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WHICH TOOL IS RIGHT FOR THE JOB? AGRICULTURAL PRICING POLICIES FOR LARGE DEVELOPING COUNTRIES

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Abstract. Less developed countries typically have at their disposal a limited choice of tax policy instruments. The taxation of agriculture is no exception. Recognizing the administrative infeasibility of many domestic taxes in LDCs, this paper focuses on direct price setting and border taxes. The paper investigates the equivalence of different types of tax instruments and shows how the choice of policy tools interacts with the government's objectives. We analyze optimal policies and policy reform for a dual economy that is large in international markets.

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1. Introduction

Less developed countries (LDCs) typically have at their disposal a limited choice of tax policy instruments. The taxation of agriculture is no exception. Income taxation is only very rarely administratively feasible. Indirect taxes on agricultural production and consumption, too, are seldom observed. Rather, consumer and producer prices are frequently set by fiat, and these legislated prices may or may not be systematically related to world prices. Less frequently, yet still not uncommon, domestic agricultural prices are given by applying trade taxes to world prices.

This paper investigates equivalences between different types of tax instruments and shows how the choice of policy tools interacts with the government's objective. We focus on a large dual-economy whose government sets urban consumer and farm prices directly. The only explicit tax it can levy is a border tax, while the officially set prices give implicit taxes or subsidies on urban consumption or rural production. We ask: When is a border tax equivalent to domestic price setting as a means of achieving welfare and governmental revenue objectives? We also consider when, if ever, prices set by autonomous marketing boards attain these welfare and revenue goals. The answers to these questions depend crucially on whether arbitrage possibilities prevent a divergence of urban and rural prices.

Agricultural pricing has been carefully analyzed in the Public Economics literature. Newbery (1988) develops implementable price reform rules in a partial equilibrium context, while Sah and Stiglitz (1987) investigate the potential for Pareto-improving price reforms in a two-sector model. These papers, and the related optimal taxation literature, take as a premise the need to raise government revenues. Especially in a developing country context, this seems imminently reasonable. Throughout the Public Economics literature on agricultural pricing, international competition has played a negligible or nonexistent role. [1] When the rest of the world is modelled at all, it is often assumed that the country whose policies are under investigation is a small country in agricultural markets. That is, the country is assumed to take the world price of agricultural products as given. In markets for cocoa, tea, rice, coffee, bananas, sugar and some edible oils, the small country assumption may not be appropriate. [2]

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[1] When studies of agricultural pricing in LDCs consider large country effects, the focus is different from ours. For example, Bautista (1986) empirically considers large country effects of pricing policies on agricultural income, but does not look at either optimal policies or the welfare effects of policy reform.

[2] See, for example Sanchez-Ugarte and Modi (1987) who calculate optimal export duties for selected commodities.

The role of border taxation in achieving welfare objectives of large countries has been considered at length in the International Trade literature, but the revenue requirements so integral to the Public Economics approach are seldom taken into consideration. When revenue goals are considered, the usual approach is to consider the border tax which would achieve the government objective. Studies which consider tax equivalence issues for large open economies, taking into account revenue objectives, are Dixit (1985), and Boadway, Maital, and Prachowny (1973). Dixit's paper, as well as Cordon (1984) and Bhagwati (1964) provide a survey of issues related to the interface in International and Public Economics.

This paper presents a model of agricultural pricing when developing countries are large in world markets and their governments must raise some revenue. Recognizing the administrative infeasibility of many domestic taxes in LDCs, the paper focusses on direct price setting and border taxes. We begin in section 2 by establishing notation and considering a benchmark case in which a country is large in the world market. The government sets consumer and farmer prices directly and does not face revenue requirements. Optimal price setting in this context emulates a large country's optimal export tax. The often seen pattern of agricultural taxation coupled with urban food subsidization makes economic sense when one considers a large country's effect on world markets. While in this benchmark case a border tax is equivalent to domestic price setting, this equivalence is not robust to many economically important changes in the benchmark case scenario. These changes are the subject of the following sections.

In section 3, we show that when a government maximizes revenue instead of welfare, trade policy can never raise as much revenue as direct domestic price setting. We also consider the possibility that for political or administrative reasons, the LDC government is constrained to use border taxes to raise revenue. The second best policies that result are characterized. In many cases, the informational requirements necessary to set optimal policy are unlikely to be met. Recognizing this, Section 4 derives easily implementable Pareto-improving price reform rules. Section 5 shows that when policy goals include distributional elements, trade policy is seldom the right tool for the job. In many LDC's the price setting role of the government is decentralized and autonomous marketing boards set policy. Section 6 focusses on autonomous marketing boards and shows that the institutional structure of the price setting authority affects the policies that result. The paper concludes by summarizing the results and their applicability.

