

**AGRICULTURAL POLICY ANALYSIS UNDER COSTLY ENFORCEMENT:
AN ECONOMIC ANALYSIS OF CHEATING**

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Saskatoon

By

Konstantinos Giannakas

Fall 1998



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KONSTANTINOS GIANNAKAS

Department of Agricultural Economics
College of Agriculture
University of Saskatchewan

Fall 1998

Examining Committee:

Dr. G. Entwistle	Dean/Associate Dean Dean's Designate, Chair College of Graduate Studies and Research
Dr. J. Spriggs	Chair of Advisory Committee Dept. of Agricultural Economics
Dr. M.E. Fulton	Advisor, Dept. of Agricultural Economics
Dr. W.H. Furtan	Dept. of Agricultural Economics
Dr. R.S. Gray	Dept. of Agricultural Economics
Dr. K.C. Tran	Dept. of Economics

External Examiner:

Dr. B.L. Gardner
Dept. of Agricultural and Resource Economics
University of Maryland
College Park, MD 20742
U.S.A.

AGRICULTURAL POLICY ANALYSIS UNDER COSTLY ENFORCEMENT: AN ECONOMIC ANALYSIS OF CHEATING

Agricultural policy analysis has traditionally taken place under the implicit assumption of perfect and costless policy enforcement. The objective of this study is to introduce policy enforcement costs into the economic analysis of output quotas, deficiency payments and decoupled area payments. Policy design and implementation is modeled in this thesis as a sequential game between a regulator who designs the farm program, an enforcement agency that determines the level of policy enforcement, and the farmer who makes the production and cheating decisions.

Analytical results show that cheating on output subsidies and decoupled area payments results in welfare gains for producers that constitute a direct transfer from taxpayers. When, however, an output quota scheme is in effect, above-quota production results in losses for producers and welfare gains for consumers. The penalties on detected cheating and the policy enforcement costs mean that, contrary to what is traditionally believed, taxpayers have an interest in the manner output quotas are introduced and enforced.

The weight placed by program enforcers on producer welfare determines policy enforcement, cheating, and government intervention. The greater is the importance of producer welfare for policy enforcers, the lower is equilibrium enforcement, and the greater is farmer misrepresentation under an output subsidy or a decoupled area payment scheme. Reduced enforcement and increased misrepresentation result in lower government payments required for a given surplus to be transferred to producers. The reverse is true when a production quota is in effect.

The introduction of enforcement costs and cheating affects the transfer efficiency and the normative ranking of the farm programs. The efficiency of output subsidies and decoupled area payments in transferring income to producers is maximized when the political preferences of policy enforcers and the regulator coincide. The transfer efficiency of output quotas under alternative political preferences of policy enforcers is determined by a trade-off between the resource costs of intervention and the monitoring costs.

Ultimately, the ranking of the policy instruments in terms of transfer efficiency depends on market conditions, the deadweight losses from taxation, the extent of intervention, the political preferences of policy enforcers, and the size of enforcement costs.

BIOGRAPHICAL

1969	Born in Arta, Greece
1992	Bachelor of Science (B.Sc.), Agricultural Economics, Aristotle University of Thessaloniki
1993	Specialized Post-Graduate Diploma (D.S.P.U), Management/Marketing, Mediterranean Agronomic Institute of Chania (M.A.I.Ch.)
1994	Master of Science (M.Sc.), Agricultural and Resource Economics, Mediterranean Agronomic Institute of Chania (M.A.I.Ch.)

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University of Saskatchewan,
51 Campus Drive,
Saskatoon, Saskatchewan, S7N 5A8
CANADA

ABSTRACT

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Agricultural policy analysis has traditionally taken place under the implicit assumption of perfect and costless policy enforcement. Monitoring farmers' actions requires resources however. The resource costs associated with policy enforcement may result in enforcement that is incomplete. Imperfect enforcement generates economic incentives for farmers to cheat on the farm programs by producing over and above the quota limit in the case of output quotas, or over-reporting the output and the past cultivated acreage in the case of output subsidies and decoupled area payments, respectively.

The main objective of this study is to introduce policy enforcement costs and cheating into the economic analysis of output quotas, deficiency payments and decoupled area payments. Policy design and implementation is modeled in this thesis as a sequential game between a regulator who designs the farm program, an enforcement agency that determines the level of policy enforcement, and the farmer who makes the production and cheating decisions.

Analytical results show that cheating on output subsidies and decoupled area payments results in welfare gains for producers that constitute a direct surplus transfer from taxpayers. When, however, an output quota scheme is in effect, violation of the quota limit results in losses for producers and welfare gains for consumers. The revenues from penalties on detected cheating and the costs associated with the enforcement of output restrictions mean that, contrary to what is traditionally believed, taxpayers have an interest in the manner output quotas are introduced and enforced.

The weight placed by program enforcers on producer welfare is crucial in determining the level of enforcement, cheating, and government intervention. The

greater is the importance of producer welfare for policy enforcers, the lower is the equilibrium enforcement, and the greater is the farmer misrepresentation under an output subsidy or a decoupled area payment scheme. Reduced enforcement and increased misrepresentation result in lower government payments (i.e. output subsidy and area payment) required for a given surplus to be transferred to producers. The reverse is true when a production quota is in effect. More specifically, an increase in the relative weight placed by program enforcers on producer surplus results in increased enforcement, decreased cheating, and increased output quota that achieves a specific income transfer to producers.

The introduction of enforcement costs and cheating affects the transfer efficiency and the normative ranking of the farm programs. The efficiency of output subsidies and decoupled area payments in transferring income to producers is maximized when the political preferences of policy enforcers coincide with those of the regulator, i.e., when both agencies have a relatively high weight attached to producer welfare. The transfer efficiency of output quotas under alternative political preferences of policy enforcers is determined by a trade-off between the resource costs of intervention and the enforcement and monitoring costs.

Ultimately, the ranking of the policy instruments in terms of transfer efficiency depends on market conditions, the deadweight losses from taxation, the extent of intervention, the institutional arrangement characterizing agricultural policy making, the political preferences of policy enforcers, and the size of enforcement costs.

In addition to providing an understanding of the incidence of agricultural policies and the prevalence of cheating on farm programs, the results of this study can assist in explaining potential differences in compliance with policy rules observed in different areas/countries. Furthermore, the significance of the enforcement agency's political preferences can help to explain the focus of the lobbying efforts by European farm organizations on their national ministries of agriculture, as well as the resources spent by commodity groups in the US in lobbying the ASCS.

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CHAPTER I

INTRODUCTION

1.1 Problem Statement

Agricultural policy analysis principally focuses on four issues: the effect of policy instruments on market prices and quantities; the impact of policy intervention on producer, consumer, and taxpayer welfare; the efficiency of the policy instruments in redistributing income between interest groups; and the factors that determine the choice of policy mechanisms and the extent of government intervention. Implicit in the traditional analysis of agricultural policy instruments is the assumption that (i) either farmers do not cheat or (ii) enforcement of farm programs is perfect and costless.

It is well known, however, that policy enforcement requires resources. Even though the actions of the farmers are potentially perfectly observable to agricultural policy enforcers, monitoring every farmer is costly. Because of the monitoring and enforcement costs, agricultural policy makers may find it economically optimal to under investigate farmers' actions. Under investigation results in enforcement that is imperfect which, in turn, creates economic incentives for farmers to cheat.

Under an output quota scheme, farmers may find it optimal to produce over and above the regulated quantity. Under an output subsidy, producers may report and

collect payments on greater than produced quantities; while, when a decoupled area payment is in effect farmers may misrepresent their base acreage cultivated. Very few studies have incorporated misrepresentation or cheating in agricultural policy analysis. An exception is Alston and Smith who raise the question of cheating and “black market” activity in an examination of rationing in an industry with an effective minimum price policy in place.

Cases of cheating on farm programs are often reported by the European press (Moyer and Josling). A recent report on the extent of cheating on farm subsidies in the European Union (EU) estimates the “losses” through fraud and lax controls in the payment of farm subsidies and subsidy overpayments to \$4 billion per year (EU Fraud and Waste on Farm Subsidies, *117 Journal of Commerce*, 12/22/97). The extent of cheating on farm subsidies varies among the countries/members of the EU as well as between different areas in these countries. For the 1993 crop year, the total area on which payments were claimed exceeded the base area in parts of Spain, Scotland and former East Germany by up to 15 per cent (Swinbank and Tanner). In the United States (US), the existence of a United States Department of Agriculture (USDA) “hotline” where cases of “fraud” related to “submission of false claims/statements” can be reported might indicate that the problem of cheating on farm programs is not unknown to US agricultural policy makers (www.usda.gov/oig/hotline.htm).

1.2 Objective of the Study

The principle objective of this study is to relax the assumption of perfect and costless enforcement of farm programs and to introduce policy enforcement costs into the economic analysis of output quotas, deficiency payments and decoupled area payments.

The specific objectives are as follows:

- To examine the impact of farmer misrepresentation and cheating on the welfare of interest groups and the efficiency of the policy instruments in transferring income to producers.
- To analyze the effects of enforcement costs on policy design and implementation.
- To determine the factors affecting cheating, enforcement, and intervention and to provide insights for better understanding the incidence of agricultural policies and the prevalence of cheating on farm programs.
- To improve our understanding of the processes and institutions involved in agricultural policy making.
- To assist in explaining the different levels of compliance with program rules observed in different areas/countries.

1.3 Methodology

Policy design and implementation is modeled in this thesis as a sequential game between a regulator who designs the farm program, an enforcement agency that determines the amount of policy enforcement, and the farmer who makes the production and cheating decisions. The objective functions of the agents involved in policy making are assumed

to be common knowledge. The regulator moves first and decides on the level of intervention, knowing exactly how his choices will affect program enforcement and farmer cheating. The optimal policy enforcement is determined next. Finally, the representative farmer, observing both policy variable and enforcement parameters, decides on whether he will cheat or not (and if so, by how much).

The institutional arrangement with separate regulatory and enforcement agencies can be viewed as approaching the agricultural policy making structure in most developed countries and certainly the EU and the US. Different scenarios concerning the political preferences of the enforcement agency and the decision variables it controls are analyzed. The paradigm of a single agency that determines both agricultural policy and enforcement is also examined.

All formulations of the sequential game developed in the thesis are solved using backwards induction (Kreps; Gibbons; Osborne and Rubinstein). The problem of the farmer is considered first, the payoff function of the enforcement agency is derived next and, finally, the solution to the regulator's problem determines the optimal intervention, enforcement, and cheating on the program. The use of backwards induction enables us to avoid multiple Nash equilibria involving non-credible threats that can exist in a sequential game. The equilibrium associated with the backwards-induction outcome of such a game is the only subgame-perfect Nash equilibrium, i.e., the only Nash equilibrium that does not involve a non-credible threat.

Finally, the impact of cheating on the farm programs on the welfare of the interest groups and the transfer efficiency of the policy mechanisms is considered in the context of a static, partial equilibrium, closed economy model.

1.4 Organization of the Study

The remaining chapters of the dissertation are organized as follows. Chapter II describes agricultural policy design and implementation in the EU and the US. Chapter III examines the economics of output quotas under costly enforcement. The chapter analyzes the effects of enforcement costs on equilibrium production, enforcement and level of intervention. The impact of enforcement costs and cheating on the welfare of the interest groups and the transfer efficiency of the policy mechanism is also investigated. In addition, the basic model is extended to account for alternative scenarios regarding the institutional arrangement and the endogenous to policy makers decision variables. Chapters IV and V introduce enforcement costs and farmer misrepresentation into the economic analysis of deficiency payments and decoupled area payments, respectively. Chapter VI examines the effect of enforcement costs on the (normative) ranking of the policy mechanisms. Chapter VII summarizes the main findings and concludes the dissertation.

CHAPTER II

AGRICULTURAL POLICY MAKING IN THE EU AND THE USA

The institutional arrangement characterized by decentralized policy making can be viewed as approaching the agricultural policy making structure in both the EU and the US. In the EU, the Council of Agricultural Ministers decides the level of intervention, while the countries/members of the EU implement and enforce the policy. In the US, the Congress decides on the farm policy and the USDA implements it.

2.1 Policy Making in the EU

In 1957, Belgium, West Germany, France, Italy, Luxembourg, and The Netherlands, formed the European Economic Community (EEC) by signing the Treaty of Rome. The objective was the establishment of "... a common market... to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, and accelerated raising of the standard of living, and closer relations between the states belonging to it" (Swinbank, p. 57-58).

The "common market" included agriculture and trade in agricultural products. The result was the development of a common agricultural policy (CAP) for the countries/members of EU in 1962, based on the principles of a single market,

community preference and joint financing. The objectives of CAP were to increase agricultural productivity; increase the individual earnings of persons engaged in agriculture; stabilize markets; assure the availability of supplies; and ensure reasonable prices to consumers (Article 39(1) of the Treaty of Rome).

The “continuous and balanced expansion” resulted in the accessions of Denmark, Ireland, and the United Kingdom in 1973; Greece in 1981; Portugal and Spain in 1986; and Austria, Finland and Sweden in 1995. With the Maastricht Treaty in 1992, the EEC has evolved to European Union (EU) reflecting a move towards common foreign and security policy and co-operation in the fields of justice and home affairs. The expansion of the EU resulted in a significant diversity in terms of agrarian structures and the importance of the agricultural sector across the member states. Structural and organizational farm characteristics are quite different between countries. Product bases differ too. Average farm size varies between 4 and 64.4 hectares in Greece and the UK respectively. The contribution of the sector to national GDP varies between 1.3 and 16.1 percent in Germany and Greece respectively. Finally, the proportion of farmers to total labor population varies between 2.2 and 21.3 in UK and Greece respectively (Table 2.1).

Even though the principles of CAP remain those established back in 1957, the policy has been judged as having asymmetric weights placed on its objectives. Farm income support has been seen as being the primary objective of agricultural policy makers (Marsh; Franklin; Swinbank). Price supports, producer and export subsidies, production and input controls, import restrictions and direct income payments have

been among the main policy mechanisms used to “ensure a fair standard of living for the agricultural community.”

The guidelines for agricultural policy making in the EU are set by the Treaty of Rome as follows:

The Council shall, on a proposal from the Commission and after consulting the European Parliament...by a qualified majority...make regulations, issue directives, or take decisions, without prejudice to any recommendations it may also make (Article 43(2) of the Treaty of Rome).

The institutions involved in CAP design are the Council of Agricultural Ministers, the European Commission, the Special Committee on Agriculture (SCA), and the European Parliament. The Council of Agricultural Ministers (usually mentioned as the Farm Council or the Agricultural Council) consists of the Ministers of Agriculture of the member states. The Farm Council decides on the Regulations and Directives¹ that describe the adopted agricultural policy. Asymmetries in importance of a commodity (or the sector as a whole) between countries/members of the EU usually generate asymmetries in objectives and opinions between the members of the Council (Kirschke; Field and Fulton). After all, it is the agricultural sector of their home countries that the Ministers of Agriculture have been assigned by the national governments to serve.

¹ Regulations apply to everybody in EU, citizens and governments. They are automatically integrated into national law. Directives are not part of the Community law. Directives are binding on governments as of their intention.

Effectively, agricultural policy is decided by the Farm Council with a qualified majority vote.² The Farm Council, however, is unable to legislate without a proposal by the European Commission.

The Commission of the European Communities proposes an agricultural policy and the Farm Council has to decide upon its approval (qualified majority vote) or rejection (unanimity is required) (Brassley). Modifications of the initial proposal are not unusual in cases of disagreement between the Commission and the Council. The Commission has currently 20 members who, even though appointed by the governments of their home countries, are required to act in the interest of the EU. Each commissioner is responsible for a specific area of policy. The draft proposals for agricultural policy are prepared by the Directorate-General No. 6 (DG VI) and are adopted as the formal Commission proposal on a majority vote. DG VI is the Commission service responsible for the administration of CAP.

Once the proposal has been completed it is sent to the Council. The Presidency of the council will forward the proposal for evaluation by the national governments and the Special Committee on Agriculture (SCA). The SCA is a body consisting of national civil servants that determines possible conflicts of interest between the member states prior to the Farm Council meeting.

At the same time, the European Parliament, whose members are directly elected by the EU citizens, will review the proposal and will provide its opinion to the Farm

² The total number of votes in the Farm Council of 15 Agricultural Ministers is 87. Sixty-two votes for the adoption of a proposed policy constitute the qualified majority. Obviously 26 votes can hold-up the policy proposal and constitute what is called the blocking minority.

Council. The opinion of the European Parliament, even though non binding, is necessary for the Council of Agricultural Ministers to decide (Swinbank and Tanner).

During this process and before the meeting of the Farm Council, interest groups are lobbying at almost all levels of policy making. Due to their central role in CAP decision making, the Farm Council and the Commission of the European Communities are the main focus of the lobbying effort. It is usually the case that the European association of farmers' lobbying groups (COPA) will exercise pressure to both the Commission (and DG VI) and the Council (Petit et al.). The national farm organizations will lobby the national governments. The national farmer unions dominate in the Farm Council due to their close linkages to agricultural ministers and ministries (Moyer and Josling; Cox et al.). However, the ties between national farm lobbies and their governments vary significantly between the countries/members of the EU (Petit et al.; Swinbank and Tanner; Ockenden and Franklin). The strongest linkages between national government and farm organizations are thought to exist in Germany (Field and Fulton). Agriculture is also very important in France while it is less important in UK.

Even though the Commission and DG VI are formally responsible for the implementation of a policy decided by the Farm Council, "it is in fact the member states that deal with farmers and traders, provide intervention stores and ensure that charges are collected and payments are legally made" (Swinbank, p. 76). Implementation and enforcement of EU law is, in general, the obligation of the administrative and judicial bodies of the countries members of EU. The Treaty of Rome sets that:

Member states shall take all appropriate measures, whether general or particular, to ensure fulfillment of the obligations arising out of this Treaty or resulting from actions taken by institutions of the Community. They shall facilitate the achievement of the Community's tasks (Article 5 of the Treaty of Rome).

Different parts of the national governments are responsible for the implementation of farm programs but it is usually the case that policy administration at the country level is undertaken by the Ministry of Agriculture. The national ministries of Agriculture operate the payments and monitor producer compliance with the program provisions, while the penalties for breaking EC Directives are set by the legal system (From and Stava). Obviously, since EC Regulations are automatically part of the national law, agricultural policy makers have no involvement on penalties related to Regulations' violation.

Overall, for a specific commodity program, it is the Council of Agricultural Ministers that decides on the total transfer to producers and determines the level of policy instrument(s) that achieves the surplus transfer. The role of the Commission of the European Communities in policy design is crucial since the Farm Council can only regulate in the presence of a proposal by the European Commission. The enforcement of the farm program is the responsibility of the countries/members of the EU.

2.2 Policy Making in the US

Agricultural commodity programs in the US date back to the early 1930s. The effects of the Depression on farm income served as the justification for the adoption of the *Agricultural Adjustment Act* of 1933 (Moyer and Josling). Through time, even though the policy mechanisms employed to achieve farm price and income support might have changed, agriculture continues to be supported at the expense of consumers and/or taxpayers (Bonnen). The basic vehicle of agricultural policy in the US is the 5 year “Farm Bills” which are approved by the Congress and signed by the president.

Agricultural policy making in the US has similarities and, at the same time, differences with CAP decision making. Among the main similarities between the two institutional arrangements is the fact that policy making is decentralized. There are distinct regulatory and enforcement agencies in both cases; the Council of Agricultural Ministers and the countries/members in the case of EU, the Congress and the USDA in the US case. Generally speaking, the Congress designs US agricultural policy and the USDA implements it (Gardner 1987a).

However, the role of USDA is not restricted to policy implementation. The USDA bureaucracy has also significant input in the information required for the formation of each Farm Bill. Similar to the Commission of the European Communities, prior to the expiration of a Farm Bill the USDA forms a proposal for agricultural policy which is submitted by the Secretary of Agriculture to Congress.

The proposal formation is the responsibility of the Secretary of Agriculture who usually assigns it to the assistant Secretary of Economics or/and to the Under-Secretary

for International Affairs and Commodity programs. Both the Secretary of Agriculture and the highly-ranked USDA officials are appointed by the President. Prior to the submission to the Congress, the USDA proposal is “examined” by agencies with interest on agricultural policy such as the Office of Management and Budget, White House staff, the Department of State, the Department of Commerce, and the Treasury (Moyer and Josling).

Once the USDA proposal has been cleared by the interested agencies, it is submitted to the Congress. Unlike the EU case, the USDA proposal is not binding for the regulatory agency (i.e. the Congress). There are policy formation proposals submitted by the commodity groups and individual members of Congress which are also considered by the Congress. The Congress holds hearings on the proposals at the Agricultural Committees of the House and the Senate; before the full Agricultural Committee and eight sub-committees in the House, and before the full Committee on Agriculture Nutrition and Forestry in the Senate. Interest groups, academics, government representatives and members of the Congress are invited to the hearings to provide their input with respect to the proposed policy designs.

Once the hearings are over, the Chairmen of the House and Senate Agricultural Committees introduce a comprehensive bill to the full Agricultural Committee in the House and the full Senate Agricultural Committee, respectively. It is important to mention that the vast majority of Congressmen with agricultural constituencies represent districts or states where agriculture is important (Moyer and Josling). The Agricultural Committees “mark-up” the comprehensive bills which are then submitted

to the full House and Senate for debate and approval by simple majority vote. It is quite common that, at this stage, the two bills are different from the USDA proposal and different from each other as well.

After the full House and Senate have decided on the proposed Farm Bills, the chairmen of the House and Senate Agricultural Committees along with members of the House and the Senate form the Conference Committee. The role of the Conference Committee is the determination of the final Congressional Bill. Once the final Congressional Bill is formulated, it is submitted for approval to the House and Senate. In case of disapproval, the bill is reconsidered by the Conference Committee.

The final Congressional Bill is submitted to the President. Once the bill is signed by the President, it becomes law. In case of disagreement, the President can veto the bill, which is then returned to the full House and Senate. Overruling of the Presidential veto requires two thirds of the full House and Senate votes (more precisely, two thirds of the members present during the vote). If no consensus can be reached prior to the expiration of the “present” Farm Bill, the permanent 1948 farm legislation, which includes price supports, comes automatically into effect.

Responsibility for the administration of the Farm Bill lies with the USDA. The funds for agricultural policy administration are determined by the annual Agricultural Appropriations Bill. The agricultural appropriations bill is approved by the House and Senate Appropriations Committees and their agricultural sub-committees. The Secretary of Agriculture determines the level of policy intervention that achieves the policy objectives described by the Farm Bill in effect.

The implementation of agricultural commodity programs is the responsibility of the Agricultural Stabilization and Conservation Service (ASCS). ASCS is a USDA agency with offices in all states and most counties of the country. ASCS has been traditionally the focus of lobbying efforts by the farm (commodity) groups and is considered a strongly pro-farmer agency (Moyer and Josling).

Commodity groups have developed close ties with both USDA and the Agricultural Committees in Congress. In Bonnen's words:

When the interest group leadership, the ASCS administrator of that commodity program and the House and Senate subcommittees with relevant jurisdiction agree, it matters not what the Secretary of Agriculture, or the President, or anyone else thinks about it. They are locked out of the policy process for that commodity by the "triangle of power" and can influence the outcomes only with extra-ordinary political effort and cost (Bonnen, p.16).

According to Moyer and Josling agricultural policy is formed by compromises between the various commodity "triangles of power." Even though other interest groups such as consumers, agribusiness, environmentalists and grass-roots agricultural reformists are active in lobbying for their positions, the commodity groups dominate the agricultural policy process (Browne).

Overall, for a specific commodity program, the Congress determines the policy objectives and designs the farm program, the Secretary of Agriculture decides on the level of intervention that achieves the policy objectives, and the ASCS implements and enforces the commodity programs.

As it is apparent from the analysis in this chapter, agricultural policy making in the EU and the US is characterized by a separation of powers between the agencies responsible for policy design and implementation. For this reason, an institutional arrangement characterized by distinct regulatory and enforcement agencies is adopted in this thesis when examining the effects that enforcement costs have on the design and implementation of output quotas, deficiency payments and decoupled area payments (chapters III, IV and V respectively). Even though centralized policy making does not generally describe agricultural policy making, the paradigm of a single agency that designs and implements farm programs is also considered for expositional purposes.

Table 2.1. The Agricultural Situation in the European Union and the United States

Country	Average Farm Size (ha)	% of GDP	% of Total Civilian Employment
Austria			
Belgium	14.8	2.1	2.5
Denmark	32.2	3.5	5.4
Finland			
France	28.6	3.0	5.1
Germany	16.8	1.3	3.0
Greece	4.0	16.1	21.3
Ireland	22.7	8.1	12.7
Italy	5.6	3.9	7.5
Luxembourg	30.2	1.9	3.0
Netherlands	15.3	3.9	4.6
Portugal	5.2	4.7	11.7
Spain	13.8	4.1	10.1
Sweden			
United Kingdom	64.4	1.4	2.2
EU 12	12.3	2.8	5.6
US	117	2	3

Sources: EU data from the Commission of the European Communities, *The Agricultural Situation in the Community 1993*, Brussels, 1994; CEC, 1994. US data from USDA, *Farm Real Estate: Historical Series Data*.

CHAPTER III

THE ECONOMICS OF OUTPUT QUOTAS IN THE PRESENCE OF CHEATING

3.1 Introduction

Output quotas have traditionally been a common means of market intervention by policy makers who desire to transfer income to producers. Supply restrictions increase producer welfare through their effect on market price while, at the same time, eliminating undesired surpluses arising from support linked to the level of production. Furthermore, output restrictions do away with the need for policy makers to raise funds through taxation. However, the distortions in the use of productive resources under the farm program generate social welfare losses.

Figure 3.1 presents the static, partial equilibrium welfare effects of production quotas in a closed economy under linear approximations of the supply and demand curves (Nerlove; Wallace). Assuming that producers and quota holders are the same group, quantity restriction at \bar{Q} increases producer surplus by the area $p(\bar{Q})ADp^c$ -DBC while consumer losses from the increased prevailing market price are given by the area $p(\bar{Q})ABp^c$. The distortionary costs of market intervention are equal to the triangle

ABC. The policy mechanism has no effect on the welfare of taxpayers; income is redistributed directly from consumers to producers. Producer welfare is maximized if the quota is set at the monopoly output (i.e. $MR=MC$).

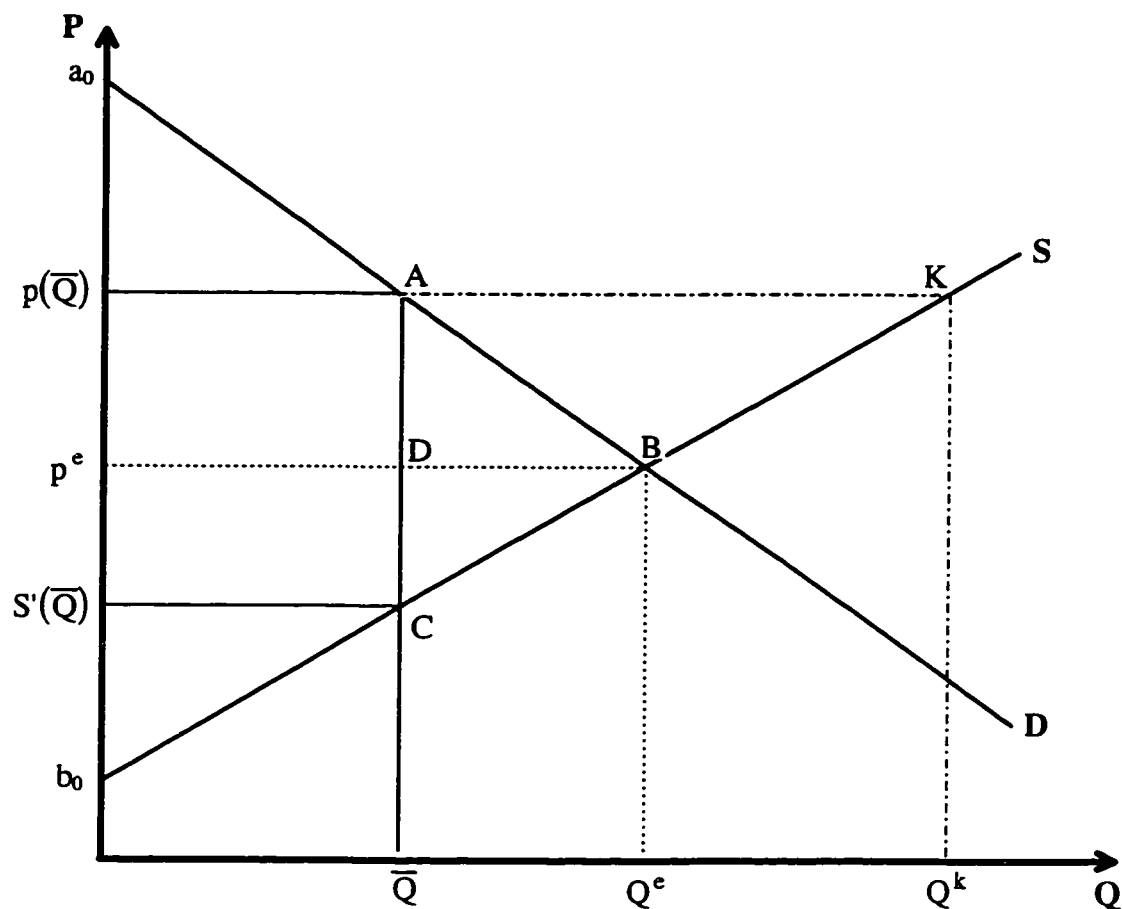


Figure 3.1 Traditional Welfare Effects of Output Quotas

Under certain market conditions output quotas are a more efficient means of transferring income to producers than output subsidies. When there are positive distortionary costs from taxation and when the transfers to producers are relatively

small, output restrictions can even be better than lump-sum transfers in terms of efficiency in redistributing income to producers (Gardner 1983; Alston and Hurd).

