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Implicit Contracts and the Grey Market for Fertilizer in China

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The Issue

A common occurrence in many countries is that policy outcomes differ from the official objectives of the policy directives. A good example can be found in China. In 1994, the fertilizer market in China underwent a significant change. In response to strong complaints from farmers in a number of regions about shortages and substantial price increases, the central government set the markup rate for fertilizer as it moved from fertilizer plants to farmers and granted the Agricultural Means of Production Corporations (AMPCs) a monopoly role as the supplier of fertilizer.

The results of the 1994 policy reforms were not as expected. Controls on maximum retail prices failed to produce the desired effect and prices for agricultural inputs continued to increase by large margins. In both 1995 and 1996, the actual fertilizer price greatly exceeded the government-mandated price (Xiao, 1998).

Nor did enterprises fully follow the controls in other respects. Some broke the allowed limit of 10 percent for products to be sold directly by fertilizer producers, and some trading agencies overcharged by adding more transport and handling expenses than were allowed (Zhou, 1996; Zhang and Ji, 1995; MOA,1996). In addition, although the AMPC was to be the sole trader, the private traders in many provinces continued to play a significant role – the market share of the private traders ranged from approximately

5 percent in Yunnan province to nearly 25 percent in Shaanxi (Xiao, 1998). Thus, while private trading was not officially sanctioned, a well-defined grey market clearly existed in which private dealers purchased fertilizer from the AMPC and retailed it to farmers.

Implications and Conclusions

The purpose of this paper is to examine why the outcome of the 1994 policy retrenchment was different from what was intended and to illustrate the consequences of the behaviour that resulted in this policy deviation. The paper begins by showing how grey market activity by private traders and margin inflation emerge as outcomes of the decision by the central government to impose price controls. A key finding of the paper is that a grey market emerged because of non-compliance with the implicit contracts that were introduced as part of the 1994 policy change. In addition, this paper shows that this non-compliance enhances the performance of the fertilizer market. The paper also presents empirical evidence that shows that the grey market activity of private traders is higher in the more remote villages and in villages where the state grain purchasing quotas are smaller. These results are consistent with the argument that grey market activity is more common when monitoring costs are high and when the benefits of compliance are low.

China's Fertilizer Policy

The Chinese government has long played an important role in the country's domestic fertilizer market. Prior to 1985, the fertilizer system was centrally planned. The National Agricultural Inputs Distribution Committee decided how much fertilizer to allocate to each of five different uses, with the largest portion – the so-called bonus fertilizer – determined on the basis of how much grain and cotton farmers sold to the state at the planned price. The State Planning Committee and Ministry of Agriculture (MOA) then allocated the fertilizer to the different provinces. The Ministry of Chemical Industry was responsible for putting the fertilizer production plan into practice and the state-owned trading company Sinochem purchased the required imports. Distribution was the responsibility of the State Agricultural Input Corporations (AICs, now known as the AMPCs). Fertilizer was transferred among the players and ultimately to farmers via a complex set of planned product prices, with any difference between the planned price and the import price subsidized by the state budget (Xiao, 1998).

Starting in 1985, a dual price system was introduced for fertilizer. Managers of supply and marketing co-operatives (SMCs) were allowed to set market-based prices for fertilizer and farmers and private traders were permitted to engage in fertilizer trade. Unlike earlier periods, fertilizer sourcing was not restricted and traders could cross county or provincial boundaries to procure fertilizer. However, a grain supply shortage and grain price increase – in part attributable to erratic access to fertilizer – made this freedom short-lived. The

government once again centralized control over distribution channels and re-implemented price controls beginning in 1987 (Xiao, 1998).

The government moved to relax restrictions on the fertilizer market in 1992-1993, the same time that grain markets were being liberalized. Many township SMCs began to contract out fertilizer trade to individuals on a fixed-rent basis. The bonus fertilizer allocation was removed and other traders, such as agricultural stations and private dealers, were allowed to engage in fertilizer trading (Xiao, 1998).

