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Strategic Tax Distortion, Allocative Production Efficiency, and the Optimal Export Trade Policy

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Abstract

Apart from the traditional literature on trade policy, this paper establishes a trade model that includes the home country's domestic tax system. In the case where the home country manufacturers' cost structures are heterogeneous, we make several important discoveries. First of all, the home country government can upgrade the home country industry's allocative production efficiency by strategically distorting the tax system, and thereby achieve the objective of enhancing the home country's social welfare. Secondly, as long as the market demand curve is not too concave, or the coefficient of variation of the home country manufacturers' costs is sufficiently low, the tax policy and the export tax trade policy will be substitutes for each other, in the sense that if the corporate tax system is introduced, the optimal export tax rate (subsidy rate) will be reduced (increased). Finally, when the market inverse demand function is convex (linear, concave), the market equilibrium price will decrease (remain constant, increase), after the tax system is introduced.

Keywords: Corporate tax; Strategic trade policy; Cost difference; Tax distortion

Introduction

Studies in the traditional strategic export trade theory literature have tended to neglect the influence of a country's domestic tax system on its export trade policy.[1] For this reason, based on a traditional trade model involving three countries and many manufacturers, this paper incorporates a tax system in the home country's economic environment that operates under the assumptions of a Cournot-Nash quantity competition, and looks at how the introduction of the tax system influences the home country government's optimal export trade policy. What becomes particularly apparent is that the bringing in of the tax system is likely to increase the manufacturers' effective marginal cost (simply referred to as EMC in what follows), thereby influencing the setting of the home country's optimal export trade policy. It is for this reason that we will consider this issue from three different angles in what follows.

First of all, we will discuss the effect of different tax systems on the optimal export trade policy. Because the profits tax system is neutral in regard to the manufacturers' output policy, when the tax system that the manufacturers face is a profits tax system, bringing in the tax system will not influence the manufacturers' output policy, and for this reason will also not influence the setting of the optimal export trade policy. However, because of the difference between accounting cost and economic cost, within a real economic system, the tax system faced by the manufacturers is not a profits tax system but is rather a corporate tax system.[2] It is for this reason that in this paper the tax system discussed refers to a corporate tax system.[3]

Secondly, we discuss the introduction of the corporate tax system's influence on the home country government's optimal export trade policy. That is to say, when an exogenous corporate tax system is introduced or the corporate tax rate is increased, how will the optimal export tax rate (note that when the tax rate is negative, it represents a subsidy policy) respond? Intuitively speaking, because under a Cournot-Nash quantity competition the market equilibrium is decided by the average marginal cost after taking into account the policies of the home country and the foreign country manufacturers (assuming that the cost structure is characterized by a constant marginal cost), when the average marginal costs of both the home country's and the foreign country's manufacturers do not change, the market equilibrium will also remain constant. In addition, it is particularly worth pointing out that, regardless of whether a corporate tax or an export tax is used, both will increase the manufacturers' EMCs. What is actually different, however, is that the influence of these two policies on the extent of the increase in each individual manufacturer's EMC is not the same. Under the home country government's export tax policy, the extent of the increase in the EMCs of all of the home country's manufacturers is the same, but under the home country

[1] For a review of the strategic trade theory literature, see Brander [7].

[2] According to federal tax regulations, it is not possible to deduct the opportunity cost of capital that a company provides to its shareholders from taxable income, whereas the payment of salaries can be regarded as an expense that can be deducted from taxable income. For this reason, the opportunity cost of hired labor is not part of the tax base, while the opportunity cost of capital should be included in the tax base, and for this reason some economists regard the corporate tax as a kind of capital tax and not a profits tax.

[3] The main difference between this tax system and the profits tax system hinges upon whether or not within the tax system there are cost items that cannot be expensed. If these kinds of cost items exist, then the tax system will not be a profits tax system; on the contrary, when all cost items can be expensed, then the tax system will be a profits tax system.

government's corporate tax system, the home country manufacturers' EMCs will not increase by the same amount, and the higher the costs incurred by the manufacturers among them, the greater will be the increase in their EMCs. In other words, traditional export trade policies will only have what Fevrier and Linnemer [1] refer to as an average impact (AI), but the impact of the corporate tax system's tax policy will be able to be decomposed into what Fevrier and Linnemer have referred to as the AI and the heterogeneity impact (HI).[4]

Apart from this, we find that, regardless of whether or not there exists a mutually substitutive relationship between the corporate tax rate and the export tax rate, when the corporate tax rate increases, whether or not the optimal export tax rate will decrease is an issue that is very much related to what Long and Soubeyran [2] refer to as the allocative production efficiency effect. What is particularly obvious is that the heterogeneity impact of levying the corporate tax will cause the differences in cost to the home country manufacturers to increase, while these manufacturers maintain the same average marginal cost. This also indicates that the amount by which the output quantities of those manufacturers with relatively low costs decrease will be smaller compared to those of manufacturers with relatively high costs, and hence the manufacturers' productive allocative efficiency will increase, thus giving rise to the so-called allocative production efficiency effect referred to by Long and Soubeyran [2].

However, as to whether the average impact (AI) of levying the corporate tax can increase the allocative efficiency of the home country industry's production, or in other words can give rise to this positive allocative production efficiency effect, it is necessary to observe the concavity of the third country market's demand curve before determining the outcome. For example, when the market's inverse demand function is a concave (linear, convex) function, the extent of the increase in the manufacturers' costs will cause the size of the decrease in the output quantities of those manufacturers whose costs are relatively low to be smaller (equal to, larger) than in the case of those manufacturers whose costs are relatively high. Thus the home country industry's allocative production efficiency will increase (remain constant, decrease) [see Long and Soubeyran [2], Proposition 3]. In addition, in order to analyze whether or not there exists a mutually substitutive relationship between the corporate tax rate and the export tax rate, it is assumed that the original export trade policy has already been optimized (corresponding to a certain market equilibrium). If at this time the corporate tax system is introduced, this will raise the home country manufacturers' average marginal cost, which will in turn cause the trade policy to diverge from the optimal policy. Under the situation where the home country manufacturers' cost structures are homogeneous (i.e., where there are no cost differences or an allocative production efficiency effect), in order to respond to this change, the export trade policy will be to lower the export tax rate in response (i.e., the home country's manufacturers' average marginal cost will accordingly decrease). This will cause the home country manufacturers' average marginal cost to revert to its original level, indicating that the export trade policy and the tax policy are substitutes for each other. That is to say, if the corporate tax system is introduced, when the optimal export trade policy is an export tax (subsidy), the export tax rate (subsidy rate) will be lower (higher) as compared with the traditional literature.

