WPS 2839

Marketing Externalities and Market Development

M. *Shahe Emran*

Forhad Shilpi

Abstract

Emran and Shilpi use survey data from Bangladesh to present empirical evidence on externalities at household level sales decisions resulting from increasing returns to marketing. The increasing returns that arise from thick market effects and fixed costs imply that a trader is able to offer higher prices to producers if the marketed surplus is higher in villages. The semi-parametric estimates identify highly nonlinear own and cross commodity externality effects in the sale of farm households. The vegetable markets in villages with low marketable surplus seem to be trapped in segmented local market equilibrium. The analysis points to the coordination failure in farm sale decisions as a plausible explanation for the lack of development of rural markets even after market liberalization policies are implemented.

Marketing Externalities and Market Development[1] [2]

M. Shahe Emran
Stanford University and
George Washington University

Forhad Shilpi
World Bank

Key Words: Increasing Returns, Externalities, Marketing, Market Development, Semiparametric Estimation

JEL Classification: D13; D43; O12; M31

Marketing Externalities and Market Development

Introduction

The importance of increasing returns, externalities, and multiple equilibria in explaining the persistence of underdevelopment has been a perennial theme in the development literature. [1] That there can be multiple Pareto-ranked equilibria due to increasing returns and its associated pecuniary externalities, and that an economy (or a region) can be trapped in a low-level equilibrium has gained wide acceptance in recent theoretical literature, ranging from endogenous growth theory to new economic geography. Different sources of increasing returns and externalities have been identified and analyzed (for example, fixed costs of production in urban manufacturing sector as in Krugman (1991) and in subsequent literature on new economic geography, and endogenous technology adoption in final goods sector in Ciccone and Matsuyama(1996)). [2] However, the extant literature has not paid adequate attention to the role of **marketing** which is an important source of increasing returns and externalities in a market economy, especially at an early stage of development. The increasing returns to marketing arise from thick market effects and from the existence of fixed costs, for example, in hiring a truck and in renting in a storage space.[3] Understanding the implications of increasing returns and externalities associated with marketing for development of markets is of paramount importance, as well-functioning markets are widely viewed as the *sine qua non* of economic development. The objective of this paper is to address this important but largely neglected issue; particularly to provide formal empirical evidence on the existence and magnitudes of the externalities in farm level sales decisions that result from increasing returns to marketing.

---

[1] The literature can be traced back at least to the presidential address of Allyn Young to the Royal Economic Society (1928). The recent revival in interest owes much to the work of Murphy et. al. (1989). See also, Matsuyama (1992), Eswaran and Kotwal (1996), Rodriguez-Clare (1996), Hoff and Stiglitz (2000) and Ray (2000), among others. Hoff (2000) provides an excellent summary of the theoretical literature focusing on underdevelopment traps.

[2] There is a small (relative to the theoretical literature) but rapidly expanding empirical literature on increasing returns, externalities and multiple equilibria. For instance, in Ciccone and Matsuyama(1996), private return to investment increases with the aggregate level of investment. Productivity of firms increases with the size/density of activities e.g. in Ciccone and Hall(1996).

[3] In their in-depth study on the peasant marketing in Indonesia, Hayami and Kawagoe (1993) report that there are large economies of scale in long-distance trade. It costs about Rp. 1000- Rp. 2000 to charter a pony wagon to Garut bazaar, carrying a load up to 200 kg. It costs Rp. 5000 to charter a mini truck for any load, up to the maximum capacity of 2 tons. Therefore the cost of transportation is Rp. 5/kg or higher if a load of up to 200 kg of soybean is carried from the study village to Garut Bazaar by pony wagon, but the cost declines to Rp. 2.5/kg if a two ton load is carried by a mini truck. (P.54)

The increasing returns to marketing imply that a trader can offer better prices to a farm household located in a village with high aggregate surplus, as she can achieve significant economies of scale in marketing. This results in pecuniary externalities at the households level; the sales of an individual household of any given commodity becomes a positive function of the village level aggregate marketed surplus of (i) the commodity itself (called *own externality*), and (ii) all other commodities produced in the village (called *cross externality*). The cross externality effect arises from the fact that, when the marketable surplus of any given commodity is small, a trader needs to pool multiple commodities for reaping economies of scale.

The existence of fixed costs and externalities also implies that there can be multiple equilibria which can be identified with different levels of market development. We identify three distinct stages of market development in the rural areas of developing countries. In the first and most underdeveloped stage, the rural markets are isolated, and the market clearing occurs at the local level. The marketable surplus is so low that it constrains the emergence and operation of a long-range intermediary class that can connect the local market to the central or urban market(s), as it is not possible to reap any significant economies of scale in marketing. At this stage of market development, both the own and cross externality effects in the sales decisions discussed earlier are absent or insignificant. Moreover, the price an individual farm household gets for the output is likely to be negatively correlated with the aggregate supply brought to the local market due to the standard supply shift effect. This, in turn, implies a negative *own externality like effect*, as a farm household's sales, *ceteris paribus*, tend to be lower, when the neighbors bring in more to the market, and thus depress the (local) market price. Observe that the existence of fixed costs implies that there can be a coordination problem in the sales decisions of the farm households and a village can be trapped in a segmented local market equilibrium. Given the local market clearing, it might be individually optimal for the farm households not to produce more surplus, but when everyone produces enough surplus, this might make long range marketing intermediary profitable, and thus integrate the market with the urban centers. [4] In the second stage of the market development, the long range marketing intermediaries are in operation, but

---

[4]Observe that the coordination failure can occur at two levels. First, the sales decisions of all the farm households need to be coordinated. But that might not be sufficient to break out of the local equilibrium, as the increased surplus will only glut the local market if it can not be coordinated with the entry of the prospective marketing intermediary.

they need to pool together multiple commodities to cover the fixed costs in transportation and storage and to reap the economies of scale. So this intermediate stage of market development is characterized by the presence of both own and cross externality effects. In the last and most developed stage of market development, the marketable surplus of each commodity is large enough to permit commodity-wise specialization by the marketing intermediaries. As such there is no cross commodity externalities at this stage, and it is characterized by the existence of only own externality effect.

Using household level data from Bangladesh, we find significant evidence of both own and cross commodity externality effects. While there are evidence of strong own externality effects in rice markets, the cross externality effect seems to be absent. The evidence thus imply that the rice markets in Bangladesh have attained the most developed stage of the three stages described earlier. For a farm household located in a village in the first quartile (sorted by village surplus of rice), the total sales of rice increases by 47 percent when the average sales of rice by all others in the village doubles. In contrast, for vegetables, there is a negative own externality like effect in villages with low marketable surplus, indicating the existence of segmented and local market equilibrium. The sales of vegetables by a farm household in a village in the first quartile (sorted by surplus of vegetables) tends to *decrease* by 26 percent when the average sales by all others doubles, *ceteris paribus*. [5] The vegetables markets in these villages seem to be trapped in the low-level isolated market equilibrium. The analysis and evidence presented here thus point to a plausible explanation of the apparently puzzling observation that, in many developing countries, the deregulation and liberalization policies have largely failed to accelerate the development of the rural markets (Kherallah et. al. (2000)). To the best of our knowledge, ours is the first attempt at a formal econometric analysis of the externalities associated with increasing returns to marketing in the rural markets of developing countries.[6]

The rest of the paper is organized as follows. Section 1 discusses the different sources of increasing returns to marketing and the many economic functions performed by a marketing intermediary in developing countries. Section 2 describes a simple model of a marketing interme-

---

[5]The elasticities reported here are based on 2SLS estimates.

[6]It is interesting to compare our analysis to that of Demsetz (1968). Using data from a well developed market, i.e. the New York Stock Exchange, Demsetz finds evidence of significant scale economies in securities trade. The scale economies arise from thick market externalities from better matching of buyers and sellers when trade volume of a given security increases. Thus only a subset of what we call own externality effects is considered.

3

diary that guides the empirical analysis. A discussion of the econometric issues involved in the estimation of externality effects and of the specification of the estimating equation is provided in the next section. Section 4 gives a brief discussion of the data. The main empirical results on externalities, using a semi-parametric approach, are presented in section 5. Section 6 concludes the paper with a summary of the results and a discussion on the implications of the results of this paper for the broader theme of agricultural market development and poverty alleviation in developing countries.

Section 1: The Economics of Marketing and Market Development

Several sources of increasing returns to marketing can be identified from existing theoretical and empirical literature. First, the cost of transacting in a market can decline with the scale of trading due to *thick market externalities* from better matching of buyers and sellers, and from better generation and transmission of information (e.g. Demsetz (1968), Diamond (1982), Rubinstein and Wolinsky (1987)). Second, as we mentioned above, two of the most important components of marketing: transportation and storage give rise to natural increasing returns due to fixed costs involved. These are known as increasing returns to *bulking* in the marketing literature. Third, setting up of a marketing network frequently involves substantial sunk investments in "intangible assets" like trust and reputation. The available empirical evidence from developing countries indicate that markets in agricultural and many manufacturing inputs and outputs operate on the basis of relational contracts. The relational contracts facilitate information sharing and informal enforcement of contracts (Aoki and Hayami(1999)). The intermediaries traders need to incur significant costs in developing these informal relationships, which can be termed as a trader's "social capital". *An important implication of the existence of increasing returns to marketing is that, under plausible conditions, it generates pecuniary externalities at the level of individual farm households.* As the aggregate volume of trade increases allowing a trader to take advantage of the many different sources of increasing returns, part of the gain is passed on to the producers in the form of higher prices, especially when the entry into marketing is not restricted.[7] Also, there

