WELFARE IMPROVEMENTS FROM INCOME REDISTRIBUTION: GETTING ACCESS TO CULTURAL GOODS

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ABSTRACT

Economic theory has proved that income redistribution in imperfect competitive markets can increase social welfare and lead to situations in which all the economic agents involved improve their level of welfare. This paper shows that under certain assumptions self-financing tax subsidy schemes can also have pareto-improving effects in perfect competitive markets, which stem from external economies of scale.

1. INTRODUCTION

Economic theory has proved that income redistribution in imperfect competitive markets can increase social welfare and lead to pareto-improving situations. A government intervention through income transfers, for instance, could correct the market failures associated with imperfect competition and restore the Pareto efficiency. Dillén (1995) and Chipman (1970) tackle the issue in a general equilibrium setting, while Thépot (2003) explores the case of a monopoly in which the implementation of a tax subsidy scheme brings about welfare improvements for all the agents involved. This paper shows that under certain assumptions self-financing tax subsidy schemes can also have pareto-improving effects in perfect competitive markets, which stem from external economies of scale.

The issue is relevant in the context of economics of education. Recently, some groups have suggested adopting policies with similar features, as a way to enhance the access to new technologies and education. In particular, the implications of this paper could be suitable to examine policies such as the "One Laptop Per Child (OLPC) program". This project involves providers of software and computers as well as some developing countries that made tentative commitments to put $150 laptop computers (US$) into hands of millions of students. If a sufficient large number of computers were ordered, Taiwanese producers would be expected to begin his task by mid-2007. Walter Bender, OLPC president for software and content, explained in August 2006 that even though no agreement had been signed, "we continue to cooperate with Thailand, Brasil, Argentina, and Nigeria."

In this context, we advocate that implementing income transfer policies in competitive markets might be beneficial to society. The capability of the implemented policies to influence the elasticity of demand in the desired way, together with economies of scale in the industry, permits the realization of pareto-improving situations. Using the distinction between internal and external economies of scale introduced by Marshall (1920, p.221), we recognize external economies when a fall in unit costs arises from an expansion of an industry (without a necessary increase in the size of individual firms). A number of studies have documented examples of industries that experience external economies of scale. This feature is commonplace in various kinds of manufacturing industries (for instance, Broadberry and Marrison (2002) report evidence for the presence of external economies of scale in the cotton industry), but it also affects some of the most prominent markets, like those for cultural goods. (See Maravasti (1994) who, based on available data on trade, stresses how highly populated countries dominate exportation of most cultural products such as books, motion pictures, recorded music, newspapers, etc.). The presence of economies of scale in these types of industries is particularly significant within the scope of this study.

The analysis of this issue, developed for linear specification of the functions, is carried out adopting a redistributive transfer, which is implemented in two steps. The setting conveys very encouraging results, since these types of transfers are always feasible to implement and bring about gains for all the economic agents. If the transfer is arranged in this way, the taxes collected in the first step of the process do not harm the incumbent consumers, while the subsidy improves the welfare of new consumers. To avoid the threat of cheating, the provision of the subsidies could be implemented through an auctioneer mechanism. This gives rise to a second wave of transactions in the industry, enhancing social welfare and gaining access to survival commodities for individuals who were initially excluded.

Our findings, even if attained from the analysis of linear functions, are valid beyond the linear framework. The study of non-linear specifications of the functions merits further research, although the basic conclusions presented here do not depend on linearity. Unlike other studies, our results do not derived from correcting market failures associated with market power. Instead, they occur in competitive markets, stemming from the greater efficiency of taking into account external economies of scale.[1]

The paper is organized as follows. Having described in the introduction the motivation of the study, in Section 2 a plausible implementation of the income redistribution is both described and analyzed. Then, Section 3 concludes commenting on the main implications obtained throughout the analysis.

