# The Normative Efficiency Ranking of Output and Export Subsidies under Costly and Imperfect Enforcement

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**Abstract**

*This paper builds on the literature on agricultural policy analysis under costly and imperfect enforcement by analyzing the effect of enforcement costs and noncompliance on the relative transfer efficiency of output and export subsidies. Analytical results show that, in addition to changing the incidence of output and export subsidies, relaxing the assumption of perfect and costless enforcement found in the traditional analysis of these policy instruments can affect their relative efficiency in transferring income to producers. The effect of enforcement issues is shown to depend on the way export subsidies are being administered and the size of the exporting country.*

**Key words**: *Agricultural policy, export subsidies, output subsidies, enforcement, noncompliance, transfer efficiency*

## Introduction

Traditional analysis of farm subsidies takes place under the assumption that farmers comply fully with the provisions of the programs, or alternatively, that policy enforcement is perfect and costless. In such a world, the welfare effects and the efficiency of output and export subsidies in transferring income to producers depend on market conditions, the production share consumed domestically, the deadweight losses from taxation, and the level of government intervention in agriculture (see Gardner 1983, 1987, 1995; Alston, Carter and Smith 1993, 1995).

Policy enforcement is not costless, however, and, as far as government programs are concerned, it is far from being perfect (Giannakas, 1998). When imperfect enforcement generates adverse economic incentives, full compliance with program provisions is by no means assured. Under an output or an export subsidy scheme, for instance, subsidy recipients might find it beneficial to misrepresent their production or exports and collect government payments on greater quantities than those actually produced or exported.

Giannakas (2003) and Giannakas and Fulton (2000a, 2000b) relax the unrealistic assumption of perfect and costless enforcement found in the traditional analysis of output and export subsidies and analyze the effects of introducing enforcement costs and noncompliance into the economic analysis of these policy instruments. A key result of these studies is that the economic effects of enforcement costs and noncompliance are policy-

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specific. For instance, while the efficiency in redistribution[1] of output subsidies increases with the extent of farmer noncompliance, the effect of enforcement costs and misrepresentation on export subsidies depends on the way the policy is implemented. In particular, while the explicit consideration of enforcement issues reduces the transfer efficiency of export subsidies when those are paid to trading firms, it increases the transfer efficiency of export subsidies paid directly to the producers of the regulated commodity.

An important implication of these results is that enforcement costs and misrepresentation alter the relative transfer efficiency of output subsidies and export subsidies paid to trading firms. Since enforcement issues increase the transfer efficiency of output subsidies while reducing the transfer efficiency of export subsidies paid to trading firms, they increase the relative efficiency of output subsidies in redistributing income in the economy. This is quite significant as it implies that accounting for costly and imperfect enforcement increases the likelihood that an all-or-nothing policy choice between output subsidies and export subsidies paid to trading firms will favor the former.

The effect of enforcement issues on the relative transfer efficiency of output subsidies and export subsidies paid to producers of the subsidized commodity are far from obvious, however. The reason is that the incorporation of enforcement costs and noncompliance into the economic analysis of these policies results in both policies being more efficient means of income redistribution than it is traditionally believed.

The objective of this paper is to analyze the ramifications of enforcement costs and farmer noncompliance for the relative transfer efficiency of output subsidies and export subsidies paid to the producers of the subsidized commodity. Thus, in what follows the term "export subsidies" will refer to "export subsidies paid to producers." To assess the relative efficiency in redistribution of the two policies under costly and imperfect enforcement, we review the economic causes of noncompliance with the terms of the output and export subsidy schemes and the consequences of this noncompliance for the welfare effects of the policy instruments and their efficiency in redistributing income to producers.

The rest of the paper is as follows. The next section reviews the economic causes of farmer noncompliance and its consequences for the welfare effects of output and export subsidies. The section following analyzes the effects of enforcement costs and misrepresentation on the transfer efficiency and the normative ranking of these policy mechanisms. The final section summarizes and concludes the paper.

