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UNIVERSITY OF CALIFORNIA, DAVIS

THE ECONOMIC IMPLICATIONS OF ENFORCING
AGRICULTURAL LAWS IN EGYPT

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Dyaa K. Abdou, University of Zagazig, Egypt
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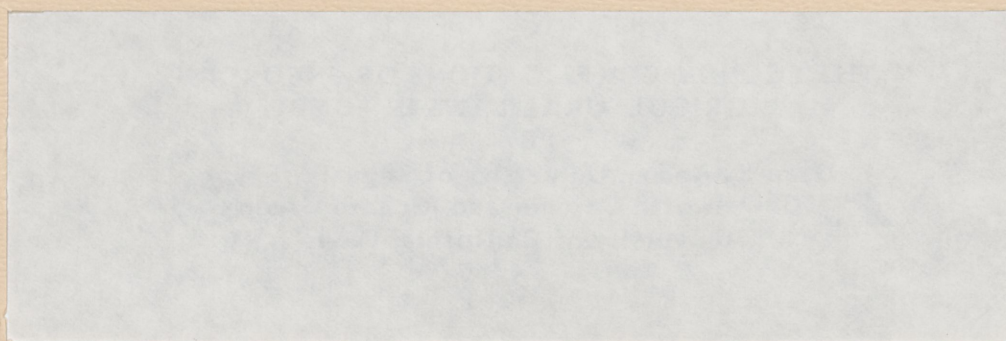University of California, Davis

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Introduction

Any government policy--agricultural or non-agricultural--is directed toward achieving specific targets through specific instruments. Usually, these instruments aim to change behavior to a more socially desirable type or to proscribe certain types of behavior by choosing agents that are considered inimical to the purposes of the policy. Agricultural laws are the most common instruments used to alter such behavior in the agricultural sector. Enforcement of prescribed or proscribed behavior is a most difficult task in actual policy implementation in Egypt.

Optimal private behavior may differ from optimally-social private behavior. Breaking contracts and stealing are examples. Laws and administrative rules are invoked to reduce the discrepancy between optimal private and optimal social behavior, at least as perceived by those having power to make such laws and rules. However, it must also be pointed out that any restriction on human freedom to act may destroy private utility, profit, or satisfaction and must be factored into the calculus of what is socially optimal. Mandatory land allotments that fix cropping patterns could be an example.

The principles developed from the economics of crime and punishment derive from the concepts of welfare economics and externalities and are useful tools in assessing the economic implications of such laws. This entire subject, however, has been neglected in the Egyptian economic literature despite its importance to agricultural policy decision makers.

Specifically, most of the agricultural laws and administrative rules in Egypt aim directly or indirectly to alter consumer or producer behavior. When the government sets crop prices, mandatory quota deliveries, compulsory

cropping patterns, forbids inter-governorate transport of commodities, and fixes profit margins, it attempts to direct human action in ways that would permit the achievement of desired socioeconomic goals.

A departure from prescribed or proscribed behavior becomes a violation of the law and a crime. Accordingly, fines and other punishments are levied on offenders who violate the law. Given the level of the punishment, however, it appears that the government does not expect everyone to obey the law. Thus, punishment for law violation in the form of fines and imprisonment can be viewed as the shadow price of the social importance of the law. If it is very important, the punishment must be severe, and the shadow price will be high. If it is not very important, the price for violation will be low. On the other hand, obeying the law may be costly in foregone income, and the costs will vary by economic agent, possibly depending upon age, family size, risk preference, farm size, dependence on off-farm markets, income and wealth, diversification, market information, and perhaps other factors.

If the law is intentionally violated, it can be assumed that the private benefits of doing so exceed the punishment costs. The violation of agricultural laws is most often not considered immoral,[1] as are other crimes such as stealing and slander. Quota delivery and land allotment law violations are simply regarded as economic actions that are inconsistent with regulations issued to achieve specific national economic goals.

Still, if a law is to be taken seriously while private incentives to break it are strong, large human and capital resources must be devoted to its

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[1]Osman, Amal, "Explanation of Economic Punishments Law in Supply Crimes," Dar-El-Nahda El-Arabia, Cairo, Egypt, 1983.

enforcement. It would be costly to closely monitor each individual.
Inducement to obey the law will be influenced by the the size of the fine and
the probability of getting caught in a violation.[2] If some law-breaking can
be tolerated, economic efficiency will be enhanced by implementing an
enforcement system that will permit those who bear the highest cost of obeying
the law to break it. A given level of low compliance would be thus achieved
at the least private cost.

A system of fines might well be an efficient system since: (1) The level
of the fine can be set to reflect the importance of the law. If the social
benefits of a law tend to be high compared to the private costs of obeying it,
the fine (shadow price) should be high. (2) The level of investment in law
enforcement can also depend on the net social benefit of law obedience. There
is some optimal tradeoff between the two. Reduced enforcement will reduce the
probability of getting caught, but increasing the fine will increase the price
for those who do. The correct model seems to be an "expected loss" model
where the expected price is the product of the probability of getting caught
and the fine (price).

The study reported in this paper has two major objectives. The first is
to relate the concepts of the economics of crime and punishment to the
Egyptian agricultural laws. Specific attention will be given to the mandatory
land allotment and quota delivery laws. The second objective is to identify
and quantify the importance of the major factors affecting the farmer's
choice to violate or obey these laws. Econometric models are specified and
statistically estimated using maximum likelihood estimation techniques. The

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[2]Stigler, George J., "The Optimum Enforcement of Laws," Journal of
Political Economy 78, (May/June 1970).

estimated models are used to examine the probabilities of violating these laws attached to some characteristics of farmers. Cross-section data used to estimate these models come from a sample of violators and non-violators of these laws.

This paper is divided into four parts. Major existing agricultural and food distribution laws and administrative rules are discussed first. Then a conceptual and analytical frame for rice quota delivery and cotton land allotment violations is presented. The third section presents the empirical results, and the last is a statement of summary and conclusions.

EXISTING MAJOR AGRICULTURAL AND FOOD DISTRIBUTION LAWS

The major types of agricultural and food distribution laws and administrative rules in Egypt can be classified as follows:

1. Land allotment [crop rotation].

2. Mandatory crop quota delivery.

3. Land and other resources reservation and protection.

4. Intergovernorate transport of crops and livestock.

5. Rationed food distribution and pricing.

6. Other subsidized non-rationed food distribution and pricing.

7. Market organization (for non-subsidized food commodities).

8. Health control.

As mentioned above, each set of these laws intends to affect and alter the specific behavior of economic agents so policy goals can be achieved. For example, the first and second sets apply to specific crops. They require that the farmers behave differently than they would choose if they were permitted to act freely. Also, they tend to constrain decisions on input use. Laws related to the pricing and distribution of food tend to alter consumer response to market forces. These laws change responses by changing the shape of the market demand and supply curves. Since these consumer laws are pervasive in the economy, they are of great economic significance. The major laws pertaining to food distribution are discussed first, followed by major agricultural laws.

