagram shows that it had gradually increased, then, attained its peak around 1976 or 1977. After the peak, it has continued to shrink to this day. This tendency has already been observed in the STC analysis, and is reconfirmed here.

Secondly, the movement of the dead weight loss can also be indirectly observed as a distance between each year's point on the STC diagram and the 45 degree angled line. Here, in Figure 5, this movement is more straightforwardly revealed as an individual line. It had increased from the start, implying that the efficiency of the policy mix of the year had deteriorated. Efficiency became especially low after the acreage control program was introduced in 1970. The level of the dead weight loss reached the peak (the efficiency was worst) around 1993, and then it has decreased (the efficiency has improved) to this day.

The focal point of Figure 5 is the relationship among the other three lines, that is, the argument as to which parts shoulder the burden of producers' protection. The amount of the reduction of consumer surplus brought about by trade barriers is relatively large and no specific tendency can be found, though there were slight ups and downs presumably because of fluctuations of the exchange rate.

On the other hand, the amount of the reduction of consumer surplus brought about by domestic policy and government spending both show specific tendencies. Consumers, as far as domestic policy was concerned, were the position to be protected in the 1950s, 1960s, and even several years in the 1970s. This position changed in the 1980s without consumers' knowledge. In the 1990s and the 2000s, consumers have shouldered the burden of producers' protection instead of the government, that is, instead of taxpayers. Conversely, government spending was drastically diminished in the 1980s. The burden



of the government was relatively high during from the 1950s to the 1970s, however, it has been definitely lightened after the 1980s<sup>6</sup>.

## **Discussion**

The result of the analyses suggests that external pressures have a considerable impact on the degree of protectionist farm policies. Still, the method of these protectionist policies differs between 1987 and 1994. It may be affected by internal affairs, especially political situations.

In 1986, when the RMA in the U.S. demanded the opening of the rice market in Japan, the ruling party's grip on power was strong, enabling the government to reduce its spending on the agricultural sector. The level of protection was maintained if it is calculated from the domestic equilibrium, though it was reduced if it is calculated from the international market price. Since the government possessed a great majority and was able to determine the policy mix with discretionary power, it was able to select the most suitable and most appropriate policy measures at the stage. Further, it may have been the case that the government was able to utilize external pressures for internal policy improvement.

In 1993, when Japan accepted the final resolution of the GATT Uruguay Round and a considerable volume of rice imports as minimum access was compulsorily executed, the political landscape was characterized by the newly established, unstable

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<sup>6</sup> This change was apparently affected by the financial and administrative reform of the government executed by former Prime Minister Yasuhiro Nakasone. He decisively carried out the reform, aiming at smaller government and cutting the budget, similar to the policy in the U.S. in the 1980s known as "Reaganomics." Former President Ronald Reagan and Yasuhiro Nakasone were on friendly terms, so much so that their first-name-basis relationship became known as "Ron-Yasu relationship."

coalition government. From not only the results measured from the international market price but also those measured from the domestic market equilibrium, it was apparent that the government made a capitulation to external pressure. At that time, additionally, a large amount of compensation was paid in order to appease farmers' grievances about the capitulation. This compensation was not a type of direct payment but a subsidy for land improvement. If this additional government spending is added to the STC analysis, overall efficiency at that time might be much worse. This can be considered a typical case when external pressure disturbs domestic policies and erodes their efficiency.

These two cases in which external pressures had a considerable impact on domestic protectionist farm policies provide a good lesson to a contemporary burning issue, Japan's participation in the TPP. In order to consolidate a reciprocal partnership with the U.S., Japan should consider participating in the TPP in a positive light. Nevertheless, under the present situation, where the political power of the present government is not so strong, the dispute between the industry sector and the farm sector over Japan's participation ended in deadlock. Moreover, even if a certain policy measure alleviates the damage to the farm sector, it does not assure that such a policy change derived from external pressures promises to improve the domestic farm policy. Careful examination of the policy mix is needed.

### **Concluding remarks**

The result of the analyses suggests that external pressures have a considerable impact on domestic protectionist farm policies. In the case in 1986, when the RMA (Rice Milling Association) in the U.S. demanded that Japan should open the rice market, the STC diagram clearly shows that this external pressure diminished the level of protection.

Nevertheless, the level of protection estimated from the domestic equilibrium was not reduced at that time. This implies that the government successfully pretended to resist external pressure, while in reality reduced the level of protection, considering the US demands. In 1994, when the UR agreement was finalized, the STC diagram shows that this acceptance reduced the level of protection. Then, the level of protection estimated from the domestic equilibrium was also reduced at the same time. These two observations suggest that external pressures clearly impact on the degree of protectionist farm policies, while the methods of protection depend on domestic political conditions.