2. Price Setting in a Large Dual Economy: A Benchmark Scenario

We consider a developing country that is large in an international agricultural market. The country is comprised of a rural and an urban sector. The rural sector is itself comprised of many agricultural households. These households as an aggregate produce the agricultural good, Q, according to a quasiconcave production function. X^A of this output is consumed on the farm. The rest is marketed surplus which is sold to the government at a fixed price P^A. Agricultural households value on-farm consumption at its opportunity cost, P^A. Marketed surplus then is given by:

$$MS(P^A) = Q(P^A) - X^A(P^A). \tag{1}$$

$MS' > 0$ since by assumption $Q' > 0$ and $X^{A'} < 0$. The marketed surplus schedule is shown in Figure 1. As the government lowers P^A, farms produce less and consume more on the farm. At some price denoted $\overline{P}$, marketed surplus becomes zero. Changes in rural welfare are accurately reflected by changes in agricultural producer surplus. [3] This producer surplus is in turn given by,

$$PS = \int_{\overline{P}}^{P^A} MS(P)dP. \tag{2}$$

The urban sector does not produce any of the agricultural commodity. The government is the sole seller of the agricultural commodity in the urban sector. This commodity sells at an officially set price price, P^U. Urban utility is denoted U and is a concave function of urban food consumption X^U. Food demand is of course a function of the set urban food price and is given by, $X^U = X^U(P^U)$. Welfare in the urban sector is given by consumer surplus, CS,

$$CS = U(X^U) - X^U(P^U)P^U. \tag{3}$$

Not all of the marketed surplus is consumed by the urban sector. The amount not so consumed is sold by the government on the world market. Hence export supply, X. is given by.

$$X(P^U, P^A) = MS(P^A) - X^U(P^U). \tag{4}$$

The government buys all agricultural output at P^A and sells as much as is demanded in the urban sector at price P^U. In this sense, the government is acting as a centralized marketing board. There is no *a priori* reason to expect the government to set equal rural and urban prices. If, however, differential pricing is to be at all effective, domestic arbitrage must be disallowed. We assume, for now, that this is the case. This assumption will be amended in later sections of the paper.

The net revenues raised by the government are given by:

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[3] The proof, due to Kala Krishna, proceeds as follows. Rural households can be represented by an aggregate household so that the rural sector is assumed to choose X^A, L, and n to maximize $W = U(X^A, L) + n$ subject to the constraints, $P^A X^A + n = P^A Q$ and $Q = f(L)$ where L and n are rural labor supply and rural consumption of the numeraire good, respectively. The utility function, $U(\cdot)$, and the production function, $f(L)$, are well behaved so that second order conditions are satisfied. First order conditions give $U_x = P^A$ and $U_L = -P^A f_L$ and implicitly define $X^A(P^A)$ and $L(P^A)$. Hence welfare can be expressed as

$$W = U(X^A(P^A), L(P^A)) + P^A[Q(P^A) - X^A(P^A)]. \tag{i}$$

First order conditions and standard integration techniques allow us to rewrite $U(\cdot)$ as

$$U(P^A) = P^A[X^A(\cdot) - Q(\cdot)] - \int_{\overline{P}}^{P^A} [X^A(\cdot) - Q(\cdot)]dP. \tag{ii}$$

In deriving (ii), we assume $U(\overline{P}) = 0$ since $X^A(\overline{P}) = Q(\overline{P})$ and since we are only interested in measuring changes in welfare. Substituting (ii) into (i) give equation (1) in the text.

$$\pi^{MB} = P^U X^U + P^* X - P^A MS \tag{5}$$

$$= (P^* - P^A)MS + (P^U - P^*)X^U \tag{6}$$

where P^* denotes the world price. The first two terms on the right hand side of (5) are the revenue that the marketing board collects while the last term is the marketing board's costs. Making use of (4), marketing board profits may be rewritten as in (6). This formulation highlights the implicit tax on agricultural production and the implicit subsidy on urban agricultural consumption. The first right hand side term of (6) gives the implicit tax revenue from rural agricultural taxation (assuming $P^A < P^*$) and the second term gives the implicit revenue cost of urban food subsidization (assuming $P^U < P^*$).