Food distribution and pricing regulations started in Egypt in 1945 when Law No. 95 was issued to deal with shortages growing out of World War II. The first article of this law specified the right of the Minister of Supply to

deal with problems of supply adequacy and distributional equity by doing one or more of the following:

1. Imposing restrictions on the production and distribution of some major strategic commodities. These may include the rationing of some of these commodities.

2. Imposing restrictions on inter-regional transport of some commodities.

3. Limiting the number of new licenses issued for specific industries and traders.

4. Specifying maximum quantities for specific commodities.

5. Maintaining the right to nationalize (to be under complete government control) any factory or commodity.

6. Fixing prices for commodities captured and handled by the Ministry of Supply.

Article 5 of this important law specified a penalty of three months imprisonment and/or a fine of no more than L.E. 1000 for violation. Law No. 109 of 1980 changes the penalty specified by the 1945 law to imprisonment for not less than one year and no more than five years and a fine ranging from L.E. 300 to L.E. 1000. This law has the same penalty for violations related to subsidized goods except that the fine ranges from L.E. 500 to L.E. 1000.

As of laws governing pricing of commodities, law No. 163 of 1950 was the major one. This law stated fixed prices and profits for specific commodities. The Ministers of Supply, Industry, and Trade had the right to change the prices, profits, and commodities to be included. This law was adjusted by Law No. 128 of 1982. The penalty for violating this law is specified to be a 1-5 year imprisonment and/or a fine ranging from L.E. 300 to L.E. 1000. For

subsidized commodities this fine ranged from L.E. 500 to L.E. 1000. Thus, there is great similarity between the rationing and supply control law and the fixed pricing law in terms of the specified penalties.

The laws pertaining to regulating inter-governorate transport of livestock did not last long. Law No. 244 of 1980 was issued on September 3, 1980, and was canceled by Law No. 264 of 1980, issued in September 30, 1980. The penalty for private transfer of major commodities specified by this law depends upon the commodity. For rice, the penalty is no more than three months imprisonment and/or a fine of L.E. 50-250, while for onions it is 1-5 years imprisonment and L.E. 300-1000. The penalty for transferring beans is no more than one year imprisonment and L.E. 100-L.E.500.

Other laws are issued to regulate trade, exchange, and product specifications. Law No. 169 of 1980 specifies the weights of a bread loaf, while Laws No. 308 of 1981 and Nos. 235 and 236 of 1982, deal with milling rice for public use. The fine for milling rice for purposes other than for home-consumption is no more than three months imprisonment and/or a fine of L.E. 100-L.E. 250. Also, Consumer Protection Law No. 106 of 1982 stated the need for specifying expiration dates in all products. The penalty for violating this law is six months to two years imprisonment and/or a fine of L.E. 500-L.E. 1000.

To regulate the rationing book distribution, Laws No. 112 of 1966, No. 22 of 1980, and No. 106 of 1980 specified a penalty for rationing book holders that get more than that specified by law to be three months imprisonment and/or a fine of L.E. 100. The same penalty was applied to holders of more than one rationing book and misuses or reselling of rationed commodities. For groceries, Law No. 109 of 1980 specified a penalty of not less than six

months imprisonment and/or a fine ranging from L.E. 100 to L.E. 150 for misuse

of the quantities rationed. The fine increases up to L.E. 500 for hoarding

rationed quantities.

To regulate pricing, Law No. 69 of 1945 was adjusted by Law No. 132 of

1948, and finally by Law No. 163 of 1950 which is still valid. Many

ministerial decrees have been issued to implement this law. It was adjusted

partially by Law No. 108 of 1980. This law requires that prices be listed and

forbids advertising for rationed food. Violation of this law results in six

months to two years imprisonment and/or a fine of L.E. 50 to L.E. 100.

Figure 1 indicates the regulating and catching procedure for these major

distribution and pricing laws. Many government agencies are involved in

enforcing the increasing number of laws. Although estimating optimum law

enforcement measures is not attempted in this study, it must be apparent that

large quantities of government resources are expended for enforcement.

For regulating agricultural production and land allotment, the major

unified agricultural Law No. 53 was issued on September 10, 1966. This law is

still in force and it canceled the previous agricultural Law No. 11 of 1964

which related only to land rotation. Articles 1 through 4 of this law gave

the Minister of Agriculture the right--within the frame of the general

national policy--to determine crops and varieties to be produced. Also, he

can issue ministerial rules pertaining to several issues such as land and crop

rotation on the village level, the dates of planting and harvesting, the

method of farming and seeding, the type of containers used, and the crops to

be included in the cooperative marketing system.

This major agricultural law specified penalties for violating methods of

farming, containers, and cooperative marketing to be a fine ranging from

Laws — Orders — Decrees
Law (No. 163 of 1950)
Law (No. 128 of 1982)

Execution	Ministry of Supply	Ministry of Interior	Ministry of Justice
Agencies	" " Industry		
	" " Economics		

