State Trading Enterprises: What Analyses are Required?

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1. Introduction

It has long been recognised that agricultural markets exhibit various forms of market failures. In the context of agri-food supply chains in developing countries, there are perhaps two that are more important than the others. First, there is the buying power of middlemen (also referred to as intermediaries) downstream from the farm sector. The second is risk and uncertainty, i.e., the variability of prices and quantities, which, in the presence of low household income and lagged production response, can lead to food insecurity and livelihood insecurity, that is, to vulnerability (OECD, 2009, p. 15). It is also well known that markets for risk are at best incomplete but are often non-existent.

In response to these market failures, governments tend to intervene through the manipulation of producers' input and output prices and the manipulation of consumers' prices. Often the instruments employed are used in combination. They include: input subsidies (to make inputs more affordable in the presence of credit rationing, to reduce the marginal costs of production, and to increase production); minimum farm-gate prices (to reduce down-side price risk and to increase livelihood security); food subsidies for the poor (to improve food security); public storage stocks (to smooth consumption through time and to stabilise prices); and statutory marketing boards (to reduce or to remove the buying power of the downstream sector through narrowing the mark-up).

State Trading Enterprises (STEs), of which marketing boards are an example, are also a common feature of agricultural markets in developing countries, either operating alone, or operating in conjunction with private firms, or operating in conjunction with product and input price manipulation.[1] From notifications of STEs to the WTO, it is known that the objectives being pursued are many but, of particular relevance for developing countries, they include income support for producers, price stabilisation, continuity of domestic food supply, and control of foreign trade operations (OECD, 2001, p. 15).

The means used by STEs to achieve these ends are also many but of particular relevance are being exclusively responsible for importing and exporting, having exclusive rights to procure

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[1] For a description one such STE, the Food Corporation of India, see Panagariya (2008) especially chapters 14 and 16).

and to sell domestic production often in conjunction with government-determined floor and ceiling prices, and maintaining emergency stocks (OECD, 2001, p. 16). Given the range of objectives sought and the variety of activities undertaken by STEs, the economic analysis of their effects and an assessment of their successes or failures is not straightforward.

STEs are part of the agri-food supply chain in several countries and it is necessary to determine their effects on the efficient functioning of that chain. This task is approached here by reviewing the existing results in the research literature in which an STE is compared with a private sector counterfactual in a deterministic situation (section 2). A stochastic element is introduced on the supply side and it is assumed that producers can adjust to a price that differs from the one on which the production decision was made (section 3). Conducting this analysis in the setting of a closed economy allows the conclusion to be drawn that the STE and the pure middleman have different effects on the level of consumer and producer prices and on the stability of producer prices. This conclusion has implications for government policy but it may be of limited relevance because of the special assumptions that are made. Therefore, the conclusion may not be a general one and it is necessary to extend the analysis to allow for different assumptions. What are regarded *a priori* as the most important of these different assumptions are listed in section 4. They form the basis of a research agenda in which are identified the analyses that are required to determine the policy conclusions that are to be drawn about the appropriate role, if any, for STEs in the agri-food supply chain.

2. STEs and Market Failures

In the context of the first of the two market failures noted above, there exist some results from the research literature about the effects of STEs as an intermediary when compared first, with a market that is free of government intervention and second, when compared with a market in which there is a minimum procurement price. To date, these analyses have assessed the role of STEs in moderating market power downstream from the farm sector and the consequent effects on overall social welfare and the components of it, when compared with the outcomes produced by an imperfectly competitive downstream sector. As these recent analyses have been conducted in an open economy context, the effects that STEs have on imports and exports is also known.