Implicit in the above analysis is the assumption that (i) either farmers do not cheat and produce more than their quota or (ii) enforcement of the quota levels is perfect and costless. Enforcement, however, is not costless; monitoring farmers' actions requires government resources. Because of the monitoring costs, policy enforcers might find it optimal to investigate part, rather than all, of the farmer population. Imperfect enforcement due to enforcement costs creates economic incentives for farmers to cheat by violating the quota limit, i.e., to over-produce and sell the above-quota level through alternative channels.

The objective of this chapter is to introduce enforcement costs into the economic analysis of output quotas and to examine the effects of cheating on policy design and implementation. As has been posed in chapter I, policy design and implementation is modeled as a sequential game between a regulator who decides on the level of quota, an enforcement agency that determines the amount of program enforcement, and a farmer who makes the production decisions. The payoff functions of the agents involved in policy making are assumed to be common knowledge. The regulator moves first and decides on the level of intervention (i.e., the quota), knowing exactly how his choices will affect policy enforcement and production. Once the optimal quota is determined, the enforcement agency chooses the degree to which the quota will be enforced by selecting an enforcement parameter. Finally, the farmer decides on the quantity to produce while observing both the policy variable and the

enforcement parameter. In the analysis, different scenarios concerning the political preferences of the enforcement agency and the decision variables it controls are examined. The hypothetical case of a single agency that designs and implements output restrictions is also analyzed.

3.2 Optimal Cheating by the Representative Farmer

Under an output quota scheme and costly enforcement, producers may find it economically optimal to cheat on the program by producing over and above the quota limit. The supply curve in Figure 3.1 indicates that, at market price $p(\bar{Q})$, producers are willing to supply quantity Q^* . Assuming that farmers know with certainty the market price corresponding to the regulated quantity, the penalty charged per unit of over-produced and detected quantity, and the probability that they will be investigated, the decision of the individual farmer on whether he will over-produce (and if so, by how much) can be modeled as decision making under uncertainty.

Assuming producer neutrality toward risk, the farmer has the choice between a certain outcome (i.e., his profits if he does not cheat) and the expected payoff in case of over-production. The expected benefits for the farmer that violates the quota limit are given by the revenues from production, minus the cost of production and the expected penalty on above-quota quantity. More specifically, the problem faced by the representative risk-neutral producer of the regulated commodity can be written as:

$$\max_{q_m} E[\Pi] = p(\bar{Q})(\bar{q} + q_m) - c(\bar{q} + q_m) - \delta \rho q_m \quad (3.1)$$

where $p(\bar{Q})$ is the market price when the quota is set at \bar{Q} ; \bar{q} is the quota limit for the representative farmer; $c(\bullet)$ is the cost function; q_m is the quantity produced over and above \bar{q} ; ρ is the penalty per unit of over-produced and detected quantity; and δ is the probability that the farmer will be audited. If the farmer cheats on the farm program by producing more than \bar{q} , the audit probability δ reflects the probability that he will be detected and punished for his action. On the other hand, for the farmer that does not violate his quota limit, auditing will simply verify his compliance with the provisions of the farm program. Since q_m equals zero, the farmer that does not over-produce incurs no costs from being investigated (i.e. $\delta \rho q_m$ equals zero).

The probability δ takes values between zero and one (i.e. $\delta \in [0, 1]$), and is assumed to be a linear function of the quantity over-produced, i.e. $\delta = \delta_0 + \delta_1 q_m$. The base audit probability, δ_0 , is assumed to be a function of the resources spent by policy enforcers on auditing the farmers, Φ . The parameter δ_0 increases with an increase in Φ , although at a decreasing rate (i.e. $\delta_0'(\Phi) \geq 0$, $\delta_0''(\Phi) \leq 0$). The change in audit probability caused by a change in quantity over-produced, δ_1 , is assumed strictly positive and exogenous to agricultural policy makers.

Optimization of the representative farmer's objective function yields the following F.O.C. for a maximum:

$$p(\bar{Q}) = c'(\bar{q} + q_m) + (\delta_0 + 2\delta_1 q_m)\rho \quad (3.2)$$

Equation (3.2) indicates that the farmer will produce up to the point where the (distorted) market price, $p(\bar{Q})$, equals the marginal cost of production, $c'(\bar{q} + q_m)$, plus the marginal penalty $(\delta_0 + 2\delta_1 q_m)\rho$. The marginal penalty, mp, is the change in the expected penalty for a unit change in the above-quota production, where the expected per unit penalty is $\delta\rho$.³

Figure 3.2 graphs equation (3.2). The optimal above-quota production is determined by the intersection of a horizontal line at $p(\bar{Q})$ with the vertical summation of the mc and mp curves. The mc curve is assumed linear while the linearity of the mp curve comes from the fact that the penalty function, $pf = (\delta_0 + \delta_1 q_m)\rho q_m$, is quadratic in q_m . The mp curve has the same intercept as the average penalty function, $apf = (\delta_0 + \delta_1 q_m)\rho$, while the slope of the mp curve is twice the slope of the apf. The expected producer benefits in the presence of cheating are given by area $Op(\bar{Q})Fq^* - OJGq^* - CGHI$ in Figure 3.2, where q^* is the total quantity produced (i.e. $q^* = \bar{q} + q_m$).

³ The model in equation (3.1) can be modified to include aversion toward risk by the representative farmer and/or private costs from cheating. The risk averse farmer chooses q_m to maximize his expected utility (i.e. $\max_{q_m} E[U(\Pi)] = (1-\delta)U[p(\bar{Q})(\bar{q} + q_m) - c(\bar{q} + q_m)] + \delta U[p(\bar{Q})(\bar{q} + q_m) - c(\bar{q} + q_m) - \rho q_m]$). The aversion of the representative farmer toward risk results in reduced cheating relative to the risk neutral producer of the regulated commodity. Cheating is also reduced when potential costs incurred by farmers in protecting themselves from detection (i.e. $k(q_m)$), are incorporated into the representative farmer's objective function. Even though both risk averse behavior and private costs from cheating change the results quantitatively, the qualitative nature of the results in this chapter remains unaffected.

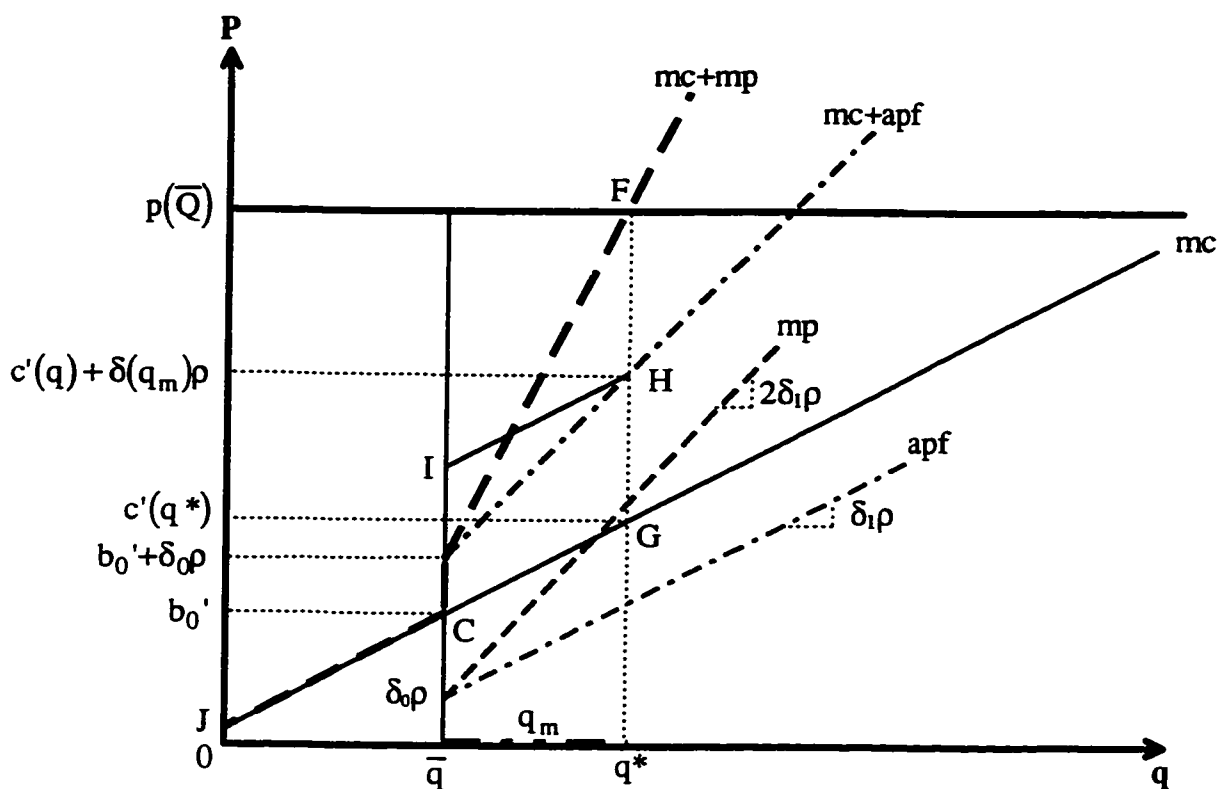


Figure 3.2. Individual Farmer Output Determination With a Quota and Cheating

The production level derived by equation (3.2) and graphed in Figure 3.2 represents the optimal choice of the representative farmer that believes his output decisions do not affect the behavior of other farmers. When, however, it is optimal for farmers to cheat, their combined output decisions result in increased production that depresses the market price. The quantity produced is closer to the competitive output and producer surplus is reduced. Thus, the choice of output that appears optimal for the individual farmer is not optimal for the producers as a group.

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The MP and APF curves have an intercept at δ_0 while their slopes are equal to $\frac{\delta_1}{N}$ and $\frac{2\delta_1}{N}$, respectively, where N is the number of representative farmers/quota holders producing the commodity. For linear approximations of the demand and supply curves (i.e. $D(Q^*) = a_0 + a_1 Q^*$ and $S(Q^*) = b_0 + b_1 Q^*$ where $a_1 < 0 < b_1$ and $a_0 > b_0$), the aggregate above-quota production can be written as:

$$Q_m = \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0 \rho}{b_1 - a_1 + 2\delta_1' \rho} \quad (3.3)$$

where Q^e is the undistorted equilibrium production and $\delta_1' = \frac{\delta_1}{N}$. All other variables are as previously defined.

Equation (3.3) indicates that the above-quota production depends on market conditions, the policy variable (\bar{Q}), and the enforcement parameters δ_0 , δ_1 and ρ .

Manipulating equation (3.3) it can be shown that Q_m will be positive when δ_0 is less

than $\frac{(b_1 - a_1)(Q^e - \bar{Q})}{\rho}$, or when ρ is less than $\frac{(b_1 - a_1)(Q^e - \bar{Q})}{\delta_0}$, or when the

regulated quantity \bar{Q} is less than $Q^e - \frac{\delta_0 \rho}{b_1 - a_1}$. These critical values of δ_0 , ρ , and \bar{Q}

are denoted as δ_0^{nc} , ρ^{nc} and \bar{Q}^{nc} respectively, where the superscript nc stands for no

cheating.⁴

Graphically, an increase in δ_0 results in a parallel upwards shift of the S+MP curve in Figure 3.3 and reduced cheating. An increase in ρ will increase both the intercept and the slope of the S+MP curve; the intercept will shift upwards while, at the same time, the curve will rotate leftwards. The result is a lower over-produced quantity and hence a lower total output.

An increase in \bar{Q} reduces over-produced quantity due to the negative slope of the demand curve and the increasing marginal cost of production. More specifically, the increase in \bar{Q} moves the S+MP curve to the right and increases its intercept by the change in the marginal costs of production. Furthermore, the higher quantity corresponds to a lower market price. Increased costs and reduced returns result in reduced expected benefits from cheating and, therefore, a reduced over-produced quantity. While the above-quota production is reduced, the increase in \bar{Q} leads to an increase in the total quantity produced (i.e. $\frac{\partial Q^*}{\partial \bar{Q}} > 0$).

When the combination of policy variables and enforcement parameters is such that cheating occurs, the welfare effects of the policy instrument change. Figure 3.3 shows the welfare effects of cheating on output quotas. Relative to the “perfect and costless enforcement” situation examined in the traditional analysis of output quotas

⁴ Assuming that the per unit penalty exceeds the gains by producers in violating the quota limit at the margin (i.e. $\rho > p(\bar{Q}) - c'(\bar{Q}) = (b_1 - a_1)(Q^c - \bar{Q})$), implies that the base audit probability that completely deters cheating, δ_0^{nc} , is less than one.

(Figure 3.1), cheating results in decreased producer surplus, increased consumer surplus and the introduction of taxpayers among the interest groups of the policy.

More specifically, for above-quota production Q_m , producers lose the area $p(\bar{Q})AEp(Q^*)-EFHI$ and consumers gain the area $p(\bar{Q})AFp(Q^*)$.⁵ Taxpayers gain the area $CGHI$ that corresponds to penalty payments on detected above-quota quantity. There are also the resource costs of monitoring and enforcement that, though not present in Figure 3.3, have to be taken into account. These costs, denoted as $\Phi(\delta_0)$, are assumed to be an increasing function of δ_0 (i.e. $\Phi'(\delta_0) \geq 0$, $\Phi''(\delta_0) \geq 0$) and have to be included into both taxpayer costs and welfare losses from market intervention. More specifically, the change in taxpayer surplus in the presence of cheating equal $(1+d)[CGHI-\Phi(\delta_0)]$ where d is the marginal deadweight loss from taxation (Fullerton; Ballard and Fullerton). Finally, the distortionary costs of market intervention are decreased by area $AFGC$ and increased by $(1+d)\Phi(\delta_0)$ relative to the “costless deterrence” approach.

It should be mentioned that there are also fixed budgetary costs arising from the operation of the agency responsible for agricultural policy enforcement. These costs are not associated with the existence of a specific farm program, however. Instead, the operation of the enforcement agency is due to government intervention in agriculture. Since the existence of the enforcement agency is not contingent upon the presence of

⁵ Recall that the welfare of producers/quota holders is maximized at the monopoly output. Any increase of the supplied quantity above the monopoly output results in reduced producer surplus. Therefore, even if there were no transfer to taxpayers through penalty payments, above-quota production reduces producer surplus whenever the regulated quantity is set at, or more than the monopoly output.

any farm program in particular, the fixed costs from the operation of the enforcement agency are not incorporated into the taxpayer costs from output restrictions.

3.3 Optimal Enforcement by the Enforcement Agency

Equation (3.3) indicates that the optimal choice of the farmers in terms of above-quota production depends on the level of quota and the enforcement parameters. Both \bar{Q} and δ_0 are endogenous to agricultural policy makers. Penalties on detected above-quota quantities are usually set elsewhere in the legal system and are, therefore, exogenous to agricultural policy enforcers. Since the payoff functions of all agents are assumed to be common knowledge, equation (3.3) indicates that it is the decisions of the agencies responsible for agricultural policy design and implementation that determine the returns and, therefore, the economic incentives for above-quota production.

This section of the chapter examines the problem of the agency responsible for the enforcement of the farm program in an institutional arrangement with separate regulatory and enforcement agencies. In the current setting, the enforcement agency has to determine the optimal enforcement of an output quota scheme designed by the regulator, knowing exactly how its decisions will affect the behavior of the farmers and the welfare of all interest groups born by the policy. More specifically, the objective of the enforcement agency is the determination of the base audit probability that maximizes its objective function. For linear approximations of the supply and demand curves, the problem of the enforcement agency can be written as:

$$\begin{aligned}
\max_{\delta_0} W &= kCS + \theta PS + TS = \\
&= k \left\{ -\frac{1}{2} a_1 [\bar{Q} + Q_m]^2 \right\} + \\
&+ \theta \left\{ (b_1 - a_1) [\bar{Q} + Q_m] Q^e + \left(a_1 - \frac{1}{2} b_1 \right) [\bar{Q} + Q_m]^2 - (\delta_0 + \delta_1 Q_m) \rho Q_m \right\} + \\
&+ (1+d) \{ (\delta_0 + \delta_1 Q_m) \rho Q_m - \Phi(\delta_0) \} \tag{3.4}
\end{aligned}$$

$$\begin{aligned}
\text{s. t. } Q_m &= \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0 \rho}{b_1 - a_1 + 2\delta_1 \rho} \\
\delta_0 &\leq \frac{(b_1 - a_1)(Q^e - \bar{Q})}{\rho}
\end{aligned}$$

where CS, PS and TS stand for consumer surplus, producer surplus and taxpayer surplus respectively.⁶ The parameters θ and k represent the weights placed by the enforcement agency on producer surplus and consumer surplus respectively. All other variables are as previously defined.

The problem specified in equation (3.4) is a simple, static optimization problem with both equality and non-equality constraints. The equality constraint reflects the best response function of the farmers producing the commodity (equation (3.3)). The non-equality constraint requires that the optimal base audit probability should not exceed the level that eliminates cheating. The reasoning is as follows. Since monitoring farmers requires resources, the only effect of an increase in δ_0 above δ_0^{nc} would be the growth of $\Phi(\delta_0)$. Alternatively, the inequality constraint can be seen as requiring the above-

⁶ The treatment of all farmers as a single group by the enforcement agency is consistent with the assumption of producer homogeneity adopted by this study.

quota quantity to be greater than, or equal to, zero.

Assuming that the resource costs of monitoring, $\Phi(\delta_0)$, equal $\frac{1}{2}\psi\delta_0^2$ (where ψ is a strictly positive scalar depending on things like the agrarian structure and the number of representative farmers⁷), the Lagrangean of the enforcement agency's problem is:

$$\begin{aligned}
L = & k \left\{ -\frac{1}{2}a_1 \left[\bar{Q} + \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0\rho}{b_1 - a_1 + 2\delta_1\rho} \right]^2 \right\} + \\
& + \theta \left\{ (b_1 - a_1) \left[\bar{Q} + \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0\rho}{b_1 - a_1 + 2\delta_1\rho} \right] Q^e + \left(a_1 - \frac{1}{2}b_1 \right) \left[\bar{Q} + \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0\rho}{b_1 - a_1 + 2\delta_1\rho} \right]^2 \right\} - \\
& - [\theta - 1 - d] \left\{ \left(\delta_0 + \delta_1 \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0\rho}{b_1 - a_1 + 2\delta_1\rho} \right) \rho \frac{(b_1 - a_1)(Q^e - \bar{Q}) - \delta_0\rho}{b_1 - a_1 + 2\delta_1\rho} \right\} - (1 + d) \frac{1}{2} \psi \delta_0^2 + \\
& + \lambda \left\{ \frac{(b_1 - a_1)(Q^e - \bar{Q})}{\rho} - \delta_0 \right\}
\end{aligned}$$

while the Kuhn-Tucker conditions for a maximum are:

⁷ Obviously, the greater is the number of the representative producers of the regulated commodity, the greater are the resource costs of monitoring their actions. Similarly, extensive fragmentation and dispersion of the farm land results in increased costs associated with the enforcement of the program.

$$L_{\delta_0} = \frac{a_1(b_1 - a_1)k\rho Q^e + (1+d)(b_1 - a_1)^2(Q^e - \bar{Q})\rho - 2a_1\delta_1\rho^2\bar{Q}(\theta - k) + (b_1 - a_1)[-a_1\bar{Q} - (b_1 + 2\delta_1\rho)(Q^e - \bar{Q})]\theta\rho}{(b_1 - a_1 + 2\delta_1\rho)^2} - \frac{(1+d)\{\psi(b_1 - a_1 + 2\delta_1\rho)^2 + 2\rho^2(b_1 - a_1 + \delta_1\rho)\} + a_1k\rho^2 - (b_1 + 2\delta_1\rho)\theta\rho^2}{(b_1 - a_1 + 2\delta_1\rho)^2} \delta_0 - \lambda \leq 0, \quad \delta_0 \geq 0 \rightarrow L_{\delta_0} \delta_0 = 0$$

$$L_{\lambda} = \frac{(b_1 - a_1)(Q^e - \bar{Q})}{\rho} - \delta_0 \geq 0, \quad \lambda \geq 0 \rightarrow L_{\lambda} \lambda = 0$$

Solving the optimality conditions for δ_0 it can be shown that, for given market conditions and resource costs of monitoring, the optimal audit probability depends on the relative weight placed by policy enforcers on the welfare of the producers of the commodity. More specifically, the K-T conditions imply that whenever θ is less than a critical value θ_c , where

$$\theta_c = \frac{(1+d)(b_1 - a_1)(Q^e - \bar{Q})[\psi(b_1 - a_1 + 2\delta_1\rho) + \rho^2]}{-a_1\bar{Q}\rho} + k \quad (3.5)$$

δ_0 will equal:

$$\delta_0^{\theta < \theta_c} = \frac{a_1(b_1 - a_1)k\rho Q^e + (1+d)(b_1 - a_1)^2(Q^e - \bar{Q})\rho - 2a_1\delta_1\rho^2\bar{Q}(\theta - k) + (b_1 - a_1)[-a_1\bar{Q} - (b_1 + 2\delta_1\rho)(Q^e - \bar{Q})]\theta\rho}{(1+d)\{\psi(b_1 - a_1 + 2\delta_1\rho)^2 + 2\rho^2(b_1 - a_1 + \delta_1\rho)\} + a_1k\rho^2 - (b_1 + 2\delta_1\rho)\theta\rho^2} \quad (3.6)$$

If θ is greater than or equal to θ_c , cheating will be completely deterred by a base audit probability that equals δ_0^{nc} , i.e.,

$$\delta_0^{\theta \geq \theta_c} = \frac{(b_1 - a_1)(Q^e - \bar{Q})}{\rho} \quad (3.7)$$

where the superscripts denote the relative weight placed by the enforcement agency on the welfare of producers of the regulated commodity.

The optimality conditions indicate that an increase in θ increases the optimal enforcement (i.e., $\frac{\partial \delta_0^{\theta < \theta_c}}{\partial \theta} > 0$) and the likelihood that cheating will be completely deterred (i.e. the likelihood that $\theta \geq \theta_c$). Since θ_c is an increasing function of ψ and k , the likelihood that cheating will be completely deterred falls with an increase in either the resource costs of monitoring and/or the weight placed on consumer welfare. The reasoning is as follows. In the previous section it has been shown that the greater is the above-quota production, the lower is the producer surplus and the greater is the consumer surplus. Therefore, increased significance of producers dictates increased enforcement and reduced cheating while increased significance of consumers dictates the opposite.⁸

Based on the previous results it is easy to determine the optimal enforcement in the limiting case where the enforcement agency places no weight on producers and

⁸ An alternative interpretation of the optimality conditions is as follows. For given market conditions and weights on the interest groups (θ and k), the optimal δ_0 will be given by equation (3.5) whenever the resource costs of monitoring (ψ) are greater than $\psi_c = \frac{-(1+d)(b_1 - a_1)(Q^e - \bar{Q})\rho^2 - a_1(\theta - k)\rho^2\bar{Q}}{(1+d)(b_1 - a_1)(b_1 - a_1 + 2\delta_1\rho)(Q^e - \bar{Q})}$.

For relatively low enforcement costs (i.e. $\psi \leq \psi_c$) the optimal response of the enforcement agency will be the complete deterrence of cheating (i.e. $\delta_0 = \delta_0^{nc}$).

consumers of the regulated commodity.⁹ In such a case, the level of monitoring is derived by substituting zero for θ and k into equation (3.5) i.e.,

$$\delta_0^{\theta^0, k^0} = \frac{(b_1 - a_1)^2 (Q^e - \bar{Q})\rho}{\psi[b_1 - a_1 + 2\delta_1'\rho]^2 + 2\rho^2[b_1 - a_1 + \delta_1'\rho]} \quad (3.8)$$

where $\delta_0^{\theta^0, k^0}$ denotes the optimal choice of the enforcement agency that is merely concerned with minimizing taxpayer costs from cheating. Equation (3.8) indicates that when $\theta = k = 0$ the optimal enforcement is always positive while, comparing $\delta_0^{\theta^0, k^0}$ to δ_0^{nc} , it can be shown that $\delta_0^{\theta^0, k^0}$ will always be less than the δ_0 that completely deters cheating. Thus, the optimal policy under θ^0 and k^0 will always involve allowance of some cheating. Since the weight placed by policy enforcers on producer surplus is the lowest possible, the amount of enforcement under θ^0 and k^0 is minimized. Obviously, taxpayers incur a loss whenever the optimal δ_0 is greater than $\delta_0^{\theta^0, k^0}$, i.e., the benefits from enforcement ($\delta\rho Q_m$) are less than the enforcement costs ($\Phi(\delta_0)$).

Manipulating $L\delta_0$ it can be shown that when $\theta \in [0, \theta_c)$, the optimal monitoring is determined by equating the marginal benefits from investigation (MBe) with the

⁹ The payoff function of the enforcement agency when $\theta = k = 0$ is measured by the addition to regulator's revenues net of monitoring (investigation) costs. Alternatively, the enforcement agency can be seen as seeking δ_0 that minimizes the total budgetary costs from cheating, the resource costs of investigation minus the penalties collected from farmers detected cheating.

marginal costs of enforcement (MCE),¹⁰ i.e.

$$\frac{a_1(b_1 - a_1)k\rho Q^e + (1+d)(b_1 - a_1)^2(Q^e - \bar{Q})\rho - 2a_1\delta_1\rho^2\bar{Q}(\theta - k) + (b_1 - a_1)[-a_1\bar{Q} - (b_1 + 2\delta_1\rho)(Q^e - \bar{Q})]\theta\rho}{(b_1 - a_1 + 2\delta_1\rho)^2} - \frac{(1+d)2\rho^2(b_1 - a_1 + \delta_1\rho) + a_1k\rho^2 - (b_1 + 2\delta_1\rho)\theta\rho^2}{(b_1 - a_1 + 2\delta_1\rho)^2}\delta_0 = (1+d)\psi\delta_0$$

where the terms on the LHS and the RHS of the equation sign are the MBe and the MCE respectively. The marginal benefits from investigation include penalties collected on detected above-quota quantities and also benefits from induced honesty. These latter benefits include the consequences for interest group welfare of increased enforcement and reduced above-quota production. Graphically, the MBe curve can be seen as a linear downward sloping straight line in the relevant area for program enforcement (i.e. $0 \leq \delta_0 \leq \delta_0^{nc}$). The MBe curve is downward sloping due to the decrease in cheating caused by increases in δ_0 .

The position of the MBe curve depends on the relative weights placed by the enforcement agency on the well-being of the interest groups, while the resource costs of monitoring determine the position (slope) of the MCE curve. When the enforcement agency places no weight on producers and consumers, the optimal δ_0 is determined by the intersection of the MCE curve with the relevant MBe curve, denoted as $MB_e^{\theta^0, k^0}$, in Figure 3.4, Panel (a).

¹⁰ Note that when $\theta < \theta_c$, $0 < \delta_0 < \delta_0^{nc}$. From K-T conditions $L\delta_0$ and λ will equal to zero.