Finally, when viewed from the point of view of social welfare, because the AI resulting from bringing in the corporate tax system will, under the optimal trade policy, offset the AI for the trade policy, the influence of bringing in the corporate tax system on the social welfare level will in the end only leave the HI remaining. As explained above, the corporate tax system's HI has the function of increasing the home country's welfare. For this reason, under the optimal export trade policy's equilibrium, bringing in the corporate tax system, or else raising the corporate tax rate will both enhance the social welfare. In addition, when the tax system is a profits tax system, introducing the tax system will not have an effect on the level of the home country's social welfare. For this reason, supposing that the original tax system is a profits tax system, if at this time the approach whereby certain costs among the manufacturers' production costs cannot be expensed is adopted, and the tax system is changed from a profits tax system to a corporate tax system, then this may lead to an increase in social welfare. In other words, under the optimal export trade policy equilibrium, strategically distorting the tax system can enhance the home country's social welfare. What is particularly worth mentioning is that, when seen from the point of view of the second best theory, when the home country manufacturers have a homogeneous cost structure (i.e., there are no cost differences or an allocative production efficiency effect), the adoption of the traditional uniform tax/subsidy policy (uniform taxes/subsidies) is already the first best policy, and for this reason there will not be room for welfare to be enhanced, and neither will bringing in a corporate tax system at this time give rise to a welfare enhancement effect. However, in the case where the home country manufacturers' cost structures are heterogeneous, the traditional uniform tax/subsidy policy is not the first-best policy [3], and hence there will still be room for welfare to increase.

Basic Model

As described above, the main purpose of this paper is to include within the traditional structure of trade an economic system that encompasses a corporate tax system. Within this system, in terms of the design of the trade structure, this paper is based on Dixit [4], Salant [5], Krishna and Thursby [6], and Long and Soubeyran [2], and considers an open economic system that comprises three countries and many manufacturers in which production costs differ. The manufacturers in both the home country and the foreign country each produce homogeneous products all of which are sold to a third country, in whose market they engage in a Cournot-Nash quantity competition.[5] We therefore denote the numbers of manufacturers in the home country and the foreign country by m and m^*, respectively. It should be noted that, unless a specific explanation is given later, should the mathematical notation not include a superscript then this represents the home country, and if a superscript in the form of an asterisk (*) is included, then this represents the foreign country. As for the manufacturers' production technology, it is assumed that this is based on a production model with a constant marginal cost, and

[4] The AI referred to by Fevrier and Linnemer means that the costs of all of the manufacturers increase by the same amount, while the HI indicates that the amounts by which the costs of manufacturers with different cost structures are different are not the same, but when averaged out equal zero.

[5] To simplify the analysis, this paper imitates Brander and Spencer [8], by neglecting the home country's consumer market. Besides facilitating a comparison with the traditional literature, such an assumption can also focus the discussion on the influence of the tax system and tax evasion on the optimal export trade policy.

denoted by c_i, i=1,…, m and c_j^*, j=1,..,m^* for the home and foreign country manufacturers, respectively. In addition, without losing generality, in order to simplify the analysis, we assume that all of the manufacturers' fixed costs are zero. Furthermore, we let the home country manufacturers' quantity of output be q_i and total output be q,

$$\text{i.e., } q = \sum_{i=1}^{m} q_i$$

as well as letting the quantity of output of the foreign country manufacturers and total output be q_j^* and q^*, respectively, and likewise.

$$q^* = \sum_{j=1}^{m^*} q_j^*$$

Moreover, let the total quantity demanded of the third country market be Q, so that $Q=q+q^*$, and thus the third country market's inverse demand function is $p(Q)$, $p'(Q)<0$.

This paper differs from previous studies in that the optimal export trade policy discussed here includes an exogenous domestic tax policy in the home country. In order to compare our results with those obtained in the traditional literature, we ignore the foreign country government's trade policy and tax policy, and in what follows assume that only the home country manufacturers need to face the tax policy and export trade policy. In other words, the foreign country government does not provide subsidies to or tax its manufacturers' exports, and its manufacturers also do not have to pay the corporate tax. Therefore, based on the assumptions in this paper, the foreign country manufacturers' profit function is identical to that in the literature referred to above and, apart from being faced with the traditional export trade policy (which may be a tax or a subsidy), the home country manufacturer must face a corporate tax system. Based on this assumption, the model in this paper can be seen as a two-stage game. In the first stage, under an exogenous corporate tax system, the home country government determines the optimal export trade policy (which may be an export tax or an export subsidy) in order to maximize the social welfare level. In the second stage, given the home country government's export trade policy and tax policy, the home country and the foreign country manufacturers engage in a Cournot-Nash quantity competition in the third country market.

In order to solve this subgame perfect equilibrium, in what follows we adopt backward induction, by first solving the second stage of the optimal strategy of the manufacturers in the two countries, and only then solve the first stage that is concerned with the government's optimal export trade policy. It is assumed that the home country manufacturers face a corporate tax system with tax rate t, $0<t<1$, [6] where based on the corporate tax law not all production costs can be expensed.[7] For this reason, in what follows the manufacturers' cost functions consist of two kinds, one for which taxable items can be deducted (e.g., wage costs), and the other for which taxable items cannot be deducted (e.g., capital).