This policy did not last long. In 1994, the fertilizer market changed significantly. Prices jumped in a number of areas and shortages of fertilizer supply occurred in others. Worried about losing control over the fertilizer market, and faced with strong complaints from farmers, the central government intervened. In 1994, the State Council issued a decree aimed at regaining control over fertilizer production and marketing. The policies they introduced included provisions for: (1) projecting demand and making an overall plan for fertilizer production and importation; (2) setting production levels and prices for the 17 large fertilizer plants built by state investment and run by the central government; (3) establishing and allocating quotas for fertilizer imports; (4) setting the AMPCs' markup rates for fertilizer as fertilizer was moved from fertilizer plants to farmers; and (5) granting AMPCs the role as the dominant channel of fertilizer business (Xiao, 1998).

The Incentives for Grey Market Activity

The 1994 policy retrenchment in China was introduced with the stated objective of reducing fertilizer prices and returning control over the market to the state-owned businesses. The outcome, however, was very different from what was intended – fertilizer prices rose and private traders continued to operate in the market. The reason for this departure of practice from the stated policy is that the policy directives created incentives that led to participants not complying with the stated policy objectives.

Conceptually, the 1994 policy retrenchment can be viewed as an implicit contract that the government made with the state-owned businesses – in return for being granted a monopoly, the businesses were to keep fertilizer prices down. The policy retrenchment, however, did not have the intended impact because of two pressures that were at work: the policy directives created incentives to not comply with the terms of the implicit contract and it was costly to enforce the contract terms. As a consequence of these pressures, the implicit contract could not be completely enforced and the outcome differed from the stated policy objectives. Viewed in this manner, the departure of the outcome from the objective can be conceptualized as a failure by government to induce the desired behaviour from the parties – or agents – affected by the policy.

Specifically, the fertilizer policy changes introduced in China in 1994 created a number of incentives for the various agents involved in the fertilizer industry to not comply with the terms of the policy: (1) the AMPCs could earn higher returns selling

fertilizer to the grey market than selling at the state-controlled price; and (2) the private traders could earn profits by selling to the grey market.

Since the actions of the AMPCs and the private traders cannot be fully detected, this grey market activity can persist. The actions of the AMPCs and the private traders cannot be completely detected for at least two reasons. One explanation focuses on the costs of contract monitoring. When monitoring costs are high, monitoring will generally be less than complete and individuals, knowing that they can participate in the grey market without always being caught doing so, may find it advantageous to not comply with the policy directives.

The other explanation focuses on *guanxi*. Guanxi is the set of interpersonal connections and networks developed by the Chinese for their personal advantage. Guanxi is not the same as bribery, which is understood to be the making of a payment in exchange for an immediate benefit. Guanxi, in contrast, is the development of a long-term relationship with no sense that immediate benefit will result. Guanxi historically arose in China as a counter to bureaucratic control. In a hierarchical society in which a few powerful individuals – often acting arbitrarily – control access to limited resources, guanxi has been a mechanism for people outside the hierarchy to gain access to these resources. Guanxi is particularly important when market information is imperfect and when labour and capital cannot move freely. Collectively-owned and privately-owned firms in China are believed to rely heavily on guanxi (Luo, 2000). Luo argues that guanxi can improve market and business performance. The findings presented in this paper are consistent with this view.

Guanxi plays a number of roles in the market for a product like fertilizer. Within the official market, the greater the quanxi that individuals have cultivated, the more likely they are to have access to fertilizer. Thus, farmers that have been able to cultivate an extensive quanxi network will be more likely to receive their fertilizer quota at the official price. This suggests that farmers that have not been able to develop quanxi will rely more on the grey market. Quanxi, of course, also plays a role in the operation of the grey market. The role examined in this paper is the role played by quanxi in giving private traders access to grey market fertilizer. Specifically, a more extensive quanxi network is likely to result in a private trader having better access to grey market fertilizer and/or being less likely to be "caught" engaging in grey market activity.