---

[7]In 1960s, there were extensive government interventions in the agricultural markets of developing countries that often restricted entry by private traders. The markets have, however, been deregulated and liberalized starting from late 1970s. Although stories of monopsonistic behavior in agricultural markets abound in popular accounts, the prevailing consensus from more careful studies is that the markets, especially at the local level, are reasonably

are significant cross commodity externalities, especially at the early stages of development, as the marketed surplus of a single commodity may not be large enough to recover the fixed costs, thus providing incentives for pooling of different commodities.[8]   The lack of specialization in marketing, both horizontally and vertically, at early stages of development is well-documented (see, for example, Hirsch (1961), Hayami and Kawagoe (1993)).   The wide prevalence of producers and traders associations in developing countries probably reflects, at least in part, the outcome of attempts to capture increasing returns to marketing at low levels of production and marketable surplus. [9]

While the existence of increasing returns to marketing can generate positive externalities, an increase in the volume of trade, particularly of different commodities, can also increase transaction costs, and thus eventually limit the number of commodities traded in a given market (Demsetz (*op cit*)).   Market intermediaries play a critical role in inspecting and verifying quality of a commodity thereby facilitating its exchange even without personal examination by the buyers.[10] This is especially important in developing countries because of a lack of standardization.   The marketing intermediary can be looked upon as an expert in judging the quality of a product who helps resolve the adverse selection problem *á la* Akerlof's lemon, and thus can stop a market from unravelling completely (see, for example, Biglaiser (1993)).   However, at early stages of development, any given intermediary usually handles a number of commodities, and she can not be expected to be equally expert in verifying quality of all of them.   The *diseconomies of scope* in performing quality verification is higher, the larger the number and volume of commodities in

competitive or at least "contestable" (see, for example, Chowdhury (1992) on Bangladesh, Kherallah et al (2000) on Sub-Saharan Africa).   That these markets are essentially contestable was forcefully argued early on by Bauer and Yamey (1954).

[8]For instance, in smaller markets, once a truck is hired, traders are often seen to pool different commodities so as to operate the truck near its capacity (to the extent possible). If a single trader's volume is not large enough, then multiple traders, possibly dealing with different commodities, may hire a truck in partnership (see, for example, Belshaw (1965) for evidence on Fiji, and Hayami and Kawagoe (*op cit*) for Indonesia.)

[9]There are evidence that the same produce gets better price when marketed through a marketing association in comparison to individual marketing.   For example, while per box of squash marketed through the Ha-ee vegetable marketing group in Korea got $6.58, the price fetched by individual marketers was $5.92 in 1982 (P.118, Abbot, 1987).   This gave an average $800 additional income to a member of the group.   Although part of the price differential might reflect better bargaining power of the group, economies of scale in marketing (transportation, storage and packaging) arising from fixed costs is also an important factor.

[10]Even for relatively homogenous commodities like foodgrains, there are multiple dimensions of quality that can be important: color, taste, appearance of kernels, moisture content, impurity, breakage of kernels, and baking qualities (Gabre-Madhin, 1999).

5

the portfolio of a trader.[11]   With the increase in income and production, as marketed surplus increases beyond a threshold, a trader can reap the economies of scale without pooling different commodities together which leads to specialization in marketing and creates experts in quality verification.   The above discussion forms the basis for the three stages of market development discussed earlier.

We utilize household level survey data from Bangladesh to test for the existence of the externality effects and to estimate them when they are present.   The choice of Bangladesh as a case study is motivated by two characteristics of its agriculture.   The average farm size is very small and economic activity is very densely distributed over geographic space, an ideal combination for generating pecuniary externalities at the individual farm level.[12]   If the farm size is large enough as is the case in much of Latin America, it is easy for individual farmers to reap the benefits of increasing returns to marketing, and one should not observe any externality effects across different producers.   On the other hand, if the farms are small but geographically isolated, it would be extremely difficult, if not impossible, to reap any economies of scale in marketing.   The high geographic density and small farm size coupled with the fact that most of the households produce multiple commodities due to risk diversification reasons, imply that the forces of both own and cross externalities are likely to be important in Bangladesh agriculture.

Section 2: Price formation in the presence of increasing returns to marketing

At the heart of our analysis of externalities in farm level sales is the formation of producer price of a commodity at a given market (or at the farm gate) in the presence of increasing returns to marketing.   In this section, we develop a simple model of price formation by considering the optimization problem of an intermediary/trader.   Let q_i denote the amount of commodity i shipped from the local market, and Q be the total volume of all commodities shipped from that

---

[11]As pointed out before, even if traders are specialized commodity wise, but deal with relatively small volume, a number of traders can pool together and hire a truck to transport to the nearest urban market. In this case, there are no diseconomies from spreading thin the quality inspection skill, but there are costs associated with coalition formation and collective action. Time and efforts need to be spent to establish such an arrangement and to hold it together. Private marketing cooperatives, producers' associations fit into this category. The model developed in the next section of the paper can be easily adapted to represent such an association where the quality verification costs are replaced by the costs of coalition formation and collective action.

[12]With population density of more than 2000 per square mile, Bangladesh is considered as the most densely populated non-city country in the world. The average farm size is about 1 hectare.

market. We assume that there exists a variable cost per unit of the commodity i shipped to the destination market u, denoted as $d_i(t_u, w)$, where t_u is the distance between local market and the destination market u, and w denotes the wage rate.[13] It is assumed that $d_i(.)$ is a positive function of both distance and wage rate. The wage rate reflects the costs of hiring labor for packaging, and loading and unloading of commodities. The demand for commodity i in the destination market is described by the inverse demand curve $\tilde{P}_i = \gamma_i q_i^{-\sigma_i}$ where $0 < \sigma_i < 1$. We assume, for simplicity, that supply in the local market can be described by an upward sloping supply curve $P_i = \eta_i q_i^{\delta_i}$ where $\delta_i > 0$. [14] Both the demand and supply curves satisfy the conditions for an interior solution. In order to capture the positive externality generated by an increased volume of trade, we assume that, for a long-distance trader operating from the local market, there is a set up cost $\Gamma(q_i, Q_{-i}) = F + C(q_i, Q_{-i})$, where $Q_{-i} = \sum_{k \neq i} q_k$. Observe that the set up cost equation $\Gamma(q_i, Q_{-i})$ is an affine function implying that there is a pure fixed cost component F which includes costs incurred in building a trader's "social capital" along with any fixed costs in transportation and storage. The other part of the set up cost function $C(q_i, Q_{-i})$ captures the increasing returns due to factors like thick market effects, and possibly quantity discounts in transportation and storage. The marginal quality verification cost for commodity i, denoted as $M_i(Q_{-i})$, is assumed to depend positively on the volume of all other goods that are being traded by the intermediary. This is the diseconomies from spreading the quality verification skill over a portfolio of multiple commodities. The optimization problem for a typical trader operating from the local market can be described as:

$$Max_{\{q_1....q_n\}}\Pi = \sum_{i=1}^{n}[\tilde{P}_i - P_i - \tau_i d_i(t_u, w) - M_i(Q_{-i})]q_i - \Gamma(q_i, Q_{-i}) \qquad (1)$$

There are two important features of the profit equation as defined above. First, instead of defining the profit equation separately for each commodity, we allow the trader to combine different commodities in her portfolio and to optimize the joint profit. Second, the function $\Gamma(..)$

---

[13]Here u stands for urban.

[14]Although the specifications of demand and supply functions are simple, they allow for regional variations. The demand for a commodity may depend on the region it is produced. This can be due to the fact that different aspects of the quality of a commodity depend, among other things, on the agro-climatic characteristics of the geographical region it is produced. For example, mango produced in Rajshahi usually command a premium in Bangladesh. The supply of a commodity also is dependent on agro-climatic characteristics of a producing region.

captures the own and cross externalities that arise from different sources of increasing returns discussed earlier. From equation (1), the first-order conditions for optimization can be derived as:

$$(1 - \sigma_i)\tilde{P}_i - (1 + \delta_i)P_i - \tau_i d_i(t_u, w) - M_i(Q_{-i}) - C^i(q_i, Q_{-i}) = 0 \qquad (2)$$

for all $i = 1, 2, ...n$, and where $C^i = \frac{\partial C}{\partial q_i}$.[15] The marginal benefits from an increase in q_i consist of the marginal revenue in the destination market and the marginal benefit $(-C^i())$ generated by an increase in trade volume. The marginal costs on the other hand comprise of the marginal procurement, transportation and quality verification costs. The optimal q_i is chosen so as to balance the marginal benefits and costs.[16]

In order to detect the strength of the own and cross externality effects in the empirical analysis, we solve equation (2) to derive an equation for the producer price at the local market:

$$P_i = \mu_i \tilde{P}_i - v_i d_i + \lambda_i g_i(q_i, Q_{-i}) \qquad (3)$$

where $\mu_i = \frac{(1-\sigma_i)}{(1+\delta_i)}$, $v_i = \frac{\tau_i}{(1+\delta_i)}$, $\lambda_i = \frac{1}{(1+\delta_i)}$ and $g_i(q_i, Q_{-i}) = -M_i(Q_{-i}) - C^i(q_i, Q_{-i})$. So the function $g_i(q_i, Q_{-i})$ represents the effects of own and cross externalities on the producer price received by the farmers in the local market, assuming that the intermediary can cover the fixed cost F. From simple partial differentiation, we have:

$$\frac{\partial g_i}{\partial q_j} = -M_i^j - C^{ij}$$

$$\frac{\partial g_i}{\partial q_i} = -C^{ii}$$

As defined before, $C^{ij} = \frac{\partial^2 C}{\partial q_i \partial q_j}$ and $C^{ii} = \frac{\partial^2 C}{\partial q_i^2}$. We assume that $M_i^j > 0$ and $M_i^{jj} > 0$. Note that if $C^{ij} > 0$, then $\frac{\partial g_i}{\partial q_j} < 0$. The intermediary can do better by specializing either in q_i or q_j as the overall cross externality effect is negative. Similarly, if $C^{ii} > 0$, then the intermediary faces

---

[15]We use superscripts to a function for denoting partial derivatives.