To simplify the notation, it is assumed that within the production cost, the share of those cost items that cannot be deducted is θ, and that $0<\theta<1$. [8]

Solving the Market Equilibrium

The home country manufacturers' strategy

In the Section basic model, given the corporate tax rate t, it is assumed that the home country government levies an export tax of τ dollars on each unit of the home country manufacturers' exports.[9] As for the home country's i^{th} manufacturer (for simplicity referred to as manufacturer i in what follows), given the quantity of output of other manufacturers $q_{\sim i}$, manufacturer i's profit function after tax is as follows:

$$\pi^i(q_i, q_{\sim i}) = (1-t)[(p - c_i - \tau)q_i] - t\theta c_i q_i, \quad i = 1,...,m \quad (1)$$

Where $q_{\sim i} \equiv (q_1,...,q_{i-1},q_{i+1},...,q_m;q^*)$, $t\theta c_i q_i$ because certain cost items cannot be listed as expense items under the corporate tax system. For this reason, the first-order necessary conditions for maximizing the ith manufacturer's profit are as follows:

$$\partial\pi^i / \partial q_i = (1-t)(p + p'q_i - c_i - \tau) - t\theta c_i = 0, \quad i = 1,...,m \quad (2)$$

Equation (2) indicates that the home country manufacturers' output policy will cause their marginal cost after tax to be equal to their marginal revenue. This equation can be further rearranged as follows:

$$p + p'q_i - c_i - \frac{t\theta}{1-t}c_i - \tau = 0, \quad i = 1,...,m \quad (3)$$

Let the $c_i + [\theta t c_i/(1-t) + \tau]$ in the above equation be $\tilde{c}_i$, i.e., the manufacturers' "effective marginal cost" (simply referred to as EMC hereafter), and then equation (3) can be expressed as follows:

$$p + p'q_i - \tilde{c}_i = 0, \quad i = 1,...,m \quad (4)$$

From equation (4) we know that, regardless of whether a tax policy or an export policy is adopted, in the end by changing the manufacturers' EMC, the manufacturers' production decisions will be affected. What is particularly interesting is that the influences of these two policies on the individual manufacturers' EMCs are not the same. Under the traditional export trade policy (in which case an export tax

[6] Generally speaking, the corporate tax system implemented by different countries is the marginal tax rate progressive tax system. To give an example, the highest corporate tax rates for various countries are 35% for the U.S., 33% for the U.K., 28% for Canada, and 40% for Germany. On this, please refer to Mennel and Forster [9].

[7] Generally speaking, the corporate tax system is not a profits tax system. Within the current structure of corporate tax law, according to Article 29 of Taiwan's Income Tax Act, interest on capital is paid out from the distribution of profit and, as such, shall not be listed as expense or loss. In addition, Rosen [10] pointed out that viewing the corporate tax as being purely a tax on economic profits was a big mistake, because true profits should be gross income less all kinds of input costs. However, the capital provided by the shareholders cannot be deducted, and for this reason the corporate tax tax base includes more factors than in the case of economic profit. Stiglitz [11] pointed out that as long as the company can deduct the interest expenses in relation to its creditors, then the corporate tax happens to be a tax on economic profits.

[8] When θ=0, the corporate tax system faced by the manufacturers is a regressive profits tax system.

[9] When τ is negative it is then an export subsidy.

of τ dollars is levied on each of the home country's exporters), the amount by which each home country manufacturer's EMC changes will always be the same (all will increase τ), this being the level effect referred to in the Introduction. However, under the tax policy (referring to the levying of a corporate tax), as indicated by the definition of $\tilde{c}_i$ in equation (4), the influence of the corporate tax rate on the manufacturers' EMC will vary because the manufacturers' marginal costs are also different, for the higher (the lower) the marginal cost, the larger (the smaller) will be their EMCs because the amount by which the corporate tax rate increases will be larger (smaller). For this reason, the levying of a corporate tax will result in the differences in the costs of the home country manufacturers increasing, thus causing the degree of the home country manufacturers' industrial concentration or the variance of the EMC to increase. This result will have the function of increasing social welfare. What is particularly worth noting is that levying the corporate tax will give rise to what Fevrier and Linnemer [1] referred to as the AI (average impact, AI) and the HI (heterogeneity impact, HI). In addition, when θ=0, the corporate tax system will be reduced to a profits tax system. When the trade policy is not taken into consideration (i.e., τ=1), after taxation the manufacturers' EMC will not change (being equal to the pretax marginal cost), indicating that the manufacturers' output policy will not be influenced by the tax. That is to say, the profits tax system still exhibits neutrality towards the manufacturers' output policy.[10] If θ is seen as a distortion factor, when the distortion factor does not exist, the presence of the tax system will not change the manufacturers' EMC; on the contrary, when the distortion factor does exist, the presence of the tax system will influence the manufacturers' EMC, and will "substantially" influence their output policies. From this we can learn that, when we incorporate the manufacturers' tax burden in the discussion on trade policy, all influential factors that are correlated with the tax (referring to τ and θ) will, by influencing the manufacturers' EMC after levying the tax, influence their output policies, and in turn influence the formulation of trade policy.

The foreign manufacturer's optimal policy decision

As for foreign manufacturer j, given the other manufacturers' quantities of output, $q^*_{\sim j}$, the profit function will be as follows:[11]

$$\pi^*(q^*_j, q^*_{\sim j}) = (p - c^*_j)q^*_j, \quad j = 1, ..., m^* \quad (5)$$

Where $q^*_{\sim j} \equiv (q^*_1, ..., q^*_{j-1}, q^*_{j+1}, ..., q^*_m; q)$. From this equation, the first-order necessary condition for foreign country manufacturer j's profits to be maximized can be obtained as follows:

$$\partial \pi^*(q^*_j, q^*_{\sim j}) / \partial q^*_j = p + p' q^*_j - c^*_j = 0, \quad j = 1, ..., m^* \quad (6)$$

Analysis of market equilibrium

To solve the third country's market equilibrium, equations (4) and (6) are added together for i and j, and rearranged to arrive at the following equation:

$$np + p'Q = \sum_i \tilde{c}_i + \sum_j c^*_j = m\tilde{c}_M + m^* c^*_M \quad (7)$$

where $\sum_i \tilde{c}_i / m \equiv \tilde{c}_M$ is the home country manufacturers' average EMC, and $\sum_j c^*_j / m^* \equiv c^*_M$ is the foreign country manufacturer's average cost. From equation (7), the market equilibrium quantity Q functions for $\tilde{c}_M$ and c^*_M can be obtained, and substituted into equations (4) and (6), namely, the first-order conditions for the home country and foreign country manufacturers' profits to be maximized. That is, the individual manufacturer's equilibrium output levels qi and q^*_j, which are also functions of $\tilde{c}_M$ and c^*_M, can be solved. What is particularly worth mentioning is that the comparative statics analysis encompassing the market equilibrium quantity Q, $\tilde{c}_M$ and c^*_M is as follows:

$$\frac{\partial Q}{\partial \tilde{c}_M} = \frac{m}{Qp'' + (m + m^* + 1)p'} < 0, \quad \frac{\partial Q}{\partial c^*_M} = \frac{m^*}{Qp'' + (m + m^* + 1)p'} < 0 \quad (8)$$

The denominator to the right of the equals sign in the above equation is negative, and is based on the stability conditions [4].