Figure 1 provides a framework for analyzing the incentives created by the policy changes and the impact of the behaviour that results from these incentives. The farmers' demand for fertilizer is given by the curve labeled Aggregate Retail Demand. The marketing costs incurred by the wholesaling and trading firms are c_w and c_t, respectively. The sum of these two terms represents the retail price that would emerge in a perfectly competitive market. This sum also represents the lowest retail price that could be charged to farmers while still covering marketing costs.
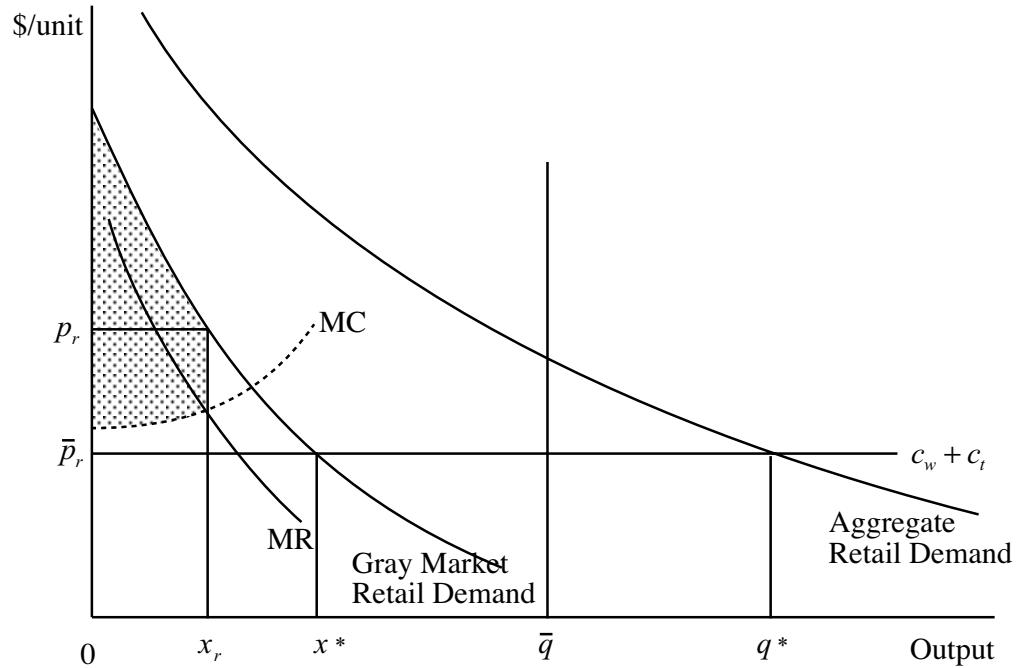
Figure 1 Determination of fertilizer sales in the grey market

In the absence of price controls, assume that the quantity supplied by the AMPC and distributed to farmers is less than the quantity q^* that would be supplied under a perfectly competitive market; the market price in turn is higher than it would be in such a market. Quantity is likely to be restricted because the AMPC has a degree of monopoly power in the fertilizer market and is known to pursue commercial objectives such as the maximization of profit (see Rozelle and Park [1996] for evidence on this last point). The fact that the market price is greater than $c_w + c_t$ represents part of the reason for the introduction of the price controls in 1994.

Assume that under the 1994 policy, the government mandates that a quota amount $\bar{q}$ be sold by the AMPC at a price of $\bar{p}_r$. In figure 1, $\bar{p}_r$ has been drawn so that it is equal to $c_w + c_t$, although this need not be the case. This policy directive, however, may not be followed by the AMPC. Since it is costly to monitor the activities of the AMPC, the AMPC can pursue its commercial objectives – that is, earn larger profits – by selling fertilizer to the grey market through the private traders. This grey market emerges because the quota $\bar{q}$ is assumed to be less than q^*, thus implying an unfilled, farm-level demand. This unfilled, farm-level demand – or grey market demand – schedule is given by the curve labeled Grey Market Retail Demand in figure 1. The AMPC can also augment this grey market by not fully supplying all of the quota fertilizer.

If private trading were legal and the traders and the AMPC acted competitively, the quantity supplied to the secondary market would be $x^* = q^* - \bar{q}$ and the price would be

driven down to $\bar{p}_r$. However, neither of these conditions holds in China. By virtue of its monopoly and the commercial objectives that it has adopted, the AMPC cannot be expected to behave competitively. As well, since private trading is not legal, private traders incur costs when they sell to the grey market.

