CONTRACTING IN AGRICULTURE: EMPIRICAL EVIDENCE FROM BARLEY PRODUCTION IN UKRAINE

by

Daryna Grechyna

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Abstract

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by Daryna Grechyna

Head of the State Examination Committee: Mr. Serhiy Korablin,
Economist, National Bank of Ukraine

This paper investigates the issue of economic interaction between the participants of the contract. A typical principal-agent problem, reflected in controversial goals on the way of fulfillment of the common task, is considered on the example of malt-producing company and farms-suppliers of barley. The aim is to find crucial determinants of the quality of agents' performance, measured as a yield of barley, and to test whether contract relations lead to the increased performance.

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GLOSSARY

Agent is a party authorised to act on behalf of another party (called the Principal) to perform some task in exchange for payment or other reward (http://en.wikipedia.org).

Contract A binding agreement between two or more parties for performing, or refraining from performing, some specified act(s) in exchange for lawful consideration (http://www.investorwords.com).

Malt Grain, usually barley that has been allowed to sprout, used chiefly in brewing and distilling. As main input for beer production

Principal is a party, who authorises an Agent to act on its behalf (http://en.wikipedia.org).

Principal-agent problem arises when one party called the principal delegates authority to another party called the agent to make decisions that affect principal's welfare (Coupè, Lecture Notes).

Chapter 1

INTRODUCTION

Among the determinants of highly developed economy, strong and well-functioning contract systems availability is of particular importance. Optimal allocation of resources and rational production process organization may result in mutual gains for all participants of the contract. This paper considers determinants of optimal arrangement in agricultural sector of Ukraine, more specifically, in malting barley production. That issue is frequently neglected, especially in transition countries, where agricultural production is considered to be almost completely determined by the climate and technology. The aim is to test whether the managerial efforts, determined by the proper contract conditions, positively and significantly influence desired outcomes.

Currently the agricultural sector of Ukraine needs more attention of researchers. The gradual transformation of the farms by type of property coincides with changes in land tenure regulations, causing all process of transition to proceed painfully for farmers and economy. Investment attempts often results in unprofitable activities, with usual explanation of low level of social capital in the rural area (Chopenko, 2005). Reports about wasted sowing lands and standstill of resources, as well as overuse of machinery, or inability to manage to gather the harvest in time are quite popular in Ukrainian specialized press. More advanced farmers and large investors wish to deal with scientific approach when conducting agricultural business. However, there are only a few institutions in Ukraine, providing full scale investigation of agricultural issues. In the USA, on the contrary, there is great attention to the agriculture, including the state and

federal control, and highly developed, continuing research of related topics. Therefore, this study is expected to make some contribution to several agricultural economics issues concerning agricultural contracts specification and fulfillment, at least on the level of effective barley cultivation in the regions studied.

The paper consider principal-agent problem with the malt-producing company contracting farmers for particular output (barley), being principal, and farmers supplying barley being agents. Such contracts represent some kind of vertical integration and are assumed to improve efficiency of production and sales of output (Minot, 1986). Determination of the price, quantity and quality of final good in the forward contract, as well as investment in the production by the principal helps to "adjust supply and demand toward each other", thus leading market to equilibrium. So, contracts, in particular in agriculture, can be viewed as highly desirable and perspective components on the way of increasing total economic efficiency.

Schematically, the problem can be approximated by the following statement: The objective of the malt-producing company is to obtain a particular amount of high quality barley from the farmers. The objective of farmers is to get maximum utility (strictly dependent on profits) from farming, thus, to get high revenues with low costs (effort level). The theoretical question the principal faces is how to efficiently induce farmers to fulfill his objective.

This paper considers principal maximization problem from two sides: First, utility (determined by profits) of principal is assumed to be strictly positive dependent on the yield of barley. Thus, agricultural determinants of yield are taken into account. Second, non-agricultural characteristics of the contract, as well as personal qualities of agents (farmers) may have significant influence on their desire to work productively. Therefore, contract-related and personnel

information is examined, in order to check whether contract conditions affect the farms' performance.

The problem of available data suitability usually arises in such kind of studies. In order for the data to be consistent with the model, it should in some way take into account the parameters of production function, utility levels of principal and agents, risk-aversion, and other determinants of the particular problem examined (Garen, 1994). The paper considers significant amount of influencing variables, so it is expected to capture main effects on the dependent variable, yield in this case. Data has been taken from the statistical reports of malt-producing company, which operates in six oblasts in Ukraine. Available observations reflect descriptions of input factors, soil conditions, weather, and yield of barley, as well as personnel characteristics for 239 farms in these oblasts, with each farm operating on several fields, so, total number of observations is 582. Data set is cross-sectional for year 2005.

The paper proceeds as follows: second chapter discusses recent related literature concerning econometric yield estimation, contracting in agriculture, and economic performance of the participants of the contract, as dependent on the internal and external conditions of contract signed. Third chapter is devoted to the description of contract relations in the malting-barley industry in Ukraine. In fourth chapter the methodological base is constructed, including detailed description of the data. Results of the empirical estimations, including robustness checks, are also presented in the fourth chapter. Fifth chapter gives policy recommendations to both principal and agents, and conclusions.

Chapter 2

LITERATURE REVIEW

2.1. Theoretical Supports of Farmers Contracting

The question of agricultural sector development is crucial for Ukraine. Among the problematic tasks the farmers face now are lack of equipment, finances, and managerial skills. In addition to those, the rare use of scientific approach in agriculture aggravates the gap between Ukrainian and developed countries agricultural activities.

Different suggestions have been formulated by Ukrainian authorities how to improve situation in agricultural sector. They take the form of State Programs of Agricultural Development (e. g., "Program About Grain in Ukraine 200-2004" (Ministry of Agrarian Affairs in Ukraine, 2001), Complex Program "Prosperity through Agriculture Development" (Chopenko, 2006)), and stimulations of private investments in the agricultural sector by way of creating attractive environment for foreign and domestic investors. This is planned to be achieved by developing farmers crediting, government subsidizing and regulation through the activities of executive bodies (such as Agrarian Fund, State Reserve Fund), which are now in the process of elaboration (www.minagro.kiev.ua).

Recently there is a trend to increased interest of foreign investors in agricultural activities in Ukraine. With incorporation of own enterprises, they also try to establish own local raw materials suppliers. This causes creation of links between Ukrainian farms and producers of final manufactured and food products. The relationship typically takes a form of farms contracting and results

in financial support of the farm by the principal-producer. Minot (1986) describes contracting as an alternative to vertical integration, and as a tool for solving some problems of market imperfections (imperfect information, lack of finances or inputs, risk of entrepreneurship). The shortcoming of the full vertical integration for the case of agricultural production, according to the author, lies in the peculiarities of agricultural output and production process ("sharp seasonable fluctuations of supply, perishable goods, wide variation in quality, geographic dispersal of production"). Whereas contracts "provide advantages of vertical integration on a temporary basis". The list of advantages was well-defined by Roy (1972), and is quoted here: these are "reduced risk, relatively fixed income, reduced responsibility, access to inputs, technical assistance, reduced marketing problems, reduced need for operating capital, being 'employed' by agribusiness". So, contracts can be considered as increasing Pareto – efficiency, by dealing with some of market imperfections, though they may also cause the strengthening of the market power of the contracting principal.

Hueth et al. (2004) consider different types of integration under financial constraints. The authors derive conditions under which the farmers can 1) integrate with upstream, 2) join into cooperation, 3) use loans of investors. The crucial benchmark for any choice is revenue level, generated by agricultural production in each case.

Farms contracting, though is only on the stage on development in the countries of transition, is quite popular in the world. In USA contractual-based agricultural output has significant share of the total agricultural production (30% for year 1993 (Economic Research Service/USDA, 1994)). Moreover, the majority of contracts specify the principal's responsibility for agricultural inputs costs, which are then covered by farm output revenues, decreasing in such a way the risk of the farmer.

Zylbersztajn and Miele (2001) studied the stability of contracts on the example of wine industry in Brazil. From the authors' conclusions we can state, that more developed enterprises exhibit higher stability of contract relationship with farmers, because they face higher risk of losses otherwise.

Possible negative features of the contracts should not be neglected. Hayenga et. al (2000) in their study of contracts effect on the market competitiveness mention loss of independence by farmers-participants of the contract, with consequent output choice limitations, risk of principal's failure and "low possibilities to bargain in the spot market or for new contracts arrangements". The authors also mention increased concentration of production, and fall in the number of farms. However, I doubt whether it is a problem in terms of efficiency for Ukraine, as larger and more concentrated farms are able to use resources more productively, and economize on scale by applying available machinery for the larger area harvested. Similarly, stated by authors increased environmental pollution, as a result of contracts popularity in farming, may be put under consideration, if we assume that principal-contractor stimulates production technologies development (which is logically, as it directly influences contractor's profit).

Makdissi and Wodon (2004) develop a model showing possible negative influence of contracting on farmers. The authors compare two schemes of farmers operations: first scheme includes fully integrated firm that supply raw materials and buys farmers' output at a unique predetermined price. Under the second scheme each farmer is free to bargain own input and output prices. The paper concludes, that in the latter case the farmer's gain or loss depends on his elasticity of demand for inputs and supply of outputs, thus causing some farmers (those with low elasticities) to suffer from contracting.

Eventually, there arises a question of further perspectives of contracting. Carriquiry and Babcock (2004) try to find whether the coexistence of contracting and spot markets is possible in the future, and show that such coexistence represent a Nash equilibrium "for a wide range of parametrizations". The model they used include farmers as "upstream pricetaking input providers" and downstream, represented by "perfectly competitive market for processed products". The authors also show that if processors are able to decrease the share of spot market, they will gain at the expense of farmers.

2.2. Empirical Studies of Contracting and Barley Yield

The further discussion first concerns agricultural determinants of barley yield, and then takes into account managerial farm operation approach from the contract theory point of view, as both issues coincide in the problem considered. At the end possible econometric problems are briefly discussed.

Agricultural determinants of yield

Taking the barley production as issue, no widely accepted farm-level research concerning barley yield determinants was conducted in Ukraine. On the contrary, barley yield discussions are rather popular in the world literature. The fundamental study devoted to "barley as the world's fourth most important cereal crop, as ancient as agriculture itself" by Slafer et al. (2002) describes all issues devoted to barley production, starting from its history and ending by varieties improvements on genetic level. In particular, the authors focus on malting barley, as it is the main commercial use of the barley crop (feed from barley is less popular and cheaper (Slafer et al, 2002) and is not of the interest here, unless as an alternative use in case of low malt quality).

Among the possible determinants of barley yield, climate, soil fertility, date of sowing, nitrogen fertilizer, seeding rate and crop rotation are the most frequently highlighted in the literature. All the corresponding variables are planned to be included in the model of study in some way. However, it is worth to take into account previous conclusions for proper construction of the model and correct interpretation, as well as for comparison.

Weather, especially rainfalls have significant influence on any crop yield. Griffiths et al. (1999) regressed yield on rainfalls in the season. The other explanatory variables included time trend, reflecting technology change, and rainfalls squared, reflecting diminishing returns of rains. Cox et al. (1985) measured temperature, rains, radiation (sun activity) and farmers' management influence on the barley crop. They found all variables having negligible yield response, except rainfalls. Barley turned out to be sensitive to "excessive flooding". The conclusion: to avoid estimation bias from omitted variables, the amount of rains should be included into regression.

Droughts and high temperatures are other factors, which may cause reductions in the barley yield (Rutter and Brooking, 1994, Savin and Nicolas 1996). The mild climate of Ukraine lacks huge droughts, as a rule, however, climatic changes and more warm summer caused significant reductions in cereal crops in the recent years. So, temperature should be taken into account.

Crop rotation is useful tool for improving agricultural yield. Rotation here means cultivation of different crops in the same area at different years, which under proper alternation of plants results in better soil fertility and microenvironment. The effect of rotation on plant diseases was studied by Cook and Veseth (1991), Krupinsky et al. (2002), Krupinsky et al.(2004). Brunt (1997) showed negative interdependence of cereal crops, as they "tend to compete for

nutrients" and positive one between wheat and root crops, as the latter "fix nitrogen in the soil and raise wheat yield".

Goodwin and Mishra (2002) stress on the importance of diversification of the farm for achieving higher yields. The more diversified and the larger is the farm, the more effective rotation can be applied. Significant influence of rotation was also found by Arnberg (2002) which used dynamic model with lagged crop variables.

To avoid bias the fertilizers effect should be also taken into account in the yield estimation. For malting barley the crucial is nitrogen fertilizer, as increasing quality of yield through the grain protein content and quality through "genetic increases in total photosynthesis" (Richards, 2000). However, excess accumulation of nitrogen can result in reduction of malt quality (Cox et al., 1985). Thompson et al. (2004) showed that malting barley has traditional quadratic response to nitrogen fertilizer. The corresponding structure of variables should be applied in the model of investigation.

Other cereal yield influencing factors, according to the theory, are date of sowing and seeding rate. Hossain et al. (2003) examined winter wheat response functions depending on sowing date and found significant results. Shah et al. (2002) found "late sowing date and weed infestation as second major cause of low yield". On the base of survey of farmers the authors concluded that sowing date significantly affects seed germination and grain yield. Ben-Ghedalia et al. (1995) after studying the effect of seeding rate on the yield and quality of cereals got insignificant influence, with positive impact on yield in cases where the effect was found.

Contract Theory Determinants of Yield

Besides agricultural factors, there are significant structural, personal, and financial determinants of the agricultural yield, measured as contract performance and they will be discussed more widely below. According to Goodwin and Mishra (2002), "yield performance tends to be associated with a number of observable farm factors, such as diversification, livestock production, and size of farm operation". Also matter type of ownership (Brada, 1986, Cheng et. al (2000), Lerman and Stanchin, 2003), household structure (Botticini and Kauffman, 2000), type of the contract and contract enforcement (Bierlen et al.,1999), investments in business (Cungu and Swinnen), prices movements (Provencher, 1995a), financial aid (Bezlepkina, Bevan et. al. 1999).

Quality of output was shown to positively influence stability of the contracts on the example of wine production in Brazil (Zylbersztajn and Miele, 2001). Also, geographical location of the farm matter. The distance to the farm location in this example of perishable good turned out to be inversely related to the contract stability, which reflects negative influence of higher transportation costs.

Agricultural operations peculiarity relies in the strong dependence on land ownership by the operating agents. Huge amount of literature is devoted to sharecropping system of contracting when land is a necessary production input, involved in the form of lease (Stiglitz, 1974, Braverman and Stiglitz, 1986). Although it is not the most efficient mechanism of income distribution (Stiglitz, 1974), it handles with allocation of resources and sharing of risks in pareto-improving way under weak financial markets conditions (Braverman and Stiglitz, 1986). Extension of the Stiglitz model show other incentive features of

sharecropping system, generally agreeing that "more risky projects tend to be share-cropped" (Chiappori and Salanié, 2000). Agricultural operations always contain some stochastic probability of risk, which highly depends on the weather in the season. Thus, considering contracts based on the payment for output produced, one should take into account the tendency of risk diversification by the agents, and the volatility of their decision to harvest. Logically would be assume that harvest decision is determined by the expected price of the output. Provencher (1995a, b) tried to explain the harvest decisions of timber producers. He firstly found the "revenue shock" as necessary determinant of solution to harvest (Provencher 1995a). Then, however, he explained it as capturing random components arising from uncertainty with inputs collection (Provencher, 1995b).

Uncertainty during the production process is the up-to-date issue for Ukraine. Farmers can not be sure about the magnitude of the completeness of machinery available, fertilizers delivered, quality of seed bought for sowing. Crocher and Reynold (1993) tested the type of contract, as dependent on the uncertainty and supported the hypothesis that "contracts will be less complete when environment is more uncertain and complex" (Chiappori and Salanié, 2000). Environmental factors, described as variations in the inputs supply and machinery availability were mentioned by Brada (1986) as causing poor harvests.

Related to this, crucial determinant of the contract performance is financial security. Bezlepkina (1999) studied the financial factors (debts and budget constraints) influence on the agricultural production, using the farm-level data, and found significant effect. According to the author, the farms in Russia "operate under liquidity constraints that lower their productivity". Subsidies, on the other hand, increase productivity. However, government support of agriculture is other, highly controversial issue of consideration for Ukraine, and will not be discussed here. Strong influence of finances on enterprise

performance was also shown by Bevan et. al (1999). The credit constraints were tested by Bierlen et. al (1999). Among other determinants of the contract choice, they found the financial position and the production expenses of the operating agent. What matters also are alternative uses of the land, availability of land and size of the farm Bierlen et. al (1999). Credits is a highly discussed topic for Ukraine. Among the problems of Ukrainian farmers crediting Lishka (2004) mentions managers' negligence, low productivity, and low stability of agricultural activities.