National welfare, denoted W, is the sum of consumer surplus, producer surplus, and marketing board profits (government revenue.) As a benchmark scenario, we first consider simple national welfare maximization and the resulting government set prices. Government revenue requirements, then, are for now ignored. Using (2), (3), and (5) and simplifying, national welfare may be written as,

$$W = U(X^U(P^U)) - P^* X^U + (P^* - P^A)MS + \int_{\overline{P}}^{P^A} MS(P)dP. \tag{7}$$

In order to determine the optimal choices of P^A and P^U, some assumption must be made about the world market. While the LDC is large, it need not be the only supplier, in which case we would need to specify any strategic interaction among governments. In order to focus on the choice of border taxes versus price setting, we abstract from such strategic issues and assume a single suppler. [4] Given the large country assumption, the more the country sells abroad, the lower the world price of the good. World inverse demand is given by:

$$P^* = P^*(X) \quad \text{and} \quad P^*_X < 0. \tag{8}$$

Differentiating (8) with respect to P^A and making use of the fact that $X_{MS} = 1$ from (4) allows us to express the effect of a change in the rural price on P^* as, [5]

$$P^*_{P^A} = P^*_X MS_{P^A}. \tag{9}$$

Noting, again from (4), that $X_{X^U} = -1$, we can write the effect of a change in the urban fixed price on the world price as,

$$P^*_{P^U} = -P^*_X X^U_{P^U}. \tag{10}$$

[4] For analyses of strategic policy issues with marketing boards, see Thursby (1988) and Krishna and Thursby (1988).

[5] Here and throughout this paper, subscripts denote partial derivatives.

Differentiating (7) and making use of (9) and (10) yield first order conditions $W_{P^A} = 0$ and $W_{P^U} = 0$. [6] These in turn define the optimally set urban and rural prices for the agricultural commodity.

$$P^A - P^* = XP_X^* \tag{11}$$

$$P^U - P^* = XP_X^* \tag{12}$$

Taken alone, (11) implies that agricultural output should be taxed since $XP_X^* < 0$. Similarly, (12) implies that urban agricultural consumption should be subsidized. Taken together, (11) and (12) imply that at a welfare optimum, $P^A = P^U$. In this case, optimal price setting is exactly equivalent to the optimal export tax so familiar in the International Trade literature. Optimal domestic price setting, then, exactly emulates the effects of optimal trade policy. Finally, note that the no arbitrage assumption is not binding in this case as it is optimal to set P^A and P^U at the same levels.

The benchmark scenario above shows that in a large dual economy, welfare maximization yields price setting policies that could be emulated by a simple border tax – in this case, an optimal export tax. Often, a border tax is easier to administer than direct price setting. It is usually easier to monitor the fewer and larger transactions at the border than it is to monitor the many and smaller transactions between every farmer and every consumer. In the benchmark case, then, there is no welfare cost to using the administratively more simple border tax. There are several possible concessions to the realities of developing economies which change this basic result. These changes are the subject of the following sections.

3. Revenue Maximization: Domestic Price Setting versus Trade Policy

In the absence of administratively feasible income taxes, developing economies generally rely on taxation of agriculture to raise government revenues. The benchmark case above ignored the revenue requirements that a government may face. In this section, we suppose that pricing policies are implemented to maximize government revenue instead of national welfare. In the light of the large fiscal deficits many LDC's experience coupled with pressure from international lending institutions to reduce or eliminate these deficits, a revenue maximization objective for agricultural pricing is well within reason. In this section we characterize revenue maximization policies for the large dual economy. We show that trade policy will never be equivalent to optimal price setting.

Recall, government revenues are given by (5). Revenue maximization implies $\pi_{P^A}^{MB} = 0$ and $\pi_{P^U}^{MB} = 0$. Let η [> 0] denote the price elasticity of supply of marketed surplus. Then setting P^A to maximize revenues implies:

$$P^A - P^* = XP_X^* - \frac{P^A}{\eta} \tag{13}$$

[6] We assume that our welfare function is well behaved. A sufficient condition is that it is concave in prices.

Since the supply of marketed surplus slopes upward, the revenue maximizing price paid to farmers and defined by (13) is still below the world price. Agriculture is still implicitly taxed.

It would be tempting to compare (13) and (11) and conclude that revenue maximization results in a higher implicit tax on agriculture than does welfare maximization. Such simple comparisons are not valid, though, since the arguments of each equation are evaluated at different points. In the case at hand, it is true that the implicit tax on agriculture is higher when the government maximizes revenue. That is, P^A at the welfare maximum is higher than P^A at the revenue maximum. This is because if the converse was true, it would be possible to lower P^A toward its welfare maximizing level. From (2), it is clear that lowering P^A decreases producer surplus. Consumer surplus is unchanged. If welfare is increasing, then, revenue must be increasing. But this cannot be true since revenue is already maximized. Hence, the implicit tax on agriculture is greater when the government's objective is revenue maximization than when the goal is welfare maximization.