The imperfect nature of the grey market means that the grey market price remains above $\bar{p}_r$. Figure 1 illustrates a grey market price of p_r, with corresponding sales to the grey market of x_r. While figure 1 is drawn on the assumption that no diversion of quota output to the grey market has taken place, the formal model developed below shows product diversion is likely to occur. The greater the amount of quota output not fulfilled, the more the Grey Market Retail Demand shifts rightward. The quantity x_r is determined by equating the marginal revenue curve (MR) with the marginal cost curve MC. The MR curve is derived from the grey market demand curve and reflects the fact that the AMPC has some market power in the fertilizer market, while the MC curve reflects the marginal cost of selling in the grey market – both the real costs associated with handling the product (these costs are given by $c_w + c_t$) and the costs associated with operating in an illegal market (the derivation of these costs is developed in the next section).

Although the emergence of a grey market means that the policy directives are not fulfilled, the existence of this market can improve the efficiency of the overall fertilizer market. The area below the Grey Market Retail Demand curve, above the MC curve and to the left of x_r (the shaded area in figure 1) represents the increased economic surplus available because of the emergence of the grey market. If product were diverted from the quota to the grey market, the welfare calculations would have to include the cost of this diversion – the cost is equal to the difference between the grey market price and $\bar{p}_r$ times the amount of product diverted (these costs are not shown in figure 1 because the diagram is drawn on the assumption that product is not diverted).

Theoretical Model

The model developed in this section examines the decisions of both private traders and the AMPC. In keeping with the 1994 policy dictates, the wholesaling firm – the AMPC – is assumed to sell fertilizer through official channels at the mandated price level. The AMPC also makes a decision about how much fertilizer it sells to the private traders through the grey market; the amount sold determines the price in this market. Private traders in turn sell the fertilizer to farmers. Although private traders may be liquidators in the market or may be selling lower quality fertilizer to the farmers, for simplicity it is assumed that both the AMPC and the private traders are selling the same quality product to the farmers. It is also assumed that traders are operating on their own account and not as agents.

Formally, the result is a two-stage game in which the AMPC moves first and selects an amount to sell to the traders. The AMPC makes its decision knowing the demand curve

of the private traders for grey market fertilizer, which is determined in the second stage of the game. The solution to this game is obtained by backward induction (see Kreps, 1990) – the problem of the traders is considered first, followed by the problem of the wholesale firm.

Private Traders

Consider a representative, price-taking, risk-neutral, profit-maximizing private trader that is deciding on the amount of fertilizer (x) to trade in the grey market. The problem facing the trader is:

$$\max_{x} E(\Pi) = (p_r - p_w)x - c_t x - \Psi(x) \tag{1}$$

where $E(\cdot)$ is the expectations operator, x is the quantity of fertilizer sold to the (grey) retail market, p_r is the retail price of fertilizer, p_w is the wholesale price of fertilizer, c_t is the marginal cost to the trader of handling the fertilizer, and $\Psi(x)$ is the cost associated with selling through a grey market. It is assumed that this cost increases with the amount sold through the grey market (i.e., $\Psi'(x) = \psi(x) > 0$).

The term $\Psi(x)$ has two interpretations. Under the first, $\Psi(x)$ is the expected penalty to be paid by private dealers who participate in the grey market. For instance, $\Psi(x)$ can be written as $\Psi(x) = \delta(x)\rho$, where $\delta(x)$ is the probability of being detected selling to the retail market and ρ is the penalty paid per unit of product sold to the retail market. Since $\delta'(x) > 0$, $\Psi'(x) > 0$. This approach to defining $\Psi(x)$ can be found in Giannakas and Fulton (2000), who examine cheating and misrepresentation by farmers on agricultural policies. A different interpretation of the term $\Psi(x)$ is that it represents the cost of cultivating guanxi. In this interpretation, the term $\Psi(x)$ is not an expected penalty. Instead, it represents a real cost that must be incurred to allow the trader to operate in the grey market.