Investment in the farms decrease with the increased frequency of contract breaches (Cungu and Swinnen). However, there are specific investments important for production (durable machinery, built storehouses), which prolong contract durations (Chiappori and Salanié, 2000).

Type of ownership has been proven several times to determine the productivity of the operating object. Particularly, Brada (1986) shows that volatility of the crop is larger in socialized farms, than that in private ones. The main reason is condition of profit-maximization for private owner's operations with resulted harvests flexibility to market price signals. Whereas socialized (or state-owned) farms used to use fixed wage (decrease in incentives) and orient on the planned crop indicators, thus getting lower yield. Clark (1992) considers that problem from the historical prospective, studying the medieval farmers' behavior. The author argues, that lease structure, occurred at those times caused lower yields because of land over utilization, when the leasing farmers did not care about land fertility and "sacrificed future yield for higher output".

Peculiarities of transition process followed by structural reformations in the CIS countries cause significant temporary difficulties for operating agents, in particular, in the area of ownership operations. For example, Lerman and Stanchin (2003) consider different types of land ownership in Turkmenistan after

the reforms, followed the collapse of Soviet Union. They argue that private farms performance is significantly higher than that of so-called "association leaseholds", with the latter fulfilling state plans, regardless of the low quality land, allowed for private activities by Turkmenistan law base. In Ukraine reforms resulted in the problems of obtaining agricultural land in the private use. The issue of agricultural land ownership is highly debated in the Parliament. Restrictions to buy the agricultural land in the private ownership were expected to protect national lands from foreign expansion. However, external effects resulted in inefficient land use, and uncertainty of the farmers about stability of their farms. Permission to trade agricultural land will allow the farmers to become competent owners (www.minagro.kiev.ua/reforms/) and is expected to be completely legally implemented by 2007.

Ukrainian private agricultural enterprises were shown by Galushko et al. (2004) to be more "technically efficient" than cooperatives or agricultural associations. However, they estimated "structural technical efficiency" as reflecting the influence of type of ownership more precisely, and found it to be highest in agricultural associations (0.94 vs 0.86 in private agricultural enterprises, or 0.79 in cooperatives (Galushko et al., 2004). The authors conclude that transformation of former kolhoses (collective state farms in Soviet Union) into private farms is highly effective in both economical and technological sense.

Interesting to consider are also typical individual characteristics of the farms. Size of the operation was found to be significant determinant of contract by Bierlen et. al (1999). Berry (1972) views this issue from another side: he declares smaller farms to be more "socially" efficient, because larger farms distribute income unequally by hiring people, which frequently have no alternative revenues, and undervaluing their efforts. Size of the farm was also mentioned above as enhancing crop rotation.

Botticini and Kaufman (2000) focus on household structure effect on the contract type. In particular, they study the influence of granddaughters (or, generally, family members), working in other than agricultural occupations and found them decreasing household risk aversion in agricultural activities.

The last factor that determine contract performance and is briefly discussed here will be incentive schemes. Sappington (1991) considers effectiveness of individualized and relative performance schemes under the conditions of risk-aversion and risk-neutrality of the participants of the contract. The above mentioned sharecropping system is also used to induce the agent (tenant) to apply higher efforts and is effective under particular conditions (agent's risk-aversion).

Hueth and Hennessy (2002) in their book discuss organizational efficiency of the risk, the farmers are facing. They state two particular points of effective contracts with farmers: relative performance schemes (tournaments) and quality incentives. The authors reviewed pork and poultry output contracts to study the determinants of contract design and found different structures: for poultry, for example, rewards for relatively better performance act by reduce overall risk by a half, while in the pork production risk turned to be linear and independent of incentive schemes.

According to some authors, to incorporate risk-aversion in the model, lagged variables should be included. For example, Coyle (2005) studies dynamic models of crop investment under risk aversion. The author uses several approaches to estimate investment in crop (fertilizers, machinery) as dependent from prices, wealth and insurance. Risk aversion is captured by "multi-period lags in expected price for output and price variance". In my paper the full set of variables is available only for one year, therefore risk-aversion is expected to be caught by other explicative variables.

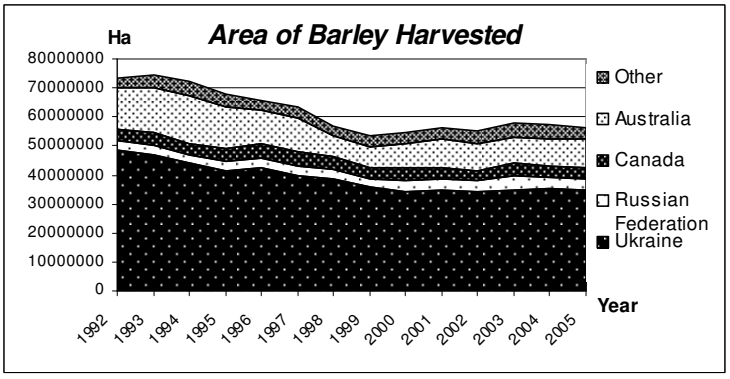
Chapter 3

INTEGRATION OF THE MARKETS IN BARLEY-MALTING INDUSTRY

3.1. Description of Barley Production in Ukraine

Popularity of barley production (fourth culture by area sown and total harvest in the world, and second after wheat in Ukraine) is explained by its high value for food production, relatively low cultivation requirements, and good responses for technology improvements (Zagynajlo, 2005). Besides processing industry (42-48% of the total yield), barley is used for fodder (16%), food industry (15%), and beer production (8%). The share of the last category increases permanently, because of profitability and rapid development of beer industry in Ukraine. Ukraine is among the main producers and exporters of barley in the world (US Grains Council, USDA). However, the production of high quality barley, which can be used for malt production and thus has high market value, is underdeveloped and beer producers have to import inputs from abroad.

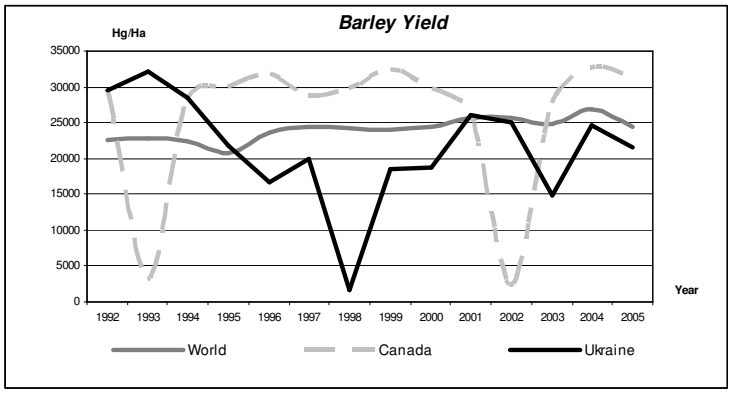
Figure 1. Area of Barley Harvested



Source: www.faostat.org

Yield of barley indexes remain lower that average in the world (see Figure 2). Low productivity is stipulated by bad on average technical equipment base, lack of the financial resources for proper inputs in the crop, absence of well-functioning market for agricultural goods.

Figure 2. Barley Yield in Ukraine, Canada and World



Source: www.faostat.org

However, positive trends are observed now in the Ukrainian agriculture. Rich natural resources attract foreign and domestic investors-producers of food

products to establish own suppliers on the base on Ukrainian agricultural farms. The examples are milk and pork production; sunflower-seed oil production; beer production. The latter will be discussed in more details in the scope of the present paper.

Ukrainian beer industry has been rapidly extended recently (Kalinichenko, 2004), causing increased demand for malting barley, and therefore, creating favourable conditions for barley cultivation in Ukraine. . The beer industry is one of the profitable sectors in Ukraine (Murina, 2004), and one of those quickly developing. It attracts foreign investors, which stand out as the primary providers of the means for plants construction and new technologies incorporation. *The main problem, which brakes further industry development, is precariousness of high quality malting barley in Ukraine.* Lack of domestic barley induces malt and beer producers to import up to the 60% of malt in the market. Taking into account complementarities of import operations (high rates of custom duties for malt (30% of the value), and weakness of the national agricultural sector markets, the strategic targets of the producers are establishment of own sources of raw materials, according to the own requirements to the quality of barley.

Malt producers try to ensure provision of necessary inputs by arrangements of contracts with farmers. This leads to mutually profitable cooperation, when principal company leases necessary inputs to farmers-producers, and gets in return the expected output with demanded quality characteristics.

Because such types of cooperation are relatively new for Ukraine, as well as for other CIS countries, which used to have collective centrally planned agricultural associations, the structures of the farmers contracting are now in the process of development

3.2. Contracting vs. Integration in Agriculture

The issue of contracting in agriculture as compared with vertical integration or spot market is in details considered by Minot (1986), and the interested reader is encouraged to refer to this source. Here we will just briefly discuss benefits of either type of organization in case of barley production.

Spot Market

The simplest way of trading in agriculture is through the spot market. Producers sow particular areas of barley, orienting on the expected market demand for this good. The market is perfectly competitive, thus producers know beforehand that the price for which barley will be sold will not exceed the marginal cost of cultivation. Moreover, the farmers are not interested in providing too many inputs for production (fertilizers, pesticides), if the costs of those will not be outweighed by expected profits. Frequently, producers are not equipped with the necessary tools for production of high quality barley which is demanded for malt. Financial and technological constraints induce the majority of barley cultivators in Ukraine to end up with low quality output, which can be only sold as input for forage production.

Low quality products and financial instability of agro-producers in Ukraine is an up-to-date issue and remains under government consideration. Manifold programs of national farmers' development proposed by the Ministry of Agricultural Affaires of Ukraine include mechanisms of governmental support, formation of national agricultural exchanges, and stimulation of any kinds of investments in agriculture. The latter is hampered by 1) political and thus investment climate instability, 2) difficulty to get agricultural land tenure.

From the consumers' side, barley spot market imperfections result in unsatisfied demand for high quality input for malt production. Unable to find necessary amount of malting barley in Ukraine, the consumers have to import it from abroad, which is not very efficient, taking into account custom duties and transportation costs. Spot market trading cannot assure a particular amount of barley supplied and adds uncertainty in consumer's plan of production process.

Contracting

To decrease uncertainty about inputs availability, and avoid other spot market imperfections (information asymmetry, transportation costs, operations constraints, lack of principal's supervision and quality control), malt-producers tend to stick to "own" contracted farms. The former will be further called as principal, and the latter as agents. The principals prefer to arrange contract agreement with suitable agents in such a way as to insure themselves with a particular quality and quantity of malting barley. The target is reached with the help of the following measures:

- The agents which can get a contract offer are chosen on the base of merit and own technical resources availability;
- The principal offers loans with collateral being future yield;
- The principal assists contracting farm with production inputs and scientific supervision of crop generation.

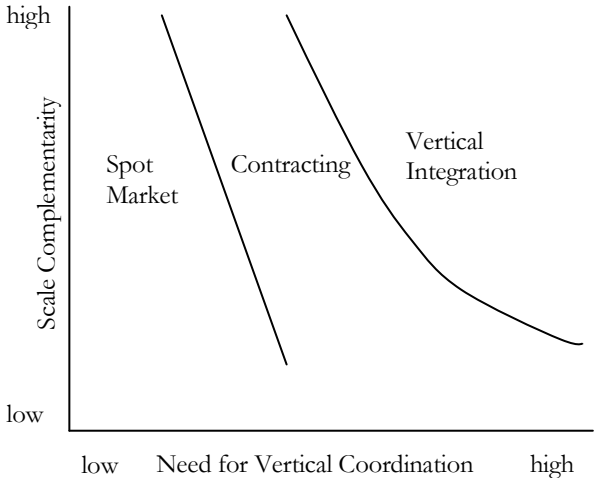
Such an organization has shown itself to be quite efficient (see chapter 2) and to allow for principal's management of the agents actions while preserving flexibility of both contract participants in own operations.

Vertical Integration

The situation, when the "upstream" and "downstream" producers merge into a one firm is called vertical integration. In agriculture vertical integration would mean that malt-producers buy farms-suppliers of barley and take absolute control over these farms activities. Roughly speaking, it can be considered as an extreme case of contracting, when the principal's target becomes the only target, fulfilled by the agent, and on the permanent basis.

Minot (1986) considers benchmarks for the optimality of either type of production organization. Depending on the quality requirements on the "upstream" good, and complementarity of total production process the optimal structure can vary (see Figure 3).

Figure 3. Types of Vertical Organization



Source: adopted from Minot (1986), p.20.

Generally accepted by malting companies and evidence based optimal structure for malting barley is that arranged by contracting. To support these argument the following claims can be made:

- **Farming is not very connected to malt-production.** That is, technology of barley differs significantly from technological process of malt-creation, so the need for vertical integration is not high enough. At the same time, malt-production requires specific (high) quality barley inputs, so the barley production can not be absolutely neglected by malt-producers (the case of spot market).

- **The areas sown by barley are too large to be all acquired by malt producer.** Even if malt-producers decided to acquire farms-suppliers of barley, they will not be able to do it because of high expense of inputs for barley production (land and machinery). More optimal is to lease those inputs and transfer production responsibilities to the owner.

- **In agriculture the diversification of production helps much in reducing risk, but is of low interest for malt-producers**. Contract allows for the diversification of agricultural production by contract-performing agents, which can sell other than barley entities to different consumers, and simultaneously insure the particular amount of barley supply.

Thus, even though contracting can be viewed as a type of integration, we should concentrate further on the contract conditions and peculiarities in the light of barley-malt production consideration.

Chapter 4

EMPIRICAL STUDY

4.1. Methodology

Taking into account previous findings on the topic under consideration, factors relationships discussed in the literature, and own suggestions, the following specification is considered: Yield is affected by the available resources, agent's effort, and random component ("state of Nature"). The resources include land, equipment used for barley cultivation and specific inputs - seeds, fertilizers, crop rotation effect. Agent's effort is unobservable and cannot be included into regression directly. Labor economics suggests different proxies for the measurement of effort level (actual output, scores of subjective evaluations, alignment of agent's target with that of the principal). Under the condition of malting barley production the effort level might be approximated, though not ideally, by the ratio of the output accepted by the principal (satisfying necessary quality conditions) to the total output level. This measure would also reflect the magnitude of the farm's "effectiveness". To test whether the contract has any influence on the farm's performance, the significance of contract-related factors should be checked; similarly, the comparison of regressions of the accepted output and of the total output on the set of available determinants should give some intuition about the alignment of the two tasks of the agent: quality and quality of barley yield. The magnitude of farmer's effort and success can be influenced by:

- the time of being in the contract relationship,

- the extent of cooperation with a principal while performing the contract,
- particular personnel characteristics of the farmer (hard-working, industrious, skilled),
- the availability of other activities for the farmer (multitasking problem),
- initial farmer's endowment (wealth).

A priori we assume that personnel disparities between farmers result in different output levels.

Agricultural nature of the output under consideration (malting barley) induces to take into account weather influence on the product. This is stochastic, independent of the agent's effort or available resources in its influence on the barley yield. So, Nature influence does not enter directly into production function, but can alter the level of output given other production process characteristics. Therefore, the Nature effect should be added as a multiplier to the original production function.

Thus, for each farm, yield, Y is a stochastic function of:

$$Y = g(\theta)F(L,T,K),$$

where θ represents the "state of Nature", T is the amount of land, L is a set of labor determinants, and K is a set of other technical inputs, including equipment, used in the farm. Assume: $g(\theta) = e^{\theta}$.

It should be mentioned for further consideration, that we consider a single principal which uses the same type of contract for all farms under study, on the base of "take-it-or-leave-it" offer. That is, farms supply barley of a specified quality for a given price.

To find the influence of factors of production on yield the Cobb-Douglas production function is assumed:

$$Y = AL^a T^b K^c e^{\theta+\varepsilon},$$

A is a constant, reflecting current technology level; error term ε has exponential form, which does not change the essence of the results, but adds simplicity to log-linearization of the model.