Next, consider the consumer price that maximizes government revenue. Denote the urban price elasticity of demand for the agricultural commodity by ξ. ($\xi < 0$.) Then $\pi^{MB}_{PU} = 0$ implies,

$$P^U - P^* = XP^*_X - \frac{P^U}{\xi} \tag{14}$$

Since $-\frac{P^U}{\xi}$ is positive, it is possible that while welfare maximization implied an implicit urban subsidy, revenue maximization implies an implicit tax on urban agricultural consumption. Letting ξ^* denote the elasticity of demand in the foreign market, (14) can be manipulated to give:

$$\frac{P^*}{P^U} = \frac{1+\frac{1}{\xi}}{1+\frac{1}{\xi^*}} \tag{15}$$

Hence the urban sector might still be implicitly subsidized in the revenue maximization scenario if the urban demand is more elastic than the foreign demand for the agricultural commodity. [7] This is because when the government maximizes revenues, it acts like a price discriminating monopolist. This is especially evident if (13) and (14) are rewritten to (respectively) give:

$$P^* + XP^*_X = P^A(1+\frac{1}{\eta})$$
$$P^* + XP^*_X = P^U(1+\frac{1}{\xi}).$$

The price farmers receive is set to equate the marginal expense to the government of buying the commodity with the marginal revenue it receives from exports. Likewise the urban price equates the marginal revenue from urban sales with the marginal revenue from exports.

Finally, consider whether trade policy might also achieve the revenue maximum. Restricting a government's policy tools to trade policy is equivalent to forcing P^A to be set equal to P^U. In other words, being

[7] It is unlikely that this would often be the case, as it implies that domestic agriculture exercises greater monopoly power over the rest of the world than it does over urban consumers at home.

restricted to trade policy is equivalent to allowing domestic arbitrage. In the benchmark case, this was a non-binding constraint. If the goal is revenue maximization, though, the constraint binds. Suppose trade policy could achieve the revenue optimum. Then P^A equals P^U, and (13) and (14) together imply

$$\frac{P^A}{\eta} = \frac{P^U}{\xi}.$$

η, then, must equal ξ. But this cannot be since it is assumed that demand and supply curves have slopes of opposite signs. **Trade policy can never raise as much government revenues as can direct price setting.**

Suppose that either administrative or political constraints make revenue maximizing direct price setting infeasible, or if it is feasible, arbitrage ensures $P^A = P^U$. Then the country may still raise revenue with border taxes (or the equivalent fixed domestic prices) on the agricultural commodity. With P^A constrained to be the same as P^U, government revenue is given by

$$\pi^{MB} = (P^A - P^*)(X^U - MS). \tag{16}$$

Setting P^A to maximize (16) implies,

$$P^* - P^A = XP_X^* - \frac{X}{X_{P^A}}. \tag{17}$$

Direct comparison of the welfare maximizing trade tax and the revenue maximizing trade tax given by (11) is not valid as, again, variables are evaluated at different points. One can show, nonetheless, that (17) implies a higher tax on agriculture than does (11) [8] This is simply the well known result from trade theory that the maximum revenue tariff exceeds the optimum (maximum welfare) tariff.

4. Pareto Improving Policy Reforms

The above sections focused on setting optimal policy. While in some cases policymakers were assumed to be subject to administrative or political constraints, the resulting policy rules were optimal policy rules. The informational requirements of even simple optimal policy rules, though, are often excessive. Optimal policy rules require information about elasticities evaluated at points that may be very different from the current or past economic environments. Econometric estimation of the necessary elasticities by its very nature limits one to information about elasticities around the observed data points. What these elasticities really are at points far away from the data is anybody's guess. It is useful, then, to develop policy reform rules, for these rules only require local (and hence observable), as opposed to global, information.

Section Two characterized the national welfare optimizing agricultural pricing policies in the large country. At the welfare optimum, one group of the economy (urban consumers, rural farmers, or the government)

[8] The proof proceeds by supposing otherwise. Then P^A at the welfare maximum is lower than it is at the revenue maximum. Starting at the revenue maximizing P^A, then, if we lower P^A welfare must increase. But $\frac{\delta W}{\delta P^A} > 0$ evaluated at the revenue maximum when P^U is constrained to equal P^A. Hence the supposition is false.

can only increase its welfare at the expense of the other groups of the economy. When the economy is not already at the optimum, though, Pareto improving price reforms are possible. We follow the lead of Sah and Stiglitz (1987) who developed such rules for the small country. Application of their rules to a country that is large in international markets would be inappropriate and yield misleading policy advice.

Note first that if a country is restricted to trade policy, Pareto improving price reform is impossible. Recall, trade policy imposes that $P^A = P^U$ so that $dP^U = dP^A$. If rural welfare is to increase, then from (2), P^A must increase. But if P^A increases, P^U must also increase and from (3), urban welfare falls. Likewise, an decrease in P^U would increase urban welfare, but the accompanying fall in P^A decreases rural welfare.