The first-order condition for the problem specified in equation (1) implies that

$$p_r - p_w = c_t + \psi(x) \tag{2}$$

where $\psi(x)$ is the marginal cost (over the cost of handling the fertilizer) of selling another unit of output through the grey market. Equation (2) shows that the markup between the retail price and the wholesale price exceeds the traders' handling cost c_t, thus implying that margin inflation is a direct consequence of operating in a grey market.

Equation (2) can be solved for x to give the quantity sold in the grey market by the traders. Using a specific functional form for $\Psi(x)$, namely $\Psi(x) = \frac{1}{2}\psi x^2$, the quantity sold in the grey market is:

$$x = \frac{p_r - (p_w + c_t)}{\psi}. \tag{3}$$

Equation (3) represents the supply of fertilizer to the grey retail market. The quantity sold in the grey market is a function of the difference between the retail price and the cost of acquiring and handling the product (i.e., $p_r - (p_w + c_t)$) as well as the marginal cost ψ of operating in the grey market. Thus, the greater is the retail price p_r, the lower is the cost of acquiring and handling the product ($p_w + c_t$), and the smaller is the marginal cost ψ, the greater is the quantity sold by private traders in the grey market.

Government Wholesaling Firm (AMPC)

Now consider the monopoly wholesaling agency that is given the directive to sell a fixed quantity ($\bar{q}$) of fertilizer at an official, controlled wholesale price $\bar{p}_w$ (the price $\bar{p}_w$ is, of course, directly linked to the official retail price $\bar{p}_r$, i.e., $\bar{p}_w = \bar{p}_r - c_t$). As was argued above, the agency may not fully comply with this directive and the analysis must account for this possibility. Specifically, there are two ways in which the agency may not comply: (1) it can divert some product away from the official market; and (2) it can set the wholesale price for the grey market, which in turn determines sales to that market.

Assuming the agency is risk neutral and maximizes profits, its problem is:

$$\max_{p_w, q} E(\Pi) = p_w x + \bar{p}_w q - c_w(x+q) - \Phi(x) - \Gamma(\bar{q} - q) \tag{4}$$

where q is the quantity sold in the official market. The term $\Phi(x)$ represents the agency's cost associated with selling through the grey market, while the term $\Gamma(\bar{q} - q)$ represents the cost of diverting product from the official market (the amount of product diverted from the official market is given by $\bar{q} - q$). As with the private traders, the terms $\Phi(x)$ and $\Gamma(\bar{q} - q)$ have two interpretations. Under the first interpretation, these terms represent the expected penalty payment in money terms made by the wholesaling agency for not complying with the policy dictates. Alternatively, these terms can represent the cost of acquiring and maintaining quanxi.

When solving the problem outlined above, the monopoly wholesaling agency takes into account the supply and demand situation in the retail market. The supply curve for the retail grey market is given by equation (3). The grey market retail demand curve is assumed to be of the form $p_r = p_r(x,q)$, where q is the quantity sold in the official market and x is the quantity sold to grey market. The grey market retail price is assumed to be inversely related to the quantity sold in this market ($\partial p_r / \partial x < 0$) and inversely related to the quantity sold in the official market ($\partial p_r / \partial q < 0$).

Solving the retail supply and demand curves simultaneously gives the derived demand for grey market fertilizer faced by the wholesale agency. This derived demand curve has the form $x = x(p_w, q)$, with $x_{p_w} = \partial x / \partial p_w < 0$ and $x_q = \partial x / \partial q < 0$. For instance, if the grey market retail demand curve is linear (e.g., $p_r = a - b_x x - b_q q$), then the derived demand can be written as:

$$x = \frac{a - b_q q - c_t - p_w}{(\psi + b_x)} \ . \tag{5}$$

Substituting this expression into the wholesaler's problem gives:

$$\max_{p_w, q} E(\Pi) = p_w x(p_w, q) + \bar{p}_w q - c_w(x(p_w, q) + q) - \Phi(x(p_w, q)) - \Gamma(\bar{q} - q) \ . \tag{6}$$