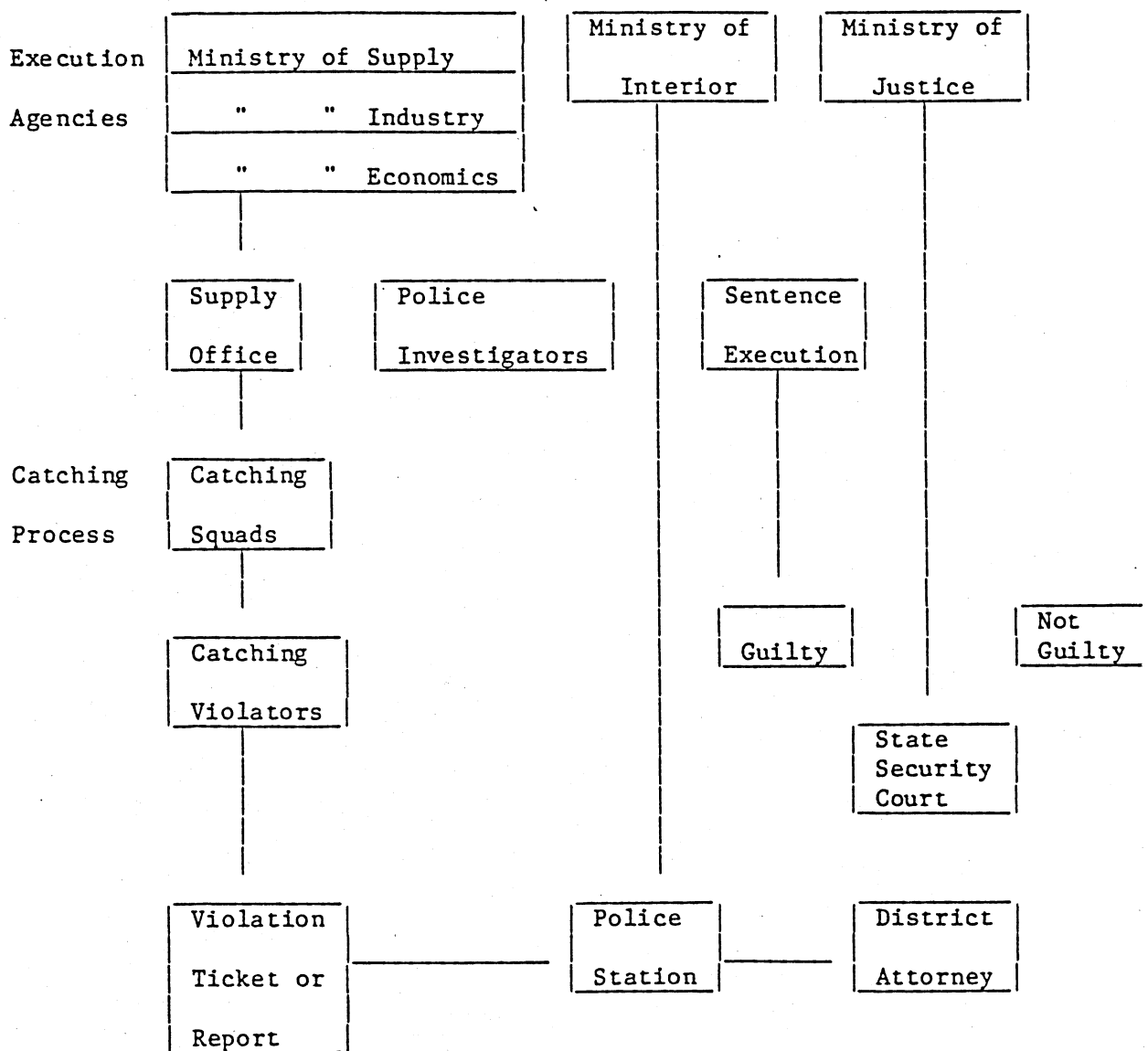| | Supply Office | Police Investigators | Sentence Execution | |
Catching	Catching Squads			
Process				
	Catching Violators		Guilty	Not Guilty
			State Security Court	
	Violation Ticket or Report	Police Station	District Attorney	

Figure 1: Regulating and Catching Procedures for
Distribution and Price Violations

L.E. 5 to L.E. 30. The fines for violating area or dates of farming range from L.E. 20 to L.E. 50 for one feddan or less.

The commodities to be included under the cooperative marketing system are specified to be those commodities of great importance as food or other economic crops such as onion, garlic, cotton, rice, sugarcane, peanuts, sesame, and potatoes. The major objectives were specified to be insuring an adequate food supply in domestic markets, insuring an adequate supply for factories, insuring adequate quantities for exports, and insuring high quality of cotton fiber.

Quota delivery is regulated through ministerial rules. Decree No. 307 of 1981, for example, states that all rice producers in cooperative marketing must deliver the quota until the end of December 1981. The specified quota is 1.5 ton/feddan, 1.25 ton/feddan, or 1.0 ton/feddan, depending upon region. Law No. 238 for the 1982 crop stated the same quantities. The fine for violating rice quota delivery is specified to be L.E. 150/ton with a maximum of L.E. 500. Also, it was indicated that the fine for less than one ton would be L.E. 0.15/Kg. For onions, Decree No. 51 of 1982 states that for the 1981/1982 crop a quota should be delivered not later than the end of July 1982. The penalty established is a six-month to one-year imprisonment and a fine of L.E. 20/ton with a maximum of L.E. 100. For peanuts, Decree No. 221 of 1982, regulating the 1982/1983 season's quota has a fine of L.E. 27/ardab with a maximum of L.E. 1000. For beans, Decree No. 101 of 1982 established a fine of L.E. 75/ardab with a maximum of L.E. 500.

Figure 2 summarizes the regulating and catching procedures for the land allotment and quota delivery laws. The complexity of the system is obvious. Also, the involvement of a sizable portion of the Ministry of Agriculture (and other Ministries) resources is obvious.

Ministry of Agric.
(decrees related to
Coop. Marketing)

Village
Agri. Coop.

Farmers

Total Violator

Partial Violator

Late Farming

Land Allot. Violator

Agricultural Directorates
(located in Governorates)

Crop
quantities
&
prices

Complaints
& Petitions

Village Banks in
Directories

Credit Banks in
Districts

Notification

Complaints & Petition
Committee
Mainly 5 Persons

Complaints Results

Agric. Directory Representative	Agric. District Repersentative	Agric. Coop. Representative	Agric. Village Supervisor	Shiekh of the District (M. of Interior