If it is feasible to directly set the urban and farm prices separately, Pareto improving price reforms are possible. We derive rules for Pareto improving price reform.

First consider Pareto improving changes in the price farmers receive. From (2), producer surplus increases if P^A increases. From(3), consumer surplus is unaffected. If the increase in P^A is to be a Pareto improvement, government revenue must not decrease. The requisite condition then is $\frac{\delta \pi^{MB}}{\delta P^A} \geq 0$. Straightforward calculations yield our first price reform rule.

Rule 1: The government should increase the price farmers receive (P^A) if:

$$(t + \epsilon^*)\eta \geq \frac{P^A}{P^*}$$

$$\text{where } \epsilon^* = P^*_X \frac{X}{P^*} \text{ (the terms of trade elasticity) } < 0$$

$$t = \frac{P^* - P^A}{P^*} \text{ (the implicit tax rate on agriculture.) and}$$

$$\eta \text{ is the supply elasticity of marketed surplus.} \qquad (18)$$

Note that (18) is more likely to hold as the supply of marketed surplus becomes more elastic while the terms of trade elasticity approaches zero. Intuitively, a more elastic farm supply means that as P^A rises, the government collects less revenue per unit sold but the sales are higher. As the terms of trade elasticity falls (in absolute value) the extra exports generated by the rise in P^A have a less adverse effect on the world price. [9] Due to the large country effect ($\epsilon^* \neq 0$), what would have been Pareto improving for a small country may no longer be. The benefit of the extra revenue raised by the increased farm output is partially offset by the adverse effect this extra output has on the country's terms of trade.

Next, consider a decrease in the price urban consumers pay for the agricultural commodity. Farmers are unaffected, and consumer surplus rises so urban consumers are better off. If the rise in P^U is to constitute a Pareto improving price reform, it must be the case that government revenue does not fall. That is, $\pi^{MB}_{PU} \geq 0$. This leads to the second price reform rule.

Rule 2: The government should decrease the urban price of the agricultural commodity if:

[9] If ϵ^* is set to 0, (18) may be rearranged to yield the price reform rule in Sah and Stiglitz.

$$P^U \geq \frac{P^*(1+\epsilon^*)}{1+\frac{1}{\xi}} \tag{19}$$

Note that if the country is small in world markets, $\epsilon^* = 0$ and we have Sah and Stiglitz's rule. Sah and Stiglitz comment that their condition for a Pareto improving urban price reform is not likely to be met in most situations, since it implies that ξ must be large in absolute value. That is, demand for the agricultural commodity must be elastic. In fact, demand for agricultural commodities tends to be inelastic. If a country is large in the international market, the existence of a Pareto improving urban price reform is more likely. Intuitively, as the urban food price falls, urban demand increases. This in turn reduces exports which leads to an improvement in the terms of trade. The improved terms of trade serve to increase government revenue.

To summarize, if the government of our simple dual economy is restricted to border taxation, there are no Pareto improving policy reforms. If the government can set urban and rural prices separately, though, such reforms are possible. Introducing the terms of trade effect makes these reforms less likely to exist in the case of rural price reform and more likely in the case of urban price reform.

5. The Choice of Policy Tools and Income Distribution

Thus far, all of the analysis has ignored distributional concerns. The usual response to such concerns in the International Trade literature is that distributional concerns are best left to domestic taxes. In this section, we show that the usual response is indeed correct in our model. That is, domestic price setting (without arbitrage constraints) can attain distributional objectives that trade policy (or domestic price setting with arbitrage constraints) cannot. Put another way, if a country is restricted to using trade policy, it is also restricted in its ability to attain distributional objectives.

National welfare has three components, agricultural welfare, urban welfare, and government revenue. Denote these respectively as W^A, W^U, and R. W^A is simply consumer surplus defined by (3); W^U is producer surplus defined by (2); and R is π^{MB} defined by (6). Social welfare, V, is given by,

$$V = V(W^A, W^U, R)$$

Social welfare maximization implies:

$$V_{P^A} = V_{W^A} W^A_{P^A} + V_R R_{P^A} = 0$$
$$V_{P^U} = V_{W^U} W^U_{P^U} + V_R R_{P^U} = 0$$

V_{W^A}, V_{W^U}, and V_R are interpreted as social weights. Simple manipulation of the immediately above first order conditions yield the socially optimal fixed prices. These are:

$$P^A = \frac{V_R \eta}{(1+\eta)V_R - V_{W^A}}(XP^*_X + P^*) \tag{20}$$

$$P^U = \frac{V_R \xi}{(1+\xi)V_R - V_{WU}}(XP_X^* + P^*) \tag{21}$$

Note that if $V_{PA} = V_R$, (20) gives the same rural price as (11). Similarly, if $V_{PU} = V_R$ (21) gives the same urban price as (12).