Incorporation of sets of variables for each factor category gives the final model to estimate:

$$Y = A\prod_{i=1}^{k} L_i^{a_i} T_{quality}^{b_1} T_{quantity}^{b_2} \prod_{i=1}^{p} K_i^{c_i} e^{RV+RV^2+\varepsilon}$$

Where A is constant, caught for the level of current technology; L is a set of labor-related factors; T are land quality and quantity characteristics; K is a set of capital inputs. Error term represents other unobserved factors; and random components of the Nature are caught by the amount of rains (RV) and amount of rains squared (reflecting diminishing returns). Transformation to logarithmic form makes possible to estimate the model:

$$\ln Y = A + a_1 \ln L_1 + a_2 \ln L_{21} + ... + a_k \ln L_k +$$
$$+ b_1 \ln T_{quality} + b_2 \ln T_{quantity} + c_1 \ln K_1 + ... + c_p \ln K_p + RV + RV^2 + \varepsilon$$

This specification is used to measure the determinants of gross barley output, and net yield - that of a particular quality suitable for malt production. The question of interest is whether the presence of principal influences either quantity or

quality of the agent's output. The answer is expected to be found by running the regressions:

- gross yield regressed of the factors of production
- net yield regressed of the factors of production
- ratio of net to gross yield (reflecting "effectiveness" of production),

and comparing the results.

4.2. Data Description

The empirical investigation of this paper is based on the sample of the farms, operating in six oblasts of Ukraine. The data set was kindly provided by the malt-producing company, contracting given farms for provision of barley. The data set contains information on the sowing company of 2005 year, farms' characteristics, including size of operations, share of barley in total production, the machinery and management proxies. The total number of observations is 582. All farms under consideration are located in the South-Northern part of Ukraine, namely, the set represents operating agents in Chernigivska, Chercasska, Kharkivska, Sumska, Kyivska and Poltavska oblasts. Location of farms is determined basically by the geographical length to the customer's plants, located in Kyiv and Kharkiv, and by favourable climate conditions for barley production in that particular part of Ukraine (forest-steppe zone). Northen-Western part of Ukrainian rural territory is occupied by another, rival, malt-producing customer; which is supposed not to differ much in its operating strategy with regard to producing agents and is not studied here.

Let us now consider in more details the information contained in the data set. The data set consists of the description of sowing company for 239 agricultural farms operating in the mentioned regions. Each farm has several heterogeneous fields for barley cultivation. Thus, considering yield for every

field differently gives the total of 582 observations. The information is for 2005 year.

The farms' characteristics include:

Resources and Inputs:

- equipment used by the farm
- amount of applied fertilizers
- density of seeds per ha
- soil conditions of the farm

Individual Farm's Specifics:

- total size of the farm, measured by the land area, available for harvesting
- type of ownership (private/collective/state)
- age of the farmer
- level of cooperation with principal:
  - share of barley production in the total of farmer's activities
  - the extent of following the supervisor's (principal's) recommendations)
  - years of cooperation
  - amount of loans from the principal

Nature Shocks Proxies:

- the amount of rainfalls (mm^3) per each decade during the months of cultivation period.

The information on explanatory variables in summarized in the table below.

Table 4.1. Summary Satistics

Variable	Obs	Mean	Std. Dev.	Min	Max

Barley yield (hg/ha)	702	4.101545	0.915785	1.9	6.84
Net barley yield (purchased) (hg/ha)	702	2.128902	1.100949	0	5.6
Area sown (ha)	702	100.9017	95.98892	7	1580
Share of barley in prod (%)	593	18.68983	10.11599	3	56
Age of farmer	597	45.76047	7.60792	26	65
Size of farm (Ha)	597	2720.245	2495.131	100	17500
Private farm	700	0.207143	0.405549	0	1
Collective farm	702	0.62963	0.483248	0	1
State farm	702	.014245	.1185838	0	1
Financing	600	103403.9	155716.2	4425	1839943
Years of cooperation	597	2.279732	1.317337	1	5
Following principal's recommendation (%)	596	87.64094	20.18108	0	100
Machinery bad (1/0)	702	0.710826	0.453702	0	1
Machinery avg (1/0)	702	0.089744	0.286018	0	1
Machinery good(1/0)	702	0.198006	0.398781	0	1
Soil bad (1/0)	702	0.182336	0.386396	0	1
Soil avg (1/0)	702	0.725071	0.446796	0	1
Soil good (1/0)	702	0.091163	0.288035	0	1
Density of sowing	702	3.773219	0.231032	3.3	4.5
Date of sowing (# of day in April)	699	10.69528	3.942294	2	29
Fertilizer N (kg/ha)	702	14.94231	13.73358	0	78
Fertilizer P (kg/ha)	702	14.30813	13.53078	0	56
Fertilizer K (kg/ha)	702	14.28205	13.87493	0	60
Dummy for preceding culture	702	16 varieties			
Rains in April 20-30	702	28.25711	15.33407	5.75	58
Rains in May 1-10	702	22.63837	9.534692	5	53.56
Rains in May 10-20	702	9.194207	7.946086	0	26
Rains in May 20-30	702	5.256402	4.401744	0	31.56
Rains in June 1-10	702	33.8531	11.66718	5	68
Rains in June10-20	702	73.8274	24.31377	0	113
Rains in June 20-30	702	12.53513	8.357463	0	52
Rains in July 1-10	699	18.84277	12.86024	0	54

Barley yield shows the actual yield of barley in hectograms per hectare of the area sown. *Net barley yield* is the yield of barley in hectograms per hectare of the area sown which satisfied the quality requirements and was bought by the principal.

Share of barley in production is the percentage of the barley cultivation in the total of farmer's activities, proxies the level of farmer's multitasking.

Age of the farmer was taken to test whether younger farmers apply more effort than the elder ones. According to the career concerns concept, younger farmers might care more about output and apply more efforts with aim to build good reputation and maybe get higher awards in the future. At the same time, the age may be crucial for the experience (this especially matters in agriculture), which adds more value to the elder farmers.

Size of the farm is the total agricultural area available to the farm; it is supposed to positively influence output because of positive production spillowers (Goodwin and Mishra, 2002). Economies of scale in the production process may also add advantages for the large producers.

Dummy for *type of ownership* are expected to catch the difference among different types of farms and to support or reject previously stated argument about higher efficiency of private farms, when comparing with collective.

Financing reflects the amount of credits in the form of sowing seeds made by the consumer before the actual realization of the crop. The price of that amount is extracted from the total farmer's revenue, after the harvest is gathered. This variable reflects explicit principal's engagement in the production process and in case of being significant will support the hypothesis of farmers' crediting importance.

Years of cooperation is the number of years for given farm being in the contracting relations with a principal. If the contract availability leads to the increased effectiveness and productivity of the farm, the coefficient of this variable should be strictly positive and significant.

Following recommendations is a variable, which reflects the extent (%) of farmer's carrying out the scientific recommendations of the principal on the way of his supervision. This is the contract-related determinant, reflecting cooperation of the two contracting parties.

Dummy for machinery reflects the availability of good/average/bad machinery in the farm. Initial dataset contains the names of machines for each farm. The binomial specification was chosen due to the following reasons: even though I found technical descriptions for all types of machines, used by the farms under study, they do not clearly differ in characteristics. However, I could divide 13 available machineries into three categories according to the experts' valuation. More detailed description of machinery variables is given in appendix 1.

Soil condition is a proxy for the condition of soil preparedness for barley sowing, obtained from agricultural inspections of fields. There are three possible levels for this measure: perfect, good, satisfactory. The dummy for each level is used, because it is impossible to impose the scale of distances from one type of condition to the other (thus, use categorical data).

Density of sowing describes density of seeds per square meter of sowing area. This is an agricultural determinant of yield, which must be in the boundaries 3.5-4 mln pc/ha and is considered for the precision of estimates.

Date of sowing is a number from 1 to 31 which shows the particular day in April, in which the barley was sown for that particular farm. The date of sowing is generally considered to have significant influence on the future yield, and can partially proxy the level of the agent's effort (carefulness). Traditionally, the most favourable date is 12-14 April. However, standstill, unprepared machinery or unfavourable weather conditions can delay the sowing company. Squared value of this variable is considered because of possible quadratic response.

Fertilizers (Nitrogen, Phosphor, and Calcium, measured in hg/ha) inputs are supposed to enhance yield quality and are proposed to be included in estimation (see chapter 2).

Preceding cultures used as dummies reflect the influence of plants, growing on the particular field in the season previous to considered. These variables should reflect the effect of crop rotation, when different plants have opposite influence on the barley yield (see chapter 2). Alternative experts' specification uses categories for positive/neutral/negative effect. Both measures can be applied. For more detailed description of preceding culture variables see appendix 1.

Rains variables reflect the influence of Nature. Another Nature characteristics – temperature – turned out not to differ much across the regions and was therefore excluded from the regression. The data for weather conditions was taken from the Ukrainian HydroMeteoCentre which kindly supplied information from the hydremeteorological stations of the regions of farms locations. The observations for each particular farm were constructed by choosing the information on the nearest to the particular farm station, or by applying the average conditions in case if the farm is located between the two or more stations.

Calculation of correlations did not indicate high dependence between any pair of variables, thus implying that the problem of multicollinearity is avoided.

4.3 Estimation and Basic Results

The output of estimations of gross barley yield and net barley yield as determined by the set of variables, described above, is presented in the appendix. Interesting to notice is that correlation coefficient between these two variables is only 0.46, though they describe the same output. That is why, I consider gross

barley yield as the indicator of quantity of barley produced, and net barley yield as proxy for quality.

The OLS results[1], after correction for the detected heteroskedasticity, indicate two different patterns of determinants in both cases (appendix 2). It turned out that most of the variables explaining gross yield become insignificant when measuring net yield and vise averse (see Table 4.2).

Table 4.2 Factors of Barley Output

Variable	Significance		Sign	
	Gross Yield	Net Yield	Gross Yield	Net Yield
Area sown (ha)		V	+	+
Share of barley in prod		V	+	+
Age of farmer		V	+	+
Size of farm (Ha)		V	+	+
Private farm	V		+	-
Collective farm	V		+	+
Financing		V	-	
Years of cooperation		V	-	+
Following principal's recommendation (%)	V	V	+	+
Machinery bad (1/0)			-	-
Machinery good(1/0)	V		+	-
Soil bad (1/0)	V	V	-	-
Soil good (1/0)	V	V	+	+
Density of sowing			-	-
Date of sowing (#)	V	V	-	-
Fertilizer N (kg/ha)		V	-	+
Fertilizer P (kg/ha)		V	+	-
Fertilizer K (kg/ha)		V	+	+
Rains in April 20-30		V	-	-
Rains in May 1-10		V	+	+
Rains in May 10-20	V	V	+	+
Rains in May 20-30	V	V	+	-
Rains in June 1-10		V	-	-
Rains in June10-20		V	+	-
Rains in June 20-30		V	+	-
Rains in July 1-10	V	V	-	-

This makes attractive to try seemingly unrelated equations specification. Both net and gross yields should have correlated residuals, and estimation of the regressions through GLS might increase efficiency, as the explicative variables seem to be different. However, GLS results turned out not to differ much from those in OLS, and the correlation between the residuals was not very high (0.22), though they turned out to be dependent by Breusch-Pagan test (appendix 3).

Thus, we will proceed with independent regressions. Let us consider the distinctions in results for barley yield, when measured by quantity (gross) and quality (net, purchased by the principal).

Gross barley yield turned out to be determined mostly by production factors (seeding rate, soil conditions, previous crop rotation effect, date of sowing and Nature influence). Surprisingly, there was not discovered any significant equipment influence, except positive effect of good equipment at 15% significance level (appendix 4, table A4.1). Among the farm's specific characteristics, the type of ownership matters for the quantity, but not for the quality of output. Private farms seem to be more productive then collective ones, as the fact of private ownership has an effect of 10% increase in the gross yield on average (comparing to 6.9% in case of collective farm, or even negative coefficient (-3%) if plugging dummy for state ownership instead of collective dummy into the regression).

Net barley yield turned out to be much more affected by the extent of farm's cooperation with principal according to the t-statistics of corresponding variables. In particular, the share of barley in production is positive and significant, meaning that the farmer applies more effort for the principal's target output, when this output is of his own major objective. The number of years being in the contract is also significant. According to estimates, each additional year of cooperation adds to the net output 3.38% on average ceteris paribus

[1] Square terms were not included into the original regressions.

(appendix 4, table A4.2). The amount of credits to the farmers, however, turned out to have negative effect. Does this mean that the principal should not lend to its agents? Not necessary, because the loans are in the form of inputs for harvesting. Thus, negative dependence may reflect the fact that less effective farms have to borrow more. In fact we can end up with causality problem due to the loans variable. Those farmers, who had lower yield previous year, might need more investment current year. This issue of endogeneity will be studied more broadly below.

Consider now separately the groups of factors, influencing net yield. Wald test indicates the joint significance of the contract-related characteristics of the farm (share, years of cooperation, following recommendations, financing). Moreover, the first three of those do not differ much in the extent of their influence on the output (appendix 5). That is, additional year of cooperation has the same positive effect as the fulfillment of the principal instructions during the process of cultivation, or increasing the share of contract production with respect to other farmer's activities. Thus, all three variables reflect the positive influence on the effort level, applied by the agent.

Interesting to notice is that the elder farmers seem to perform better while estimating quality of output. That is, experience matter.

Popular among agrarians hypothesis about significance of crop rotation effect is weakly supported by estimation results. The joint influence of preceding cultures is important, though the effect of some particular plants is not distinguished from other, which is contrary to the theoretical predictions of the different spillovers from different types of preceding crop (e.g., sugar beet and sunflower were supposed to differ in the extent of influence, but turned out to have nearly the same coefficients). Possible explanation is that the separate effect of the particular preceding culture was not caught by the estimation, because

these dummies reflected also some other unobservable factors (farm specific effect).

Initial endowment of the farm, reflected in the farm's soil conditions makes farm more competitive in the output levels. Perfect soil availability helps to increase gross yield on 13% points on average, and net on 20% (appendix 4). Soil fertilization affects net yield, thus may be actively used for the purpose of barley quality facilitation.

So, the estimations results imply that though quality and quantity of barley yield both represent the targeting directions of principal and agents cooperation, they are determined by the slightly different factors, and the disparity between these two measures end up in inefficiencies of production process. To move near the two indicators, the principal should facilitate cooperation with the agent, thus, approaching the same target task. Without this, the agent does not concentrate on the quality of yield, spreading his attention on just the quantity of final production, or on the performing of his other tasks.

Additionally, to study the determinants of *effectiveness* of the farms under consideration, the effectiveness measured as ratio of yield purchased by the principal to the total yield produced by the farm is regressed on the set of available variables (appendix 6). In fact, effectiveness can be considered as an extent of alignment between the quality and quality of output. Such specification is marginally correct, according to the Ramsey RESET test, and confirms the result obtained before. Namely, long-term and large scale engagement in the contract relationship facilitates alignment between principal and agent's output target (years of cooperation, share of production are significant and positive); there exist positive spillovers of the farm size (the effect of specialization and diversification).

The type of ownership does not matter for the extent of farm's effectiveness. That is, private farms are more productive in the sense of output

quantity, but when the quality is of main importance, the disparity disappears. The explanation comes as follows: quality requires some specific effort measures, which cannot be substituted by technological or other advantages of private vs. collective farms. The equipment, when explaining effectiveness turned to be significant and negative. So, in our case machines can enhance the technological productivity, without effect on quality.

4.4 Extensions and Robustness Check

The check for the form specification and for omitted variables in the models, described above, indicates that there are some omitted variables (RESET tests using powers of regressors and regressant are significant at 10% level). To avoid bias estimates, the squared terms of factors of production were included into regression. However, squared terms of date of sowing, rains, and fertilizers did not alter the results significantly, and had negligible effect on the dependent variables.

In order to test the functional form of regression, log-linear vs. linear model, the MacKinnon, White, and Davidson test (MVD test) (Gujarati, 1995) was performed (appendix 7). In the given particular situation it turned out that we cannot reject either of specifications. So, we will proceed with the log-linear model.

Let us now concentrate on the possible endogeneity problem. One can claim, that the yield pattern can affect the amount of lending by farmer, as well as the share of his activity, devoted to the yield production. To avoid spillovers effect and to make a check for robustness, the estimation for the farms, operating in contract only for one year was performed (appendix 8). The farms which operate under contract conditions just for one year cannot have some 'historical' influence hidden in the explicative variables.