An increase in the relative value of θ will shift the MBe curve upwards increasing both its intercept and its slope.¹¹ For positive but relatively low θ (i.e. $\theta \in (0, \theta_c)$), δ_0 is determined by the intersection of the relevant MBe curve, $MB_e^{\theta < \theta_c}$, and the MCe curve in Panel (a) of Figure 3.4. When θ is relatively high (i.e. $\theta > \theta_c$), the optimal δ_0 will equal δ_0^{nc} since, in this case, the MBe and MCe curves do not intersect inside the relevant region for policy enforcement (i.e., the area to the left of δ_0^{nc}). Note that the MCe curve meets the MBe curve at δ_0^{nc} whenever $\theta = \theta_c$. Obviously, for any given $\theta \in [0, \theta_c)$, the greater are the resource costs of monitoring, the greater is the slope of the MCe curve, and the lower is the amount of enforcement.¹²

Figure 3.4 graphs also the strategic interdependence between the enforcement agency and the farmers; it shows the effect enforcement decisions have on cheating. Panel (b) depicts the cheating equilibrium for the N representative farmers. The above-quota production is determined by the intersection of the industry demand curve with the relevant $S+MP$ curve i.e., the $S + MP^{\theta \geq \theta_c}$, $S + MP^{\theta < \theta_c}$, or the $S + MP^{\theta^0, k^0}$ curve depending on the political preferences of policy enforcers. An increase in δ_0 causes a parallel upward shift of the $S+MP$ curve faced by the farmer which results in reduced

¹¹ The reverse is true for an increase in the weight placed on consumers. An increase in k will shift the MBe downwards by decreasing its intercept and slope resulting in lower θ_c and, thus, reduced likelihood that cheating will be deterred.

¹² Notice that while Panel (a) of Figure 3.4 illustrates the case of increasing marginal enforcement costs, the marginal costs from enforcement can in fact be constant, i.e. the case of constant returns to government spending on program enforcement. In such a case, the relevant MCe curve in Panel (a) of Figure 3.4 would be a horizontal line that would meet the vertical axis at ψ' , the level of the constant marginal costs.

above-quota production.

Mathematically, the optimal Q_m under the alternative scenarios concerning the weights placed by policy enforcers on the welfare of the interest groups can be derived by substituting the relevant δ_0 into farmers' reaction function in equation (3.3). Since enforcement increases with an increase in the relative weight placed by policy enforcers on producer surplus, the greater is θ , the lower is the above-quota production (i.e.

$$Q_m^{\theta^0, k^0} > Q_m^{\theta < \theta_c} > Q_m^{\theta \geq \theta_c} = 0).$$

Overall, for any given output quota, the greatest monitoring and the lowest production will occur in the case where producer surplus is weighted highly and consumer surplus has no weight for program enforcers. On the other hand, enforcement is minimized and cheating is maximized when the enforcement agency places no weight on producers and consumers. The above result holds whenever the weight placed on producer welfare, θ , is greater than or equal to the weight placed on consumers, k . In a situation where $k > \theta$, the minimum enforcement and the maximum production will occur when the enforcement agency places zero weight on producers and positive weight on consumers. This is not however, a realistic assumption for a developed country's agricultural policy makers.

3.4 Regulator and Optimal Intervention

Consider now the case of a regulatory agency that desires to transfer a given surplus to producers of the regulated commodity.¹³ The level of intervention and enforcement that occur when a given surplus is transferred to producers can be used to determine the marginal efficiency in redistribution of the policy mechanism under the different scenarios considered in this chapter.

In the current setting, the problem of the regulator is to determine the quota level that will achieve the desired income redistribution knowing the reaction functions of both the enforcement agency and the farmers. In other words, the regulator decides on the level of output quota knowing exactly how this choice will affect the levels of enforcement and production.

Suppose the regulator desires to increase producer surplus to the level represented by the areas B+C+D+E in Figure 3.5, and that this surplus is smaller than the producer surplus corresponding to the monopoly output. In a world where cheating is perfectly and costlessly deterred, \bar{Q}^{pce} in Figure 3.5 will be the quota level that achieves the regulator's objective, i.e., it increases the producer surplus to the desired level B+C+D+E.

When, however, monitoring farmers is costly, the levels of enforcement and production depend on the relative weight placed by policy enforcers on producer

¹³ Implicit in this formulation is the assumption that the government is not concerned with the distribution of resources within the farm sector; the purpose of government intervention is to transfer income to agriculture. This assumption is consistent with the assumption of homogeneity of producers adopted by this study.

welfare. In general, the greater is the weight placed by the enforcement agency on producers, the greater is the amount of enforcement, and the lower is the above-quota production. The greater is enforcement and the lower is cheating, the greater is the quota level that achieves the desired surplus transfer to producers.

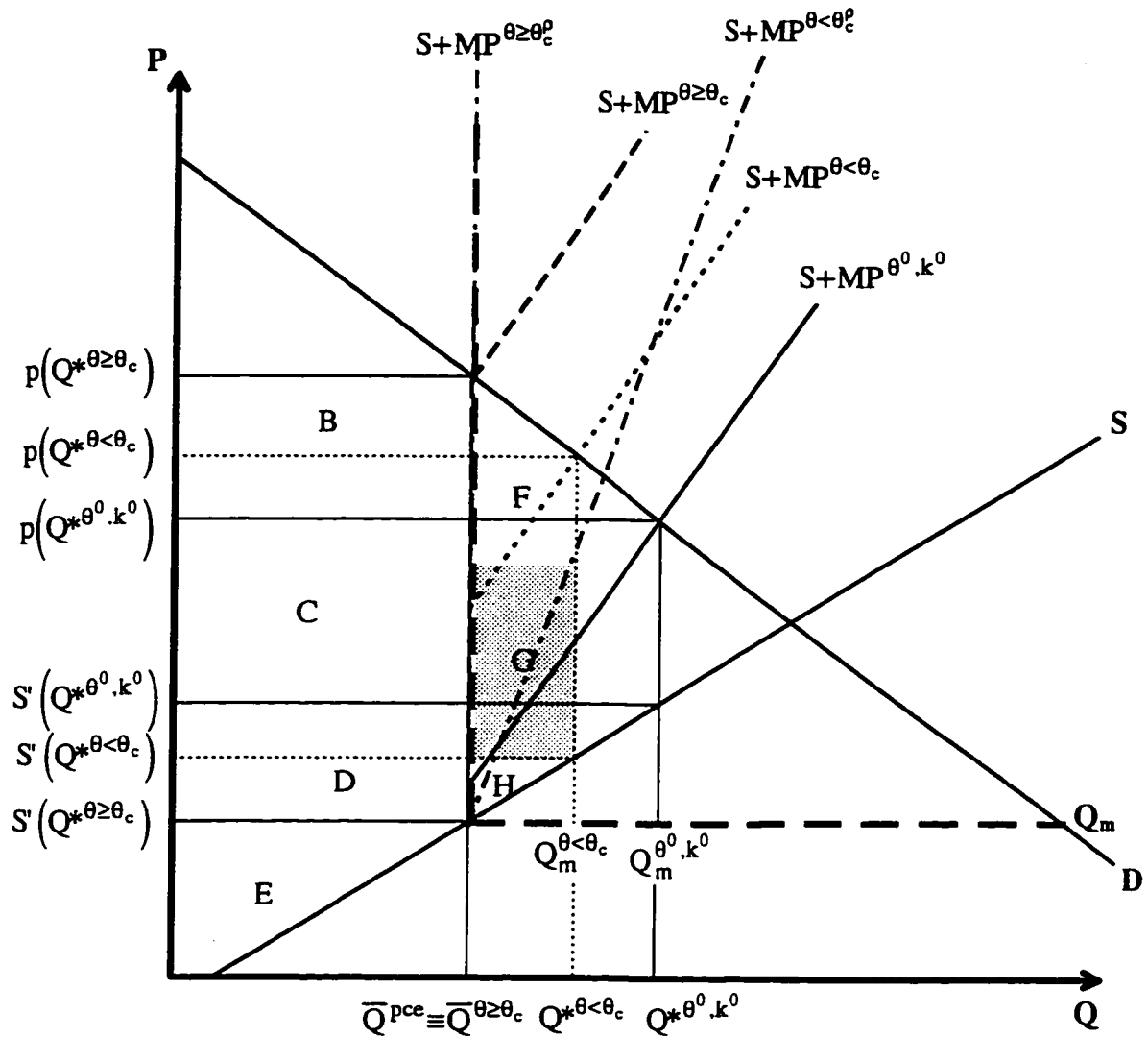


Figure 3.5. Welfare Effects of Output Quotas With Cheating

Consider first the case where the enforcement agency places relatively high weight on producer well-being (i.e., $\theta \geq \theta_c$) and cheating is completely deterred. The relevant S+MP curve is depicted as the dashed $S + MP^{\theta \geq \theta_c}$ curve in Figure 3.5. In such a case, an output quota set at $\bar{Q}^{\theta \geq \theta_c} (\equiv \bar{Q}^{pce})$ will be the optimal choice of the regulator that desires the specific increase in producer surplus, i.e.,

$$\bar{Q}^{\theta \geq \theta_c}: p(\bar{Q}^{\theta \geq \theta_c}) \bar{Q}^{\theta \geq \theta_c} - C(\bar{Q}^{\theta \geq \theta_c}) = BCDE$$

When the enforcement agency places a positive but relatively low weight on producer surplus (i.e., $\theta \in (0, \theta_c)$), complete deterrence of cheating is not economically optimal and some cheating will always occur. The relevant effective supply curve is shown as the $S + MP^{\theta < \theta_c}$ curve in Figure 3.5. Under a quota set at \bar{Q}^{pce} , the above-quota production will equal $Q_m^{\theta < \theta_c}$ and the total production $Q^{* \theta < \theta_c} (= \bar{Q}^{pce} + Q_m^{\theta < \theta_c})$. The corresponding market price is reduced and there is a surplus transfer from producers to taxpayers through the penalties paid (i.e. the shaded area G). Because of the increased production and the expected penalty, producer welfare is effectively reduced relative to the “perfect and costless enforcement” situation for a quota set at $\bar{Q}^{pce} (\equiv \bar{Q}^{\theta \geq \theta_c})$. Thus, for the desired increase in producer welfare to occur, the optimal quota level when $\theta < \theta_c$, denoted as $\bar{Q}^{\theta < \theta_c}$, should be less than \bar{Q}^{pce} . More

specifically, $\bar{Q}^{\theta < \theta_c}$ will be given by:

$$\bar{Q}^{\theta < \theta_c}: p(\bar{Q}^{\theta < \theta_c} + Q_m^{\theta < \theta_c})Q^{*\theta < \theta_c} - C(\bar{Q}^{\theta < \theta_c} + Q_m^{\theta < \theta_c}) - [(\delta_0^{\theta < \theta_c} + \delta_1' Q_m^{\theta < \theta_c})\rho]Q_m^{\theta < \theta_c} = BCDE$$

Similarly, when the enforcement agency places no weight on producers and consumers, enforcement is minimized and total production is maximized for any given level of quota. The relevant “supply” curve is given by the $S + MP^{\theta^0, k^0}$ curve in Figure

3.5. The quota level that could achieve the regulator’s objective is given as:

$$\bar{Q}^{\theta^0, k^0}: p(\bar{Q}^{\theta^0, k^0} + Q_m^{\theta^0, k^0})Q^{*\theta^0, k^0} - C(\bar{Q}^{\theta^0, k^0} + Q_m^{\theta^0, k^0}) - [(\delta_0^{\theta^0, k^0} + \delta_1' Q_m^{\theta^0, k^0})\rho]Q_m^{\theta^0, k^0} = BCDE$$

Obviously, since $\delta_0^{\theta^0, k^0} < \delta_0^{\theta < \theta_c} < \delta_0^{\theta \geq \theta_c}$ and $Q_m^{\theta^0, k^0} > Q_m^{\theta < \theta_c} > Q_m^{\theta \geq \theta_c} = 0$ for any given

level of quota, it will always hold that $\bar{Q}^{\theta^0, k^0} < \bar{Q}^{\theta < \theta_c} < \bar{Q}^{\theta \geq \theta_c} (= \bar{Q}^{pce})$.

Following these results, it is easy to determine the level of total production (i.e. output quota plus above-quota production) when the objective of the regulator is to transfer a given surplus to producers. Crucial in determining the level of total production is the transfer from producers to taxpayers through the penalties on detected above-quota production. In a hypothetical case of no punishment for cheating, violation of the quota limit by farmers would only require the establishment of the quota such that the total production (output quota plus above-quota production) would be at the level that achieves the desired transfer to producers.

When penalties are charged, there is surplus transferred from producers to taxpayers. Because of this transfer, the total quantity should be reduced further for the desired producer welfare increase to occur. In general, the greater is the transfer from producers to taxpayers, the lower is the total production of the regulated commodity. Since the expected penalty increases with a decrease in enforcement and an increase in cheating, it always holds that $Q^{*\theta^0, k^0} < Q^{*\theta < \theta_c} < Q^{*\theta \geq \theta_c} (= Q^{*pce})$. A further consequence of this is that consumer surplus falls with an increase in cheating when the objective of the regulator is to transfer a given surplus to producers.

Implicit in the above analysis is the assumption that the total surplus $B+C+D+E$ can be achieved by the appropriate quota under all scenarios concerning the enforcement agency's political preferences and prevailing enforcement. However, this is not generally true; not all income transfers can be achieved under cheating. Consider the case where the government has a very high political weight attached to producer welfare and the targeted producer surplus corresponds to the monopoly one. When enforcement is perfect, this requires nothing but the establishment of the quota at the output level determined by the equality of marginal revenue with marginal costs.

Under imperfect enforcement and cheating, however, this targeted level of producer surplus is not feasible. The reason is the transfer from producers to taxpayers through the penalties on detected cheating whenever above-quota production occurs. Thus, even if the quota was set such that the total, after-cheating, production would equal the monopoly one, the producer surplus would be less than the maximum possible level. The difference would be the expected penalties on above-quota production. This

constraint on the maximum possible surplus transfer under cheating could result in either the adjustment of the desires of the regulator, or in the use of direct income payments that would make up the difference between the desired and the feasible under imperfect enforcement of output quotas transfer.

3.5 Efficiency in Redistribution

Implicit in the previous analysis is the assumption that the sole purpose of government intervention is to transfer income to producers of the regulated commodity. In this part of the chapter the welfare losses from the program are explicitly linked to the surplus transferred to producers.

In the interest group surplus space, the surplus transformation curve (STC) shows the trade-off between producer surplus and consumer plus taxpayer surplus for various levels of policy intervention. The slope of the STC, denoted as $s = \frac{\partial PS}{\partial (CS + TS)}$, is the marginal rate of surplus transformation. It shows the efficiency of output quotas in redistributing income to producers at the margin; how much of an extra dollar “taken” by consumers and taxpayers is received by producers. The inverse of s gives the marginal cost to consumers and taxpayers for transferring an extra dollar to producers, while one minus the absolute value of s shows the marginal welfare losses associated with the specific transfer. The closer is s to -1, the smaller are the welfare losses, and the greater is the transfer efficiency of the policy instrument.

In a world where program enforcement is perfect and costless the STC of output quotas is shown as STC^{pce} in Figure 3.6. The STC^{pce} is equivalent to the STC proposed by the traditional analysis of the policy instrument (Gardner 1983; Josling). Point E in Figure 3.6 corresponds to the competitive output; the point of nonintervention.¹⁴ The STC^{pce} is concave and reaches its maximum (slope of zero) at the level of quota that equals the monopoly output. Producer surplus increases at the expense of consumer surplus for output quotas set between the competitive and the monopoly output. Further restrictions on production result in losses for both producers and consumers. Since taxpayers are not involved in the surplus trade-off when enforcement is perfect and costless, the slope of STC^{pce} can be written as

$$s^{pce} = \frac{\partial PS}{\partial CS^{pce}}.$$

Consider now the case where monitoring farmers' actions requires resources. When the weight placed by the enforcement agency on producer welfare is greater than the critical θ_c (i.e., $\theta \geq \theta_c$), cheating is completely deterred by a base audit probability that equals δ_0^{nc} . Producer and consumer welfare are the same as in the "perfect and costless enforcement" case while the taxpayer costs are increased by the monitoring costs associated with δ_0^{nc} , i.e., $(1+d) \Phi(\delta_0^{nc})$. The slope of the relevant STC, $STC^{\theta \geq \theta_c}$, will equal to:

¹⁴ As long as there is government intervention in any other commodity market, the taxpayer surplus corresponding to point E embodies the fixed costs associated with the operation of the enforcement agency. When non-intervention in the specific market also reflects *laissez-faire* conditions in the whole agricultural sector, taxpayer surplus at point E on Figure 3.6 would increase by the fixed costs associated with the existence of the agency responsible for the enforcement of agricultural policy.

$$s^{\theta \geq \theta_c} = \frac{\partial PS}{\partial (CS^{\theta \geq \theta_c} + TS^{\theta \geq \theta_c})} = \frac{\partial PS}{\partial [CS^{\theta \geq \theta_c} + (1+d)\Phi(\delta_0^{nc})]} \quad (3.9)$$

where $\partial CS^{\theta \geq \theta_c}$ equals ∂CS^{pce} .

The higher costs required for a given transfer to occur result in reduced transfer efficiency of the policy instrument relative to the “perfect and costless enforcement” case. Since δ_0^{nc} is a decreasing function of \bar{Q} , the greater is the level of intervention (i.e. the further left from E we move), the greater is the base audit probability that deters cheating. Increased δ_0 results in increased resource costs of monitoring and enforcement. Graphically, the increased enforcement costs result in a leftward elongation of $STC^{\theta \geq \theta_c}$ relative to the STC^{pce} with the horizontal distance between the two STCs reflecting the monitoring costs associated with δ_0^{nc} . Both curves reach a maximum at the same level of producer surplus i.e., the same level of surplus can be transferred to producers under both situations.

When, however, $\theta \in [0, \theta_c)$, the monitoring level that completely deters cheating is not economically optimal. Above-quota production will occur and some part of producer surplus is transferred to taxpayers through the penalties paid on detected over-production (i.e., $R_p^{\theta < \theta_c} = (\delta_0^{\theta < \theta_c} + \delta_1 Q_m^{\theta < \theta_c}) p Q_m^{\theta < \theta_c}$ when $0 < \theta < \theta_c$, and $R_p^{\theta^0, k^0} = (\delta_0^{\theta^0, k^0} + \delta_1 Q_m^{\theta^0, k^0}) p Q_m^{\theta^0, k^0}$ when $\theta = k = 0$). The slope of the $STC^{\theta < \theta_c}$ can be written as:

$$s^{\theta < \theta_c} = \frac{\partial PS}{\partial (CS^{\theta < \theta_c} + TS^{\theta < \theta_c})} = \frac{\partial PS}{\partial \left\{ CS^{\theta < \theta_c} + (1+d) \left[\Phi(\delta_0^{\theta < \theta_c}) - R_p^{\theta < \theta_c} \right] \right\}} \quad (3.10)$$

while the slope of STC^{θ^0, k^0} equals:

$$s^{\theta^0, k^0} = \frac{\partial PS}{\partial (CS^{\theta^0, k^0} + TS^{\theta^0, k^0})} = \frac{\partial PS}{\partial \left\{ CS^{\theta^0, k^0} + (1+d) \left[\Phi(\delta_0^{\theta^0, k^0}) - R_p^{\theta^0, k^0} \right] \right\}} \quad (3.11)$$

where $|\partial CS^{\theta^0, k^0}| > |\partial CS^{\theta < \theta_c}| > |\partial CS^{\theta \geq \theta_c}|$.

Similar to the previous cases, when total production falls below the monopoly output producer surplus falls when $\theta \in [0, \theta_c)$. The consumer/taxpayer surplus is reduced initially but rises after the point is reached where the penalties collected on detected cheating exceed the resource costs of monitoring and the loss in consumer surplus. The result is the backward bending portion of the $STC^{\theta < \theta_c}$ and STC^{θ^0, k^0} curves in Figure 3.6.

The transfer R_p from producers to taxpayers under imperfect enforcement implies that, in order for a given surplus to be transferred to producers, the output level has to be reduced more than would otherwise be required. This reduction in total output results in increased distortionary costs of market intervention relative to the “perfect and costless enforcement” case. Moreover, the positive δ_0 that occurs when $\theta \in [0, \theta_c)$ means positive monitoring and enforcement costs.

Because of the increased resource costs associated with a given transfer to producers the $STC^{\theta < \theta_c}$ and STC^{θ^0, k^0} will lie underneath STC^{pce} everywhere to the left of E. Hence, the most efficient income redistribution through output restrictions occurs in a world where policy enforcement is perfect and costless. The implication of this result is that the traditional analysis of the policy instrument, by ignoring the costs associated with the enforcement of the farm program, overestimates the transfer efficiency of output quotas.

Consider next the relative transfer efficiency of output restrictions under the different political preferences of the enforcement agency when program enforcement is costly. The analysis in the previous section shows that both enforcement and total production increase with an increase in the weight placed by the enforcement agency on producers (i.e., $\delta_0^{\theta^0, k^0} < \delta_0^{\theta < \theta_c} < \delta_0^{\theta \geq \theta_c}$ and $Q^{*\theta^0, k^0} < Q^{*\theta < \theta_c} < Q^{*\theta \geq \theta_c}$). As long as the increase in monitoring costs (associated with the higher δ_0) is smaller than the reduction in the welfare losses from misallocation of resources (due to higher production), the transfer efficiency of the policy instrument increases with an increase in θ , i.e., $|s^{\theta^0, k^0}| < |s^{\theta < \theta_c}| < |s^{\theta \geq \theta_c}|$. For given market conditions, relatively low enforcement costs result in a STC^{θ^0, k^0} that lies under $STC^{\theta < \theta_c}$ which, in turn, lies under $STC^{\theta \geq \theta_c}$ everywhere to the left of E (Figure 3.6). More generally, the lower are the enforcement costs, the greater is the likelihood that the transfer efficiency of the policy instrument increases with an increase in θ for any level of market intervention.

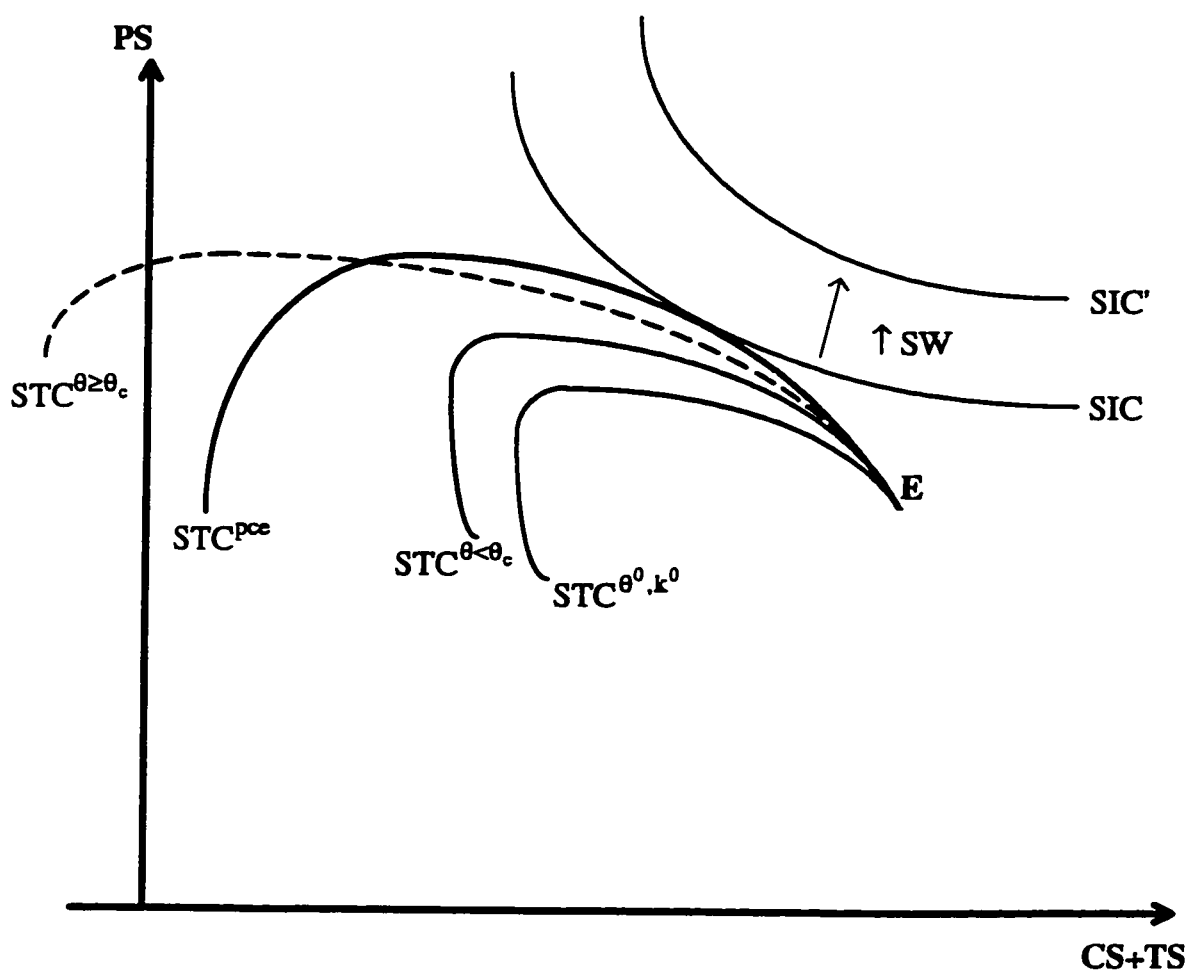


Figure 3.6. Surplus Transformation Curves of Output Quotas Under Costly Enforcement (Low $\Phi(\delta_0)$)

When enforcement costs are high, income redistribution is more efficient under reduced enforcement; STC^{θ^0, k^0} lies above $STC^{\theta < \theta_c}$ which, in turn, lies above $STC^{\theta \geq \theta_c}$. This is true for the range of intervention where the increase in enforcement costs outweigh the relevant decrease in deadweight welfare losses. As long as the reduction in the deadweight loss is greater than the increase in monitoring costs, $STC^{\theta \geq \theta_c}$ will eventually cross $STC^{\theta < \theta_c}$ and STC^{θ^0, k^0} from below (Figure 3.7).

Recall that, because of the transfers from producers to taxpayers through penalties on detected above-quota production, the maximum transfer that can be achieved when some cheating is allowed is always smaller than the maximum feasible transfer when cheating is completely deterred. Therefore, the STC^{θ^0, k^0} and $STC^{\theta < \theta_c}$ reach their maximum at a lower level of producer surplus than $STC^{\theta \geq \theta_c}$ (and STC^{pce}).