Optimal Export Trade Policy

When seen from the viewpoint of social welfare, the tax levied by the home country's government on the manufacturers, or else the export tax/subsidy in relation to them, in terms of the home country's welfare, is merely a transfer of income between the home country's government and local manufacturers. When the home country's consumer market is taken into consideration, the home country government's social welfare level will be equal to the home country manufacturers' profits before tax, without including the corporate tax and the amount of the export tax. For this reason, the social welfare function will be as follows:[12]

$$SW = \Sigma(p - c_i)q_i$$

From the first-order condition for maximizing the home country manufacturers' profits, i.e., equation (4), since we know that $q_i = -(p - \tilde{c}_i)/p'$, by substituting this equation into equation (9), the social welfare function can be further expressed as follows , as a function of both τ and t:

[10] When θ=0, the tax will cause the manufacturers' marginal revenue and marginal cost curves to shift downwards by the same amount and for this reason the optimal output quantity will not change. However, when θ≠0, the tax will cause the manufacturers' marginal revenue to shift downwards by less than the marginal cost curve, and the home country manufacturers' optimal output quantity will as a result decline.

[11] Because the fixed costs item will not influence the manufacturers' output policy, for this reason in this study it is assumed that this item is not in the production function.

[12] In this study it is assumed that there are m home country manufacturers, and that their cost structures are different. This simplifies the design of our analysis and is the same as assuming that the distribution of manufacturers is a uniform distribution. What is worth mentioning is that this simplified design will not affect the results obtained in this paper.

$$SW(\tau;t)=-\sum_i (p-c^i)(p-\tilde{c}_i)/p' = -\sum_i [p^2-(\tilde{c}_M+c_M)p+c_i\tilde{c}_i]/p' \quad (10)$$

Where the definition of cM similar to $\tilde{c}_M$ is the home country manufacturers' average cost, i.e.,$c_M \equiv \sum_i c_i/m$. In addition, because Q is a function of $\tilde{c}_M$ and c^*_M, from equation (10) we know that, when the policy changes (including τ and t), there are several S channels that influence the level of social welfare. When τ changes, Q and p are first indirectly influenced by $\tilde{c}_M$. Secondly, through the influence on $\tilde{c}_M$ and $\tilde{c}_1,...,\tilde{c}_m$, the overall welfare level will in turn be affected. For convenience of analysis, we in addition express the social welfare function in the form of $W(Q,\tilde{c}_M,\tilde{c}_1,...,\tilde{c}_m)$, and for this reason given the exogenous corporate tax rate t, the optimal export policy (let this be τ*) satisfies the following first-order condition:

$$\frac{\partial SW}{\partial \tau} \equiv SW_\tau = \frac{\partial W}{\partial Q}\frac{\partial Q}{\partial \tilde{c}_M}\frac{\partial \tilde{c}_M}{\partial \tau}+\frac{\partial W}{\partial \tilde{c}_M}\frac{\partial \tilde{c}_M}{\partial \tau}+\sum_i \frac{\partial W}{\partial \tilde{c}_i}\frac{\partial \tilde{c}_i}{\partial \tau}=0 \quad (11)$$

Where $\partial \tilde{c}_M/\partial\tau=\partial \tilde{c}_i/\partial\tau=1$. What is particularly worth mentioning is that, when θ=1, this model is reduced to the traditional models of Dixit [4], Salant [5], Krishna and Thursby [6] and Long and Soubeyran [2]. In this case, the optimal export trade policy will be related to the number of manufacturers, the degree of concentration in the home country manufacturers' market, and the extent of the demand curve's concavity. Since relevant conclusions have already been clearly presented in these studies, we do not intend to discuss this issue here, and interested readers can refer to Long and Soubeyran [2]. When θ≠0, from the above analysis we know that the home country manufacturers' output policy will be distorted. Against such a background, we will now discuss the following question: How will the production policy distortion resulting from the tax policy after all influence the formulation of the export trade policy?

First of all, the social welfare function is a function of τ and t, and in relation to the total differential of the first-order condition of the social welfare to be maximized, i.e., $SW_\tau=0$, we can obtain the following results for the comparative statics analysis:

$$\frac{\partial \tau^*}{\partial t}=-\frac{SW_{\tau t}}{SW_{\tau\tau}} \quad (12)$$

Where the denominator in the above equation $SW_{\tau\tau}<0$, and because of the second-order condition of social welfare to be maximized, therefore

$$sign\left(\frac{\partial \tau^*}{\partial t}\right)=sign(SW_{\tau t}) \quad (13)$$

As shown in Mathematical Appendix 1 at the end of this paper, we can derive,

$$SW_t=\frac{\theta c_M}{(1-t)^2}\left[SW_\tau-\frac{mVM}{cMp'}\right] \quad (14)$$

Therefore, by partially differentiating the above equation with respect to τ, we obtain,

$$SW_{\tau t}=SW_{t\tau}=\frac{\theta c_M}{(1-t)^2}\left[SW_{\tau\tau}+\frac{mVM}{cM}\frac{p''}{(p')^2}\frac{\partial Q}{\partial \tilde{c}_M}\right] \quad (15)$$

By combining equations (12) and (15) we obtain:

$$\frac{\partial \tau^*}{\partial t}=-\frac{\theta c_M}{(1-t)^2}\left(1+\frac{mVM}{cM}\frac{p''}{(p')^2}\frac{\partial Q}{\partial \tilde{c}_M}\frac{1}{SW_{\tau\tau}}\right) \quad (16)$$

From the above equation we know that, when θ=0, $\partial\tau^*/\partial t=0$, indicating that when the tax system is not distorted (i.e., it is a profits tax system), the size of the manufacturers' tax burden will not influence the formulation of the optimal export trade policy. This is perhaps one of the important factors within the tax system that the traditional literature on the optimal export trade policy neglects. When θ≠0, the sign of $SW_{\tau\tau}$ must then hinge upon the positive and negative signs within the parentheses on the right-hand side of equation (15) and other such equations, where $V_M=\Sigma(c_i-c_m)^2/m>0$ and $SW_{\tau\tau}<0$. Since we know from equation (8) that $\partial Q/\partial c_M<0$, the positive and negative signs within the parentheses depend upon whether p" is positive or negative, i.e., on the market inverse demand function's concavity, as well as on the differences in the home country manufacturers' cost structures. In what follows, we discuss the differences in the home country manufacturers' cost structures.