Table 4.3. Comparison of Regressions for Effectiveness for All and One Year of Cooperation

Effectiveness	Coef. For one year[2]	Coef. For all years
share	0.002747*	0.0031674***
size	0.0000184***	0.0000241***
recomend	0.003939***	0.0050828***
lnfinance	-0.02907*	-0.0758796***
soilgood	0.102072**	0.0665511**
soilbad	0.097256***	0.0606597***
equipbad	-0.08328*	-0.0720171**
equipgood	-0.20771***	-0.105199***
_cons	0.409136*	0.7076745***

The two regressions from table 4.3 show the effectiveness determinants, and have very close coefficients in case of inclusion of experienced farms, and those new-comers, which is the fact in favor of absence of endogeneity problem.

In case of measuring net or gross yield separately, the results do not differ significantly either. So, we could say that the endogeneity is not present in this particular case.

Alternatively, the inverse causality between barley yield and its explicative factors can be tested with the help of lagged yield values. The above mentioned possible problem of financing variable endogeneity was tested in such a way. Suppose that those farms, which perform worse in the previous period, need more financing current period than more successful ones. Then, there is an ambiguity whether the financing influence yield, or the yield of particular farm affects the extent of its financing by principal. Availability of 112 observations of

[2] ***** - significance at 1% level, ** - significance at 5% level, *- significance at 10% level**

barley yield for the previous year allowed to test the hypothesis. According to the estimates, the causality problem is absent in the described situation (appendix 8).

Another issue that needs attention is the farm's specific effect, which may have unobservable factors, not caught by the previous estimation. Each farm operates on several fields with different cultivation conditions. Therefore, dummy for the farms were included to test for fixed effect. The results are quite convenient (appendix 9). Goodness of fit increased considerably well after the inclusion of farms' indicators (up to 95%), whereas the influence of other variables did not change significantly for the estimation of farms' effectiveness (see table 4.4).

Table 4.4 Comparison of the Results for Effectiveness with and without Inclusion of Fixed Effect

effectiveness	Coef. without Fixed Effect	Coef. with Fixed Effect[3]
share	0.0031674***	0.006624*
size	0.0000241***	0.0000017
yearcoop	0.0235336***	0.07309*
recomend	0.0050828***	0.008853***
lnfinance	-0.0758796***	-0.11083
soilgood	0.0665511**	0.027531**
soilbad	0.0606597***	0.0606597***
equipbad	-0.0720171**	-0.00516
equipgood	-0.105199***	-0.04693
fertn	.0035368***	-0.00435*
fertp	-.0069362*	-0.00142
fertk	.0025293	0.004768*

Some farms turned out to have strictly positive effect of their availability on the barley yield, while others - strictly negative, and the coefficients of the rest are insignificant. This indicates the heterogeneous structure of the farms set, with particular characteristics of each particular farm being crucial for its performance.

[3] ***** - significance at 5% level, ** - significance at 10% level**, *- **significance at 15% level**

The direction of other influencing variables remains the same after the inclusion of farms' specific effect, with approximately the same magnitude of influence, so the model may be considered as robust.

Chapter 5

CONCLUSIONS

The present paper was devoted to the investigation of the issue of economic interaction between the two participants of the contract: malt-producing principal, and barley cultivating agent. The contracting relationship assumed the provision of the high quality barley by farmers. The question of study was to find the determinants of the contract fulfillment and to check whether the principal presence and farms particular characteristics do influence the final output of interest.

The estimation showed that indeed the extent of agents' performance in agriculture depends on the level of cooperation with principal. However, the external Nature shocks and particular inputs are also crucial for the output.

It turned out that the part of theoretical determinants of barley yield becomes insignificant, when the target of estimation is quality of barley, or the share of total output, which meet the principal's requirements. In particular, the type of farm's ownership does not matter for the quality, while is strictly significant for quantity determinants. What matters for quality, and, therefore, for contract targets fulfillment, is the prolongness of mutual cooperation, principal's supervision and scientific recommendations during the process of cultivation, and the share related to contract fulfillment in the total of farmer's employment.

According to the performed estimation, the contract relations may be fruitful for the both parties. The malt-producers should devote more attention to the development of cooperation with their input suppliers (barley producers). Keeping the same suppliers for different sowing seasons allows to increase efficiency of agents. The latter may gather knowledge (specific human capital) for

production of the particular quality barley, which is not possible for new-comers into contact relations. The principal should also enhance cooperation through the supervision of the agents' activities. Making recommendations, as well as periodical examinations of the situations on fields helps to facilitate agents efforts (partially, by creation of psychological pressure).

Barley producers are better off in case of performing contract in comparison with trading at the spot market, mainly because of certainty with respect to future profits. If the revenues from contract fulfillment are reasonably high, the farmers should devote more of their resources to the barley production, because of economies of scale (the 1% increase in the share of total farm production devoted to barley leads to 1.2% increase in output other things being equal).

The results should be treated with caution because the sample is for one year, and does not reflect the dynamic of cooperation. There may also be some selection bias, as the only farms operating with the considered principal are discussed, and the general picture for Ukraine may not be fully reflected.

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APPENDIXES

Appendix 1

Description of Variables

Table A1.1 General Description of Variables

Yield	Yield of barley (kg/ha)
Netyield	Net yield of barley (that, purchased) (kg/ha)
Area	The area sown
Share	The share of barley in the total of farm's activities
Size	The size of the farm (ha)
Private/ collective	Type of farm ownership (private -1/0, collective-1/0)
Finance	Sum of prefinancing
Yearcoop	Years of cooperation with a farm (#)
Recommend	Percent of following the recommendations (%)
Equipbad/equipgood	Mashinery (good-1/0, bad-1/0)
Density	Density of sowing
Date	Date of sowing (# of day in April)
Sugarbeet/ fallowland/ barley/ sunflower/ mustard/ rye/maizesilage/ wwheat/ flax annualgrass/ cerealcrop/ rape/ buckwheat/ soy	Preceding culture (if that particular culture is preceding – that 1, otherwise – 0.
april2/ april3/ may1/ may2/ may3/ june1/ june2/ june3/ july1/ july2	The amount of rains in the ten days of the particular month during the cultivation season.
fertn/fertp/fertk	The amount of fertilizer (N, P, K) used for a particular field.
Soilbad/soilgood	The condition of soil (good-1/0, bad-1/0)
Prestige/ pasadena/ jersey/ barke/ astoria/ scarlett/ tolar/ annabel	Variety of barley (if a particular variety is sown in a field, that 1, otherwise -0).

Table A1.2 Machinery Classification

Equipment		
Good	**Average**	**Bad**
John Deere	W.M.P.S.FLEXICOIL	S.S.C3-3,6
W.M.P.S.Horsh	W.M.P.S.Acord	WM.PS.ДТ-6
LM.G.C.Smragd	G.S.C3-5,4	L.M.G.S.СПУ-6
W.M.G.C.Premiera	L.M.G.S. Lida	

L.M.G.S.KLION	L.M.G.S.СПУ-7	

Table A1.3 Preceding Cultures Effect

Theoretical effect on barley yield	Positive	Neutral	Negative
Culture	sugar beet	cereal crop	sunflower
	fallow land	mustard	wheat
	annual grass	rape, flax	maize
	soy		
	mustard		
	peas		

Appendix 2

General Estimation of Gross and Net Barley Yield

***** - significance at 1% level**
**** - significance at 5% level**
***- significance at 10% level**

Table A2.1 Regression of gross barley yield on the total set of available determinants

Regression with robust standard errors			Number of obs = 581		R-sq = 0.5044
Lnyield	**Coef.**	**Std. Err.**	**P>|t|**	**[95% Conf.**	**Interval]**
Lnarea	0.012816	0.013125	0.329	-0.01297	0.038599
Share	-2.5E-05	0.001039	0.981	-0.00207	0.002016
Age	0.001217	0.001095	0.267	-0.00093	0.003368
Size	3.91E-06	5.54E-06	0.48	-6.97E-06	1.48E-05
Private	0.177468***	0.053353	0.001	0.07266	0.282275
Collective	0.153616***	0.04963	0.002	0.05612	0.251112
Lnfinance	-0.02036	0.016403	0.215	-0.05259	0.011859
Yearcoop	-0.0026	0.007398	0.726	-0.01713	0.011938
Recommend	0.002919***	0.000477	0	0.001982	0.003857
Equipbad	-0.01419	0.028173	0.615	-0.06953	0.041157
Equipgood	0.031261	0.029692	0.293	-0.02707	0.08959
Lndensity	-0.4452	0.377081	0.238	-1.18596	0.295552
Date	-0.00372	0.002426	0.126	-0.00849	0.001044
Sugarbeet	0.364546***	0.039189	0	0.287561	0.441531
Maizesilage	0.359097***	0.042759	0	0.275099	0.443094
Wwheat	0.332219***	0.042587	0	0.24856	0.415878
Annualgrass	0.34828***	0.057537	0	0.235251	0.461309
Cerealcrop	0.191131**	0.079124	0.016	0.035696	0.346566
Rape	0.311257***	0.063748	0	0.186027	0.436487
Buckwheat	0.319178***	0.052217	0	0.216601	0.421755
Soy	0.444292***	0.05051	0	0.345067	0.543517
Flax	0.056463	0.141466	0.69	-0.22144	0.334364
Rye	0.172822*	0.093827	0.066	-0.0115	0.357139
Sunflower	0.289808***	0.071751	0	0.148857	0.430759
Mustard	0.313766***	0.079773	0	0.157056	0.470476
Fallowland	0.319281***	0.076375	0	0.169247	0.469315
Barley	0.270722***	0.056208	0	0.160305	0.381139

april2	0.002764	0.003457	0.424	-0.00403	0.009555
april3	-0.00218**	0.001079	0.043	-0.0043	-6.4E-05
may1	0.001937	0.00139	0.164	-0.00079	0.004668
may2	0.009918***	0.001727	0	0.006525	0.013311
may3	0.004534	0.003075	0.141	-0.00151	0.010575
june1	-0.00084	0.001537	0.584	-0.00386	0.002176
june2	0.000547	0.000592	0.356	-0.00062	0.001711
june3	0.000306	0.001696	0.857	-0.00303	0.003638
july1	-0.00381***	0.001319	0.004	-0.0064	-0.00122
july2	-0.0021*	0.001155	0.069	-0.00437	0.000167
Fertn	-0.00125*	0.000821	0.13	-0.00286	0.000367
Fertp	0.001763	0.002974	0.554	-0.00408	0.007606
Fertk	0.001505	0.002671	0.573	-0.00374	0.006752
Soilbad	-0.10375***	0.023273	0	-0.14947	-0.05803
Soilgood	0.123553***	0.020676	0	0.082936	0.16417
Prestige	0.050563	0.038607	0.191	-0.02528	0.126404
Pasadena	-0.00564	0.051859	0.913	-0.10751	0.096238
Jersey	0.05507	0.038882	0.157	-0.02131	0.131452
Barke	0.053512	0.075167	0.477	-0.09415	0.201172
Astoria	0.047442	0.057732	0.412	-0.06597	0.160852
Tolar	0.007458	0.032527	0.819	-0.05644	0.071355
Annabel	0.018778	0.036972	0.612	-0.05385	0.091408
_cons	1.334557	0.575237	0.021	0.204537	2.464576

Table A2.2 Regression of net barley yield on the total set of available determinants

Regression with robust standard errors				**Number of obs = 567**		**R-sq = 0.6282**
Lnnetyield	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
Lnarea	0.059056**	0.028004	2.11	0.035	0.00404	0.114071
Share	0.01271***	0.00205	6.2	0	0.008683	0.016737
Age	0.007917***	0.002445	3.24	0.001	0.003114	0.01272
Size	4.66E-05***	1.04E-05	4.49	0	2.62E-05	0.000067
Private	-0.02768	0.218285	-0.13	0.899	-0.45651	0.401158
collective	0.095083	0.215913	0.44	0.66	-0.32909	0.519257
lnfinance	-0.16019***	0.030706	-5.22	0	-0.22051	-0.09986
yearcoop	0.021612	0.018198	1.19	0.236	-0.01414	0.057363
recomend	0.014825***	0.001099	13.49	0	0.012666	0.016983
equipbad	-0.07867	0.061808	-1.27	0.204	-0.2001	0.042753
equipgood	-0.07607	0.077938	-0.98	0.33	-0.22919	0.077044
lndensity	0.278538	0.616568	0.45	0.652	-0.93275	1.489825
date	-0.00689	0.004812	-1.43	0.153	-0.01634	0.002568

sugarbeet	0.303958***	0.082158	3.7	0	0.142554	0.465363
maizesilage	0.298927***	0.090653	3.3	0.001	0.120835	0.47702
wwheat	0.283272***	0.088148	3.21	0.001	0.110099	0.456445
annualgrass	0.248523*	0.136233	1.82	0.069	-0.01912	0.516162
cerealcrop	0.259072*	0.14831	1.75	0.081	-0.03229	0.550437
rape	-0.02264	0.133958	-0.17	0.866	-0.2858	0.240535
buckwheat	0.224928**	0.108659	2.07	0.039	0.01146	0.438396
soy	0.362223***	0.115535	3.14	0.002	0.135247	0.589199
flax	-0.27964	0.177129	-1.58	0.115	-0.62762	0.068346
rye	0.06568	0.216426	0.3	0.762	-0.3595	0.490862
sunflower	0.399627***	0.112477	3.55	0	0.17866	0.620595
mustard	0.135133	0.106268	1.27	0.204	-0.07364	0.343903
fallowland	0.308206*	0.160786	1.92	0.056	-0.00767	0.62408
barley	0.343079**	0.139649	2.46	0.014	0.06873	0.617428
april2	0.000757	0.007188	0.11	0.916	-0.01336	0.014879
april3	-0.01237***	0.002411	-5.13	0	-0.0171	-0.00763
may1	0.013307***	0.002806	4.74	0	0.007794	0.018821
may2	0.016086***	0.003679	4.37	0	0.00886	0.023313
may3	-0.01585***	0.006022	-2.63	0.009	-0.02768	-0.00402
june1	-0.01126***	0.002945	-3.82	0	-0.01705	-0.00547
june2	-0.00148	0.001156	-1.28	0.202	-0.00375	0.000793
june3	-0.02118***	0.003262	-6.49	0	-0.02759	-0.01477
july1	-0.0069***	0.002636	-2.62	0.009	-0.01208	-0.00172
july2	-0.00157	0.002521	-0.62	0.535	-0.00652	0.003388
fertn	0.004912***	0.001839	2.67	0.008	0.001299	0.008524
fertp	-0.01585**	0.006539	-2.42	0.016	-0.02869	-0.003
fertk	0.016123***	0.00565	2.85	0.004	0.005023	0.027222
soilbad	-0.08055	0.051933	-1.55	0.122	-0.18257	0.021479
soilgood	0.21155***	0.054236	3.9	0	0.105	0.3181
prestige	0.033698	0.082127	0.41	0.682	-0.12765	0.195042
pasadena	0.001087	0.095952	0.01	0.991	-0.18742	0.189591
jersey	-0.01405	0.081221	-0.17	0.863	-0.17362	0.145513
barke	0.053775	0.131545	0.41	0.683	-0.20465	0.312203
astoria	-0.13862	0.108611	-1.28	0.202	-0.35199	0.074753
tolar	-0.12415*	0.064324	-1.93	0.054	-0.25052	0.00222
annabel	-0.1012	0.090419	-1.12	0.264	-0.27883	0.076432
_cons	0.367456	0.992943	0.37	0.711	-1.58324	2.318155

Appendix 3

Seemingly unrelated regression Estimation

sureg (lnyield private collective recomend date lndensity soilbad soilgood sugarbeet maizesilage wwheat annualgrass cerealcrop soy flax rye barley may2 may3 july1)(lnnetyield lnarea share age size yearcoop recomend lnfinance soilgood soilbad april3 may1 may2 may3 june1 june2 june3 july1), corr

Table A3.1 Seemingly unrelated regression

Equation	Obs	Parms	RMSE	R-sq	chi2	P
lnyield	568	19	0.158962	0.4685	496.51	0.0000
lnnetyield	568	17	0.348174	0.5835	801.72	0.0000