## Producer Noncompliance and Welfare Implications

### *Producer Noncompliance under Output and Export Subsidies*

When a subsidy scheme is in effect with subsidies linked to the output produced or to the output exported farmers might find it beneficial to misrepresent the quantity that is eligible for government payments and collect subsidies on phantom production or exports. Assuming that farmers know the level of the (output or export) subsidy, the penalty in case they are found in noncompliance, and the probability that they will be detected, their problem can be viewed as decision making under uncertainty. In particular, an individual farmer has the choice between a certain outcome (i.e., his profits if he adheres to the terms of the subsidy program) and an expected payoff associated with mis-

representation of production or exports. In the simplest case, consider a risk-neutral farmer that decides on the quantity to produce and the quantity to misrepresent. The problem of the representative farmer can be written as:

$$\max_{q_t,\, q_m} E[\Pi] = (p_w + v)\, q_t - c(q_t) + \left[(1-\delta)v - \delta\rho\right] q_m \qquad (1)$$
$$s.t.\ q_m \geq 0$$

where $q_t$ is the quantity produced; $q_m$ is the quantity reported as eligible for government payments over and above the quantity produced in the case of output subsidies or the quantity exported in the case of export subsidies; $p_w$ is the world price of the subsidized commodity; $v$ is the per unit (output or export) subsidy that makes up the difference between some domestic "target" price $p_t$ and the lower world price $p_w$; $c(\bullet)$ is the cost function; $\rho$ is the penalty per unit of misrepresented and detected quantity; and $\delta$ is the probability that the farmer will be detected (and penalized) in case he cheats on the farm programs.

Following Giannakas (2003) and Giannakas and Fulton (2000a, 2000b), the detection probability takes values between zero and one and is assumed to be a linear function of the quantity misrepresented i.e., $\delta = \delta_0 + \delta_1 q_m$. The parameter $\delta_0$ reflects the probability that a farmer will be audited and is a function of the resources spent by policy enforcers in monitoring producers, $\Phi$, with $\delta_0^{'}(\Phi) \geq 0$ and $\delta_0^{''}(\Phi) \leq 0$. The slope of the detection probability function, $\delta_1$, is strictly positive and exogenous to policy enforcers. The parameter $\delta_1$ is assumed to depend on the observability of farmers' actions by third parties and the social attitudes towards producer noncompliance, i.e., the extent to which a third party that observes the illegal behavior will report it to policy enforcers.

The problem specified in equation (1) is a simple, static optimization problem with a non-equality constraint. The objective function of the representative farmer consists of the profits from farming in the presence of the (output or export) subsidy program, $\pi_f = (p_w + v)q_t - c(q_t)$, and the expected benefits of misrepresentation, $EB_c = vq_m - \delta(v+\rho)q_m$. The non-equality constraint requires that the quantity misrepresented should be non-negative – profit-maximizing producers should not under-report the quantity that is eligible for payments.[2]

Solving the optimality conditions for $q_t$ shows the standard result that the quantity produced is determined by the equality of the price received by producers with the marginal cost of production i.e.,

$$p_w + v = c'(q_t) \qquad (2)$$

Regarding the quantity misrepresented, $q_m$, the Kuhn-Tucker conditions indicate that noncompliance decisions depend on the subsidy $v$ and the enforcement parameters $\delta_0$ and $\rho$. Specifically, if $\delta_0 < \frac{v}{v+\rho}$ the optimal $q_m$ is determined by equating the ratio $\frac{v}{v+\rho}$ and the marginal penalized output (*mpo*),[3] i.e.,

$$\frac{v}{v+\rho} = \delta_0 + 2\delta_1 q_m \tag{3}$$

The optimal quantity to misrepresent, $q_m$, is determined graphically by the intersection of a horizontal line at $\frac{v}{v+\rho}$ and line *mpo* in Figure 1. The shaded area in this Figure illustrates the expected benefits from misrepresentation, $EB_c$. $EB_c$ and $q_m$ are both positive whenever $\delta_0$ is lower than $\frac{v}{v+\rho}$. If, on the other hand, $\delta_0 \geq \frac{v}{v+\rho}$ the expected costs from noncompliance outweigh the expected benefits and producers will find it optimal to truthfully report their production or exports (i.e., $q_m = 0$).