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Figure 1A Stringent acreage control

(1970–73, 78–present)

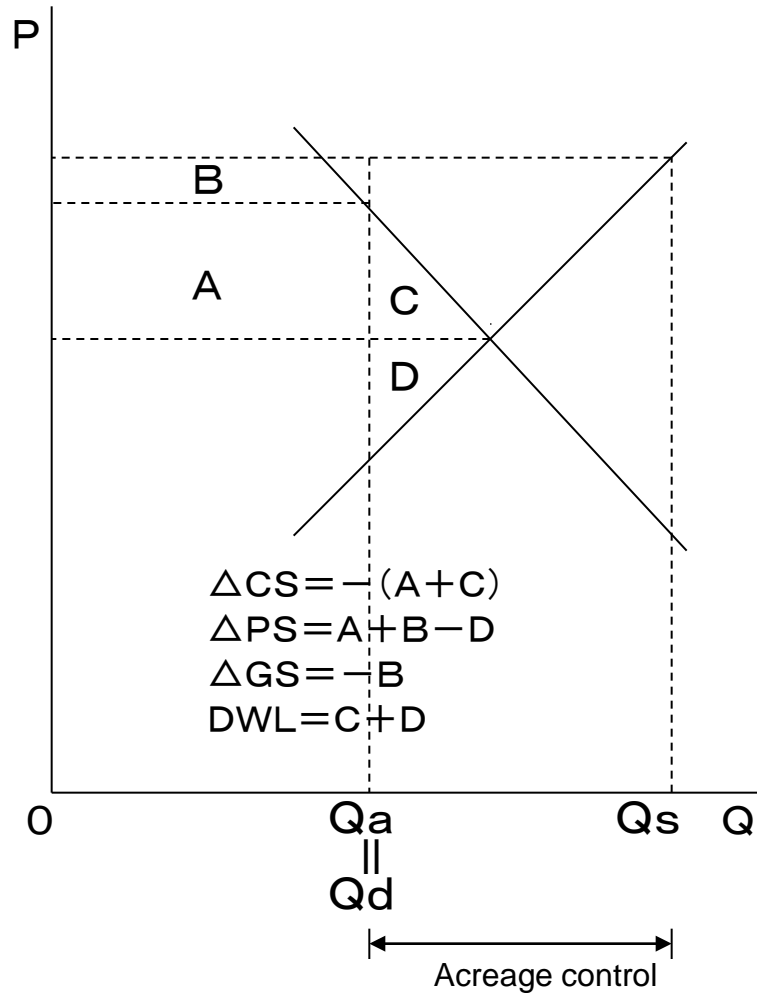


Figure 1B Lenient acreage control

(1974–1977)

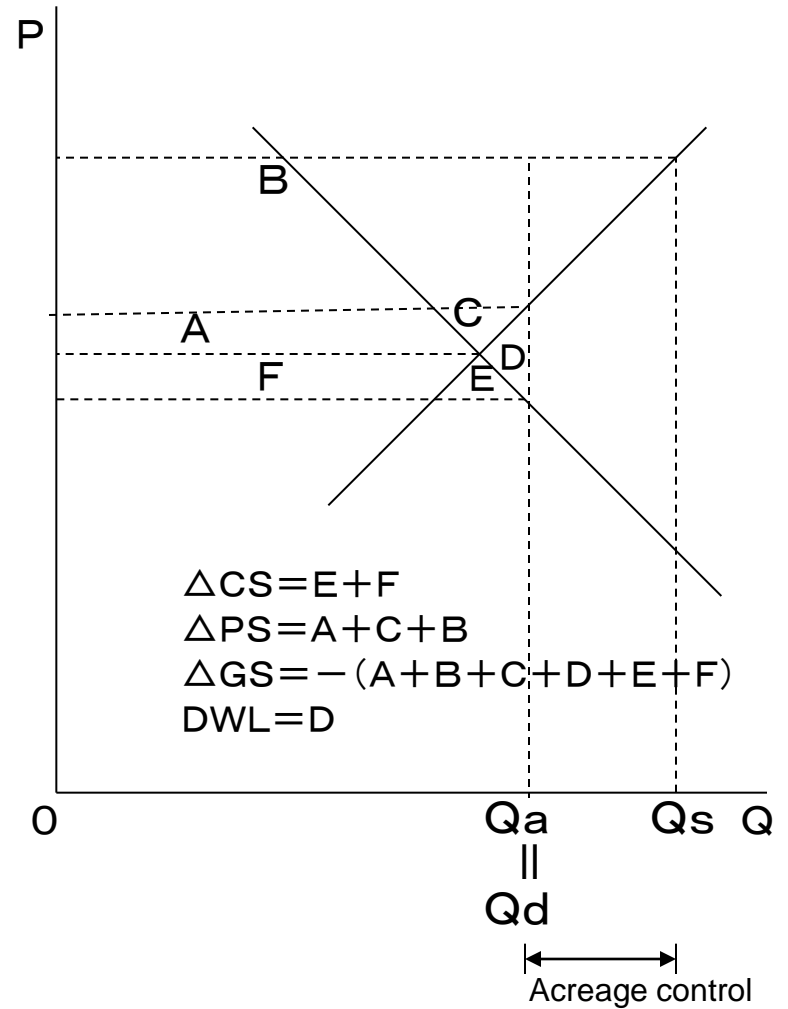


Figure 1C Two-tier price without overproduction (1955–1964)      Figure 1D Two-tier price with overproduction (1965–1969)