First of all, when the home country manufacturers' cost structures are homogeneous (or there is a single home country manufacturer), VM=0. Therefore, $\partial\tau^*/\partial t=-\theta c_M/(1-t)^2<0$ indicates that, in such a situation, no matter how concave the market inverse demand function is, there will exist a mutually substitutive relationship between the tax policy and the export tax policy, i.e., when the exogenous corporate tax rate increases, if the optimal export trade policy is an export tax (subsidy), then the export tax rate (subsidy rate) will decrease (increase). It is worth noting that the export tax rate τ represents that part of the increase in the home country manufacturers' average marginal cost due to the levying of the export tax. Therefore, if we make $\theta c_M t/(1-t)\equiv \bar{t}$, then $\bar{t}$ represents that part of the increase in the home country manufacturers' average marginal cost due to the levying of the corporate tax. For this reason $d\bar{t}=\theta c_M dt/(1-t)^2$ then represents the minimal change in the home country manufacturers' average marginal cost from levying the corporate tax, and so we can also infer that $\partial\tau^*/\partial\bar{t}=-1$. This result indicates that, under these circumstances, there must be a mutually substitutive relationship between the tax policy and the export tax policy, and that these two policies will cause the sizes of the changes in the home country manufacturers' average marginal costs to be the same, so that after the policy is implemented, the home country's average marginal cost will not change.

Proposition 1: When the home country manufacturers' cost structures are homogeneous or there is a single home country manufacturer, there must be a mutually substitutive relationship between the tax policy and the export tax policy, i.e., when the exogenous corporate tax rate increases, if the optimal export trade policy is an export tax (subsidy), then the export tax rate (subsidy rate) will fall (rise). Moreover, these two policies will cause the sizes of the changes in the home country manufacturers' average marginal costs to be the same.

Because under a Cournot-Nash quantity competition the market equilibrium hinges upon the home country and foreign country manufacturers' average marginal costs after the policy (assuming that the cost structure is one where marginal costs are fixed), when the average marginal costs of the home country and foreign country manufacturers do not change, the market equilibrium will also remain

constant, and so from the results obtained from Proposition 1 we can very easily infer the following corollary:

Corollary 1: Under the situation where the home country manufacturers' cost structures are homogeneous or there is a single home country manufacturer, the introduction of a corporate tax system will not change the output quantities of the home country and foreign country manufacturers, or the market equilibrium price and equilibrium quantity.

Secondly, we consider the situation where the home country manufacturers' cost structures are heterogeneous. When the home country manufacturers' cost structures are different, indicating that $V_M > 0$, then whether the sign within the parentheses on the right-hand side of equation (15) is positive or negative depends on the concavity of the market's inverse demand function, i.e., the sign of p''. When $p'' \geq 0$, then $SW_{\tau t} < 0$; when $p'' < 0$, because $SW_{\tau\tau} < 0$, as long as the absolute value of p'' is not too large (the market inverse demand function cannot be too concave), then $SW_{\tau t} < 0$. In addition, even if the absolute value of p'' is very large, as long as V_M / c_M is sufficiently low, $SW_{\tau t}$ can still be negative. In particular, when V_M / c_M approaches zero, regardless of how concave the market's inverse demand function is, as long as the stability conditions can be established (i.e., the function cannot be too convex),[13] then the tax policy and the export tax policy will be substitutes for each other. By summing up the above analysis, we can draw the following conclusion:

Proposition 2: Under the situation where the home country manufacturers' cost structures are heterogeneous, as long as the market demand curve is sufficiently concave and the coefficient of variation of the home country manufacturers' costs sufficiently large, the tax policy and the export tax policy will exhibit complementarity. In other words, as long as the market demand curve is not too concave, or the coefficient of variation of the home country manufacturers' costs is sufficiently low, the tax policy and the export tax policy will exhibit substitutability.

In addition, if equation (16) is rewritten as follows:

$$\frac{\partial \tau^*}{\partial t} = -\left(1 + \frac{m V_M}{c_M} \frac{p''}{(p')^2} \frac{\partial Q}{\partial \tilde{c}_M} \frac{1}{SW_{\tau\tau}}\right) \quad (16)$$

the left-hand side of the above equation represents the influence of a change in the corporate tax rate that results in the change in the home country manufacturers' average marginal cost on the optimal export tax rate. We can go further and obtain the following result:

$$-\frac{\partial \tau^*}{\partial t} \begin{matrix} > \\ = \\ < \end{matrix} 1 \quad \Leftrightarrow \quad p'' \begin{matrix} > \\ = \\ < \end{matrix} 0 \quad (17)$$

Proposition 3: Under the situation where the home country manufacturers' cost structures are heterogeneous, when the markets' inverse demand function is a convex (linear, concave) function, after introducing the corporate tax system, the way in which the export trade policy responds will cause the extent of the decrease in the home country manufacturers' average marginal cost to be larger (equal to, smaller) than the extent of the increase in the home country manufacturers' average marginal cost after levying the corporate tax.