[16]A zero profit condition characterizes the equilibrium due to free entry or contestability. The zero profit condition determines the equilibrium wage rate w^*.

diseconomies of scale as $\frac{\partial g_i}{\partial q_i} < 0$. We focus on the more plausible case where both $C^{ij} < 0$ and $C^{ii} < 0$. In order to rule out the possibility of a complete specialization irrespective of the level of market development, we further assume that $g_i(q_i, Q_{-i}) > 0$ at $Q_{-i} = 0$, $q_i \simeq 0$. Note that in the case where the positive cross externality $(-C^{ij} > 0)$ out weighs the rising quality verification costs $(M_i^j > 0)$, the net externality effect is positive, i.e., $\frac{\partial g_i}{\partial q_j} > 0$. In order to allow for the possibility that the positive cross externality may wear out with an increase in trade volume at higher level of market development, we assume that $C^{ijj} > 0.^{17}$ Under these assumptions, we can show with simple differentiation that $g_i()$ is a concave function of Q_{-i}. The decoupling of trading of q_i from all other commodities (Q_{-i}) occurs if net externality generated by pooling trade of these commodities is non-positive at $q_j = 0, \forall j \neq i$, i.e., if $-(C^{ij} + M_i^j) \leq 0$. If we define marginal benefit from an increase in trade volume as $(-C^i)$, the assumptions that $C^{ij} < 0$ and $C^{ijj} > 0$ *for all* $j \neq i$ im ply that the marginal benefit is increasing at a decreasing rate with an increase in the volume of trade of all other commodities. We summarize the above discussion in the following propositions.

Proposition 1: *Given that (i) the marginal benefit from an increase in volume of trade $(-C^i)$ is increasing $(-C^{ij} > 0)$ but at a decreasing rate $(-C^{ijj} < 0)$ for all $j \neq i$, (ii) the cost of quality verification is a rising $(M_i^j > 0)$ and convex $(M_i^{jj} > 0)$ function of volume of all other commodities $j \neq i$, and (iii) the net externality function $g_i(q_i, Q_{-i}) > 0$ at $Q_{-i} = 0$, then $g_i(q_i, Q_{-i})$ is a concave function of Q_{-i}. Moreover, for any $q_i > \hat{q}_i$, where $\hat{q}_i$ is such that $\left(C^{ij}(\hat{q}_i, 0) + M_i^j(0) \leq 0, \forall j \neq i\right)$, there is complete specialization in q_i.*

Compared with the cross externality effects, the relationship between own externality effect and market development is different because such effects are likely to be present even in highly developed markets (as in Demsetz (*op cit*)). Also, even with own externality effects, one can expect diseconomies to set in eventually with an expansion in trade volume, as a trader needs to delegate decision making and monitoring responsibility with the attendant incentive problems. We present these insights in the form of a proposition below.

---

[17]We identify the level of market development with the volume of trade.

Proposition 2: *Given that the marginal benefit from an increase in volume of trade $(-C^i)$ is increasing $(-C^{ii} > 0)$ but at a decreasing rate $(-C^{iii} < 0)$ for all i, and the net externality function $g_i(q_i, Q_{-i}) > 0$ at $q_i \simeq 0$, then $g_i(q_i, Q_{-i})$ is a concave function of q_i.*

Observe that both own and cross externality effects are subject to important threshold effects, especially at the low levels of marketable surplus, due to the pure fixed costs (F) involved in marketing. Also, it follows from the concavity of $g_i()$ that the cross externality effects are stronger at relatively low level of market development when the volume of trade is small.

Section 3: Econometric Specification

(3.1) An Econometric Model of Household's Sales Decision

In the preceding section, we developed the relationships between producer's price of a commodity and the volume of (*i*) trade of that commodity itself and (*ii*) trade of all other commodities. In this section, we embed these relationships in a standard econometric model of the sales decision of a farm household. [18] The relevant optimization of a farm household involves a two stage recursive process. In the first stage, land allocation and planting decisions are made based on the expected prices which are primarily determined by the last period's actual prices. In the second stage, sales decisions are made taking output as predetermined, and the volume of sales depends on the current producer prices offered by the trader and on other household and village characteristics. The sales decision of a household (h) for a given commodity i can be described by the following equation:

$$Y_{ih} = \beta'_{i1} X_h + \beta'_{i2} X_r + \pi_i P_i + \epsilon_{ih} \tag{4}$$

Where $i = 1, 2, \dots$, Y_{ih} is the sales of commodity i by household h, β_i and π_i are parameters,

---

[18]From the discussion on the price formation in the preceding section, it seems natural to estimate a (producer) price equation (equation (3)) to detect the externality effects. However, in our data set, it was not possible to match the consumer and produce prices due to differences in units and quality, which renders this approach non-feasible. The second option is to estimate an equation for the land price which reflects the expected producer prices because of capitalization. But this approach is fraught with two important difficulties. First, the land price commands a premium due to its collateral value in the credit market which dilutes the link between the producer prices and the land price. Second, the land price may not reflect the producer price faithfully enough when the land market is thin or virtually nonexistent. These problems seem to be important in case of Bangladesh. We focus on the sales at individual household level which avoids the problems associated with a land price equation discussed above.

X_h is a vector of control variables representing household and farm characteristics, X_r is the vector of village/region level characteristics, and P_i denotes the producer price in the local market that the household has accesses to, and ϵ_{ih} is the error term. Utilizing equation (3) to substitute for P_i, we have:

$$Y_{ih} = \beta'_{i1} X_h + \beta'_{i2} X_r + \eta_i \tilde{P}_i + \psi_i d_i(t_u, w) + \phi_i g_i(q_i, Q_{-i}) + \epsilon_{ih} \tag{5}$$

Where $\eta_i \equiv \pi_i \mu_i$, $\psi_i \equiv \pi_i \nu_i$ and $\phi_i \equiv \pi_i \lambda_i$. To allow for the differences in the own and cross externality effects at different levels of market development, and for tractability in estimation, we decompose $g_i()$ into two separable parts as:

$$g_i(q_i, Q_{-i}) = s_i(q_i) + e_i(Q_{-i}) \tag{6}$$

Where $s_i(q_i)$ represents the own externality effects, and $e_i(Q_{-i})$ the cross externality effects. Since there is no theoretical guidance in our framework about the functional specification of $d_i(t_u, w)$, we adopt a linear function, which gives us the following form for the sales equation:

$$Y_{ih} = \beta'_{i1} X_h + \beta'_{i2} X_r + \eta_i \tilde{P}_i + \psi_{i1} t_u + \psi_{i2} w + \phi_i(s_i(q_i) + e_i(Q_{-i})) + \epsilon_{ih} \tag{7}$$

(3.2) Econometric Issues and Estimating Equation

If individual households are small producers, and hence are price takers in the market, then village level total sales of commodity i and of all other commodities can be used as explanatory variables in the household level sales regressions for commodity i to identify the own and cross externality effects respectively.[19] However, several econometric issues including endogeneity and omitted variables complicate the identification of these effects. For example, both the average sales by households and the village level sales are typically higher in villages which are endowed with better infrastructure.[20] Hence omission of variables like infrastructure which may affect

---

[19]This is similar to the argument made by Rauch (1993) that since a worker is a price taker in the labor market, average human capital in a city can be used to identify the positive human capital externality in individual wage regressions.

[20]The existing evidence on Bangladesh show that both producer price and marketed surplus are higher in villages

11

both individual and village level sales positively can potentially cause serious upward bias in the estimates of own and cross externality effects. In order to control for the level of development, we include a number of village level variables such as village population, median household expenditure, a number of dummies denoting whether there are markets within the village, whether the village has electricity, telephone connection, paved roads and formal banks. We also included percentage of operated land irrigated in the village so as to control for any supply shifts that may affect both individual and village level sales due to adoption of HYV technology. This also partially mitigates the effects of village level weather shocks (like rainfall).[21] We include regional dummies to control for regional production shocks, and use yield per acre at household level as a control for unobserved heterogeneity, including factors like household-specific and village level production shocks, and land quality differences for which data are not available. All regressions also include a set of variables depicting household and farm characteristics that may influence a household's sales decisions.

The village level sales variables (q_i and Q_{-i}) could also be spuriously correlated with sales by the household (q_{ih}) if there are very few sellers in a village.[22] Thus, instead of using aggregate village level sales, we take out the sales by the household itself from the village level sales and normalize by the number of producers. The per capita[23] sales of a given commodity i and that of all other commodities are denoted as $\tilde{q}_i$ and $\tilde{Q}_{-i}$ respectively. Using these adjusted variables, we can rewrite the own and cross externality functions of equation (6) as $s_i(\tilde{q}_i)$ and $e_i(\tilde{Q}_{-i})$ respectively. An important problem in estimation of the externality effects arise from the fact that, even after controlling for all the effects discussed in the previous paragraph, the per capita sales variables are likely to suffer from endogeneity due to simultaneity between own sales and sales by others in the village. To address this problem we use instrumental variables and employ a two-stage approach to the estimation. In addition to the other exogenous and predetermined

---

with relatively developed infrastructure. For example, Ahmed and Hossain (1990) report that paddy and rice prices are 2 percent and 6 percent higher respectively in villages with developed infrastructure. The marketed surplus depending on the landownership groups are as follows. For less than 0.5 acre land ownership group, the marketed surplus is 52 percent (developed infrastructure) and is 14 percent (underdeveloped infrastructure).

[21]It is important to note here that the survey year 1995-96 was NOT subject to flood or drought in Bangladesh.

[22] Moreover, there could be villages in the sample which do not sell (production for subsistence only) a given commodity. If such cases are not insignificant in a data set, both q_{ih} and q_i might be significantly censored resulting in near-perfect fits.