Police
Report

District Attorney
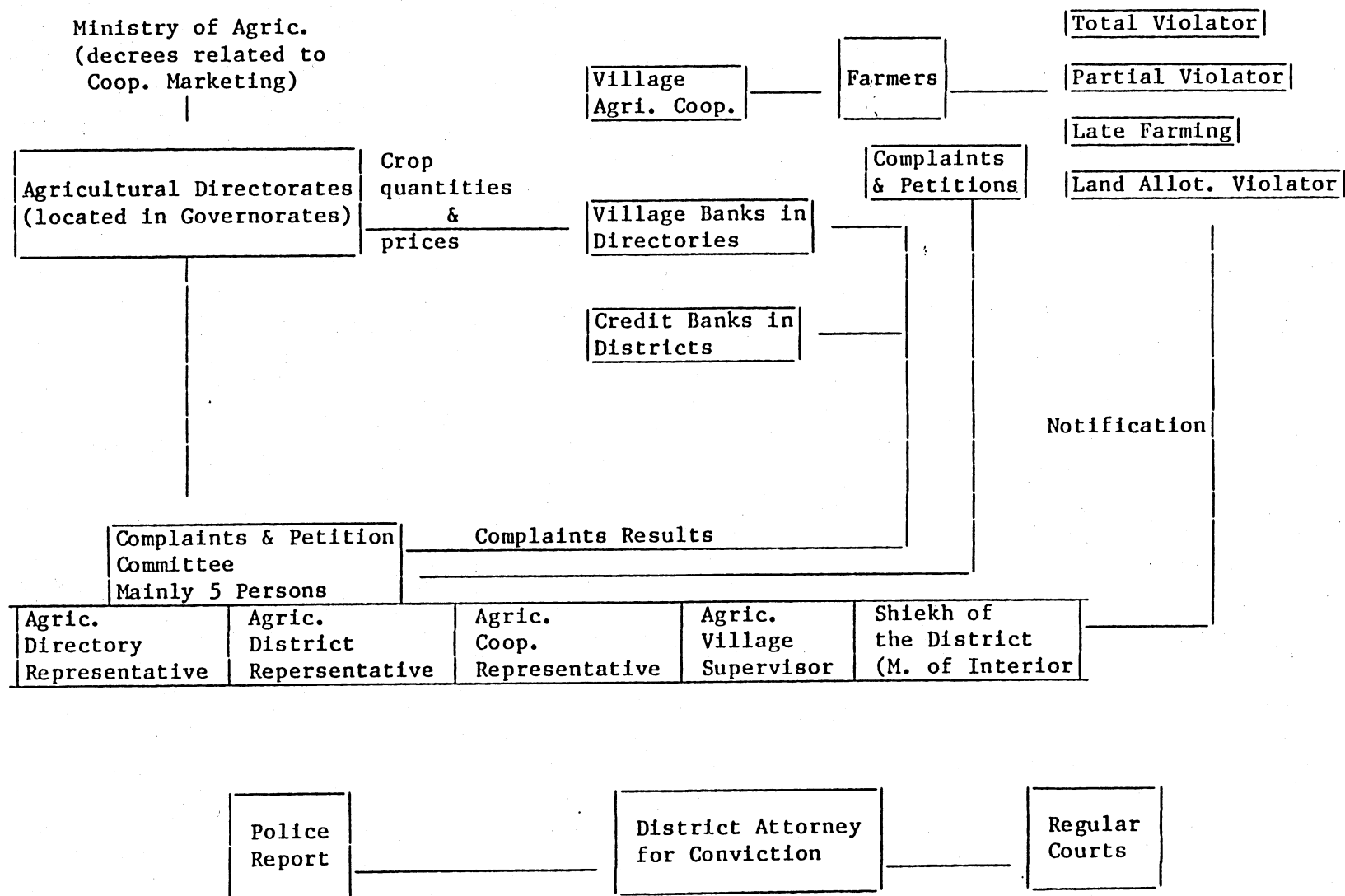for Conviction

Regular
Courts

Figure 2: Regulating and Catching Procedures for Land
Allotment and Crop Quota Violators

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Quota Delivery and Land Allotment Violation:

When laws are issued to alter human response to economic signals, the government does not expect all economic agents to obey it unless the probability of getting caught for a violation is very high and the fine makes the cost so high that all agents will choose to obey. Thus, it has been argued that the fine and associated probability of being caught reflect the shadow price of law obedience.

However, the probability of being caught is not the crucial factor under the Egyptian conditions for a given farmer. Usually, violators are reported by agricultural village supervisors, so the probability of detection is virtually unity. By the end of each agricultural year, however, it is common practice for the government to waive most of the previous fines levied on farmers. This is another way of indicating that existing violations for these laws are tolerated by the government. Thus, it is the probability of having to pay the fine that deters farmers from ignoring the law completely. This point makes it even more obvious that the resources needed to implement the huge law enforcement bureaucracy will be largely misallocated.

The alternatives available to the government to reach better enforcement for existing laws seem to be to increase the fine, increase the catching and/or prosecution probabilities, or increase the government guaranteed farm price. The difference between the quota price and the free market price and per feddan profitability between rotation crops and other substitutes are major factors affecting quota and area violations, respectively.

The quota violations decreased from 1975/76 to 1978/80 (Table 1) as a result of the recent increase in government prices. In the case of rice and onions, beginning with the 1979/1980 season, farmers delivered more than the expected quota requirement. On the average, they delivered about 7 percent

TABLE 1: QUOTA REQUIRED AND DELIVERED FOR SOME MAJOR CROPS
1975/1976 AND 1979/1980 (Tons)

Crop	75/76			79/80		
	Quota Required	Quota Delivered	%	Quota Required	Quota Delivered	%
Rice	1,278,999	1,217,139	95.0	1,257,098	1,344,139	107.0
Beans	525,040	337,193	64.0	471,088	383,116	81.0
Lentils (Ardab)	115,151	76,486	66.5	27,656	21,236	68.0
Peanuts	---	---	--	239,745	219,600	92.0
Onion	110,675	103,715	93.0	76,038	97,420	128.0

Source: Ministry of Agriculture

over what was expected for rice. However, this does not mean that all farmers delivered their quota requirement. For example, in that year, there were 5,693 violations; 3,803 farmers violated the rice quota delivery totally. The assigned quantity to these farmers was 3,043 tons. Also, about 1,890 farmers partially violated i.e., they delivered only a portion of the required rice quota. Their assigned quantities were only 912 tons. In the 1980/1981 season, 5,340 farmers totally violated quota deliveries on rice, and 15,546 farmers partially violated delivery. The total quantity not delivered to the government was 9,379 tons, while on the average the government received quantities over expected quotas.

For beans, about 36 percent of the required quota was not delivered in 1975/1976. This percentage decreased to only 19 percent for the 1979/1980 season. Over 80 percent of the quantities not delivered was from farmers who totally violated the quota delivery. Aggregate delivery for onions was about 28 percent over quota requirements in 1979/1980. Some farmers must have delivered over their assigned quantities in large volume to offset the quantities not delivered by violators. In this season, about 420 farmers totally violated the quota delivery of onions, and about 86 farmers violated quota delivery partially. Actually, about 15,261 tons were not delivered by these farmers.

Violations are probably related to a host of socioeconomic factors. Differences between the government quota prices and free market prices (Table 2) appears to be an important factor for those farmers who have good access to the free markets. Although the government prices have been increased recently, sizable differences still exist between these prices.

TABLE 2:   GOVERNMENT FARM PRICE, FREE MARKET PRICE, AND FINES
FOR SOME MAJOR CROPS, 1980/1981

Crop	Government-Quota Price	Market Price	Fine
Rice (L.E./Ton)	98.8 .049/lb. or .109 /kg.	.085/lb 170 .187/kg.	150 (Max. L.E. 500)	✗✗
Beans (L.E./Ardab)	36.38	75	75 (Max. L.E. 500)
Peanuts (L.E./Ardab)	30.31	49	27 (Max. L.E. 1000)
Onions (L.E./Ton)	47.23	65	20* (Max. L.E. 100)
Lentils (L.E./Ton)	375	554	75 (Max. L.E. 500)

*Plus imprisonment for 6 months

 Source: Ministry of Agriculture

✗✗ $\Delta = 71.2/ton$
$\Delta = .036/lb.$ or $.078/kg.$

if $P^M - P^c = 71.2$ LE/ton.   and Penalty = 150 LE/ton
then it $\rho_d \rho_f < 47.5\%$ $\Rightarrow$ non-compliance.

The existence of quota delivery violations even in years when the quota

delivery is oversubscribed suggests that violations are always an issue and

stresses the importance of identifying and quantifying major factors affecting

farmers' decisions to violate. This could have significant policy

implications. Understanding socioeconomic characteristics of quota or area

violators may help policy makers predict the responses to policy measures that

are designed to generate greater delivery. These measures may include higher

prices and should consider the per unit profitability according to farm size,

family size, off-farm income, farm location relative to market, etc. In the

following section, a more complete conceptual frame will be presented that

will examine the farmer's choice of whether or not to violate, and this will

be followed by the empirical results. As suggested earlier, the study

concentrates on the agricultural laws pertaining to rice mandatory quota

delivery and cotton mandatory area allotment.

