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A Review of Different Types of Subsidies and How They Work in Theory

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Abstract This paper gives a brief review on types of subsidies and how they work in theory. The paper identified three types of subsidies: subsidies that increase revenue, subsidies that lower the cost of production, and subsidies that are not linked to production or input. With the use of graphic examples to describe the partial effects of subsidies on supply and demand, the following findings were obtained: one, for producers to sell more, they will need to produce more, and in order to produce more, a higher input level is required, which depends on the marginal productivity of the inputs; two, the larger the elasticity for supply and demand of input (the more responsive supply and demand are to changes in the price of the input), the larger quantity of input used for a given level of support, and thereby increasing the associated environmental damage from the use of that particular input; three, for a given demand curve, a shallow supply curve (reflecting a large price elasticity of supply) will yield larger volume effects in response to a certain change in price compared to a steep supply curve and vise a verse. Finally, the study found input subsidy as an example of subsidies that lower the cost of production, and direct income support or unconditional lump sum support to an industry as an example of subsidies that are not linked to production or input.

Key words Subsidy, Elasticity, Income, Supply, Demand, Producers, Consumers, Environment

1 Introduction

Subsidies are useful and powerful tools, which can be used to influence the economy in a certain direction. Subsidies can be used to promote growth and employment as well as increasing income in a particular sector. Furthermore, subsidies may be provided by governments in order to overcome market failures, help weak regions or weak groups of the population and can be used to promote resource saving technologies that are not yet competitive on the market. However, it is well known that some subsidies can have adverse effects on the economy, which are most often efficiency losses as a result of relative market prices being distorted. These economic effects are usually expressed by means of a monetary value, *e. g.* changes in GDP (World Bank 1997). Furthermore and perhaps less well known, some subsidies may have negative environmental effects. For instance when subsidies are used to keep prices artificially low, this may encourage overuse or wasteful use of the resources being subsidised. From the viewpoint of society these subsidies are unwanted if the negative effects outweigh the benefits from the subsidies. Estimating the net benefits can be difficult, though, especially because of inadequate knowledge about the linkages between subsidies and the environmental effects and also because environmental effects are often not valued in monetary terms (Mindel et al., 2008; Minot and Benson, 2009; USAID, 1982). However, according to Tiba (2008) the initiation of structural adjustment to subsidy programs in early 1980s during liberalisation agenda, universal subsidies came under heavy criticisms by donor institutions highlighting several negative impacts of these subsidy programs. It was emphasised that universal subsidies are not compatible with the principles of the free market, they are expensive, involve high implementation and transaction costs and constitute a heavy burden on government budget. In addition, they distort market and farmer incentives, slow down the development of the private sector and, most importantly, benefit wealthier farmers who are not eligible to such transfers. Following these arguments, donors withheld support to input subsidy programs, subsidies were gradually abolished and government parastatals and institutions were dismantled and privatised. Consequently, the cost of fertiliser rose sharply which restricted access to small-scale farmers. Notwithstanding, this paper is not in to the history of global arguments regarding subsidies but rather reviewing types of subsidies and how they work in theory. The paper gives a short summary on types of subsidies and how they work in theory by looking at subsidies that increases revenue, subsidies that lower the cost of production, subsidies that are not linked to production or input and finally draws a few conclusions within the abovementioned scope.

2 Types of subsidies and how they work in theory

Subsidies can be given in many ways and both to producers and consumers. A general typology of subsidies and their usage as producer and consumer subsidies is illustrated in Table 1. Producer subsidies are in general given in form of direct payments, support that increases revenues or support to inputs in production. The types of consumer subsidies are in general analogous to producer subsidies (Steenblik 1995 and 1998), *e. g.* direct payments or support that lowers prices on specific products.

Different subsidy mechanisms are described in the following in

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relation to; how they work, their effectiveness of achieving their goals, and their environmental effects. Focus will be on producer subsidies since consumer subsidies in general are analogous to producer subsidies. Also, producer subsidies in general are more difficult to justify than consumer subsidies since they are targeted at a limited interest group (World Energy Council 2001). However, it is worth noting that certain consumer subsidies may have just as harmful effects as some producer subsidies. Graphic examples are used to describe the partial effects of subsidies on supply and demand. Usually it is necessary to use general equilibrium models to describe all the dynamic effects on production and consumption in society, and the descriptions in this paper are thus rather simplified.