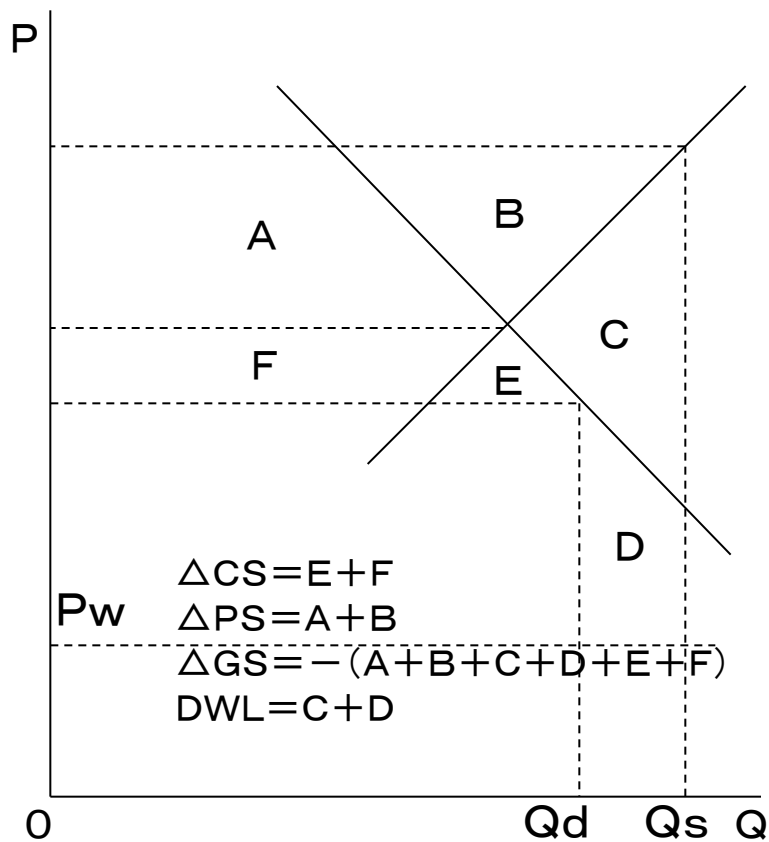
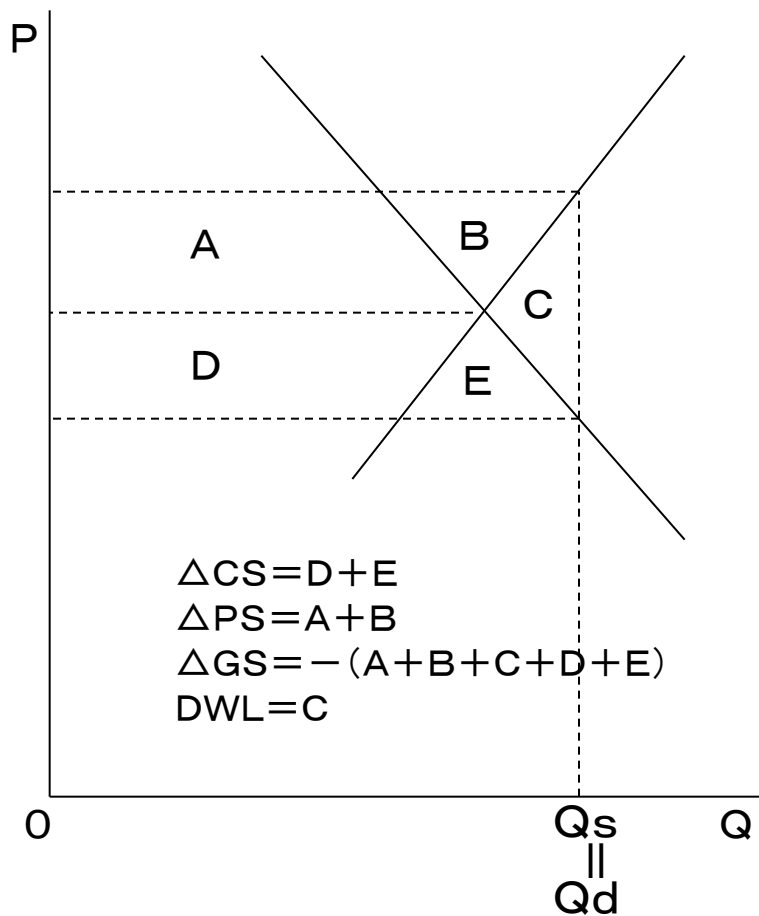