The first-order condition with respect to the wholesale price p_w is $(p_w - c_w - \phi(x)) x_{p_w} + x = 0$, where $\phi(x) = \Phi'(x)$. Noting that the absolute value of the elasticity of demand in the wholesale grey market is given by $\eta = -x_{p_w}(p_w / x)$, this first-order condition can be rearranged to give:

$$p_w = \frac{\eta}{\eta - 1}(c_w + \phi) \ . \tag{7}$$

Equation (7) implies that the wholesale price is raised above the marginal cost c_w. Combining the results of equation (7) with those of equation (2) and rearranging terms shows that the retail price of fertilizer in the grey market will be raised above $c_w + c_t$, i.e.,

$$p_r - (c_w + c_t) = \frac{1}{\eta - 1} c_w + \frac{\eta}{\eta - 1} \phi + \psi \ . \tag{8}$$

The result in equation (8) is consistent with that illustrated in Figure 1. The inflated margin is a result of the cost of operating in a grey market (the terms ψ and ϕ) and the market power of the AMPC [the terms $1/(\eta - 1)$ and $\eta/(\eta - 1)$].

Taking the first-order condition of the problem in equation (5) with respect to the quantity sold in the official market q gives $(p_w - c_w - \phi) x_q + \bar{p}_w - c_w + \gamma(\bar{q} - q) = 0$, where $\gamma(q) = \Gamma'(q)$. Assuming a specific functional form for $\Gamma(\bar{q} - q)$, namely $\Gamma(\bar{q} - q) = \frac{1}{2} \gamma(\bar{q} - q)^2$, the quantity sold in the official market is:

$$q = \bar{q} + \frac{\bar{p}_w - c_w}{\gamma} + \frac{(p_w - c_w - \phi)}{\gamma} x_q \ . \tag{9}$$

Equation (9) indicates that the quantity sold in the official market increases with an increase in the quota amount $\bar{q}$, an increase in the official price $\bar{p}$ and a decrease in the grey market wholesale price p_w.

Substituting in the expression for p_w from equation (7) and q from equation (9) into the derived demand curve [equation (5)] gives the final reduced form equation for the quantity sold in the grey market:

$$x = \frac{a - b_q \left[\bar{q} + \dfrac{\bar{p}_w - c_w}{\gamma} + \dfrac{1}{(\eta - 1)} \dfrac{(c_w + \phi)}{\gamma} x_q \right] - c_t - \dfrac{\eta}{\eta - 1}(c_w + \phi)}{(\psi + b_x)} \ . \tag{10}$$

The amount of product sold in the grey market is a function of the overall size of this market – the greater is the demand intercept parameter a, the greater is the amount of grey market sales. Sales to the grey market are also affected by the quota amount $\bar{q}$ and the official wholesale price $\bar{p}_w$: the higher are $\bar{q}$ and $\bar{p}_w$, the greater are the benefits of participating in the official market and the smaller is the amount x sold in the grey market.

Equation (10) also indicates that grey market sales are related to the costs of participating in the grey market (the parameters ψ, ϕ, and γ). More specifically, the greater are the costs of grey market participation, the smaller are grey market sales. The less is the effort made by the state in monitoring grey market activity and/or the smaller is the penalty imposed on those caught participating in the grey market, the smaller are the costs of participating in the grey market.

The effort made by the state in monitoring grey market activity and the penalty imposed on this activity are both choice variables for the state. While a formal consideration of the actions of the state in its choice of these variables is outside the scope of this paper, it can be argued that the state will not reduce grey market activity to zero. Part of the reason has to do with costs. Since monitoring is costly, the effort made by the state in monitoring is unlikely to be complete. As well, since the state's objectives include improving the performance of the fertilizer market, the state has an incentive to ensure that some grey market activity takes place – as was shown earlier, grey market activity increases the efficiency of the fertilizer market. At the same time, however, the state cannot be expected to fully allow grey market activity. The 1994 policy retrenchment described in the *Fertilizer Policy* section is a sign that the state aimed at a greater role for the state-run agencies, which would be undermined if grey market activity became too prevalent. Thus, an intermediate situation is likely to emerge in which some grey market activity is allowed – the outcome illustrated in the model presented above.