Table 1 A general typology of subsidies

	Producer subsidies	Consumer Subsidies
Budgetary money handouts	X	X
Capital cost subsidies	X	
Public provision of goods & services below cost price	X	X
Policies creating transfers through the market	X	X
Regulations	X	X
Price subsidies	X	X
Export subsidies	X	

Source: Adapted from Beers & van den Bergh (2000).

2.1 Subsidies that increase revenue In this category, subsidies are in general granted to output from production. One type of support here is market price support. Market price support is often used either to maintain income levels as is the case in the agricultural sector or ensure a desired level of employment in the subsidised sector, such as with coal mining (OECD 1998ab). This type of subsidy allows producers to increase their income by increasing the level of profitable production. For producers to sell more, they will need to produce more, and in order to produce more, a higher input level is required. The quantity of extra inputs required depends on the marginal productivity of the inputs. The marginal productivity of inputs often decreases as output expands, leading to increased input requirements per unit of output. This means that some of the subsidy is spent on inputs, leaking away to the input suppliers rather than staying within the recipient sector. The increased demand for inputs may in turn push the price of the inputs up. This will increase the leakage effect but also adversely affect other users of the input who will suffer from the increased prices.

If the political objective is to maintain income levels in the intended recipient sector, as with most agricultural support in OECD countries, regulation which set minimum prices is clearly a cost-inefficient mean of obtaining this objective. As an example, it is estimated that as much as 75% of total agricultural price support leaks away from the intended recipients-primarily to input suppliers (Dewbre 2002), meaning that the transfer efficiency is very low. Therefore, market price support is a very cost – inefficient way of increasing farm incomes. The minimum price regulations will increase the product price for the downstream market, which thus faces a decrease in competitiveness and perhaps requires political implementation of measures to support the downstream industries.

In Fig. 1, the effect on demand D and marginal private costs (private supply) S from an output subsidy is illustrated. Furthermore, as an example of the linkage between a subsidy and environmental effects, marginal social costs (public supply) MSC is shown, which consists of private marginal costs plus externality costs. P is the price before and P' the price after introducing the minimum price regulation.

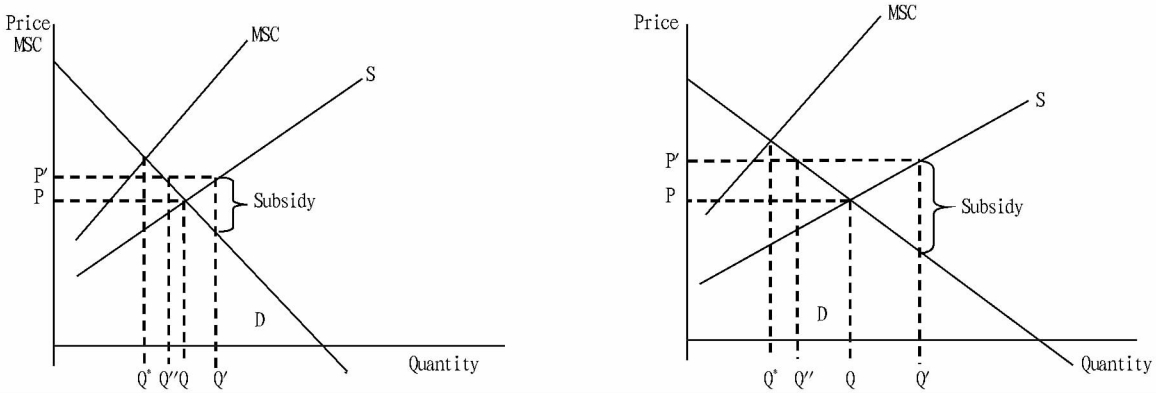
The quantities produced before and after the minimum price regulation are Q and Q' respectively. The price support results in higher consumer prices that in turn leads to lower demand Q''. The surplus production ($Q' - Q''$) will have to be dealt with through other measures, *e. g.* by governmental purchase.