Figure2 STC analysis and its illustration

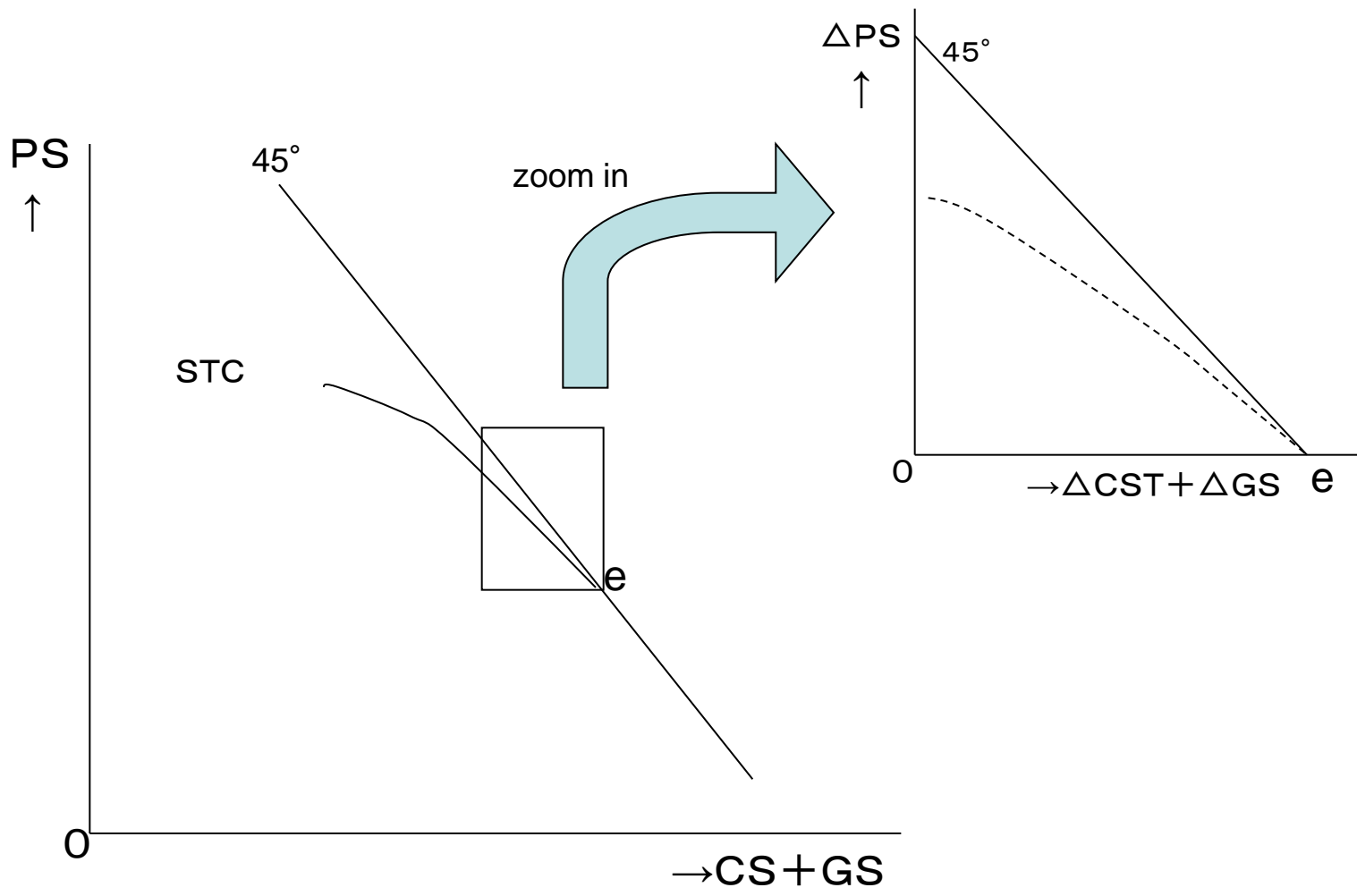


Figure 3A (unit: million dollar)