CONCEPTUAL AND ANALYTICAL FRAME

The conceptual framework of the analysis differs slightly for quota delivery and cropping pattern restrictions. The following framework is based on the notion that the relative expected net revenue from violating these laws or not is the core of the farmer's decision. Actually, expected revenue is a reflection of many socioeconomic factors in Egyptian agriculture. We shall see how risk enters the picture although data limitations prevented its formal incorporation in the choice model.

The following is the conceptual frame for the choice of whether to violate the rice quota delivery law or not. In the empirical analysis, efforts were made to obtain data approximating major variables.

Quota Delivery:

Let:

x_o	rice quota per feddan
x_t	total output per feddan
$x_m = (x_t - x_o)$	free market output per feddan
P_{x_o}	quota price
P_{x_m}	free market price
f	fine per unit of non-delivery of quota
$Pr(v)$	probability of getting caught and prosecuted successfully

If it can be assumed that the costs of the producing and marketing quotas are equal to those in the free market, then we can focus on the revenue side.

Let:

Revenue per feddan from obeying the law be R_o and

$$R_o = x_o \, P_{x_o} + x_m \, P_{x_m}$$

Revenue from violating the law be R_v and

$$R_v = x_t P_{x_m} - f x_o [Pr(v)]$$

assumed complete violation

If $R_o > R_v$, the law will be obeyed.

The choice becomes a function of:

1. The amount of the quota – If $P_{x_o} < P_{x_m}$, the higher the quota the lower R_o will be and the greater the incentive to violate. Rice area, total land holdings, percentage of rice area, and family size are among the proxy variables representing the effect of quota size on the farmer's decision. These variables reflect the adequacy of rice marketable surplus and the portion kept for home consumption that are affected by the amount of quota.

2. The relative prices – The lower the quota price, relative to the free market price, the lower R_o and the greater the incentive to violate. Given that data were collected from a cross-section sample at a specific point in time, price difference is not expected to be observed empirically with a satisfactory degree of accuracy.

3. The size of the fine – The greater is f, the lower is R_v and the greater the incentive to obey the law.

4. The probability of getting caught and prosecuted – The greater is $Pr(v)$, the lower is R_v and the greater the incentive to obey the law. However, data on the probability of getting caught and prosecuted are not available. The farmer with higher risk preference will have greater incentives to violate the law, however. The quota price is usually known in advance of planting, whereas the market price is not. Further, the farmer knows he can sell his quota, but there may

be uncertainty about finding a home for his rice in the free market. The number of land pieces owned or rented by the farmer might tend to reflect risk preference. The greater the number of pieces, the greater the opportunity for diversification, a common mechanism for averting risk.

Cotton Land Allotment:

For the cotton land allotment, a similar conceptual frame is used as applied to area law violation.

Let:

Crops freely chosen are numbered 1 . . . . n

$\hat{x}_j$ = yield of crops j where j = 1 . . . . . n

$\hat{a}_j$ = area in feddans planted to crops j where j = 1 . . . . . n

$\hat{C}_j$ = per unit costs of crops j

$\hat{P}_j$ = price per unit of crops j

$\hat{s}_j$ = scale factor increasing net revenue for crops j

f = fine imposed per feddan for violating the law

pr(v) = probability of getting caught and prosecuted for violation

R_v = total net revenue for law violation

$\dot{a}$ = total acreage in violation of the law

$$R_v = \hat{a}_1 \hat{x}_1 (\hat{P}_1 - \hat{C}_1)\hat{s}_1 + \hat{a}_2 \hat{x}_2 (\hat{P}_2 - \hat{C}_2)\hat{s}_2 + \ldots + \hat{a}_n \hat{x}_n (\hat{P}_n - \hat{C}_n)\hat{s}_n$$

$$- [\dot{a} \, f \, pr(v)] = \sum_{j=1}^{n} \hat{a}_j \hat{x}_j (\hat{P}_j - \hat{C}_j)\hat{s}_j - [\dot{a} \, f \, pr(v)]$$

Crops mandated by law are numbered 1 . . . . m

x_i = yield of crops i where i = 1 . . . . . m

a_i = area in crops i where i = 1 . . . . . m

C_i = per unit costs of crops i

P_i = price of crops i

s_i = scale factor increasing net revenues for crops i

R_o = total net revenue for obeying the law

$$R_o = a_1 x_1 (P_1-C_1)s_1 + a_2 x_2 (P_2-C_2)s_2 + \ldots + a_m x_m (P_m-C_m)s_m$$

$$= \sum_{i=1}^{n} a_i x_i (P_i-C_i)s_i$$

If $R_v > R_o$, the law will be violated.

This decision is a function of:

1. relative prices of crops j and i - The higher $\hat{P}_j$ relative to P_i, the greater the tendency for violation

2. relative yields - The higher $\hat{x}_j$ relative to x_i, the greater the tendency for violation.

3. costs of crops j and i - The higher $\hat{C}_j$ relative to C_i, the less the violation

4. economies of scale - If cropping pattern restrictions prevent economies of scale, the greater the incentive to violate

5. the per feddan fine - The greater the fine, the greater the incentive to comply with the law

6. the probability of getting caught and prosecuted - The higher $pr(v)$, the greater the incentive to obey the law

The same variables presented earlier are used to approximate these choice decision variables.

In some ways, the above conceptual frame is a simplication of real life. The farmer's choice regarding the violation of mandatory land allotment regulations should also include the rotation profitability. Net revenue approximates profitabilities and substitute crops are included. However, the framework presented enables us to identify most of the decision variables affecting the farmer's expected loss function.

Given that the farmer's decision is based on an economic rationale, the quantitative analysis reported in this paper attempted to model the farmer's choice behavior. The farmer has to choose from two finite and discrete alternatives, namely, to violate the law or not to violate it. Quantitative models of this type are called "models with qualitative variables" or "binary choice models." The models used in this study are the Probit and the Logit models.[3]

this includes partial violations?

These models estimate and predict the probability of violating the law by farmers, given actual information pertaining to their major socioeconomic characteristics. These models are applied to farmers' choices and behavior related to the obligatory delivery of the rice quota and the mandatory land allotment for cotton.