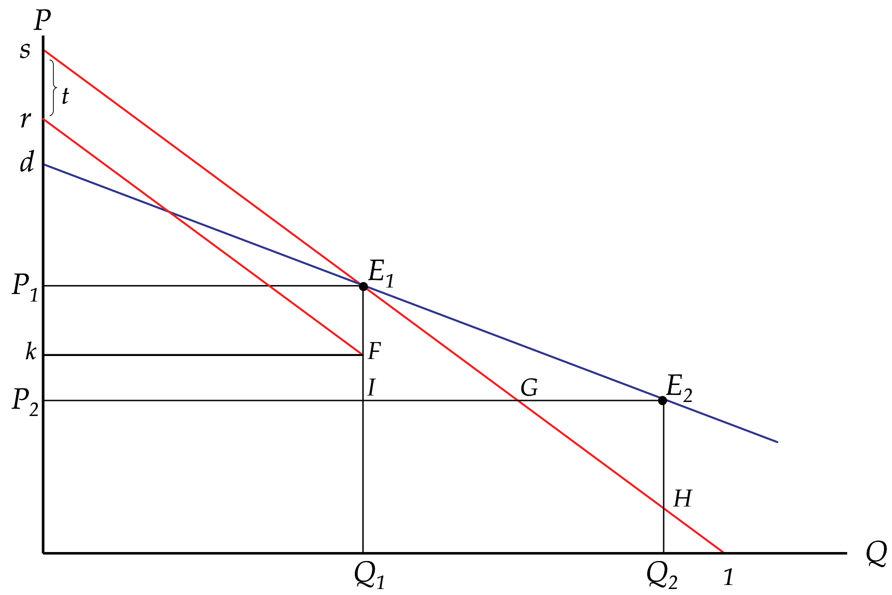
2. THE MODEL

The issue of pareto-improving income redistributions within a competitive framework can be studied using very generic specification of the underlying functions. The basic idea of the paper is illustrated in Figure 1. For the sake of clarity, the model presented thereafter is settled for linear specifications of the demand and supply functions. The initial demand of the industry D_1 (Q) is depicted as (sE_1GH1) and the long-run aggregate supply as (dE_1E_2). The equilib-

[1] The debate on the compatibility of economies of scale with perfect competition finds support in the literature, provided that the economies are external to the firms, which is precisely the topic analyzed here. For instance, Meade (1952, p. 33) states that perfect competition can prevail under conditions of increasing returns as long as these economies are external to individual firms. For a broader discussion on this issue, see Chipman (1965, p. 736-49).

rium is initially reached at (P_1, Q_1), where P denotes the price and Q accounts for the total quantity exchanged in the industry.

Figure 1



Any change in the demand function increasing the equilibrium quantity while diminishing the price is potentially able to draw the approval of all the economic agents. Consider the case of a market in which a continuum of consumers exists. The individuals' preferences are assumed to be identical, whereas the disposable income for this good differs among them. Firstly, the total quantity demanded in the industry at zero price is normalized to 1. Secondly, if the income of the population is uniformly distributed, the primary aggregate demand D_1 (Q) is of the form: $P = s – s·Q$. Note that both linearity and normalization of the demand function do not entail loss of generality.

We assume the following total cost function: $CT (x, Q) = F + a·x^2 – b·x·Q$, where x is the production of the individual firm while F is the fixed set-up cost. The corresponding aggregate supply in the industry is a linear function with negative slope in the long run: $P = 2·(a·F)^{1/2} – b·Q$. In this expression the degree of external economies of scale is driven by b. Note that the form of the total cost function is such that the external economies do not alter the optimal level of production of the individual firms: $x = (F/a)^{1/2}$. To ensure the existence of equilibrium in the industry (for positive values of price and quantity), the following assumption upon the parameters is made:

$$b < 2\,(a·F)^{1/2} < s \qquad (1)$$

To illustrate how pareto-improving policies can be implemented when positive economies of scale exist in the industry, we describe now a self-financing transfer in two steps. For the analysis to be properly applied it must deal with situations in which consumers are disposed to pay as much money as they can afford. In a market with these characteristics, the initial equilibrium indicates how many individuals can initially afford this good and what price they pay for it:

$$(Q_1, P_1) = \left(\frac{s - 2\sqrt{a \cdot F}}{s - b}, \frac{2\sqrt{a \cdot F} - b}{s - b} \cdot s \right) \tag{2}$$

