The 7th Keio and Tsinghua Student's Environmental Symposium

Promoting the removal of Environmentally Harmful Subsidies

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Preface

Recently, as Russia has announced to ratify the Kyoto Protocol, it will enter into force in the near future and the international corporation to cope with the problem of global warming has indeed moved a step forward. Global warming is said to be caused by the increase in the atmospheric concentration of Green House Gases (GHGs) led by the increased anthropogenic emissions. The emission of CO2, which is the major component of GHGs, is increasing year by year. The three-fourths of its emission are caused by the burning of fossil fuels[1]. To mitigate global warming, the significant emission reduction of CO2 will be essential, requiring the efficient use of fossil fuels.

Despite this situation, there exist lots of supportive measures to the fossil fuels sector. As we will mention in chapter 2, subsidies cause the loss of economic welfare. When subsidies are given to goods with negative externalities such as fossil fuels, they expand such negative externalities[2]. Yet, what is the reason of the existence of such harmful subsidies which causes negative impacts on the economy and the environment? The existence of social purposes seems to be the answer to this question. Specifically, reduction of poverty problems, prevention of unemployment and improvement of energy security seem to be the reasons of subsidies on fossil fuels. For example, subsidies on coal industry protect workers' jobs, preventing the expansion of poverty and reducing import dependency of energy supply. If these social purposes are neglected, the occurrence of political problems such as riots and so on will ruin social stability.

In spite of its importance, it is unclear whether or not subsidies on fossil fuels are rational measure to solve social problems. This paper, therefore, intends to clarify if subsidies on fossil fuels are valid, in the light of the aggregated outlook based on the economy, environment and the society.

In the first chapter, the issue of climate change is addressed with emphasis on the existence of subsidies which accelerate climate change. Chapter 2 explains the economic theory of subsidies and illustrates its nature to cause negative impacts on both economy and environment in the case of subsidies on fossil fuels. In spite of its harmfulness, lots of subsidies are given for the reason of social purposes. In chapter 3, the importance of social purposes is explained from the perspective of poverty, employment and energy security issues. Chapter 4 considers whether subsidies on fossil fuels are able to be justified for the reason of social purposes or not. Finally, we

[1] IPCC (2001a) pp.7, "About three-quarters of the anthropogenic emissions of CO2 to the atmosphere during the past 20 years is due to fossil fuel burning. The rest is predominantly due to land-use change, especially deforestation."
[2] The terms of economics are explained in chapter 2.

conclude that subsidies on fossil fuels must be removed.

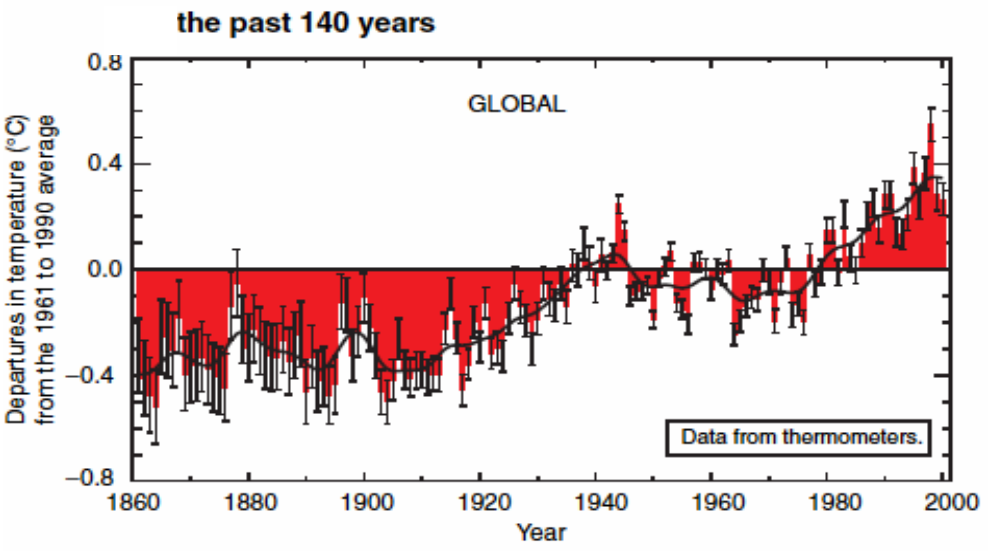
Chapter 1 Climate change and energy issues

1 - 1 The effects of climate changes

In 1990, IPCC first assessment report made it clear scientifically that world wide climate change has been occurring and asserted that unless we take practical actions, the average temperature of the earth will rise 3℃ and also the sea level will rise about 65cm by the end of 2100.

After a decade from the first report, in 2001, IPCC gathered more scientific information about climate change and reported in the TAR that the average temperature of the earth actually rose almost 0.6 degrees during the 20th century and especially the 90's was the warmest decade in the last 140 years. Figure 1-1 shows that the average temperature has been rising rapidly from the 90's. And also TAR reported with stronger evidence[3] that most of the warming observed over the last 50 years was attributed to human activities. It means that we must reduce our negative contribution to the global warming to avoid serious effects.

【Figure 1 － 1】 Trend of the average temperature of the earth in the last 140 years



source : IPCC(2001a)

What kind of damages does climate change bring to us both socially and economically? Damages of climate change such as the reduction of glacier or the extinction of some animals and plants have being reported every year and these

[3] IPCC(2001a)pp.10 "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities"

phenomena might do an irreversible harm to the ecosystem. And also extreme weathers are increasing. You can easily remember the severe heat wave in France in 2003 or the new record of typhoons attacked Japan this year, 2004. The more extreme events happen, the more the damages cost us. IPCC (2001b) reported that the economic loss by these kinds of extreme weathers have become more than 10.3 times the loss calculated 50 years ago[4].

And socially, the risk of increasing floods or expansion of diseases such as malaria tends to fall on the economically and socially vulnerable areas more than rich areas. The damages in the vulnerable areas are more severe making these areas more unstable. Then, what are the causes of climate changes which create such large damages to the economy and the society?

1 - 2 The importance to solve energy issues in combating against Climate Changes

First of all, global warming is mainly caused by the concentration of GHG in the atmosphere such as CO_2. Radiations from the sun pass through the atmosphere and are absorbed into the ground. Then when the warmed ground emits the heat as infrared rays into space GHG prevent some of the heat from passing and radiates it back to the ground again. This system has been keeping an adequate temperature of the earth in which life can survive. However, as the concentration of GHG got higher, containment of the heat became too much and it caused global warming.

Moreover, we must focus on the fact that over 75% of anthropogenic CO_2 emission in the last 20 years came from fossil fuel burning. Nowadays the CO_2 emission from fossil fuel amounts over 6 billion t-C per year. According to the IPCC (1995) if the atmospheric concentration is to remain below 550ppm, in the next 100 years we have to control the CO_2 emission under the average amount we emit today and beyond the end of the next century, we have to reduce it substantially. It means that we have to use fossil fuel more efficiently to control the CO_2 emission.

In spite of these reports, there are some wrong energy subsidy policies that distort the price of fossil fuels. These subsidies make the price of fossil fuel cheaper than real market price and it makes the consumption of fossil fuels bigger. Then in the end, people use fossil fuels too much and the CO_2 emission will increase. From now on we examine these kinds of subsidies are actually valid or not. In the next part we explain the economic theory of subsidies as well as the characteristic of these subsidies on fossil fuels.

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[4] IPCC (2001b) pp.13 "Global economic losses from catastrophic events increased 10.3-fold from 3.9 billion US$ yr-1 in the 1950s to 40 billion US$ yr-1 in the 1990s."

Chapter 2 Economic theory of subsidies

2 - 1 Nature of Subsidies

Subsidization is one of the most popular economic methods of government intervention. In terms of Economics, the role of government is to correct "market failure[5]" and allocate resources effectively.[6] The methods of government intervention include regulatory methods and economic methods, such as taxation and subsidization. Regulatory methods are the methods that the government legislates and enforces laws of contract, justice and so on, in order to enforce economic entities to meet their obligations. Some of the examples of regulatory methods include various regulations on financial institutions and regulations on automobile. Since regulatory methods control economic entities directly, implementation of those policies always causes controversy. On the other hand, economic methods are the methods that the government pursues the allocation of resources which maximizes the economic welfare[7] by using taxation, subsidization and so on. As for taxation, introducing new taxation is not easy to undertake, as it is kind of "common response" for people to be against additional taxes.

On the other hand, subsidization, one of the economic methods, is easier to get public acceptance, and thus considered as a highly feasible method by policy-makers. In addition, subsidization includes various methods to implement. Reducing or removing tax burden in order to strengthen particular entities' competitiveness in the markets has the same effects as subsidies.

These are widely- known advantages of subsidy. However, it is more important to focus on its drawbacks, which have not been recognized by public. Actually subsidies have the nature to lowers the economic welfare. In addition, if subsidies are introduced in the polluting sector with negative externalities, they give negative impacts on the environment as well. We would like to explain these drawbacks of subsidies with economic theories below.

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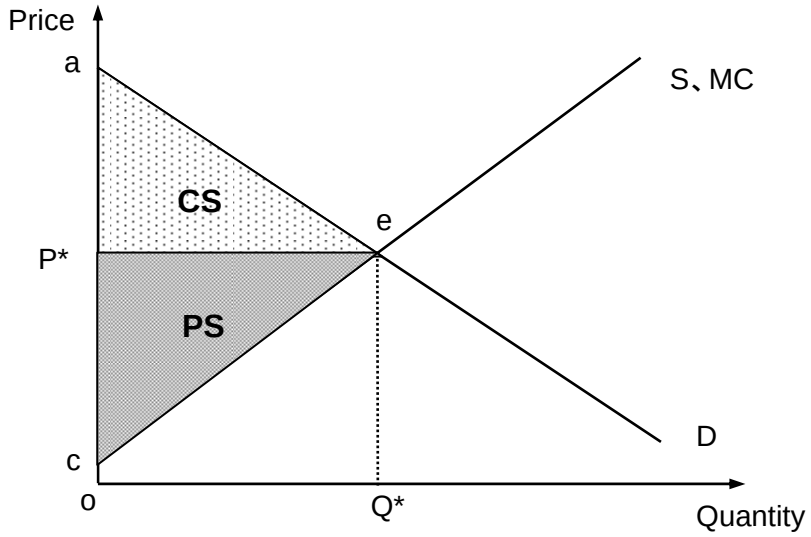
[5] Theoretically, markets is said to achieve an economically efficient allocation of resources. However, markets can fail to achieve the allocative efficiency when the resources which are not treated through markets exist.