Next we ask whether trade policy can achieve the social optimum implied by (20) and (21). Since trade policy imposes that $P^U = P^A$, the necessary condition is:

$$\frac{V_R \eta}{(1+\eta)V_R - V_{WA}} = \frac{V_R \xi}{(1+\xi)V_R - V_{WU}} \tag{22}$$

If the social weight placed on any one component of social welfare differs from the social weight placed on the either of the other two components, (22) will not hold. For all but a utilitarian social welfare function, then, an economy restricted to trade policy (or price setting with arbitrage) is an economy that cannot achieve maximum social welfare. The right tool for obtaining distributional goals is direct price setting.

6. The Institutional Structure of the Price Setting Authority

Thus far, the central government has set prices which maximize its objective function. The price setting authority, or marketing board, which implements these policies has performed solely as a marketing agent. Often marketing boards are established with statutory objectives, and the boards then set prices according to these objectives. In practice, the organization and objectives of boards vary widely. [10] For example, many marketing boards are essentially autonomous producer cartels, while others are often established to provide the government with revenue. In reality, many marketing boards lie somewhere between these two cases. Marketing boards may be set up to provide government revenue, but if large farmers are a politically powerful force, the board will seldom ignore the welfare of the producers.

It is natural to ask, in the context of this paper, how pricing policies by an autonomous board compare with those of the central government. In this section, we examine pricing policies of two types of boards To approximate the behavior of a board established to raise government revenue, we examine a board which chooses P^A and P^U to maximize board profits. The second type of board we consider is one which acts as a producer cartel and maximizes farmers' returns. We continue to assume that both type of marketing boards transact all purchases from farmers and all sales in the urban and export markets. The key difference between these two types of boards is that the producer cartel acts to maximize the area above the marketed surplus curve in Figure 1 plus export revenues and distributes its revenues to the farmer, while the profit maximizing board exercises monopsony power and revenues are returned to the government. [11] We model

[10] For examples of the many types of marketing boards, see Currie and Hoos (1979).

[11] Our profit maximizing board does not act as a price discriminating monopsonist in the sense that all farmers receive the same price for their output. The 1986 World Development Report notes that in the past some boards (e.g. coffee and cocoa in New Guinea) have price discriminated, but these schemes were abandoned in favor of more simply administrated schemes.

each of the two types of boards in turn. [12]

A. *The Profit Maximizing Board.*

The profit maximizing marketing board buys and sells the good and it determines the prices P^A and P^U to maximize board profits which are still given by (6). It is immediately clear that the farm and urban prices that will result are those that maximized revenues in Section 3. It makes no difference, then, whether the central government or a marketing board sets the prices.

In many instances, the marketing boards' domestic urban price setting is regulated by the central government. A very common such regulation requires the marketing board to marginal cost price in the urban sector. Denoting the marginal cost of marketed surplus as $c(MS)$, the profit maximizing board pays farmers P^A and $P^A = c(MS) = P^U$. Hence, P^A is the marketing board's only choice variable and $dP^A = dP^U$. The marketing board's problem now is exactly the same as the central government's pricing problem when the government either could not segment markets or was restricted to trade policy.

The profit maximizing board replicates the pricing decisions of unconstrained revenue maximizing central government unless the marketing board is regulated to marginal cost price in the domestic urban sector. If the marketing board is so regulated, the board's pricing replicates the decision of the central government when the government is restricted to trade policy.

B. *The Autonomous Marketing Board.*

Suppose the marketing board's objective (either *de jure* or *de facto*) is to maximize farmers' profits. We refer to such a marketing board as an autonomous board. Then, unlike the profit maximizing board above, the prices determined by an autonomous board do not replicate those of any of the central government's decisions modeled above. This nonequivalence occurs whether or not the autonomous board is regulated in its domestic urban pricing. The nonequivalence with revenue maximization prices occurs because the total cost of the profit maximizing board (or the revenue maximizing central government) included the producer surplus associated with marketed surplus. Here, the autonomous board only considers the areas under $c(MS)$ as total cost. The nonequivalence with the welfare maximization of our benchmark case occurs because the autonomous board exploits its monopoly power and does not take consumer surplus into account.

Consider first the unregulated autonomous marketing board. Such a board acts as a producers' cartel. The profits of such a marketing board are denoted π^{PC}.

$$\begin{aligned}\pi^{PC} &= P^U X^U + P^* X - \int_0^{MS} c(Q)dQ \\ &= P^U X^U + P^* X + \int_{\overline{P}}^{P^A} MS(P)dP - P^A MS \end{aligned} \tag{23}$$

[12] The concerns in this section are similar to those of Markusen (1984) and Lloyd (1982). Markusen compares welfare and revenue maximizing trade taxes with several types of profit maximizing boards. His analysis is general equilibrium and he does not allow monopsony power, so that his board is analogous to our producer cartel. Lloyd shows the equivalence of state trading with private trading given the use of appropriate tax/subsidy instruments. Instead, we focus on equivalences or the lack thereof given limited policy tools.

