Double Dividend Hypothesis of Environmental Tax in Republic of Korea : For sustainable development

Ga-hyeong Hur

I. Introduction

One of most popular word in last decade was sustainable development after the broad agreement on its concept in UNCED. However the implication did not happen easily in real condition, facing objection that the sustainable development is only for environment and adverse for economy. The concept of sustainable development is rather different with conventional thinking way, which says that economic development and environmental consideration are conflicted.

The conventional concept starts from current production system. Then it may be hard to achieve the two goals as long as it is kept. Whereas they can be achieved with conceptual change in production and consumption pattern. Education and public awareness are useful to change the consumption pattern. However to aware the fact is often not accompanied with implementing, as shown in the case of education of tobacco, traffic accident, drunken driving, drug addiction etc. Subsidization scheme has also facilitated environmental protection measures and explains a major part of the substantial improvements in local environmental quality but plays only limited role in long term. It is necessary to make an incentive for consumer and producer to change the conventional pattern.

Economic instruments in environmental policy have only recently been accepted as visible instruments, despite it has been discovered to be a cost effective instrument to achieve specific environmental target. And in particular taxation is known to have social adjustment effect. Since tax makes an impact to shrink the imposed activities, well designed tax system toward sustainable way may change the fundamental production system.

Taxes possess two incentive effects. A direct effect through price signal stimulate conservation measures and efficient system investments, and eventually change the economies production and consumption structures. An indirect effect; through the recycling of the collected fiscal revenues, reinforce the direct effects and alleviate expected adverse reaction. Publics acceptance of new taxes is closely related to the way in which the revenues are to be used.

Traditional economic concern was unemployment, which means labour is underused. Whereas there is concerns on overuse of environment. Then tax can adjust the system to discourage to use resource and to encourage to use labour. Its the concept of double dividend hypothesis.(이정전, 2000)

However, the substitution may not be so simple. To examine the potential of double dividend hypothesis, more specifically, its important to investigate the following effects; environmental effect, employment effect, efficiency in resource allocation, the competitiveness of industry. This paper will review the

theoretic consideration and potential of implementing it in Korea.[1]

II. Theoretical issues in Double Dividend Hypothesis

1. Double Dividend Hypothesis

Current tax system has created inefficient resource allocation in general, and inefficiencies in labour participation rates in particular. It was in the light of this that the double dividend hypothesis (DDH) was borne. The early concept of double dividend hypothesis was begun by Tullock (1967) who introduced the way to use revenue of environmental tax. Terkla (1984), Lee and Misiolea (1986), Pearce (1991) and Gee, D (1997) followed and suggested more elaborated reasons.

Generally, tax is known to have social adjustment effect since it shrinks the production of imposed object. Production is for consumption and consumption is for living and pleasure. The more production means more welfare in economics. Therefore tax cannot but induce welfare reduction which is called excess burden of taxation. It is rational to encourage socially appropriate behaviour and discourage inadequate behaviour. So tax is supposed to take the role.

After Pigou (1920) suggests environmental tax, it is agreed that environmental tax lead efficient use of resource, which is called the first dividend or environmental dividend. In addition, environmental tax is supposed to make substantial revenue. And the second dividend is supposed to arise from recycling of the revenue when the revenues from the environmental tax is recycled to lower distortionary taxes such as labour taxes. There are several approaches to use the revenue, but OECD (1996) reports that it is most effective to recycle the revenue for employment due to the excess burden of labour tax and prevalent unemployment matter. Then it can be the second dividend or employment dividend.

In current system, relatively high tax rate was imposed on employment and low tax rate was on resource use. That is, labour tax makes excess burden on labour cost. In the view of companies, it is natural to try to pursue the least production cost. Since the additional cost on labour was accompanied, they try to reduce the labour cost and to increase labour productivity. Every productivity index indicates the labour productivity. But as a matter of fact, labour is renewable production factor while resource is facing the danger of scarcity. Therefore resource productivity should be stressed on and effective use of resource should be facilitated. This is the basic scheme of double dividend hypothesis.

The intuition behind is very simple and sound idea to use taxes to adjust prices for resources. In other words, we should tax good things, such as labour, to a lesser extent, and bad things, such as pollution, to a large extent. Thus if there exists a double dividend, a revenue neutral change in the tax mix will improve welfare no matter how the environmental effect is.

It is expected that most of environmental tax has similar potential of adopting double dividend hypothesis, but carbon tax is suggested to maximize the revenue recycling and employment dividend, since it has broad tax base and stable revenue. Therefore this paper will deal with carbon tax but the concept of

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[1]) This paper is amendment of master degree thesis of author

double dividend hypothesis and its potential is not limited in only carbon tax.