Empirical Determinants of the Private Traders' Market Share

The purpose of this section is to show that the size of the grey market can be empirically linked to variables that reflect monitoring costs and quota obligations. While the results of the regression model presented below should not be viewed as conclusive evidence for the theory advanced in this paper, the results do provide some support for the view that policy departures are both commonplace and can be systematically understood using an economic framework.

The regression model estimated in this section is a version of the reduced form equation represented in equation (10). In the regression model, the dependent variable is the market share of the private traders in each village – since private traders are not legally allowed to sell fertilizer, the private traders' share is a direct measure of the size of the grey market. The independent variables include: the distance of each village from the county town (Distance); the state grain purchasing quota (Quota) (this variable acts as a proxy variable for the amount of quota fertilizer the AMPC must supply since fertilizer and grain quotas have been historically linked); the per capita cultivated land in each village (Land); the per capita income of each village (Income); and a dummy variable for each province. The dummy variables were introduced to account for province-level demand, cost and enforcement effects not captured by the other variables.

Village-level data in China are very difficult to obtain. The variables used in the regression reported in this section were collected as part of a 1996 survey of 184 villages in 42 counties of six provinces. The provinces are: Zhejiang province in the eastern coastal area; Yunnan province in the southwestern highland area; Sichuan Province in the southwestern basin area; Shandong province in the northern coastal area; Hubei province in the central area; and Shaanxi province in the northwestern plateau. In each province, four villages from each of eight counties (six counties for Yunnan) were randomly selected. A questionnaire was administered to the village leader in each village and information was obtained for two years – 1988 and 1995 (for details on the survey, see Xiao, 1998). The analysis in this paper uses only the 1995 data. While the data collected have obvious limitations (for instance, the variables for which relevant data were collected are limited to those described above), they represent one of the few sources of information on the market share of private traders and hence grey market activity in China.

The theoretical model developed in the previous section provides an indication of the expected impact of the independent variables. Larger quota values can be expected to lead to a reduction in the market share of the private traders. The distance of a village from the county town can be expected to lead to a higher market share for the private traders. The greater is the distance of the village from the county town, the smaller is the value of ψ that is expected. This smaller value of ψ reflects the higher monitoring costs that exist in the more remote villages. More remote villages can also be expected to realize a lower

price from sales through the official market, since the more remote is the village, the larger are the transportation and marketing costs that must be incurred by the state trading enterprise. As a result of these higher costs, the AMPC receives an effective price that is less than $\bar{p}_w$. Finally, the more remote is the village, the less likely are the farmers in that village to have access to fertilizer via the official market (i.e., the less important are quanxi networks likely to be) and the greater will be the demand for grey market fertilizer.

Higher amounts of per capita land in a village can be expected to result in a greater retail demand for fertilizer (via a larger parameter a, for instance), which, for a given quota level, results in a higher market share for the private traders. The effect of higher per capita village incomes could be either positive or negative. Higher income levels may partly reflect higher agricultural yields, which imply a greater demand for fertilizer (and thus a larger value for the parameter a). As well, higher village income levels may reflect more opportunities for off-farm employment in the village. Off-farm employment opportunities may alleviate income constraints for agricultural producers and allow the purchase of more inputs such as fertilizer. At the same time, village employment opportunities may also result in less time being devoted to agricultural production and a less intensive use of agricultural inputs (and thus a smaller value for the parameter a).

Table 1 shows the results of two regressions. In Model 1, the independent variables are Distance, Quota, Land and Income. Model 2 adds the provincial dummy variables (note that Yunnan is excluded). The regression models explain only a very small percentage of the variation in the dependent variable – anywhere from 5 percent to 8 percent depending on the model. Since important explanatory variables are obviously missing, the regression results must be treated with caution. Specifically, the parameter estimates will be biased if the missing variables are correlated with those that have been included. However, since the key explanatory variables – Distance, Quota and Land – have relatively high *t*-values (depending on the model, the independent variables are statistically significant at either the 5 percent or 10 percent level), these variables appear to be correlated in some way with the market share of the private traders.