We assume that the government is able to evaluate accurately the external economies of scale that operate in the industry. The tax consists here of a fixed identical amount paid by each of the Q_1 contributing consumers, whereas the subsidy is assumed to be proportional to the lack of disposable income of subsidized consumers. Besides, we presume that tax collecting takes place in an early stage (when the first group of consumers buy the good) while the provision of the subsidy occurs only afterwards. The process is described also in Figure 1.

The issue allows for different approaches, among which we have chosen here the policy whose implementation is possibly easier to carry out than the others. For a policy to have greater credibility it must provide all the agents involved with incentives for participation.[2] Had the government not intervened in the industry, Q_1 would be the total quantity exchanged in the industry at price P_1. However, the provision of subsidies among individuals beyond Q_1 will permit a second wave of transactions in the market. The process may be described in two subsequent steps:

a) Some individuals pay the higher initial price P_1, which is considered the only way through which they can ensure enjoying the provision of this good. Otherwise, if waiting for the second round, they face a certain risk of not getting the commodity, as it may be exhausted. Then, consumers who are able to afford P_1 (those located between 0 and Q_1) are certainly willing to pay the initial price, on the grounds that they were already paying this price at the beginning.

[2] The way in which the transfer is implemented here implies that the producers eventually get extraordinary profits, although this feature is not essential to our results. Various other arrangements could be conceived for the income transfer redistribution, which would lead to similar results to those we present here. The design of a transfer accounting for positive producers' surplus makes goes beyond the requirements of a pareto-improving transfer, since all the agents end up with improved welfare situations.

b) At a second stage, consumers located between Q_1 and Q_2 receive from the government individual subsidies of the size that permits them to afford the subsequent prices. We consider that the price for each additional unit of this good declines along with the long-run aggregate supply function, starting at the level of P_1 and ending at the final price P_2.

Firstly, note that the two-stage setting avoids any possibility of cheating on the part of the consumers.[3] Secondly, the manner in which the transfer is designed generates profits for the producers, thereby making them ready to meet the petitions made by the government. Consider, for instance, that the suppliers are encouraged to produce a larger amount of the commodity through the promise that the public sector will purchase the exceeding quantity (at the price indicated by the shape of long-run supply). Then, the government intervention enlarges the size of the market from Q_1 to Q_2, which permits producers to reduce the minimum average cost they incur from P_1 to P_2. Since the government agreed to pay prices greater than these, the policy yields extraordinary profits to the producers while giving access to the market to additional consumers. The demand function can then be considered as:

$$D(Q) = \begin{cases} s - t - s \cdot Q & for \quad 0 < Q < Q_1 \\ 2\sqrt{a \cdot F} - b \cdot Q & for \quad Q_1 < Q < Q_2 \\ s - s \cdot Q & for \quad Q_2 < Q < 1 \end{cases} \tag{3}$$

Note that, after the intervention, the competitive price in the industry is in fact P_2, indicating that the initial buyers are at the same time contributing consumers: they pay a higher price at the level of P_1. This account of the facts implies that the producers keep the amount $kFIP_2$ as profits. Alternatively, the arrangement could be done for the Q_1 initial consumers to pay the price P_2+t, implying that the additional surplus would go to them, instead of the producers. Regardless of whether we assume the former or the latter, the government collects a total tax of sE_1Fr with which to afford the subsidy payment.