2.Environmental effect

The environmental dividend of environmental tax comes from internalisation of external cost. It is commonly known that market failure results in overuse of resource, since external cost is not reflected in the price of resource but only private marginal cost is considered. Therefore the environmental tax corrects the distortion of resource use, with absorbing difference between social marginal cost and private marginal cost. It is the theory of so-called Pigou tax.

Depending on the rate of carbon tax, fossil fuel consumption may be reduced and it will accompany with decreasing CO_2 emissions and secondary pollutants. CO_2 reduction is beneficial of climate change mitigation and prevention, which are global and long-term and the reduction of secondary pollutant will be helpful in region and short-term. However there are relatively few economic studies valuing the additional environmental benefits including green house gas reduction and secondary pollutant reduction into monetary term, mainly due to the difficulty of quantifying them.

However, the presence of environmental effect of carbon tax is agreed. At present several Northern European countries (Denmark, Finland, the Netherlands, Sweden, Norway) implement carbon tax and Norway reports that CO_2 emission reduction was substantial for last 5 years. As analysed with economic model, Dessus and O`Connor (1999) use CGE and say that for CO2 reductions over the next decade of 10-15 % of baseline emissions, the benefits to Chile are quite likely to exceed the costs. Burtraw et al (1999) find that ancillary benefits from a tax of $10 per metric ton of carbon emissions would yield NOx related health benefits of about $3 per metric ton of carbon reduced (1996 $). A review of the literature by Pearce et al(1996) found that the estimates of additional environmental benefits range widely, from $2 per ton of carbon abated, to over $500/tC.

3. Employment effect

Many studies on environmental tax suspect negative impact in economy, based on a theory that environmental tax will lead production reduction. This theory is caused by assumption of equilibrium economy where all resource is being used. Tax on resource will increase of resource and lead the reduction of production. However, there is unused resource, that is, unemployed labour. Provided that overall production cost can be kept with subsidizing the labour cost, the production factor can be substituted to labour some extend.

Then it should be examined that the substitution can be feasible at the same time. In fig.1, point A represent labour tax regime which has high tax burden on labour and low tax burden on resource, while point B represent environmental tax regime with opposite condition. The isocost passing by A and B meets isoquantity in A and B. It means the points represent the least cost point in each condition and in the equilibrium. Then labour tax regime may be changed to environmental tax regime under revenue-neutral condition with zero cost, which means more employment and less consumption of environmental goods.

According to the model of the studies, however, the analysis of employment effect may show different

results. Attempts based on traditional economic instruments such as general equilibrium models deny presence of significant second dividend. However, it may be understood that it does not consider the weight of energy. Neoclassical production theory systematically underestimate the role of energy and overestimate the role of human labour, since neoclassical theory assume the contribution of production factors to value added are proportional to their prices. Thus they may underestimate the second dividend of the ecological tax reform on the labour market see Bovenberg A.L and L.Goulder(1997), Bovenberg, A.L and F. vand der Ploeg (1994), Brunello (1994) and etc

<FIg.1> labour tax regime and environmental tax regime
source : Schob, R., Koskela, E., Sinn, H., 1999, "Green Tax reform and Competitiveness" NBER working paper No.6922

Whereas Proops and Van Regemoter (1995) use Input-Output Analysis and shows 4.6 % increase in employment and 3.45% decrease in CO2 emission. Barker (1997) analyse substantial increase of employment (744,000 person) with 16.6% CO2 emission reduction. Bossier and Brechet (1995) also indicate presence of second dividend. And commonly the impact of double dividend hypothesis may be different in industry. The first manufacturing industry may get more burden and industries with unskilled labour such as construction, service industry may be beneficial from decreased labour tax burden.

According to the work of Norwegian Commission, in long term equilibrium, the effects of employment may be small. But it would be plausible that when there is unemployment at the outset and given that labour markets are imperfect there may be positive effects on both overall employment and the environment in a medium term perspective (5-15 years) if the magnitude of the changes are moderate (Baranzini, 2000).

3. Competitiveness

Since carbon tax is supposed to make substantial impact in economy, there are concerns about losing international competitiveness. However, international competitiveness is determined by several factors besides product price and double dividend hypothesis intends to lead the substitution on production factor with zero cost., so that the competitiveness loss may not be major problem.