[23]Throughout this paper per capita implies average over the producers.

variables, the following are used in the first stage regressions as instruments for the average sales by others in the village : (i) average household size and composition, (ii) average farm size and input uses, and (iii) average per acre yield, where the *average is taken over all other households in the village*, i.e., when estimating the sales equation for household h_1, the average is over all $h \neq h_1$.[24] Note that (i) the average farm size, and (ii) the average household size and composition of *all others* in the village are arguably exogenous with respect to the sales decision of a given farm household and thus can be considered as identifying instruments. Also, observe that the yield and input use qualify as instruments because production can be treated as predetermined, given the two-stage sequential optimization by a farm household. In addition, the household composition variables of *any given household* (like share of adult, average year of male education) can also be treated as exogenous for the sales decision of *that very household* in a given year.

Although $s_i(\tilde{q}_i)$ and $e_i(\tilde{Q}_{-i})$ functions are likely to be concave in their arguments, the existence of threshold effects makes it difficult to approximate their curvature with a simple quadratic specification of the functional form. Hence we utilize a semi-parametric approach to identify the functional forms of both $e_i(\tilde{Q}_{-i})$ and $s_i(\tilde{q}_i)$. Notice that a fully non-parametric estimation in this case is both computationally expensive and subject to the curse of dimensionality, as there exist a large number of regressors besides $\tilde{Q}_{-i}$ or $\tilde{q}_i$. The semi-parametric method suggested by Robinson (1988) also involves running a large number of bivariate kernel regressions.[25] Instead of using a fully semi-parametric approach, we utilize a much simpler approach based on dummy variables (see Cosslett, 1991). Taking discrete approximation, the function $e_i(\tilde{Q}_{-i})$ can be rewritten as:

$$e_i(\tilde{Q}_{-i}) = \sum_{j=1}^{l} \theta_j \omega_j \tag{8}$$

where ω_j is a dummy, θ_j is the parameter to be estimated and l is the total number of dummies. To approximate $e_i(\tilde{Q}_{-i})$, the entire domain of observed $\tilde{Q}_{-i}$ is divided into intervals and each ω_j

---

[24]The first stage regressions also include a set of dummies indicating village level infrastructure and 7 regional dummies.

[25]The semi-parametric approach á la Robinson(1988) will require kernel estimations of $E(Y|\tilde{Q}_{-i})$ and $E(X_j|\tilde{Q}_{-i})$ for all j explanatory variables excluding $\tilde{Q}_{-i}$ at the first stage. In the second stage two more kernel regressions are needed to determine the parametric and non-parametric parts of the model.. The estimation of the kernel regressions in our case is especially complicated because most of the dependent variables are censored and the explanatory variables include a large number of dummies. As the kernel estimation technique for discrete choice models, censored and ordinary regression models are different, fully semi-parametric estimation of each equation would require combination of different kernel regression techniques also.

takes the value of unity if it belongs to a certain interval and zero otherwise. We define 20 such dummies, and include 19 of them in the regression as each regression also contains an intercept term. Similarly, we defined 20 dummies (denoted as v_j, $j = 1, .., 20$) over the entire domain of $\tilde{q}_i$ and include 19 of them in the regression:

$$s_i(\tilde{q}_i) = \sum_{j=1}^{k} \xi_j v_j \tag{9}$$

Now substituting equations (8) and (9) into equation (7), we have the following estimating equation:

$$Y_{ih} = \beta'_{i1} X_h + \beta'_{i2} X_r + \eta_i \tilde{P}_i + \psi_{i1} t_u + \psi_{i2} w + \phi_i \sum_{j=2}^{k} \xi_j v_j + \phi_i \sum_{j=2}^{l} \theta_j \omega_j + \epsilon_{ih} \tag{10}$$

which can be estimated consistently using appropriate estimation technique given that k and l are fixed. Note that the finer are the dummies the better will be the approximation of $e_i(\tilde{Q}_{-i})$ and $s_i(\tilde{q}_i)$. However, such finer approximation is achieved at the cost of roughness of the estimated parameters $\hat{\theta}_j$ and $\hat{\xi}_j$. To obtain smoothed estimates $\hat{e}_i(\tilde{Q}_{-i})$ and $\hat{s}_i(\tilde{q}_i)$, we follow the two-step procedure suggested by Jacoby (2000). In the first step, an appropriate estimator (see the discussion below) is used to estimate the parameter vector in equation (10). We calculate $\sum_{j=1}^{l} \hat{\theta}_j \omega_j$ for each observation utilizing the estimated parameters. In the second step, $\hat{e}_i(\tilde{Q}_{-i})$ is estimated by running a simple kernel regression of $\sum_{j=1}^{l} \hat{\theta}_j \omega_j$ against $\tilde{Q}_{-i}$ using locally weighted scatterplot smoother (LOWESS). We follow a similar procedure to obtain the smoothed estimate of $s_i(\tilde{q}_i)$.

There are alternative econometric approaches one can follow to estimate the parameters of the sales equation (10). Since there is significant censoring in the data due to non-participation of the households in the market, and heteroscedasticity is an important problem in the cross-section data, Tobit is likely to over-estimate the (slope) parameters, while OLS (with standard errors corrected for clustering effects) is likely to under-estimate them (for a lucid discussion of alternative estimators, see Deaton, 1997).[26] So when both of these estimation methods are employed, one can provide with bounds for the estimated values of the parameters. Another

---

[26]It is important to emphasize that we use instruments and employ a two-stage procedure to correct for endogeneity biases in both Tobit and OLS regressions.

option is to use Censored Least Absolute Deviation (CLAD) (Powell, 1984) for estimation of the parameters which is free of distributional assumptions and is expected to give better estimates, compared to both Tobit and OLS. However, as we discussed above, endogeneity (simultaniety) is likely to be a significant problem in estimating the sales equations, and thus an instrumental variables approach is necessary to tackle the problem. Unfortunately, not much is known, to our knowledge, about the properties of CLAD when instrumental variables are used, which renders CLAD unsuitable for our purpose.[27] Since our basic objective is to see if there is any evidence of the externality effects in the data due to increasing returns to marketing, a bounds approach seems a sensible route which we follow here.

Section 4: Data and Descriptive statistics

The data come from the 1995/96 Household Expenditure Survey of Bangladesh, a nation wide representative households survey conducted periodically by the Bangladesh Bureau of Statistics. A two-stage stratified random sample of 7420 households were drawn from 371 primary sampling units (PSUs). A separate community questionnaire was administered in a subset of 252 rural PSUs generating much of the community level data utilized in our study.

The household questionnaire collected detailed information on a household's food and non-food expenditure, income, education and other household characteristics. The survey included a module where information on agricultural production, home consumption and sales were collected for 27 different crops. Of these 27 crops, we focus on only three broad groups: rice (both high yielding varieties (HYV) and local varieties), vegetables, and fruits. The survey provides information on input uses (expenditure on fertilizer) and size of the operational holdings. In addition to the farm characteristics, we include household characteristics such as household size, composition, average years of education for male and female adults as explanatory variables. As the consumer prices at relevant destination markets are not available in the data set, we control for them with a set of regional dummies.

[REFER TO TABLE 1]

---

[27]We note that when CLAD is employed for estimation using the instrumental variables, the parameter estimates are, in general, very close to the estimates obtained by 2SLS. Moreover, the shapes of the own and cross externality curves from nonparametric estimation remain essentially the same as the ones reported here. The results of CLAD estimation are available on request.

Descriptive statistics are reported in Table 1. Nearly 81 percent of 4980 rural households are engaged in crop production.[28] The predominance of rice cultivation is evident as about 78 percent of the farmers produce some rice. Market participation rate is fairly high with about 75 percent of the farmers selling some output in the market. However, there exist wide variations in the market participation rates among farmers producing different crops. The market participation rates are higher for rice compared with vegetables and fruits. Average sales by a producer is highest for rice, about taka 5400, and is less than tk.1000 for vegetables and fruits.

The village level summary statistics also point to the predominance of rice both in production and sales. Although a smaller percentage of production (29 percent) of rice is sold in the market, its market appears to be thicker than other crops. Both mean and median sales of rice exceed that of any other crops. These variations in the market thickness of different crops along with variations in the market participation of households even within a single crop category provide an excellent opportunity to test the externality effects in trading of different crops.

Section 5: Empirical Results

In this section, we present the estimates of the household's sales equations for rice, vegetables and fruits. The dependent variable is the logarithm of quantity of commodity i sold by household h.[29] As noted before, we use instruments to tackle potential endogeneity problems in the estimation of the own and cross externality effects. The first stage regressions for instrumental variable estimates show that the instruments have high explanatory power, as the F tests for joint significance of the instruments have a P-value of 0.00 in all of the first stage regressions.[30]

[REFER TO TABLE 2]

The results of the semiparametric estimates of the sales equations are presented in Table 2. The estimates of the parametric part suggest that, among the household and farm characteristics, household size, farm size and yield per acre are the major determinants of household's sales decisions. The wage rate has a consistently negative sign across the sales equations for all three

---

[28]About 5038 households are rural but IDs of three PSUs in the household data could not be matched with that of PSUs reported in the community data forcing us to drop around 60 observations.

[29]Since there is censoring, and natural log of zero is undefined, we define the dependent variable as ln(quantity sold+1). In what follows, we use the phrase 'logarithm of quantity of i' to denote $\ln(q_i + 1)$.

[30]The results of first stage regressions are omitted for the sake of brevity and are available on request.

crop groups, which confirms the hypothesis that a higher wage increases the costs of a trader. Consistent with the á priori expectations, the Tobit estimates are, in general, numerically larger than those from TSLS.

The Wald tests of joint significance of the dummies capturing the own externality effects show strong evidence of own externality effects across all three crop groups; the null hypothesis of no own externality can be rejected in all cases with a P-value of 0.00, except for the TSLS regression for rice where the null is rejected with a P-value of 0.04. The evidence on cross externality is mixed. According to the Tobit estimates, cross externality effects are statistically significant for all three crops. However, the TSLS estimates indicate that it is insignificant for rice (P-value 0.35), marginally significant for fruits (P-value 0.18) but significant for vegetables (P-value 0.09) (see Table 2).