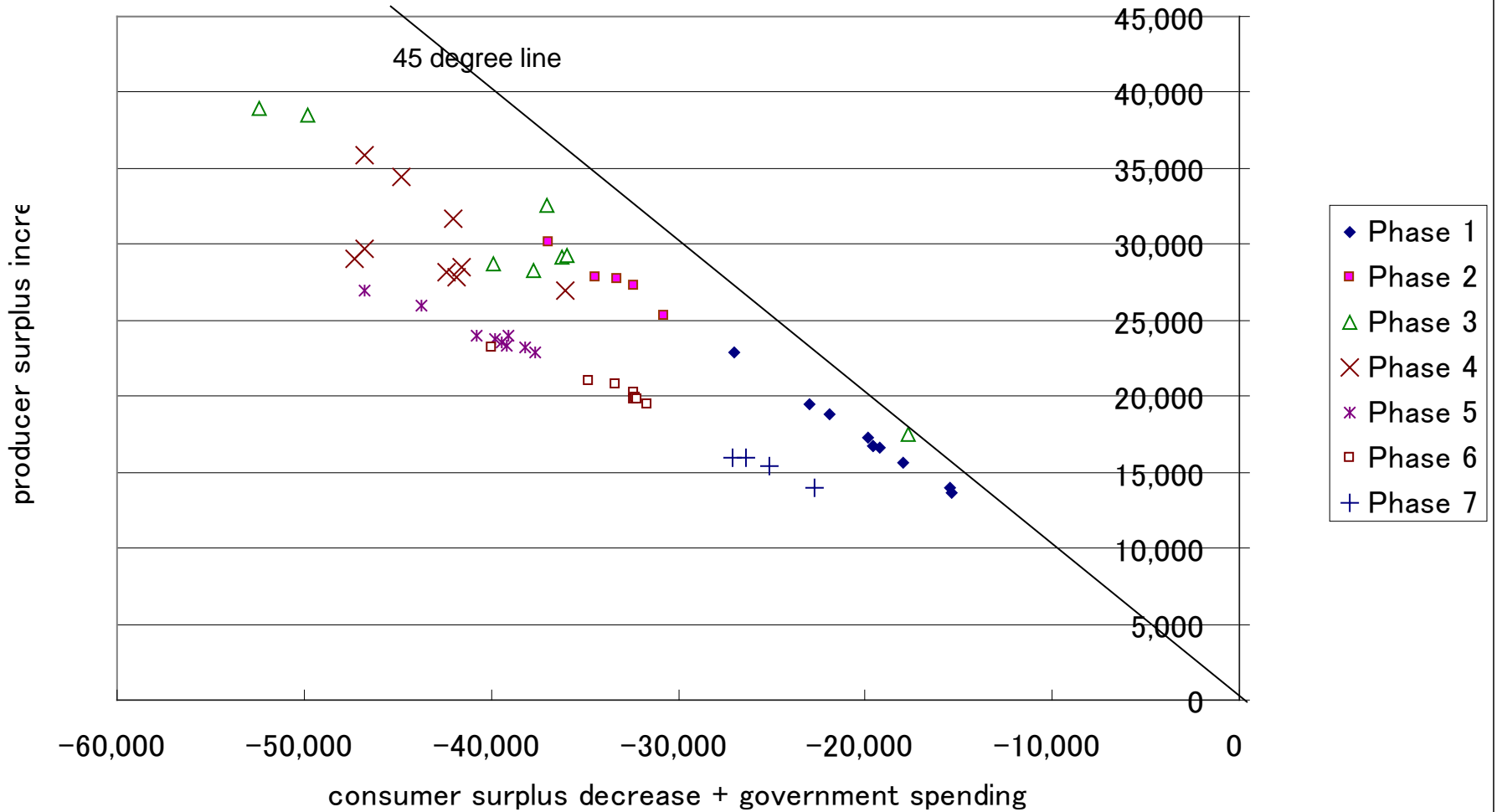




Figure 3B (unit: million dollar)