In a series of papers McCorriston and MacLaren (2005, 2007a, 2007b and 2008) have shown both theoretically and empirically that an STE in an importing country is likely to act as a tariff and restrict imports, especially where its objective is to increase domestic producer surplus; whereas an STE in an exporting country is likely to act as an export subsidy,

especially where again its objective is biased towards domestic producers.[2] These authors have shown that the sign and the magnitude of the tariff equivalent or the export subsidy equivalent depends upon the counterfactual market structure that is assumed, on the extent to which the STE has exclusive rights and the objective of the STE. They have also shown that partial deregulation of an STE does not guarantee that welfare is improved compared with the status quo of no deregulation. While important insights are provided in these papers about the role of an STE in correcting the market failure that arises in procurement by the sector downstream from agriculture, what has not been considered is the other market failure noted above, namely, uncertainty in the context of incomplete markets for risk.[3]

In their important book that grew out of the extensive debates during the 1970s about international commodity price stabilisation, Newbery and Stiglitz (1981) conceded that the market structure of intermediaries, while important, would be a research question to be analysed later. They identified two issues: first, what effect does the degree of imperfect competition in the downstream sector have on price stability; and second, what effect would price stabilisations schemes have on this market structure? In what follows, we consider only the first of these.

3. Preliminary Analysis

What is missing from the research literature is an assessment of the role of the STE in providing market stability and security and a comparison of the outcomes achieved by it with those of a downstream sector composed of private firms. Consider the following typical situation of an agricultural commodity market in a developing country. There are many small producers of a homogeneous product that sell their marketable surplus to a downstream sector. The firms in this downstream sector maximise profit through procurement of the commodity from the farm sector and sales of it to many final consumers. When the downstream sector is a single firm, the situation is described as a pure middleman, i.e., a monopsony/monopoly.

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[2] As noted above, the objectives of STEs are varied. However, for the purposes of the analyses undertaken in these papers, it was assumed that the STE maximises a weighted objective function in which the arguments are consumer surplus, producer surplus and its own profits. By altering the weights, the STE can be biased towards consumers or producers, or it may maximise its own profits or it may be neutral and maximise social welfare.

[3] In a commodity market open to international trade, as well as the market failure caused by an imperfectly competitive downstream sector, there is also the market failure caused by that sector not optimally exploiting the country's terms of trade.

The producers of this commodity are assumed to be risk averse and to experience stochastic production. Production (i.e., area multiplied by yield) is stochastic owing to random weather and to the incidence of pests and diseases and these effects may or may not be uniform across space. Risk markets are incomplete or non-existent. There is a lag between planned output and realised output with the uncertainty about realised output and the procurement price that is received not resolved at the time at which the production decision is made. Therefore, producers of the commodity are vulnerable to fluctuating incomes and may be exposed to livelihood insecurity. Final consumers of the product are also risk averse, some of them are poor and those who are may be vulnerable to food insecurity.

Before setting out some preliminary analysis, it is necessary to make the important distinction that will be required later (see section 4) between fluctuations in the contexts of certainty and of uncertainty. The former describes a situation in which the decision maker, albeit at some additional cost, can adjust the optimal choice of the variable, e.g., the amount to sell, after the uncertainty is resolved; the latter describes the more realistic and prevalent situation in agricultural production in which the decision once made, cannot be adjusted when the uncertainty has been resolved (Just *et al.*, 2004, p. 467).

Irrespective of these nuances about the nature of risks facing producers and consumers, governments often intervene in agricultural production through setting a minimum procurement price. This removes the producers' down-side price risk but leaves the individual producer's idiosyncratic quantity risk in place where production is stochastic. At the same time, the minimum purchase price also limits the buying power of the middleman and improve the livelihood security of producers. To increase the degree of food security of low-income consumers, the consumer price of the commodity may be subsidised, either for all consumers or for only the poor. In place of these two price policy instruments, the government could introduce instead (or as well as) an STE which would achieve the same qualitative outcomes but through the manipulation of market structure rather than through the manipulation of prices.