	Coef.	Std.	Err.	z
lnyield				
private	0.095728	0.052001	1.84	0.066
collective	0.0652	0.050927	1.28	0.2
recomend	0.003676	0.000382	9.62	0
date	-0.00425	0.001996	-2.13	0.033
lndensity	-0.27871	0.11502	-2.42	0.015
soilbad	-0.10202	0.018992	-5.37	0
soilgood	0.13925	0.022403	6.22	0
sugarbeet	0.047489	0.025047	1.9	0.058
maizesilage	0.04635	0.026396	1.76	0.079
wwheat	0.035774	0.027819	1.29	0.198
annualgrass	0.043724	0.046052	0.95	0.342
cerealcrop	-0.12293	0.059484	-2.07	0.039
soy	0.121714	0.041646	2.92	0.003
flax	-0.20603	0.113688	-1.81	0.07
rye	-0.13816	0.081603	-1.69	0.09
barley	-0.07612	0.092778	-0.82	0.412
may2	0.009387	0.001006	9.34	0
may3	0.002907	0.001989	1.46	0.144
july1	-0.00509	0.000699	-7.28	0
_cons	1.390418	0.17079	8.14	0
lnnetyield				
lnarea	0.084021	0.025123	3.34	0.001
share	0.01133	0.001834	6.18	0
age	0.005311	0.002014	2.64	0.008

size	3.91E-05	8.10E-06	4.83	0
yearcoop	0.042293	0.014044	3.01	0.003
recomend	0.015668	0.000847	18.5	0
lnfinance	-0.12362	0.02899	-4.26	0
soilgood	0.212488	0.050038	4.25	0
soilbad	-0.11782	0.044177	-2.67	0.008
april3	-0.01266	0.002001	-6.33	0
may1	0.012499	0.00258	4.84	0
may2	0.017636	0.002831	6.23	0
may3	-0.01944	0.005772	-3.37	0.001
june1	-0.01111	0.002286	-4.86	0
june2	-0.00152	0.000912	-1.67	0.095
june3	-0.02338	0.002809	-8.32	0
july1	-0.0109	0.002455	-4.44	0
_cons	0.646482	0.351157	1.84	0.066

Correlation matrix of residuals:

	lnyield	**lnnetyield**
lnyield	**1.0000**	
lnnetyield	**0.2239**	**1.0000**

Breusch-Pagan test of independence: chi2(1) = 28.468, Pr = 0.0000

Appendix 4

Essential Regressions

***** - significance at 1% level**
**** - significance at 5% level**
***- significance at 10% level**

Table A4.1 Regression of gross barley yield on the set of significant determinants

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Regression with robust standard errors				Number of obs = 590		R-sq = 0.4546
lnyield	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
private	.1050691***	.0222997	4.71	0.000	.0612695	.1488686
collective	.0697825***	.0185202	3.77	0.000	.0334064	.1061586
recomend	.0032475***	.000425	7.64	0.000	.0024128	.0040822
date	-.0051299**	.002287	-2.24	0.025	-.0096219	-.0006379
lndensity	-.2148526*	.1265428	-1.70	0.090	-.4633996	.0336945
soilbad	-.0945944***	.018846	-5.02	0.000	-.1316105	-.0575782
soilgood	.1267766***	.0203765	6.22	0.000	.0867544	.1667988
sugarbeet	.0560242**	.0251479	2.23	0.026	.0066303	.105418
maizesilage	.050919*	.0265667	1.92	0.056	-.0012616	.1030995
wwheat	.0423439*	.0266598	1.59	0.113	-.0100197	.0947074
annualgrass	.0378446	.0408859	0.93	0.355	-.0424607	.1181499
cerealcrop	-.1301895**	.0663286	-1.96	0.050	-.2604679	.0000888
soy	.1339339***	.0375745	3.56	0.000	.0601325	.2077353
flax	-.239193*	.1452355	-1.65	0.100	-.524455	.0460691
rye	-.1541745*	.0858841	-1.80	0.073	-.3228625	.0145135
may2	.0095762***	.0010122	9.46	0.000	.0075882	.0115642
july1	-.005099***	.0007169	-7.11	0.000	-.0065071	-.0036909
lnarea	.0191976*	.0123397	1.56	0.120	-.0050392	.0434345
equipgood	.0293117	.0202199	1.45	0.148	-.0104028	.0690263
_cons	1.267002	.1843447	6.87	0.000	.9049247	1.62908

Table A4.2 Regression of net barley yield on the set of significant determinants

Regression with robust standard errors				Number of obs = 570		R-sq = 0.6126
lnnetyield	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**

lnarea	.0715798***	.0267678	2.67	0.008	.0189971	.1241625
share	.0122386***	.0019649	6.23	0.000	.0083789	.0160984
age	.0072958***	.002209	3.30	0.001	.0029564	.0116352
size	.0000396***	7.52e-06	5.27	0.000	.0000249	.0000544
yearcoop	.0338854**	.0162213	2.09	0.037	.0020203	.0657504
recomend	.0149483***	.0010154	14.72	0.000	.0129537	.0169429
date	-.0083083*	.0045595	-1.82	0.069	-.0172653	-.0172653
lnfinance	-.1433797***	.0300493	-4.77	0.000	-.2024086	-.0843508
soilgood	.200399***	.050116	4.00	0.000	.1019513	.2988468
soilbad	-.0875543*	.0488508	-1.79	0.074	-.1835169	.0084082
april3	-.0130729***	.0022055	-5.93	0.000	-.0174054	-.0087403
may1	.01272***	.0023729	5.36	0.000	.0080586	.0173814
may2	.0149371***	.0030702	4.87	0.000	.008906	.0209683
may3	-.015824***	.0056049	-2.82	0.005	-.0268342	-.0048138
june1	-.0100733***	.0025861	-3.90	0.000	-.0151535	-.0049931
june2	-.0016392*	.0009407	-1.74	0.082	-.0034872	.0002087
june3	-.0218996***	.0027514	-7.96	0.000	-.0273045	-.0164948
july1	-.008455***	.0025245	-3.35	0.001	-.0134141	-.0034959
equipbad	-.0312838	.0412685	-0.76	0.449	-.1123516	.049784
sugarbeet	.310907***	.0937973	3.31	0.001	.1266515	.4951624
maizesilage	.2907055***	.0979393	2.97	0.003	.0983136	.4830974
wwheat	.2922667***	.0971442	3.01	0.003	.1014367	.4830967
annualgrass	.2100603	.1363507	1.54	0.124	-.057787	.4779076
cerealcrop	.2282985	.1468413	1.55	0.121	-.0601566	.5167536
buckwheat	.2134898*	.1114609	1.92	0.056	-.005464	.4324436
soy	.3508062***	.1270674	2.76	0.006	.1011951	.6004172
flax	-.2543018*	.1448044	-1.76	0.080	-.5387556	.030152
sunflower	.3826886***	.1134371	3.37	0.001	.1598528	.6055244
mustard	.1551256	.1017651	1.52	0.128	-.0447818	.355033
fallowland	.2151391	.1526556	1.41	0.159	-.0847374	.5150157
barley	.3484297**	.1428147	2.44	0.015	.0678845	.6289748
fertn	.0051528***	.0016437	3.13	0.002	.001924	.0083817
fertp	-.0156716***	.0059569	-2.63	0.009	-.0273733	-.0039699
fertk	.0155588***	.0053581	2.90	0.004	.0050334	.0260842
_cons	.4711026	.3764912	1.25	0.211	-.2684765	1.210682

Appendix 5

Tests for Regression of Net Yield

```
. test share= yearcoop= recomend= lnfinance
 ( 1)  share - yearcoop = 0
 ( 2)  share - recomend = 0
 ( 3)  share - lnfinance = 0

       F(  3,   532) =   10.96
            Prob > F =    0.0000

. test share= yearcoop= recomend
 ( 1)  share - yearcoop = 0
 ( 2)  share - recomend = 0

       F(  2,   532) =    1.06
            Prob > F =    0.3474

. test share= yearcoop

 ( 1)  share - yearcoop = 0

       F(  1,   532) =    1.43
            Prob > F =    0.2319

. test share=recomend

 ( 1)  share - recomend = 0

       F(  1,   532) =    1.00
            Prob > F =    0.3172

. test  sugarbeet= maizesilage= wwheat= buckwheat= sunflower
 ( 1)  sugarbeet - maizesilage = 0
 ( 2)  sugarbeet - wwheat = 0
 ( 3)  sugarbeet - buckwheat = 0
 ( 4)  sugarbeet - sunflower = 0

       F(  4,   532) =    1.07
            Prob > F =    0.3709
```

Appendix 6

Effectiveness Estimation

Table A6.1 Estimation of Effectiveness with Total Set of Determinants

Regression with robust standard errors				**Number of obs = 570**		**R-sq = 0.5090**
eff	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
lnarea	0.019723	0.012712	1.55	0.121	-0.00525	0.044693
share	0.004622	0.000877	5.27	0	0.002899	0.006346
size	2.21E-05	5.42E-06	4.07	0	1.14E-05	3.27E-05
yearcoop	0.030539	0.007638	4	0	0.015534	0.045543
recomend	0.004222	0.000401	10.53	0	0.003434	0.00501
lnfinance	-0.07414	0.01626	-4.56	0	-0.10608	-0.0422
soilgood	0.035069	0.023734	1.48	0.14	-0.01155	0.081691
soilbad	0.016879	0.022645	0.75	0.456	-0.0276	0.061362
equipbad	-0.0508	0.028213	-1.8	0.072	-0.10622	0.00462
equipgood	-0.05574	0.033265	-1.68	0.094	-0.12109	0.009603
fertn	0.003462	0.000849	4.08	0	0.001795	0.005129
fertp	-0.00623	0.003504	-1.78	0.076	-0.01312	0.000651
fertk	0.004078	0.003511	1.16	0.246	-0.00282	0.010976
private	-0.0897	0.077785	-1.15	0.249	-0.2425	0.063092
collective	-0.0297	0.07712	-0.39	0.7	-0.18119	0.12179
date	-0.00151	0.002058	-0.73	0.465	-0.00555	0.002537
sugarbeet	0.098464	0.037275	2.64	0.008	0.025243	0.171686
maizesilage	0.090189	0.039164	2.3	0.022	0.013257	0.167121
wwheat	0.105284	0.039766	2.65	0.008	0.02717	0.183398
annualgrass	0.081963	0.059669	1.37	0.17	-0.03525	0.199175
cerealcrop	0.120198	0.067018	1.79	0.073	-0.01145	0.251846
buckwheat	0.100664	0.049648	2.03	0.043	0.003137	0.198191
soy	0.124112	0.052849	2.35	0.019	0.020298	0.227925
flax	-0.01443	0.110427	-0.13	0.896	-0.23135	0.202488
sunflower	0.211537	0.060987	3.47	0.001	0.091737	0.331337
mustard	0.011117	0.044899	0.25	0.805	-0.07708	0.099316
fallowland	0.063129	0.051368	1.23	0.22	-0.03778	0.164033
barley	0.094889	0.081821	1.16	0.247	-0.06584	0.255615
april2	-0.00336	0.003133	-1.07	0.284	-0.00951	0.002794
april3	-0.00416	0.001068	-3.9	0	-0.00626	-0.00207

may1	0.002069	0.001244	1.66	0.097	-0.00037	0.004513
may2	0.00386	0.001639	2.36	0.019	0.000641	0.00708
may3	-0.01285	0.003302	-3.89	0	-0.01934	-0.00637
june1	-0.00368	0.001373	-2.68	0.008	-0.00637	-0.00098
june2	-0.0015	0.000522	-2.87	0.004	-0.00253	-0.00047
june3	-0.00965	0.001576	-6.12	0	-0.01275	-0.00655
july1	-0.00134	0.001334	-1.01	0.315	-0.00396	0.001278
july2	3.35E-05	0.001089	0.03	0.975	-0.00211	0.002173
lndensity	0.142863	0.131365	1.09	0.277	-0.11518	0.40091
_cons	0.971245	0.269065	3.61	0	0.442705	1.499786

. ovtest

Ramsey RESET test using powers of the fitted values of eff
Ho: model has no omitted variables
F(3, 570) = 1.65
Prob > F = 0.1763

Table A.6 Estimation of Effectiveness with the Set of Significant Determinants

Obs: 587		**R-square**	**=0.3393**
eff	**Coef.**	**Std. Err.**	**p-value**
lnarea	.0212708*	.0132789	0.110
share	.0031674***	.0009297	0.001
size	.0000241***	4.28e-06	0.000
yearcoop	.0235336***	.0071652	0.001
recomend	.0050828***	.0004058	0.000
lnfinance	-.0758796***	.0160802	0.000
soilgood	.0665511**	.0273703	0.015
soilbad	.0606597***	.0209758	0.004
equipbad	-.0720171**	.0299393	0.016
equipgood	-.105199***	.0323196	0.001
fertn	.0035368***	.0013344	0.008
fertp	-.0069362*	.0036582	0.058
fertk	.0025293	.0032758	0.440
_cons	.7076745***	.1767917	0.000

Appendix 7

Functional Form Specification MWD Test

Test description (from Gujarati, 1995, pp. 265-266):

H_0: Linear Model: Y is a linear function of regressors.

H_1: Log-linear Model: lnY is a linear function of logs of X's.

1. Obtain estimated Yf from the linear regression.
2. Obtain estimated lnf from the log-linear regression.
3. Obtain z1=lnYf-lnf.
4. Regress Y on X's and z1. Reject H_0 if the coefficient of z1 is statistically significant.
5. Obtain z2=exp(lnf)-Yf.
6. Regress lnY on log of X's and z2. Reject H_1 if the coefficient of z2 is statistically significant.

Estimation Results:

```
Regression with robust standard errors                Number of obs =     574
                                                      F( 34,   539) =   24.89
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.5381
------------------------------------------------------------------------------
             |               Robust
    netyield |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        area |   .0015449   .0006374     2.42   0.016     .0002929    .0027969
       share |   .0084062   .0041566     2.02   0.044     .0002411    .0165712
         age |     .00893   .0048169     1.85   0.064    -.0005322    .0183923
        size |    .000039   .0000203     1.92   0.055    -7.99e-07    .0000789
```

yearcoop	.1493582	.0343893	4.34	0.000	.0818048	.2169116
recomend	.0264786	.0019527	13.56	0.000	.0226426	.0303145
finance	-1.16e-06	4.64e-07	-2.49	0.013	-2.07e-06	-2.44e-07
soilgood	.5172026	.1173049	4.41	0.000	.2867717	.7476334
soilbad	-.0902376	.0944852	-0.96	0.340	-.275842	.0953669
april3	-.0190301	.0041847	-4.55	0.000	-.0272503	-.0108098
may1	.0131779	.0054039	2.44	0.015	.0025626	.0237931
may2	.0350728	.0067775	5.17	0.000	.0217593	.0483863
may3	-.0731985	.0151251	-4.84	0.000	-.1029099	-.0434871
june1	-.0272197	.0057033	-4.77	0.000	-.0384231	-.0160164
june2	-.0047391	.0021878	-2.17	0.031	-.0090368	-.0004414
june3	-.0515552	.0067187	-7.67	0.000	-.0647532	-.0383571
july1	-.014249	.0053712	-2.65	0.008	-.0247999	-.003698
equipbad	-.0964377	.0926582	-1.04	0.298	-.2784533	.0855778
sugarbeet	.644617	.1433059	4.50	0.000	.3631104	.9261237
maizesilage	.5454796	.1523788	3.58	0.000	.2461506	.8448086
wwheat	.5410445	.157912	3.43	0.001	.2308461	.8512428
annualgrass	.4780811	.2561969	1.87	0.063	-.0251857	.9813479
cerealcrop	.5384722	.2225268	2.42	0.016	.1013462	.9755983
buckwheat	.4707698	.1991073	2.36	0.018	.0796484	.8618913
soy	.9390775	.2428178	3.87	0.000	.4620924	1.416063
flax	-.5051056	.2208463	-2.29	0.023	-.9389305	-.0712807
sunflower	.9364736	.239938	3.90	0.000	.4651454	1.407802
mustard	-.000224	.1636386	-0.00	0.999	-.3216717	.3212236
fallowland	.4197261	.202352	2.07	0.039	.0222309	.8172212
barley	.3367543	.3506188	0.96	0.337	-.3519924	1.025501
fertn	.0122137	.0041878	2.92	0.004	.0039873	.02044
fertp	-.0058126	.0180226	-0.32	0.747	-.0412158	.0295906
fertk	.0074797	.0178681	0.42	0.676	-.0276199	.0425793
z1	**-.9967038**	**.3100932**	**-3.21**	**0.001**	**-1.605843**	**-.3875645**
_cons	.5791553	.5033586	1.15	0.250	-.4096297	1.56794

```
. reg lnnetyield lnarea share age size yearcoop recomend lnfinance soilgood
soilbad  april3 may1 m> ay2 may3 june1 june2 june3 july1 equipbad sugarbeet
maizesilage wwheat annualgrass cerealcrop buckwheat soy flax sunflower mustard
fallowland barley fertn fertp fertk z2, robust

Regression with robust standard errors                Number of obs =     570
                                                      F( 34,   535) =   32.42
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.6185
```