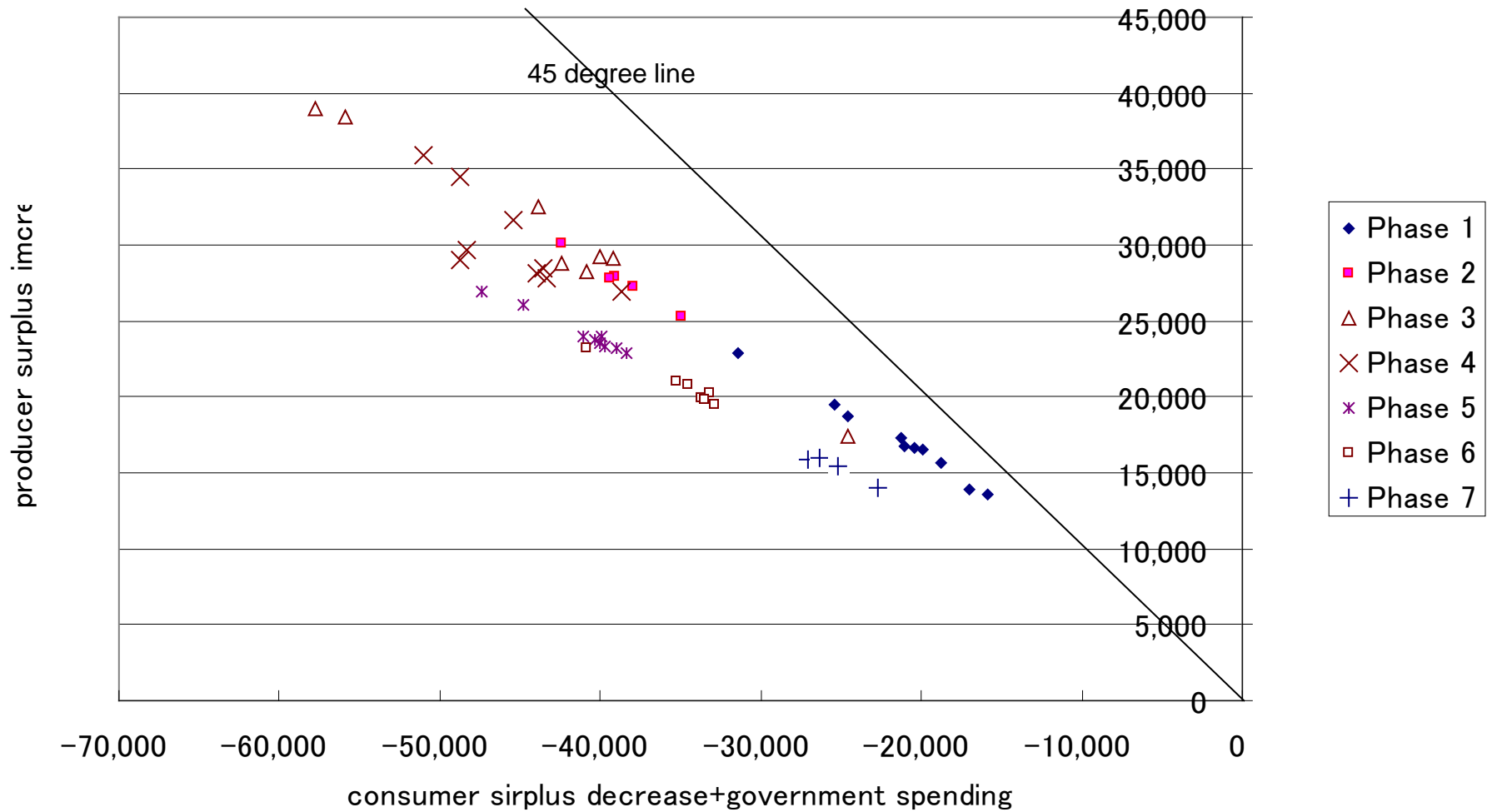


Figure 4A (unit: million dollar)