Generally, the dependent variable takes the value of one for farmers violating the law and zero for farmers obeying (not violating) the law. The model can be expressed in linear form as follows:

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[3]Judge, G. G., R. Carter Hill, W. Griffiths, T. Lee. Introduction to the Theory and Practice of Econometrics. John Wiley & Sons, 1982.

$$Y_i = a + b_1 x_{1i} + b_2 x_{2i} + \cdots + b_k x_{ki} + e_i$$

where Y_i =
$\begin{cases} 1 & \text{for farmers violating the law} \\ 0 & \text{for farmers not violating the law} \end{cases}$

x_{ik} = k explanatory variables related to major socioeconomic characteristics

a, b_k = unknown intercept and regression coefficients, respectively

e_i = unknown disturbance term

If the Ordinary Least Squares method is used to estimate the parameters, some problems are apparent. First is the probability of occurrence of violation is assumed to be a linear function of the explanatory variables and there is nothing in the above linear form to ensure that the predicted probability will fall in the unit interval. Thus, although the linear binary choice model is straightforward and easy to use, it provides fitted values of probabilities that are unrealistic and logically inadmissible.[4] To avoid this problem, two transformations are used; one leads to the probit model and the other to the logit model.

The use of these models stems from specifying an index $I_i = x_i'B$, an unobservable index variable, linear in B, such that the larger the value of I_i (for example $R_v - R_o$), the greater the probability of the event E (violation) occurring. Since that probability must lie between zero and one, the monotonic relationship between I_i and Pr $[E/I_i]$ can assume the general form of a cumulative distribution function.[5] In the probit model, a normal cumulative

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[4]Wonnacott, T. H. and R. J. Wonnacott, Regression: A Second Course in Statistics. John Wiley & Sons, 1981.

[5]Judge, G. G., Op. Cit.

distribution function is chosen, while a logistic cumulative distribution function is chosen for the logit model.

The logic of using a normal cumulative distribution function is based on the fact that each farmer makes a choice to violate the law —E —or not, by comparing I_i to a threshold level, I_*. Thus, if $I_i \geq I_*$, then E occurs. For each farmer, the value of the threshold I_* (in this case, revenue) is determined by many independent factors, such as landholding size, government and free market price differences, number of land pieces, family size, level of the fine, catching and prosecuting probability, etc., and thus by the central limit theorem, it can be assumed to be normally distributed.[6] In the logit model, the log-odds ratio (for violating to not violating) can be proved to equal $x_i'B$. That is, $\ln [P_i/(1-P_i)] = x_i'B$ by Taylor expansion.[7] Thus, the predicted probabilities for violation $\hat{P}_i = F(\hat{x}_* \hat{B})$ are confined to unit intervals. In both models, the amount of the increase in the probability depends on the initial values of all the independent variables and their coefficients. That is, when interpreting the results, levels of the explanatory variables have to be specified. In this paper, probabilities and parameter estimates are evaluated at mean values, $\bar{x}_i$.

Since there is only one observation on each farmer in the present study, maximum likelihood methods are used to estimate the parameters of the specified models. The likelihood function is defined as:

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[6]Judge, G. G., Op. Cit.

[7]Zellner, A. and T. H. Lee, "Joint Estimation of Relationships Involving Discrete Random Variables," Econometrica 33:382-394, 1965.

$$\ell = \prod_{i=1}^{N} P_i^{Y_i} (1 - P_i)^{(1 - Y_i)} \qquad \text{where } Y_i = 1 \text{ or } Y_i = 0$$

$$= \prod_{i=1}^{N} F(x_i'B)^{Y_i} [1 - F(x_i'B)]^{(1 - Y_i)}$$

where the cumulative distribution function, $F(x_i'B)$, follows a standard normal or logistic distribution, x_i' represents the explanatory variables, and B represents the parameters to be estimated. The logarithm of this likelihood function is maximized using numerical methods.[8] The maximum likelihood estimators are consistent, asymptotically efficient, and asymptotically normally distributed.

Maximum likelihood estimators reflect the effect of a change in an independent variable on the inverse of the normal cumulative distribution function, $F^{-1}(P_i)$, for the probit model, and on the log-odds ratio, $\ln[P_i/(1-P_i)]$, for the logit model. To estimate marginal changes in probabilities from changes in the independent variables, the following equations are used for the probit model

$$\frac{\partial P_i}{\partial x_{ij}} = f(\bar{x}_i'\hat{B}) \cdot \hat{B}_j$$

and for the logit model

$$\frac{\partial P_i}{\partial x_{ij}} = \frac{\hat{B}_j \cdot e^{(-\bar{x}_i'\hat{B})}}{[1 + e^{(-\bar{x}_i\hat{B})}]^2}$$

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[8]For a more in-depth explanation of the use of the maximum likelihood estimation method, see, for example, Judge, G. G., Op. Cit., pp. 522-523 or Theil, H., Principles of Econometrics, John Wiley & Sons, 1971, pp. 89-91 and pp. 392-396.

These equations are used to estimate marginal changes in probabilities with respect to changes in independent variables for the estimated models discussed in this study. The estimates are evaluated at the mean values of the explanatory variables.

EMPIRICAL RESULTS

Two villages were chosen for study from Belbies District, Sharkia Governorate. From the lists taken from the agricultural cooperative's files, 36 rice quota violators and 45 non-violators were chosen at random, while 34 violators and 49 non-violators were randomly chosen for cotton land allotment requirements. Also, ten government agricultural supervisors from this district were interviewed to gain understanding of the perception of the government officials concerning causes for violation.

The statistical significance for differences between means for major socioeconomic variables is tested for rice and cotton. This analysis helped greatly in respecifying the probit and logit models. A discussion of the empirical results related to the rice quota delivery violations and cotton area allotment are presented separately.

Rice Quota Delivery Violation:

Table 3 represents the t-values for the differences between means of major socioeconomic variables for the mandatory rice quota violators and non-violators. These variables were chosen to represent major factors included in the conceptual frame. Most of the differences in the means of the variables presented are significant at 0.05 or 0.1 level of significance. Generally, sampled farmers violating the mandatory rice quota delivery seem to have less total land holdings, less owned land, less number of land pieces, fewer cattle, and consume less rice. These sampled farmers are required to cultivate rice on relatively large fractions of their land holdings. Also, it is of interest to note that the percentage of owned to total holdings was about 73 percent and 93 percent on the average for sampled farmers violating and obeying the law, respectively. This result indicates that farmers renting

TABLE 3: T-VALUES FOR DIFFERENCES BETWEEN THE MEANS OF MAJOR SOCIOECONOMIC VARIABLES FOR RICE QUOTA VIOLATORS AND NON-VIOLATORS

	Violators		Non-Violators		T-Values for
	$\overline{x}_1$	Std. Dev.	$\overline{x}_2$	Std. Dev.	$\overline{x}_1 - \overline{x}_2$
Family Size (number)	7.0	1.93	8.0	3.17	1.93*
Total Area Holding (Fed.)	1.70	1.13	2.11	0.96	1.76**
Owned Area (Fed.)	1.25	1.07	1.98	0.98	3.21*
Number of Land Pieces (Units)	1.58	0.73	2.24	1.03	3.26*
Required Rice Area (Fed.)	0.92	0.86	1.21	0.61	1.77**
% of Rice Area From Total Holding (%)	65.40	31.69	63.15	26.13	0.35
Number of Cattles (Heads)	1.0	1.66	2.0	1.59	1.41
Farm-Coop Distance (Km)	0.67	0.73	1.58	1.63	3.11*
Farm-Market Distance (Km)	2.81	2.54	6.76	2.05	7.79*
Age (Years)	48.5	11.94	45.22	10.44	1.32
Family Total Rice Consumptions (Kg)	492.44	253.1	667.9	533.18	1.82**

* Significant at the 0.05 level

** Significant at the 0.10 level

land may have higher risk preference. They want to maximize the net revenue from rented pieces even if they violate the law.