The prices that maximize cartel profits are implicitly defined by setting π^{PC}_{PA} and π^{PC}_{PU} equal to zero. This exercise yields:

$$P^A - P^* = P^*_X X \tag{24}$$

$$P^U - P^* = X P^*_X - \frac{P^U}{\xi}. \tag{25}$$

Equation (24) is identical to (11) – the equation which implicitly defined the tax on agriculture in the benchmark case. While (24) and (11) look the same there are two important differences. First, the implicit tax defined by (11) yields revenue that goes to the government, while the autonomous marketing board returns the revenue to the farmer. Second, both exports and the terms of terms of trade effect, P^*_X are evaluated at different points in the two equations. This is because the urban price defined in (25) is not the same as the urban price in the benchmark case. Hence domestic consumption will differ and, since production is the same in the two cases, exports will differ. In both scenarios, though, the government or the autonomous marketing board exercises market power in the world market.

Equation (25) is identical to (14) which defined the urban price in the unconstrained revenue maximization case of section 3. Again, though, each equation is evaluated at different points, so the urban prices may differ in the two cases. Note that the autonomous marketing board may set P^U higher than P^*. Without regulation, the board exercises its monopoly power domestically as well as abroad.

Finally, note that trade policy cannot replicate the prices that the unregulated autonomous board sets as $P^U \neq P^A$, and (24) and (25) imply that the urban price will exceed the producer price. More general comparisons, though, are not possible.

Now suppose that the autonomous board is regulated to marginal cost price at home. Does this type of marketing board replicate either the policies of a marketing board run by the central government or trade policy?

This marketing board chooses the producer price of the agricultural commodity to maximize cartel profits which are still given by (23) subject to the constraint that $P^U = c(MS(P^A))$. Substituting in the constraint and differentiating, straightforward manipulations give:

$$[P^* - P^A + X P^*_X] X_{PA} = -X^U \tag{26}$$

Since $X_{PA} > 0$ and $-X^U < 0$, the term in brackets must be negative. This in turn implies that $P^* - P^A < -X P^*_X$. Hence, the optimally set rural price may be either above or below the world price. Intuitively, the marginal cost pricing regulation gives the marketing board the incentive to sell more than it otherwise would as it can increase its net returns by driving up the marginal cost (assuming increasing marginal costs in the relevant range of production.)

Even when agriculture is taxed by this board, the resulting tax will be less than that set by the welfare maximizing government. [13] The proof is by contraposition. If P^A defined by (26) were less than the welfare maximizing price, then an increase in P^A would increase welfare. Notice that welfare in (7) can be written as $CS + \pi^{PC}$. We know from (26) that π^{PC} would decline with an increase in P^A, and given the constraint on P^U, consumer surplus would also decline. Hence P^A defined by (26) must exceed the rural price defined by (11).

Thus the prices that result from the regulated autonomous marketing board are not replicated by any of the central government decision making scenarios that we consider. Due to the marginal cost pricing constraint, though, the prices that this board chooses mimic a trade policy. In this case, though, the equivalent trade policy may be either an export tax or an export subsidy.

7. Summary

We have investigated agricultural pricing policies for a large developing (dual) economy. We have asked when trade policy will achieve the same objective that is achieved by domestic direct price setting. We have also shown how the institutional structure of the price setting authority will effect the resulting policies. Section 2 showed that trade policy can achieve the first best outcome if the government's goal is straightforward welfare maximization. In this particular case, the often observed pattern of paying farmers below the world price and then selling in the urban sector at a subsidized rate makes economic sense. (This result, though, is completely dependent on the large country assumption.)