Empirical studies on carbon taxes competitive losses indicate that carbon taxes did not produce a significant impact (Grossmand and Krueger, 1994, Jaffe et al, 1995). OECD(1996) concluded that environmental taxation has very small impacts on costs and prices and that in addition those impacts are relatively difficult to distinguish from other changes. Even Poter (1990) claims that properly designed environmental policies can trigger innovation and production efficiency gains leading to an absolute advantage over non-regulated firms.

In designing carbon taxes, competitiveness may be considered in various options; point of imposition of the tax, border tax adjustment and industry adjustment. It may be a matter of condition in which the carbon tax is imposed.

4. Distributive impact

Distributional implications seem to be a major issue on political agenda. Carbon tax is supposed to be regressive, i.e. they fall proportionately more on the poor because low-income households spend a larger fraction of their available income on energy than high income households do. Besides the direct use of energy, low-income households relative consume more product which contains more energy, while high-income households tend to spend money more on service which doesn't have much energy input.

However these critics are for the Pigougian tax. It can be made up for under the revenue-neutral carbon tax. Results from empirical studies show that carbon taxes without revenue recycling are generally regressive, but less than first expected. The overall weak regressive effect of carbon taxes is generally due to taxes on domestic energy, because the tax of transport fuels possesses a weakly progressive outcome. Transport fuel tax showed rather weakly progressive for most European Union countries (Barker and Kohler, 1998). Therefore the regressiveness of revenue neutral carbon tax may not be significant.

Furthermore, the reason of regressiveness is due to the increase of production cost. If the revenue is recycled to compensate labour cost, recycling of carbon taxes revenues may offset some of the regressive impacts and the extent of change in production cost may be negligible in the view of companies.

III. Potential of DDH in ROK

In spite of its positive effect, environmental tax was limitedly applied in Korea. Environmental tax based on revenue-neutral may eliminate the concerns on potential adverse economic effect. So the potential of DDH in Korea should be examined

1.Demand on efficient energy use

Since 1970, heavy industry has taken leading role in economic development of Korea. The share of heavy and chemical industry was 40 % in 1975, 56.4% in 1985 and 80% in 1996. To facilitate the industries which are mostly energy intensive, it was indispensable to keep low energy price policy and substantial subsidies on electricity. With the support from the Government, the industries have not needed to consider efficient energy use. Therefore, GDP elasticity which represents energy use in production is 1.16, while the average GDP elasticity of OECD countries is 0.72, which means that Korean companies use more than 50% of energy in producing same value added.

Average increase rate of energy consumption of Korea from 1985-1995 is 10.3%/year, which is much higher than average increase rate of OECD countries, 1.8%/year. Since GHG emission increases with the proportion of energy consumption, GHG emission per capita is 2.41 TC and supposed to be 4.1TC in 2020. Korea does not have any mandate of the Climate Change Convention yet to reduce GHG emission, however it may be changed sooner or later. Since Korea depends 97% of its energy on imported source, rapid and forceful change may lead substantial shock to Korean economy. On the other hand, if it keeps current energy consumption system, Korean industries will lose their international competitiveness eventually. Therefore, it is necessary to facilitate efficient energy use.

2. Employment condition

The employment condition of Korea has been quite stable. The unemployment rate was 3.7% during 1986 to 1990 and 2.5% during 1991 to 1995. On the other hand, the recent economic crisis of Korea brought unemployment, which is expected to last for a while(조우현 & 조준모, 1998),

If the reason of unemployment is simply the economic crisis, the employment rate should be recovered. The enterprises, however, intend to reduce the production cost. Among capital, resource and labour cost, companies may be likely to reduce labour cost instead of resource cost which is regarded as minor factor regardless of external cost or capital cost which is regarded as important factor due to technological development. In fact, restructuring of organization seems to mean reduction of labour cost in many cases in the other countries as well.

Korean Labour Institute and Korea Development Institute estimated unemployment rate might be stable in 5% level for the time being after its highest point in 1999.

3. Tax burden on human and resource

One reason of companies preference on labour cost reduction may be increase of tax burden on labour. The overall tax revenue of Korea Government is composed of income tax, social contribution, property tax, trade tax and etc. The labour tax in broad definition includes income tax and social contribution, and has increased 155.8 times and 1358 times respectively, while other taxes increased about 100 times in nominal value. The increase of labour tax indicates relatively high excess burden on the value of labour and make companies consider additional cost on labour.

<Table 1> growth rate of labour tax (1972-1996)

Tax	composition	Growth rate
Income tax	33%	155.8
Social contribution	10%	1358
Property tax	2%	98.2
Capital tax	39%	120
Trade tax	7%	90
others	9%	

The labour tax in the view of enterprise is health insurance and Social Contribution which includes employment insurance fund, national pension fund and workplace accident compensation insurance. In 1999, total labour tax is amount of about 8-12% of wage, depending on the industrial characteristic.