From the results obtained based on this Proposition we know that, under the situation where the home country manufacturers' cost structures are heterogeneous and the optimal trade policy, when the market's inverse demand function is a convex (linear, concave) function, after introducing the corporate tax system, the home country manufacturers' average marginal cost will decrease (remain constant, increase). From this result, we can very easily infer the following corollary:

Corollary 2: Under the situation where the home country manufacturers' cost structures are heterogeneous, when the market's inverse demand function is a convex (linear, concave) function, after bringing in the corporate tax system, the market's equilibrium price will decrease (remain constant, increase), and the equilibrium quantity will increase (remain constant, decrease).

The economic meaning of the above Proposition is explained as follows. From equation (4) we know that regardless of whether the corporate tax policy or the export tax trade policy is implemented, both will influence the home country manufacturers' policies by increasing their EMCs. For this reason, these two kinds of policies can frequently serve as substitutes for each other. In the case where the home country manufacturers have a homogeneous cost structure, a change in the tax policy or trade policy will not give rise to the allocative production efficiency effect that Long and Soubeyran [2] refer to in their paper. Therefore, when the exogenous corporate tax rate is increased, the home country industry's average cost will correspondingly increase, thereby causing the trade policy to deviate from the optimal policy. In order to respond to this change, the optimal export trade policy will bring about a decrease in the export tax rate in order to make up for this lack, thereby indicating that these two policies are perfect substitutes for each other. Under the situation where the home country manufacturers' cost structures are heterogeneous, the change in the tax policy or the trade policy will give rise to what Long and Soubeyran [2] in their paper refer to as the allocative production efficiency effect, and this effect will be related to the concavity of the market's inverse demand function, i.e., when the market's inverse demand function is a concave (convex) function, the amount by which the manufacturers' costs increase will cause the extent to which the quantities of output of manufacturers with relatively low costs decrease to be smaller (larger) than that in the case of the manufacturers with relatively high costs, and therefore the home country industry's allocative production efficiency will increase (decrease) [see Long and Soubeyran [2], Proposition 3]. For this reason, when the exogenous corporate tax rate increases, the home country industry's average cost will correspondingly increase. If the trade policy purely responds to this change, then it will surely bring about a decrease in the extent of the export tax rate. However, because the home country's manufacturers have heterogeneous cost structures, the adjustment in the export tax rate will give rise to an additional allocative production efficiency effect, and for this reason the extent of the decrease in the export tax rate will be affected. When the market inverse demand function is a convex function, a decrease in the export tax rate is able to increase the allocative production efficiency, and for this reason the extent of its decrease will be greater than the production efficiency effect where there is no such allocation, and so the export tax rate will only decrease and will not be able to increase. In other words, the situation where both the corporate tax rate and the export tax rate simultaneously increase will not arise.

In addition, when the market's inverse demand function is a concave function, the decrease in the export tax rate will reduce the

[13] The stability condition is $Q_p''+(m+m^*+1)p'<0$, and so the market's inverse demand function also cannot be too convex.

allocative production efficiency, and for this reason the extent of the decrease will be smaller than in the case of the production efficiency effect without allocation. In particular, when the coefficient of variation (V_M/c_M) in relation to the costs of the home country's manufacturers is sufficiently high or the market's inverse demand function is sufficiently concave (corresponding to a significantly high home country industry's degree of market concentration), the increase in the allocative production efficiency effect brought about by the increase in the export tax rate will be sufficient to make up for the other welfare effects.[14] Such an effect will result in the export tax rate not falling but rather rising, and so this will cause the tax policy and the export tax policy to have a complementary and not substitutive relationship. Summing up the above analysis, as long as the coefficient of variation (V_M/c_M) in relation to the home country manufacturers' costs is sufficiently low, or else the market's inverse demand function is not too concave, the situation where the corporate tax policy and the export tax policy exhibit a complementary relationship can be avoided.

Using linear demand as an example, when the third country's market demand is linear (p"=0), the first-order condition for equation (11) can be simplified as follows:

$$\frac{t\theta c_M}{1-t}+\tau^*=\frac{m-m^*-1}{m}(p-c_M) \quad (18)$$

Where $t\theta c_M/1-t$ represents the amount by which the home country industry's average marginal cost increases as a result of levying the corporate tax. What is particularly worth noting is that, even if p among the items on the right-hand side of equation (18) includes τ*, this equation is an implicit function and not an explicit function. However, by means of the relationship resulting from Q being a function of $\tilde{c}_M$ and c_M^*, we can further infer that $t\theta c_M/1-t+\tau^*$ is a function of cM, c_M^*, m, and m*. This result indicates that when the corporate tax rate causes the industry's average cost to increase by one unit, τ* will decrease by one unit in response. That is to say, the tax policy and the export trade policy will be substitutes for each other, and moreover these two policies will adjust the industry's average cost by the same amount, but the direction will be reversed. This will be because, when the market demand is linear, the change in the trade policy will not give rise to the allocative production efficiency effect referred to above (because the extent of the increase in the manufacturers' costs will not change the differences in the output quantity levels among the manufacturers), and thus when the exogenous corporate tax rate increase causes the home country industry's average cost to correspondingly increase, responding to this changing trade policy will bring about a decrease in the amount by which the export tax rate changes. What is particularly worth noting, and also differs from the situation mentioned earlier where the home country's manufacturers' cost structures are homogeneous, is that even if at this time these two policies are adjusted by the same amount, increasing the corporate tax rate by the means of the tax policy will still be able to increase social welfare, the main reason for this being that the corporate tax policy, compared with the traditional export trade policy, will also give rise to the HI referred to by Fevrier and Linnemer [1] above, for the HI can cause the degree of concentration in the home country's industry to increase, which in turn will increase the level of social welfare [see the explanation given for Proposition 4 later in this paper]. For this reason, when looked at from the point of view of social welfare, these two policies are not characterized by a completely substitutive relationship.