To prevent cheating on the part of the second group of consumers, the subsidies could be granted through an auction process. Each participating consumer purchases one-unit good per period, but paying a different price. The first group of consumer paid P_1, but those located within Q_1 and Q_2, given that they do not know the quantity of good that will be available, bet for the good offering to pay as much as indicated by the aggregate demand. This is still less

[3] One might be suspicious that individuals who can actually afford the initial price would also try to benefit from the subsidy. Yet, if the government gives no information about the quantity that will be available at the subsidized price, such a threat of inefficiency in the allocation of the subsidy is avoided, given that the fear of being excluded prevents any attempts at cheating of the Q_1 initial consumers.

than the price the producers were promised to receive, and therefore, the government has to add part of the payment. The process finishes in Q_1, where the total tax equals the subsidy.

At this stage we are in a position to analyze the effects of this income transfer program. The initial assumptions on the slope and intercepts of the functions stated in (1) still apply. Besides, in order for the policy to be plausible, two conditions are needed. Firstly, the transfer redistribution must be a self-financing one, which is enforced by the condition that the total tax payment has to be equal to the total subsidy. It means that, within this framework, the following condition ought to be fulfilled:

$$t \cdot Q_1 = \int_{Q_1}^{Q_2} 2\sqrt{a \cdot F} - b \cdot Q - (s - s \cdot Q) dQ \tag{4}$$

Condition (4), in the present framework, leads to establishing a relationship between the value of the tax and the total number of consumers who eventually buy the good, Q_2. Specifically, for the transfer programme to be self-financing, we need:

$$Q_2(t) = \frac{s - 2\sqrt{a \cdot F} + \sqrt{2 \cdot t}\sqrt{s - 2\sqrt{a \cdot F}}}{s - b} \tag{5}$$

Secondly, the transfer should be implemented in such a way that it leads to pareto-improving situations. To ensure that every consumer enjoys a welfare level at least as high as the one they had before the transfer, the fall in prices must be larger than the tax: $P_1 - P_2 \geq t$. It is also possible to express the change in prices as a function of t. Then, on the basis that the relationship between t and Q_2 shown in (5) holds, the condition for a pareto-improving redistribution can be expressed in the following form:

$$t \leq \frac{s - 2\sqrt{a \cdot F}}{(s - b)^2} 2 \cdot b^2 \tag{6}$$

As Figure 1 illustrates, the increase in social welfare is the sum of areas $kFIP_2$ and E_1IE_2. We can then define the increasing-welfare function as:

$$W(t) = \frac{s - 2\sqrt{a \cdot F}}{(s - b)^2}\left((2 \cdot b - s) \cdot t + b\sqrt{2 \cdot t}\sqrt{s - 2\sqrt{a \cdot F}}\right) \tag{7}$$

This expression is going to be useful in determining the optimal tax t*, as well as in checking whether or not other possible values of the tax t convey improvements in welfare. Now we are ready to obtain and examine the values of t for the three most significant situations: (I) the tax level $\mathbf{t_f}$ to reach the full coverage; (II) the level in which the tax $\mathbf{t_p}$ equals the drop in prices; and (III) the optimal tax **t*** yielding the maximum increase in social welfare. These three values are going to be calculated in terms of the parameters.

(I) **Tax t_f of full-coverage.** In order to guarantee that the whole population gains access to the good, the government might apply the tax associated with full coverage. This solution corresponds to the point where the demand is perfectly satisfied, so that t_f is obtained by substitution of $Q_2 = 1$ in expression (5), which leads to:

$$t_f = \frac{1}{2} \cdot \frac{(2\sqrt{a \cdot F} - b)^2}{(s - 2\sqrt{a \cdot F})} \tag{8}$$

(II) **Tax t_p equalizing the drop in the price.** Another conceivable policy is establishing the level of t which provokes a market price drop of exactly the same amount as the tax. The tax level t_p is then calculated as the value for which condition (6) holds as a strict equality. The application of this level of income redistribution bears increases of welfare for the producers as well as for the second group of consumers.