[6] Generally speaking, policy-makers aim to improve people's lives by implementing policies.

[7] The economic welfare is the sum of each entity's surplus. Detailed explanation would be given later.

Economic Welfare under Competitive Market



【Figure 2-1】 Economic welfare under the competitive market

At first, we would like to explain about the concept of economic welfare. Figure 2-1 gives us the demand curve (D) and the supply curve (S).[8] Under the competitive market[9], the intersection of D curve and S curve is called market's equilibrium, and the price and quantity at this point are called the equilibrium price and the equilibrium quantity respectively.

How can the economic welfare be drawn on Figure 2-1? The economic welfare consists of consumer surplus and producer surplus. Consumer surplus (CS), which measures the benefit to buyers of participating in a market, is the amount a buyer is willing to pay for a good[10] minus the amount the buyer actually pays for it. In Figure 2-1, buyers' willingness to pay equals to the area oQ^*ea when buyers buy goods by the quantity Q^*. In other words, if buyers purchase the quantity Q^* of goods, they would get the utility by the amount of oQ^*ea. On the other hand, the amount the buyers actually pay for the goods equals to the area oQ^*eP^*, which is computed by price P^* in height multiplied by the quantity Q^* in width. Thus, CS can be indicated by the triangle aeP^*, which is computed by the area oQ^*ea minus the area oQ^*eP^*.

[8]Though actual demand curve and supply curve are not linear and their shapes are more complicating, only simplified information should be given here in order to explain the basic theories of welfare economics. See Annex for more information about these curves.

[9] Perfectly competitive market is a market with many buyers and sellers trading identical products to maximize their benefits. It is assumed that no monopoly, oligopoly or externality exists in the perfect competition.

[10] Willingness to pay is defined as the maximum amount that a buyer will pay for a good.

On the other hand, Producer Surplus (PS) is the benefit to producers of participating in the market[11] and equals to the amount producers receive by selling their products minus costs of production. Figure 2-1 illustrates that PS can be indicated as the triangle *ceP**, which is computed by the amount of producer's revenue (*oQ*eP**) minus costs of production (*oQ*ec*). Then finally the economic welfare as a sum of CS and PS can be seen as the triangle *ace*.[12]

Economic Welfare under Subsidization

If subsidies were introduced to the condition described above, how would the economic welfare be changed? Figure 2-2 illustrates changes in the economic welfare led by subsidization. Supposed that the government lowers the price of goods from the equilibrium price (*P**) to *P'* in order to support buyers' consumption of the goods[13], the quantity demanded should increase from *Q** to *Q'*. On the other hand, producers should set the selling price at *P"* if the quantity *Q'* of products are produced and sold. Thus, here exists the difference between the price demanded and the price supplied. To solve the problem, the government supports the producer by giving subsidies. Under this condition, the amount of CS would be indicated as the triangle *agP',* which is computed by the amount of buyer's willingness to pay (*oQ'ga*) minus the amount actually paid for the products (*oQ'gP'*). On the other hand, the amount of PS would be illustrated as the triangle *cfP",* which is computed by the producer's revenue (*oQ'f P"*) minus costs of production (*oQ'fc*). Perhaps some might think that the sum of surplus has been increased when compared with that of pre-subsidized situation in Figure 2-1. However, the government expenditures (GE) used as subsidies should be deducted from the total surplus, since GE has been collected as taxes that imposed on both buyers and producers. Figure 2-2 shows the amount of GE, which is computed by the price of subsidy per unit (the difference between the price supplied *P"* and the price demanded *P'*) multiplied by the quantity *Q'*. Thus, the economic welfare under subsidization is illustrated by the sum of CS (*agP*) and PS (*cfP"*) minus GE (*P'gfP"*), that is, the triangle *ace* minus the triangle *efg*. As a result, it is found that subsidies lead loss of economic welfare by the triangle *efg*, which is called as Dead weight loss.

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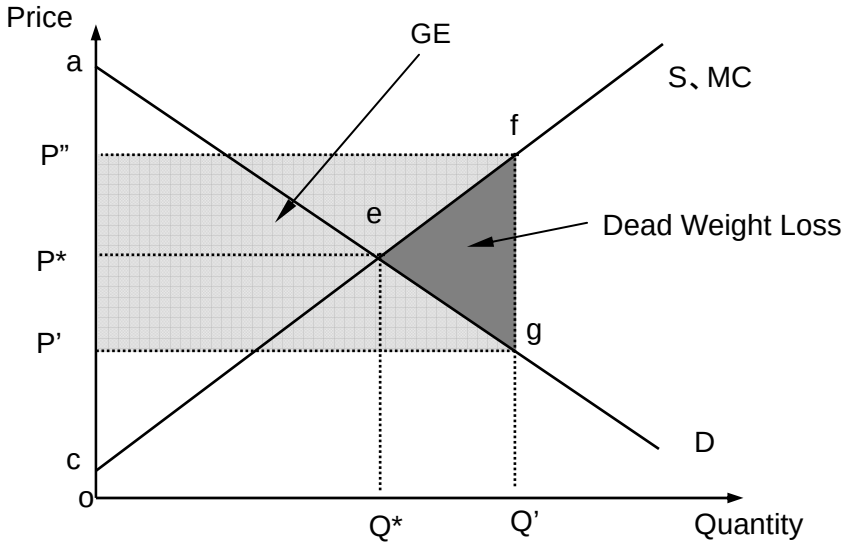
11 Assumed no fixed cost exists.

12 Under the competitive market, the economic welfare is maximized at the equilibrium point. See Turner *et al* (1994) or Microeconomics textbooks.

13 Here we consider about the under-pricing, the one of the methods of subsidization. Under-pricing is a method that the government lowers the selling price of products in order to make buyers able to buy more products, and support producers by providing subsidies. This method is often used in energy sectors in developing countries in order to support the poor, as described in chapter 3.



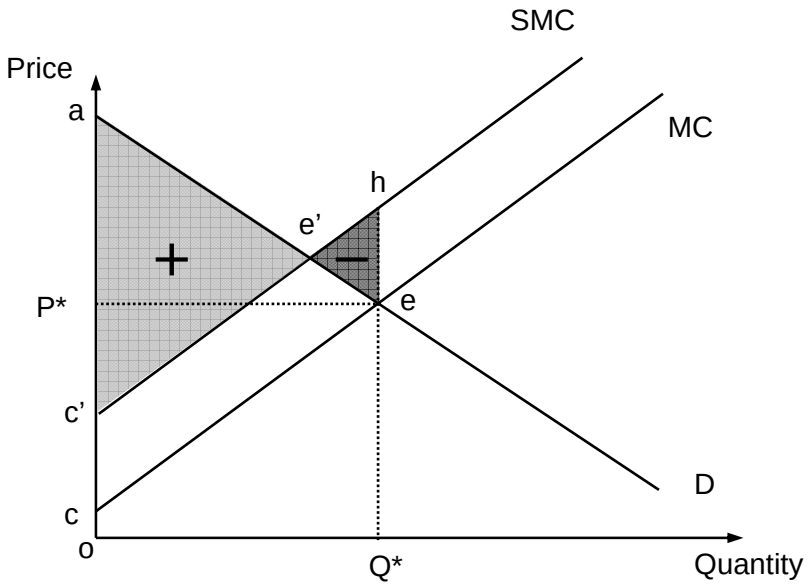
【Figure 2-2】Welfare loss of subsidies

2 - 2 Subsidies for the goods yielding negative externalities

Though it has been obviously shown so far that subsidies are the method that give negative impacts on economy, subsidization remains still popular among policy-makers. However, policy-makers should notice the other drawback of subsidies. It is that, if subsidies are used for the goods yielding negative externalities, they damage not only the economy but also the environment.

Externalities are usually defined as “unintentional side-effects of production and consumption that affect a third party either positively or negatively (Turner *et al* (1994) p.25).” The crucial feature of externalities is that there are goods people care about (e.g. clean air and water, landscapes, and so on) that are not sold on markets. For example, the factory that pollutes the surrounding local atmosphere to such extent that the local incidence of some respiratory illnesses increases, has created a negative externality (external costs). That is, an activity by one agent (the factory) has caused a loss of welfare to another agent (the people made ill). Since the loss of welfare is not taken in account through the market, there is no incentive for polluters to compensate for it.[14]

[14] By contrast, it is called as positive externalities that an activity by one agent has caused an increase in welfare to another agent.



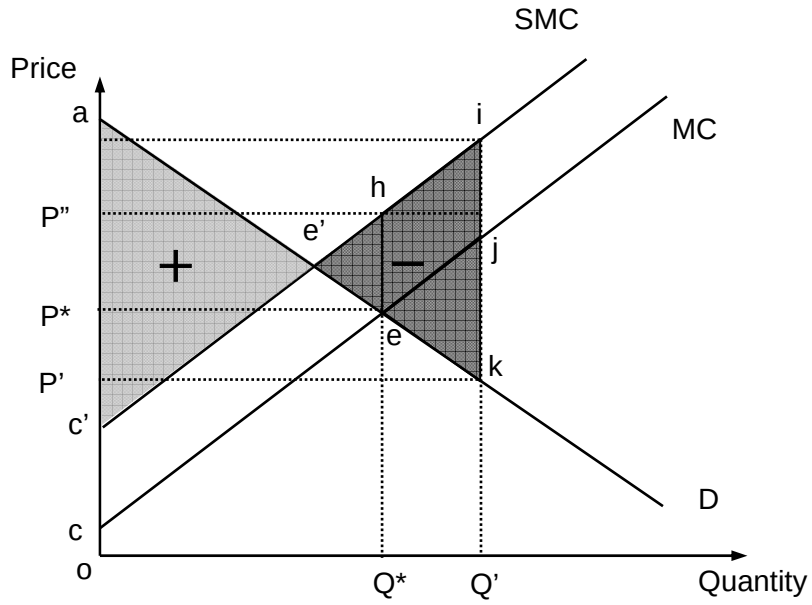
【Figure 2-3】Economic welfare with negative externalities

Figure 2-3 shows the economic welfare under the condition of goods yielding negative externalities. The marginal cost (MC, see Annex for detailed explanation) curve shows producer's private costs of production. With the existence of negative externality, however, for each unit of production, the extra external costs (the difference between *c'* and *c*) are created. Thus, actual producer's private costs of production should be increased by the extra social costs involved, shifting the MC curve to the SMC (social marginal cost) curve[15].