In addition, it is particularly obvious that when θ=0, or t=0, from equation (18) the following result can be inferred:

$$\begin{matrix} > & & > \\ \tau^*=0 \Leftrightarrow & m-m^*-1=0 & (19) \\ < & & < \end{matrix}$$

Which is the result obtained in the traditional literature. That is, when the number of home country manufacturers is larger than the corresponding number of foreign country manufacturers, and is more than one, a reduction in the home country manufacturers' quantity of output can increase their average profits, in which case the optimal export trade policy will be to levy an export tax. When the number of home country manufacturers is one more than the corresponding number of foreign country manufacturers, increasing the quantity of output of the home country manufacturers will not influence their average profits, and the optimal export trade policy will be free trade. When the number of home country manufacturers is smaller than the corresponding number of foreign country manufacturers, then increasing the quantity of output of the home country manufacturers will be able to increase their average profits, and for this reason the optimal export policy will be an export subsidy [see Gaudet and Salant [5], Long and Soubeyran [2]]. In addition, if we interpret the right-hand side of equation (18) as the overall effect of the policy (while at the same time including the tax policy and the export trade policy), when the overall effect of this policy is positive it will signify a tax, and if it is negative it will signify a subsidy. We can then modify the result obtained in the traditional literature, namely, when the number of the home country manufacturers is greater than the number of foreign country manufacturers, and exceeds one, the reduction in the quantity of output of the home country manufacturers will on the contrary be able to increase their average profits, in which case the optimal policy should be to cause the overall effect to be positive. By contrast, if the number of home country manufacturers is smaller than that of the foreign country manufacturers, then increasing the quantity of output of the home country manufacturers will be able to increase their average profits. For this reason, the optimal policy should cause the overall effect to be negative. What is particularly worth noting is that, when the overall effect is negative, the optimal τ* will definitely be negative; however, when the overall effect is positive, the optimal τ* may be positive, or else it may be negative. What this result implies is that, when the tax effect is sufficiently strong, and when the number of home country manufacturers is greater than the number of foreign country manufacturers, and is more than just one manufacturer, the optimal export trade policy is likely to revert to an export subsidy (i.e.,

[14] Other effects such as the profit-shifting effect, etc., are also related to the number of manufacturers. For example, under the situation where the tax problem and the cost difference have been traditionally neglected, when the number of home country manufacturers is one more than the number of foreign country manufacturers, a reduction in the quantity of output will increase the home country manufacturer's average profits, and then the optimal export policy will be to levy an export tax. On the contrary, if the number of home country manufacturers is greater than the number of foreign country manufacturers but less than one, then increasing the quantity of output will be able to increase the home country manufacturers' average profits, and for this reason the optimal export policy will be an export subsidy.

τ^* is likely to be negative).[15] Similarly, if the number of the home country manufacturers is less than the number of foreign country manufacturers, then the optimal export trade policy will still be an export subsidy.

Finally, Proposition 2 has the following policy implications. According to the design of this paper, the tax policy and export tax policy are substitutes for each other, and for this reason, after the corporate tax system is introduced, the optimal export trade policy will tend towards a practical subsidy policy. That is to say, if under the traditional setup the tax problem is ignored, the optimal export trade policy will be a subsidy (tax), and then taking into consideration the tax problem will cause the subsidy rate to increase (and the tax rate to decrease). What is relatively interesting is that from this Proposition we can draw the following conclusion:

Corollary 3: If the tax problem is taken into consideration, when the effect of the tax policy is sufficiently strong, then the optimal export trade policy will be likely to revert from an export tax to an export subsidy.

From the above analysis we can learn that, under a corporate tax system, the size of the corporate tax rate will affect the formulation of the optimal export trade policy. However, what arouses our curiosity even more is whether or not, under an optimal export trade policy, the increase in the corporate tax rate (i.e., the increase in the home country manufacturers' tax burden) will inevitably reduce social welfare. In what follows, this issue will be discussed in further depth.

In order to understand the impact of a change in the corporate tax rate on the level of social welfare in the home country, we obtain the result of the comparative statics analysis for exogenous variable t in relation to $SW(\tau^*;t,\theta)$. From the envelope theorem and equation (14) we can obtain the following result:

$$\frac{\mathrm{dSW}}{\mathrm{dt}} = SW_\tau \frac{d\tau^*}{dt} + SW_t = SW_t = -\frac{\theta m V_M}{p'(1-t)^2} \quad (20)$$

This result arises because, under the optimal export trade policy, the first-order effect of a minimal change in the export tax rate will be zero, i.e., $SW_\tau=0$. From this we know that, as long as the tax system is distorted ($\theta\neq0$), or there are differences in the home country manufacturers' costs ($V_M>0$), equation (20) will be greater than zero, indicating that when there are differences in the home country manufacturers' costs, under the corporate tax system's optimal export trade policy, increasing the home country manufacturers' tax burden can enhance social welfare. This result shows that the tax policy and the export trade policy are substitutes for each other, but that they are not perfect substitutes. However, when the manufacturers' cost structures are homogeneous, or else there is only one home country manufacturer (i.e., $V_M=0$), equation (20) is equal to zero, indicating that increasing at this time the home country manufacturers' tax burden is unable to enhance social welfare. This result reflects the perfect substitutability that exists between the tax policy and the export trade policy, indicating that the increase in the corporate tax rate or the tax burden can be fully replaced by the reduction in the export tax.

Proposition 4: When the home country manufacturers' costs are different, under the optimal export trade policy, increasing the home country manufacturers' tax burden can enhance social welfare. When the manufacturers all have homogeneous cost structures, or else there is only one home country manufacturer, increasing the home country manufacturers' tax burden cannot enhance social welfare.

The economic implication of Proposition 4 is that, under the situation where the home country manufacturers' costs are different, even if the tax policy and the export policy have certain degrees of substitutability with each other in terms of their influence on the home country manufacturers' output policies, because of the AI arising from bringing in the corporate tax system, under the optimal trade policy this will be offset by the AI of the trade policy. For this reason, because of the influence of the corporate tax system that has been brought in on the social welfare level, in the end only the HI will remain. As mentioned above, the corporate tax system's HI will cause the EMCs of the home country manufacturers with higher costs to increase more sharply, thereby causing the home country manufacturers' degree of industrial concentration to increase, i.e., Long and Soubeyran's [2] so-called allocative production efficiency effect, an effect that will be beneficial to the enhancement of the home country's social welfare level. What is particularly worth noting is that, when the manufacturers' cost structures are all homogeneous, or else there is only one home country manufacturer, the home country manufacturers' marginal cost variance will be zero. At this time, social welfare will not be able to be enhanced by increasing the tax burden. This result will arise because the manufacturers' cost structures are all homogeneous, or else there is only one home country manufacturer. The tax policy and the trade policy are truly fully substitutable, and thus the equilibrium under the uniform tax rate's optimal export policy has already reached the first best solution. For this reason, by increasing the tax burden it is not possible to enhance social welfare. In addition, if the given corporate tax rate is t, by solving for the value of $\frac{\mathrm{dSW}}{\mathrm{d}\theta}$, a similar result can also be obtained:

$$\frac{\mathrm{dSW}}{\mathrm{d}\theta} = SW_\tau \frac{d\tau}{d\theta} + SW_\theta = SW_\theta = -\frac{tmV_M}{(1-t)p'} > 0, \quad (21)$$