Since the subsidy results in increased production and thereby an increase in the use of inputs, the associated externalities (MSC) will also increase. Note: in the figure the optimal production level for society is Q*. The graph on the right hand side in figure 1 shows what happens when the price elasticity of supply is larger (than in the left-hand figure). For a given demand curve, a shallow supply curve (reflecting a large price elasticity of supply) will yield larger volume effects in response to a certain change in price compared to a steep supply curve. This results in a larger quantity of production and consequently also more associated waste and pollution. A shallower supply curve will increase the governmental burden of coping with the environmental problems, especially in the long term as supply curves in general can be expected to be shallower in the long term (OECD 1998b).

Furthermore, this type of subsidy can have a negative influence on technological innovations if the subsidy is made contingent on output levels. If a producer is guaranteed a minimum price and quantity sold for a particular product, the incentive to consider new unsupported products or processes will be reduced. This is the case even though the unsupported products may prove more cost-effective if the support was not available (OECD 1998a).

2.2 Subsidies that lower the cost of production Subsidising inputs in the production is one way to lower the producer's average costs. When considering supports to inputs, the relative elasticity of supply and demand for the subsidised input will determine how much of the subsidy that is leaked to the input supplier and how much goes to the producer, who is the intended recipient. If the producer has a low elasticity of demand, meaning that he will not change the quantity of input used in the production process in response to a change in the input price, the input supplier (upstream market) can raise the input prices and thereby capture a larger proportion of the subsidy. The larger the elasticity for supply and demand of input (the more responsive supply and demand are to changes in the price of the input), the larger quantity of input used for a given level of support, and therefore the associated environmental damage from use of the input will also be increased. The effects on the downstream consumers will be parallel to those in the upstream market. The subsidy given to the producer (that

has not leaked to the input suppliers) will reduce production costs, thus enabling the producer to lower the prices to the downstream consumers. The extent to which the subsidy is translated into reduced product prices will depend on the relative market bargaining powers of the producer and the consumers. Reduced prices will stimulate demand. The increased production that results from the subsidy will most likely increase the environmental damage generated by the production process (OECD 1998a).



Notes: P is the price of the good before the subsidy; P' is the price after support; D is the demand curve; S is the supply curve (marginal private costs); MSC is the marginal social cost.

Fig. 1 Effects of price support on output and the role of price elasticity

When analysing input subsidies, it is important to consider the transfer efficiencies of the subsidy and the price elasticity of supply and demand on the finished product. The transfer efficiency can be revealed by comparing the change in prices relative to the amount of total support. This will indicate support leakage to non-target recipients. If the objective is to support the finished product-producing sector there will be a leakage of support to consumers as measured by any reduction in price of the finished product, and a leakage to the input producers indicated by any increase in the price of inputs. Conversely, if the intention is to support the input producer, then any reduction in the selling price of the inputs to the downstream producer will constitute a leakage to this downstream industry. Some of these effects are illustrated in figure 1 as follows: Introduction of input subsidies (with the value of $P - P''$) shifts the marginal private costs curve downward to S' leading to lower consumer prices P' and higher demand Q'. The leakage effect can be described depending on the initial recipient of the subsidy and the price elasticity. In the figure on the left, with relatively low price elasticity, the value of the subsidy ($P - P''$) will be split between the producer and the consumer with the biggest share ($P - P'$) going to the consumer (whose demand is represented by demand curve D). In the figure on the right, with higher price elasticity, the producer receives the bigger share of the value of the subsidy. The figure also illustrates that the increase in production ($Q' - Q$) caused by the subsidy is further away from the optimal production level in society Q^* than before the subsidy was introduced.

Input subsidies can also discourage technological development, in that if an input is supported the producer will try to use a higher proportion of this input relative to other unsupported inputs. Therefore, development of more efficient and perhaps more environmentally sound alternatives are not encouraged and this is referred to as "lock-in" effect (OECD 1998a).

In general, the magnitude of the price, volume and leakage effects of an input subsidy depends on the slopes of the supply and demand curves. If the elasticity of the two curves differs the support will be distributed unevenly between the producer and the consumer. The relative elasticity of supply and demand will determine the transfer efficiency of the subsidy. See the table below for the effects of price elasticity on transfer efficiency of a subsidy which reduces the costs of inputs (OECD 1998b).