4. Reduced labour tax

The labour tax can be distinguished as labour tax on employee containing income tax and labour tax on employer such as social contribution and health insurance. The former affect on supply of labour and the latter on demand. Both of them may lead increase of employment when they are reduced with the revenue. However in Korea where unemployment rate is not extremely high, the determinant power of

employment may be on demand side, not supply side. To maximize the effect of production factor substitution and employment dividend, the benefit of recycled revenue should be given to the entity which takes the tax burden. The reduction of social contribution may bring similar result with employment subsidy which has been given during the economic crisis Government provided about US$ 360 per month to company to keep the employment. That is, the more resource use, the more tax, while the more employee, the more reduction on social contribution. It may give companies economic incentive for substitution. But depending on the condition of each countries, the revenue can be recycled in various way.

5. Substitution between production factor

Regarding current direction of technical development, there is solicitude that the substitution between energy and other production factors is likely to happen toward capital, instead of labour. Jung and Lee(1998) shows that in case of carbon tax, 8 industries will substitute energy with capital, 5 industries with labour, 5 industries with other intermediate goods and other 11 industries which are mainly in manufacturing will afford the burden without substitution. However, the industries in intermediate substitution category are mainly service industry, which has potential to increase employment, depending on the incentive. It rather indicates that the imposition of carbon tax should take into consideration the characteristic of each industry and accompanied with other policies.

6. Employment effect of revenue neutral carbon tax in Korea

The employment effect of revenue neutral carbon tax may be dependent on size of revenue, which is expected to be enough to cover most of labour tax in Korea. OECD report (1996) says that the revenue of carbon tax would be amount of 1-2 % of GDP. Park (1995) analyses US$ 0.45 billion revenue from oil and coal. Korea tax institute (1996) analyses US$ 0.56 billion revenue from 10% tax on oil. On the other hand, revenue from Social contribution in 1996 was US$0.41 (US$0.293 billion from employers). That is the revenue would be more than enough to cover the labour cost of company.

Jung and Lee (1998) analysed the impact of carbon tax on product price , based on Input-Output analysis. They estimated carbon tax increase product price 3% in overall economy and 0.57.24% on various industries. Under the revenue-neutral tax, it can be offset with the revenue and eventually may increase employment. However, several industries which endogenously use more resource, in particular manufacturing industry, may have negative impact from carbon tax.

Hur (2000) analysed the employment effect of double dividend hypothesis in case of carbon tax, and indicates second dividend (employment effect) may be seen at least in short term. The model use three dependent variables (output, real wage + labour tax, product price) and independent variable as number of employee. And the impact of carbon tax is reflected in product price which was calculated in Input-Output table and the revenue recycling is designed to be included in labour tax. The analyse shows that employment increase 0.7 and 1.7% in all economy with 55% and 90% reduction of Social contribution only. Specifically, mining shows the highest increase, then transportation is the second, while employment in manufacturing industry decreases slightly. It indicates that employment effect from double dividend hypothesis is likely to happen at least for short term in general and in industry with unskilled and short-term labour in particular in Korea.

IV. Conclusion

In modern Europe, once tax was imposed on window, buildings without windows were built. It indicates how the social adjustment effect of tax works. In Korea, tax revenue composed of one third of national budget so the impact of tax system in economy is substantial.

Since there is distortion in tax system of Korea, there is room for considerable improvement in the efficiency of the overall tax system (김성태 외, 1999). Using energy more efficiently or using renewable, environmentally benign energy forms should be supported rather than impeded. Thus, we may hope to increase the value added using less energy but more capital and more labours and consequently, it will move the focus of rationalization from labour to energy.

DDH can be applied for a number of other environmental taxes, in areas where there is still need for some clarification of principles. It is proposed that the following taxes are further evaluated; tax on road transportation, tax on emission concessions, tax on noise pollution from airplanes, environmentally differentiated axes on ships and shipping, nature tax etc.

Under the condition that it is needed to make compromise plan between economic development and environmental consideration, the potential of double dividend hypothesis has being discussed. As a matter of fact, most studies both theoretical and empirical mention the result of analysis is rather limited in certain condition. It should be pointed out, however, that it is in general difficult for economic model to analysis the possibility of double dividend only, under the pre-existing tax system. Since several countries adopted the concept of double dividend hypothesis, it will be an empirical issue whether any double dividends can be found in long term in those countries; Sweden, Norway, The Netherlands, Denmark and Finland adopted and Switzerland and UK are currently discussing proposals

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