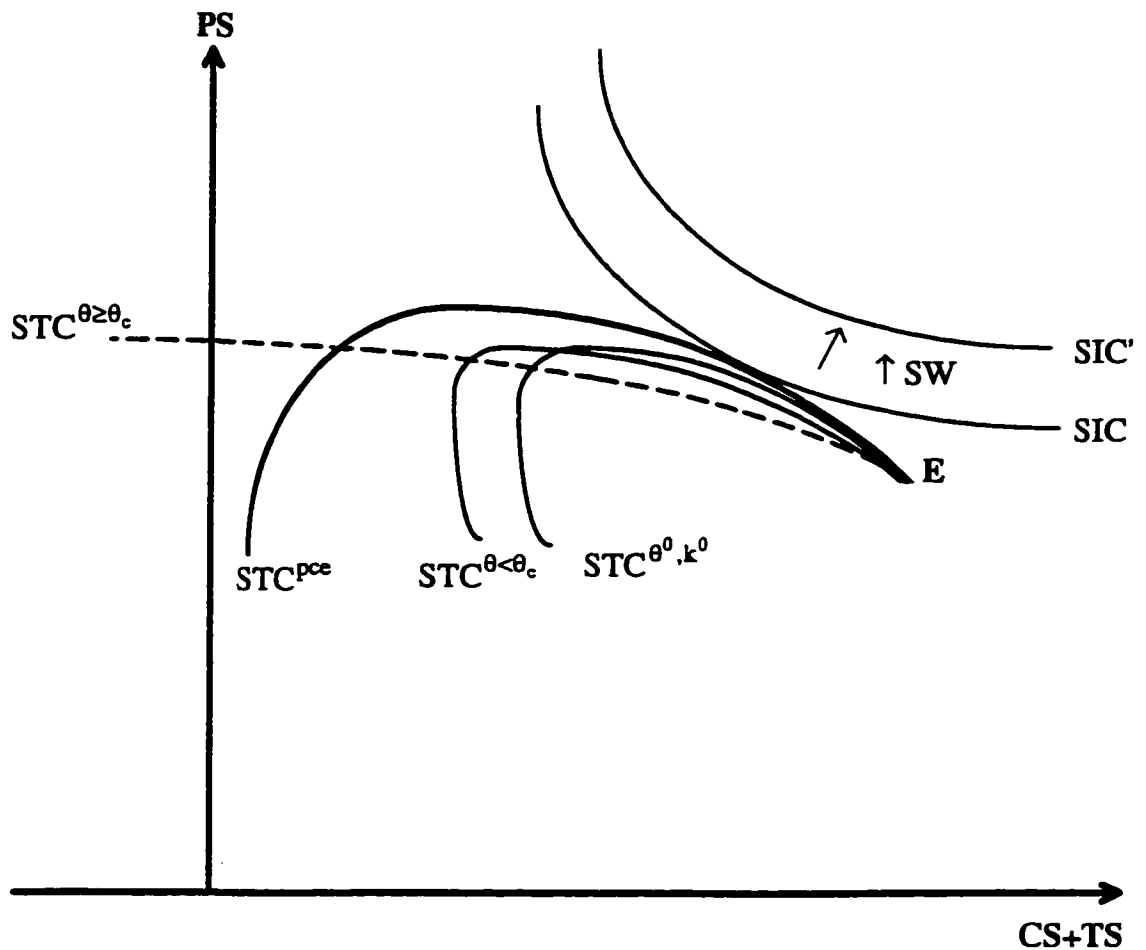


Figure 3.7. Surplus Transformation Curves of Output Quotas Under Costly Enforcement (High $\Phi(\delta_c)$)

Overall, the efficiency of output quotas in redistributing income to producers of the regulated commodity depends on the amount of enforcement and the associated monitoring costs. When enforcement costs are low, the efficiency of output quotas increases with an increase in enforcement and the reduction in cheating. When, on the other hand, enforcement costs are high, the transfer efficiency of the instrument depends on the desired transfer to producers. For relatively small transfers, the transfer efficiency increases with a reduction in monitoring. Because there is a limit on the maximum income redistribution that can be achieved under imperfect enforcement, when political preferences dictate the transfer of a large amount to producers, complete deterrence of cheating is the only feasible way to achieve this objective.

3.6 Optimal Transfer

The STC framework developed above can be proved useful in determining the socially optimal income redistribution. Consider the case where the objective of the regulatory agency is the determination of the surplus transfer to producers that maximizes some social welfare function (SWF) (rather than the determination of the quota level that transfers a *given* surplus to producers). Assume that the political preferences of the regulator result in social indifference curves (SIC) similar to those graphed in Figures 3.6 and 3.7, with the SWF value increasing with the northeast shift of the SIC.

The optimal transfer to producers under the various levels of program enforcement is determined by the tangency of the SIC with the relevant STC. In the relevant area for policy intervention through output restrictions (i.e. the area to the

right of the point corresponding to monopoly output), the level of optimal total transfer to producers increases with an increase in the efficiency of the policy instrument in redistributing income.

The maximum transfer to producers will take place in an environment where cheating is perfectly and costlessly deterred. Since the transfer to producers under an output quota occurs through the market effects of the policy instrument, there will be less output produced under perfect and costless enforcement than when program enforcement is costly (i.e., the level of production under perfect and costless enforcement will be closer to the monopoly output). Obviously, the traditional analysis of output quotas, by assuming perfect and costless enforcement of output quotas, inflates the socially optimal total transfer to producers and the social welfare value from intervention as well.

When program enforcement is costly, both the optimal total transfer to producers and the social welfare from intervention increase with an increase in enforcement when enforcement costs are low. When enforcement costs are high, the optimal transfer and the value of the SWF fall with an increase in the level of monitoring (Figure 3.7).

3.7 Extensions of the Model

3.7.1 *Endogenous Penalties*

Crucial for the previous analysis and results is the assumption that penalties are exogenous to agricultural policy makers. This part of the chapter relaxes this assumption and derives the equilibrium enforcement, cheating and intervention as well as the transfer efficiency of output quotas in an environment where policy enforcers have control over both base audit probability and penalties.

Assuming that there are no economic costs associated with setting the level of penalties on detected above-quota production, the main implication of endogenous penalties is that policy enforcement is not necessarily costly. Since both δ_0 and ρ affect farmers' production decisions, the enforcement agency could achieve its objectives by substituting costly monitoring with costless penalties.

Endogeneity of penalties requires another K-T condition to the optimization problem of the enforcement agency presented by equation (3.4), i.e.,

$$L_\rho \leq 0, \quad \rho \geq 0 \rightarrow L_\rho \rho = 0$$

Obviously, the optimal choice of an enforcement agency that places a relatively high weight on producer surplus would still be the complete deterrence of cheating. In this case however, the induced farmer compliance will be achieved by the establishment of a

zero base audit probability¹⁵ and a huge per unit penalty on above-quota quantities.

More specifically, whenever θ is greater than or equal to the critical value θ_c^p , where

$$\theta_c^p = \frac{(1+d)(b_1 - a_1)(Q^e - \bar{Q}) - 2a_1 k \bar{Q}}{(b_1 - 3a_1)\bar{Q} - (b_1 - a_1)Q^e} \quad (3.12)$$

the solution to the enforcement agency's problem is:

$$\delta_0^{\theta \geq \theta_c^p} = 0 \text{ and } \rho^{\theta \geq \theta_c^p} = \frac{(b_1 - a_1)(Q^e - \bar{Q})}{\delta_0} \quad (= \infty) \quad (3.13)$$

When, however, θ is less than θ_c^p , program enforcement is imperfect and some cheating occurs. The optimal enforcement consists of a zero δ_0 and a positive but smaller than ρ^{nc} penalty, i.e.,

$$\delta_0^{\theta < \theta_c^p} = 0 \text{ and} \quad (3.14)$$

$$\rho^{\theta < \theta_c^p} = \frac{(b_1 - a_1) \left[-(1+d)(b_1 - a_1)(Q^e - \bar{Q})^2 - 2a_1 k (Q^e - \bar{Q})Q^e - 2\theta(b_1 \bar{Q} - a_1 Q^e)Q^e + \theta(b_1 - a_1)(Q^{e^2} - \bar{Q}^2) \right]}{2\delta_1(Q^e - \bar{Q}) \left[-2a_1(\theta - k)\bar{Q} - (\theta + 1 + d)(b_1 - a_1)(Q^e - \bar{Q}) \right]}$$

¹⁵ Zero δ_0 does not mean that cheating goes undetected. What it means is that policy enforcers will not spend resources to detect over-production over and above that would otherwise occur.

Consistent with *a priori* expectations, an increase in θ increases both the program enforcement and the likelihood that cheating will be completely deterred (i.e. the likelihood that $\theta \geq \theta_c^p$). The opposite is true for an increase in the weight placed on consumers.

The optimality conditions indicate that when $\theta \geq \theta_c^p$, the enforcement of output quotas will be perfect and costless.¹⁶ In such a case, the quota level that transfers the desired surplus to producers, the transfer efficiency of the policy instrument, and the socially optimal income redistribution are those derived by the traditional analysis of the policy mechanism. Therefore, one interpretation of the assumption of “perfect and costless policy enforcement” implicit in the traditional agricultural policy analysis is the costless establishment of enormous fines on farmers producing over and above their quota.

Even though induced honesty through the establishment of huge penalties is a standard result in crime literature (i.e. Becker’s “optimal fine” result), severe punishment of producers that violate their quota limit seems neither costless, nor credible or just (Carr-Hill and Stern; Stern; Stigler). And certainly it is not what is observed in (most of) today’s world. Agricultural policy making should incorporate the same principles of social justice that underlie all other areas of policy making. Penalties are generally the responsibility of the legal system and are usually set in accordance with the structure of the law enforcement and punishment within the community.

¹⁶ Graphically, infinite per unit penalty results in an infinite slope of the S+MP curve faced by the producers of the regulated commodity.

When $\theta < \theta_c^p$, above-quota production occurs and the quota level that achieves the desired transfer to producers is reduced relative to the “perfect and costless enforcement” case, i.e., $\bar{Q}^{\theta < \theta_c^p} < \bar{Q}^{pce}$.¹⁷ So does the level of total production. Reduced production results in increased welfare losses from misallocation of resources associated with a given transfer to producers and, thus, reduced transfer efficiency of the policy instrument relative to the “perfect and costless enforcement” case.

Finally, when the enforcement agency controls both enforcement parameters and places no weight on the welfare of the interest groups, cheating will never be completely deterred due to the budgetary benefits from penalties on detected above-quota production. The combination of enforcement parameters that solves enforcement agency’s problem when $\theta = k = 0$ is:

$$\delta_0^{\theta^0, k^0} = \frac{(b_1 - a_1)^2 (Q^e - \bar{Q})\rho}{\psi[b_1 - a_1 + 2\delta_1'\rho]^2 + 2\rho^2[b_1 - a_1 + \delta_1'\rho]} \quad \text{and} \quad (3.15)$$

$$\rho^{\theta^0, k^0} = \frac{[B + \sqrt{4A^3 + B^2}]^{1/3}}{6 \cdot 2^{1/3} \delta_0^2 \delta_1^2} - \frac{A}{3 \cdot 2^{2/3} \delta_0^2 \delta_1^2 [B + \sqrt{4A^3 + B^2}]^{1/3}} - \frac{b_1 - a_1}{2\delta_1}$$

$$\text{where } A = 3(b_1 - a_1)^2 \delta_0^2 \delta_1^2 \left[\delta_0^2 + 4\delta_1(Q^e - \bar{Q}) \{ \delta_0 + \delta_1(Q^e - \bar{Q}) \} \right]$$

¹⁷ Graphically, the reduction in ρ will decrease the slope of the $S+MP$ curve ($S + MP^{\theta < \theta_c^p}$ in Figure 3.5). More specifically, a reduction in ρ will result in a rightward rotation of the $S+MP$ curve through $S(\bar{Q})$, the intercept of the effective supply curve whenever δ_0 equals zero.

$$\text{and } B = 18(b_1 - a_1)\delta_0^2\delta_1 A$$

Since the relative weight placed on producers is the lowest (i.e. $\theta = k = 0$), enforcement will be the smallest and above-quota production will be the greatest compared to all other scenarios involving endogenous penalties. The quota level that transfers a given surplus to producers will always be less than \bar{Q}^{pce} and the STC of the program will always lie underneath STC^{pce} .

3.7.2 *Centralized Policy Making*

Consider finally agricultural policy making in a hypothetical institutional arrangement where a single agency is responsible for both policy design and implementation.¹⁸ Since output quotas involve surplus transfers from consumers to producers, a necessary and sufficient condition for the adoption of the farm program is the relatively higher weight placed by single agency's policy makers on the welfare of producers. The problem of the single agency that decides both the level of quota and the enforcement of the program is to determine the least cost way of transferring the desired surplus to producers.

When penalties are exogenous to agricultural policy makers, the optimal choice in terms of enforcement is determined by a trade-off between the resource costs of

¹⁸ Even though interesting as an extension, it is difficult to imagine a country where policy design and implementation are contained in the hands of a single agency.

monitoring and the distortionary costs of market intervention. In general, for given market conditions and weights on the interest groups, the lower are the enforcement costs, the greater is the likelihood that cheating will be completely deterred. Actually, the level of enforcement under a single agency will be equal to the enforcement in a decentralized policy making in the case where the weights placed by policy enforcers on the welfare of the interest groups under the two institutional arrangements are the same.

When penalties are endogenous to a single agency policy maker, the economically optimal choice of the single agency in terms of enforcement will be to completely deter cheating with the establishment of a zero δ_0 and an infinite per unit penalty. The reason is that perfect and costless enforcement of the program enables the policy makers to implement the desired transfer to producers while incurring the minimum possible costs, namely the distortionary costs of market intervention associated with \overline{Q}^{pce} .

It is worth noting that the amount of policy enforcement depends on the relative weight placed by policy enforcers on producer welfare rather than the institutional arrangement characterizing policy making. The equilibrium enforcement, production and intervention under the two institutional arrangements will be the same when the political preferences of the enforcement agency under decentralized policy making coincide with those of the single agency policy makers.

3.8 Concluding Remarks

By operating under the implicit assumption of perfect and costless enforcement of output quotas, the traditional analysis of the farm program overestimates the quota level that transfers a given surplus to producers, the transfer efficiency of the policy instrument, the socially optimal total transfer to producers, and the social welfare value from intervention.

A simple model that incorporates enforcement costs has been developed in this chapter. Analytical results suggest that policy enforcers will always find it optimal to investigate farmers; program enforcement will always be positive. The amount of enforcement depends on the relative weights placed by policy enforcers on the welfare of the interest groups, on the resource costs of monitoring, and the market conditions. For given market conditions and monitoring costs, enforcement increases with the increase in the relative weight placed on producer surplus. Alternatively, for given market conditions and weight on producers and consumers, the likelihood that cheating will be completely deterred increases with the decrease in monitoring and enforcement costs.

The level of enforcement affects the choice of the regulator that desires to transfer a given surplus to producers of the regulated commodity. More specifically, the level of output quota that achieves a desired income redistribution towards producers increases with an increase in enforcement. So does the total quantity produced. The greater are enforcement and production, the greater are the monitoring costs and the lower are the resource costs from misallocation of resources.

The trade-off between the distortionary costs of intervention and the resource costs of monitoring determines the transfer efficiency of output quotas. For low monitoring and enforcement costs, the transfer efficiency of the policy mechanism increases with an increase in enforcement, while when enforcement costs are high, an increase in monitoring results in reduced efficiency of output quotas in transferring income to producers.

Contingent upon the prevailing enforcement and the size of monitoring costs is also the level of the socially optimal total transfer to producers. More specifically, both optimal total transfer and social welfare increase with an increase in enforcement when monitoring costs are relatively low. When enforcement costs are high, the optimal transfer and the value of social welfare fall with an increase in monitoring.

CHAPTER IV

THE ECONOMICS OF DEFICIENCY PAYMENTS IN THE PRESENCE OF CHEATING

4.1 Introduction

After examining the effects of enforcement costs on the economics of output restrictions in chapter III, we turn our attention to the economic analysis of deficiency payments when program enforcement is costly. Deficiency payments have traditionally been used by policy makers to encourage production of a specific commodity and/or to transfer income to producers. Both producers and consumers have benefited from this policy while taxpayers have incurred the costs. Figure 4.1 depicts the static, partial equilibrium welfare effects of the target price-deficiency payment scheme for a closed economy with linear approximations of supply and demand curves (Nerlove; Wallace; Gardner 1983, 1987a). In this static context the target price-deficiency payment scheme is equivalent to a producer subsidy. In what follows, the terms output subsidy and subsidy will be used to denote a producer subsidy and/or a deficiency payment.

Under a per unit output subsidy of v , producers receive an increase in producer surplus equal to the area p^1BCp^c , consumers gain area p^cCDp^c , while taxpayers lose area $(1+d)p^1BDp^c$, where d is the marginal deadweight loss from taxation. Taxpayers'

cost is given by the product of the market clearing quantity and the subsidy paid to farmers, adjusted to account for the positive deadweight losses from taxation. The distortionary costs of market intervention equal the area BCD plus $d(p^t B D p^c)$.

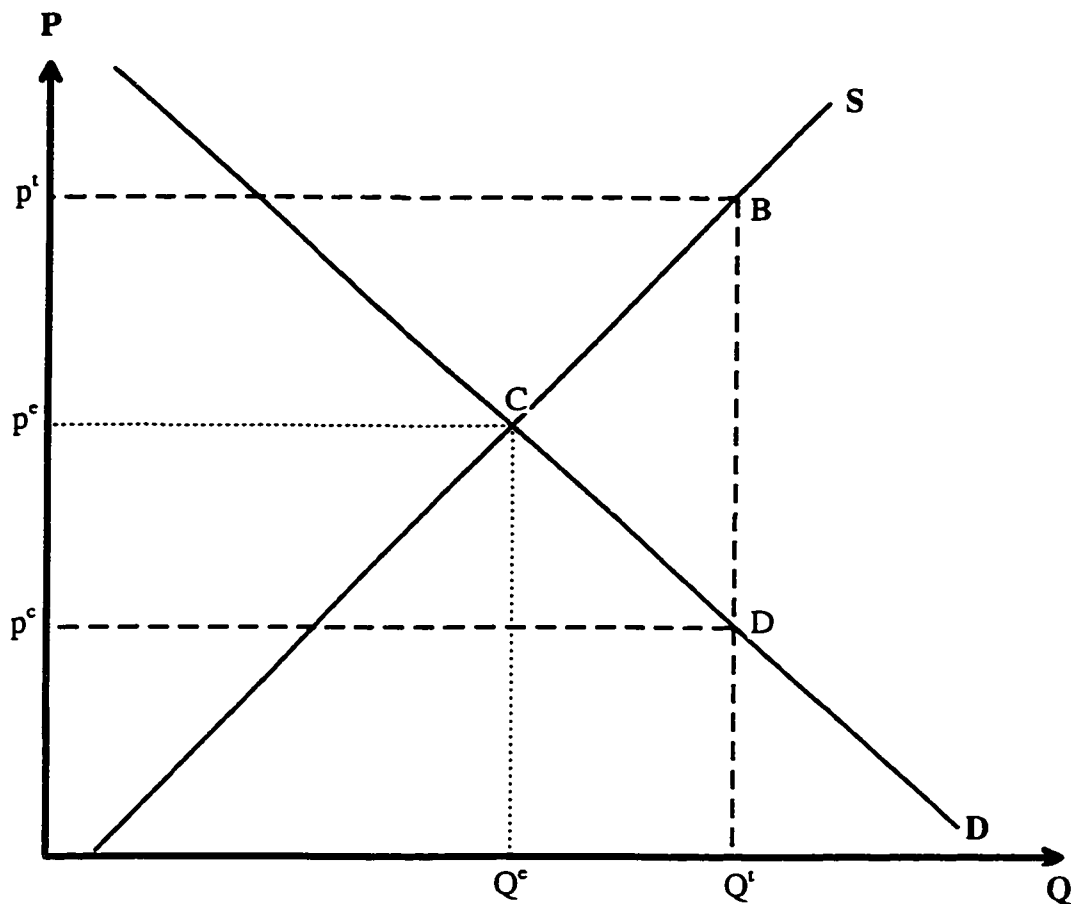


Figure 4.1. The Welfare Effects of Deficiency Payments and Producer Subsidies

The analysis presented above can be viewed as taking place under the implicit assumption that farmers comply completely with the provisions of the farm program, or alternatively, that policy enforcement is perfect and costless. Enforcement, however, is not costless; monitoring farmers' actions requires government resources. Because of

the cost associated with program enforcement, enforcement is likely to be incomplete. Imperfect enforcement in turn creates economic incentives for farmers to cheat on the program by misrepresenting the quantity produced. The possibility of cheating arises from the fact that eligibility for government payments requires farmers to make an application for the payment. By over-reporting the level of their production on the application, farmers can collect payments on quantities greater than those produced.

The purpose of this chapter is to introduce farmer misrepresentation into the economic analysis of output subsidies. Similar to the quota case, policy design and implementation is modeled as a sequential game between the regulator who decides on the level of intervention, an enforcement agency that determines the amount of policy enforcement, and the farmer who decides on the quantity to produce and the quantity to misrepresent. The payoff functions of all agents are assumed to be common knowledge. The regulator moves first and decides on the subsidy knowing exactly how his decisions will affect enforcement and misrepresentation. Optimal enforcement is determined next. Finally, the farmer makes her production and cheating decisions observing both policy variable and enforcement parameters. Different scenarios concerning the political preferences of the enforcement agency and the decision variables it controls are examined within this framework. Similar to chapter III, this chapter focuses on a decentralized policy making as it reflects agricultural policy making in most (if not all) countries and certainly the EU and the US (see chapter II). The hypothetical institutional structure where a single agency designs and implements farm programs is also examined.

4.2 Optimal Misrepresentation by the Representative Farmer

Under an output subsidy scheme, farmers may find it economically optimal to cheat on the program by over-reporting the level of their production. Assuming farmers know with certainty the subsidy for their production, the penalty in case they are caught cheating, and the probability of being investigated, their decision on whether to cheat (and if so, by how much) can be modeled as decision making under uncertainty. In this framework, the individual farmer's choice can be viewed as a choice between a certain outcome (profits if she does not cheat) and her profits in case she misrepresents her level of production. Assuming the representative farmer is risk neutral, her objective function can be written as:

$$\max_{q^t, q_m} E[\Pi] = (p^c + v)q^t - c(q^t) + [(1 - \delta)v - \delta\rho]q_m \quad (4.1)$$

where p^c is the market clearing price; v is the output subsidy; q^t is the quantity produced; $c(q^t)$ is the cost function; q_m is the quantity reported over and above q^t ; ρ is the per unit penalty charged on detected misrepresentation; and δ is the probability the farmer will be audited (and detected and punished if she misrepresents her actual production). The probability of audit takes values between zero and one (i.e. $\delta \in [0, 1]$) and reflects the intensity with which agricultural policy is enforced and with which cheating is investigated.

In accord with the previous chapter, the audit probability is assumed to be a linear function of the amount of cheating, i.e. $\delta = \delta_0 + \delta_1 q_m$. The audit probability is assumed to be equal to a fixed base probability (δ_0) plus a component that depends on the misrepresented quantity ($\delta_1 q_m$). δ_0 is assumed to be dependent on the resources spent by the enforcement agency on auditing the farmers. The variable component ($\delta_1 q_m$) depends on factors affecting the observability of farmers' actions (i.e. such as location and dispersion of the farms) and is assumed to be outside the control of policy enforcers.

The first order conditions (F.O.C.) for the representative farmer's problem are:

$$\frac{\partial E[\Pi]}{\partial q^t} = 0 \Rightarrow p^c + v = c'(q^t) \quad (4.2)$$

$$\frac{\partial E[\Pi]}{\partial q_m} = 0 \Rightarrow v - \delta_0(v + \rho) - 2\delta_1(v + \rho)q_m = 0 \Rightarrow q_m = \frac{v - \delta_0(v + \rho)}{2\delta_1(v + \rho)} \quad (4.3)$$

Equation (4.2) shows that the farmer will produce where the market price plus subsidy equals the marginal cost of production. Note that the optimal output level does not depend on any of the parameters associated with farmer misrepresentation.

Equation (4.3) shows the optimal choice of the quantity misrepresented by the representative farmer as a function of subsidy payments, per unit penalty and audit

probability parameters.¹⁹ Equation (4.3) thus reflects the best response of the farmer to the choices made by the regulatory and enforcing agencies. Consistent with *a priori* expectations, misrepresented quantity increases with the subsidy payment and decreases with an increase in the audit probability and per unit penalty parameters.

Manipulation of the expression for q_m indicates that the over-reported quantity is positive when δ_0 is less than $\frac{v}{v+\rho}$, when v is greater than $\frac{\delta_0 \rho}{(1-\delta_0)}$, or when ρ is less than $\frac{(1-\delta_0)v}{\delta_0}$. These critical values for δ_0 , v and ρ are denoted δ_0^{nc} , v^{nc} and ρ^{nc}

respectively, where the superscript nc stands for no cheating. A manipulation of equation (4.3) shows that the optimal level of misrepresentation is given by equating

$\frac{v}{v+\rho}$ and $\delta_0 + 2\delta_1 q_m$. Figure 4.2 shows this relationship graphically.

The horizontal line $\frac{v}{v+\rho}$ shows the ratio of the marginal benefits in case cheating goes undetected, over the opportunity cost in case the farmer is caught cheating. The line $\delta_0 + 2\delta_1 q_m$ shows the change in the output that is expected to be penalized for a change in the quantity misrepresented, or the marginal penalized output

¹⁹ Similar to the case of output quotas in chapter III, the model in equation (4.1) can be modified to include risk aversion of the representative farmer and/or the private costs from cheating. The risk averse representative farmer will choose q_m that maximizes her expected utility (i.e. $\max_{q^t, q_m} E[U(\Pi)] = (1-\delta)U[(p^c + v)q^t - c(q^t) + vq_m] + \delta U[(p^c + v)q^t - c(q^t) - \rho q_m]$). In terms of output misrepresentation, risk aversion results in reduced cheating relative to the case where risk neutrality is assumed. Cheating also falls when the costs incurred by farmers in protecting themselves from detection (i.e. $k(q_m)$) are incorporated into the representative farmer's objective function. Even though both risk averse behavior and private costs from cheating change the results quantitatively, the qualitative nature of the results in this chapter remains unaffected.

(mpo). Finally, line delta in Figure 4.2 graphs the audit probability, δ .

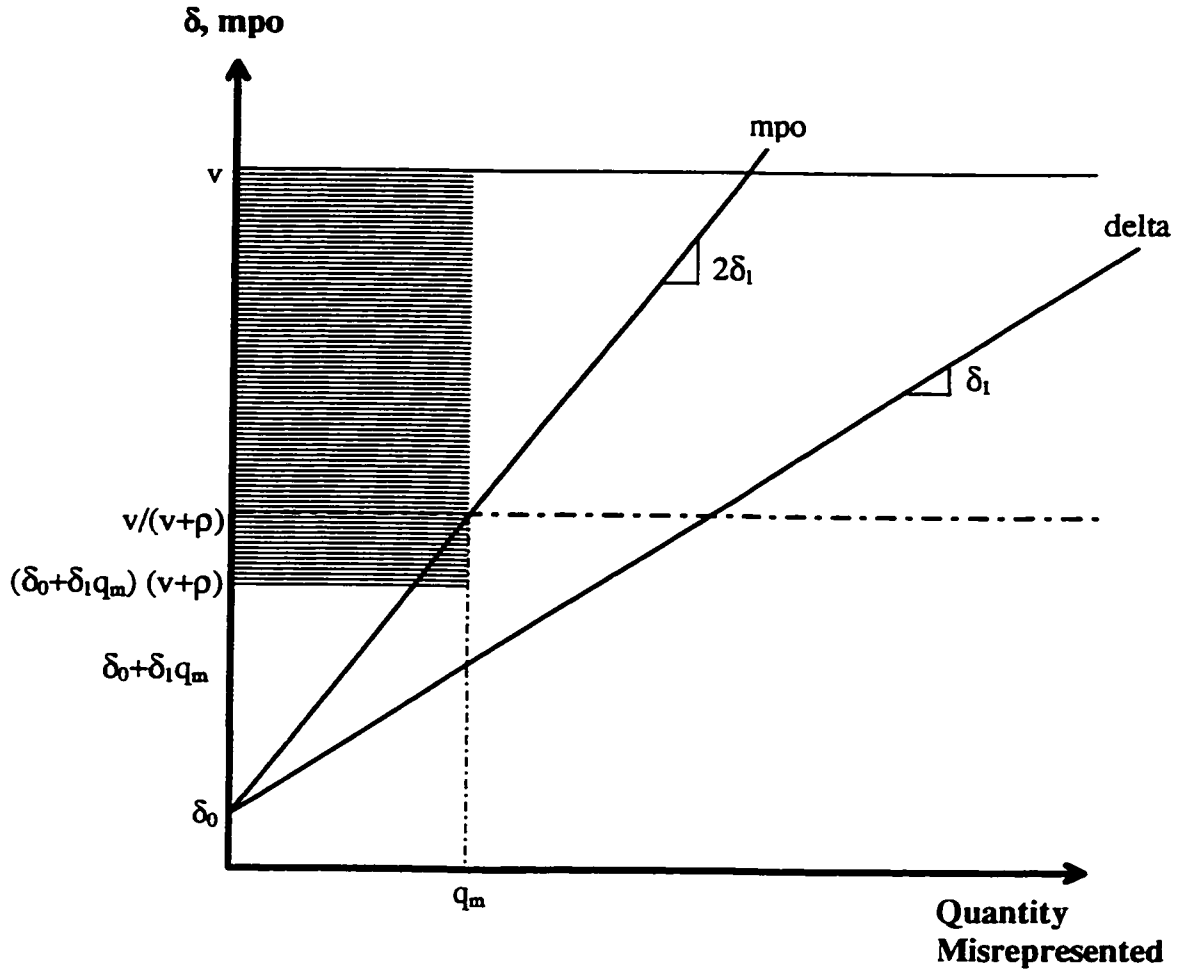


Figure 4.2. Misrepresentation on Output Subsidies (Cheating Equilibrium)

Figure 4.3 graphs the determination of optimal misrepresentation at the industry level. The lines DELTA and MPO are the horizontal summation of individual farmers' delta and mpo curves respectively. Both curves have an intercept at δ_0 . The slopes of DELTA and MPO curves are $\frac{\delta_1}{N}$ and $\frac{2\delta_1}{N}$ respectively, where N is the number of

representative farmers producing the commodity. The intersection of $\frac{v}{v+\rho}$ and MPO

gives the aggregate quantity misrepresented at equilibrium which can be written as:

$$Q_m = Nq_m = \frac{v - \delta_0(v+\rho)}{2\delta_1'(v+\rho)} \quad (4.4)$$

where $\delta_1' = \frac{\delta_1}{N}$.