With the SMC curve, the optimum point should be *e'* at which the SMC curve intersects the demand curve and thus the economic welfare is maximized. However, the market's equilibrium remains to be at the point *e*, because it is not the SMC curve but the MC curve that reflects actual producer's private costs of production. Thus, it can be said that the full costs of producing and consuming the goods were not reflected properly at the equilibrium point *e*.

The existence of negative externalities lowers the economic welfare. With the market's equilibrium *e*, CS and PS equal to the triangle *aeP** and the triangle *ceP** respectively, and thus the sum of surplus equals to the triangle *ceP**. This time, however, the total external costs, which equals to the area *cehc'*, should be deducted from the sum of surplus. Finally, it is found that there appears the loss of economic welfare by the triangle *e'eh*, which is called dead weight loss.

[15] Assumed that a fixed amount of external costs would be created for each unit of production.



【Figure2-4】Subsidies for the goods yielding negative externalities

Then, if subsidies were introduced for the goods yielding negative externalities, how would it affect the economic welfare? Figure 2-4 shows the economic welfare under subsidization[16] introduced for the goods yielding negative externalities. As Figure 2-4 indicates, if subsidies are introduced, the dead weight loss would be enlarged by the triangle *ejk.* In addition to that, the extra external costs of the area *ejih* would be also increased as the quantity demanded has increased from *Q** to *Q'*. Finally the dead weight loss of subsidies has become larger than before subsidization.

The economic theories described above clearly indicate that some subsidies give negative impacts on both the economy and the environment. OECD calls this kind of subsidies as "Environmentally Harmful Subsidies (EHS)." [17]If the removal of the EHS was undertaken, the equilibrium quantity supplied would come back from *Q'* to the previous level (*Q**), so it could achieve both the environmental improvement of the area *ejih* and the economic gain of the triangle *ejk.* According to IEA (1999), the removal of energy subsidies in eight of the largest non-OECD countries would reduce primary energy use by 13 per cent, lower carbon dioxide emissions by 16 per cent and raise GDP by almost 1 per cent in those countries as a whole (see Table 2-1).

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16 The same assumption as introduced in Figure 2-2 is made for the method of subsidization (under-pricing).

17 OECD (2003) defined the EHS as following; "a subsidy can be defined as 'environmentally harmful' if it encourages more environmental damage to take place than what would occur without the subsidy."

【Table 2-1】 The impact of the removal of energy consumption subsidies in selected countries

Country	Average rate of subsidy (% of market price)	Annual economic efficiency gain(% of GDP)	Reduction in energy consumption (%)	Reduction in CO_2 emissions (%)
China	10.9	0.4	9.4	13.4
Russia[A]	32.5	1.5	18.0	17.1
India	14.2	0.3	7.2	14.1
Indonesia	27.5	0.2	7.1	11.0
Iran[B]	80.4	2.2	47.5	49.4
South Africa	6.4	0.1	6.3	8.1
Venezuela[B]	57.6	1.2	24.9	26.1
Kazakhstan	18.2	1.0	19.2	22.8
Total sample	21.1	0.7	12.8	16.0
Total world	n.a.	n.a.	3.5	4.6

Source: IEA（2002c）

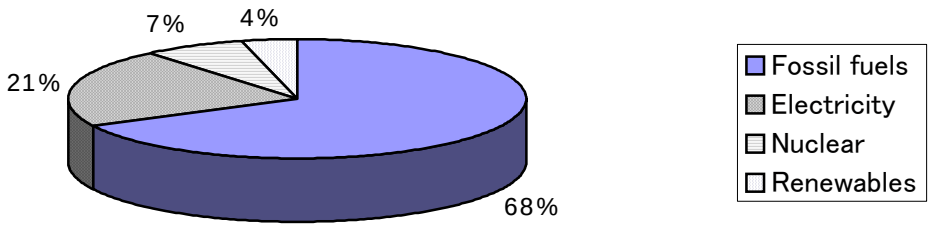
As described above, it is obvious that the governments should consider about removal of the EHS. However, actually unfortunately a large size of the EHS still remains in the world. As indicated in Table 2-2, global subsidies probably total over 1 trillion USD per year and this accounts for 4 per cent of world GDP. It can be also found that those subsidies are concentrated in agriculture, energy and road transport, in which subsidies have possibilities to enlarge negative impacts on the environment. In addition, Figure 2-5 clearly indicates that almost 70 per cent of energy subsidies flow to fossil fuels, which have strong negative impacts on the environment especially in terms of climate change and air pollution issues. As explained above, a huge amount of EHS still remains in the world; nevertheless it damages both the economy and the environment.

【Table 2-2】 Estimates of world subsidies, 1994-98 (USD billion)

	OECD countries	Non-OECD countries	World Total
Agriculture	335	65	400
Water	15	45	60
Forestry	5	30	35
Fisheries	10	10	20
Mining	25	5	30
Energy	80	160	240
Road Transport	200	25	225
Manufacturing	55	-	55
Total	725	340	**1,065**
Total as % GDP	3.4	6.3	**4.0**

Source: Van Beers and de Moor (2001)

【Figure 2-5】The costs of energy subsidies per year, 1995-98 (USD billon)



Source: Van Beers and Moor (2001)

Chapter 3 Justification of Environmentally Harmful Subsidies

3－1　Social benefits

In chapter 2, we explained that the environmentally harmful subsidies have characteristics that reduce the economic welfare and expand the environmental burdens. By reducing such subsidies, we can distribute the energy resources more efficiently, lightening the financial load of the government, and also, we can reduce the environmental burden as well. OECD started to research on the environmentally harmful subsidies in the midst of 1990's and has been insisting that these subsidies should be abolished. But as it is shown in table 2-2 there still exist lots of these subsidies. What is the reason of this situation?

Generally policymakers often judge the validity of a policy in consideration of the following aspects: the economy, environment and the society. If we focus only on the economic growth, that will destroy the environment and bring pollutions with a big cost to recover them. So eventually, the economic growth would be retarded. And also environmental damages often strike poor areas harder than rich areas[18]. This leads to the feelings of unfairness in the poor areas and cause social unrests[19]. In the worst cases, finally riots might happen and may cost us a lot to restore the order[20]. Thus, policymakers have to judge the necessity to introduce a new policy in consideration of the economy, environment and the society comprehensively. Regardless of the harmful effects both on the economy and the environment, there still exist many environmentally harmful subsidies. It means that policymakers believe that the social benefit is bigger than the losses on the economy and the environment.

We have explained about the natures of environmentally harmful subsidies in terms of economic welfare and environmental burdens in chapter 2. Then, which social factors should we take into consideration? Mainly, there are three social purposes to

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[18] A typical example of this is the issue of climate changes. As explained in chapter1, extreme weathers resulted from climate changes do more harm to developing countries than developed countries. While developed countries have an ability to manage the serious effects of climate changes, developing countries do not have it.

[19] There might be some controversies to decide what is unfair or not. But in case small damages fall on to rich people who have an ability to adapt to environmental harms while serious damages fall on to poor people who do not have it, we can easily imagine that it leads the social unrest.

[20] We explain about the society as an indicator later, but in general policymakers are elected based on the support of citizen under the democratic system. So to introduce a policy that makes the citizen feel unfair might lose their support and lead to a subversion. It means policymakers have to introduce a policy based on a social justice. We can understand this because contentions such as employment issues and poverty problems are usually the focus of the election.

introduce the policy to subsidize fossil fuels: to resolve poverty problems, to prevent unemployment and to improve energy security[21]. These three purposes are all very important political issues and our lives are deeply related to them.

3－2 The necessity of achieving social purposes

Poverty reduction

Poverty is a global policy issue. According to World Bank (2004), 1.1 billion people still live with the daily income of less than US$1 and some are dying at this very moment. This situation can not be neglected.

If poverty problems such as malnutrition, disease, and so on, are neglected, these have negative effects on the economy and the environment. The poor usually do not have incentives for economic activities because their other basic needs, such as health care and education, are insufficient. Under this situation, economic growth can not be expected. The poor is more vulnerable to environmental damages like pollution, and these damages may aggravate poverty problems. Hence the poverty problems must be solved. In these situations, some energy policies are taken to help poor people. Energy is essential for life, therefore both the rich and the poor need some degree of energy. Table 3－1 shows the share of energy expenditure in household budget in developing countries such as Uganda, Ethiopia, and developed country such as United Kingdom. The share in Ugandan poverty group is 15% and the wealthy in the United Kingdom is 2%. This means that the poorer, the larger the share of energy expenditure.

【Table 3－1】 the share of energy expenditure in household budget[22] (%)

	Uganda	Ethiopia	India	South Africa	United Kingdom
Poverty	15.0	10.0	8.5	7.2	6.6
Wealthy	9.5	7.0	5.0	5.5	2.0

Source: IEA(2002b)

Under the recognition that policies that lower the price of energy contribute to reduce the burden for energy expenditure and improve their living standard, state support to fossil fuels are being introduced now.

[21] The concept of society varies. In general, future can be contained other than these 3 purposes. In this paper we focus on these 3 purposes that are thought to be related to the environmentally harmful subsidies deeply.

[22] Poverty is the lowest part of that divide income range (the amount that maximum income minus minimum that) into five equal part, and wealthy is the highest part of that.