Mathematically, the optimal quantity to misrepresent when $\delta_0 < \frac{v}{v+\rho}$ is given by:

$$q_m = \frac{v - \delta_0(v+\rho)}{2\delta_1(v+\rho)} \tag{4}$$

while the total quantity misrepresented by *N* producers of the subsidized commodity is:

$$Q_m = Nq_m = \frac{v - \delta_0(v+\rho)}{2\delta_1'(v+\rho)} \quad \text{where} \quad \delta_1' = \frac{\delta_1}{N} \tag{5}$$

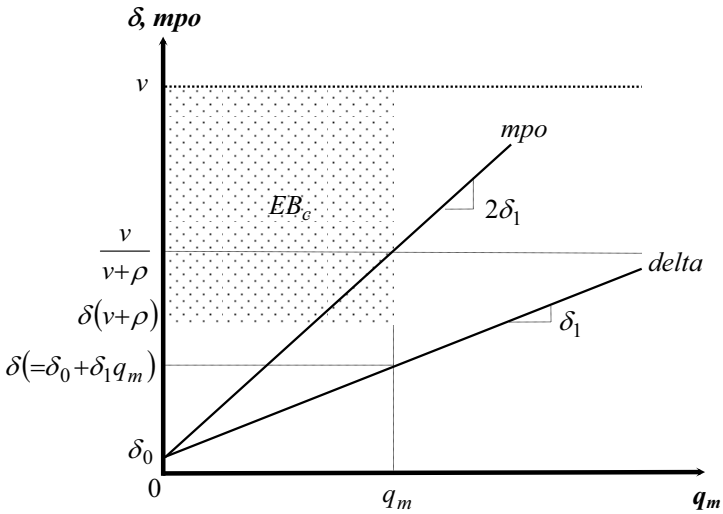


**Figure 1.** Equilibrium misrepresentation on output and export subsidies

Panels (a) and (c) of Figure 2 graph the determination of the total quantity misrepresented under an output subsidy, $Q_m^{os}$, and an export subsidy, $Q_m^{es}$, respectively, while Panel (b) of the same figure depicts the determination of the world price under the two subsidy schemes. Note that Figure 2 illustrates the case of a large country where output and export subsidies are set so that the same surplus is transferred to producers through the market effects of the policies, i.e., the same domestic "target" price $p_t$ is achieved under both policy regimes.[4]

The aggregate misrepresentation is determined by the intersection of a horizontal line at $\frac{v}{v+\rho}$ with the relevant *MPO* curve when they are graphed relative to the origins of *O* in Panels (a) and (c) of Figure 2. The *MPO* curves are the horizontal summation of the individual farmers' *mpo* curve in Figure 1. Consistent with *a priori* expectations, $Q_m$ increases with an increase in the (output or export) subsidy payment and decreases with an increase in the detection probability and per unit penalty parameters.

*Welfare Effects of Producer Noncompliance*

When the combination of the policy variable and the enforcement parameters is such that $Q_m > 0$, the traditional analysis of the policy instruments fails to consider the aggregate expected benefits from misrepresentation to producers, $\left[v-\delta\left(v+\rho\right)\right]Q_m$. These benefits come at the expense of taxpayers and are shown by the (shaded) areas $EB_c^{os}$ and $EB_c^{es}$ in Panels (a) and (c) of Figure 2, respectively.

It is important for the subsequent analysis to emphasize that both the extent of misrepresentation and the producer benefits from noncompliance may differ under the two subsidy schemes. The reason is that the level of the subsidy that achieves a given domestic producer price, $p_t$, is always greater under an export subsidy when the domestic country faces a downward sloping export demand curve (i.e., $v^{es}\left(=p_t-p_w^{es}\right) > v^{os}\left(=p_t-p_w^{os}\right)$).

The reasoning for $v^{es} > v^{os}$ is as follows. Due to the reduced domestic consumption under an export subsidy, the quantity exported to the world market is greater than that under an output subsidy scheme (compare $E^{es}$ with $E^{os}$ in Figure 2). The increased quantity exported to the world market when the large country subsidizes exports (rather than output) means that the world price has to be reduced more than would be "required" for the market to clear if an output subsidy was in effect (i.e., $p_w^{es} < p_w^{os}$). Lower world price under an export subsidy translates into a higher subsidy needed to achieve the targeted producer price in the domestic market.