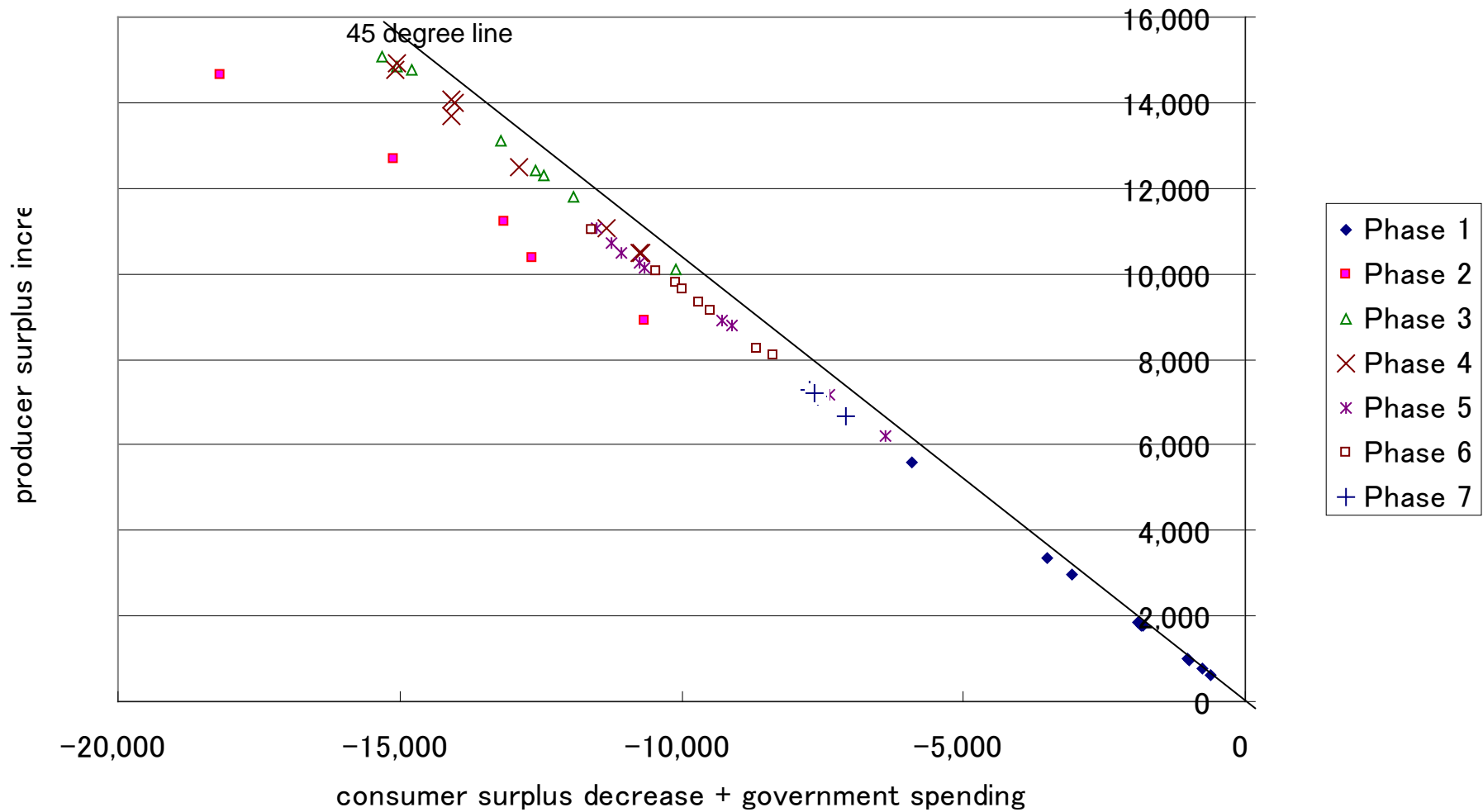


Figure 4B (unit: million dollar)