[REFER TO FIGURES 1 AND 2]

To analyze the pattern of non-linearity in the externality effects, we plot the non-parametric 2SLS estimates of the own externality $(s_i(\tilde{q}_i))$ and cross externality $(e_i(\tilde{Q}_{-i}))$ functions along with their confidence intervals in Figure 1 and Figure 2 respectively.[31] The estimated own externality curve, $\hat{s}_i(\tilde{q}_i)$, for rice show that it is monotonically upward sloping.[32] Although there is no evidence of significant non-linearity, the curve is mildly concave indicating that the strength of own externality effect weakens at higher level of trade. For fruits, the own externality curve is quasi concave, indicating that there is important threshold effects in operation. At very low level of sales there is little or no evidence of any own externality effect, but the effect picks up strongly after sales passes a threshold. Vegetables by far display the most non-linearity; the own externality curve is convex up to a point and then it becomes concave. The own externality effect is negative at lower levels of trade and then increases up to a point before tapering off to some extent at higher levels of trade. As discussed before, such negative own externality effects for vegetables is primarily due to the effects of supply shifts on the local market price. This

---

[31]The shapes of the curves remain essentially same when Tobit estimates are used instead.

[32]Note that each of the regression includes an intercept term and hence for normalization we dropped one dummy ($\theta_1 = 0$ for dummies ω_j capturing the spline of $e_i(.)$ and $\xi_1 = 0$ for v_j defining the spline of $s_i(.)$). Therefore the estimated functions are in fact $\frac{s_{ij}}{s_{i1}}$ and $\frac{e_{ij}}{e_{i1}}$ respectively where $j = 2...k$. Even if we drop the intercept term, identifications of both θ_1 and ξ_1 are not possible. What matters for our analysis is the shape of each of the functions. For a sense of numerical magnitude of the externality effects, we present the elasticity estimates in the following sections.

means that the producer price is determined by market clearing at the local level, which in turn implies that there is a meagre marketable surplus for the village as whole and the local markets are not integrated with the urban markets. So a statistically and numerically significant negative own externality indicates that the vegetables markets in villages with low levels of marketable surplus might be caught in underdevelopment trap, as the marketing intermediaries are unable to recover the fixed costs involved (the storage and transport costs are much higher for perishable commodities like vegetables). The weakening of own externality at a high level of trade, on the other hand, may be due to agency problems in trading as the intermediary has to delegate decision making and decentralize operations when the scale of trade grows beyond a point.

The cross externality functions plotted in Figure 2 show that, for rice, there are no significant evidence of any cross externality effects as the curve is nearly a horizontal line with few minor bumps. The absence of any significant cross externality effect for rice, however, is not surprising. The current consensus among the observers of rural markets in Bangladesh is that the rice market is by far the most developed one, and thus it is only natural that a feature of relatively undeveloped markets like cross externality will be absent from a developed market. The cross externality curve is concave shaped for fruits; there seems to be significant positive cross externality effects at low levels of trade which yields to the diseconomies of scope after a threshold is reached. In case of vegetables, the cross externality curve seems to be flat up to a point after which it has a negative slope indicating the onset of diseconomies of scope. An apparently plausible alternative explanation of the negative cross externality effect for fruits and vegetables is that it is due to crowding out in production that results from fixity of land. For example, as more land is allocated to other crops (rice plus fruits), less is available for planting vegetables. However, observe that such crowding out effects are not likely to be important in our analysis, as we exclude a number of crops and the adding up constraint in land allocation is not relevant for our case.

Estimates of Elasticities

While the graphs of the nonparametric functions of the own and cross externality effects are excellent tools for identifying the shapes of the relationships, they do not provide us with any sense of the numerical magnitudes of these effects. In this section, we report the estimates of elasticities of own and cross externality effects for different quartiles of households sorted according

18

to the level of sales. The elasticities of household sales with respect to the per capita sales of the commodity itself (own externality) and of all other commodities (cross externality) by all other households in the village are calculated using the estimated $e_i(\tilde{Q}_{-i})$ and $s_i(\tilde{q}_i)$ functions. For the elasticity estimation, we divide the entire domain of the explanatory variables, log of $\tilde{Q}_{-i}$ and log of $\tilde{q}_i$, into five intervals each containing approximately 20 percent of the observations. Next we estimated a straight line spline through the mean of two consecutive intervals. The elasticity is then estimated as the slope of the spline. The estimated elasticities are presented in Table 3.

[REFER TO TABLE 3]

The pattern of the elasticity of own externality effect varies widely across different crop groups. The magnitude of the elasticity is the highest in the first quartile for rice, and then it declines monotonically (Tobit estimates) or remains constant (TSLS estimates). The elasticity is monotonically increasing for both vegetables and fruits according to the estimates from TSLS, while the Tobit estimates indicate that there are non-linearities in the relationships, particularly for fruits. If we focus on the relatively conservative estimates of the TSLS regressions, the evidence indicate that a doubling of per capita sales of rice by all other households in the village increases the total sales of rice by a given household by 47 percent if it belongs to a village in the first quartile, and by 38 percent if the household belongs to any of the other three quartiles.[33] For vegetables, the elasticities for the first two quartiles are negative in both TSLS and Tobit estimates (-0.26 (TSLS), -0.49 (Tobit) for the first quartile, and -0.18 (TSLS) and -0.35 (Tobit) for the second quartile), indicating an initial phase of diseconomies. According to TSLS estimates, this initial phase of diseconomies is eventually overcome in the third quartile (elasticities are 0.10 for third quartile and 0.27 for fourth quartile). According to the Tobit estimates, this initial phase of diseconomies weakens significantly in third and fourth quartiles but does not disappear entirely (elasticities are -0.04 (third quartile) and -0.01 (fourth quartile)). For fruits, the own elasticity is small in the first quartile (0.10 (TSLS)), but increases dramatically with the volume of sales (0.49 for fourth quartile(TSLS)). Note that the elasticity estimates in case of fruits for different quartiles obtained from the Tobit are consistently much higher than the TSLS estimates.

---

[33]It is interesting to note that, according to the Tobit estimates for rice, the own externality effect is very high (0.89) in first quartile but dies down very fast at higher levels of trade; the elasticity for the last quartile being only 0.29.

The elasticity estimates for cross externality effects show a monotonically declining (algebraically) trend in case of fruits with a positive effect for the first one or two quartiles, depending on the estimator used. The elasticity estimates for the last two quartiles are, however, significantly negative, irrespective of the estimation method employed. Except for the second quartile where elasticity estimates are rather small (-0.02 (TSLS) and 0.05 (Tobit)), the effects are large in magnitude for all other quartiles. For example, concentrating on the TSLS estimates, a doubling of per capita sales of all other commodities by all other households in the village tend to *increase* the total sales of fruits by a typical household by 11 percent if the village level surplus is low enough to be in the first quartile. In contrast, the total sales of fruits of a typical household *decreases* by (*i*) 28 percent if it belongs to a village in the third quartile, and (*ii*) 49 percent if the sales volume in the village is high enough to be in the fourth quartile. The elasticity estimates for the cross externality effects for other two crop groups, i.e., rice and vegetables do not follow any monotonic pattern. For rice, consistent with the flat shape of the nonparametric curve, the magnitudes of the elasticity are very small across second and third quartiles and is large only for first quartile. The important thing to note in the elasticity estimates for vegetables is that the cross externality is negative for the first and fourth quartiles. In contrast, for the second and third quartiles, the estimates are positive and numerically significant, especially according to the Tobit estimates, providing strong evidence of pooling of other commodities to achieve economies of scale in this range of overall commodity trade.

Are the Results due to unobserved heterogeneity?

In the above, we presented evidence of strong own externality effects for all three crop groups: rice, vegetables, and fruits. The vegetables exhibit the strongest cross externality effects, especially at medium volumes of trade, among three crop groups and there are weak evidence of its operation, only at low volume of trade, for fruits. The evidence on rice suggest a virtual absence of cross externality effects.[34] A more skeptical among us might still have reservations about the results on the ground that we did not have adequate controls for heterogeneity at household (like soil quality) or village (weather shocks, pest attacks) levels in our data set. A strong counterargument is that any heterogeneity in production, both at household and village levels, should be

---

[34]Recall that the overall cross externality effects are insignificant for rice according to the TSLS estimates.

adequately controlled for by the per acre yield variable. In this section, we provide additional evidence to support the conclusion that the correlations between individual sales and the village level sales are, in general, not driven by unobserved heterogeneity in the production side. We concentrate on the sub-sample of households who produce a commodity but do not sell anything in the market. If the increasing returns in marketing due to fixed costs and thick market effects are the real driving forces behind the correlations between a given household's sales and the average sales of its neighbors, then such correlations will be absent for the sub-sample of households who do not sell anything in the market. Observe that the preceding argument encounters a difficulty because the sales of a household is zero, by definition, if it does not participate in the market, and we can not estimate a sales equation to test the validity of the argument. However, a related argument can still be made focusing on the production of such self-sufficient households. Consider the case where some unobserved household level production characteristics rather than the economies of scale in marketing are the driving force behind the observed correlations between the sales of an individual farmer and that of the neighbors in a village. Such correlations in the production side implies that the production of even a self-sufficient farm household will be correlated with the production of , and hence with the sales of, its neighbors in the village. So the production of the non-participants in the market can be used as a dependent variable to test the hypothesis that the correlations are not due to increasing returns to marketing, rather due to some omitted correlated production characteristics or shocks. The results are reported in Table 4 where the dependent variable for both the sub-sample and the full sample is the logarithm of production and the estimation is done using OLS with standard errors corrected for the clustering effects.