The relatively higher export subsidy results then in increased economic incentives to noncompliance; both $Q_m$ and $EB_c$ are greater when a large country subsidizes exports rather than output (i.e., $Q_m^{es} > Q_m^{os}$ and $EB_c^{es} > EB_c^{os}$ where $Q_m^{es} = \frac{v^{es}-\delta_0\left(v^{es}+\rho\right)}{2\delta_1^{'}\left(v^{es}+\rho\right)}$,

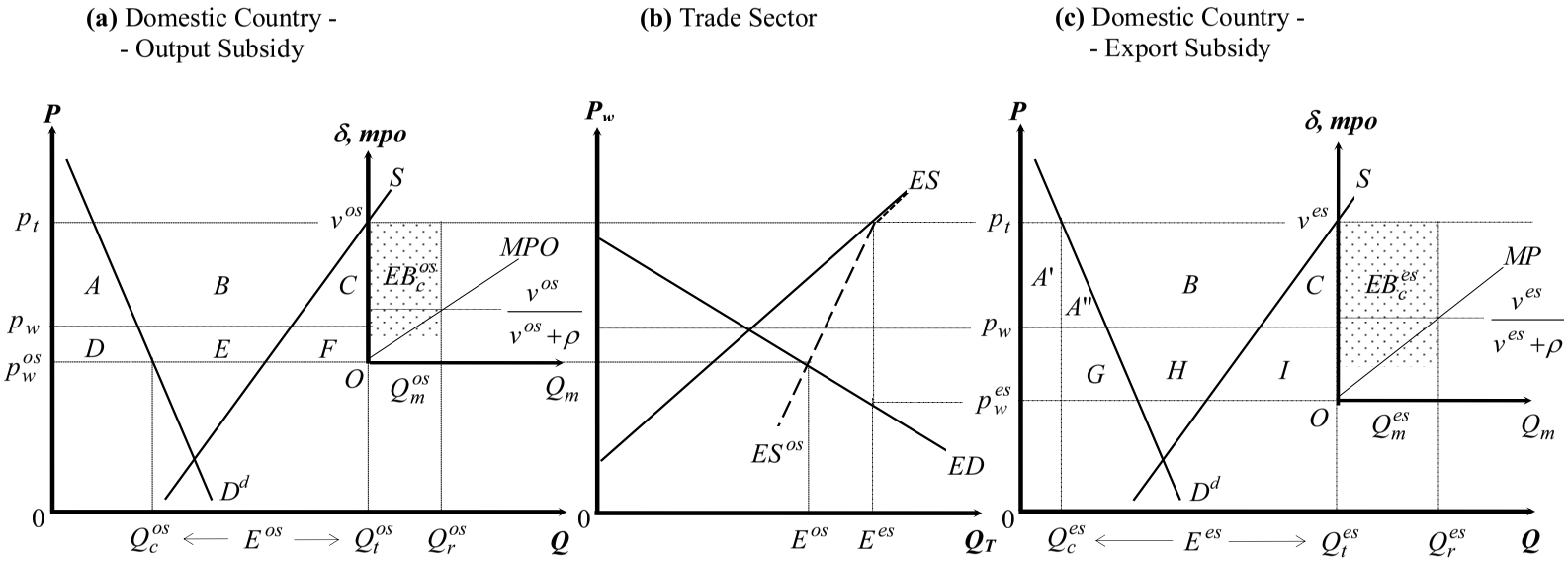


**Figure 2.** The welfare effects of output and export subsidies under costly enforcement and misrepresentation in a large country

$Q_m^{os} = \dfrac{v^{os} - \delta_0\left(v^{os} + \rho\right)}{2\delta_1^{'}\left(v^{os} + \rho\right)}$, $EB_c^{es} = \left[\left(1-\delta\right)v^{es} - \delta\rho\right] Q_m^{es}$, and $EB_c^{os} = \left[\left(1-\delta\right)v^{os} - \delta\rho\right] Q_m^{os}$ ).

Since the transfer to producers through misrepresentation is greater under an export subsidy, when output and export subsidies are set such that the same $p_t$ is achieved under both subsidy schemes the *total* transfer to producers (i.e., transfer through the market plus transfer through misrepresentation) is always greater when an export subsidy is in place (i.e., $\Delta PS_c^{es}\left(= \Delta PS_{pce}^{es} + EB_c^{es}\right) > \Delta PS_c^{os}\left(= \Delta PS_{pce}^{os} + EB_c^{os}\right)$ where $\Delta PS_{pce}^{es} = A' + A'' + B$ and $\Delta PS_{pce}^{os} = A + B$ in Panels (c) and (a) of Figure 2, respectively, with the subscripts *c* and *pce* standing for "cheating" and "perfect and costless enforcement," respectively).