In order to construct a model that incorporates the stylised facts described above, it is useful to begin with an extreme case and then to relax some of the more specific assumptions. Therefore, suppose for the moment that only some of the characteristics described above are present. In particular, consider stochastic production and prices in a two-period (or two-situation) model in which there are no price policy interventions on inputs, production and consumption, and no markets for risk. The supply side is assumed to be the source of fluctuations and producers can adjust *ex post* to the procurement price offered, once the

uncertainty has been resolved. The supply function takes one of two positions with known probabilities. The demand function is deterministic and is the same in each time period. The effects on prices and quantities of this stochastic production under different assumptions about the structure of the downstream sector needs to be analysed and, in particular, the effects of these fluctuations on the uncertainty that they create for both producers and consumers, and which manifests itself in livelihood security and food security, respectively.

Assume *either* that the downstream sector is a pure middleman, which maximises expected profit, *or* that there is an STE, which has exclusive rights to procure from the farm sector and to sell to consumers, and its objective is to maximise returns to producers.[4] The market is assumed here to be closed to international trade, a common (but probably misguided) outcome in countries in which the government pursues a policy of self-sufficiency in staple cereals.

Consider the following geometry, which is adapted from Just *et al.* (2004, p. 478), to explore the implications of these two different structures of the downstream sector when supply is stochastic. It is assumed initially that the source of the variability in supply is multiplicative, i.e., the supply function rotates. In Figure 1a, the pure middleman maximises expected profit across the two periods through equating the horizontal aggregation of the marginal revenue function ($\sum MR$) with the horizontal aggregation of the marginal outlay functions ($\sum MO$). In the period of high production (S_1) the quantity stored is $(q_1 - q^*)$ and in the period of low production (S_0) the quantity released from storage is $(q^* - q_0)$. This equilibrium generates the same consumer price in each of the two periods (p_c) as well as the same procurement price (p_f) in each period. Thus storage enables the effects of fluctuating production to stabilise both consumer and producer prices.[5] However, this result for producer prices is not a general one.

To understand the lack of generality, suppose it is assumed instead that the stochastic term in the supply function is additive rather than multiplicative. The outcome is a parallel shift in the supply function caused by the change in the intercept (Figure 1b). The effect is that the

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[4] It is also possible that the STE may be required to maximise consumer surplus or to maximise social welfare. In different countries, there are examples of each of these three objective functions, as well as examples of governments switching over time from one to another.

[5] Stability of prices would also occur if the downstream sector were perfectly competitive and there was storage, although the prices would be different from those with the pure middleman. Of course, in the absence of storage, prices would fluctuate.

consumer price is again the same in each period, brought about through storage, but the procurement price fluctuates with the value taken by the stochastic term. Therefore,

Figure 1a:

**Market Behaviour with a Pure Middleman and Multiplicative Risk**
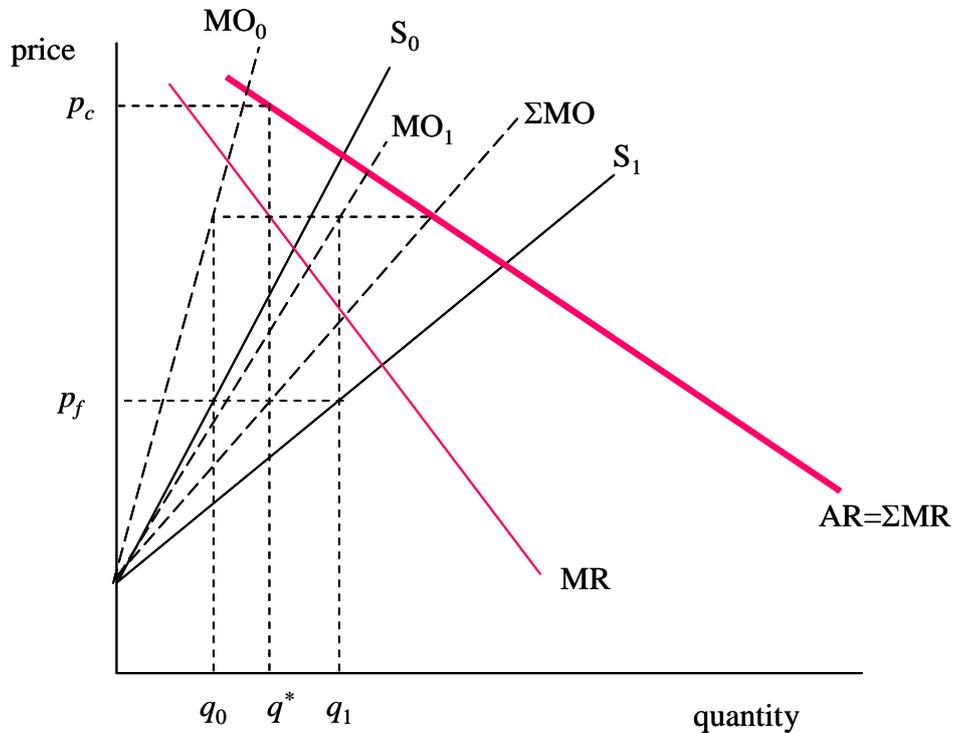
Note: The AR function is interpreted to be the demand function in one period.