The results, in general, support the conclusion that the correlations between the sales of an individual household and the average sales of its neighbors are not driven by unobserved heterogeneity. The evidence is very strong in case of own externality effects for rice and vegetables where the coefficients of the own externality variables are both numerically and statistically insignificant for the sub-sample of non-market producers, but are markedly larger in magnitude and statistically highly significant for the full sample. For fruits, however, the evidence indicate that unobserved production heterogeneity might be important (the coefficient in the sub-sample of non-market producers is numerically and statistically significant). But observe that the mag-

21

nitude of the coefficient in the full sample (0.09) is 50 percent higher than the estimate from the sub-sample (0.06). So it is unlikely that the own externality effect in case of fruits is exclusively due to unobserved heterogeneity.

The evidence on cross externality effects show that, in case of rice, there is no significant difference between the coefficient estimates from the full- and sub-sample, thus confirming our earlier result that cross externality effects are virtually absent from rice sales. For vegetables, on the other hand, the evidence clearly indicate that the cross-externality effect is not driven by unobserved production heterogeneity (the coefficients are: for sub-sample -0.003 ($t = -0.12$) and for full sample -0.04 ($t = -1.57$)). Similar results are obtained for cross-externality effect in case of fruits, where the coefficient for the full sample -0.06 ($t = -1.73$) is much larger than the corresponding coefficient for the sub-sample of non-market producers -0.01 ($t = -0.35$).

The above discussion leads us to conclude that, except for the case of own externality effect for fruits, our results are not likely to be due to unobserved heterogeneity.

Conclusions:

Using a simple model of a marketing intermediary in the presence of increasing returns to marketing due to thick market effects and fixed costs, we provide evidence on pecuniary externalities at the producer level sales decision in the rural markets of Bangladesh. The evidence, first of its kind, show that there are strong own externalities stemming from the expansion of the scale of trading of a commodity itself, and also cross externalities from trading of different commodities. The evidence on the rice market show that there is strong own externality effects, but no significant cross externality effect, implying that rice marketing is specialized and the market has attained a level of maturity. There are evidence of a negative own externality like effect in the vegetables markets in villages with low or moderate marketable surplus. These vegetables markets might be caught in an underdevelopment trap in that they are not served by long-range marketing intermediaries, and hence the markets are essentially small and isolated local markets. At medium volume of trade, there is also strong cross externality effects in the case of vegetables. The significant cross externality effects suggest that the intermediaries dealing with vegetables, particularly in moderately developed vegetables markets, still need to pool other commodities to reap the increasing returns to marketing. Although the evidence in case of fruits indicate that

they are serviced by formal marketing intermediaries, the level of development of these markets is also low. It seems that vegetables and to some extent, fruits markets are characterized by a lack of specialization in marketing.

The results reported in this paper have important implications for the design and placement of poverty alleviation projects and for policies to accelerate the development of rural markets. An important implication of the findings reported in this paper is that an otherwise identical farm household is expected to get, on an average, lower prices for its produce if located in a relatively low income, low surplus, and hence less commercialized region . This might result in geographic pockets of subsistence dominated economy with high incidence of poverty. The extent of development of markets in a particular geographic region, from this perspective, is a local public good for individual households located in that very region.[35] Another important implication of the results reported here is that market deregulation and liberalization may not always generate spontaneous and cumulative forces of market development. For example, our analysis and evidence indicate that certain markets might be trapped in a low level of development due to factors like low marketable surplus, and a lack of storage and transportation facilities, as they constrain the ability of a marketing intermediary to reap the economies of scale and might create a coordination failure at the farm level sales decisions. More importantly, one would, in general, observe *uneven* development of rural markets for different commodities and across different geographic locations even if the same generic policies of deregulation and liberalization are implemented across the country. Although necessary, deregulation and liberalization may not be sufficient for development of rural markets. The recent evidence on the rural markets in Sub-Saharan Africa show that the policies of deregulation and liberalization implemented during the 1980s have improved the efficiency of marketing, but have largely failed to generate a spontaneous and sustained dynamics of market development (see, for example, Kherallah et al. (2000), Jerome and Ogunkola (2000)). Although development of a market is best viewed as a highly complex path dependent evolutionary process, the results of this paper indicate that the increasing returns to marketing and the resulting externalities at the farm level might be important in shaping that process in the rural areas of developing countries.

---

[35]While free mobility of labor can, in principle, mitigate the effects of geographic poverty traps, the underdevelopment traps in our case can persist due to the area specificity of agricultural land.

References

(1) Abbot, J.C. (1987): *Agricultural Marketing Enterprises for the Developing World*, Cambridge University Press, Cambridge, New York.

(2) Aoki, M and Y. Hayami (2001) (edited) *Communities and markets in economic development*, Oxford university press.

(3) Bauer, P and B. Yamey (1954): "The economics of marketing reform," *The Journal of Political Economy*, 62, 210-235.

(4) Belshaw, C.S (1965): *Traditional Exchange and Modern Markets*, Prentice-Hall Inc. NJ.

(5) Biglaiser, G (1993): "Middlemen as experts," *RAND Journal of Economics*, 24, 212-223.

(6) Chowdhury, N (1992): Rice markets in Bangladesh: A study in structure, conduct and performance, USAID, Dhaka.

(7) Ciccone, A. and K. Matsuyama (1996): "Start-up costs and pecuniary externalities as barriers to economic development," *Journal of Development Economics*, 49, 33-59.

(8) Ciccone, A. and R.E. Hall (1996): "Productivity and density of economic activity," *American Economic Review*, 86, 54-70.

(9) Cosslett, S. R. (1991): "Semiparametric estimation of a regression model with sampling selectivity", in W. A. Barnett, J. Powell, And G. E. Tauchen (eds.), *Nonparametric and Semiparametric Methods in Econometrics and Statistics*, New York, Cambridge University Press, 175-197.

(10) Deaton, A (1997): *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*, Johns Hopkins University Press.

(11) Demsetz, H (1968): "The cost of Transacting," *Quarterly Journal of Economics*, 82, 33-53.

(12) Diamond, P (1982): "Aggregate demand management in search equilibrium", *Journal of Political Economy*, 90, 881-894.

(13) Eswaran, M and A. Kotwal (1996): "Demand externality and industrial productivity growth in LDCs," *Journal of International Trade and Economic Development*, 5, 1-22.

(14) Gabre-Madhin, E (1999): "Of markets and middlemen: The role of brokers in Ethiopia," MSSD discussion paper no. 39, IFPRI, Washington, DC.

(15) Hayami, Y and T. Kawagoe (1993): *The Agrarian Origins of Commerce and Industry: A Study of Peasant Marketing in Indonesia*, St. Martin's Press.

(16)Hirsch, L.V (1961): "The contribution of marketing to economic development: a generally neglected area," in *The Social Responsibility of Marketing,* edited by W.D. Stevens, Chicago, IL, American Marketing Association.

(17) Hoff, K (2000): "Beyond Rosenstein-Rodan: The Modern Theory of Underdevelopment Traps," mimeo, The World Bank.

(18) Hoff, K and J. Stiglitz: "Modern economic theory and development" in *Frontiers of Development Economics: The Future in Perspective,* ed. by G.M. Meier and J.E. Stiglitz, Oxford University Press.

(19) Jacoby, H.J (2000), "Access to markets and the benefits of rural roads," *Economic Journal,* 110, 713-37.

(20) Jerome, A, and O. Ogunkola (2000): "Characteristics and behavior of African commodity/product markets and market institutions and their consequences for economic growth," CID WP#35, Center for International Development at Harvard University.

(21) Kherallah, M, C. Delgado, E. Gabre-Madhin, N. Minot, and M. Johnson (2000): "Agricultural market reforms in Sub-Saharan Africa: A synthesis of research findings," mimeo, IFPRI, Wasington, DC.

(22) Murphy, K, A. Shleifer, and R. Vishny (1989):"Industrialization and big push," *Journal of Political Economy,* 97, 1003-1026.

(23) Powell J. E. (1984), "Least absolute deviations estimation for tobit models," *Journal of Econometrics,* 25, 303-25.

(24) Ray, Debraj (2001): What's new in Development Economics, mimeo, NYU.

(25) Rauch, J (1993): "Productivity gains from geographic concentration of human capital: evidence from the cities", *Journal of Urban Economics,* 34, 380-400.

(26) Robinson, P.M.(1988), "Root-N-consistent semiparametric regression," *Econometrica,* 56, 931-54.

(27) Rodriguez-Clare, Andres (1996): "The division of labor and economic development", *Journal of Development Economics,* 49, 3-32.

(28) Rubinstein, A and A. Wolinsky (1987): "Middlemen", *Quarterly Journal of Economics,* 102, 581-593.