Other than the transfer to producers through misrepresentation, taxpayers also fund the subsidy payments on actual output as well as any costs associated with policy enforcement. The monitoring and enforcement costs, $\Phi\left(\delta_0\right)$, are assumed to be an increasing function of $\delta_0$ (i.e., $\Phi'\left(\delta_0\right) \geq 0$, $\Phi''\left(\delta_0\right) \geq 0$ ) and, even though not present in the stylized Figure 2, need to be included into both the budgetary costs and the deadweight welfare losses (*DWL*) from output and export subsidies.

More specifically, the taxpayer costs under an output subsidy and an export subsidy scheme are given by

$(1+d)[A+B+C+D+E+F+EB_c^{os} + \Phi\left(\delta_0\right)]$ and $(1+d)[A''+B+C+G+H+I+EB_c^{es} + \Phi\left(\delta_0\right)]$,

respectively, where *d* is the marginal deadweight loss from taxation (Ballard and Fullerton 1992), while the deadweight welfare losses from output and export subsidies are

$$DWL_c^{os} = d\left(A + B + D + EB_c^{os}\right) + \left(1+d\right)\left[C + E + F + \Phi\left(\delta_0\right)\right]$$

and $$DWL_c^{es} = d\left(B + EB_c^{es}\right) + \left(1+d\right)\left[A'' + C + G + H + I + \Phi\left(\delta_0\right)\right],$$

respectively.[5] Relative to the situation in a world where policy enforcement is perfect and costless, enforcement costs and misrepresentation increase the *DWL* of output and export subsidies by $dEB_c^{os} + \left(1+d\right)\Phi\left(\delta_0\right)$ and $dEB_c^{es} + \left(1+d\right)\Phi\left(\delta_0\right)$, respectively.

Before concluding this section it should pointed out that our finding that export subsidies result in greater subsidy payments, greater misrepresentation, and greater surplus transfers to producers, holds only for the large country case – this result is not valid in the case of a small open economy. Since, by definition, the small country-exporter of the subsidized commodity faces a perfectly elastic export demand curve, the domestic policy choices have no effect on the world price. The consequence of this is that the subsidy that achieves some (any) given increase in domestic producer price (i.e., $v = p_t - p_w$) is the same no matter if it is the exported surplus or the total production of the small country that is being subsidized. Thus, both the extent of noncompliance and the transfers to producers through misrepresentation are the same under an export subsidy and an output subsidy scheme when those are considered in the context of a small open economy.

**Output Misrepresentation and Transfer Efficiency**

After having analyzed the economic causes of noncompliance and its consequences for the welfare effects of output and export subsidies, this section of the paper examines the effects of enforcement costs and misrepresentation on the transfer efficiency of the policy instruments and their (normative) ranking in terms of their efficiency in redistributing income to producers. The transfer efficiency and the ranking of the policies under "perfect and costless enforcement" are used as benchmarks for the analyses.

*Policy Enforcement and Transfer Efficiency*

The previous analysis indicates that noncompliance decisions depend on the level of the (output or export) subsidy and the detection probability and per unit penalty parameters. Since, however, $\delta_1$ has been assumed exogenous to policy enforcers and since penalties are usually set by the legal system, the only avenues policy makers have for influencing the behavior of farmers is through the choice of $v$ and $\delta_0$.

Specifically, a *ceteris paribus* increase in $\delta_0$ reduces both the quantity misrepresented and the expected benefits from noncompliance (i.e., $\frac{\partial Q_m}{\partial \delta_0} < 0$ and $\frac{\partial EB_c}{\partial \delta_0} < 0$). At the same time the higher $\delta_0$ means increased monitoring and enforcement costs (since $\Phi'(\delta_0) \geq 0$). Similarly, a change in $v$ changes producer surplus in the same direction through the effect of the subsidy on the transfer to producers through the market (i.e., $\frac{\partial \pi}{\partial v} > 0$) and the transfer through misrepresentation (i.e., $\frac{\partial EB_c}{\partial v} > 0$). The change in the subsidy also changes the deadweight losses from (output and export) subsidies in the same direction (i.e., $\frac{\partial DWL_c}{\partial v} > 0$).

The implication of this is that agricultural policy makers can reduce the welfare losses associated with a given transfer to domestic producers by simultaneously reducing $v$ and $\delta_0$. The reasoning is as follows. A lower $v$ reduces the surplus transferred to producers and the welfare losses from the programs (i.e., the *DWL* triangles, the deadweight losses from taxation, and the transfers to foreign consumers of the subsidized commodity). This reduction in producer welfare can nevertheless be compensated by a lower level of monitoring. The lower $\delta_0$ increases output misrepresentation and the transfer to producers through noncompliance while, at the same time, reducing the monitoring and enforcement costs from the program.