Preventing unemployment

Preventing unemployment is also an important public concern. What would happen if unemployment were prevailing in the society? Citizens' anxiety for the future would be inflated, restraining their consumptions; people will save instead of spending. That will indeed decline the revenues of companies, leading to economic slump. More restructurings will occur, and this will produce more unemployment leading to further inflation of people's anxiety. There will be a vicious cycle if the issue of unemployment is elongated.

Furthermore, if this issue was neglected, it will lead to the distrust of the government and even to riots in the worst cases. Vast amount of cost will be needed to recover the social stability. Thus, unemployment issue can be said to be at the core concern of many nations, and it is one of the reasons why the weakening coal industries in the UK and Germany are heavily subsidized.

Improvement of energy security

It is also quite important to secure energy supply. At present (the end of November, 2004), on the grounds of anxious situations in the Middle East and damages to the oil production facilities in the Central America by severe hurricane attacks, crude oil spot prices in New York Mercantile Exchange(NYMEX) continue to mark quite high at around 50 dollars/barrel, which human beings have never experienced[23].

As witnessed under the former oil shocks, soaring of the prices of energy which can greatly influence the basic lives of people may cause serious depression of economy. If large scale blackout occurs by energy supply disruption, major social infrastructures such as transport and medical services might be greatly confused.

Without enough energy supply, so many difficulties could fall upon the public. Moreover, as Figure 3-1 illustrates, the oil import dependency of each region seems to rise gradually in the future with background of rapid economic development in China and India and so on. It is a vital issue to improve energy security, because oil as major primary source of energy is deemed to exhaust in the near future[24]. Thus, subsidies are introduced on domestic energy supply to improve energy security.

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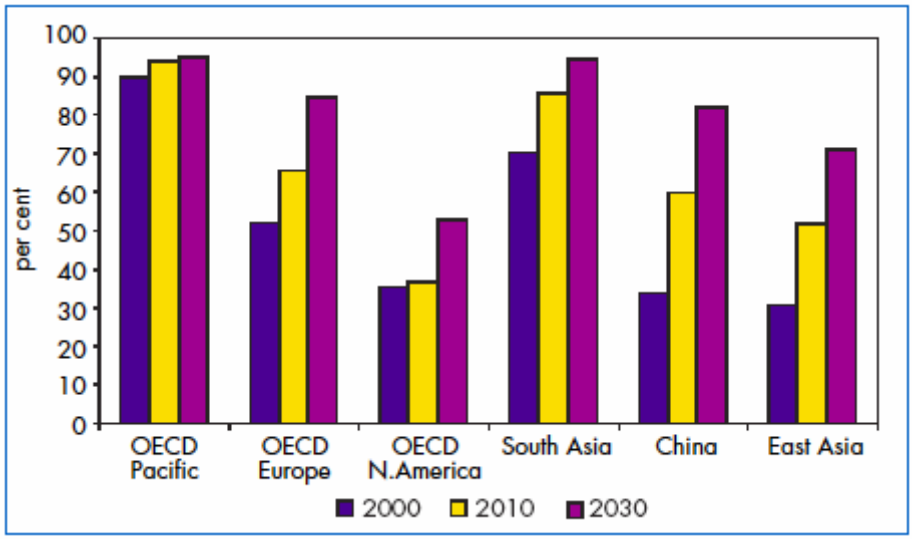
[23] Historically, sudden price soaring tend to happen when energy supply were physically shut out, just witnessed during the Gulf War and the oil shocks. The current situation, however, occurs without supply disruption. Other than anxiety, inflow of speculation money into spot markets, decrease of energy supply surplus and increase of energy demand in developing countries may be the factors causing current situation.

[24] As described after, the importance of energy security can be sensed from the fact that the IEA announces its purpose of establishment to secure energy supply.

【Figure 3-1】future outlook of the oil import dependency by region



Source: IEA (2002a)

The existence of social purposes such as reduction of poverty problems, prevention of unemployment and improvement of energy security seem to be the reason to justify environmentally harmful subsidies which causes negative impacts on economy and environment. Apparently, social purposes are tremendously important political issues. But is it rational to subsidize fossil fuels, causing the loss of economic welfare and damage to environment?

Chapter 4 The rationality of Environmentally Harmful Subsidies ～Are EHS' justifiable?～

4 - 1 Importance of selecting the rational policy

In Chapter 3, we have mentioned the importance of achieving social purposes. However, even for aiming to achieve such social benefits, environmentally harmful subsidies can not be justified. For instance, if an EHS causes the amount of 100 units of damages to each the economy and the environment (200 units of damages in total), but achieves social benefits of less than 200 units, then such EHS can not be justified. If the relation below

Economic loss + environmental damages > social benefits

is achieved[31], the existence of EHS is hardly justifiable since the negative impacts overweighs the benefits. In other words, when the damages to the economy and the environment overweigh the benefits of achieving a social purpose, such EHS can never be called a rational policy.

What happens in the opposite case? If the benefits achieved from introducing an EHS were larger than the negative impacts to the economy and the environment, it looks as though the EHS can be justified. However that is not always the case. For instance, if assume that an energy subsidy causes 80 units of damage to the economy, 80 units of damage to the environment (total of 160 units of damages), but produces 200 units of social benefit, the benefits of achieving the social purpose are larger than the negative damages. However, if alternative measures that can achieve the same benefits with less damages exist, then such EHS also can not be justified. Using the same example, let us assume other measures can create 200 units of benefit with only 50 units of economic loss and 50 units of environmental damages(total of 100 units of damages) whereas an EHS produces 200 units of benefit and 160 units of damages in total(80 units of economic damages, 80 units of environmental damages). The net benefit of the EHS is 40 units (200-160=40), while the net benefit of the alternative measure is 100 (200-100). In this case, the alternative measure can be said to be more rational.

Since government's expenditures consist of citizens' taxes, government must

[31] Economic loss, environmental damages and social benefits can not be compared directly unless converted to monetary values. However, there are many disputes to achieving proper conversion. This paper not provides quantitative analysis, but aim to achieve the conceptual understanding of the readers.

choose the most rational policy. By selecting the best possible measures, the total national benefits to the economy, environment, and the society will be increased. Therefore, although the benefits of introducing an EHS may exceed the costs, it will not be justified unless it is proved to be more efficient than the other measures.

Thus, when policymakers are introducing an EHS, they must prove to the public the following 2 points.

1) The benefits are much larger than the damages
(economic loss + environmental damages < social benefits)
2) EHS is better than other possible measures
(economic and environmental loss of EHS < economic and environmental loss of alternative measure)

Unless these 2 points are proven, EHS can not be justified. Unfortunately at present, hardly any reports which prove that the social benefits of fossil fuel subsidies overweigh the economic and environmental loss can be found. This means that even the first point is not yet proven. However, in this paper, we assume that there may be a possibility where the benefits exceed the costs, and aim to analyze the second point. We will focus on to each of the social purposes in the context of fossil fuel subsidies, which are poverty reduction, prevention of unemployment, and increasing energy security, by comparing the effectiveness of EHS with that of possible alternative measures.

4－2 Poverty reduction

Can environmentally harmful subsidies be justified in reducing poverty? Actually, not only environmentally harmful subsidies can not contribute to poverty reductions but the also expand income inequality. The following case study of liquefied petroleum gas (LPG) subsidies in India depicts this matter.

Indian government subsidized small cylinders of LPG for cooking and water heating. By this subsidy, the price of LPG was lowered than the market price by 31.6%[25]. This subsidy has two purposes; ＜Ⅰ＞expanding access to modern energy[26], ＜Ⅱ＞alleviating indoor air pollution[27] caused by burning wood fuels[28], and improving

[25] By IEA (1999b) pp136 “LPG …enjoys heavy subsidies (31.6%).”
[26] As described later, expanding access to energy can not always reduce poverty directly, but in this section we assume that it can reduce poverty.
[27] Some may say that LPG subsidies are not environmentally harmful subsidies because these have purpose that alleviating indoor air pollution. But actually people who use LPG before introduced

high infant mortality rate. However these purposes were not achieved. The reason of the failure to expand access to modern energy is as follows. LPG subsidy lowered the price of LPG cylinders, and then the demand for LPG increased. But the supply of LPG could not meet the demand and the shortage of LPG supply occurred. As a result, Indian government limited sales only to areas with more than 20,000 inhabitants, hence poor people in rural area could not purchase these LPG cylinders and continued to use traditional fuels like wood fuels. In the case of this subsidy, only richer people in urban areas could benefit from this subsidy, therefore it failed to achieve first purpose. As for the second purpose, ＜Ⅱ＞, this subsidy could not alleviate indoor air pollution because of the failure to achieve the first purpose, ＜Ⅰ＞. And infant mortality rate[29] was not improved substantially, still marking higher levels than Japan as indicated in table 4－1. Therefore, it can be said that the LPG subsidy in India has also failed to achieve the second purpose, ＜Ⅱ＞. As a consequence, LPG subsidy could not help poor people in rural area that need access to modern energy.

【Table 4－1】 The trend of infant mortality rate（per 1000 live birth）

	1998	2000	2002
India	69	68	65
Japan	4	3	3

source：United Nations homepage

However, some may say that the reason of failure to help poor people was not the subsidy itself but the way of targeting the poverty group. In other words, some may think that it could not help poor people only because everyone could benefit from this subsidy regardless of their income. If the poor were properly targeted and ensured the access to energy, it may have reduced the burden for energy expenditure and improved their living standard. However, targeting is very difficult. The middle and the poor often live in the same area, therefore, it is necessary to execute very complex researches to identify and to help only the poor people. But monitoring costs for such researches

subsidies increased the demand more and other people continued to use biomass fuels, and the energy use of biomass fuels did not shift to LPG completely. Therefore the effect of environmental improvement by the shift from biomass to LPG is smaller than the effect of environmental damages by increase of demand for LPG. As a result, these subsidies had purpose that improve environment but became environmentally harmful subsidies.

[28]About three-fourths of all households use biomass fuels for cooking and heating in India. Indoor air pollution caused by burning biomass fuels is very big issue, therefore switching to cleaner fuels is needed in India.