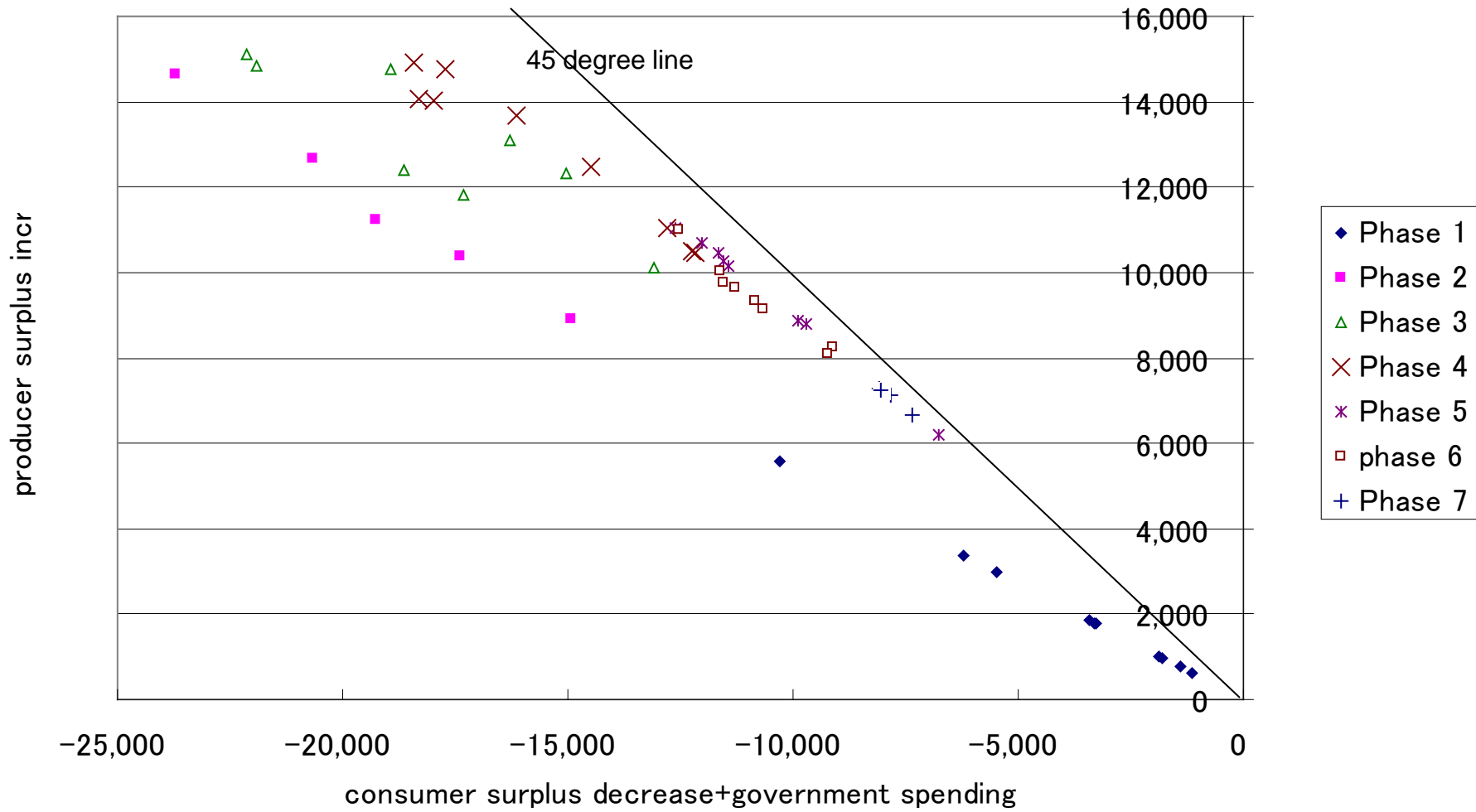
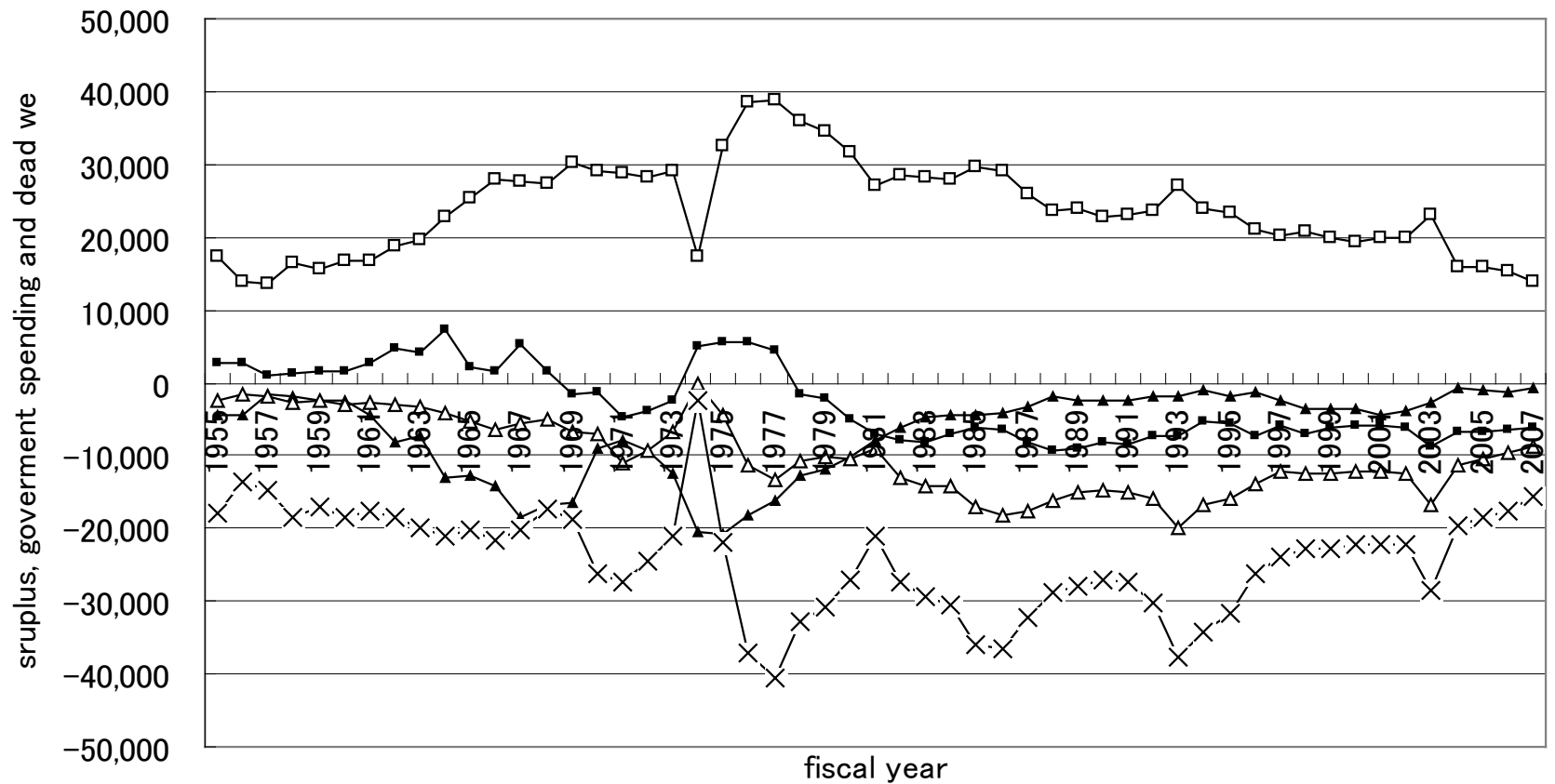


Figure 5 Decomposition of the burden of protection (unit: million dallor)



- ▲— Government spending
- △— Dead weight loss
- Consumer surplus (domestic policy)
- Producer surplus
- ×— consumer surplus reduction (trade barriers)