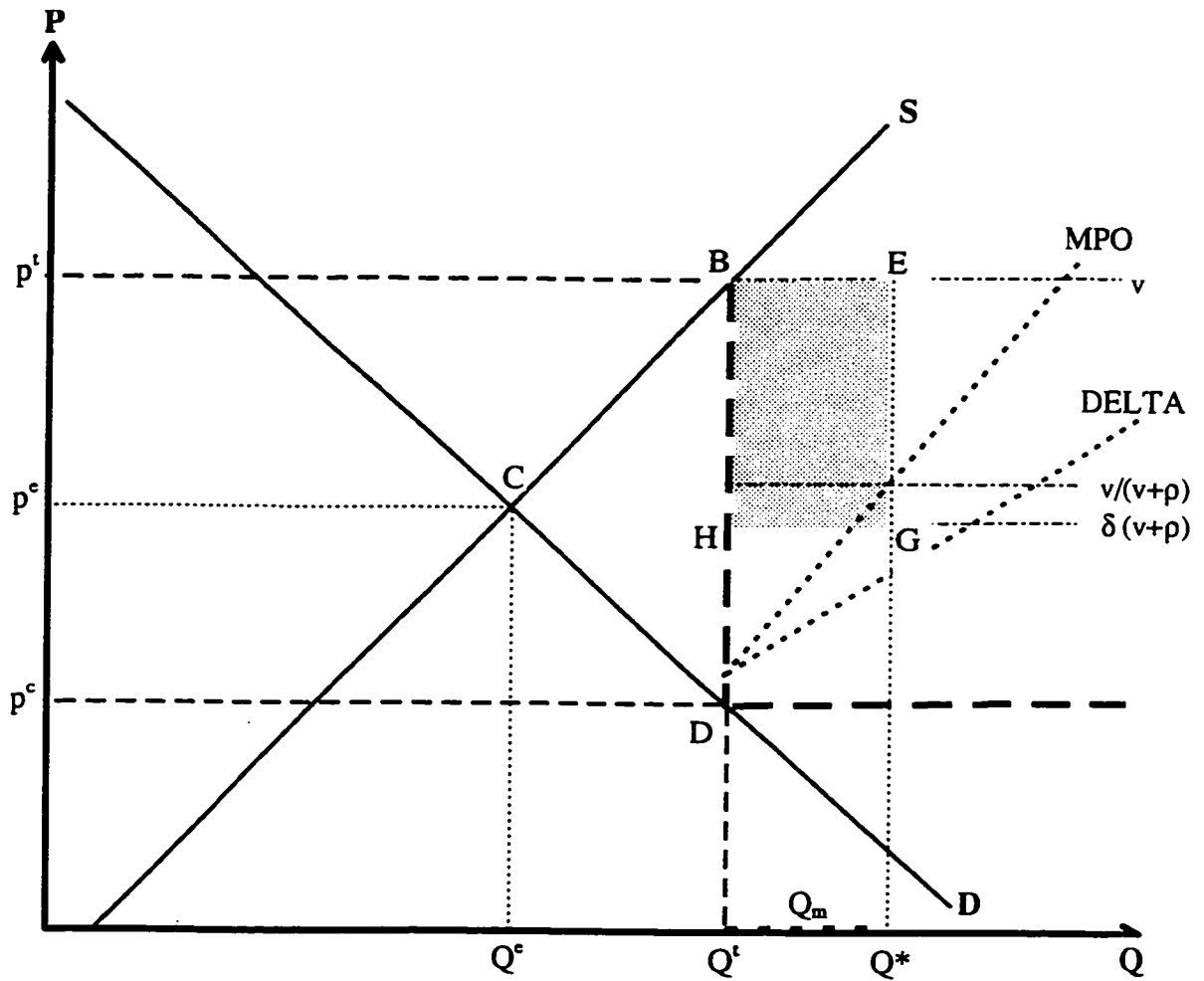


Figure 4.3. The Welfare Effects of Output Subsidies under Costly Enforcement and Misrepresentation

When the combination of policy variable and enforcement parameters are such that farmers misrepresent, traditional analysis fails to consider the area BEGH. This area represents farmers' expected benefits from cheating, $E[B_c] = [v - \delta(v + \rho)]Q_m$. The benefits from cheating constitute a decoupled income transfer from taxpayers to producers. The transfer is decoupled since it does not affect farmers' production decisions. Furthermore, there are resource costs associated with any positive level of δ_0 . A positive number of audits means positive resource costs. Even though not present in the stylized Figure 4.3, monitoring costs should be included in both the taxpayers' costs and the welfare losses from market intervention. The resource costs of monitoring, denoted as $\Phi(\delta_0)$, are assumed to be an increasing function of the base audit probability (i.e. $\Phi'(\delta_0) \geq 0$, $\Phi''(\delta_0) \geq 0$). Similar to the analysis of output restrictions in chapter III, the fixed costs associated with the operation of the enforcement agency are not incorporated in the taxpayer costs from output subsidies. The reason for the exclusion of these fixed costs lies in the presumption that the existence of the agency depends on government intervention in agriculture rather than the presence of any commodity program in particular.

4.3 Optimal Enforcement by the Enforcement Agency

Equation (4.4) indicates that farmer misrepresentation under a subsidy scheme depends on the level of the payment and the enforcement parameters. Since, however, the enforcement parameters and the policy variable are endogenous to agricultural policy makers, the question that naturally arises is why cheating occurs. Or, put a different

way, is complete deterrence of cheating the optimal response of regulatory and enforcement agencies to the (optimizing) behavior of the farmers (which has been proved to include cheating when allowed by the circumstances)? This section of the chapter examines the problem of policy enforcers under decentralized policy making. In the current setting, the enforcement agency has to determine the degree of enforcement of a subsidy scheme designed by the regulator knowing exactly how its decisions will affect the (optimizing) behavior and welfare of farmers.

The level of enforcement is determined by the combination of the enforcement parameters, the audit probability and the penalties. As has been mentioned in chapter III, penalties for producers detected cheating on farm programs are generally set elsewhere in the legal system and are, therefore, exogenous to agricultural policy makers. With ρ exogenous to agricultural policy makers, the problem of the enforcement agency is the determination of δ_0 that maximizes its objective function. The general form of the enforcement agency's problem can be written as:

$$\begin{aligned}
 \max_{\delta_0} W &= \theta PS + TS = \\
 &= \theta \left\{ S(Q^t) Q^t - \int_0^{Q^t} S(Q) dQ + \left[(1-\delta) (S(Q^t) - D(Q^t)) - \delta \rho \right] Q_m \right\} - \\
 &\quad - (1+d) \left\{ \left[S(Q^t) - D(Q^t) \right] Q^t + \left[(1-\delta) (S(Q^t) - D(Q^t)) - \delta \rho \right] Q_m + \Phi(\delta_0) \right\} \quad (4.5)
 \end{aligned}$$

$$\text{s.t. } Q_m = \frac{v - \delta_0(v + \rho)}{2\delta_1'(v + \rho)}$$

where $D(Q)$ and $S(Q)$ are the inverse demand and supply functions respectively, and θ is the weight placed by the enforcement agency on producer welfare. All other variables are as previously defined. The consumer surplus can be safely assumed away from the objective function of policy enforcers since for any output subsidy v cheating involves direct transfers from taxpayers to producers. Due to the decoupled nature of the transfer through cheating, consumer welfare is not affected by the amount of enforcement and farmer misrepresentation.

Assuming the resource costs of investigation $\Phi(\delta_0)$ are equal to $\frac{1}{2}\psi\delta_0^2$ (where ψ is a strictly positive scalar depending on things like the agrarian structure and the number of representative farmers), the F.O.C. for the problem is:

$$\frac{\partial W}{\partial \delta_0} = 0 \Rightarrow (1+d)\psi\delta_0 = [(1+d)-\theta] \left[\frac{S(Q^t)-D(Q^t)}{2\delta_1'} - \frac{[S(Q^t)-D(Q^t)+\rho]}{2\delta_1'} \right] \delta_0 \quad (4.6)$$

Equation (4.6) indicates that the optimal audit probability is determined by equating the marginal resource costs of monitoring and enforcement ($MCE = (1+d)\psi\delta_0$), with the marginal benefits from investigation ($MBe = [(1+d)-\theta] \frac{v - \delta_0(v+\rho)}{2\delta_1'}$). The marginal benefits from investigation include benefits from penalties on the current level of misrepresentation and the benefits from induced honesty. These latter benefits include the consequences for interest group welfare of increased enforcement and reduced misrepresentation.

The effect of policy enforcement on farmers' well-being may or may not be taken into account by policy enforcers. For various reasons, the enforcement agency might place a relatively high weight ($\theta = \theta^H$, where $\theta^H \geq 1+d$), a low weight ($\theta = \theta^L$, where $\theta^L \in (0, 1+d)$), or no weight ($\theta = \theta^0 = 0$) on producer surplus. Substituting these values into equation (4.6) and solving for δ_0 generates the best response function of the enforcement agency to the output subsidy chosen by the regulator for the three values of θ .

More specifically, when the enforcement agency does not consider the effect of its choices on producers' welfare (i.e., $\theta = \theta^0 = 0$) but its objective instead is to minimize taxpayer costs from cheating,²⁰ the base audit probability will equal:

$$\delta_0^{\theta^0} = \frac{S(Q^t) - D(Q^t)}{S(Q^t) - D(Q^t) + \rho + 2\delta_1\psi} = \frac{v}{v + \rho + 2\delta_1\psi} \quad (4.7)$$

where the superscript denotes the weight placed by policy enforcers on producer surplus. Similarly, when the enforcement agency places a positive but relatively low weight on producer surplus (i.e. θ is lower than the marginal cost of public funds, $1+d$), the optimal δ_0 , $\delta_0^{\theta^L}$, will equal:

²⁰ Substituting θ^0 into equation (4.5) shows that enforcement agency's payoff function is measured by the addition to the regulator's revenue net of monitoring costs. Alternatively, the enforcement agency can be viewed as seeking a δ_0 that minimizes total budgetary costs from cheating, i.e., the resource costs of investigation plus the payments on quantity misrepresented minus the penalties collected from those detected cheating.

$$\delta_0^{\theta^L} = \frac{[(1+d)-\theta][S(Q')-D(Q')]}{[(1+d)-\theta][S(Q')-D(Q')+\rho]+(1+d)2\delta_1\psi} = \frac{[(1+d)-\theta]v}{[(1+d)-\theta](v+\rho)+(1+d)2\delta_1\psi} \quad (4.8)$$

When the weight placed on producers exceeds the marginal cost of misrepresentation to taxpayers (i.e. $\theta \geq 1+d$), the best response of policy enforcers is complete allowance of cheating, i.e.,

$$\delta_0^{\theta^H} = 0 \quad (4.9)$$

A zero base audit probability does not mean that cheating goes undetected. Since δ_1 is assumed to be strictly positive, a zero δ_0 means that policy enforcers will not actively spend resources to deter misrepresentation over and above that would otherwise occur.

The reaction functions of policy enforcers under the different θ s indicate that δ_0 decreases with the increased weight placed on producers (i.e. $\delta_0^{\theta^0} > \delta_0^{\theta^L} > \delta_0^{\theta^H}$).

Maximum enforcement occurs when policy enforcers place zero weight on producer welfare. Enforcement, however, will always be incomplete due to the positive resource costs of monitoring (i.e. $\psi > 0$); the audit probability will be less than the one that deters cheating (i.e. $\delta_0 < \delta_0^{nc} = \frac{v}{v+\rho}$).

Graphically, the optimal δ_0 under the alternative political preferences of the enforcement agency is determined by the intersection of the M_{Ce} curve with the relevant M_{Be} curve in Figure 4.4, Panel (a). When θ equals zero the relevant marginal

benefit function is shown as the downward sloping solid MBe curve. The MBe curve is downward sloping due to the decrease in misrepresentation caused by increases in δ_0 . The intersection of the MBe curve with the horizontal axis determines the base audit probability that completely deters cheating, δ_0^{nc} . Obviously, δ_0^{nc} would be the optimal choice of policy enforcers if investigating farmers was costless (i.e. $\psi = 0$). In this case, the MBe curve would coincide with the horizontal axis. However, monitoring farmers' actions is costly. The greater are the monitoring costs (i.e. the larger is ψ), the greater is the slope of the MBe curve, and the lower is the base audit probability.

An increase in the weight policy enforcers place on producer surplus reduces both the intercept and the absolute value of the slope of the marginal benefit function. More specifically, increases in θ cause a leftward rotation of the MBe curve through δ_0^{nc} . *Ceteris paribus*, this results in a reduced base audit probability. Under θ^L , the relevant MBe curve (shown as the downward sloping dashed MBe curve in Figure 4.4, Panel (a)) will always fall between the MBe curve under θ^0 and the horizontal axis; $\delta_0^{\theta^L}$ is always positive.

When $\theta=1+d$, the weight placed by policy enforcers on producers equals the marginal cost of public funds, i.e. the implicit weight placed by the enforcement agency on taxpayer surplus. Since taxpayer gains from increased enforcement constitute producer losses (in a one-to-one correspondence) and since the welfare of the interest groups are weighted equally, the marginal benefits from enforcement are zero. Hence, when $\theta=1+d$, the MBe curve coincides with the horizontal axis, and both the slope and

the intercept equal zero. The only point where the MCE curve meets the horizontal axis is at the origin. Thus, the optimal δ_0 equals zero.

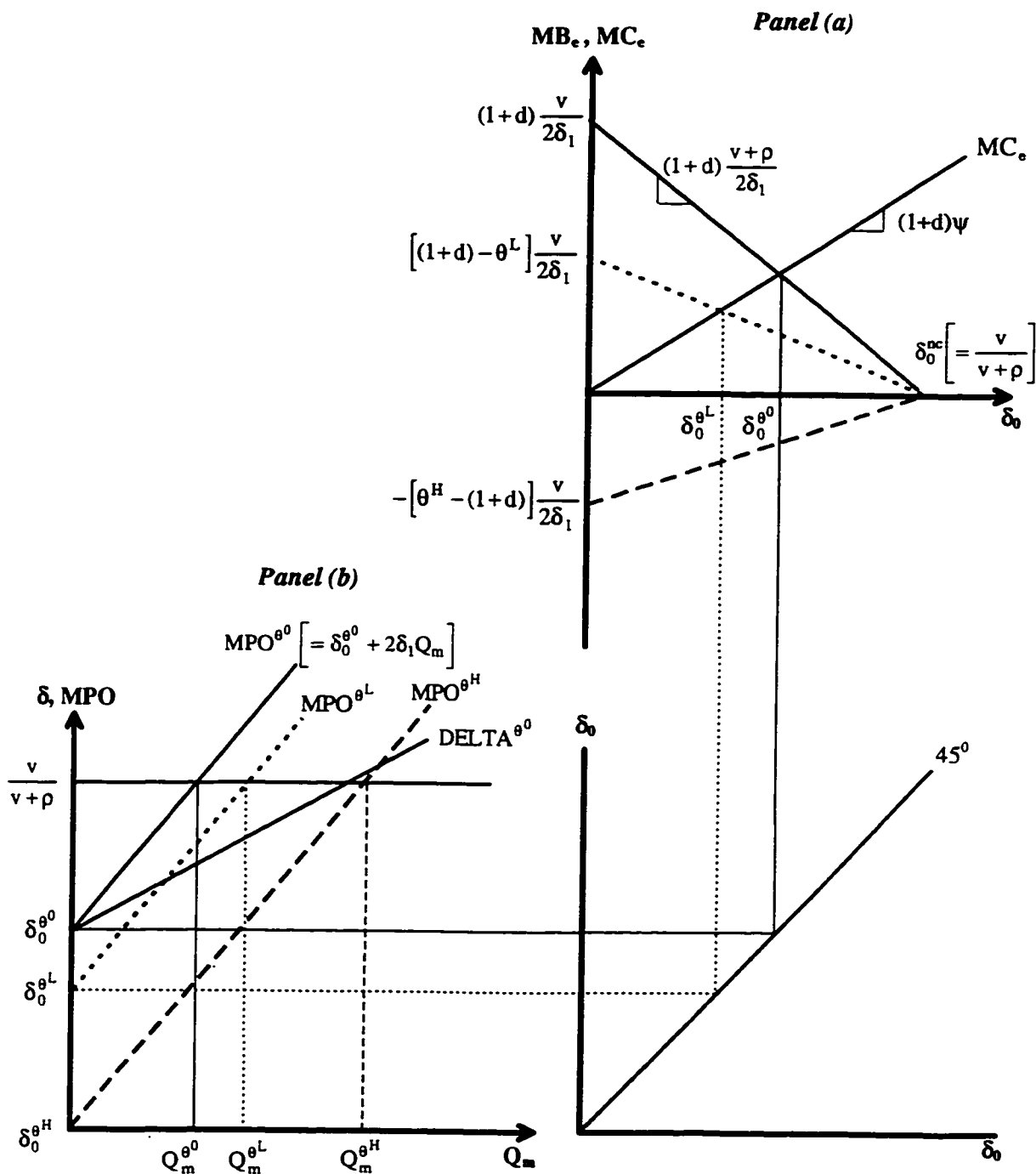


Figure 4.4. Optimal Enforcement and Strategic Interdependence between the Enforcement Agency and the Farmers

Finally, values of θ greater than $1+d$ result in a further leftward rotation of the MBe curve. The relevant MBe curve is shown as the upward sloping dashed line in Figure 4.4, Panel (a). Since the weight placed on producers exceeds the marginal cost of public funds, the benefits from investigating farmers are never positive. Thus, when monitoring farmers is costly (i.e. whenever $\psi > 0$), the best response of policy enforcers that place relatively high weight on producers is to choose a zero base audit probability.

Figure 4.4 also graphs the strategic interdependence between the enforcement agency and farmers; it shows the effect enforcement decisions have on output misrepresentation. Panel (b) of Figure 4.4 depicts the cheating equilibrium for the N representative farmers. Changes in δ_0 result in parallel shifts of the MPO curve faced by the farmers. More specifically, reductions in δ_0 caused by increases in θ translate into downward parallel shifts of the MPO curve and increased output misrepresentation for a given subsidy and penalty. Mathematically, Q_m under the different political preferences of policy enforcers is derived by substituting the appropriate δ_0 into farmers' reaction function in equation (4.4). Hence, when $\theta = \theta^0$ output misrepresentation will equal:

$$Q_m^{\theta^0} = \frac{\psi v}{(v + \rho)(v + \rho + 2\delta_1 \psi)} \quad (4.10)$$

Similarly, the equilibrium Q_m under θ^L and θ^H , $Q_m^{\theta^L}$ and $Q_m^{\theta^H}$ respectively, will equal:

$$Q_m^{\theta^L} = \frac{(1+d)\psi v}{(v+\rho)[(1+d)(v+\rho+2\delta_1\psi) - \theta(v+\rho)]} \quad (4.11)$$

and

$$Q_m^{\theta^H} = \frac{v}{2\delta_1(v+\rho)} \quad (4.12)$$

Figure 4.4 is well suited for comparative static analysis. For instance, an increase in the penalty will result in a parallel downward shift of the $\frac{v}{v+\rho}$ line in Panel (b) and a reduction in Q_m (direct effect). Increased ρ also results in a clockwise rotation of the relevant downward sloping MBe curve through the intercept in Panel (a). The optimal δ_0 is reduced and Q_m increases (indirect effect). A change in the subsidy will result in parallel shifts of the $\frac{v}{v+\rho}$ line in Panel (b) (direct effect on Q_m), and will also change both the intercept and slope of the MBe function in Panel (a) (indirect effect).

Overall, when program enforcement is costly, complete deterrence of cheating on output subsidies is never optimal from an economic perspective. The optimal enforcement and, therefore, the optimal output misrepresentation depend on the weight placed by policy enforcers on producer surplus. Enforcement is maximized and cheating is minimized when the enforcement agency minimizes total taxpayer costs from cheating. When farmer welfare is weighted highly, complete allowance of cheating will be the optimal choice of the enforcement agency and maximum misrepresentation the best response of the farmers.

4.4 Regulator and Optimal Intervention

Consider next the case of a regulatory agency in a decentralized policy making environment that desires to transfer a given surplus to producers of the regulated commodity. The regulator's problem can be seen as the determination of the subsidy level that achieves the desired income redistribution. Since the reaction functions of all parties involved in agricultural policy design and implementation are assumed to be common knowledge, the regulator knows exactly whether and how his decision will affect the amount of enforcement and output misrepresentation.

Assume that the political preferences of the regulator result in the desire for an income transfer to producers given by the areas A+B in Figure 4.5. When policy enforcement is perfect and costless, the quantity reported as eligible for government payments equals the actual production level. In such a case, the optimal choice of the regulator in terms of v that transfers areas A+B

$\left(= \left[(p^c + v)Q^t - C(Q^t) \right] - \left[p^e Q^e - C(Q^e) \right] \right)$ to producers will equal the difference between p^t and p^c shown in Figure 4.5. The optimal subsidy under perfect and costless enforcement is denoted as v^{pce} .

When, however, monitoring farmers' actions is costly, enforcement of output subsidies is incomplete and some output misrepresentation will always occur. The extent of misrepresentation depends on the weight policy enforcers place on producer surplus. Because of this misrepresentation, there is always more than the desired surplus transferred to producers under a subsidy payment set at v^{pce} . The excess transfer increases with the increase in misrepresentation.

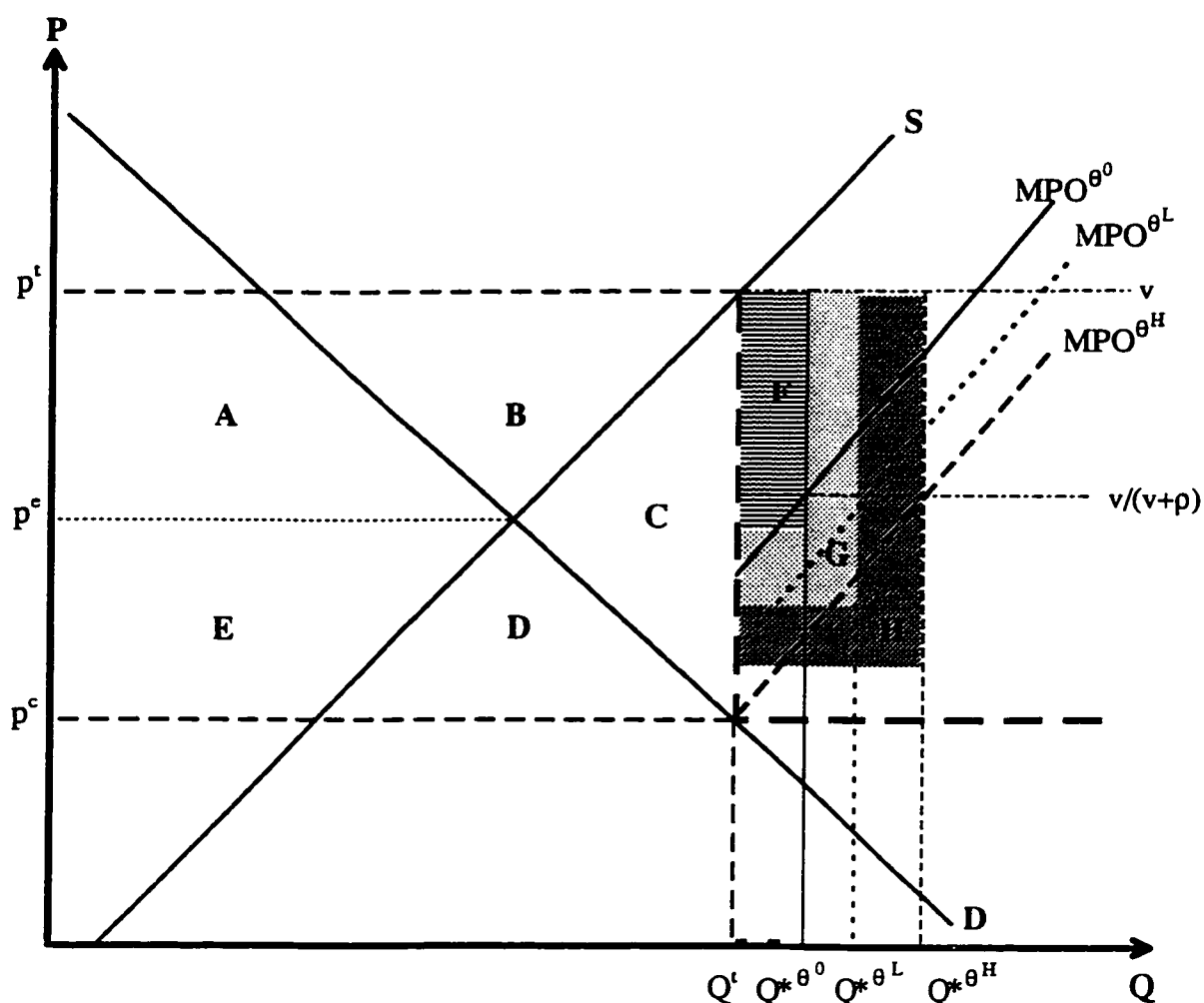


Figure 4.5. The Welfare Effects of Output Subsidies under Costly Enforcement

Figure 4.5 shows output misrepresentation and the welfare effects of a given subsidy under the alternative political preferences of the enforcement agency. The greater is θ , the lower is δ_0 , and the greater is Q_m . The lower is enforcement and the greater is misrepresentation, the greater is the *total* transfer to producers for any given subsidy level. Thus, for the equivalent of area A+B to be transferred to producers, the regulator has to reduce the unit payment to the level at which the total transfer to

producers (i.e. payments for output produced plus benefits from misrepresentation) will equal $A+B$. Therefore, the optimal subsidy that transfers a *given* surplus to producers reduces with the increase in misrepresentation, i.e. $v^{\theta^H} < v^{\theta^L} < v^{\theta^0} < v^{pce}$. A consequence of this is that consumer surplus falls with an increase in cheating. The taxpayer costs associated with the specific income redistribution are reduced by the amount foregone by consumers plus the change in the deadweight welfare loss triangle, adjusted to account for the distortionary costs from taxation. Furthermore, the reduced auditing associated with increased weight on producers (and increased cheating) results in reduced enforcement costs incurred by taxpayers.

4.5 Efficiency in Redistribution and Total Transfer

Assuming that the sole purpose of market intervention is income transfer, the trade off between producer surplus and consumer plus taxpayer surplus under an output subsidy scheme is reflected by the Surplus Transformation Curve (STC).²¹ The slope of the

STC, denoted as $s = \frac{\partial PS}{\partial (CS+TS)}$, reflects the efficiency of the policy in redistributing

income to producers at the margin, or 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 transfer. The efficiency in redistribution links the resource costs of market intervention to the transfer. The closer is s to -1, the smaller are the

²¹ Since the presumed purpose of output subsidies is producer welfare increase, taxpayers and consumers are treated as a single group.

welfare losses, and the more efficient is the income redistributional mechanism.

The analysis in the previous sections show that the levels of intervention and monitoring vary with the political preferences of the enforcement agency. The same is true for the welfare loss associated with a given transfer to producers. Variation in the social cost of a transfer implies variation in the transfer efficiency of output subsidies. In general, less monitoring means lower resource costs of monitoring and enforcement associated with the specific transfer to producers. At the same time, the lower is the subsidy level that achieves the desired transfer, the lower are the distortionary costs of market intervention (i.e. the Harberger triangle and the deadweight losses from taxation). And the lower are the welfare losses from a given transfer to producers, the greater is the transfer efficiency of output subsidies.