Thus, a simultaneous reduction of $v$ and $\delta_0$ can lessen the total welfare losses from the programs while transferring the same surplus to producers. The welfare losses associated with any given income redistribution are minimized (and the transfer efficiency of both output and export subsidies is maximized) when $\delta_0$ is set equal to zero.[6] The optimal level of $v$ is then determined by the rate at which agricultural policy makers wish to substitute consumer and taxpayer surplus with producer surplus.

When enforcement is costly and $\delta_0$ is set at its optimal value (i.e., $\delta_0 = 0$), the transfer efficiency of output and export subsidies is given by equations (6) and (7), respectively, as:

$$\left(\frac{DWL}{\Delta PS}\right)_c^{os} = \frac{DWL_{pce}^{os} + dEB_c^{os}}{\Delta PS_{pce}^{os} + EB_c^{os}} \tag{6}$$

and

$$\left(\frac{DWL}{\Delta PS}\right)_c^{es} = \frac{DWL_{pce}^{es} + dEB_c^{es}}{\Delta PS_{pce}^{es} + EB_c^{es}} \tag{7}$$

Equations (6) and (7) show that if output and export subsidies are less efficient means of income redistribution than lump-sum transfers to producers in a world where policy enforcement is perfect and costless (i.e., if $\left(\frac{DWL}{\Delta PS}\right)_{pce}^{os} > d$ and $\left(\frac{DWL}{\Delta PS}\right)_{pce}^{es} > d$), the transfer efficiency of the policy instruments is greater than traditionally believed (i.e., $\left(\frac{DWL}{\Delta PS}\right)_c^{os} < \left(\frac{DWL}{\Delta PS}\right)_{pce}^{os}$ and $\left(\frac{DWL}{\Delta PS}\right)_c^{es} < \left(\frac{DWL}{\Delta PS}\right)_{pce}^{es}$). Farmer noncompliance increases the transfer efficiency of both output and export subsidies since it allows agricultural policy makers to substitute distortionary transfers through the market with more efficient (decoupled) transfers through misrepresentation.

The surplus transfers to producers through misrepresentation result in an income redistribution that approximates more closely the more efficient lump-sum transfer policy. Therefore, the surplus transformation curves[7] for output and export subsidies under costly and imperfect enforcement lie above those proposed by the traditional agricultural policy analysis for every positive level of market intervention.

*Normative Efficiency Ranking of Output and Export Subsidies*

After showing that producer noncompliance increases the transfer efficiency of both output subsidies and export subsidies paid to producers of the subsidized commodity, the question that naturally arises is whether and to what extent enforcement costs and misrepresentation affect the relative transfer efficiency and, therefore, the normative ranking of the policy mechanisms under consideration. Specifically, the analysis demonstrates that noncompliance increases the transfer efficiency of both output and export subsidies; the greater the output misrepresentation, $Q_m$, the greater the producer benefits from noncompliance, $EB_c$, and the greater the efficiency of output and export subsidies in transferring income to producers relative to the "perfect and costless enforcement" case.

The analysis in this paper also shows that when output and export subsidies are structured such that the same "target" price is received by the producers of a large exporting country, the extent of misrepresentation and the benefits to producers from noncompliance under an export subsidy exceed those under an output subsidy scheme (i.e., $Q_m^{es} > Q_m^{os}$ and $EB_c^{es} > EB_c^{os}$). Since the increase in transfer efficiency is proportional to the level of misrepresentation and since more misrepresentation occurs when an export

subsidy is in effect, the transfer efficiency of export subsidies increases more than the transfer efficiency of output subsidies when producer noncompliance is accounted for.

The implication of this is that output misrepresentation increases the likelihood that an all-or-nothing choice between output subsidies and export subsidies paid to producers on the grounds of transfer efficiency will favor export subsidies. Put in a different way, the introduction of producer noncompliance can change the ranking of the policies making export subsidies more efficient but it will never change the ranking making output subsidies relatively more efficient than export subsidies.