contrasting the results in Figures 1a and 1b, it is concluded that the specification of the stochastic term in the supply function is fundamental for any consideration of the existence of down-side price risk for producers. The issue of their livelihood security is difficult to determine from a comparison of the two diagrams but it would appear that there is greater insecurity if risk is additive because of the existence of both price and output variability.

Suppose now that the government replaces the pure middleman with an STE that is required to maximise producer surplus over the two periods. Assume also that the marketing efficiency of the STE and the pure middleman are the same. To achieve its objective, the STE will equate the horizontal aggregation of the supply functions ($\sum S$) with the horizontal aggregation of the marginal revenue functions ($\sum MR$) (Figure 2a). There are two important differences in the equilibrium values of the price and quantity variables between the pure middleman equilibrium and this STE. First, the consumer price, ($p_{s,c}$) while constant in both

periods, is lower with the STE than with the pure middleman ($p_{s,c} < p_c$).[6] This difference arises because the STE, through not exploiting its buying power, procures more than does the pure middleman ($q_{s,0} > q_0$ and $q_{s,1} > q_1$) and, although exploiting consumers, it sells more ($q_s^* > q^*$)

Figure 1b:

Market Behaviour with a Pure Middleman and Additive Risk
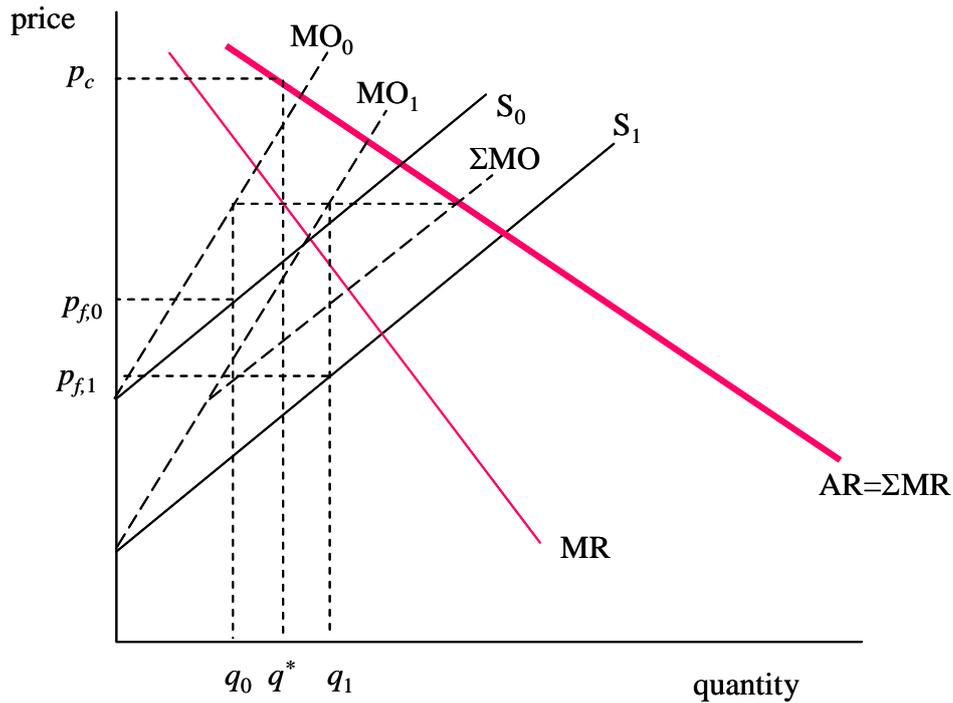
because it procures more. The second difference occurs because, by procuring more than the pure middleman, the STE has to pay a higher procurement price ($p_{s,f} > p_f$), which is the same in each of the two periods. Therefore, given the assumptions made, the STE, when compared with a pure middleman, provides greater livelihood security because it buys more and at a higher procurement price, and it helps to increase food security by selling more and at a lower consumer price. Therefore, where the alternative market structure is the extreme case of pure middleman, the STE reduces producers' and consumers' vulnerability to risk when risk is multiplicative.