Table 2 Transfer efficiency and environmental effects of an input measure

	Small price elasticity of demand	Large price elasticity of demand
Small price elasticity of supply	Small environmental effect Moderately effective transfer	Moderate to small environmentaleffect Effective transfer
Large price elasticity of supply	Moderate to small environmental effect Ineffective transfer	Large environmental effect Moderately effective transfer

Source: adapted from (OECD 1998b)

The effects identified in the table above are based on the assumption of a closed economy with no external impacts. In reality, many products are traded internationally, and once foreign buyers and suppliers come into play, the price elasticity will generally become larger. Increased elasticity will in turn correspond to an increased pollution level effect.

Using these characteristics of the elasticity it is possible to scan subsidies to determine which ones are unlikely to effectively reach the intended recipient sector but are likely to have strong effects on the environment. This type of analysis will enable a rough identification of the subsidies that are ineffective (low transfer efficiencies) and environmentally harmful (OECD 1998b).

2.3 Subsidies that are not linked to production or input

Examples of subsidies that are not conditional on production or in-

put levels are direct income support or unconditional lump sum support to an industry. This type of subsidy does not have a direct effect on the input or output markets which is why there is little or no upstream or downstream leakage effect (in other words only little or no money goes to the consumers or to the input producers). A greater proportion of the subsidy will accrue to the intended recipient sector compared to the other subsidy mechanisms. Also, the subsidy should not have a distorting impact on the market (OECD 2003). Furthermore, because the subsidy is not dependent on increased production or consumption levels, it will generally not increase the environmental damage associated with these activities – it is decoupled from production. On the other hand, the increase in profitability in the recipient sector will indirectly have an effect on production and consumption decisions by stimulating the recipient's expenditures. One possible result of this effect could be that production is kept in existence when it might have been optimal to cease production (Pearce 2003). Therefore, this might have negative economic effects, but the consequences for the environment are less clear. However, in OECD (1998a) it is stated that since the subsidy is not conditional on specific output or input levels or particular processes its effects will be less detrimental for the environment than the other abovementioned subsidy mechanisms. Finally, this type of subsidy may increase the number of producers in the particular industry who receive the subsidy, resulting in increased aggregate pollution (Mayrand et al. 2003). To further highlight some disagreement in this area, Baffes & de Gorter (2005) argue that, for instance, decoupled support programs in agriculture can have just as distorting effects as coupled subsidies.

3 Conclusions

This paper has demonstrated that there exist subsidies that are only applicable to producers but not to consumers and such are capital cost subsidies and export subsidies. Market price support is one of the types of subsidies that increase revenue that is often used either to maintain income levels as is the case in the agricultural sector or ensure a desired level of employment in the subsidised sector. Moreover, this type of subsidy allows producers to increase their income by increasing the level of profitable production. Subsidies that lower the cost of production are there to lower the producer's average costs, depending on the elasticity of supply and demand. If the producer has a low elasticity of demand, the input supplier (upstream market) can raise the input prices and thereby capture a larger proportion of the subsidy. The larger the elasticity for supply and demand of input the larger the quantity of input used for a given level of support and the larger the associated environmental damage from use of the input. Therefore, it can be said that the degree of environmental damage from an input subsidy is directly proportional to its supply and demand elasticity.

Furthermore, when analysing input subsidies, it can be concluded that it is important to consider the transfer efficiencies of the subsidy and the price elasticity of supply and demand on the finished product. The transfer efficiency can be revealed by comparing the change in prices relative to the amount of total support. This will indicate support leakage to non-target recipients. If the objective is to support the finished product-producing sector there will be a leakage of support to consumers as measured by any reduction in price of the finished product, and a leakage to the input producers indicated by any increase in the price of inputs. Conversely, if the intention is to support the input producer, then any reduction in the selling price of the inputs to the downstream producer will constitute a leakage to this downstream industry. Last but not least, the study found that there are subsidies that are not linked to production or input such as direct income support or unconditional lump sum support to an industry (producer). These kinds of subsidies are independent of production levels and have the tendency to increase the number of producers in a particular industry where it is applied.

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