Mathematically, the effect of noncompliance on the ranking of output and export subsidies can be shown using the expressions for the transfer efficiency of the policies in equations (6) and (7). More specifically, the relative transfer efficiency of the subsidies is contingent upon the sign of the expression:

$$\Delta PS_{pce}\left(DWL_{pce}^{os}-DWL_{pce}^{es}\right)+d\Delta PS_{pce}\left(EB_{c}^{os}-EB_{c}^{es}\right)+DWL_{pce}^{os}EB_{c}^{es}-DWL_{pce}^{es}EB_{c}^{os} \qquad (8)$$

A positive sign of the expression in equation (8) indicates that export subsidies are more efficient than output subsidies when enforcement is costly and imperfect (i.e., $\frac{DWL_{pce}^{os}+dEB_{c}^{os}}{\Delta PS_{pce}^{os}+EB_{c}^{os}} > \frac{DWL_{pce}^{es}+dEB_{c}^{es}}{\Delta PS_{pce}^{es}+EB_{c}^{es}}$), while a negative sign indicates the opposite.[8]

Consider first the case where both subsidies are equally efficient under "perfect and costless enforcement." In such a case, $DWL_{pce}^{os}=DWL_{pce}^{es}$ and the expression in equation (8) can be re-written as $\left(DWL_{pce}^{os}-d\Delta PS_{pce}\right)\left(EB_{c}^{es}-EB_{c}^{os}\right)$ which is clearly positive since output subsidies are always less efficient than lump-sum transfers to producers, $\frac{DWL_{pce}^{os}}{\Delta PS_{pce}^{os}}>d$, and also $EB_{c}^{es}>EB_{c}^{os}$. Thus, when output and export subsidies are equally efficient under "perfect and costless enforcement," the incorporation of producer noncompliance results in export subsidies being relatively more efficient.

When output subsidies are more efficient in a world of costless enforcement (i.e., when $DWL_{pce}^{os}<DWL_{pce}^{es}$), the incorporation of enforcement issues into the analysis could make export subsidies more efficient than output subsidies (i.e., could make the expression in equation (8) positive); while, if it is export subsidies that are more efficient under perfect and costless policy enforcement (i.e., if $DWL_{pce}^{os}>DWL_{pce}^{es}$), the expression in equation (8) is always positive – the incorporation of noncompliance can never change the ranking of the policies making output subsidies more efficient than export subsidies paid to producers of the subsidized commodity.

Before concluding the paper, we need to emphasize that the result that producer noncompliance can change the normative ranking of output and export subsidies by increasing the transfer efficiency of export subsidies by relatively more, holds only for the large country case. The reason for the asymmetric increase in the efficiency of output and export subsidies under costly and imperfect enforcement, namely the increased misrepresentation that occurs under an export subsidy scheme, is not valid for a small open economy. As pointed out earlier, both the extent of misrepresentation and the producer benefits from noncompliance are the same under output and export subsidies when

those are adopted by a small open economy (i.e., $Q_m^{es}=Q_m^{os}$ and $EB_c^{es}=EB_c^{os}$). Therefore, in the small country case producer noncompliance increases the transfer efficiency of both types of subsidies by the same amount and the efficiency ranking of output subsidies and export subsidies paid to producers remains unaffected.

## Summary and Conclusions

This paper builds on the literature on agricultural policy analysis under costly and imperfect enforcement by analyzing the effect of enforcement costs and noncompliance on the relative efficiency of output and export subsidies in redistributing income in the economy. Analytical results show that, in addition to changing the incidence of output and export subsidies, relaxing the assumption of perfect and costless enforcement found in the traditional analysis of these policy instruments, can affect their relative efficiency in transferring income to producers. The effect of enforcement issues on the relative transfer efficiency of output and export subsidies is shown to depend on the way export subsidies are being administered and the size of the exporting country.

Previous research on output subsidies and export subsidies paid to producers has shown that output misrepresentation results in decoupled lump-sum transfers from taxpayers to producers of the subsidized commodity. Deterrence of noncompliance eliminates these transfers and requires resource costs that constitute social welfare losses. Thus, deterrence is not economically optimal. The surplus transfers to producers through noncompliance result in an income redistribution that more closely approximates a (more efficient) lump-sum transfer policy as they enable the regulator to reduce the level of market intervention (i.e., the subsidy) that transfers a given surplus to producers. The substitution of (some) distortionary transfers through the market with more efficient lump-sum transfers through misrepresentation results in increased transfer efficiency of both types of subsidies; output subsidies and export subsidies paid to producers are more efficient means of income redistribution than is traditionally believed.