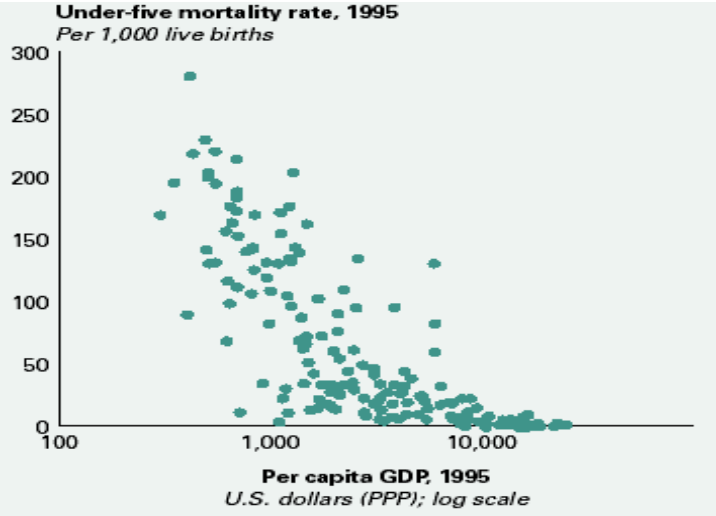
[29]Infant mortality rate is the number of babies that die below 1 year old per 1,000 live birth.

are very large. Therefore, targeting is practically impossible.

Moreover even if it is properly targeted, access to modern energy can not always reduce poverty. If the poor have LPG but do not have energy appliances such as stoves, living standard may not be improved. To reduce poverty, it is necessary to raise their incomes to fulfill their basic needs, such as food and stoves. Figure 4－1 shows the correlation between per capita GDP and the mortality rate of children under age 5. As per capita GDP increases, this rate decreases. The reason of high infant mortality rate in low income group is not indoor air pollution as explained above but chronic malnutrition. This figure shows that raising income reduces mortality rate of the aged under 5. It implies that, it is necessary to raise their income in reducing poverty[30]. There are other studies that report that raising income contributes to poverty reduction. For example, access to modern energy like electricity can be expanded by raising income. On the other hand, there is no study that reports that expanding access to energy contributes to solve poverty problem such as improving infant mortality rate. Taking this into account, unless studies show that expanding access to energy certainly reduces poverty, policies that raise income should be taken.

【Figure 4－1】

the correlation between per capita GDP and under-five mortality rate



Source： World Bank(2000/2001)

To reduce poverty, there are policies that raise income such as income support policy, and the removal of protective policies in developed countries[31]. The details of

[30] By World Bank（2000/2001）, half of all infants are undernourished in developing countries and 5% in developed countries.

[31] Poverty is often caused by unemployment and unemployment policies that will be described in the following section are effective to reduce poverty, but these policies are beyond the scope of this section.

these policies will be described in the following sections.

Income support policy

Income support policy is often introduced to help poor people that can not fulfill their basic needs. Such policy compensates the basic income and improves living standard, and provide incentives to participate in economic activities. Hence it can lead to economic growth in the longer time, though it needs government expenditure temporarily.

Moreover, such policy can be justified from the viewpoint of the equal opportunities of the future generation. If people who could not become the winners of the competition are not compensated and the inequality between the rich and the poor is expanded, the future generations are deprived of equal opportunities. Children in the poor households can not receive enough education, meaning that their starting point is different from richer children at birth. It means that there is a risk of losing the potential leading power of economic growth. Compensating their income and developing the ability of their children not only produce the equal opportunities but also raise the economic welfare of the country. The income support for poor people are more suitable for the equity and the economy. And the effect on environment would be small, therefore this policy is more effective than environmentally harmful subsidies.

The removal of protective policies in industrialized countries

There are possibilities that some governments have no money even to take policies such as income support policy described above. Under these situations, it is important to understand that the protective policies in developed countries such as agricultural subsidies indicated in figure 2－2 reduce competitiveness of developing countries. Hence the removal of these protective policies promotes the trade liberalization and raises income of the poor people in developing countries. This has positive effects on the economy.

How about the effect on environment by the removal of these protective measures in the industrialized countries? For example, if agricultural subsidies in developed countries are removed, as described in Kym Anderson (2004), the agricultural production in developed countries will shift to developing countries with lower production costs. In developed countries, a lot of pesticides are used in production, thus the shift improves environment in those countries. The production in developing countries will increase but it is less polluting, therefore global environment will be

improved. In addition, by using the economic benefits[32] produced from the removal of protective policies in developed countries for environmental provision in developing countries, it can reduce the environmental damages. By the removal of the protective subsidies that is twenty times the total amount of ODA ,as indicated in the Table 2－2, the global environment is improved and it can help the poor people. Taking this into account, developed countries should remove these trade barriers actively.

In the end, there are policies that have less negative effect on economy and environment, environmentally harmful subsidies in reducing poverty are not justified and they should be removed.

4 - 3 Preventing Unemployment

Having been mentioned already, the issue of unemployment is an important social matter that must never be neglected. When coping with any social issue, policymakers should choose the best possible measure that is available. If more environment-friendly alternatives that are more effective in managing unemployment exist, there is no way for an EHS to be justified.

What are the causes of unemployment? The two major factors that are causing such unemployment are: economic recessions and changes in the industrial structures.

Unemployment due to economic recessions

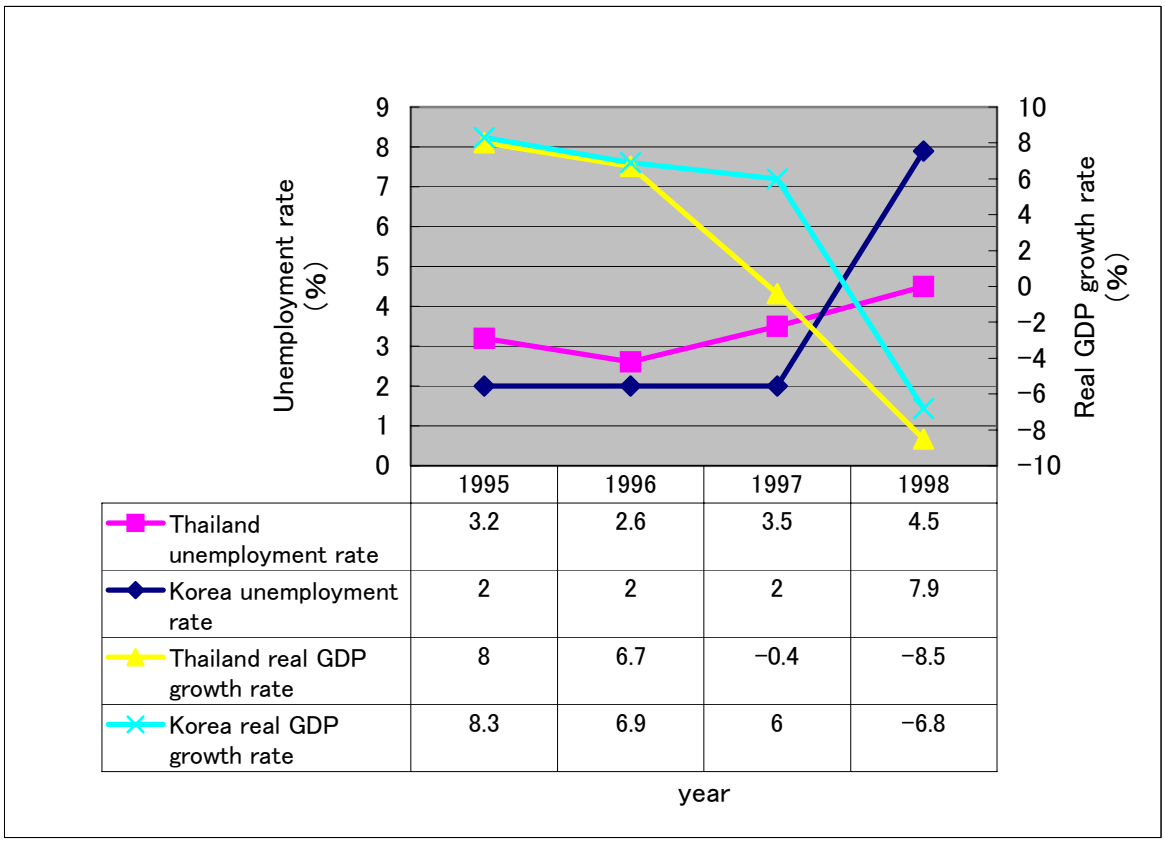
Economies are very sensitive to the world affairs; drastic depression can happen due to many things including from geopolitical factors such as wars to crisis in the market. When a nation is experiencing an economic slump, industries undergo restructurings in order to maintain their competitiveness. Consequently, many unemployed are produced through such downsizings.

For example, the incidence of the Asian monetary crisis, also known as the IMF crises, in 1997 caused a devastating effect on the economies of the Asian nations such as Thailand, Korea, Indonesia, and Malaysia. These nations experienced severe depression of the economy. As Figure 4-2 below shows, the impact of the crisis in on the economic development of Thailand and South Korea were significant. It is very clearly depicted that right after the crisis hit both countries in 1997, the real GDP growth rate of around positive 7% toppled down to severe negative values in both countries in 1998. Similarly, many affected Asian nations resulted in dreadful

[32] According to Kym Anderson(2004), the benefits of the removal of protective measures for agricultural or textile products are 9.66 billion dollars in developed countries and 4.31 billion dollars in developing countries.

recession. Consequently, as shown in Figure 4-2, the unemployment rates in both countries exacerbated. Especially in South Korea, the unemployment rate soared to 7.9% in 1998.