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[6] The consumer price, p_c, is found in Figure 2a by drawing a horizontal line from the intersection of $\sum MO$ with the $\sum MR$ function to the *MR* function, and then drawing a perpendicular to the demand function.

Figure 2a:

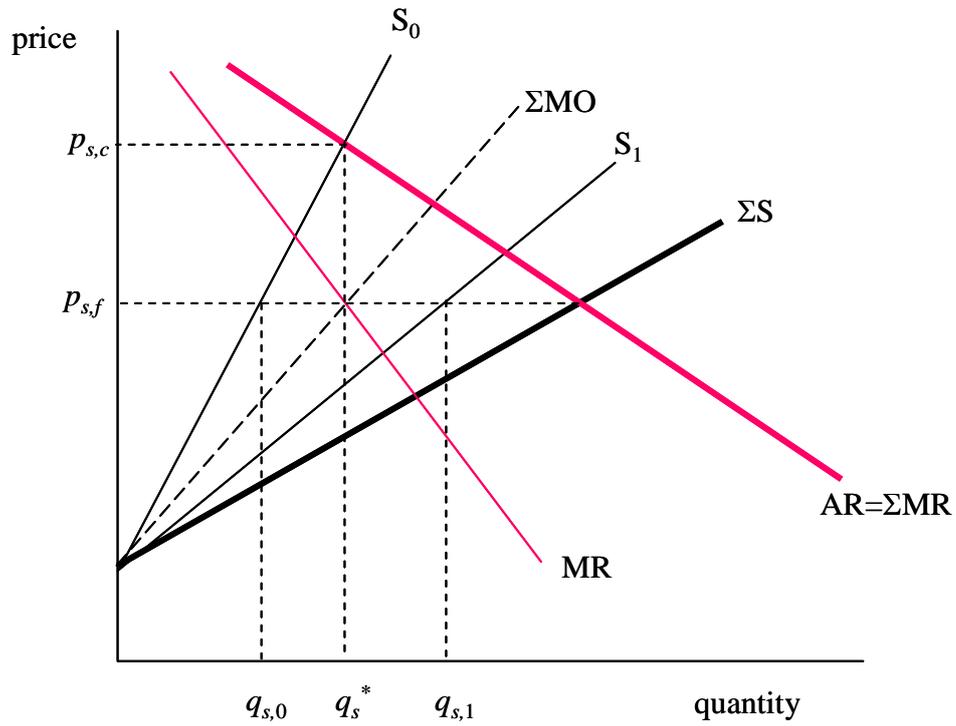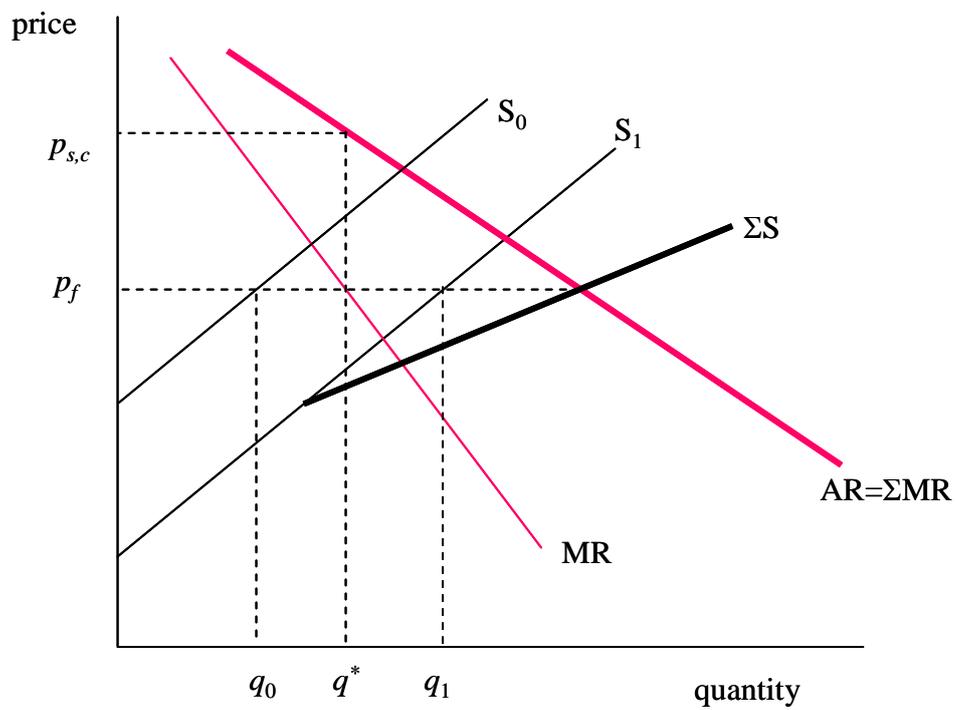**Market Behaviour with a Producer-Revenue-Maximising STE and Multiplicative Risk**