Recall that when policy enforcement is costly, both enforcement and the subsidy decrease with an increase in the weight placed by policy enforcers on producer surplus (i.e. $\delta_0^{\theta^0} > \delta_0^{\theta^L} > \delta_0^{\theta^H}$ and $v^{\theta^0} > v^{\theta^L} > v^{\theta^H}$). Since both enforcement costs and distortionary costs of intervention decrease with an increase in θ , the greater is θ , the greater is the marginal efficiency of output subsidies in transferring income to producers, i.e. $|s^{\theta^H}| > |s^{\theta^L}| > |s^{\theta^0}|$. The relevant STCs are depicted as the (concave) STC^{θ^H} , STC^{θ^L} and STC^{θ^0} in Figure 4.6.

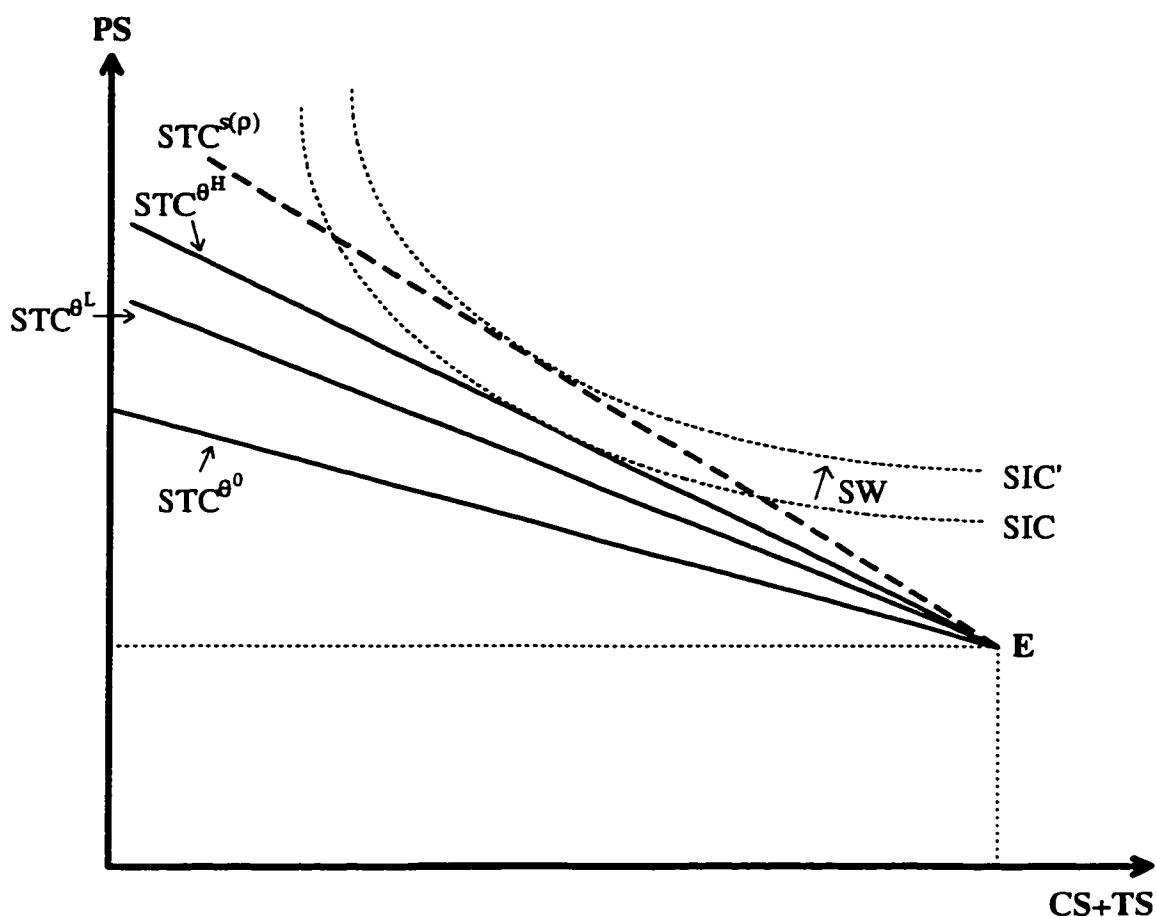


Figure 4.6. Surplus Transformation Curves for Output Subsidies under Costly Enforcement

The STCs originate from point E which is the locus of the interest group surpluses at the competitive equilibrium.²² STC^{θ^0} lies underneath STC^{θ^L} which, in turn, lies underneath STC^{θ^H} everywhere to the left of E.²³ The vertical distance

²² As has been mentioned in the analysis of output quotas in chapter III, as long as there is government intervention in any other commodity market, the taxpayer surplus corresponding to point E incorporates the costs associated with the operation of the enforcement agency. When non-intervention in the specific market also means non-intervention in the whole agricultural sector, taxpayer surplus at point E would increase by the fixed costs associated with the existence of the enforcement agency.

²³ Obviously for zero subsidy (no intervention), neither enforcement nor misrepresentation will emerge.

between the STCs reflects the difference in the welfare losses associated with the specific transfer to producers under the different θ s. Since $\delta_0^{\theta^0}$, $\delta_0^{\theta^L}$ and the distortionary costs of market intervention increase with an increase in the level of intervention, the vertical distance between the STCs increases with a leftward move from E.

It is worth noting that the efficiency of the policy mechanism in transferring income to producers increases when the political preferences of the enforcement agency and the regulator coincide (i.e., when both agents place a relatively high weight on producer welfare). Paradoxically, the transfer efficiency of output subsidies falls when the objective of the enforcement agency is to minimize total taxpayer costs from cheating. The reason is the relatively high monitoring and intervention that occur when policy enforcers place zero weight on producer welfare.

The relative position of the STC for output subsidies in a world where program enforcement is perfect and costless (i.e. STC^{pce}) is not so straightforward. When enforcement is perfect and costless, the social costs from the transfer are given solely by the distortionary costs of market intervention (i.e., the relevant Harberger triangle and the deadweight losses from taxation to finance the transfer). The marginal efficiency of redistribution of output subsidies, $|s^{pce}|$, will always be less than $|s^{\theta^H}|$, and STC^{pce} will always lie underneath STC^{θ^H} everywhere to the left of E. The reasoning goes as follows. Because of misrepresentation that occurs under θ^H , the subsidy that achieves the desired transfer to producers will be smaller than the subsidy under perfect and

costless enforcement, i.e. $v^{pce} > v^{\theta^H}$. Reduced subsidy implies reduced distortionary costs of intervention. Reduced welfare losses associated with a given transfer to producers mean increased transfer efficiency of output subsidies.

The position of STC^{pce} relative to STC^{θ^L} and STC^{θ^0} is case specific and depends on market conditions and the resource costs of monitoring and enforcement. Even though the distortionary costs of market intervention are lower under θ^0 and θ^L (since v^{θ^L} and v^{θ^0} are smaller than v^{pce}), the monitoring costs are greater than those under perfect and costless enforcement of the program. The relative position of the STCs depends on the relative size of the total costs. For given market conditions, the greater is $\Phi(\delta_0)$, the greater is the likelihood that STC^{pce} will lie above STC^{θ^L} and STC^{θ^0} . Alternatively, for relatively low monitoring and enforcement costs, STC^{pce} will lie underneath STC^{θ^L} and STC^{θ^0} .

The STC framework developed above can be used to determine the socially optimal total transfer to producers. Suppose the problem faced by the regulatory agency is the determination of income redistribution that maximizes some social welfare function (SWF) (rather than the determination of the subsidy that transfers a given surplus to producers). Assume that the political preferences of the regulator result in the social indifference curves (SIC) shown in Figure 4.6, with the SWF value increasing with a northeast shift of the SIC.

The socially optimal total transfer to producers under the different scenarios considered in this chapter is determined by the tangency of the SIC to the relevant STC (Gardner 1987a). Figure 4.6 shows that the level of total transfer to producers is directly related to the efficiency of output subsidies in transferring income to producers. More specifically, the greater is the transfer efficiency of the policy instrument, the larger is the socially optimal total transfer. Furthermore, since the SWF value increases with movements to the northeast, increases in transfer efficiency also imply increases in social welfare. Both the socially optimal total transfer to producers and the social welfare from intervention are maximized when the political preferences of the enforcement agency and the regulator coincide.

4.6 Extensions of the Model

4.6.1 Endogenous Penalties

Consider now the case of an enforcement agency that controls both enforcement parameters - δ_0 and ρ . Endogeneity of penalties calls for an additional F.O.C. to the enforcing agency's problem specified in equation (4.5), i.e.,

$$\begin{aligned} \frac{\partial W}{\partial \rho} = 0 &\Rightarrow [(1+d) - \theta] \left[\frac{\delta_0^2}{4\delta_1} - \frac{[S(Q^t) - D(Q^t)]^2}{[S(Q^t) - D(Q^t) + \rho]^2 4\delta_1} \right] = 0 \Rightarrow \\ &\Rightarrow \rho = \frac{(1-\delta_0)}{\delta_0} [S(Q^t) - D(Q^t)] = \frac{(1-\delta_0)}{\delta_0} v \end{aligned} \quad (4.13)$$

The optimal ρ in equation (4.13) is the penalty structure required to completely deter farmer misrepresentation, ρ^{nc} . Interestingly enough, the best response function of the enforcement agency does not depend on the weight it places on producer surplus. Solving equations (4.7), (4.8) and (4.9) simultaneously with equation (4.13) indicates that when penalties are endogenous to agricultural policy makers, cheating will be completely deterred by a zero base audit probability and a huge penalty on detected misrepresentation. This is true no matter the weight placed on producers, i.e.

$$\delta_0^{\theta(\rho)} = 0 \text{ and } \rho = \infty \quad \forall \theta \quad (4.14)$$

where $\delta_0^{\theta(\rho)}$ denotes the optimal δ_0 under all θ s when penalties are endogenous.

Graphically, the huge per unit penalty makes the slope of all MBe curves in Figure 4.4, Panel (a) infinite. The MBe curves coincide with the vertical axis and meet the MBe curve at the origin. The resulting zero δ_0 means that the MPO curve comes out from the origin, while the huge penalty shifts the $\frac{v}{v+\rho}$ line downwards so that it coincides with the horizontal axis in Figure 4.4, Panel (b). The optimal response of the farmer is then a zero level of misrepresentation i.e., $Q_m^{\theta(\rho)} = 0$.

Assuming that there are no costs associated with the establishment of huge penalties on detected output misrepresentation, and since no (costly) auditing prevails at equilibrium, the perfect enforcement of the program (i.e. equation (4.13)) is also costless. Since output misrepresentation is perfectly and costlessly deterred when

penalties are endogenous to the enforcement agency, the output subsidy that transfers a given surplus to producers, the transfer efficiency of the policy instrument, and the socially optimal total transfer to producers are those derived by the traditional analysis of output subsidies. Thus, one interpretation of “perfect and costless enforcement” is the costless establishment of infinite per unit penalties for farmers who are detected misrepresenting the level of their production.

However, even if potentially feasible and credible, enormous penalties indicated as optimal by the above solution(s) would likely outrage public opinion as to what is just; they do not seem to be fair. Agricultural policy making should incorporate the same principles of social justice that underlie all other areas of policy making. Penalties imposed on producers cheating on farm programs should be, and usually are, placed in the context of law enforcement and punishment within the community.

4.6.2 Centralized Policy Making

Consider finally the hypothetical case of a single agency that decides on both subsidy and policy enforcement. The problem faced by the single agency can be seen as the determination of the least cost way that transfers the desired surplus (i.e. area A+B in Figure 4.5) to producers. Since monitoring farmers requires resources, the optimal strategy mix for the single agency will involve a zero δ_0 and a subsidy that would implement the desired transfer. This is true no matter if penalties are endogenous or exogenous to the single agency’s policy makers. The relevant MPO curves will come

out from the origin and, *ceteris paribus*, will coincide with MPO^{θ^H} curve in Figure 4.5.

The reason is that in all these cases δ_0 is equal to zero.

When penalties are exogenous to the single agency, the subsidy that achieves the desired transfer to producers, v^s , will equal the optimal subsidy in a decentralized policy making where policy enforcers place high weight on producer welfare, v^{θ^H} . Notice that in both cases the weight placed by policy enforcers on producer welfare exceeds the marginal social opportunity cost of government funds (i.e. $1+d$).²⁴ Since $v^s = v^{\theta^H}$ and $\delta_0^s = \delta_0^{\theta^H} = 0$, the welfare effects of output subsidies in these two cases are exactly the same. Therefore, the slopes and the relevant STCs will coincide for any level of intervention (i.e. $s^s = s^{\theta^H}$ and $STC^s \equiv STC^{\theta^H}$ in Figure 4.6).

When penalties are endogenous, the single agency's policy makers will always find it economically optimal to completely allow misrepresentation by setting δ_0 and ρ equal to zero. The reasoning goes as follows. By setting both enforcement parameters equal to zero, output misrepresentation is maximized. The increased misrepresentation increases the producer benefits from cheating and reduces the subsidy payment, $v^{s(\rho)}$, required to transfer the desired surplus to producers.²⁵ Actually, $v^{s(\rho)}$ is the lowest subsidy compared to the optimal subsidies under all scenarios examined in this chapter.

²⁴ Since subsidies involve income transfers from taxpayers to producers, a necessary and sufficient condition for such a redistribution to occur is for the weight placed by the single agency on producer surplus to exceed the marginal taxpayer cost of the transfer.

²⁵ Graphically, zero δ_0 means that the MPO curve comes out from the beginning of the origins, while zero ρ shifts the $\frac{v}{v+\rho}$ upwards. The two curves meet at the point where Q_m is maximized.

Reduced v means reduced welfare losses associated with the specific transfer and increased transfer efficiency of the policy instrument. The relevant STC, $STC^{s(p)}$, lies above all the other STCs (dashed line in Figure 4.6). This result should be treated carefully however, for three reasons. First, centralized policy making does not generally characterize agricultural policy making. Second, penalties are usually exogenous to agricultural policy makers. Finally, institutionalized zero fines for farmers cheating on farm programs (just like the infinite penalties emerging as optimal when penalties are endogenous to the enforcement agency in a decentralized policy making), is not what is observed in today's world. Table 4.1 presents simulation results on equilibrium subsidy, enforcement and output misrepresentation for linear approximations of industry supply and demand curves for the different cases considered in this chapter.

4.7 Concluding Remarks

Agricultural policy analysis in general and the analysis of output subsidies in particular have traditionally taken place under the implicit assumption that: (i) either farmers do not cheat or (ii) enforcement of agricultural policies is perfect and costless. However, enforcement requires resources and is therefore costly. The resource costs of monitoring and enforcing an output subsidy scheme result in policy enforcement that is incomplete. Imperfect enforcement generates economic incentives for farmers to misrepresent their actual level of production and collect subsidies on production that

never took place. The lower is the amount of enforcement, the higher is the equilibrium level of farmer misrepresentation.

The level of enforcement depends on the political preferences of policy enforcers. Since cheating on subsidies results in a direct income transfer from taxpayers to producers, enforcement decreases as policy enforcers place increasing weight on producer welfare. The political preferences of policy enforcers are also crucial in determining the subsidy that transfers a given surplus to producers, the transfer efficiency of the policy mechanism, and the socially optimal total transfer to producers. The causation goes as follows. The greater is the weight placed by policy enforcers on producer surplus, the lower is the program enforcement, and the lower is the subsidy level that achieves a desired transfer to producers. Lower monitoring and intervention means lower welfare losses associated with a given transfer to producers, and greater transfer efficiency of output subsidies. The greater is the marginal efficiency of output subsidies in redistributing income to producers, the greater is the socially optimal income redistribution.

Overall, the transfer efficiency of output subsidies, the socially optimal total transfer to producers and the social welfare from intervention are maximized when the political preferences of the enforcement agency and the regulator coincide. When both the enforcement agency and the regulator attach a relatively high weight to the welfare of producers, the efficiency of output subsidies in transferring income to agricultural producers, the socially optimal income redistribution and the social welfare from intervention will be greater than is traditionally believed. A high weight on producer

welfare has been argued to characterize the political preferences of the ASCS in the US and most countries/ enforcement agencies of the CAP in the EU.

Table 4.1. Equilibrium Payment, Enforcement, and Misrepresentation on Deficiency Payments (Simulation Results)

	Decentralized Policy Making						Single Agency
	$\theta^0 (= 0)$		$\theta^L (= 0.9)$		$\theta^H (= 1.3)$		s
<i>ρ exogenous</i>							
v	12.174	>	11.692	>	11.544	=	11.544
δ_a	0.036	>	0.008	>	0	=	0
ρ	30	=	30	=	30	=	30
Q_m	8.436	<	9.074	<	9.263	=	9.263
Q^t	22.435	>	22.338	>	22.309	=	22.309
ΔPS	200	=	200	=	200	=	200
ΔCS	103.329	>	99.006	>	97.688	=	97.688
ΔTC	373.139	>	359.967	>	357.668	=	357.668
DWL	69.82	>	60.96	>	59.98	=	59.98
<i>ρ endogenous</i>							
v	15.470	=	15.470	=	15.470	>	6.877
δ_a	0	=	0	=	0	=	0
ρ	∞	=	∞	=	∞	>	0
Q_m	0	=	0	=	0	<	33.333
Q^t	23.094	=	23.094	=	23.094	>	21.375
ΔPS	200	=	200	=	200	=	200
ΔCS	133.334	=	133.334	=	133.334	>	56.914
ΔTS	410.857	=	410.857	=	410.857	>	300.953
DWL	77.52	=	77.52	=	77.52	>	43.977

$D(Q) = 110 - 2Q$; $S(Q) = 10 + 3Q$; $Q^e = 20$; $P^e = 70$; $PS^e = 600$; $CS^e = 400$; $\psi = 10000$; $\delta'_1 = 0.015$; $d = 0.15$

CHAPTER V

THE ECONOMICS OF DECOUPLED AREA PAYMENTS IN THE PRESENCE OF CHEATING

5.1 Introduction

The latest Common Agricultural Policy (CAP) reform and the 1996 Farm Bill are both characterized by the use of decoupled payments as the main means of transferring income to agricultural producers. Because of their neutrality in terms of market effects, decoupled income transfers are viewed as the appropriate policy mechanism in terms of efficiency in redistributing income to the farmers. Supply responses, trade impacts and the welfare losses from misallocation of productive resources that follow the provision of subsidies linked to output are eliminated under a farm subsidy scheme where payments are based on alternative farm characteristics. Past production levels and past cultivated area have been adopted by EU and US agricultural policy makers as among the basic determinants of the transfer to individual producers.²⁶ Decoupled farm

²⁶ Even though the payments to European farmers are based on past farm records rather than the output produced, the fact that in most cases farmer eligibility for government payments requires continued cropping of farmland has raised a debate about whether the arable area and set-aside compensatory payments are indeed decoupled in nature (Cahill; Friedeberg; Swinbank and Tanner; Tangermann). Nevertheless, the limitation of payments to past acreage cultivated has resulted in the characterization of those payments as “decoupled” and their exemption from GATT disciplines. The direct payments for various crops adopted by the 1996 Farm Bill are not contingent on that crop being planted.

subsidies constitute a transfer from the budget (i.e. taxpayers) to the farmers. Since no market intervention occurs, consumer welfare is not affected by the policy.

Implicit in the traditional analysis of decoupled income transfers to producers is the assumption that: (i) either farmers do not cheat; or (ii) enforcement is perfect and costless. However, policy enforcement requires resources. Even though the actions of the farmers are potentially perfectly observable to agricultural policy enforcers, monitoring every farmer is costly. Because of these monitoring costs agricultural policy makers find it economically optimal to under investigate farmers' actions.

Under investigation results in imperfect enforcement, which in turn creates economic incentives for cheating. Under an area payment scheme with payments linked to past acreage, farmers may report and collect on a greater area than they actually cultivated. The possibility of cheating arises from the fact that, similar to the case of deficiency payments, eligibility for government payments requires farmer application.

A recent report on the extent of cheating on subsidies in the EU estimates the losses through fraud and lax controls in the payment of subsidies and subsidy overpayments to \$4 billion per year (EU Fraud and Waste on Farm Subsidies, *117 Journal of Commerce*, 12/22/97). The extent of detected misrepresentation varies among the countries/members of the EU as well as between different areas in these countries. For the 1993 crop year, the total area on which payments were claimed exceeded the base area in parts of Spain, Scotland and former East Germany by up to 15 per cent (Swinbank and Tanner).

The current chapter introduces farmer misrepresentation and cheating into the economic analysis of decoupled area payments. Analogous to chapters III and IV, policy design and implementation is modeled as a sequential game among a regulator who selects an area payment, an enforcement agency that enforces policy, and a representative farmer who chooses the area to cultivate and the area on which claims for subsidy payments are made. The payoff functions of the agents involved in agricultural policy design and implementation are assumed to be common knowledge. The regulator moves first and decides on the area payment knowing exactly how her decisions affect enforcement and cheating. The optimal program enforcement is determined next. Finally, the representative farmer, observing both policy variable and enforcement parameters, decides on an area to report as eligible for payments. Different scenarios concerning the political preferences of the enforcement agency and the decision variables it controls are examined within this framework. Finally, the hypothetical case of a single agency that designs and implements the farm program is also analyzed.

5.2 Optimal Misrepresentation by the Representative Farmer

When an area payment is in effect, farmers may decide to misrepresent the area on which they claim payments. To model this possibility, consider a risk neutral representative farmer who is deciding whether he will cheat, and if so, by how much. Assuming the farmer knows the area payment, the penalty if he is caught cheating, and the probability of his being investigated, expected profits can be written as the sum of

the profits from farming and the expected benefits from cheating.²⁷ Formally, the farmer's problem can be written as:

$$\max_{\alpha, \alpha_m} E[\Pi] = pq(\alpha) - c(\alpha) + r\alpha_h + [(1 - \delta)r - \delta\rho]\alpha_m \quad (5.1)$$

where p is the market price for the commodity in question; $q(\alpha)$ is the quantity produced as a function of the land used, α ; $c(\alpha)$ is the cost of land function; α_h is the historical acreage on which payments are based (or the base acreage); r is the area payment; α_m is the misrepresented area (i.e., the area reported as eligible for the payments over and above α_h); ρ is the penalty paid per unit of misrepresented and detected area; and δ is the probability the farmer will be audited. If the farmer is cheating on the farm program, δ reflects the probability he will be detected and penalized. Obviously, investigation of a farmer that complies with the provisions of the policy has no effect on his objective function.

The variable δ takes values between zero and one (i.e. $\delta \in [0, 1]$) and, similar to the case of output subsidies in chapter IV, is assumed to be a linear function of farmer misrepresentation, i.e., $\delta_0 + \delta_1\alpha_m$. The base audit probability, δ_0 , is function of the resources spend by the program enforcement agency in auditing farmers. The parameter δ_1 is assumed to be strictly positive and exogenous to agricultural policy

²⁷ Obviously the expected profits for US farmers that do not plant the supported crop, include the program payments and the expected benefits from cheating. More specifically, the problem of the risk neutral farmer can be written as $\max_{\alpha_m} E[\Pi] = r\alpha_h + [(1 - \delta)r - \delta\rho]\alpha_m$.

makers.

The first order conditions (F.O.C.) for the problem outlined above are:

$$\frac{\partial E[\Pi]}{\partial \alpha} = 0 \Rightarrow p \frac{\partial q(\alpha)}{\partial \alpha} = c'(\alpha) \quad (5.2)$$

$$\frac{\partial E[\Pi]}{\partial \alpha_m} = 0 \Rightarrow \frac{r}{r + \rho} = \delta_0 + 2\delta_1 \alpha_m \quad (5.3)$$

Equation (5.2) shows that optimal land use involves equating the marginal value product of land with its marginal cost. The decoupled nature of the program means that the area payment, r , does not affect land use. Notice that, similar to the output subsidies case in chapter IV, the production decisions of the representative farmer do not depend on any of the parameters associated with farmer misrepresentation.

Equation (5.3) shows the determination of the quantity of land to report as eligible for payment over and above the historical acreage cultivated. The optimal α_m is determined by equating $\frac{r}{r + \rho}$ with $\delta_0 + 2\delta_1 \alpha_m$. The ratio $\frac{r}{r + \rho}$ is the ratio of the marginal benefits in case cheating goes undetected over the opportunity cost in case the farmer is caught cheating, while $\delta_0 + 2\delta_1 \alpha_m$ is the marginal penalized area (mpa). The mpa shows the change in the area that is expected to be penalized for a change in the area misrepresented.

Solving equation (5.3) for α_m gives the representative farmer's best response to the policy variable and enforcement parameters,²⁸ i.e.,

$$\alpha_m = \frac{r - \delta_0(r + \rho)}{2\delta_1(r + \rho)} \quad (5.4)$$

The variable α_m will be positive whenever δ_0 is less than $\frac{r}{r + \rho}$, or ρ is less than

$\frac{(1 - \delta_0)r}{\delta_0}$, or r is greater than $\frac{\delta_0\rho}{(1 - \delta_0)}$. Denote these critical value of δ_0 , ρ and r as

δ_0^{nc} , ρ^{nc} and r^{nc} respectively, where the superscript nc stands for no cheating.

Figure 5.1 graphs the determination of optimal misrepresentation at the industry level when the policy variable and enforcement parameters are such that cheating occurs. Lines MPA and DELTA are the horizontal summation of the representative farmers' mpa and δ curves, respectively. Both MPA and DELTA have intercepts on δ_0 while their slopes equal to $\frac{2\delta_1}{N}$ and $\frac{\delta_1}{N}$ respectively, where N is the number of representative farmers entitled to government payments. The aggregate area

²⁸ Similar to the cases of output quotas and output subsidies in chapter III and IV respectively, the model in equation (5.1) can be modified to include risk aversion of the representative farmer and/or private costs from cheating. In terms of area misrepresentation, the aversion of the representative farmer toward risk results in reduced cheating relative to the case where risk neutrality is assumed. Reduced cheating also emerges when we incorporate potential costs incurred by farmers in protecting themselves from detection. Even though both risk averse behavior and private costs from cheating change the results quantitatively, the qualitative nature of the results in this chapter remains unaffected.

misrepresented, A_m , is given by the intersection of the MPA and a horizontal line at

$$\frac{r}{r+\rho}.$$

Area Payment

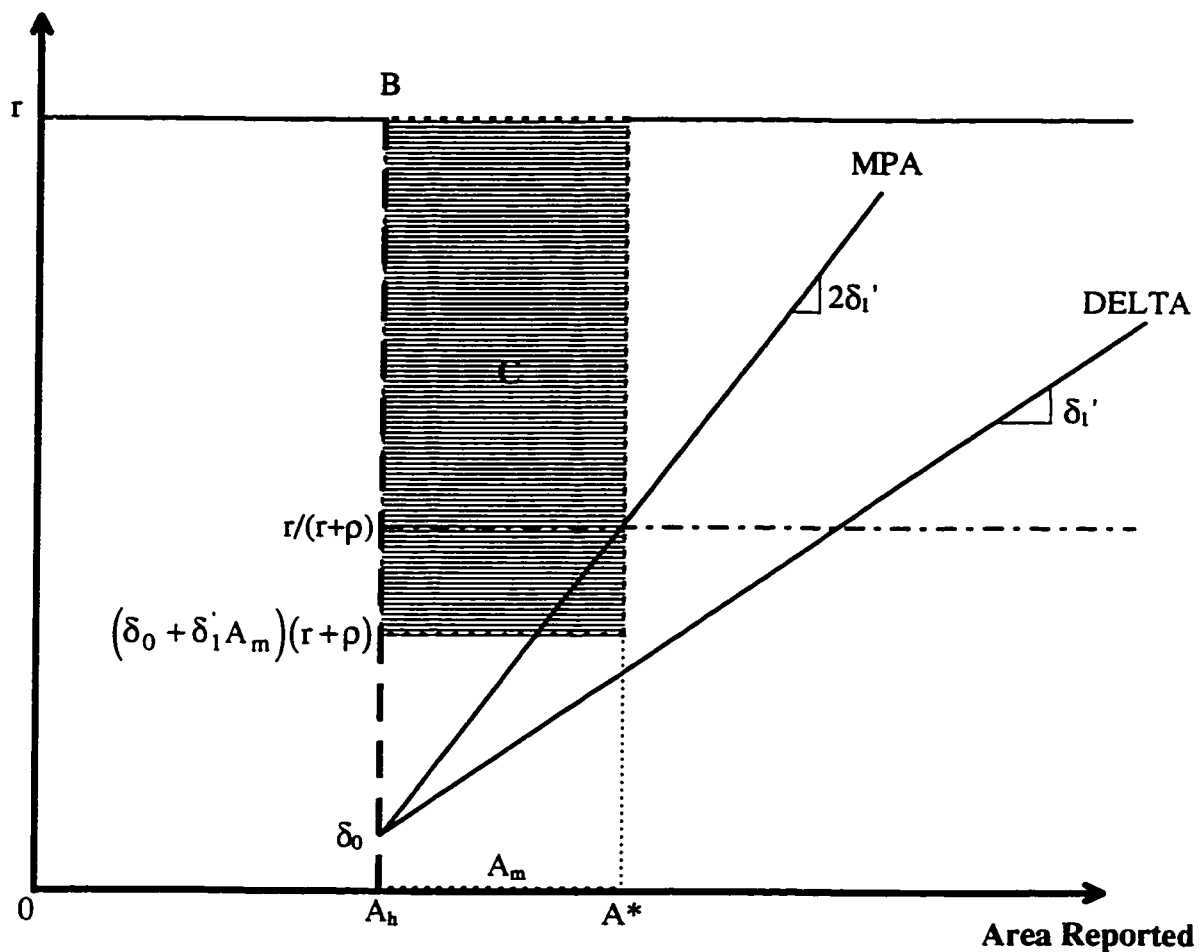


Figure 5.1. Cheating Equilibrium and the Welfare Effects of Area Payments With and Without Misrepresentation

Mathematically, the over-reported area is:

$$A_m = N\alpha_m = \frac{r - \delta_0(r + \rho)}{2\delta_1'(r + \rho)} \quad (5.5)$$

where $\delta_1' = \frac{\delta_1}{N}$.