Sampled farmers violating the mandatory rice quota delivery also have fewer numbers of pieces. This result was expected. Farmers with larger numbers of pieces have insulated themselves against risk to some extent. Even if rice cultivation and delivery is less profitable, farmers with larger numbers of pieces have more degrees of freedom to increase their aggregate net revenue through cultivating higher valued cash crops in other pieces. They could make up for any foregone gain by obeying the law and cultivating and delivering rice.

Also, sampled farmers violating this law are closer on average to the free market. They probably have better market information and lower marketing costs and both factors would lead to a greater tendency to violate the law.

Some other qualitative information was collected by interviewing the sampled farmers. The study showed that about 86 percent of the violators indicated that differences between government quota prices and free market prices was the main reason for violation. Also, about 66 percent of those farmers filed a petition for not delivering the quota due to lower yield per feddan. It is of interest to note that other information confirms the accuracy of their response regarding family needs. Large numbers of the sampled violators did not engage in any market activities—buying or selling rice. They must have consumed their entire production. Also, about 90 percent of the sampled violators paid wages in kind.

Using the information presented above, a choice probability model was specified and statistically estimated using the maximum likelihood method as explained earlier (Table 4). The presented estimates are the best among alternative fits which were attempted. All estimated parameters have a priori

TABLE 4: MAXIMUM LIKELIHOOD ESTIMATES AND CALCULATED MARGINAL CHANGES IN
PROBABILITIES W.R.T. CHANGES IN EXPLANATORY VARIABLES
FOR RICE QUOTA DELIVERY VIOLATIONS

Probit Model				Logit Model			
Variables[1]	Estimated Parameters	T Values	Calculated Marginal Probabilities[2]	Variables	Estimated Parameters	T Values	Calculated Marginal Probabilities
Intercept	1.523	–	–	Intercept	2.639	–	–
FMDIS	-0.312	4.75	-0.122	FMDIS	-0.553	4.25	-0.135
RAPER	0.007	0.95	0.003	RAPER	0.013	0.95	0.003
NOPIC	-0.314	1.41	-0.123	NOPIC	-0.541	1.25	-0.132
L.R.T. = 43.558				L.R.T. = 40.848			
R^2 (O-P)[4] = 0.484				R^2 (O-P) = 0.427			

[1]FMDIS = Farm (Home) – Market Distance (Kilometers)

RAPER = Required Rice Area as Percentage of Total Land Holding (%)

NOPIC = Number of Land Pieces (units)

[2]The calculated marginal probabilities are derived using the equations presented
earlier where mean values of explanatory variables are used.

[3]L.R.T. = Likelihood Ratio Test. This statistic has an asymptotic chi-squared
distribution with 3 d.f. It is highly significant at the 0.01 level (χ^2 = 11.4).

[4]R^2 (O-P) = R^2 between observed and predicted values.

expected signs. The probit and logit models gave similar results, and the likelihood ratio test is highly significant for both models. Convergence was achieved after four iterations using the SHAZAM computer program.

The estimated marginal probabilities confirm the previous discussion. For farmers located about 5 kilometers from the market with about 63 percent of their land cultivated with rice and who have about two pieces of land on the average, the probability of violating the rice quota delivery regulation tends to increase as they get further away from the market boundaries. The estimates indicate that the increase in distance from the market by one kilometer decreases the probability of violating the law by about 12-13 percent. Also, as the percentage of required rice area to total holding increases by 10 percent, the probability of violating the quota delivery law increases by about 1 percent. An increase in the number of pieces of land by one unit decreases the probability of violating the quota delivery law by about 12-13 percent.

Cotton Land Allotment Violation:

Table 5 presents the t-values for the differences between means of major socioeconomic variables for the mandatory cotton area allotment violators and non-violators. Of the sampled farmers, violators are the poorest. They tend to have less owned land and fewer cattle. Also, among the sampled farmers, violators seem to be less isolated from market information. Although cotton is not traded in any village market, market knowledge about substitute crops seems to be crucial. Expected government prices approximate last year's experience and reflect the quality patterns of the produced fibers. It seems that farmers that tend to obey the law are those giving a little more attention to their farming operations and cotton quality.

TABLE 5:   T-VALUES FOR DIFFERENCES BETWEEN THE MEANS OF MAJOR VARIABLES
FOR COTTON AREA VIOLATORS AND NON-VIOLATORS

	Violators		Non-Violators		T-Values for
	$\overline{x}_1$	Std. Dev.	$\overline{x}_2$	Std. Dev.	$\overline{x}_1 - \overline{x}_2$
Family Size (Number)	8.0	2.43	8.0	2.46	0.78
Total Area Holding (Fedd)	1.85	0.83	2.02	0.90	0.87
Owned Area Holding (Fedd)	1.46	0.74	1.92	0.85	2.47*
Required Cotton Area	0.70	0.41	1.04	0.42	3.71*
Number of Cattle	1.00	0.92	2.0	1.22	1.88**
Farm-Market Dist. (Kilom)	2.81	1.93	5.29	1.76	5.99*
Age (Years)	46.79	10.56	46.58	9.47	0.09
Number of Pieces	2.12	1.11	2.14	1.05	0.08
Expected Gov. Price (K.E./Qantar).	61.56	3.93	62.71	1.31	1.92*

* Significant at the 0.05 level

** Significant at the 0.10 level

The data from these sampled farmers indicate that the percentage of owned land to total holding is significantly smaller for farmers violating the law. Farmers renting land seem to have higher risk preference. They aim at maximizing net revenue from rented land even if they have to violate the law. The average number of pieces is not significantly different between violators and non-violators. However, there does seem to be relatively greater dispersion about the mean for violators than for non-violators.

The probit and logit models specified and statistically estimated for mandatory cotton area allotment violations gave similar results (Table 6). The presented equations are the best among alternative fits. Estimated parameters have a priori expected signs. The presented equations indicate that total holding size, distance to the market, and the expected government prices are among the major variables responsible for farmers violating the law. The likelihood ratio test for both models is highly significant at the 0.01 level.