Figure 2b:

Market Behaviour with a Producer-Revenue-Maximising STE and Additive Risk

Suppose it is assumed now that supply risk is additive (Figure 2b). The contrast between the conclusions to be drawn from Figures 1b and 2b are important for government policy in relation to having, or not having, an STE. With additive risk, the STE stabilises the procurement price (Figure 2b) whereas the pure middleman (Figure 1b) does not. Therefore, unlike the conclusion to be drawn where risk is multiplicative, namely, that there would appear to be no need to have an STE as a stabilising mechanism, by contrast where risk is additive, the STE provides stability of the procurement price, as well as stability of the consumer price, and it serves the purpose of helping to correct a market failure on the supply side of the market.

4. What Further Analyses of STEs are Required?

Thus far in the analysis, a number of potentially important aspects of the stylised situation have been set aside and it is necessary to determine whether the results obtained thus far are robust to changed assumptions and to additional assumptions. These issues include, in no particular order of importance, the following:

(i) the distinction between instability with certainty and instability with uncertainty;

(ii) the nature of the stochastic process that generates risk on the supply side;

(iii) the functional form of the demand and marginal revenue functions;

(iv) the measurement of welfare under risk aversion and the distinction between *ex ante* and *ex post* measures of welfare;

(v) the measurement of *ex ante* willingness to pay as the basis for public policy;

(vi) the relationship between price stability and welfare;

(vii) the effect of the number of firms in the downstream sector;

(viii) the potential role for government in correcting the market failures that are caused jointly by uncertainty, risk aversion and market power; and

(ix) the correct sequencing of the process of reform if it is found that reform is necessary.

These are all difficult topics to which there may be no unambiguous, general answers. The research agenda ahead is to try to provide answers to each of these issues (i) to (vii) and to draw conclusions from answers to (viii) and (ix) for government policy in agri-food supply chains.

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