Table 1: Descriptive Statistics

		Unit	Median	Mean	Standard Deviation	No. of Observations
Rice	Sales	taka	575	5443	12190	3157
	As % of production	%	9	20	24	3157
Vegetables	Sales	taka	0	929	4352	2803
	As % of production	%	0	22	30	2803
Fruits	Sales	taka	0	908	4506	2635
	As % of production	%	0	26	31	2635
Total	Sales	taka	1500	7579	16008	4026
	As % of production	%	27	30	27	4026
Village Level						
Rice	Sales	taka	42265	69011	76331	249
	As % of production	%	29	29	18	249
Vegetables	Sales	taka	1890	10457	38194	249
	As % of production	%	32	34	26	249
Fruits	Sales	taka	2000	9609	25943	249
	As % of production	%	27	32	25	249
Total	Sales	taka	88398	122537	120657	249
	As % of production	%	40	39	17	249

Table 2:Non-Parametric Instrumental Variable Estimation of Household's Sales Decision

Dependent variable=log(quantity sold)		Rice				Vegetables				Fruits			
		Tobit		TSLS		Tobit		TSLS		Tobit		TSLS	
		β	t	β	t	β	t	β	t	β	t	β	t
Village level	Median expenditure	-0.66	-4.96	-0.43	-3.16	-0.01	-0.07	0.01	0.09	0.23	1.30	0.15	1.18
variables	Travel time to nearest mkt	-4.E-03	-0.49	6.E-04	0.09	0.01	1.75	0.01	1.09	-0.01	-1.49	-0.01	-0.99
	Population	3.E-05	0.82	5.E-05	1.37	-5.E-05	-1.72	-6.E-06	-0.25	1.E-05	0.29	5.E-06	0.15
	Agricultural Wage Rate	-0.53	-1.93	-0.31	-1.30	-0.50	-1.91	-0.20	-0.82	-0.58	-1.67	-0.31	-0.86
Dummy for	Bank in the village	-0.64	-0.94	-0.31	-0.49	-1.31	-1.83	-0.62	-1.34	-0.66	-0.78	-0.41	-0.57
	Market in the village	-0.24	-0.75	-0.25	-0.78	0.94	2.95	0.37	1.57	0.98	2.52	0.58	1.71
	Telephone in the village	0.26	0.65	0.06	0.18	0.67	1.65	0.20	0.55	1.03	2.07	0.60	1.42
	Electricity in the village	-0.35	-1.98	-0.11	-0.71	-0.29	-1.79	-0.07	-0.53	-0.03	-0.12	0.09	0.50
	Paved road in the village	0.33	1.91	0.19	1.17	-0.54	-2.99	-0.17	-1.14	-0.28	-1.23	-0.17	-0.95
	% of land irrigated	4.E-03	1.44	1.E-03	0.55	0.01	2.16	3.E-03	1.17	-0.01	-2.08	-4.E-03	-1.24
Household	Household size	-3.07	-11.61	-1.57	-9.88	-1.93	-7.44	-0.93	-7.57	-2.04	-6.32	-1.13	-6.22
Variables	share of adult male	-0.61	-0.97	-0.23	-0.58	-0.68	-1.11	-0.18	-0.56	-1.16	-1.57	-0.57	-1.20
	share of adult female	-0.94	-1.43	-0.43	-1.10	-0.23	-0.38	-0.11	-0.42	-1.19	-1.56	-0.61	-1.44
	share of children	2.50	5.09	1.08	3.92	1.00	2.12	0.32	1.28	-0.12	-0.19	0.03	0.09
	Av. yr of male education	-0.33	-1.80	-0.18	-1.65	-0.52	-2.81	-0.23	-2.40	-0.24	-1.06	-0.14	-1.11
	Av. yr of female education	-0.16	-0.72	-0.02	-0.14	-0.54	-2.38	-0.16	-1.69	-0.49	-1.79	-0.18	-1.18
	Yield per acre	3.45	29.44	1.92	25.99	2.38	29.75	1.27	25.28	1.45	16.57	0.90	17.83
	Farm size	3.79	39.29	2.26	38.80	2.22	26.72	1.27	22.83	1.59	15.88	1.07	16.70
	Fertilizer use per acre	-0.01	-0.96	-2.E-03	-2.59	-0.09	-1.76	-0.02	-0.66	0.03	0.58	0.03	1.15
	Share in total production	-0.34	-0.92	-0.10	-0.42	0.21	0.64	-0.24	-1.29	-0.93	-2.01	-1.01	-3.98
Constant term		-10.94	-6.70	-4.34	-3.54	-1.48	-0.99	-0.04	-0.03	-0.06	-0.03	0.75	0.43
R²/Pseudo R²		0.18		0.47		0.18		0.56		0.11		0.43	
No. of Observations		2852		2852		2505		2505		1943		1943	
Tests of joint significance of		F	P-value	F	P-value	F	P-value	F	P-value	F	P-value	F	P-value
Own Externality effect		*2.09*	*0.004*	*1.71*	*0.04*	*5.54*	*0.00*	*3.14*	*0.00*	*3.14*	*0.00*	*4.07*	*0.00*
Cross Commodity Externality effect		*2.09*	*0.004*	*1.10*	*0.35*	*2.81*	*0.00*	*1.49*	*0.09*	*1.82*	*0.02*	*1.31*	*0.18*

All regressions included a set of regional dummies also (omitted for brevity)

Note: Standard errors for TSLS are corrected for within cluster correlations in residuals due to survey design.
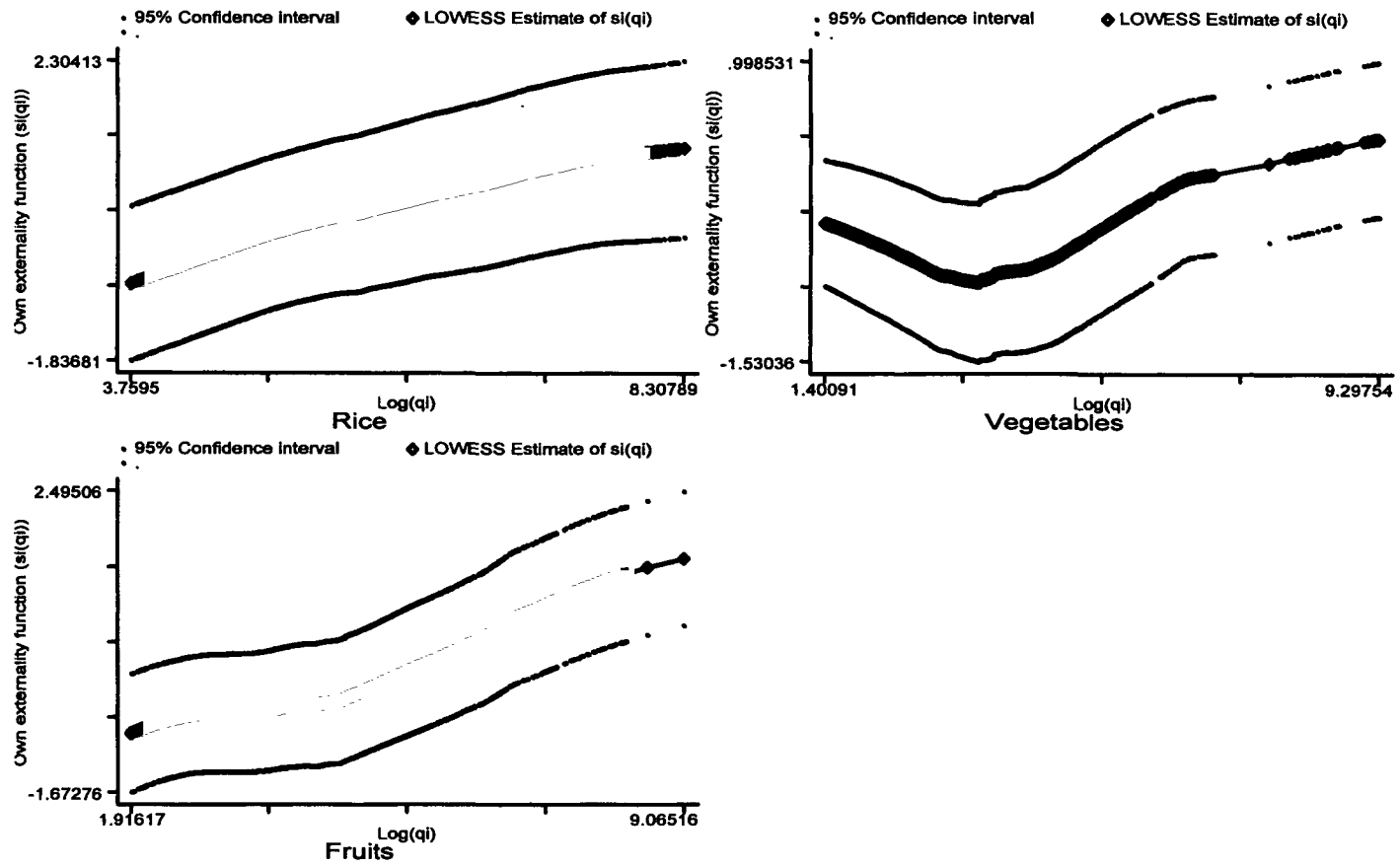
Figure 1: Own Externality
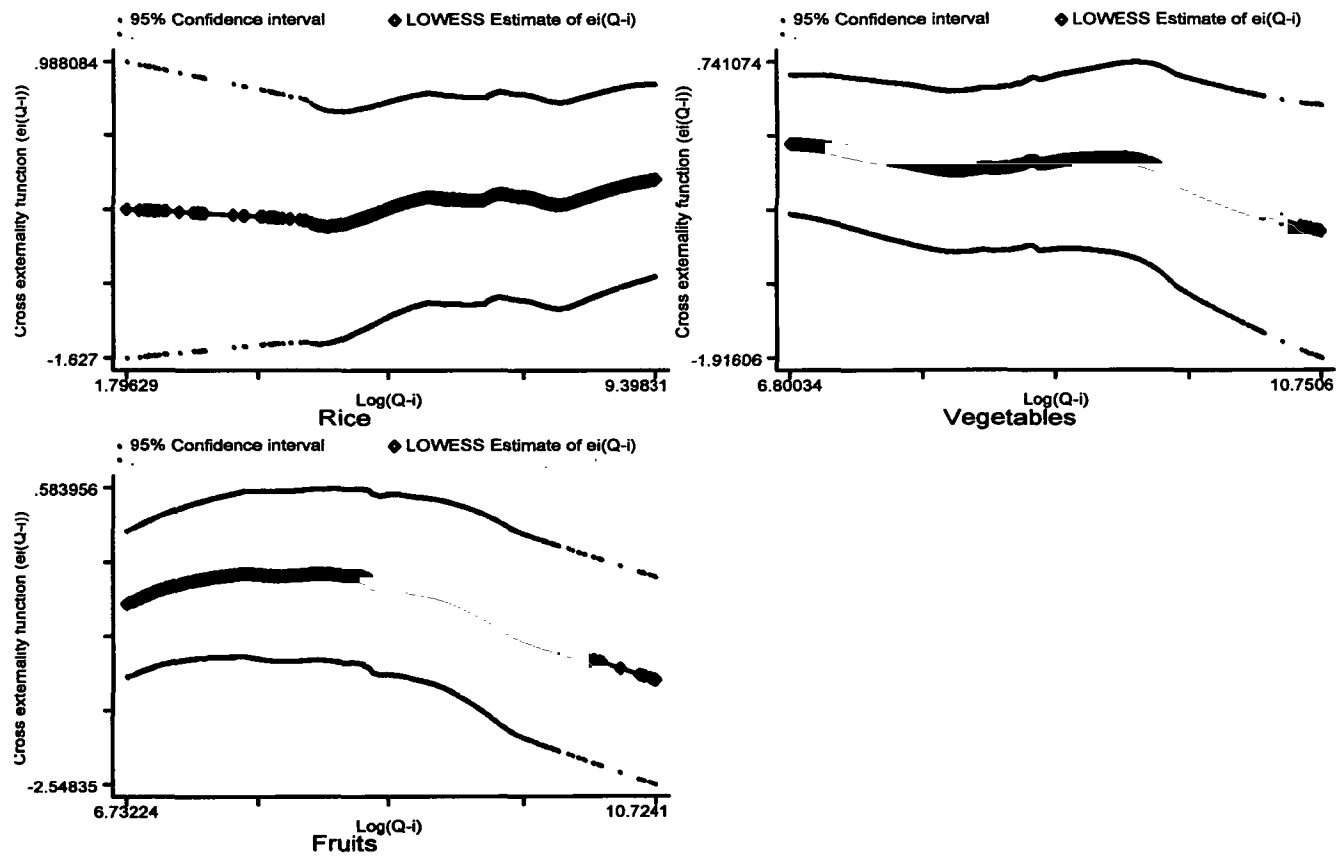
Figure 2: Cross Commodity Externality