The estimated probabilities seem logical. For farmers having about two feddans located about four kilometers from the market and expecting government prices of L.E. 62.2 per Qantar (in 1980/1981 season), the probability of violating the law increases as holding size increases and decreases as distance to the market and expected prices increase. The estimates indicate that as total holding size increases by one feddan, the probability of violating the law increases by only 1 percent. An increase in the distance to market by one kilometer decreases the probability of violation by about 18-20 percent. Also, an increase in quality produced (reflected in expected price increases of L.E. 1.0) decreases the probability to violate the law by about 10-20 percent.

TABLE 6: MAXIMUM LIKELIHOOD ESTIMATES AND CALCULATED CHANGES IN PROBABILITIES
W.R.T. CHANGES IN EXPLANATORY VARIABLES
FOR COTTON LAND ALLOTMENT VIOLATION

	Probit Model				Logit Model		
Variables[1]	Estimated Parameters	T Values	Estimated Marginal Probabilities[2]	Variables	Estimated Parameters	T Values	Estimated Marginal Probabilities
Intercept	17.802	–	–	Intercept	32.584	–	–
TAHO	0.014	1.44	0.005	TAHO	0.022	1.37	0.005
FMDIS	– 0.468	4.68	– 0.184	FMDIS	– 0.824	4.29	– 0.199
ECTGP	– 0.268	1.80	– 0.105	ECTGP	– 0.491	1.88	– 0.119

L.R.T.[3] = 35.81   L.R.T. = 36.55

R^2 (O-P)[4] = 0.418 R^2 (O-P) = 0.427

[1]TAHO = Total area holdings (Fedd).

FMDIS = Farm (Home)-Market Distance (Kilometers).

ECTGP = Expected Cotton Government Prices (L.E./Qantar).

[2]The calculated marginal probabilities are derived using the equations presented earlier where mean values of explanatory variables are used.

[3]L.R.T. = Likelihood Ratio Test. This statistic has an asymptotic chi-squared distribution with 3 d.f. It is highly significant at the 0.01 level (χ^2 = 11.4)

[4]R^2 (O-P) = R^2 between observed and predicted values.

Perception of Village Agricultural Supervisors:

Ten agricultural supervisors working in the same district were
interviewed to gain understanding of government officials' perceptions of
causes for violating the quota delivery and land allotment laws. For
mandatory quota delivery, the main reason perceived by agricultural
supervisors seems to be selling in the free market. Also, use for auto-
consumption was a probable reason for violation.

For the mandatory cotton area violation, there were diverse opinions.
Agricultural supervisors working in the villages believe that waiving
punishment at a later stage of the enforcement process, after a violation has
been reported by them, encourages farmers to violate the law. Inadequacy of
fines was also among the reasons given. Also, inadequate government prices
and shortage of labor (reflected in higher wage rates and low profitability)
seem to be important reasons. As expected, all agricultural supervisors filed
the violation report on time and with great accuracy.

SUMMARY AND CONCLUSIONS

The current agricultural and food price policy in Egypt has distinct characteristics. Retail prices of major food commodities are kept low for equity reasons. The government attempts to assure availability of major agricultural commodities either for domestic markets or for export earnings. Most of the major food and export crops are marketed through the cooperative marketing system under government control. For biological and control reasons as well as to assure availability, a land rotation is forced on Egyptian agriculture. To maximize export earnings and to minimize the subsidy costs of low retail prices, the government keeps farm prices for these commodities below world levels. These policy instruments are implemented through laws and ministerial rules.

Agricultural laws are the mechanism for implementing quota and cropping pattern policies. These laws tend to change the behavior of the economic agents to a more socially desirable type. Optimal private behavior may differ, however, from optimally-social private behavior. Laws and administrative rules are invoked to reduce the discrepancy between optimal private and optimal social behavior, at least as perceived by those having the power to make such laws and rules. Thus, the departure from prescribed or proscribed behavior is a violation.

Punishment for law violators in the form of fines or imprisonment is the shadow price of the social importance of the law. The cost of obeying the law is different for each economic agent and will depend upon age, family size, farm size, dependence on off-farm markets, income and wealth, diversification, risk preference, market information, etc. It is an economic choice. This choice affects to a great extent the success of any agricultural policy in

Egypt. This paper examines the farmer's decision pertaining to obeying or violating major agricultural laws and rules. Mandatory quota delivery and mandatory land allotment were chosen as examples for empirical analysis.

The complexity of the issuance and implementation of agricultural and food distribution laws was obvious. Sizable amounts of resources are used to enforce existing laws and rules. Resources from the Ministries of Agriculture, Justice, Interior, and Supply are used in this process. Excessive numbers of laws are issued to regulate trade, to set prices, and to regulate agriculture practices and prices. Law No. 95 of 1945 adjusted by Laws No. 112 of 1966, No. 22 of 1980, No. 109 of 1980, and No. 106 of 1981, are the major laws regulating food distribution and rationing books. Food pricing is regulated by Laws No. 163 of 1950 and No. 128 of 1982. Other related laws to trade and exchange regulation for bread and rice are Laws No. 169 of 1980, No. 308 of 1981, and Laws No. 235 and 236 of 1982. The major agricultural unified Law No. 53 of 1966 is the major agricultural law. Other ministerial rules are issued seasonally to deal with crop rotation, prices, and quota delivery of crops under the cooperative marketing system.

The farmer's choice betweem two discrete alternatives, namely to violate or obey the law, was examined. A sample of 81 farmers for rice, and 79 farmers for cotton were interviewed. The sample included 36 farmers violating the mandatory rice quota delivery, and 34 farmers violating the mandatory cotton area allotment. Violators of rice quota delivery seem to have less total land holding, less owned land, less number of land pieces, fewer cattle, and consume less rice than non-violators. Farmers violating the rice quota delivery are those located near the village market boundaries. They seem to have more information regarding free market prices and lower costs of trading in the free market. Also, violators of cotton area allotments seem to be the

poorest among sampled cotton producers. They have less owned land and fewer cattle than non-violators. Sampled cotton area violators seem to be located nearer to the village market boundaries than the non-violators.

Maximum likelihood estimates are obtained for probit and logit models specified. These models are utilized to examine factors affecting the farmer's decision to violate these laws. Model estimates indicated that the probability to violate the rice quota delivery would increase by about 0.12-0.13, for a one kilometer increase in the distance to the market. Also, this probability would increase by about one percent for each 10 percent increase in the percentage of required rice area from total land holding. Increasing the number of land pieces would tend to decrease the probability to violate mandatory rice quota delivery by about 12-13 percent.

The probability to violate the mandatory cotton area allotment tends to increase by only one percent for a one feddan increase in land holdings, and tends to decrease by about 18-20 percent for a one kilometer increase in the distance to market. Increasing expected government prices would tend to decrease the probability to violate the mandatory cotton area by about 10-20 percent.

Apparently, violation of the law and concomitant payment of fines is very pervasive and would seem to justify further analytical work that attempts to measure the social benefits and costs of having rules and regulations that are so widely violated.