Ceteris paribus, an increase in r will increase cheating while an increase in any of the enforcement parameters will reduce farmer misrepresentation. Figure 5.1 also shows the welfare effects of the policy instrument. Under an area payment scheme, farmers receive a payment r on historical acreage A_h . In addition, they receive an expected benefit from misrepresenting their eligible area, $E[B_c] = [r - \delta(r + \rho)]A_m$. This expected benefit is given by the shaded region C in Figure 5.1. Expected producer transfer, PT, is thus $rA_h + E[B_c]$. These benefits to producers come at the expense of taxpayers. Taxpayer costs equal $(1+d)\{rA_h + [r - \delta(r + \rho)]A_m + \Phi(\delta_0)\}$ where d is the marginal welfare loss from taxation, and $\Phi(\delta_0)$ are the resource costs of monitoring. Note that taxpayer costs can be written as $(1+d)[PT + \Phi(\delta_0)]$.²⁹ Similar to the cases of output quotas and output subsidies examined in previous chapters of this thesis, the cost $\Phi(\delta_0)$ is assumed to be an increasing function of δ_0 (i.e., $\Phi'(\delta_0) \geq 0$, $\Phi''(\delta_0) \geq 0$). The net social costs of the program equal $d\{rA_h + [r - \delta(r + \rho)]A_m\} + (1+d)\Phi(\delta_0)$.

²⁹ The fixed costs associated with the operation of the enforcement agency are not included in the taxpayer costs from the program. It is presumed that the existence of the enforcement agency is not dependent upon the continuation of any farm program in particular but rather it relates to government intervention in agriculture.

5.3 Optimal Enforcement by the Enforcement Agency

Equation (5.5) indicates that farmer misrepresentation depends on the choices made by the agencies responsible for policy design and implementation. This section examines the problem of program enforcers in a decentralized policy setting. The problem of the enforcement agency is to determine the degree to which the area payment scheme designed by the policy regulator is enforced, knowing exactly how its decisions will affect the behavior and welfare of farmers.

The degree to which the area payment scheme is enforced is determined by the variables δ_0 and ρ . As has been mentioned in previous chapters of this thesis, penalties on detected misrepresentation (ρ) are generally exogenous to agricultural policy makers, since they are determined elsewhere in the legal system. As a consequence, the enforcement agency is assumed to take ρ as given when choosing δ_0 to achieve a desired level of enforcement. Specifically, the enforcement agency's problem is:

$$\begin{aligned} \max_{\delta_0} W &= \theta PS + TS = \\ &= \theta \{ pQ(A) - c(A) + rA_h + [(1-\delta)r - \delta\rho]A_m \} - \\ &\quad - (1+d) \{ rA_h + [(1-\delta)r - \delta\rho]A_m + \Phi(\delta_0) \} \end{aligned} \quad (5.6)$$
$$\text{s. t.} \quad A_m = \frac{r - \delta_0(r + \rho)}{2\delta_1(r + \rho)}$$

where PS and TS stand for producer surplus and taxpayer surplus, respectively, and θ is the weight attached to producer surplus.³⁰ All other variables are as previously defined.

Assuming $\Phi(\delta_0) = \frac{1}{2}\psi\delta_0^2$ (where ψ is a strictly positive scalar depending on things like the agrarian structure and the number of representative farmers), the F.O.C. for the problem is:

$$\frac{\partial W}{\partial \delta_0} = 0 \Rightarrow (1+d)\psi\delta_0 = \left[(1+d) - \theta\right] \left[\frac{r}{2\delta_1'} - \frac{r+\rho}{2\delta_1'} \delta_0 \right] \quad (5.7)$$

Equation (5.7) indicates that the optimal δ_0 is determined by equating the marginal monitoring costs (MCE) with the marginal benefits from enforcement (MBE), where

$MCE = (1+d)\psi\delta_0$ and $MBE = \left[(1+d) - \theta\right] \frac{r - \delta_0(r+\rho)}{2\delta_1'}$. The marginal benefits from

enforcement include the penalties collected on detected cheating and the benefits from induced honesty. These latter benefits include the consequences for interest group welfare of increased enforcement and reduced misrepresentation.

For a variety of reasons, different policy enforcers may place different weights on producer welfare and program costs when enforcing policies. In the model that follows, three different weights on producer welfare are examined – a high weight ($\theta = \theta^H$, where $\theta^H \geq 1+d$), a low weight ($\theta = \theta^L$, where $\theta^L \in (0, 1+d)$), and no weight ($\theta = \theta^0 = 0$).

³⁰ Due to the decoupled nature of the transfer through cheating, the well-being of consumers is not affected by farmer misrepresentation.

Substituting these values into the F.O.C. and solving for δ_0 gives the policy enforcer's optimal base audit probability as a function of the area payment chosen by the regulator for the three values of θ .

More specifically, when the enforcement agency does not consider the effect of its choices on producer welfare but, instead, is merely concerned with minimizing taxpayer costs from cheating,³¹ δ_0 will equal:

$$\delta_0^{\theta^0} = \frac{r}{r + \rho + 2\delta_1\psi} \quad (5.8)$$

where the superscript denotes the weight placed by the enforcement agency on producer welfare. Similarly, when the enforcement agency places a positive but relatively low weight on producer surplus (i.e. θ is lower than the marginal cost of public funds, $1+d$), the optimal δ_0 , $\delta_0^{\theta^L}$, will equal:

$$\delta_0^{\theta^L} = \frac{[(1+d)-\theta]r}{[(1+d)-\theta](r+\rho) + (1+d)2\delta_1\psi} \quad (5.9)$$

When θ exceeds the marginal cost of area misrepresentation to taxpayers (i.e. $\theta \geq 1+d$), the optimal choice of policy enforcers is to completely allow cheating, i.e.,

³¹ When $\theta=0$ enforcement agency's payoff function is measured by the addition to regulator's revenue net of monitoring costs. Alternatively, the enforcement agency can be viewed as seeking δ_0 that minimizes total taxpayer costs from cheating, i.e., the resource costs of investigation plus the payments on area misrepresented minus the penalties collected on those detected cheating.

$$\delta_0^{\theta^H} = 0 \quad (5.10)$$

A zero δ_0 when $\theta = \theta^H$ does not mean that cheating goes undetected. Since δ_1 has been assumed strictly positive, a zero δ_0 means that policy enforcers will not actively spend resources to deter area misrepresentation over and above that would otherwise occur.

The reaction function of policy enforcers under the different θ s indicate that δ_0 falls with an increase in θ (i.e. $\delta_0^{\theta^0} > \delta_0^{\theta^L} > \delta_0^{\theta^H}$). Enforcement however, will always be incomplete due to the positive resource costs of monitoring farmers' actions ($\psi > 0$), i.e., δ_0 will always be smaller than the audit probability that completely deters cheating, δ_0^{nc} .

The optimal choices of δ_0 for the different values of θ can be determined graphically by the intersection of the MCE curve and the MBE curve when these are graphed as a function of δ_0 . The MCE is given by the solid upward sloping curve in Figure 5.2, Panel (a). When $\theta = 0$, the MBE curve is the solid downward sloping curve. Increases in θ cause a leftward rotation of the MBE curve through δ_0^{nc} , where δ_0^{nc} is given by the intersection of the MBE curve and the horizontal axis.

For $\theta \in (0, 1+d)$, the MBE curve always falls between the solid MBE curve and the horizontal axis (when $\theta = 1+d$, the MBE curve lies on the horizontal axis). Therefore, whenever θ is less than the marginal cost of public funds, the variable δ_0 will be positive and policy makers will actively spend resources in investigating farmer misrepresentation. When $\theta > 1+d$, the benefits from enforcement are never positive since

producer losses are weighted more than taxpayer gains at the margin. The MBe curve has a positive slope and lies below the horizontal axis. Thus, δ_0 is zero.

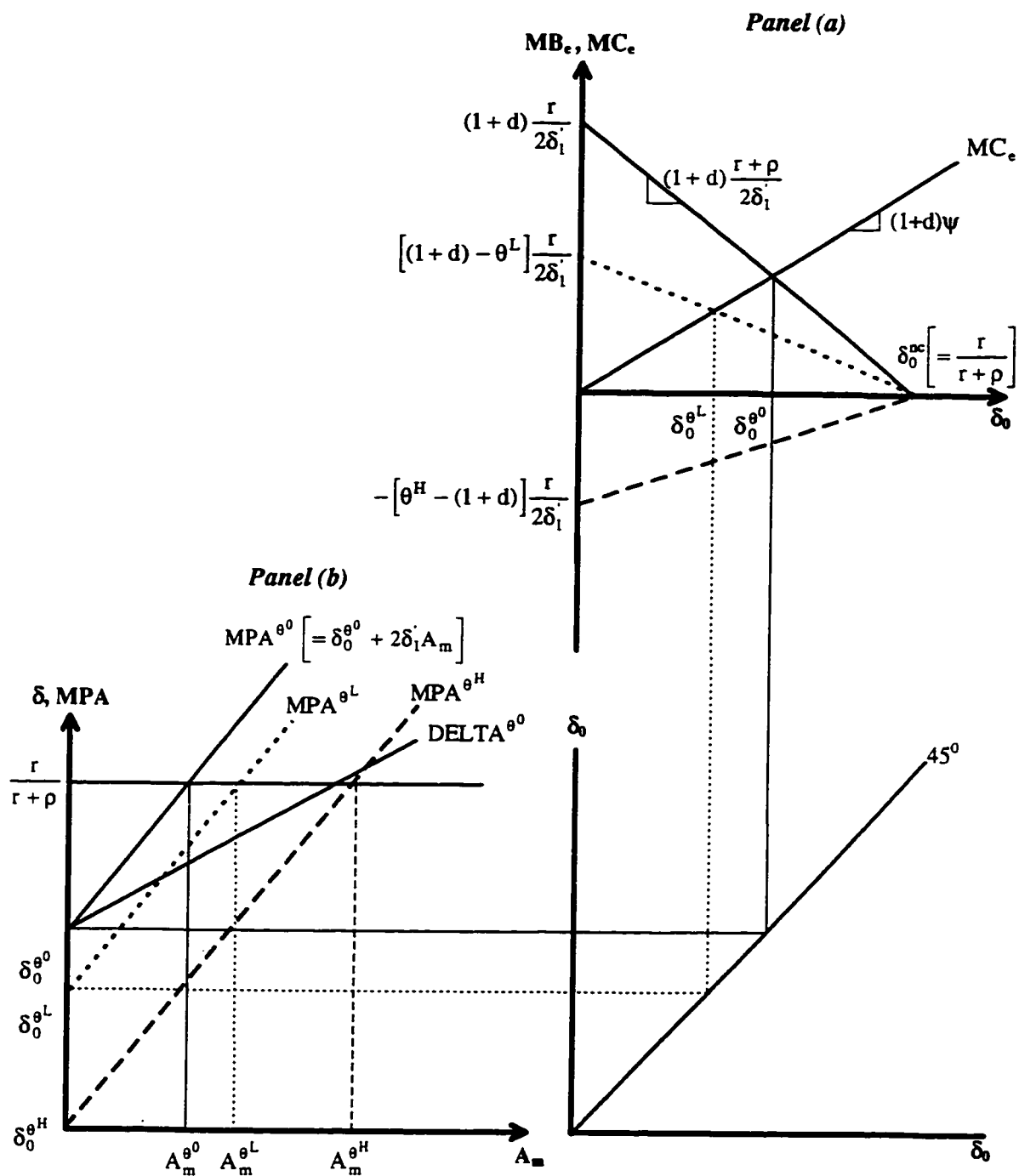


Figure 5.2. Optimal Enforcement and Strategic Interdependence between the Enforcement Agency and the Farmers

Since program enforcement falls with an increase in the weight placed by policy enforcers on producer welfare, optimal area misrepresentation increases with θ . Figure 5.2 graphs also the interrelationship between the decision of the policy enforcers and that of farmers. An increase in θ causes a parallel downward shift of the MPA curve which results in an increased A_m . Mathematically, A_m is derived by substituting the appropriate δ_0 into the farmers' reaction function in equation (5.5). Therefore, when $\theta = \theta^0$ area misrepresentation will equal:

$$A_m^{\theta^0} = \frac{\psi r}{(r + \rho)(r + \rho + 2\delta_1' \psi)} \quad (5.11)$$

Similarly, the equilibrium A_m for $\theta = \theta^L$ and $\theta = \theta^H$, $A_m^{\theta^L}$ and $A_m^{\theta^H}$ respectively, will equal:

$$A_m^{\theta^L} = \frac{(1 + d)\psi r}{(r + \rho)[(1 + d)(r + \rho + 2\delta_1' \psi) - \theta(r + \rho)]} \quad (5.12)$$

and

$$A_m^{\theta^H} = \frac{r}{2\delta_1'(r + \rho)} \quad (5.13)$$

5.4 Regulator and Optimal Intervention

Now consider the case of a regulatory agency that desires to make a given expected transfer, PT , from taxpayers to producers of a commodity. More specifically, the regulator initiates the farm program (*ex ante*) so that producers will realize a given increase in their welfare (*ex post*). Considering that total producer benefits from a decoupled area payment equal $PT = rA_h + \left[r - (\delta_0 + \delta_1' A_m)(r + \rho) \right] A_m$, the problem of the regulator is to determine the area payment that achieves the desired income redistribution.

When enforcement is perfect and costless, the determination of the optimal r calls for a simple division of the desired transfer PT over the base area A_h . However, when monitoring farmers is costly, enforcement is imperfect and area misrepresentation occurs. To make an expected transfer of PT , the regulator must decide on r knowing exactly how her choice affects the equilibrium amount of enforcement and cheating. Mathematically, the regulator chooses r knowing the reaction of farmers and enforcers as given in equations (5.8)-(5.10) and (5.11)-(5.13).

For any given area payment, r , enforcement decreases and area misrepresentation increases with an increase in the weight placed by the enforcement agency on producer welfare (i.e., $\delta_0^{\theta^0} > \delta_0^{\theta^L} > \delta_0^{\theta^H}$ and $A_m^{\theta^0} < A_m^{\theta^L} < A_m^{\theta^H}$). The result is that the expected transfer to producers increases with θ . Therefore, the area payment required to make an expected transfer of PT to producers falls as θ increases. Therefore, it always holds that $r^{\theta^0} > r^{\theta^L} > r^{\theta^H}$, where r^{θ^0} , r^{θ^L} , and r^{θ^H} are the area payments required to make an

expected transfer of PT to producers under values of θ equal to θ^0 , θ^L , and θ^H , respectively.

5.5 Efficiency in Redistribution and Total Transfer

When enforcement is perfect and costless, decoupled payments are completely efficient in transferring income to producers if d equals zero, i.e. there is a one-to-one correspondence between the amount raised by taxpayers and the increase in producer surplus. Put in the context of the standard policy analysis framework, the slope of the surplus transformation curve (STC), s , equals $\frac{\partial PS/\partial \tau}{\partial TS/\partial \tau} = \frac{\partial PS}{\partial TS} = -1$ when $d = 0$

(Gardner 1983). When d is positive, decoupled payments are never fully efficient; the slope of the STC equals $s^{pce} = -\frac{1}{1+d}$ (Alston and Hurd). The STC for the case of decoupled payments when d is positive and enforcement is perfect and costless is shown as STC^{pce} in Figure 5.3.

Consider now the case where enforcement is costly and therefore, imperfect. For a given surplus transfer from taxpayers to producers, the resource costs associated with any positive δ_0 have to be added to the taxpayers' costs. The slopes of the STCs for $\theta = \theta^0$, $\theta = \theta^L$ and $\theta = \theta^H$ are given as:

$$s^{\theta^0} = -\frac{\partial PS}{(1+d)\left[\partial PS + \partial \Phi(\delta_0^{\theta^0})\right]} \quad (5.14)$$

$$s^{\theta^L} = - \frac{\partial PS}{(1+d) [\partial PS + \partial \Phi(\delta_0^{\theta^L})]} \quad (5.15)$$

and

$$s^{\theta^H} = - \frac{\partial PS}{(1+d)\partial PS} \quad (5.16)$$

respectively, where ∂PS represents the desired increase in producer welfare and $(1+d)[\partial PS + \partial \Phi(\delta_0)]$ the reduction in taxpayer surplus due to income redistribution. Since $\Phi(\delta_0)$ is an increasing function of δ_0 , taxpayer costs decrease and the transfer efficiency of the policy instrument increases with an increase in θ . Thus, $|s^{\theta^0}| < |s^{\theta^L}| < |s^{\theta^H}| = |s^{pce}|$. Graphically, STC^{θ^0} lies under STC^{θ^L} which, in turn, lies under STC^{θ^H} everywhere to the left of E in Figure 5.3. Curve STC^{θ^H} coincides with STC^{pce} . For any given transfer to producers, the horizontal distance between the STCs reflects the difference in monitoring and enforcement costs under the different scenarios. Since the optimal δ_0 under θ^0 and θ^L increases with an increase in r , the greater is the transfer to producers (i.e., the further left from E we move), the greater is the horizontal distance between the STCs.

It is worth noting the increased inefficiencies associated with differences in the political preferences of the regulator and the enforcement agency. The efficiency of decoupled area payments in transferring income to producers is maximized when both the enforcement agency and the regulator place a relatively high weight on producer

welfare. Paradoxically, the transfer efficiency of the policy mechanism falls when the enforcement agency minimizes total taxpayer costs from cheating. The reason is the relatively high level of monitoring that results when the enforcement agency has zero weight attached to producer welfare.

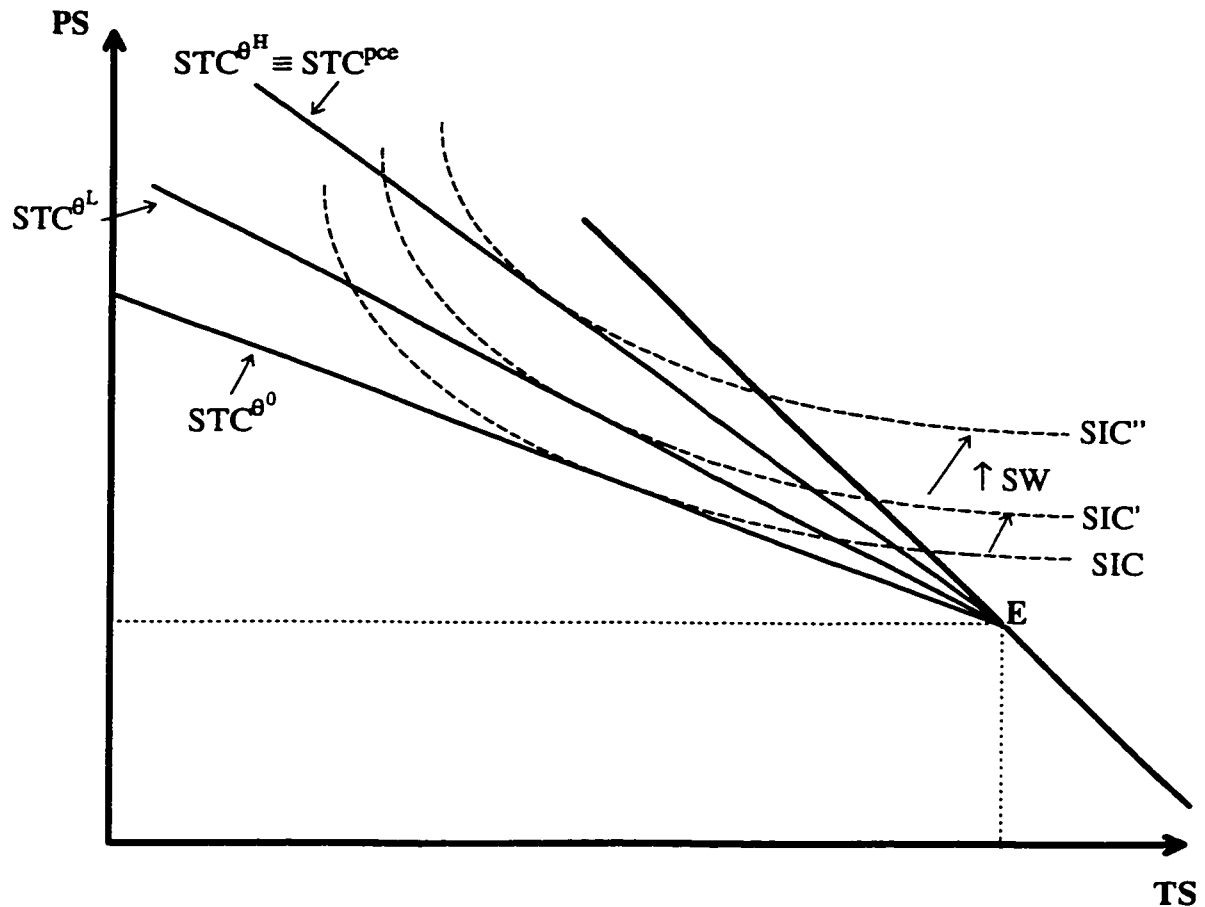


Figure 5.3. Surplus Transformation Curves for Decoupled Area Payments under Costly Enforcement

The value of s is crucial in determining the socially optimal total transfer to producers. For instance, suppose the problem of the regulator is the determination of the income redistribution that maximizes some social welfare function (SWF) and that

the political preferences of the regulator result in social indifference curves (SIC) similar to those presented in Figure 5.3. The value of SWF increases with a northeast shift of the SIC. In such a case, the greater is the weight placed by the enforcement agency on producer welfare, the greater is the transfer efficiency of the program. The greater is the marginal efficiency of decoupled area payments in redistributing income, the greater are the total transfers to producers and the social welfare from intervention. Both the socially optimal total transfer to producers and the social welfare from intervention are maximized when the political preferences of the enforcement agency and the regulator coincide.

5.6 Extensions of the Model

5.6.1 *Endogenous Penalties*

Crucial in the above analysis is the assumption that penalties are exogenous to agricultural policy makers. Allowing for endogeneity of penalties requires a second F.O.C. for the problem specified in equation (5.6), i.e.,

$$\frac{\partial W}{\partial \rho} = 0 \Rightarrow [\theta - (1+d)] \left[\frac{\delta_0^2}{4\delta_1} - \frac{r^2}{(r+\rho)^2 4\delta_1} \right] = 0 \Rightarrow \rho = \frac{(1-\delta_0)}{\delta_0} r \quad (5.17)$$

The expression for ρ in equation (5.17) is the penalty function that completely deters farmer misrepresentation, ρ^{nc} . Interestingly enough, ρ is not function of θ . Solving

equations (5.8)-(5.10) and (5.17) simultaneously indicates that, when ρ is endogenous to policy enforcers, cheating will be completely deterred by zero monitoring and a huge penalty, i.e.,

$$\delta_0^{\theta(\rho)} = 0 \text{ and } \rho = \infty \quad (5.18)$$

where the superscript $\theta(\rho)$ denotes the value of the parameter under all θ s when ρ is endogenous. Substituting the equilibrium values of the enforcement parameters into farmers' reaction function in equation (5.5), indicates that farmers' optimal choice is to report their actual amount of land. Graphically, zero δ_0 shifts the MPA curve to the origin while an infinite ρ shifts the $\frac{r}{r+\rho}$ line to the horizontal axis in Figure 5.2, Panel

(b). The two curves meet at the point where A_m equals to zero. Thus, when ρ is endogenous to the enforcement agency enforcement will be perfect and, assuming that there are no economic costs associated with the establishment of infinite penalties, costless. This is true no matter the weight placed on producer surplus.

Since cheating is perfectly and costlessly deterred when ρ is endogenous to policy enforcers, the area payment that transfers a given surplus to producers, the transfer efficiency of the policy instrument, and the socially optimal income redistribution are those derived by the traditional analysis of decoupled area payments. Therefore, one interpretation of the assumption of "perfect and costless policy

enforcement” implicit in the traditional agricultural policy analysis is the costless establishment of enormous fines on farmers misrepresenting their cultivated area.

However, as has been mentioned in the analysis of output quotas and output subsidies in chapters III and IV respectively, infinite unit penalties for farmers cheating on farm programs seem neither costless, nor credible or fair. And certainly it is not what is observed in most of today’s world. Agricultural policy making should incorporate the same principles of social justice that underlie all other areas of policy making. Penalties on farmers cheating on agricultural policy programs should be, and usually are, set in accordance with the whole structure of law enforcement and punishment within the community.

5.6.2 Centralized Policy Making

Consider finally the hypothetical case of an institutional arrangement characterized by a single agency that decides on both enforcement and optimal area payment. In such a case, the problem of the policy makers can be viewed as the determination of the least cost way of transferring the desired surplus to the farmers.

Since any level of investigation requires resources, the least cost way of implementing the desired income redistribution would involve zero δ_0 and a payment that would achieve the surplus transfer. This is true no matter if ρ is endogenous or exogenous. Since optimal δ_0 equals to zero the relevant STCs will coincide with STC^{θ^H} and STC^{pce} in Figure 5.3.

When p is exogenous to agricultural policy makers, the area payment that achieves the desired transfer PT to producers will equal r^{θ^H} . Assuming away the potential economic costs associated with the establishment of payments and penalties, there are infinite combinations of r and p that satisfy single agency's objective when p is endogenous. In general, the greater is p , the lower is PT , and the greater is r that achieves the desired transfer to producers. Table 5.1 presents simulation results on equilibrium payments, enforcement and misrepresentation for the different scenarios considered in this chapter.

5.7 Concluding Remarks

Cheating on decoupled area payments has been traditionally assumed away from the analysis of the policy instrument. The assumption of perfect and costless enforcement of the farm program is implicit in the traditional agricultural policy analysis and, to the extent that it is realistic, justifies the negligence of cheating. Investigating farmers to detect area misrepresentation is, however, costly. The resource costs of monitoring result in enforcement that is always incomplete, which in turn generates economic incentives for farmers to cheat.

The analysis in this chapter shows that the weight placed by policy enforcers on farmers' welfare is crucial in determining the enforcement that is carried out, which in turn affects the area misrepresentation that occurs and the government payments that are made. Since area misrepresentation results in gains for producers and losses for taxpayers, the more important are producers in the objective function of the

enforcement agency, the lower is the equilibrium amount of enforcement and the greater is the area that is over-reported. Reduced enforcement and increased misrepresentation result in increased benefits from cheating. The greater are the benefits from cheating, the lower is the area payment that achieves a given surplus transfer to producers.

The transfer efficiency of decoupled area payments is maximized when the political preferences of policy enforcers coincide with those of the regulator, i.e., when policy enforcers place a relatively high weight on producers. In such a case, the efficiency of the policy instrument is equal to that derived in the traditional analysis under perfect and costless program enforcement. One important implication of this result is that the efficiency of decoupled payments in transferring income to agricultural producers might be less than is traditionally believed; the marginal cost to taxpayers of transferring another dollar to producers can exceed $(1+d)$. This will occur if the enforcement agency attaches a relatively low weight to the welfare of producers and/or when the enforcement agency is concerned solely with minimizing taxpayer cost. Similar to the case of output subsidies in chapter IV, when the enforcement agency places zero weight on producer welfare the transfer efficiency of the policy mechanism is effectively minimized.