【Figure 4-2】 Real GDP growth rate and unemployment rate in Thailand and South Korea (1995-98)



	1995	1996	1997	1998
Thailand unemployment rate	3.2	2.6	3.5	4.5
Korea unemployment rate	2	2	2	7.9
Thailand real GDP growth rate	8	6.7	−0.4	−8.5
Korea real GDP growth rate	8.3	6.9	6	−6.8

Source: data from CIA World Factbook, made by writer

Clearly, for this type of unemployment, recovery of the economy to regain employment opportunities is the first remedy. In order to boost the economy, the countermeasures frequently used and generally accepted to be effective are: macroeconomic measures, such as monetary policies and fiscal policies[41], that are optimal for each country; and active investments in the development of the growing

[41] During the depression in the 1970s, the Keynesian deficit financing policy taken in the Europe and the USA were hardly effective in recovering the economy. It was because, in reality, the consumers rushed to saving in stead of spending more. The situation of Japan during the 1990s were basically similar. The deficit financing fiscal policy is generally said to be ineffective, however, fiscal policies in the context of this paper include reforms of government expenditure that aim efficient spending. For instance, the fiscal policy taken under the Clinton administration which reduced the government deficits was proved effective in recovering the American Economy. The macroeconomic fiscal policies can influence the economy greatly. Also, deficit fiscal measure taken in South Korea after the crisis was in fact helpful; such fiscal policies can indeed be effective measure.

prospective sectors. These policies were taken in Thailand and South Korea, and their unemployment rate were recovered as well as the real GDP growth rate.[42]

As seen in this example, policies aimed for the recovery of the economy are preferable for reducing unemployment caused by recessions, at the same time being less harmful to the environment and not as costly as the EHS'. Contradictory to the initial purpose, EHS which support feeble industries can be said to have unsuitable effects on the grounds of unemployment problem. Such state supports would mean spending a significant amount of government money on the unproductive, inefficient sectors. Such retrograde, conservative investments will, in turn, hinder further economic development and, thus, recovery of the nations' employment rate will be belated. Moreover, such governmental supports do not actually help the weakening sectors in a broad view. The supported industries only lose incentives to regain their competitiveness on their own, and lock themselves into inefficient, unproductive technologies and market strategies. Thus, they go through restructuring producing unemployment. This will increase social anxiety and people will restrain their expenditure, consequently reducing company revenues and inducing more restructurings. A vicious cycle it is. It would be sensible to spend the very money for less polluting policies as mentioned.

Unemployment due to the changes in the industrial structures

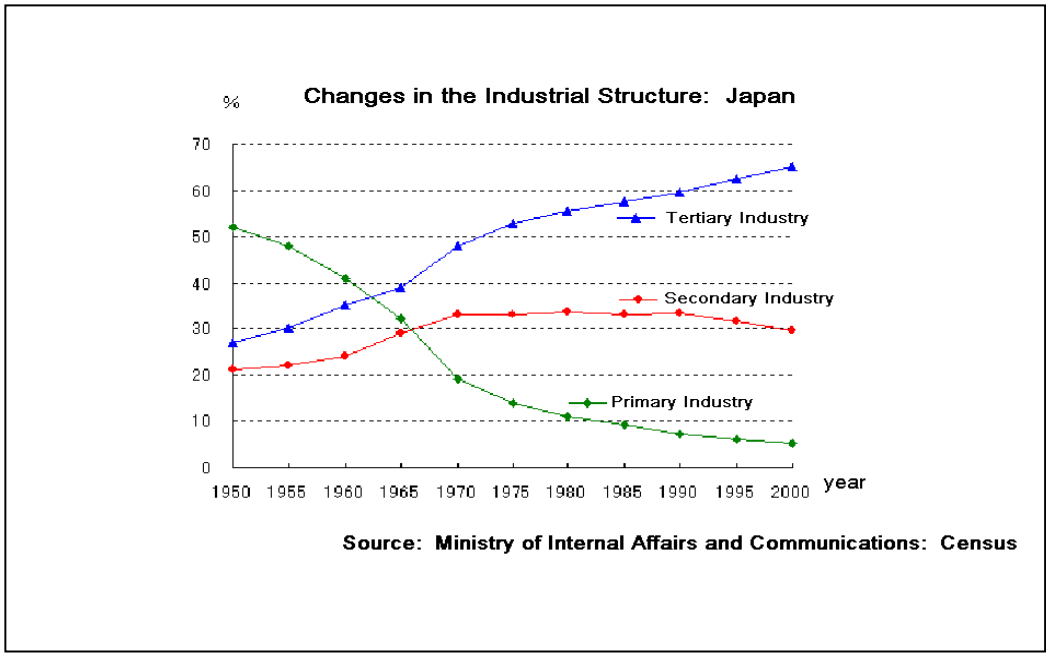
Another major cause of unemployment is the changes in industrial structures. An economy of any nation can bee seen as a complex of various industries, existing from agriculture and fishery to manufacturers, banks and communication network services. The industrial structure of a country displays the proportions of such various industries consisting to form the nation's whole economy. Generally, industries can be divided into three groups: primary industries, secondary industries, and tertiary industries. The primary industries include agriculture, stockbreeding, fishery, and forestry. They are the most primitive form of industries. The secondary industries include mining, construction, and manufacturing from raw materials. These secondary industries have higher productivity from labor, produce more values-added, and need larger

[42] In fact, policies taken in Thailand were the easy money policy and the aggressive investment in the Thai specialty craftworks, which had a growing demand around the world. The unemployment rate, indeed, has decreased after the introduction of these policies. Thailand's real GDP growth rate in the year 2003 marked 6.3%, and the unemployment rate has declined to 2.2%. Similarly in South Korea, easy money policy and fiscal policy which aimed to stimulate the economy were taken and lead to the substantial economic recovery from 1999. The GDP growth rate which once marked -6.8% recovered to +10.7% in 1999. This recovery played as an important role in the reduction of unemployment. In addition, active development of the IT venture sectors also helped to reduce unemployment in South Korea. Kase (2000) and Arita (2003)

capital than the primary industries. Finally, the tertiary industries include transport, communication network, financing facilities, and other complex businesses and services. The tertiary industries are the most sophisticated, advanced form of industries.

As a country goes through developments, the main industry of the country shifts from primary to secondary, and then finally to tertiary; making the nation wealthier. [43] In the most industrialized nations, the proportion of the tertiary industries is considerably larger than the other two. Take Japan, one of the most developed economic power, for example, the share of the primary industry has diminished to less than 10% of the total, whereas the tertiary industries have grown greatly. Figure 4-3 clearly illustrates how Japan's main industry have shifted from primary to tertiary industry.

【Figure 4-3】 Changes in the industrial structure of Japan



Thus, as the industrial structure of a country changes through economic development, the demand for labor force in each sector changes accordingly. In other words, unemployment is usually produced in the diminishing sectors. In Japan, number of workers needed in the primary and secondary industry has decreased,

[43] This is known as the 'Petty-Clerk principle', named after a British classical economist William Petty, and Colin Grant Clerk, also a British economist, who had introduced this principle in his writing "The Conditions of Economic Progress" in 1940. In extreme cases, some industries completely vanish and transferred abroad.

whereas more workers are needed in the tertiary industry[44].

Thus, transfer of the labor force from the weakening industries to the growing sectors are essential for solving unemployment and also for further economic development. Nonetheless, there are many hurdles for the smooth transfer of labor force that are causing serious unemployment. First, lack of information is one of the factors that are hampering the smooth transfer of labor force. Work seekers must know where they are wanted, and employers must know who is available. There must be enough information for both sides in order to mobilize the transfer of labor force. For instance, it is hard for work seekers who had been dismissed in the countryside to know about the job openings in the cities. Another problem is what is known as the issue of "mismatching conditions". Inevitably, the type of workers needed in the growing tertiary industries are very different from workers dismissed from the primary or secondary industries. Stamina and dexterity may be the most important thing for primary or secondary industries, whereas computer skills and foreign language skills may be necessary in the tertiary industry. The abilities wanted in each sector are different, making hard for the dismissed to be re-employed. This mismatching problem is one of the reasons causing long-term unemployment.

Therefore, for this type of unemployment, the best remedy is to mobilize the transfer of labor force by compensating the lack of information, and strengthening carrier educations to create the right human resources on demand.[45] In order to compensate the lack of information, broadening the access to job centers and carrier counselors is an effective way to encourage the smooth transfer of labor force. Strengthening public carrier and job educations can also be a suitable measure in order to improve the mismatching problem. It is important create human resources with the right abilities on demand. Recently, in some European countries, work seekers can access to job centers in subway stations and community stores. The UK's New Deal[46] policies for combating unemployment is a good example of supported carrier education.

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[44] For instance, the coal mining industry, a secondary industry, in Japan has diminished drastically since the 1960's through rationalizations in correspondence to the economic development: in order to maintain competitiveness, companies relied more on imported coal. There used to exist over 900 coal mines in the 1950's; currently reduced to approximately "none". The number of workers, inevitably, decreased drastically accordingly.

[45] Mobilization of the labor force is indeed a useful measure, however, it is also important to create a society with stabilized job opportunities and comfortable working environments. Establishing laws and regulations concerning employment, such as laws that regulate unfair dismissals, can also be an effective measure. If such safeguards were neglected, workers would never want to leave their jobs and it will hinder the mobilization. Thus safeguarding measures will be very helpful as a supplementary measures to mobilize the labor force.

[46] This is different from the New Deal policy in the USA under President Roosevelt. The UK's New Deal is a recently exercised policy which mainly focuses on the carrier education of the young unemployed.

These policies are considered to be effective, and most importantly, less polluting and less costly than subsidizing the diminishing industry.

EHS given to the diminishing industries are hazardous not only to the economic welfare and the environment, but also to the issue of unemployment. Seemingly, state supports to the declining industries looks as though they are helping to maintain the existing jobs. However, in the broad view, EHS have contradictory effect. EHS to the weak industry equally means confining the valuable work force to the unproductive, diminishing sector. It is, indeed, obstructing the smooth transfer of labor force. In addition, as mentioned earlier, EHS' are retrograde, conservative investments that hinders the structural changes that leads to further economic development of the nations.[47]

EHS' are damaging to the economy and to the environment. In addition to that, they are also measures that are exacerbating the issue of unemployment. Therefore, EHS can not and must not be justified even for the reason of preventing unemployment.

4 - 4 Improvement of energy security

What are the general ways to improve energy security? To avoid problems caused by supply disruptions or price shock of some fuels, it is necessary to construct a strong supply system and to lower the import dependency of fuel supply. General measures to secure energy supply which are considered as effective by IEA and OECD can roughly be classified into 2 groups; short-term measures and long-term measures. As for short-term measures, stockpiling is well known[33] and as for long-term ones, energy efficiency improvement and promotion of domestic energy supply are common measures. How large are the impacts on the economy and the environment caused by the introduction of each measure?