In addition, the regression results are consistent with theoretical expectations. In all the models, the coefficient on Quota is negative, while the coefficients on Distance and Land are positive. The coefficient on Income is negative, suggesting that the off-farm employment effect outweighs any agricultural productivity effect. While these results need to be treated with caution, they do lend additional support to the theory developed in the previous section. The grey market share is higher in precisely those instances where it is expected to be higher – namely in the more remote villages and in villages where the quota is small.

Table 1 Determinants of the Private Dealers' Market Share: Regression Results

Variable	Model 1	Model 2
Constant	14.6786	21.6564
	(2.6881)	(2.7926)
Distance	0.2132	0.2763
	(1.6620)	(2.0729)
Quota	-0.0999	-0.0933
	(-1.9413)	(-1.7975)
Land	3.43967	4.1357
	(1.8438)	(2.1138)
Income	-0.0024	-0.0036
	(-1.5308)	(-1.9463)
Zhejiang		-10.4949
		(-1.6035)
Shandong		-17.7353
		(-2.3973)
Sichuan		-13.3862
		(-2.0992)
Hubei		-3.9266
		(-0.5577)
Shaanxi		-5.4685
		(-0.8489)
Observations	179	179
Adjusted R^2	0.06	0.08

t-statistics in parentheses

Concluding Comments

The analysis in this paper underscores a well-known observation that policy outcomes may often differ from official policy directives. Policy directives imply a set of either explicit or – as in the case of the fertilizer market in China – implicit contracts. The degree to which the policy directives are carried out depends on the incentives to comply with the terms of the implicit contracts.

The fertilizer policy changes introduced in China in 1994 clearly created incentives that resulted in outcomes different from those that were the proclaimed objectives. Even though the policy changes were introduced to reduce fertilizer prices and to turn control of the market over to the state-owned AMPC, fertilizer prices rose and private traders continued to operate. The ability of the AMPC and the private traders to participate in a

grey market can be explained in at least two ways. One explanation focuses on the costs of contract monitoring. When monitoring costs are high, monitoring will generally be less than complete and individuals will find it advantageous not to comply. The other explanation focuses on the Chinese notion of guanxi, which traditionally arose as a counter to bureaucratic and hierarchical control (Luo, 2000).

In addition to providing a theoretical explanation for the grey market phenomenon, the paper also shows that the grey market is much more prevalent in precisely those situations predicted by the theory. In particular, private traders play a more important role in villages where the fertilizer demand is larger (as indicated by higher per capita land holdings), where the quota is smaller, and where the distance from the county town is greater.

The factors affecting grey market activity in the more remote villages are of particular interest. The more remote is the village, the greater are the costs of monitoring grey market activity and the smaller is likely to be the cost of participating in the grey market. This lower cost is consistent with the larger market share of the private traders. The more remote villages are also likely to generate lower returns for the state wholesaling agency, which in turn means a greater willingness on the agency's part to channel fertilizer through the private traders, thereby earning a higher return. Farmers in the more remote villages can also be expected to be less a part of the guanxi networks that surround the state wholesaling agency. As a result, these farmers can be expected to have a larger demand for grey market fertilizer.

A key finding of the paper is that the introduction of a grey market leads to an increase in the efficiency of the fertilizer market. However, although the existence of a grey market helps to bring the real forces of supply and demand closer together, it is an imperfect mechanism to accomplish this objective. The costs of participating in the grey market mean that the grey market price remains above the price that would exist if private traders were allowed to trade freely. Thus, while the development of a grey market for fertilizer does provide some benefits to farmers (in the absence of the grey market, these farmers would receive less fertilizer) the model developed in the paper suggests that the farmers that do purchase from the grey market are not receiving the benefits received by those farmers that are able to purchase through the official market. As was discussed in the previous paragraph, these smaller benefits are more likely to occur in the more remote villages. As a result, the grey market cannot completely remove the implicit inequities created by the attempt to control fertilizer prices and distribution.

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