Table 5.1. Equilibrium Payment, Enforcement, and Misrepresentation on Decoupled Area Payments (Simulation Results)

Separation of Powers							Single Agency
	$\theta^0 (= 0)$		$\theta^L (= 0.9)$		$\theta^H (= 1.3)$		s
<i>ρ exogenous</i>							
r	9.62896	>	9.03584	>	8.64299	=	8.64299
δ_b	0.231304	>	0.08	>	0	=	0
ρ	12	=	12	=	12	=	12
A_m	160.413	<	262.205	<	314.017	=	314.017

<i>ρ endogenous</i>							
r	10	=	10	=	10	\geq	$r^{s(\rho)}$
δ_b	0	=	0	=	0	=	0
ρ	∞	=	∞	=	∞	\geq	$\rho^{s(\rho)}$
A_m	0	=	0	=	0	\leq	$A_m^{s(\rho)}$
PT = 10000; $A_b = 1000$; N = 150; $\psi = 15000$; $\delta_l = 0.1$; d = 0.15							

CHAPTER VI

RANKING OF THE POLICY INSTRUMENTS

Institutions and organizations involved in agricultural policy making are often assumed to seek efficiency, minimizing the distortionary costs of market intervention (Nerlove; Wallace), or the resource cost of redistribution per dollar transferred (Gardner 1983). Assuming that the sole purpose of government intervention is income transfers, the desirability of a policy mechanism is based on its efficiency in redistributing income from taxpayers and consumers towards farmers. The higher is the transfer efficiency of a policy instrument, the lower is the social cost of intervention, and the more appealing is the income redistributional mechanism.

Gardner (1983) compares two means of market intervention (deficiency payments and production quotas), and identifies the supply and demand elasticities, the extent of intervention, and the social cost of raising taxes as important determinants of the relative efficiency. In a latter paper, Gardner (1987b) incorporates political and economic characteristics of consumers/taxpayers and producers, and demonstrates their importance in agricultural policy making.

The effect of welfare losses from taxation on the ranking of policy instruments is explicitly considered by Alston and Hurd for both a closed and a small open

economy, and by Moschini and Sckokai for the large country case. Chambers extends the partial equilibrium approach and uses a general equilibrium model to analyze the incidence of agricultural policy mechanisms when there are positive distortionary costs from income taxation. These studies, however, by taking place under the implicit assumption of perfect and costless program enforcement, have ignored the impact of enforcement costs and cheating on the transfer efficiency and the normative ranking of the commodity programs.

The analysis in the previous chapters has indicated that cheating and misrepresentation affect the transfer efficiency of production quotas, deficiency payments/producer subsidies, and decoupled area payments. In addition to the factors noted above, the marginal efficiency of the policy instruments in redistributing income from consumers and taxpayers to producers also depend on the objectives of the enforcement agency and the resource costs of monitoring farmers' actions.

The question that naturally arises is whether and to what extent the introduction of enforcement costs affects the (normative) ranking of the policy instruments. This chapter examines the effect of enforcement costs on the ranking of the farm programs, under the different scenarios regarding the political preferences of policy enforcers and institutional arrangements considered in this study. The relative transfer efficiency of the commodity policies under perfect and costless enforcement is used as a benchmark.

Consider first the case of an institutional arrangement characterized by decentralized policy making where the enforcement agency places relatively high weight on producer welfare. The analysis in chapters III, IV and V indicates that cheating will

be completely allowed under the deficiency payment and area payment schemes, while, when an output quota is in effect, cheating will be deterred. The efficiency of deficiency payments is increased and the transfer efficiency of decoupled area payments is exactly the same relative to the “perfect and costless enforcement” scenario. On the other hand, the transfer efficiency of output quotas is reduced relative to the “perfect and costless enforcement” case.

Figure 6.1 shows the relevant STCs for a commodity market with a supply more elastic than the demand at the initial equilibrium.

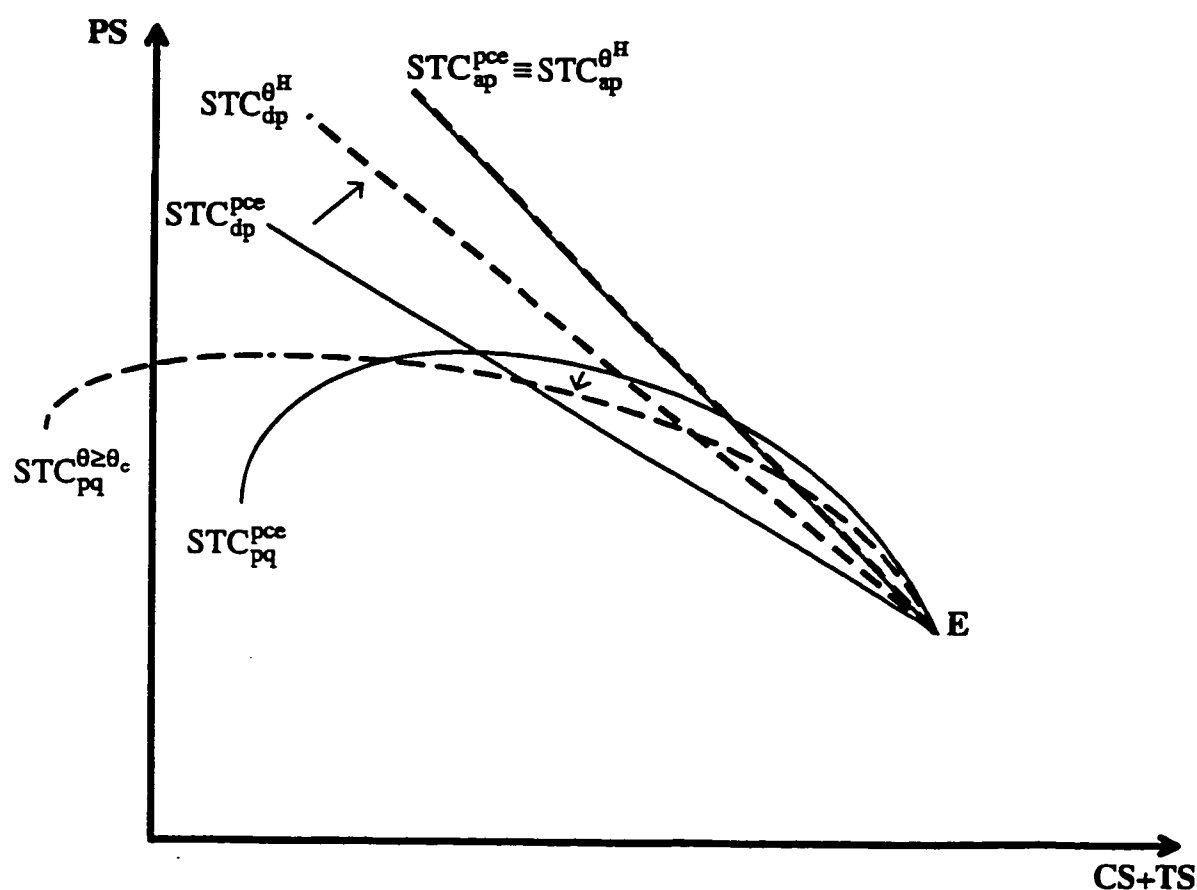


Figure 6.1. STCs of the Policy Instruments when the Enforcement Agency Places Relatively High Weight on Producers' Welfare

The dashed lines represent the STCs when policy enforcers place high weight on producers and enforcement is costly. The continuous lines show the STCs under perfect and costless enforcement (pce), for production quotas (STC_{pq}^{pce}), deficiency payments (STC_{dp}^{pce}), and area payments (STC_{ap}^{pce}). The STC for deficiency payments ($STC_{dp}^{\theta^H}$) will always lie above STC_{dp}^{pce} everywhere to the left of E. The STC for area payments ($STC_{ap}^{\theta^H}$) will coincide with STC_{ap}^{pce} , while the STC for output quotas ($STC_{pq}^{\theta \geq \theta^c}$) will lie underneath STC_{pq}^{pce} .

Figure 6.1 indicates that when monitoring farmers is costly and the enforcement agency places relatively high weight on producer welfare, decoupled area payments remain superior to deficiency payments for every positive level of intervention. The likelihood that output quotas will be more efficient than area payments in transferring small surpluses to producers falls. On the other hand, the likelihood that deficiency payments will be more efficient means of market intervention than output quotas increases. Expressed differently, the likelihood that an all-or-nothing choice between deficiency payments and output quotas will favor deficiency payments increases when monitoring is costly and policy enforcers place high weight on producer surplus.

When, however, the enforcement agency places relatively low or no weight on producer welfare, some cheating will occur under all policy mechanisms. The transfer efficiency of area payments and output quotas is reduced relative to the perfect and costless enforcement case (compare STC_{ap}^{ie} with STC_{ap}^{pce} , and STC_{pq}^{ie} with STC_{pq}^{pce} in Figure 6.2 where the superscript ie stands for imperfect enforcement). The position of

the STC for deficiency payments under imperfect enforcement, STC_{dp}^{ie} , relative to the STC_{dp}^{pce} , depends on the size of the monitoring costs. For relatively low enforcement costs, the efficiency of deficiency payments is increased (not shown in Figure 6.2), while, when enforcement costs are high, the transfer efficiency is reduced relative to the “perfect and costless enforcement” case. Obviously, the ranking of the policy instruments under costly enforcement when policy enforcers place little or no weight on producer welfare is case specific and depends on market conditions, the level of intervention, the welfare losses from taxation and the size of the enforcement costs.

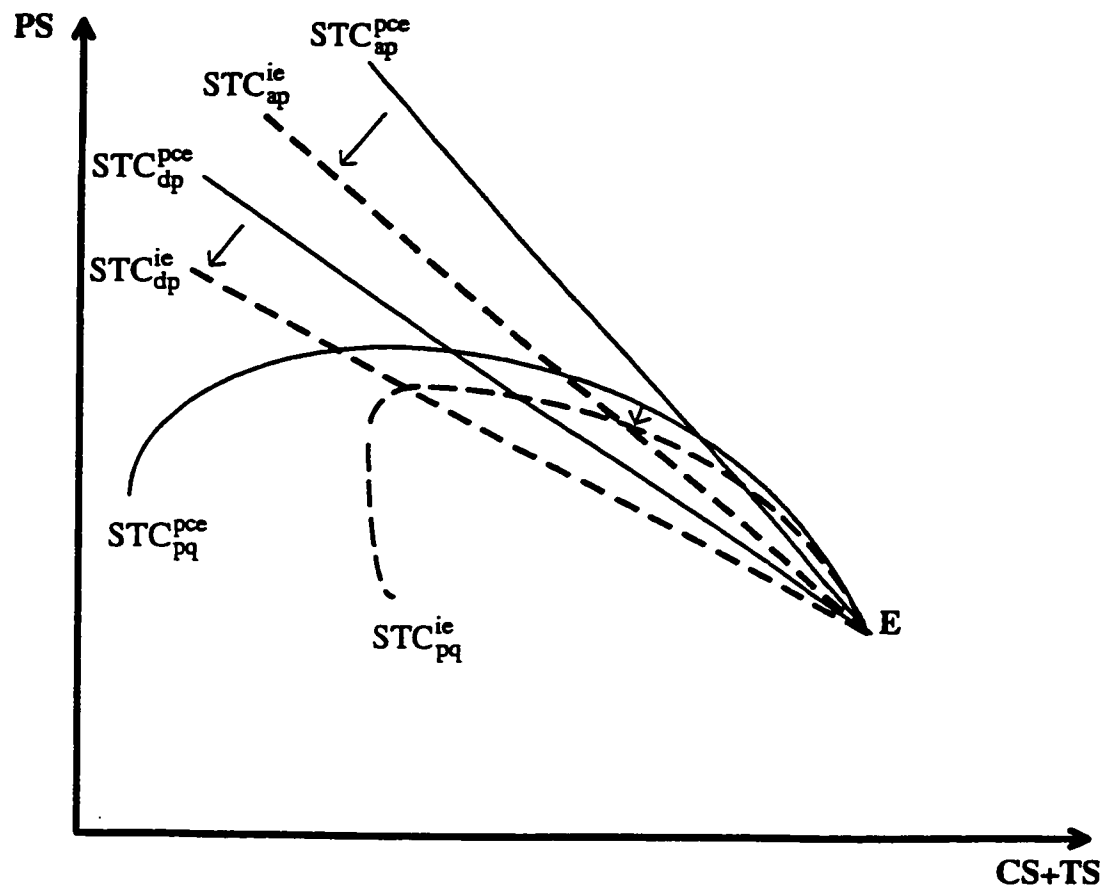


Figure 6.2. STCs of the Policy Instruments when the Enforcement Agency Places Zero or Relatively Low Weight on Producers' Welfare

When penalties are endogenous to agricultural policy makers, farmer misrepresentation on output subsidies and area payments is perfectly and costlessly deterred. This is true no matter the weight placed by the enforcement agency on producer surplus. STC_{dp}^{pce} and STC_{ap}^{pce} in Figures 6.1 and 6.2 show the relevant STCs for deficiency payments and area payments, respectively. STC_{pq}^{pce} reflects the STC for output quotas when program enforcers control both enforcement parameters and place a relatively high weight on producers. When the enforcement agency places relatively low or no weight on producers, some allowance of above-quota production will always occur and the relevant STCs will lie underneath STC_{pq}^{pce} .

Finally, in a hypothetical institutional arrangement where a single agency is authorized to design and implement farm programs, the results are equivalent to the case where agricultural policy making is decentralized, penalties are exogenous to policy enforcers, and the enforcement agency places a relatively high weight on producer surplus. More specifically, the efficiency of deficiency payments is increased and the transfer efficiency of decoupled area payments is exactly the same relative to the “perfect and costless enforcement” scenario. This is true no matter if penalties are endogenous or exogenous to single agency’s policy makers. On the other hand, the transfer efficiency of output quotas under costly monitoring is reduced relative to the “perfect and costless enforcement” case, when penalties are exogenous to agricultural

policy makers.³² When penalties are endogenous, cheating will be completely (and costlessly) deterred and the relevant STC will coincide with the STC used in traditional analysis.

The implication of these results is that the enforcement costs do affect the relative efficiency of the commodity programs in redistributing income to producers and therefore, the normative ranking of the policy mechanisms. These enforcement costs are omitted from the traditional analysis. In an institutional arrangement characterized by separation of powers and where policy enforcers place relatively high weight on producers (i.e. case of USDA and Ministries of Agriculture in most countries/members of the EU), the traditional analysis overestimates the transfer efficiency of output quotas and underestimates the transfer efficiency of deficiency payments. The transfer efficiency of decoupled area payments remains unaffected.

When the enforcement agency places zero or relatively low weight on producers, the transfer efficiency of both area payments and output quotas is overestimated by traditional analysis. The relative efficiency of deficiency payments depends on the size of enforcement costs. When enforcement costs are relatively low, traditional analysis underestimates the efficiency of deficiency payments, while, when enforcement costs are high, the efficiency of the policy instrument is lower than the one traditionally used. Ultimately, the ranking of the policy instruments depends on the

³² When enforcement costs are low, cheating will be completely deterred and the relevant STC is given by $STC^{\theta \geq \theta_c}$ in Figure 3.6. When enforcement costs are high, some allowance of cheating will occur. The relevant STC will be the outer envelope of the STC^{θ^0, k^0} , $STC^{\theta < \theta_c}$ and $STC^{\theta \geq \theta_c}$ in Figure 3.7. In any case, the relevant STC under costly monitoring lies underneath the STC_{pq}^{pce} (denoted as STC^{pce} in Figure 3.7) for every relevant level of intervention.

market conditions, the deadweight losses from taxation, the extent of intervention, the arrangement of institutions involved in agricultural policy making, the political preferences of policy enforcers, and the size of enforcement costs.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Farmer misrepresentation and cheating have been traditionally assumed away from the economic analysis of agricultural policy mechanisms. The assumption of perfect and costless enforcement of farm programs is implicit in the traditional analysis and, to the extent that it is realistic, justifies the negligence of cheating. The current study indicates that the results of the traditional analysis of output quotas, producer subsidies/ deficiency payments, and decoupled area payments are only valid when (i) policy enforcers control both audits and penalties and induce compliance by zero investigation and huge penalties on detected cheating and (ii) the establishment of enormous fines is costless.

However, agricultural policy makers charging infinite penalties on farmers cheating on farm programs seems neither costless nor credible or just. And certainly it is not what is observed in (most of) today's world. For all developed countries, penalties are usually exogenous to agricultural policy makers. They are determined elsewhere in the legal system and they are usually set in accordance with the whole structure of law enforcement and punishment within the community.

With penalties exogenous to agricultural policy makers, enforcement is based on monitoring farmers' actions. Investigation of individual farmers is costly however. The resource costs associated with monitoring and enforcement may result in enforcement that is incomplete. Imperfect enforcement generates economic incentives for farmers to cheat on the farm programs by producing over and above the quota limit in the case of output quotas, or over-reporting the output and the past cultivated acreage in the case of output subsidies and area payments, respectively.

Cheating on output subsidies and decoupled area payments results in welfare gains for producers that constitute a direct transfer from taxpayers. When, however, an output quota scheme is in effect, violation of the quota limit affects the prevailing prices and quantities. Cheating on output quotas results in losses for producers and welfare gains for consumers. The revenues from penalties on detected cheating and the costs associated with the enforcement of output restrictions mean that taxpayers have an interest in the manner output quotas are introduced and enforced.

The weight placed by program enforcers on the well-being of the farmers is crucial in determining the level of enforcement, cheating, and government intervention. The greater is the importance of producer welfare for policy enforcers, the lower is the equilibrium enforcement, and the greater is the farmer misrepresentation under an output subsidy or a decoupled area payment scheme. Reduced enforcement and increased misrepresentation result in increased producer benefits from cheating. The greater are the benefits from cheating, the lower are the government payments (i.e.

output subsidy and area payment) required for a given surplus to be transferred to producers.

The reverse is true when a production quota is in effect. More specifically, enforcement increases, cheating decreases, and the output quota that achieves a specific income transfer to producers increases with an increase in the relative weight placed by program enforcers on producer surplus. One, however, should note that these results are based on the assumption that the optimal choices of the agents involved in policy design and implementation are common knowledge. Failure of the regulator to exactly identify the type of the enforcement agency might result in more (or less) than desired surplus transferred to producers.

Because of the resource costs associated with monitoring individual farmers, policy makers in a hypothetical institutional arrangement where a single agency is authorized to design and implement farm programs will always find it economically optimal to allow farmer cheating on output subsidies and area payments. The relevant payment is then reduced to the level that achieves the desired transfer to producers. Under an output quota scheme, the choice of the single agency depends on the size of enforcement costs. Relatively low monitoring costs will result in complete deterrence of cheating while some allowance of cheating will emerge when monitoring costs are relatively high. The simultaneous establishment of payment and monitoring by the hypothetical single agency eliminates the possibility of over- or under-payments to the farmers.

The level of enforcement is inversely related to the transfer efficiency of output subsidies and area payments. The greater is the equilibrium audit probability, the greater are the resource costs associated with a given transfer to producers, and the lower is the efficiency of the policy instruments in redistributing income to producers. The efficiency of output subsidies and decoupled area payments in transferring income to producers is maximized when the political preferences of policy enforcers coincide with those of the regulator, i.e., when both agencies have a relatively high weight attached to producer welfare. Paradoxically, the transfer efficiency of the policy mechanisms falls when the objective of the enforcement agency is to minimize total taxpayer costs from cheating.

The transfer efficiency of output quotas under alternative political preferences of policy enforcers is determined by a trade-off between the resource costs of intervention and the enforcement and monitoring costs. For given market conditions, the transfer efficiency of the program increases with the increase in enforcement when monitoring and enforcement costs are low. When enforcement costs are high, the efficiency of output quotas falls with an increase in monitoring.

One important implication of these results is that the introduction of enforcement costs into the economic analysis of the policy mechanisms changes the normative ranking of the policy instruments in terms of transfer efficiency. In an institutional arrangement characterized by separation of powers, where policy enforcers place relatively high weight on producers (i.e. case of USDA and Ministries of Agriculture in most countries/members of the EU), the traditional analysis

overestimates the transfer efficiency of output quotas and underestimates the transfer efficiency of deficiency payments. The transfer efficiency of decoupled area payments remains unaffected. This is also the case for the hypothetical situation where a single agency determines both policy variable and enforcement parameters.

When the enforcement agency places zero or relatively low weight on producers, the transfer efficiency of both area payments and output quotas is overestimated by traditional analysis. The relative efficiency of deficiency payments depends on the size of enforcement costs. When enforcement costs are relatively low, traditional analysis underestimates the efficiency of deficiency payments, while, when enforcement costs are high, the efficiency of the policy instrument is reduced relative to the traditionally used one. Ultimately, the (normative) ranking of the policy instruments in terms of transfer efficiency depends on market conditions, the deadweight losses from taxation, the extent of intervention, the institutional arrangement characterizing agricultural policy making, the political preferences of policy enforcers, and the size of enforcement costs.

Finally, the optimal level of total transfer to producers under an output quota scheme is contingent upon the amount of enforcement and the size of monitoring costs. More specifically, both the optimal transfer and social welfare increase with an increase in enforcement when monitoring costs are relatively low. When monitoring costs are high the optimal transfer and the value of social welfare fall with an increase in monitoring. When an output subsidy or an area payment scheme is in place, the optimal total transfer and the value of social welfare from policy intervention increase with the

increased weight placed on producers and the subsequent reduction in the enforcement level.

In addition to providing an understanding of the incidence of agricultural policies and the prevalence of cheating on farm programs, the results of this study can assist in explaining potential differences in compliance with policy rules observed in different areas/countries. Differences in the structure of the agricultural sector and the efficiency of institutions could account for differences in enforcement costs. Obviously, the greater is the number of farmers and the more dispersed are the farms, the greater is the monitoring cost (the parameter ψ in the models in this thesis). Increased monitoring costs mean less auditing and more cheating. Moreover, the greater is the proportion of farm population, and/or the greater is the (perceived) difference between farm and non-farm incomes, and/or the greater is the contribution of agriculture to the GDP of an area/country, and/or the more effective is the farm lobby, the more important politically the sector is expected to be. Increased weight on producers (i.e., a larger θ) is translated into less enforcement and more cheating under an output subsidy or an area payment scheme and more enforcement and less cheating when an output quota is in effect.

Consider, for instance, the case of the EU. The EU consists of countries with significantly different agrarian structures (especially when comparing the north with the south), different proportions of the farm population and political power of farm lobbies, and different farm incomes. In general, the structure of agriculture is very different between the EU countries. Also, the importance of agriculture varies among the EU

countries/enforcement agencies of the CAP. This diversity is likely to be part of the explanation of the differences in compliance with policy rules observed among the different areas/countries within the Community.

Furthermore, the significance of the enforcement agency's political preferences can help to explain the focus of the lobbying efforts by farm organizations in the EU on their national ministries of agriculture, as well as the resources spent by commodity groups in the US in lobbying the ASCS.

The objective of this study has been to introduce costly enforcement and cheating into the economic analysis of the traditional policy instruments. To undertake this analysis, the restrictive assumption that all farmers are identical has been made. Morality and culture, though significant determinants of individual farmer's behavior, are not incorporated into this analysis. For instance, there are many farmers whose disutility from cheating would outweigh any expected benefit from violating the program rules. Simply put, there are people that would never cheat. By focusing on the representative farmer, the effects of personal attributes on cheating are not considered. Extensions of the model to account for producer heterogeneity and culture could provide valuable insights for further explaining discrepancies in terms of policy compliance observed between different areas/countries.

Moreover, the introduction of producer heterogeneity could allow consideration of distributional consequences of cheating other than those examined in this study. For instance, allowing these activities to occur has the undesirable effect of redistributing

income from honest people to those who cheat on the farm program(s). The focus on the representative farmer by this study precludes the consideration of this issue.

Finally, empirical analysis of cheating, though demanding in terms of quality data, could make the analysis of the policy instruments under costly enforcement more useful in practical policy settings.

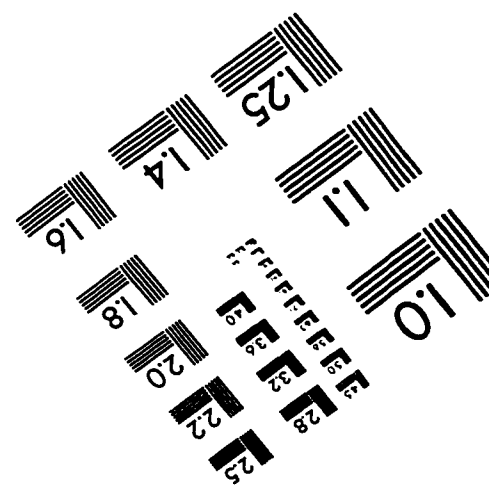
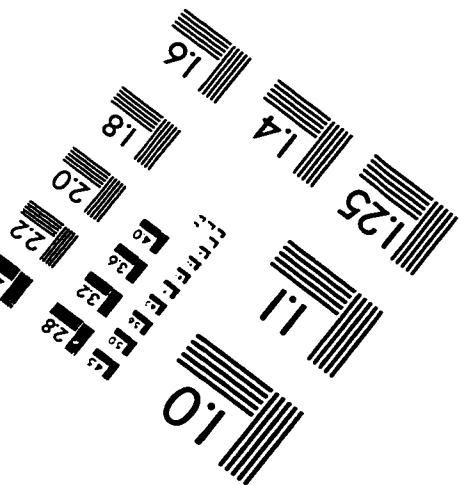
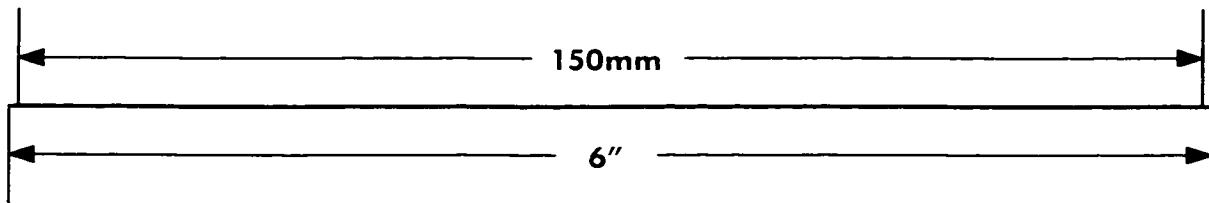
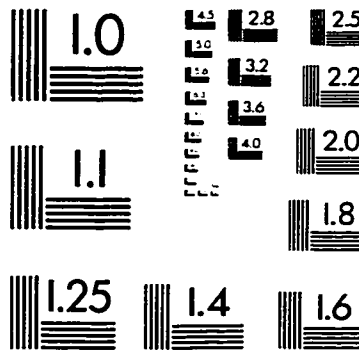
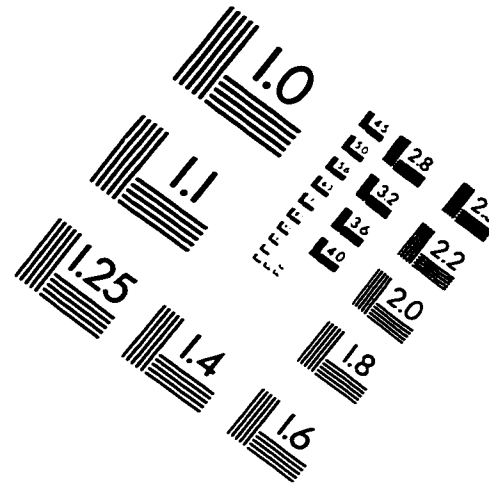
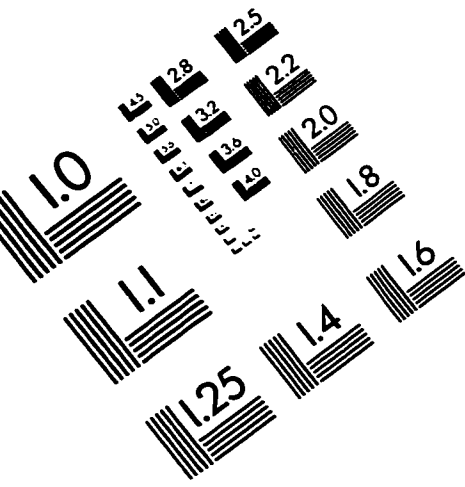
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IMAGE EVALUATION TEST TARGET (QA-3)



APPLIED IMAGE, Inc.
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
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