Root MSE = .34348

lnnetyield	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnarea	.0827013	.0268325	3.08	0.002	.0299914	.1354113
share	.0149139	.0021671	6.88	0.000	.0106567	.019171
age	.0079819	.0022085	3.61	0.000	.0036435	.0123203
size	.0000494	8.20e-06	6.02	0.000	.0000333	.0000655
yearcoop	.0242482	.015917	1.52	0.128	-.0070194	.0555157
recomend	.0145844	.0010147	14.37	0.000	.0125912	.0165776
lnfinance	-.1904585	.033799	-5.64	0.000	-.2568535	-.1240634
soilgood	.2024678	.0490751	4.13	0.000	.1060643	.2988712
soilbad	-.0990726	.0484904	-2.04	0.042	-.1943275	-.0038177
april3	-.013787	.0021947	-6.28	0.000	-.0180983	-.0094756
may1	.0141193	.0023739	5.95	0.000	.0094559	.0187827
may2	.0144309	.0030284	4.77	0.000	.0084819	.0203798
may3	-.0096627	.0063145	-1.53	0.127	-.0220671	.0027416
june1	-.0089346	.0026724	-3.34	0.001	-.0141842	-.003685
june2	-.0017756	.00096	-1.85	0.065	-.0036614	.0001102
june3	-.0205536	.0029063	-7.07	0.000	-.0262627	-.0148445
july1	-.0089026	.0025004	-3.56	0.000	-.0138145	-.0039907
equipbad	-.0373018	.0411597	-0.91	0.365	-.1181563	.0435527
sugarbeet	.3157108	.0971457	3.25	0.001	.1248771	.5065445
maizesilage	.3026808	.1011691	2.99	0.003	.1039434	.5014181
wwheat	.3017162	.1004963	3.00	0.003	.1043004	.4991321
annualgrass	.2289118	.1411762	1.62	0.106	-.0484158	.5062395
cerealcrop	.2208056	.1499566	1.47	0.141	-.0737704	.5153816
buckwheat	.2269336	.1096631	2.07	0.039	.0115105	.4423568
soy	.3286898	.1286765	2.55	0.011	.0759168	.5814629
flax	-.2641141	.141395	-1.87	0.062	-.5418715	.0136433
sunflower	.3987462	.1200872	3.32	0.001	.1628459	.6346465
mustard	.2032455	.1064276	1.91	0.057	-.0058216	.4123127
fallowland	.2167318	.1563482	1.39	0.166	-.0903998	.5238634
barley	.4257263	.1608758	2.65	0.008	.1097005	.7417521
fertn	.0052397	.0016417	3.19	0.001	.0020148	.0084645
fertp	-.020854	.0063963	-3.26	0.001	-.0334191	-.008289
fertk	.0204415	.0060974	3.35	0.001	.0084638	.0324192
z2	**-.2232293**	**.0737955**	**-3.02**	**0.003**	**-.3681939**	**-.0782648**
_cons	.802872	.3961723	2.03	0.043	.0246279	1.581116

Appendix 8

Endogeneity Check

Table A7.1 Estimation of Net Yield for Farms, Operating at Contract for One Year

Regression with robust standard errors if yearcoop==1				**Number of obs = 216**		**R-sq = 0.6339**
lnnetyield	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
lnarea	0.022995	0.045238	0.51	0.612	-0.06626	0.112251
share	0.011436***	0.002787	4.1	0	0.005937	0.016935
age	0.010741***	0.003294	3.26	0.001	0.004242	0.017241
size	4.45E-05***	1.06E-05	4.21	0	2.37E-05	6.54E-05
date	-0.00662	0.007144	-0.93	0.355	-0.02071	0.007475
recomend	0.013625***	0.001309	10.41	0	0.011043	0.016207
lnfinance	-0.09466**	0.046653	-2.03	0.044	-0.18671	-0.00262
soilgood	0.004355	0.111287	0.04	0.969	-0.21522	0.223925
soilbad	-0.16997**	0.0822	-2.07	0.04	-0.33216	-0.00779
april3	-0.00607*	0.003376	-1.8	0.074	-0.01273	0.000588
may1	0.01013***	0.003099	3.27	0.001	0.004015	0.016245
may2	-0.00407	0.011606	-0.35	0.726	-0.02696	0.018833
may3	-0.01429*	0.008452	-1.69	0.093	-0.03096	0.002389
june1	-0.00117	0.005347	-0.22	0.828	-0.01171	0.009383
june2	-0.00374***	0.001206	-3.1	0.002	-0.00612	-0.00136
june3	-0.01749***	0.00354	-4.94	0	-0.02448	-0.01051
july1	-0.00664**	0.003159	-2.1	0.037	-0.01287	-0.00041
equipbad	-0.39742***	0.097543	-4.07	0	-0.58988	-0.20497
equipgood	-0.31766**	0.141528	-2.24	0.026	-0.59689	-0.03842
sugarbeet	0.087807	0.098296	0.89	0.373	-0.10613	0.281745
maizesilage	-0.00792	0.107843	-0.07	0.942	-0.2207	0.204853
wwheat	0.098808	0.100733	0.98	0.328	-0.09994	0.297556
annualgrass	0.015035	0.212339	0.07	0.944	-0.40391	0.433983
cerealcrop	-0.45798***	0.122796	-3.73	0	-0.70026	-0.21571
buckwheat	-0.08166	0.119795	-0.68	0.496	-0.31802	0.154694
soy	0.038899	0.129713	0.3	0.765	-0.21703	0.294824
sunflower	-0.05547	0.112584	-0.49	0.623	-0.2776	0.166655
fallowland	0.002602	0.228811	0.01	0.991	-0.44884	0.454048
barley	0.015122	0.081478	0.19	0.853	-0.14564	0.17588
fertn	0.005225*	0.003229	1.62	0.107	-0.00115	0.011596
fertp	-0.00856	0.007568	-1.13	0.26	-0.02349	0.006373
fertk	0.006381	0.006662	0.96	0.339	-0.00676	0.019525
_cons	0.662004	0.627239	1.06	0.293	-0.57555	1.899553

Table A7.2 Estimation of Effectiveness for Farms, Operating at Contract for One Year

Regression with robust standard errors if yearcoop==1				**Number of obs = 229**		**R-sq = 0.2957**
eff	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
share	0.002747	0.001414	1.94	0.053	-0.00004	0.005535
size	1.84E-05	5.39E-06	3.4	0.001	7.73E-06	0.000029
recomend	0.003939	0.000552	7.13	0	0.00285	0.005027
lnfinance	-0.02907	0.022678	-1.28	0.201	-0.07377	0.015619
soilgood	0.102072	0.048082	2.12	0.035	0.007312	0.196832
soilbad	0.097256	0.029281	3.32	0.001	0.039548	0.154964
equipbad	-0.08328	0.062902	-1.32	0.187	-0.20725	0.040687
equipgood	-0.20771	0.075841	-2.74	0.007	-0.35718	-0.05824
_cons	0.409136	0.257843	1.59	0.114	-0.09902	0.917295

reg finance yield_1, robust

Regression with robust standard errors Number of obs = 105
F(1, 103) = 0.30
Prob > F = 0.5840
R-squared = 0.0029
Root MSE = 1.4e+05

finance	Robust Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
yield_1	-8906.044	16212.76	**-0.55**	**0.584**	-41060.23	23248.15
_cons	142513.5	73045.18	1.95	0.054	-2354.401	287381.4

. corr area_total yield_1
(obs=111)

	area_t~l	yield_1
area_total	1.0000	
yield_1	0.1646	1.0000

Appendix 9

Farms' Fixed Effect

.Table A8.1 Regression of Gross Barley Yield on Factors with Inclusion of Farm Specific Effect

Regression with robust standard errors				**Number of obs = 570**		**R-sq = 0.9825**
lnyield	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
private	0.172028	0.087245	1.97	0.05	0.000363	0.343694
collective	0.134599	0.158429	0.85	0.396	-0.17713	0.446328
recomend	0.00051	0.001177	0.43	0.665	-0.0018	0.002825
date	-0.00111	0.000976	-1.14	0.256	-0.00303	0.00081
lndensity	0.535753	0.191897	2.79	0.006	0.158172	0.913334
soilbad	0.002206	0.010566	0.21	0.835	-0.01858	0.022997
soilgood	0.020437	0.031767	0.64	0.52	-0.04207	0.082942
sugarbeet	0.00096	0.006135	0.16	0.876	-0.01111	0.013032
maizesilage	-0.00573	0.006044	-0.95	0.344	-0.01762	0.006163
wwheat	0.002659	0.008374	0.32	0.751	-0.01382	0.019134
annualgrass	0.002019	0.010135	0.2	0.842	-0.01792	0.021961
cerealcrop	0.008194	0.011282	0.73	0.468	-0.014	0.030391
soy	0.003933	0.011669	0.34	0.736	-0.01903	0.026893
flax	-0.20722	0.007441	-27.85	0	-0.22186	-0.19258
rye	-0.004	0.009729	-0.41	0.681	-0.02314	0.015145
may2	-0.00769	0.004656	-1.65	0.1	-0.01685	0.001473
july1	-0.0007	0.004004	-0.18	0.861	-0.00858	0.007177
lnarea	0.00247	0.004505	0.55	0.584	-0.00639	0.011334
equipgood	0.051353	0.037263	1.38	0.169	-0.02197	0.124673
var367	0.371987	0.140184	2.65	0.008	0.096158	0.647816
var366	-0.21792	0.193433	-1.13	0.261	-0.59852	0.162686
var365	-0.26951	0.150306	-1.79	0.074	-0.56525	0.026239
var364	-0.383	0.138836	-2.76	0.006	-0.65617	-0.10982
var363	-0.12445	0.191575	-0.65	0.516	-0.5014	0.252495
var362	0.167818	0.187219	0.9	0.371	-0.20056	0.536194
var360	0.07812	0.160214	0.49	0.626	-0.23712	0.39336
var359	-0.05722	0.192148	-0.3	0.766	-0.43529	0.32086
var358	-0.24048	0.162377	-1.48	0.14	-0.55998	0.079017
var258	-0.18096	0.158884	-1.14	0.256	-0.49358	0.131665
var257	-0.18477	0.161378	-1.14	0.253	-0.5023	0.132762
var256	-0.11413	0.173131	-0.66	0.51	-0.45478	0.22653
var255	0.010378	0.028653	0.36	0.717	-0.046	0.066755

var253	-0.1662	0.05802	-2.86	0.004	-0.28036	-0.05203
var252	-0.36508	0.187615	-1.95	0.053	-0.73424	0.004071
var251	0.162682	0.183442	0.89	0.376	-0.19826	0.523627
var250	0.250832	0.207563	1.21	0.228	-0.15757	0.659238
var249	-0.08439	0.147572	-0.57	0.568	-0.37475	0.205979
var248	0.090015	0.150508	0.6	0.55	-0.20613	0.386159
var247	-0.03284	0.094953	-0.35	0.73	-0.21967	0.153991
var246	-0.00447	0.170062	-0.03	0.979	-0.33909	0.330145
var245	-0.08861	0.154353	-0.57	0.566	-0.39232	0.215094
var244	0.109971	0.153184	0.72	0.473	-0.19144	0.411379
var243	-0.22903	0.098467	-2.33	0.021	-0.42277	-0.03528
var242	-0.3009	0.166656	-1.81	0.072	-0.62881	0.027017
var241	-0.0377	0.155902	-0.24	0.809	-0.34445	0.269057
var240	-0.121	0.09236	-1.31	0.191	-0.30273	0.060731
var239	-0.08257	0.195286	-0.42	0.673	-0.46682	0.301683
var238	-0.32004	0.133663	-2.39	0.017	-0.58303	-0.05704
var237	-0.44724	0.132472	-3.38	0.001	-0.70789	-0.18658
var236	-0.13082	0.133429	-0.98	0.328	-0.39336	0.13172
var235	-0.32978	0.206937	-1.59	0.112	-0.73695	0.077397
var234	-0.43231	0.0439	-9.85	0	-0.51868	-0.34593
var233	0.050742	0.101028	0.5	0.616	-0.14804	0.249527
var232	0.013199	0.136848	0.1	0.923	-0.25607	0.282465
var231	-0.12416	0.208908	-0.59	0.553	-0.53521	0.286891
var230	0.236665	0.207301	1.14	0.254	-0.17123	0.644556
var229	-0.0613	0.133942	-0.46	0.648	-0.32485	0.202245
var228	0.087759	0.118963	0.74	0.461	-0.14632	0.321832
var227	0.135505	0.118284	1.15	0.253	-0.09723	0.368243
var226	0.080747	0.162602	0.5	0.62	-0.23919	0.400685
var225	-0.00226	0.090741	-0.02	0.98	-0.1808	0.176285
var224	0.284023	0.162399	1.75	0.081	-0.03552	0.603563
var223	-0.11342	0.090551	-1.25	0.211	-0.2916	0.064746
var222	-0.03006	0.087328	-0.34	0.731	-0.20189	0.141769
var221	0.316168	0.131006	2.41	0.016	0.058398	0.573939
var220	0.196679	0.163088	1.21	0.229	-0.12422	0.517575
var219	0.295797	0.161749	1.83	0.068	-0.02246	0.614057
var218	0.243926	0.146368	1.67	0.097	-0.04407	0.531923
var217	0.09683	0.076981	1.26	0.209	-0.05464	0.2483
var216	-0.38904	0.104561	-3.72	0	-0.59477	-0.1833
var215	0.101442	0.10466	0.97	0.333	-0.10449	0.307373
var214	-0.76119	0.071747	-10.61	0	-0.90236	-0.62002
var213	-0.63982	0.106523	-6.01	0	-0.84941	-0.43022
var212	0.027306	0.117302	0.23	0.816	-0.2035	0.258112
var211	0.162293	0.254821	0.64	0.525	-0.3391	0.663683

var210	-0.07189	0.079462	-0.9	0.366	-0.22824	0.084463
var209	-0.07645	0.078537	-0.97	0.331	-0.23098	0.078078
var208	0.168836	0.07895	2.14	0.033	0.013492	0.32418
var207	0.154084	0.198228	0.78	0.438	-0.23595	0.544122
var206	0.127956	0.198039	0.65	0.519	-0.26171	0.517622
var205	-0.18886	0.19782	-0.95	0.34	-0.5781	0.200371
var204	0.304783	0.217181	1.4	0.162	-0.12255	0.732112
var135	-0.0122	0.215122	-0.06	0.955	-0.43547	0.411083
var134	-0.00286	0.217316	-0.01	0.99	-0.43046	0.424733
var133	-0.21846	0.215671	-1.01	0.312	-0.64282	0.205895
var132	0.300371	0.217064	1.38	0.167	-0.12673	0.727471
var131	0.017673	0.21487	0.08	0.935	-0.40511	0.440456
var130	0.153918	0.215279	0.71	0.475	-0.26967	0.577506
var129	0.407337	0.143774	2.83	0.005	0.124444	0.690231
var128	-0.16607	0.143373	-1.16	0.248	-0.44817	0.116039
var127	0.022872	0.213891	0.11	0.915	-0.39798	0.443727
var126	0.033548	0.169289	0.2	0.843	-0.29955	0.366645
var125	0.166227	0.215458	0.77	0.441	-0.25771	0.590167
var124	-0.24918	0.178593	-1.4	0.164	-0.60058	0.102225
var123	-0.06933	0.216032	-0.32	0.748	-0.4944	0.35574
var122	-0.0202	0.141111	-0.14	0.886	-0.29786	0.257447
var121	0.304909	0.216413	1.41	0.16	-0.12091	0.730728
var120	-0.02236	0.215165	-0.1	0.917	-0.44572	0.401005
var119	0.197405	0.140968	1.4	0.162	-0.07997	0.474776
var117	0.410893	0.21469	1.91	0.057	-0.01154	0.833322
var116	-0.05485	0.141924	-0.39	0.699	-0.3341	0.224401
var115	-0.21052	0.156358	-1.35	0.179	-0.51817	0.097137
var114	0.051642	0.214763	0.24	0.81	-0.37093	0.474214
var113	-0.0151	0.143979	-0.1	0.917	-0.29839	0.2682
var112	0.410272	0.212825	1.93	0.055	-0.00849	0.829031
var111	0.021751	0.209584	0.1	0.917	-0.39063	0.434132
var110	-0.11564	0.170736	-0.68	0.499	-0.45159	0.220301
var109	-0.04025	0.18052	-0.22	0.824	-0.39545	0.31494
var108	-0.10569	0.025975	-4.07	0	-0.1568	-0.05459
var107	-0.01087	0.12227	-0.09	0.929	-0.25145	0.229712
var106	-0.05807	0.03655	-1.59	0.113	-0.12999	0.013845
var105	-0.03861	0.157839	-0.24	0.807	-0.34917	0.27196
var104	0.08619	0.157802	0.55	0.585	-0.2243	0.396684
var103	0.185023	0.189355	0.98	0.329	-0.18756	0.557601
var102	-0.27534	0.076486	-3.6	0	-0.42583	-0.12484
var101	0.009601	0.114456	0.08	0.933	-0.2156	0.234806
var100	0.227847	0.18902	1.21	0.229	-0.14407	0.599767
var99	-0.14365	0.113452	-1.27	0.206	-0.36688	0.079582