Stockpiling

The IEA was established by OECD, after the oil shock in 1973, main purpose was to secure energy supply[34]. The IEA demands that its member countries have oil stocks

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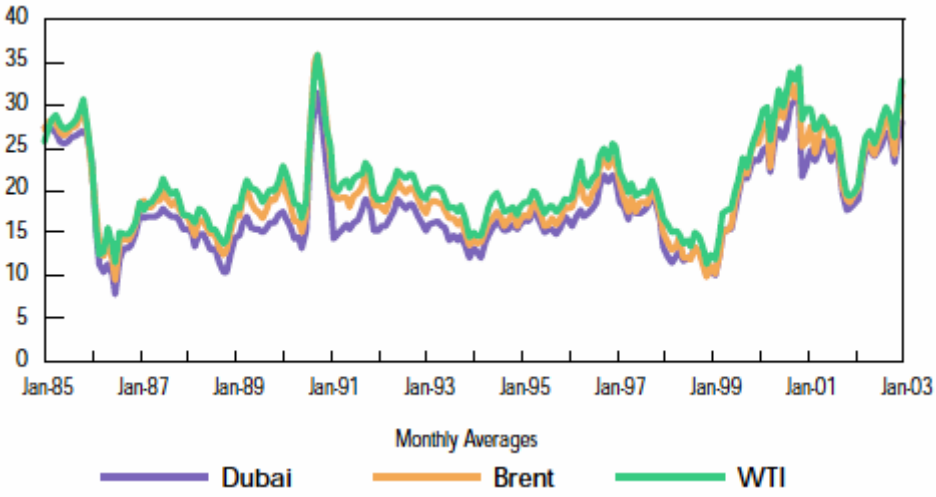
[47] Now, some readers may think " is it justifiable if EHS were given to the growing, strong sectors?". However such assertion is meaningless since growing sectors do not need supports in maintaining the employment, and such EHS should immediately be removed.

[33] Other than stockpiling, compulsory demand constraint can be said to be one of short-term measures. This measure, however, is not adopted in recent years because it strongly intervenes with economic activity. It, therefore, was excluded from detailed argument below. It is easy to understand that negative impacts on environment from this measure are nearly nothing and this measure can lead to emission reduction of CO2.

[34] The International Energy Program (IEP) provided by the IEA declares its objective of existence at

equivalent to 90 days of net oil imports[35]. That means to have extra oil aside in case of terrible situations such as sudden supply disruptions and price soaring. When those bad situations occur, IEA parties release their oil stocks. Then, extra supply from stock draw calms down the market price of oil. In that sense, stockpiling can be regarded as safety valve of market price, and it was historically considered as main policy to secure energy supply after the establishment of the IEA. When the Gulf War occurred, the market price of oil soared to near 35 dollars/barrel in 1990 as indicated in Figure4-4. In 1991, however, after IEA parties announced to draw their oil stocks, prices quickly stabilized at around 20 dollars/barrel. That lasted for a long time until the OPEC announced to decrease their oil supply in 1998.

【Figure4-4】past trends of crude oil spot prices



Source : IEA(2003)

Which measure excels economically and environmentally, compared to subsidies on fossil fuels? Economically, cost of primary investment for stockpiling facilities may be large. But, afterwards, only slight costs of maintenance emerge. On the contrary, environmentally harmful subsidies become continual burden as long as they exist. That is why economic cost of stockpiling is to be smaller than subsidies on fossil fuels. How about in the environmental aspects? Unless outflow and explosion of oil stocks happen, environmental impacts seem to be close to nothing. Continual emission increase by environmental harmful subsidies seems to be more harmful. To sum this up, economic loss and environmental impacts from stockpiling seem to be smaller than

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the preamble extracted as below.
"DESIRING to promote secure oil supplies on reasonable and equitable terms, "

[35] IEP article2.1"…net oil imports shall be reckoned at the average daily level of the previous calendar year."

supportive measures on fossil fuels.

Energy efficiency improvement

By improving the energy intensities by updating the energy production facilities and promotion of energy saving technologies, required amount of fuel can be reduced. From this measure, the same economic activity can be achieved with less fuel. This measure leads to the improvement of energy security, because the fuels equivalent to the saved amount becomes unnecessary to import from abroad.

How about are economic and environmental aspects of this measure? Economically, cost of primary investment may be significant. Saved amounts of fuels, however, can be considered as continuous economic benefits. So, in the long term, benefits may outweigh the primary cost of investment. How about the impact on environment? Through the improvement of energy efficiency, saved amounts of fuels become unnecessary. And they are not burned to acquire electricity. This leads to the reduction of CO2 emission. Under the current framework on climate change, Kyoto protocol, excess amount of CO2 emission reduction can be sold in the international market. In addition to the saved costs of import, energy efficiency improvement can also save the cost of domestic actions to reduce CO2 emission. This phenomenon further pushes up economic benefits. Improvement of energy efficiency, therefore, seems to have less negative impacts on the economy and the environment than supportive measures on fossil fuels.

Promotion of domestic energy supply

By increasing domestic energy supply, the import dependency can be reduced. It, therefore, leads to the improvement of energy security. Promotion of domestic energy supply does not mean increasing the dependency on inefficient domestic coal production. It generally means the promotion of nuclear energy and renewable energies. Nuclear energy is produced by uranium[36]. Uranium is produced all over the world and stable supply can be expected. It does not cause CO2 emission from the power generation process. Renewable energies include solar power, wind power and water power and so on. These are believed not to exhaust. These promotions match the perspective of energy security. Except for the problem of radioactive wastes, it can be noted that promotion of these energy means steady acquisition of clean and promising energy.

How about are economic and environmental aspects of this measure? From the

[36] In many cases, as uranium is not domestically produced, nuclear power generation can be classified as the semi-domestic energy supply.

economic perspective, it seems to be a little bit costly. But in the long term, as fossil fuels dry up, clean energy will definitely be needed. So this measure is not so costly in the longer term. Impact on environment is mainly thought to be positive, because it leads to CO2 emission reduction. So, it means economic benefits from saving the cost of domestic action toward CO2 emission reduction.

Subsidies on domestic production of fossil fuels

Are the supportive measures on domestic production of fossil fuels effective, from the perspective of economy and environment? Although targets of subsidies differ from country to country, situations can roughly be divided into 2 types; situations in fuel exporting countries and in importing countries[37]. In exporting countries, subsidies which lower domestic fuel prices, especially oil prices, are mainly adopted. In this case, demand for cheaper energy will be increased, stimulating domestic energy consumption. So, fuels for export have to be thrown into domestic consumption. Subsidies on fossil fuels in exporting countries, therefore, lower energy security. In addition, fuel consumed additionally in domestic market reduces the export revenues which was formerly acquired from export of fossil fuels. That further expands the loss of economic welfare from subsidies. Increased domestic energy consumption will lead to additional CO2 emission. To sum up, subsidies on fossil fuels in exporting countries cause negative impacts on economy, environment and energy security.

What will happen if subsidies are introduced in fuel importing countries? As mentioned above, it is common not to subsidize coal production but to promote nuclear and renewable energy for the improvement of energy security. Under this situation, is it necessary to subsidize coal which causes the loss of economic welfare and the damages to the environment? As illustrated in Table 4-2, unlike oil, coal is produced in politically stable countries and its reserves are reported to be the largest among the fossil fuels.

[37] In exporting countries, there exist a little bit of fossil fuel production. In such countries, to avoid the risk of the price soaring of importing fuels, domestic inefficient fuel productions are subsidized.

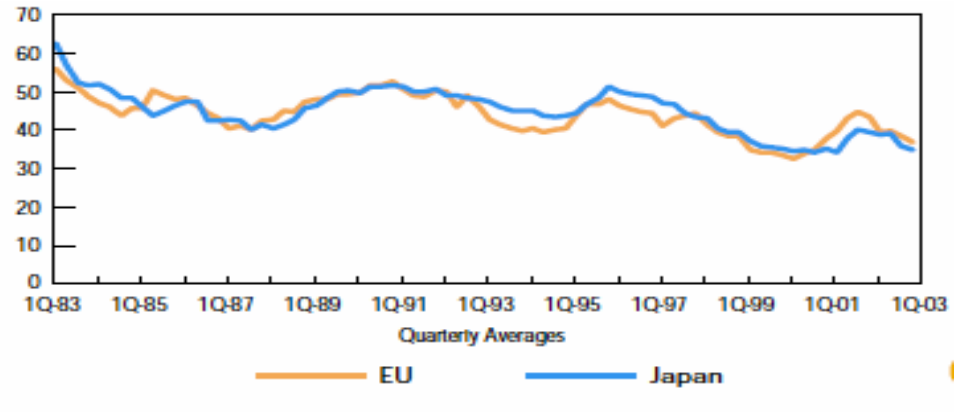
【Table 4-2】coal exporting countries and its amount of export

coal exporters	coal (Mt)
Australia	198
China	86
Indonesia	73
South Africa	69
Russia	45
United States	35
Colombia	34
Canada	27
Poland	23
Kazakhstan	14
Rest of the World	36
total	640

Source: IEA（2003）

The risks of coal supply disruption seem to be relatively low, because these coal exporting countries are stable unlike the Middle East in the context of oil markets. In fact, past trends of market coal prices do not show sudden sharp price soaring[38] and they tend to be declining (see Figure 4-5). They did not show sharp soaring even during the Gulf War, when crude oil prices were sharply soared. This experience suggests the stability of coal supply.

【Figure 4-5】past coal import prices in EU and Japan in US dollars/ton



Source: IEA (2003)

[38] From Figure 4-4, the soaring of crude oil prices were witnessed to be more than 20 dollars in the short term period. On the contrary, the volatility of coal prices do not seem to be such high.

Is it necessary to subsidize coal which has low possibility of supply disruption or price soaring? As for coal supply, to have a risk hedging supply portfolio mixed with stockpiling and other measures mentioned can lower the negative impacts on economy and environment.

Overall, other measures to secure energy supply seem to achieve the same energy security to subsidies with less negative impacts on both economy and environment, sometimes creating positive benefits on them. To subsidize fossil fuels for the purpose of the improvement of energy security, therefore, has to be severely criticized.