This result indicates that strategically increasing the distortion can increase social welfare. In other words, if the prevailing home country tax system is a profits tax system, then the tax system will be transformed from a profits tax system into a distorted corporate tax system (by allowing certain production costs to not be able to be expensed, the tax system will become distorted), and at this time the social welfare will on the contrary increase.

Proposition 5: When there are differences in the costs of the home country manufacturers, under the optimal export trade policy, strategically increasing distortion can enhance social welfare. When the manufacturers' cost structures are homogeneous, or there is only one home country manufacturer, strategically increasing the distortion cannot enhance social welfare.

This proposition indicates that, even if the corporate tax system distorts the home country manufacturers' output policy, the profits tax system will be neutral in relation to the output policy. However, when there are differences in the home country manufacturers' costs, if the export trade policy can at the appropriate time be implemented, then the social welfare under the corporate tax system will on the contrary

[15] The result more commonly seen is that where the optimal export policy reverts from an export tariff to an export subsidy. For example, Eaton and Grossman [12] bring into play the so-called price competition. Neary [13], Collie [14], and Wang and Tsai [15] introduce the marginal social cost derived by the export subsidy policy, etc.

be higher than the social welfare under the profits tax system. Similarly, when the manufacturers' cost structures are homogeneous, or there is only one home country manufacturer, the equilibrium under the optimal trade policy will already be the most preferred result, and for this reason introducing tax distortion will be incapable of increasing social welfare, and so at this time there will already be no room for strategic distortion.

To sum up, based on the structure of this paper and given the optimal export trade policy, by increasing the manufacturers' tax burden at this time, or else transforming the tax system from a profits tax system to a distortionary corporate tax system (i.e., by making the tax system distortionary), the home country industry's allocative production efficiency can be enhanced, and for this reason social welfare will on the contrary increase. In other words, under the original situation where the most preferred state has not been reached, we can sacrifice the individual manufacturer's production efficiency (the principle of the divergence of output from pretax marginal revenue being equal to the marginal cost). Using the corporate tax system to levy tax will cause the manufacturers' cost difference to expand, thereby increasing the home country industry's degree of concentration and promoting social welfare.

Conclusion

The traditional strategic trade literature neglects the influence of the tax system on trade policy, and because of this, this paper establishes an economic model that incorporates a tax system. Under the situation where the manufacturers face different costs, this paper discusses the resulting influence of tax policy and tax evasion on trade policy. In accordance with the design of this paper, we make several important discoveries. First of all, in the case where the home country manufacturers' cost structures are homogeneous or there is a single home country manufacturer, the tax policy and the export tax policy will of course be mutually substitutive, i.e., when the exogenous corporate tax rate increases, if the optimal export trade policy is an export tax (subsidy), then the export tax rate (subsidy rate) will decrease (increase), and the extent of the change in the home country manufacturers' average marginal cost brought about by these two policies will be the same. In the case where the home country manufacturers' cost structures are heterogeneous, as long as the market demand curve is sufficiently concave, and the coefficient of variation of the home country manufacturer is sufficiently large, the tax policy and the export tax policy will complement each other. In other words, as long as the market demand curve is not too concave, or the coefficient of variation of the home country manufacturer is sufficiently low, the tax policy and the export tax policy will be substitutes for each other. What this means is that, when the optimal trade policy is an export subsidy, the subsidy rate will be higher than that in the traditional literature, and the higher the tax rate or the tax burden, the higher will be the optimal export subsidy rate. When the optimal trade policy is an export tax, the tax rate will be lower than that in the traditional literature.

Secondly, in the case where the home country manufacturers' cost structures are heterogeneous, when the market's inverse demand function is a convex (linear, concave) function, after the corporate tax system is introduced, the home country manufacturers' average marginal cost will decrease (remain constant, increase). This result will cause the market equilibrium price to decrease (remain constant, increase), and the equilibrium quantity will increase (remain constant, decrease). Finally, when the home country manufacturers' costs are different, under the optimal export trade policy, strategically distorting the tax system, or else increasing the manufacturers' tax burden, may enhance social welfare; when the manufacturers' cost structures are homogeneous, or there is only one home country manufacturer, then regardless of whether the tax system's distortion is strategically increased, or the manufacturers' tax burden is increased, social welfare will not be able to be enhanced. What is particularly interesting here is that it is generally believed that increasing the tax levied on the manufacturers will lower the manufacturers' competitiveness, and therefore this will violate increasing the tax imposed on the manufacturers or cancel their preferential treatment. However, according to the findings of this study, increasing the manufacturers' tax burden will not necessarily reduce social welfare [16].

This point can be looked at from two levels for further explanation. First of all, when looked at in terms of the foreign country's profits effect, when the tax system is neutral in regard to the manufacturers' output policy, a higher or lower tax rate will not change the manufacturers' production strategy, and will not influence their export competitiveness. Secondly, if the tax system is not neutral towards the manufacturers' output policy, even if increasing the tax rate (i.e., increasing the manufacturers' tax burden) reduces the home country manufacturers' share of the export market, increasing the tax rate will be able to expand the differences in cost between the manufacturers [17]. This result will in turn increase the degree of concentration in the home country's industry, and will thereby enhance social welfare. For this reason, even if raising the tax reduces the manufacturers' competitiveness, thereby causing the home country manufacturers' output to decrease, when considered from a social welfare viewpoint, it is necessary to increase the tax levied on the manufacturers. This result may be able to provide policy-makers with something new to think about. Finally, the tax policy adopted in this paper is an exogenous variable. Endogenizing the tax policy could serve as a direction for future research.

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