Table 3: Estimates of elasticities at different quartile of the cross and own externality variables

		Rice		Vegetables		Fruits	
		TSLS	Tobit	TSLS	Tobit	TSLS	Tobit
Own Externality							
Quartile	1	0.47	0.89	-0.26	-0.49	0.10	0.29
	2	0.38	0.49	-0.18	-0.35	0.12	0.21
	3	0.38	0.32	0.10	-0.04	0.38	0.44
	4	0.38	0.29	0.27	-0.01	0.49	0.51
Average		*0.41*	*0.50*	*-0.02*	*-0.22*	*0.27*	*0.36*
Cross Commodity Externality							
Quartile	1	0.23	0.34	-0.20	-0.23	0.11	0.26
	2	0.00	0.08	0.04	0.14	-0.02	0.05
	3	-0.01	0.04	0.11	0.30	-0.28	-0.43
	4	0.08	0.17	-0.14	-0.11	-0.49	-0.94
Average		*0.07*	*0.16*	*-0.048*	*0.02*	*-0.17*	*-0.27*

Table 4: Parametric Estimation of Household's Production Decisions

Dependent variable =log(production)	Rice				Vegetables				Fruits			
	Full sample		Sub-Sample[1]		Full sample		Sub-Sample[1]		Full sample		Sub-Sample[1]	
	β	t	β	t	β	t	β	t	β	t	β	t
Village level Variables												
Own externality	0.05	2.42	-0.01	-0.44	0.10	6.44	0.002	0.10	0.09	5.02	0.06	2.91
Cross commodity externality	-0.03	-1.35	-0.04	-1.48	-0.04	-1.78	-0.003	-0.12	-0.06	-1.73	-0.01	-0.35
Median expenditure	0.13	3.49	0.17	3.92	0.06	1.61	-0.007	-0.17	0.10	2.12	0.06	1.14
Travel time to nearest mkt	0.00	1.84	0.002	1.41	0.00	2.33	4E-03	2.44	0.00	1.78	3E-03	1.05
Population	0.00	-2.27	-2E-05	-2.12	0.00	-0.45	2E-07	0.27	0.00	-0.49	-4E-07	-0.21
Agricultural Wage Rate	0.05	0.64	0.25	2.23	-0.06	-0.57	0.07	0.58	-0.06	-0.72	-0.04	-0.32
Dummy for												
Bank in the village	0.13	0.67	0.12	0.56	0.12	0.57	0.19	0.80	0.34	1.22	0.16	0.39
Market in the village	-0.19	-2.01	-0.03	-0.26	-0.27	-2.45	-0.32	-2.54	-0.41	-2.84	-0.38	-2.76
Telephone in the village	0.08	0.88	-0.02	-0.14	0.17	1.73	0.09	0.96	0.22	1.69	0.02	0.14
Electricity in the village	-0.01	-0.13	-0.17	-2.73	-0.01	-0.22	-0.03	-0.53	-0.08	-1.28	-0.16	-2.21
Paved road in the village	-0.09	-1.70	-0.12	-1.9	-0.04	-0.69	0.09	-1.43	-0.06	-1.09	-0.03	-0.45
% of land irrigated	0.00	-3.66	-0.002	-1.94	0.00	-4.21	-0.004	-3.35	0.00	-4.65	-0.005	-4.9
Household Variables												
Household size	0.73	13.49	0.76	10.02	0.64	9.85	0.65	7.57	0.63	9.45	0.57	6.09
share of adult male	0.14	2.81	0.07	0.94	0.03	0.46	-0.01	-0.13	0.11	1.54	0.09	0.85
share of adult female	0.11	1.87	0.14	1.61	0.24	3.70	0.28	3.42	0.18	2.31	0.26	2.49
share of children	-0.20	-7.08	-1.68	-4.36	-0.21	-5.94	-0.20	-4.20	-0.19	-4.85	-0.22	-4.16
Av. yr of male education	0.16	4.69	0.19	3.32	0.21	4.98	0.24	4.81	0.15	3.77	0.30	4.64
Av. yr of female education	0.16	3.30	0.12	1.57	0.02	0.37	-0.06	-0.98	0.17	2.99	0.08	1.01
Yield per acre	0.47	18.49	0.42	14.3	0.67	34.47	0.58	23.07	0.71	32.32	0.74	29.89
Hired labor (hours)	0.42	14.97	0.42	9.57	0.29	9.86	0.27	8.38	0.33	10.57	0.31	7.47
Seed Expenditure	0.23	12.90	0.22	11.3	0.28	15.16	0.23	12.29	0.28	15.40	0.27	11.94
Share in total production	-0.66	-8.45	-0.51	-5.28	0.11	0.81	0.29	1.66	-0.49	-3.18	0.09	0.49
Constant term	2.11	4.51	1.2	2.17	1.69	3.21	1.45	2.07	2.30	4.05	1.65	2.25
R^2/Pseudo R^2	0.70		0.61		0.76		0.65		0.80		0.78	
No. of Observations	2763		1200		2239		1171		1719		776	

Note: 1/: Sub-sample includes only those households which produce but do not sell the commodity.
All regressions are estimated using OLS. Standard errors are corrected for clustering effects.

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2820	The Privatization of the Russian Coal Industry: Policies and Processes in the Transformation of a Major Industry	Igor Artemiev Michael Haney	April 2002	V. Joseph 32155
WPS2821	Income, Wealth, and Socialization in Argentina: Provocative Responses from Individuals	Daniel Lederman	April 2002	P. Soto 37892
WPS2822	An Econometric Analysis of the International Bank for Reconstruction and Development's Creditworthiness	David Mckenzie	April 2002	C. Mendoza 80599
WPS2823	Real Exchange Rate Uncertainty and Private Investment in Developing Countries	Luis Servén	April 2002	P. Soto 37892
WPS2824	Trade Policy and Labor Services: Final Status Options for the West Bank and Gaza	Maurice Schiff	April 2002	P. Flewitt 32724
WPS2825	Demand for Imports in Venezuela: A Structural Time Series Approach	Mario A. Cuevas	April 2002	M. Geller 85155
WPS2826	Potential GDP Growth in Venezuela: A Structural Time Series Approach	Mario A. Cuevas	April 2002	M. Geller 85155
WPS2827	Learning to Export: Evidence from Moroccan Manufacturing	Marcel Fafchamps Said El Hamine Albert Zeufack	April 2002	E. Khine 37471
WPS2828	Beyond Oaxaca-Blinder: Accounting for Differences in Household Income Distributions across Countries	François Bourguignon Francisco H. G. Ferreira Phillippe G. Leite	April 2002	F. Bourguignon 31056
WPS2829	The Spatial Distribution of Poverty in Vietnam and the Potential for Targeting	Nicholas Minot Bob Baulch	April 2002	R. Bonfield 31248
WPS2830	Labor Market Implications of Switching the Currency Peg in a General Equilibrium Model for Lithuania	Lodovico Pizzati	April 2002	L. Pizzati 32259
WPS2831	Health Outcomes in Poor Countries and Policy Options: Empirical Findings from Demographic and Health Surveys	Limin Wang	April 2002	L. Wang 37596
WPS2832	Poverty and Survival Prospects of Vietnamese Children under Doi Moi	Adam Wagstaff Nga Nguyet Nguyen	April 2002	H. Sladovich 37698
WPS2833	School Choice, Student Performance, and Teacher and School Characteristics: The Chilean Case	Emiliana Vegas	April 2002	H. Sladovich 37698
WPS2834	Investor Protection, Ownership, and the Cost of Capital	Charles P. Himmelberg R. Glenn Hubbard Inessa Love	April 2002	K. Labrie 31001

	Title	Author	Date	Contact for paper
WPS2835	A Decade of Fiscal Transition	Asad Alam Mark Sundberg	May 2002	A. Panton 85433
WPS2836	Ethnic Minority Development in Vietnam: A Socioeconomic Perspective	Bob Baulch Truong Thi Kim Chuyen Dominique Haughton Jonathan Haughton	May 2002	E. Khine 37471
WPS2837	Reform, Growth, and Poverty in Vietnam	David Dollar	May 2002	E. Khine 37471
WPS2838	Economic Mobility in Vietnam in the 1990s	Paul Glewwe Phong Nguyen	May 2002	E. Khine 37471