var98	0.009472	0.052619	0.18	0.857	-0.09406	0.113007
var97	-0.09487	0.189237	-0.5	0.617	-0.46721	0.277481
var96	-0.01651	0.18909	-0.09	0.93	-0.38856	0.355551
var95	-0.00907	0.158667	-0.06	0.954	-0.32127	0.303121
var94	-0.1269	0.055407	-2.29	0.023	-0.23592	-0.01788
var93	0.211511	0.119281	1.77	0.077	-0.02319	0.44621
var92	-0.01761	0.057292	-0.31	0.759	-0.13033	0.095124
var91	0.275073	0.057434	4.79	0	0.162064	0.388082
var90	-0.13626	0.068288	-2	0.047	-0.27062	-0.0019
var89	0.255809	0.189876	1.35	0.179	-0.11779	0.629412
var88	-0.05175	0.073549	-0.7	0.482	-0.19647	0.092966
var87	-0.23714	0.162408	-1.46	0.145	-0.5567	0.082416
var86	-0.16196	0.091675	-1.77	0.078	-0.34235	0.018417
var85	-0.33024	0.187481	-1.76	0.079	-0.69913	0.038651
var84	-0.30642	0.188865	-1.62	0.106	-0.67804	0.065193
var83	0.058715	0.184553	0.32	0.751	-0.30441	0.421845
var82	0.104603	0.18799	0.56	0.578	-0.26529	0.474496
var81	-0.01914	0.16143	-0.12	0.906	-0.33677	0.298496
var79	-0.21771	0.15087	-1.44	0.15	-0.51457	0.079142
var78	-0.06283	0.162422	-0.39	0.699	-0.38241	0.25676
var77	0.100854	0.119071	0.85	0.398	-0.13343	0.335141
var76	0.00884	0.121375	0.07	0.942	-0.22998	0.247661
var74	0.103035	0.120763	0.85	0.394	-0.13458	0.34065
var73	-0.00578	0.074439	-0.08	0.938	-0.15225	0.140689
var72	0.214462	0.187486	1.14	0.254	-0.15444	0.583364
var71	0.345148	0.121277	2.85	0.005	0.106522	0.583775
var70	0.211407	0.191969	1.1	0.272	-0.16632	0.589129
var69	0.069687	0.092052	0.76	0.45	-0.11144	0.25081
var68	0.200392	0.163088	1.23	0.22	-0.1205	0.521286
var67	0.091447	0.100295	0.91	0.363	-0.1059	0.28879
var66	0.523397	0.166337	3.15	0.002	0.196109	0.850685
var65	0.207581	0.166147	1.25	0.212	-0.11933	0.534495
var64	0.075121	0.167131	0.45	0.653	-0.25373	0.403972
var63	0.174635	0.159844	1.09	0.275	-0.13988	0.489146
var62	-0.00682	0.162374	-0.04	0.967	-0.32631	0.31267
var61	0.077954	0.162783	0.48	0.632	-0.24234	0.39825
var60	0.017702	0.099284	0.18	0.859	-0.17765	0.213057
var59	0.160827	0.167672	0.96	0.338	-0.16909	0.490742
var58	0.109094	0.163258	0.67	0.504	-0.21214	0.430324
var57	-0.11337	0.12311	-0.92	0.358	-0.3556	0.128866
var56	0.081998	0.120548	0.68	0.497	-0.1552	0.319191
var55	0.201512	0.090477	2.23	0.027	0.023488	0.379535
var54	0.006122	0.162631	0.04	0.97	-0.31387	0.326117

var53	-0.07941	0.162436	-0.49	0.625	-0.39902	0.240206
var52	0.199221	0.162116	1.23	0.22	-0.11976	0.518204
var51	-0.10264	0.163416	-0.63	0.53	-0.42418	0.218902
var50	-0.021	0.162325	-0.13	0.897	-0.34039	0.298394
var49	-0.26758	0.090551	-2.95	0.003	-0.44575	-0.0894
var48	-0.09169	0.024155	-3.8	0	-0.13922	-0.04416
var47	0.050405	0.058975	0.85	0.393	-0.06564	0.166444
var46	-0.0934	0.128105	-0.73	0.466	-0.34547	0.158657
var45	0.197778	0.162891	1.21	0.226	-0.12273	0.518286
var44	0.035012	0.147922	0.24	0.813	-0.25604	0.326067
var43	0.265064	0.174329	1.52	0.129	-0.07795	0.608076
var42	-0.22259	0.236554	-0.94	0.347	-0.68804	0.242855
var41	0.316222	0.259802	1.22	0.224	-0.19497	0.827415
var40	0.3026	0.236185	1.28	0.201	-0.16212	0.767324
var39	0.258404	0.170234	1.52	0.13	-0.07655	0.593361
var38	0.144075	0.224492	0.64	0.521	-0.29764	0.585789
var37	-0.39776	0.117102	-3.4	0.001	-0.62817	-0.16734
var35	-0.30624	0.220336	-1.39	0.166	-0.73978	0.127299
var194	-0.10357	0.187572	-0.55	0.581	-0.47264	0.265506
var193	-0.0747	0.215788	-0.35	0.729	-0.49929	0.349884
var192	-0.25863	0.185421	-1.39	0.164	-0.62346	0.106213
var191	-0.01951	0.221547	-0.09	0.93	-0.45543	0.416413
var190	0.050882	0.192963	0.26	0.792	-0.3288	0.430559
var189	-0.15568	0.210527	-0.74	0.46	-0.56992	0.258559
var188	-0.0973	0.205856	-0.47	0.637	-0.50235	0.307748
var187	0.127961	0.238912	0.54	0.593	-0.34213	0.598049
var186	0.260728	0.196813	1.32	0.186	-0.12652	0.647982
var185	-0.25293	0.234433	-1.08	0.281	-0.7142	0.20835
var184	-0.02203	0.234377	-0.09	0.925	-0.48319	0.439137
var183	0.224975	0.188647	1.19	0.234	-0.14621	0.59616
var181	-0.17555	0.158561	-1.11	0.269	-0.48754	0.13644
var180	-0.01211	0.21591	-0.06	0.955	-0.43694	0.412717
var179	-0.32037	0.158126	-2.03	0.044	-0.6315	-0.00923
var178	-0.39546	0.155763	-2.54	0.012	-0.70194	-0.08898
var176	-0.1042	0.210159	-0.5	0.62	-0.51771	0.309319
var175	0.10194	0.220706	0.46	0.644	-0.33233	0.536206
var173	-0.08834	0.217556	-0.41	0.685	-0.5164	0.339732
var171	0.155578	0.303714	0.51	0.609	-0.44202	0.753173
var170	-0.02749	0.146943	-0.19	0.852	-0.31662	0.261635
var168	-0.37044	0.156173	-2.37	0.018	-0.67773	-0.06315
var167	0.168904	0.202622	0.83	0.405	-0.22978	0.567588
var166	0.117228	0.205754	0.57	0.569	-0.28762	0.522073
var165	-0.50999	0.069565	-7.33	0	-0.64687	-0.37311

var164	0.241673	0.18933	1.28	0.203	-0.13086	0.614203
var163	-0.09329	0.203291	-0.46	0.647	-0.49329	0.306712
var162	-0.27781	0.176621	-1.57	0.117	-0.62533	0.069712
var161	0.059996	0.160618	0.37	0.709	-0.25604	0.376031
var160	-0.09209	0.298503	-0.31	0.758	-0.67943	0.495256
var159	-0.34881	0.139604	-2.5	0.013	-0.6235	-0.07412
var158	-0.52796	0.091518	-5.77	0	-0.70804	-0.34789
var157	0.181256	0.107202	1.69	0.092	-0.02968	0.392189
var156	-0.18361	0.201724	-0.91	0.363	-0.58053	0.213308
var155	0.232226	0.228987	1.01	0.311	-0.21833	0.682786
var154	0.369417	0.154093	2.4	0.017	0.06622	0.672613
var153	0.134475	0.264731	0.51	0.612	-0.38642	0.655366
var151	0.399776	0.27472	1.46	0.147	-0.14077	0.940321
var152	0.418378	0.269472	1.55	0.122	-0.11184	0.948597
var150	0.27728	0.259579	1.07	0.286	-0.23347	0.788034
var149	0.501654	0.186494	2.69	0.008	0.134703	0.868604
var148	0.405695	0.252701	1.61	0.109	-0.09153	0.902915
var147	0.35433	0.216526	1.64	0.103	-0.07171	0.780371
var146	0.64871	0.290413	2.23	0.026	0.077288	1.220131
var145	0.47208	0.289497	1.63	0.104	-0.09754	1.041701
var144	0.482168	0.247562	1.95	0.052	-0.00494	0.969276
var143	0.50609	0.303159	1.67	0.096	-0.09041	1.102592
var142	0.027745	0.20529	0.14	0.893	-0.37619	0.431678
var141	0.070207	0.253761	0.28	0.782	-0.4291	0.569513
var140	0.393096	0.210178	1.87	0.062	-0.02046	0.806647
var139	0.137026	0.241112	0.57	0.57	-0.33739	0.611442
var138	0.093397	0.22625	0.41	0.68	-0.35178	0.538571
var137	0.449403	0.111301	4.04	0	0.230406	0.6684
var136	0.307676	0.21267	1.45	0.149	-0.11078	0.726131
var34	0.323329	0.21083	1.53	0.126	-0.0915	0.738164
var33	-0.1961	0.13108	-1.5	0.136	-0.45401	0.061816
var31	0.427806	0.226633	1.89	0.06	-0.01812	0.873734
var29	0.495746	0.302998	1.64	0.103	-0.10044	1.09193
var28	0.525352	0.260412	2.02	0.045	0.01296	1.037745
var27	0.480914	0.185909	2.59	0.01	0.115115	0.846712
var25	0.229116	0.281669	0.81	0.417	-0.3251	0.783334
var24	0.279796	0.303478	0.92	0.357	-0.31733	0.876926
var22	-0.05273	0.138762	-0.38	0.704	-0.32576	0.220301
var20	0.120011	0.21469	0.56	0.577	-0.30242	0.54244
var19	-0.51429	0.134335	-3.83	0	-0.77861	-0.24997
var36	-0.13816	0.195897	-0.71	0.481	-0.52361	0.247293
var18	0.05738	0.140418	0.41	0.683	-0.21891	0.333671
var17	0.058048	0.140776	0.41	0.68	-0.21895	0.335042

var16	0.008185	0.140841	0.06	0.954	-0.26894	0.285308
var15	0.016207	0.214147	0.08	0.94	-0.40515	0.437566
var13	0.158703	0.141599	1.12	0.263	-0.11991	0.437316
var12	0.262255	0.217655	1.2	0.229	-0.16601	0.690518
var9	0.201913	0.207607	0.97	0.332	-0.20658	0.610405
var8	-0.02267	0.132826	-0.17	0.865	-0.28402	0.238685
var7	-0.01311	0.138096	-0.09	0.924	-0.28483	0.258612
var5	0.312798	0.156274	2	0.046	0.00531	0.620287
var4	0.102772	0.215513	0.48	0.634	-0.32128	0.52682
var3	-0.13151	0.183387	-0.72	0.474	-0.49235	0.229322
var2	-0.09612	0.126901	-0.76	0.449	-0.34582	0.153568
_cons	0.551976	0.223288	2.47	0.014	0.112631	0.991322

Table A8.2 Regression of Effectiveness on Factors with Inclusion of Farm Specific Effect

Regression with robust standard errors				**Number of obs = 569**		**R-sq = 0.9338**
eff	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
share	0.006624	0.004948	1.34	0.182	-0.00311	0.01636
size	1.69E-06	7.73E-05	0.02	0.983	-0.00015	0.000154
yearcoop	0.07309	0.05148	1.42	0.157	-0.0282	0.174375
recomend	0.008853	0.00274	3.23	0.001	0.003462	0.014244
lnfinance	-0.11083	0.118407	-0.94	0.35	-0.34379	0.122132
soilgood	0.027531	0.016587	1.66	0.098	-0.0051	0.060165
soilbad	-0.00516	0.029647	-0.17	0.862	-0.06349	0.053169
equipbad	0.011339	0.031087	0.36	0.716	-0.04982	0.072503
equipgood	-0.04693	0.089402	-0.52	0.6	-0.22283	0.128964
fertn	-0.00435	0.002411	-1.8	0.072	-0.00909	0.000394
Fertp	-0.00142	0.001482	-0.96	0.337	-0.00434	0.001492
Fertk	0.004768	0.002791	1.71	0.089	-0.00072	0.010258
var367	-0.01005	0.118016	-0.09	0.932	-0.24225	0.222142
var366*	0.326365	0.203333	1.61	0.109	-0.07369	0.726417
var365	0.07153	0.161902	0.44	0.659	-0.24701	0.390068
var364	0.2003	0.213481	0.94	0.349	-0.21972	0.620317
var363**	0.34172	0.156185	2.19	0.029	0.03443	0.649011
var362	-0.05957	0.22329	-0.27	0.79	-0.49889	0.379747
var361	0.327865	0.535646	0.61	0.541	-0.72601	1.381735
var360	-0.01369	0.147182	-0.09	0.926	-0.30327	0.275884
var359	0.124169	0.153021	0.81	0.418	-0.1769	0.425235
var358*	0.390738	0.248236	1.57	0.116	-0.09766	0.879135
var258	0.09358	0.200295	0.47	0.641	-0.3005	0.487655

var257*	0.29751	0.210593	1.41	0.159	-0.11683	0.711846
var256	0.182175	0.180205	1.01	0.313	-0.17237	0.536724
var255	0.61781	0.993802	0.62	0.535	-1.33747	2.573091
var254	0.02292	0.195888	0.12	0.907	-0.36248	0.408325
var253	-0.19222	0.163722	-1.17	0.241	-0.51434	0.129896
var252	0.098917	0.16468	0.6	0.548	-0.22509	0.422922
var251	-0.07287	0.222952	-0.33	0.744	-0.51152	0.365784
var250	0.033046	0.196794	0.17	0.867	-0.35414	0.420234
var249	-0.02697	0.376269	-0.07	0.943	-0.76727	0.71333
var248	-0.26446	0.221595	-1.19	0.234	-0.70044	0.171524
var247*	0.310544	0.21813	1.42	0.156	-0.11862	0.73971
var246	0.236745	0.185203	1.28	0.202	-0.12764	0.601126
var245	-0.13335	0.171007	-0.78	0.436	-0.4698	0.2031
var244	0.162037	0.194814	0.83	0.406	-0.22125	0.545328
var242	-0.1922	0.299952	-0.64	0.522	-0.78234	0.397952
var241*	-0.26938	0.175398	-1.54	0.126	-0.61447	0.075715
var240	0.023619	0.187936	0.13	0.9	-0.34614	0.393378
var239	-0.07309	0.271873	-0.27	0.788	-0.60799	0.461817
var238*	-0.37408	0.165895	-2.25	0.025	-0.70047	-0.04768
var237	-0.12127	0.19971	-0.61	0.544	-0.51419	0.271656
var236	0.000577	0.28596	0	0.998	-0.56204	0.563197
var235	0.612427	0.972824	0.63	0.529	-1.30158	2.526436
var234	0.221059	0.15545	1.42	0.156	-0.08479	0.526902
var233	-0.00325	0.165621	-0.02	0.984	-0.32911	0.322603
var232	0.235746	0.192848	1.22	0.222	-0.14368	0.615168
var231*	-0.20685	0.138312	-1.5	0.136	-0.47897	0.065276
var230	-0.21196	0.159147	-1.33	0.184	-0.52508	0.101159
var229	0.064893	0.162977	0.4	0.691	-0.25576	0.385546
var228	0.00881	0.170319	0.05	0.959	-0.32629	0.343908
var227*	0.246236	0.154353	1.6	0.112	-0.05745	0.549922
var226	-0.09958	0.161136	-0.62	0.537	-0.41661	0.217453
var225	0.025127	0.146336	0.17	0.864	-0.26278	0.313039
var224	0.096636	0.158493	0.61	0.542	-0.2152	0.408466
var223	0.237532	0.169196	1.4	0.161	-0.09536	0.57042
var222	0.165151	0.153081	1.08	0.281	-0.13603	0.466334
var221**	0.287807	0.147667	1.95	0.052	-0.00273	0.578338
var220	0.238982	0.240828	0.99	0.322	-0.23484	0.712805
var219*	0.428446	0.151182	2.83	0.005	0.130998	0.725893
var218	-0.09278	0.134989	-0.69	0.492	-0.35836	0.172811
var217**	0.331441	0.173262	1.91	0.057	-0.00945	0.67233
var216***	0.472755	0.157827	3	0.003	0.162233	0.783276
var215	0.062519	0.165142	0.38	0.705	-0.26239	0.387432
var214	0.022685	0.168127	0.13	0.893	-0.3081	0.35347