$$t_p = \frac{s - 2\sqrt{a \cdot F}}{(s - b)^2} 2 \cdot b^2 \tag{9}$$

(III) **Tax t* maximizing the increase in welfare.** The optimal level of taxation is such that it entails the greater growth of social welfare. Note that, if $s \leq 2b$, the function W(t) does always increase along with t. If this is the case, the maximum level of welfare corresponds to a corner solution defined by the greatest feasible value of t. On the contrary, whenever $s > 2b$, the optimal level of taxation is calculated as the critical value of expression (7). The Appendix shows that the critical value defines a maximum for $s > 2b$. This critical value is congruent only if satisfying a number of additional conditions and is given by:

$$t^* = \frac{1}{2} \cdot \frac{s - 2\sqrt{a \cdot F}}{(s - 2 \cdot b)^2} \cdot b^2 \tag{10}$$

Some constraints must hold that each of the previous levels of t may be effectively implemented. These conditions depend on the value of the different parameters, which eventually determine how the magnitude of the three tax levels relates to each other. The discussion of this point is crucial in determining the outcome of the transfer programmes and the situations in which each of them ought to be implemented. Note that our approach limits us to considering those policies which are affordable, feasible and pareto-improving at the same time. The first issue is already enforced in our framework, which always considers self-financing income transfers, while the two other characteristics need further examination.

In order for the policy to be relevant, t must lay inside the feasible region. Given that in our model $Q \in (0,1)$, the quantity associated with the prevailing tax level ought to be smaller than 1. (The redistribution scheme can never involve a number of consumers beyond the total number of them in the market). Alternatively, we can state that for the policy to be potentially applicable, the size of the tax cannot be greater than the value in expression (8), which can be interpreted as a feasible constraint.[4]

3. CONCLUSION

This paper has shown how (in the presence of external economies of scale) tax subsidy schemes can be implemented so that they allow all the economic agents involved to improve their welfare status. We venture that such a theoretical possibility could help the implementation of programmes in the context of education. As an example, we mentioned the "One Laptop Per Child (OLPC) program", a project involving producers (of software and computers) as well as consumers in developing countries. The public sector can grant subsidies to enable low-income individuals getting access to cultural products that otherwise would be unaffordable to them.

The setting of the model has been designed for the redistributive policy to be self-financing. Moreover, if the transfer is properly arranged, it undoubtedly leads to pareto-improving situations. This is because none of the incumbent consumers experience losses in welfare whereas a number of new individuals get access to the market by purchasing the good at a subsidized price. Our approach involved both the demand and the supply side of the market, since the external economies affect the shape of the aggregate supply, while the tax subsidy programme influences the effective demand function. In this context, we have proved that intervention is capable of increasing the total amount of trade in the industry while the equilibrium price declines, thereby having pareto-improving effects. Naturally, this is the case unless the cost of implementing the policy was too high.

[4] The three values of t reported are relevant depending on whether or not various conditions hold. Since these restrictions take the form of inequalities, the issue can be addressed applying the Kunh-Tucker technique. We have preferred adopting instead a discursive analysis that is equally valid and leads to the same conclusions.

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APPENDIX

The increasing-welfare function, for the case in which a redistributing transfer is implemented in two steps, was reported in expression (12), which reads:

$$W(t) = \frac{s-2\sqrt{a\cdot F}}{(s-b)^2}\left((2\cdot b - s)\cdot t + b\sqrt{2\cdot t}\sqrt{s-2\sqrt{a\cdot F}}\right)$$

The first order condition to determine the critical value is then:

$$W'(t) = \frac{\partial W(t)}{\partial t} = \frac{s-2\sqrt{a\cdot F}}{(s-b)^2}\left((2\cdot b - s) + \frac{b\sqrt{2}}{2\sqrt{t}}\sqrt{s-2\sqrt{a\cdot F}}\right) = 0$$

Solving this equation leads to expression (15). Nonetheless, such a value corresponds to a maximum if and only if the second order condition holds. Therefore, we compute the second derivative of W (t) with respect to t and, after substitution of t*, obtain:

$$W''(t^*) = -\frac{1}{b^2}\cdot\frac{(s-2b)^3}{(s-b)^2}$$

Level t* defines a maximum only if W''(t*) is negative, which obviously requires:

$$s > 2\cdot b$$