Conclusion

We have asserted in this paper that, in the case where the damages to the economy and the environment by an EHS exceed the social benefits, then such EHS can hardly be called a rational policy, and thus, should be removed immediately. Currently, hardly any government provides the public with adequate analysis on environmentally harmful subsidies proving that the social benefits exceed the losses. Despite the fact that we believe the losses to the economy and the environment are significantly large, we did not neglect the possibility that, in the future, there may be some reports which may come to prove the significance of the social benefits of EHS. Hence we have also analyzed the social perspectives by comparing with possible alternative measures, to see the adequacy of EHS. Even if the social benefits of EHS were proven to be larger than the damages, EHS still can not be justified unless they are also proven to be better than the alternatives. If other measures could achieve the same benefits with smaller losses to the economy and the environment, then those alternatives are considered as more rational, so EHS is not justified. As for the three major social purposes in the context of subsidies on fossil fuels, poverty reduction, prevention of unemployment, and increasing the energy security, there exist other measures that are more suitable than the EHS, thus they can not be justified.

However there are various difficulties in abolishing these subsidies. Even if the government decided to remove these subsidies, people benefited by these subsidies would resist strongly. Such resistance may, in the end, lead to distrust of the administration in power. Thus, there are many hurdles for the policymakers to actually abolish such EHS. In Indonesia once the government tried to abolish the subsidy but the people resisted against this strongly and now the government is still giving the subsidy reluctantly. The amount of the subsidy for fossil fuels in 2004 is set at 59.2 trillion rupees (59.2 billion dollars) that is much bigger than before because of the rising price of crude oil[39].

In many cases, subsidies have already become vested interests. So policymakers can not easily declare to abolish subsidies because they must also be elected by the resisting citizens. Why do they resist so strongly? Of course, to get money by subsidies is the rational reason for the people's actions based on the economic incentives. Their resistance against the abolition is rather natural[40]. But what we have to consider is the

[39] There is an article in The Jakarta Post on October 26th 2004, "The government, with the consent of the legislature, has set aside Rp 59.2 trillion this year for fuel subsidies - a more than 300 percent increase over the earlier target of Rp 14.5 trillion, due to soaring global oil prices."

[40] Even subsidies are rational for each person, it is not rational for the whole society

fact that there exist people who unjustly became disadvantaged to compete in business because of the existence of subsidies. By abolishing such subsidies, government can regain the supports from the people who had not been supported by the subsidies because the abolition improves their life standards[41]. Regardless of this fact, why are there few strongly supported abolition cases while resistances against the abolition always stand out? We think this result from inadequate information from policymakers. Governments around the world must inform the citizens about the hidden hazardousness of the EHS in order to get the public acceptance and to accelerate the removal of EHS. The government should not be disturbed by only a part of people who was benefiting from the subsidizations, rather, they should listen to the voices of the people who were disadvantaged by the existence of EHS. It is important to establish a public which can accept the harmfulness of the EHS in order to achieve the ultimate goal of environmentally, economically, and socially sustainable society.

We hope this paper provides an opportunity for many people to recognize the fact that there exist subsidies that have bad effects both on economics and the environment. Moreover, these subsidies cannot be justified by social purposes. And lastly, we conclude this paper hoping that there will be an acceleration of efforts to abolish the environmentally harmful subsidies.

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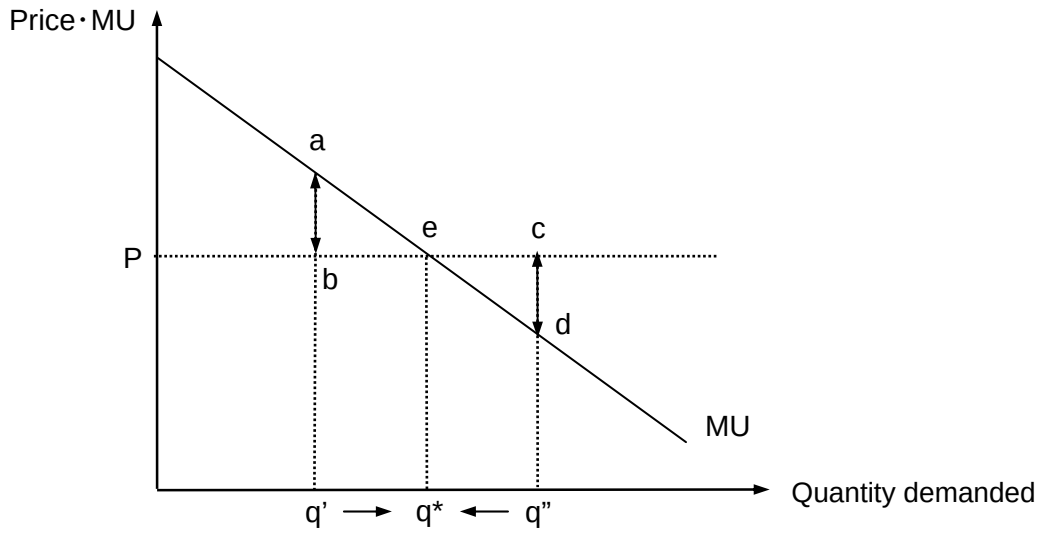
because subsidies cause the social economic loss. It is similar to moral hazard commonly explained in economics.

[41] By abolishing any subsidy, the loss of economic welfare will disappear and in case the subsidy is the environmentally harmful subsidy, the global environment and local environments will be improved at the same time.

ANNEX Derivation of demand curve and supply curve

Derivation of demand curve

Demand function reflects the relation between the price and the amount demanded of a good. This is derived from the marginal utility (MU) curve. MU is the utility that a consumer can get when he buys one additional good. Since usually the utility of second additional good is smaller than first one (law of diminishing marginal utility), the MU curve slopes downward as shown in Figure 1[42]. Under complete competition, the price of a good is given so here we set the price at *P*. In this case the utility[43] that a consumer gets by buying one product is represented as the gap between the amount of marginal utility and the product's selling price *P*. For example, the additional utility that consumers will get by buying *q'*th product in Figure 1 is equal to the gap a-b between the marginal utility by buying *q'*th product (*a-q'*) and the selling price *P*. Consumers keep buying goods additionally as long as the marginal utility is greater than the price *P*. Contrary, at *q"* consumers try to buy less because the marginal utility is less than the price *P* and the amount of *c-d* turns to be costs for consumers. Eventually, it can be found that the whole utility of the consumers would be biggest at the point *e* with the price *P* and the quantity demanded *q**. Thus, MU can be said as the function that shows the relation between the price and the quantity demanded and it can be regarded as a demand function.



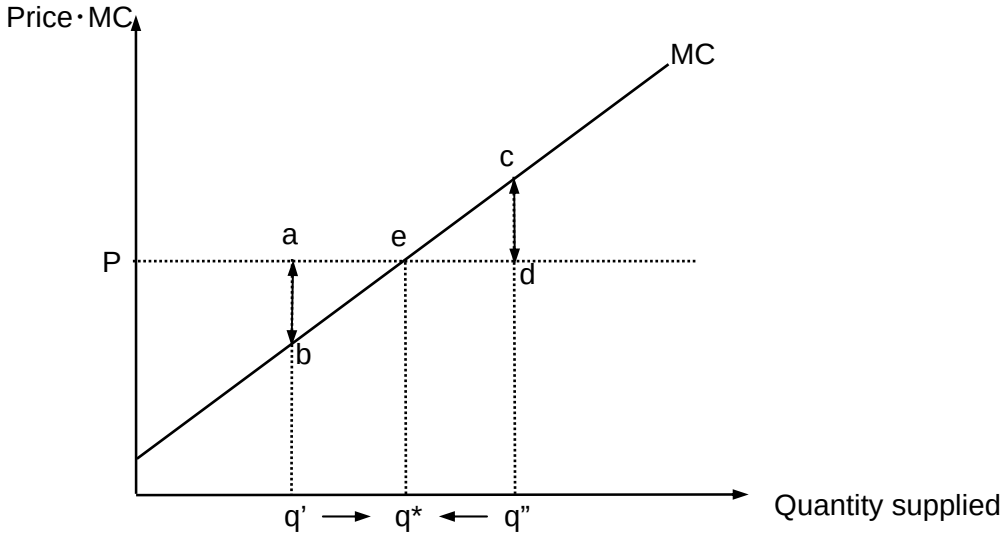
【Figure 1】 Marginal utility curve

[42] Actual MU is not linear but in this Figure it is shown as a straight line to be simplified.

[43] The utility is a concept that is widely used in the economic field to indicate the scale of "happiness" that people get from their economic activities. Though it is often questioned how accurately the utility reflects the happiness, the concept of utility helps economics analyses to a great extent.

Derivation of supply curve

Supply function shows the relation between the price and the amount supplied of a good. This is derived from the marginal cost (MC) curve. The marginal cost is the costs of producing one additional unit of output[44]. As shown in Figure 2, usually the marginal cost increases as a company produces more products[45]. Under complete competition, the price of a good is given so we set the price at P. In this case the profit that a producer gets by producing one additional unit of output is represented as the gap between the marginal cost and the selling price *P*. For example, the additional cost by producing *q*'th product equals to the gap *a-b* between the marginal cost by producing *q*'th good (*a-q*) and the selling price *P*. The producer continues producing as long as the marginal cost is less than the selling price *P*. Contrary, at *q"* the producer tries to produce less because the marginal cost is greater than the selling price *P* and the amount of *c-d* becomes deficit for the producer. Eventually, the whole costs of the producer would be biggest at the point *e* with the selling price *P* and the quantity supplied *q**. Thus, MC can be said as a function that shows the relation between the price and the quantity supplied and can be regarded as a supply function.



【Figure2】 marginal cost curve

The market equilibrium is the point at which demand curve and supply curve intersect. Please refer to a general textbook of microeconomics for detailed information.

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[44] Assumed this cost includes only a variable cost.

[45] Though actual MC curve is not linear and its slope varies as the level of supply varies, only simplified information is given here in order to explain the basic mechanism of the curve. See Turner *et al* (1994) for more information.

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