var213*	0.334635	0.235295	1.42	0.156	-0.1283	0.797572
var212**	0.233237	0.141551	1.65	0.1	-0.04526	0.511734
var211	0.137385	0.171078	0.8	0.423	-0.19921	0.473978
var210	0.013523	0.157313	0.09	0.932	-0.29599	0.323033
var209	-0.18621	0.196096	-0.95	0.343	-0.57203	0.199601
var208	-0.18016	0.203431	-0.89	0.376	-0.58041	0.220084
var207	0.278668	0.217593	1.28	0.201	-0.14944	0.706776
var206	-0.00101	0.15573	-0.01	0.995	-0.30741	0.305381
var205	-0.18837	0.167431	-1.13	0.261	-0.51779	0.141049
var204***	-0.5241	0.141507	-3.7	0	-0.80251	-0.24569
var135	-0.18067	0.162874	-1.11	0.268	-0.50112	0.139779
var134	-0.28141	0.23394	-1.2	0.23	-0.74168	0.178862
var133**	-0.2492	0.126705	-1.97	0.05	-0.49849	8.98E-05
var132***	-0.41926	0.145045	-2.89	0.004	-0.70463	-0.13389
var131	-0.18272	0.160594	-1.14	0.256	-0.49868	0.133248
var130	-0.07812	0.16405	-0.48	0.634	-0.40088	0.244648
var129	-0.00968	0.185977	-0.05	0.959	-0.37559	0.356224
var128	0.09955	0.152129	0.65	0.513	-0.19976	0.398859
var127*	-0.23347	0.142763	-1.64	0.103	-0.51436	0.047409
var126	0.111588	0.171776	0.65	0.516	-0.22638	0.449553
var125***	-0.34787	0.121763	-2.86	0.005	-0.58743	-0.1083
var124	0.071003	0.173874	0.41	0.683	-0.27109	0.413097
var123	0.077353	0.196002	0.39	0.693	-0.30828	0.462982
var122	-0.14138	0.155188	-0.91	0.363	-0.44671	0.163952
var121	-0.10335	0.133838	-0.77	0.441	-0.36667	0.159977
var120	0.07128	0.201241	0.35	0.723	-0.32466	0.467216
var119	-0.15892	0.135069	-1.18	0.24	-0.42467	0.106821
var117	-0.08699	0.137587	-0.63	0.528	-0.35769	0.183706
var116	-0.07728	0.156268	-0.49	0.621	-0.38473	0.230178
var115***	0.53437	0.195508	2.73	0.007	0.149714	0.919027
var114	0.146588	0.175496	0.84	0.404	-0.1987	0.491872
var113	-0.15407	0.157334	-0.98	0.328	-0.46362	0.155485
var112	0.116481	0.195644	0.6	0.552	-0.26844	0.501406
var111	0.048469	0.191596	0.25	0.8	-0.32849	0.425429
var110	0.323989	0.240843	1.35	0.18	-0.14986	0.797842
var109	0.208707	0.229798	0.91	0.364	-0.24341	0.660828
var108*	0.46062	0.304983	1.51	0.132	-0.13943	1.060666
var107	-0.09538	0.167142	-0.57	0.569	-0.42423	0.233464
var106	0.265716	0.206796	1.28	0.2	-0.14115	0.672582
var105**	0.328766	0.19441	1.69	0.092	-0.05373	0.711262
var104*	0.233656	0.162974	1.43	0.153	-0.08699	0.554302
var103***	-0.42726	0.131796	-3.24	0.001	-0.68656	-0.16795
var102	0.141016	0.159792	0.88	0.378	-0.17337	0.455402

var101	-0.04401	0.157556	-0.28	0.78	-0.35399	0.265979
var100*	0.336725	0.195213	1.72	0.086	-0.04735	0.720802
var99	0.184064	0.155514	1.18	0.237	-0.12191	0.490033
var98	0.149743	0.169849	0.88	0.379	-0.18443	0.483917
var97	0.190716	0.1419	1.34	0.18	-0.08847	0.469901
var96**	0.355491	0.155352	2.29	0.023	0.04984	0.661141
var95	0.273306	0.203688	1.34	0.181	-0.12745	0.674058
var94	0.058309	0.146711	0.4	0.691	-0.23034	0.34696
var93	0.012398	0.149172	0.08	0.934	-0.28109	0.30589
var92	0.009382	0.13868	0.07	0.946	-0.26347	0.282231
var91	0.01187	0.136206	0.09	0.931	-0.25611	0.279852
var90	0.289318	0.176114	1.64	0.101	-0.05718	0.635817
var89*	-0.0203	0.202159	-0.1	0.92	-0.41804	0.377443
var88	0.162406	0.167847	0.97	0.334	-0.16783	0.492641
var87	0.057684	0.144193	0.4	0.689	-0.22601	0.34138
var86	0.184194	0.142746	1.29	0.198	-0.09666	0.465044
var85	0.053576	0.153652	0.35	0.728	-0.24873	0.355883
var84	0.177969	0.174641	1.02	0.309	-0.16563	0.521571
var83	0.1345	0.191028	0.7	0.482	-0.24134	0.510343
var82*	0.274426	0.145044	1.89	0.059	-0.01095	0.559797
var81*	0.307417	0.159111	1.93	0.054	-0.00563	0.620464
var80	0.06082	0.156597	0.39	0.698	-0.24728	0.36892
var79	0.069339	0.404434	0.17	0.864	-0.72638	0.865054
var78	-0.13213	0.155586	-0.85	0.396	-0.43824	0.173979
var76	-0.02233	0.15628	-0.14	0.886	-0.32981	0.285144
var74	-0.13674	0.127443	-1.07	0.284	-0.38748	0.114001
var73*	0.599078	0.412586	1.45	0.147	-0.21267	1.410831
var72	-0.08602	0.189934	-0.45	0.651	-0.45971	0.287668
var71	0.23565	0.128922	1.83	0.069	-0.018	0.489301
var70	0.212095	0.148415	1.43	0.154	-0.07991	0.504098
var69	0.232994	0.38961	0.6	0.55	-0.53355	0.999541
var68	0.115605	0.150266	0.77	0.442	-0.18004	0.411249
var67	0.16084	0.222125	0.72	0.47	-0.27619	0.597866
var66	-0.11101	0.192251	-0.58	0.564	-0.48926	0.267237
var65**	0.386436	0.210958	1.83	0.068	-0.02862	0.80149
var64	0.171084	0.239976	0.71	0.476	-0.30106	0.64323
var63	-0.06096	0.166931	-0.37	0.715	-0.38939	0.267471
var62	0.385187	0.178021	2.16	0.031	0.034936	0.735439
var61	0.167919	0.169106	0.99	0.321	-0.16479	0.50063
var60	-0.36225	0.150676	-2.4	0.017	-0.6587	-0.06579
var59	0.219796	0.250609	0.88	0.381	-0.27327	0.712863
var58	0.113078	0.188284	0.6	0.549	-0.25737	0.483521
var57	0.276253	0.20684	1.34	0.183	-0.1307	0.683205

var56	0.082188	0.191096	0.43	0.667	-0.29379	0.458165
var55	0.192476	0.157476	1.22	0.223	-0.11735	0.502306
var54	0.07965	0.14753	0.54	0.59	-0.21061	0.369911
var53	-0.08249	0.135603	-0.61	0.543	-0.34929	0.184304
var52	0.051064	0.152716	0.33	0.738	-0.2494	0.351529
var51	0.400732	0.256367	1.56	0.119	-0.10366	0.905127
var50	-0.01365	0.158721	-0.09	0.932	-0.32593	0.298632
var49	0.212546	0.18462	1.15	0.25	-0.15069	0.575782
var48**	0.567676	0.25342	2.24	0.026	0.069077	1.066274
var47**	0.235931	0.352907	0.67	0.504	-0.45841	0.930267
var46	0.007159	0.248114	0.03	0.977	-0.481	0.495318
var45	-0.28857	0.141359	-2.04	0.042	-0.56669	-0.01045
var44	-0.03886	0.151236	-0.26	0.797	-0.33641	0.25869
var43**	0.362111	0.275524	1.31	0.19	-0.17998	0.904198
var42	0.314761	0.296352	1.06	0.289	-0.2683	0.897827
var41	-0.15703	0.386992	-0.41	0.685	-0.91843	0.604366
var40	0.01675	0.160989	0.1	0.917	-0.29999	0.333493
var39	-0.16709	0.273706	-0.61	0.542	-0.7056	0.371422
var38	-0.2209	0.1949	-1.13	0.258	-0.60436	0.162564
var37	0.038912	0.225739	0.17	0.863	-0.40522	0.483048
var35***	0.591986	0.181945	3.25	0.001	0.234012	0.949959
var194**	0.473572	0.188108	2.52	0.012	0.103474	0.84367
var193	0.101295	0.162819	0.62	0.534	-0.21905	0.421637
var192**	0.49037	0.221662	2.21	0.028	0.054256	0.926483
var191	0.136086	0.183929	0.74	0.46	-0.22579	0.497962
var190*	0.420147	0.214963	1.95	0.052	-0.00279	0.843081
var188	0.163255	0.24114	0.68	0.499	-0.31118	0.637691
var187	0.294455	0.328133	0.9	0.37	-0.35114	0.940049
var186	0.286504	0.365409	0.78	0.434	-0.43243	1.005437
var185	0.302852	0.191604	1.58	0.115	-0.07412	0.679829
var184	0.142958	0.195717	0.73	0.466	-0.24211	0.528027
var183	0.089699	0.389446	0.23	0.818	-0.67653	0.855925
var182*	0.432096	0.239638	1.8	0.072	-0.03939	0.903579
var181*	0.337731	0.199086	1.7	0.091	-0.05397	0.729427
var180	0.186996	0.16804	1.11	0.267	-0.14362	0.51761
var179*	0.376591	0.217796	1.73	0.085	-0.05192	0.805098
var178**	0.523778	0.213332	2.46	0.015	0.104053	0.943504
var176	0.263772	0.208207	1.27	0.206	-0.14587	0.673415
var175	-0.018	0.17327	-0.1	0.917	-0.3589	0.322908
var173*	0.362556	0.202546	1.79	0.074	-0.03595	0.761061
var171	-0.19455	0.230008	-0.85	0.398	-0.64709	0.257982
var170*	0.376493	0.207262	1.82	0.07	-0.03129	0.784276
var168	0.158752	0.449266	0.35	0.724	-0.72517	1.042673

var167	-0.21727	0.146271	-1.49	0.138	-0.50505	0.070519
var166*	-0.33968	0.176892	-1.92	0.056	-0.68771	0.008352
var165	0.055494	0.248121	0.22	0.823	-0.43268	0.543667
var164	-0.10989	0.174645	-0.63	0.53	-0.4535	0.233724
var163	0.046018	0.14359	0.32	0.749	-0.23649	0.328528
var162	-0.19246	0.281383	-0.68	0.494	-0.74608	0.36115
var161	-0.07432	0.410885	-0.18	0.857	-0.88273	0.734084
var160	0.000143	0.20766	0	0.999	-0.40842	0.408708
var159	0.1635	0.186139	0.88	0.38	-0.20272	0.529725
var158	0.095524	0.229388	0.42	0.677	-0.35579	0.546838
var157	0.434945	0.446644	0.97	0.331	-0.44382	1.313706
var156	-0.21081	0.156412	-1.35	0.179	-0.51855	0.096926
var155	0.197425	0.184194	1.07	0.285	-0.16497	0.559821
var154***	-0.35681	0.148379	-2.4	0.017	-0.64875	-0.06488
var153	0.219326	0.21181	1.04	0.301	-0.19741	0.636058
var151	0.05135	0.274988	0.19	0.852	-0.48968	0.592382
var152	-0.02449	0.235112	-0.1	0.917	-0.48706	0.438089
var150	0.023835	0.328615	0.07	0.942	-0.62271	0.670377
var149	0.022797	0.181579	0.13	0.9	-0.33446	0.380049
var148	0.345154	0.183787	1.88	0.061	-0.01644	0.70675
var147	-0.09317	0.160848	-0.58	0.563	-0.40963	0.223294
var146*	0.248904	0.180795	1.38	0.17	-0.10681	0.604613
var145	-0.23103	0.336055	-0.69	0.492	-0.89221	0.430152
var144	-0.0481	0.25119	-0.19	0.848	-0.54231	0.446106
var143	-0.22476	0.181814	-1.24	0.217	-0.58248	0.132951
var142	0.201799	0.219249	0.92	0.358	-0.22957	0.633166
var141	-0.13563	0.187247	-0.72	0.469	-0.50403	0.232775
var140	-0.20437	0.163901	-1.25	0.213	-0.52684	0.118101
var139	-0.13413	0.17985	-0.75	0.456	-0.48798	0.219726
var138	0.034631	0.189568	0.18	0.855	-0.33834	0.407602
var137	-0.00505	0.444584	-0.01	0.991	-0.87976	0.869654
var136	0.291477	0.196333	1.48	0.139	-0.0948	0.677756
var34	-0.00363	0.270922	-0.01	0.989	-0.53666	0.529405
var33	0.055459	0.20419	0.27	0.786	-0.34628	0.457198
var31	0.063006	0.139496	0.45	0.652	-0.21145	0.33746
var29	-0.29112	0.234698	-1.24	0.216	-0.75289	0.170637
var28	-0.20405	0.226137	-0.9	0.368	-0.64897	0.240867
var27	-0.06466	0.348781	-0.19	0.853	-0.75087	0.62156
var25	0.196433	0.207662	0.95	0.345	-0.21214	0.605003
var24	-0.16464	0.238297	-0.69	0.49	-0.63349	0.3042
var22*	0.206259	0.143218	1.44	0.151	-0.07552	0.488036
var20	-0.2347	0.187086	-1.25	0.211	-0.60279	0.133385
var19**	0.54032	0.267107	2.02	0.044	0.014793	1.065846

var36	0.128484	0.171369	0.75	0.454	-0.20868	0.465647
var18*	-0.22314	0.139883	-1.6	0.112	-0.49835	0.052081
var17**	-0.28969	0.14064	-2.06	0.04	-0.5664	-0.01298
var16	-0.19201	0.180003	-1.07	0.287	-0.54616	0.162145
var15	0.011933	0.131183	0.09	0.928	-0.24617	0.270032
var13	0.107334	0.158722	0.68	0.499	-0.20495	0.419616
var12	0.327684	0.197135	1.66	0.097	-0.06017	0.715542
var9	0.145261	0.405673	0.36	0.721	-0.65289	0.943413
var7	0.063978	0.194574	0.33	0.743	-0.31884	0.446797
var5	-0.22361	0.288626	-0.77	0.439	-0.79148	0.344251
var4	-0.14454	0.249067	-0.58	0.562	-0.63458	0.34549
var3	0.027263	0.276088	0.1	0.921	-0.51593	0.570459
var2	-0.32392	0.241548	-1.34	0.181	-0.79916	0.151319
_cons	0.610838	1.299295	0.47	0.639	-1.94549	3.167169

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