The analysis in this paper shows that both the extent of producer noncompliance and the surplus transfers to producers through misrepresentation are greater when a large country subsidizes exports rather than total domestic production. Thus, while producer noncompliance increases the transfer efficiency of both output and export subsidies, it increases the transfer efficiency of export subsidies by more. The implication of this result is that the likelihood that an all-or-nothing choice between output subsidies and export subsidies paid to producers on the grounds of transfer efficiency will favor export subsidies is increased when the unrealistic assumption of "perfect and costless enforcement" is relaxed and farmer misrepresentation is introduced into the analysis.

The change in the normative efficiency ranking of output and export subsidies paid to producers can only occur in a large exporting country, however. When the subsidizing country is a small open economy, the extent of noncompliance, the surplus transfers to producers through misrepresentation, and the increase in the efficiency in redistribution are the same under both output and export subsidies. Since the increase in the transfer efficiency of output subsidies and export subsidies paid to producers is the same, enforcement costs and misrepresentation cannot change the normative efficiency ranking of the two subsidies when these are employed by a small open economy.

Finally, the efficiency ranking of output and export subsidies can change under costless and imperfect enforcement when export subsidies are paid to the traders (and not directly to producers) of the subsidized commodity. In such a case, however, enforcement costs and noncompliance increase the relative transfer efficiency of output subsidies and, thus, they increase the likelihood that an all-or-nothing choice between output and export subsidies will favor the former. This increase in the relative transfer efficiency of output subsidies holds no matter if the exporting country is a large or a small open economy.

**Notes**

1 The efficiency in redistribution (or transfer efficiency) links the social costs of market intervention to the surplus transferred to producers. The lower are the welfare losses associated with a given transfer to producers, the greater is the transfer efficiency of a policy instrument (Gardner 1983).

2 The model in equation (1) can be modified to include aversion of the farmer toward risk. The risk averse farmer will choose $q_m$ to maximize expected utility. In terms of output misrepresentation, risk aversion results in reduced misrepresentation relative to the case where risk neutrality is assumed. Even though risk averse behavior changes the results quantitatively, the qualitative nature of the results in this study remains unaffected.

3 The *mpo* shows the change in quantity expected to be penalized, $\delta q_m$, for a change in $q_m$.

4 Note that the excess supply of the exporting country under an output subsidy scheme (i.e., the difference between domestic production and consumption), is different than the excess supply under an export subsidy scheme because, for any given "target" producer price, the level of domestic consumption under an output subsidy is greater than that under an export subsidy scheme. The reason is that, while consumers pay the domestic "target" price under the export subsidy scheme they only pay the world price under an output subsidy scheme.

5 Since output misrepresentation results in decoupled transfers from taxpayers to producers, consumer welfare is not affected by producer noncompliance; consumer surplus increases by area D in Panel (a) of Figure 2 when an output subsidy scheme is in effect. When an export subsidy is used to transfer income to producers, the domestic market price rises to $p_t$ and consumer welfare is reduced by the areas $A'+A''$ in Panel (c) of Figure 2.

6 Note that setting $\delta_0$ equal to zero does not mean that misrepresentation goes undetected. Since $\delta_1>0$, zero $\delta_0$ means that policy makers will not actively spend resources to deter noncompliance over and above what would occur otherwise. When $\delta_0$ is reduced to zero, the MPO curve comes out from the origin (point O in Panels (a) and (c) of Figure 2) and $Q_m$ is maximized (i.e., $Q_m^{os} = \frac{v^{os}}{2\delta_1'\left(v^{os}+\rho\right)}$ and

$Q_m^{es} = \frac{v^{es}}{2\delta_1^{'}\left(v^{es} + \rho\right)}$).

7 A surplus transformation curve depicts the trade off between producer surplus and consumer plus taxpayer surplus for different levels of intervention (Gardner 1983). The slope of the surplus transformation curve is the marginal rate of surplus transformation. It shows the efficiency of the policy mechanism in redistributing income to producers at the margin; how much of an extra dollar raised by consumers and taxpayers is received by producers. One minus the absolute value of s shows the deadweight loss per dollar transferred at the margin.

8 Note that since both subsidies result in the same increase in domestic price, the transfers to producers through the market effects of the policies are the same (i.e., $\Delta PS_{pce}^{es} = \Delta PS_{pce}^{os} = \Delta PS_{pce}$).

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