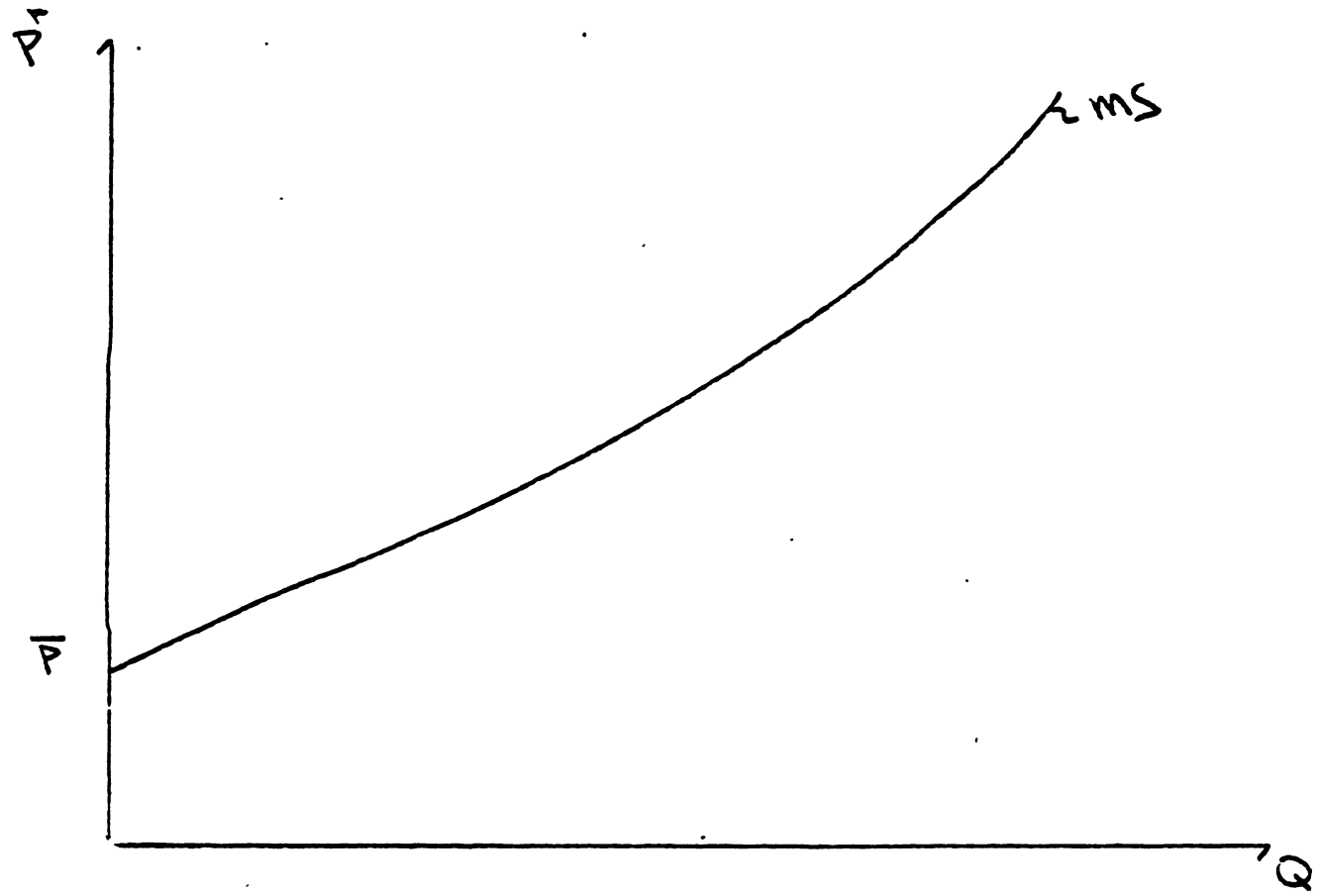
When pricing policies are used to maximize government revenue, the equivalence result is overturned. Section 3 proved that trade policy can never raise as much revenue as direct price setting. In other words, the administrative infeasiblity of direct price setting imposes a binding constraint on the government's revenue raising ability. If the economy is initially at some arbitrary point, the twin goals of increasing both revenue and welfare need not be mutually exclusive. Section 4 derived rules for Pareto improving agricultural price reform. It was shown that the large country aspect of the problem reduces the likelihood of Pareto improving producer price reform and increases the likelihood of Pareto improving consumer price reform. Section 5 showed that the trade policy's ability to emulate the welfare optimum is restricted to the case of a utilitarian social welfare function. If distributional concerns are important, trade policy cannot achieve the first best.

Section 6 showed that if agricultural pricing policies are implemented by marketing boards, as is often the case in developing countries, the institutional structure of these marketing boards greatly effects the policies that the boards can be expected to select. It was shown that the regulated profit maximizing board and a revenue maximizing government which cannot prevent arbitrage will select the same set of prices. The prices selected by the autonomous marketing board are not replicated by any of the government maximization problems considered.

[13] Analogous results have been shown in other contexts by Just (1979), Markusen (1984), Thursby (1988) and Krishna and Thursby (1988).

So, which tool is right for the job? We have shown that the answer to this question depends crucially on what the job is. Except for the case of welfare maximization without distributional concerns, trade policy is not the right tool for the job. We have established a framework with which one could empirically estimate the welfare costs of the inability to levy either domestic taxes or set prices directly. While that is beyond the scope of this paper, we hope others might be motivated to attempt the task.

Figure 1



The Supply of Marketed Surplus

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