

# **Farm - processor relationships in the Commonwealth of Independent States (CIS)**

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## **ABSTRACT**

The nature of farm - processor relationships in 5 countries (Armenia, Georgia, Moldova, Russia and Ukraine) that are members of the Commonwealth of Independent States (CIS) is analysed. Farm-processor contracting and the use of contract support measures became more prevalent over the period 1997-2003. Contract support measures have stimulated improvement in yields and the quality of output but to a varying extent. Improvements in product quality are associated with intensity of contracting and the use of contract support measures. Tobit models identify important cross-national and sub-sectoral variations in the intensity of contracting and use of contract support measures.

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## **1. Introduction**

Restructuring and privatisation in Commonwealth of Independent States (CIS) has led to the separation of many previously horizontally and vertically integrated enterprises together with the emergence of *de novo* businesses. Enterprises have had to forge their own relationships with buyers and suppliers in an environment of both weak public institutions for enforcing contractual obligations and property rights, and a high level of macroeconomic instability. These problems have been identified as impediments to growth with the dislocation to, and failure of, inter-enterprise relationships being a causal factor in the falls in output witnessed in the early years of transition (Blanchard and Kremer, 1997; Gow and Swinnen, 2001).

With the break-up of former state and collective farms, established food processors in the CIS have lost guaranteed, state directed, supplies and demand. Food processors have had to institute their own relationships to effectively procure agricultural raw materials. In meeting this challenge processing enterprises can source farm level output through three main mechanisms: spot markets, vertical ownership integration or contracting. Contracting appears to be the favored mechanism of many large food and agribusiness companies in the region and the introduction of contracting has been linked to significant improvements in productivity (Gow *et al.* 2000).

However, while case study evidence points to the potential role of contracting as an engine for growth in agri-food supply chains there is a lack of systematic evidence on its impact. Notwithstanding some notable exceptions (Dries and Swinnen, 2004), scant attention has been paid to the impact of contracting and contract support measures on product quality despite the latter being widely seen as a major barrier inhibiting international competitiveness in the region (Strokov and Meyers, 1996; Keyser, 2004). In fact, as Ioffe and Nefedova (2001) note for Russia, there is a dearth of information on how processors are reconfiguring their relationships with farmers. This paper analyses the use and determinants of contracting and contract support measures, and changes in the quality of raw materials procured, over a six year time period (1997-2003) for a sample of food processing enterprises in the CIS.

The paper is divided into five sections. The next section outlines the data set used in the analysis and discusses how companies were selected. Section 3 presents descriptive statistics on the use of contracting and contract support measures, relationships with small farms, and product quality. Determinants of the use of contracting and contract support measures are explored in Section 4. Conclusions are presented in Section 5.

## **2. Methodology**

To analyse the use and determinants of contracting and contract support measures data was collected from food processing enterprises using a standardized survey instrument. As the survey was concerned with the impact of contracting and contract support

measures, which are not common to all enterprises, purposive sampling was employed. Purposive sampling can be defined as the selection of cases ‘from which the most can be learned’ (Merriam, 1998, p.61). Respondents that are best able to offer insight into the factors of interest are chosen (Churchill, 1999). In this case, only respondents that met three criteria were selected:

- a) Senior executives of agri-food industry enterprises (excluding micro-enterprises and those that had just been established);
- b) Enterprises that had made recent capital investments in the agri-food sector;
- c) Enterprises that had contracted with farmers for some part of the period 1997-2003.

These criteria were designed to ensure that the sample contained companies that were engaged in activities that the study sought to understand and evaluate. Local researchers, who checked that potential respondents met the criteria listed above, drew up a quota of 12 companies per country. For each country a target of 4 milk processors, 4 plant based enterprises (sugar, milling, fruits etc.) and 4 value-added companies (reflecting products of national importance that varied between states such as wine, brandy and speciality cheeses / ice cream) was set. This division was designed to pick up on sub-sector differences and reflect the broad balance of the agri-food sectors in the countries studied. In subsequent analysis, companies were divided into six sub-sectors: liquid milk dairies, speciality dairies, fruit and vegetables, sugar, wine and brandy, and other. Data was collected through face-to-face interviews.

The survey instrument contained both open and closed questions. Numerical data was obtained on firm performance and background characteristics, the value of capital investments, contract relationships with farmers, the impact of contracting, quality standards and contract breaches. To analyse dynamics, data was collected for four years over a six year time period (1997, 1999, 2001, 2003). 1997 was chosen as the starting point as the privatisation of major food processing plants began in most CIS states in the mid-1990s. The last year for which data was collected (2003) represented the final year for which full financial data was available at the time of the study (2004). The sample of 60 enterprises collectively accounted for 18,556 employees in 2003 and had a combined turnover of \$215.6 million. The mean level of employment for the sample was 309 full-time equivalents with an average turnover of just under \$3.6 million per annum (Table 1). The sample therefore incorporates some major players in the CIS agri-food sector.

### **3. Descriptive Statistics on Sourcing Strategies, Contract Support Measures, Procurement from Small Farms and Product Quality**

#### *a) Sources of Supply*

Table 2 details the different sources of supply utilized by processors in four years (1997, 1999, 2001 and 2003). Small farms were defined as producers with less than 1 hectare of land or, for the dairy sector, less than 5 animals. Table 2 presents the number of enterprises using a particular potential relationship to source farm-level output and the

valid percentage figure corrects for missing data for earlier years in a small number of cases.

Table 2 reveals that the use of all potential means for sourcing agricultural raw materials increased over the period 1997 to 2003. This reflects the impact of macroeconomic recovery and the overall growth in processor level output during this period and a requirement to source more raw materials. The greatest growth has been recorded for contracting with larger farmers (from 42.3 to 75 per cent of the sample), using other agents and own farms, albeit the last is from a low base. More enterprises have contracts with larger farms than with small farms but the reverse is true for sourcing from spot markets, where relationships with small farms are more prevalent. Between 1999 and 2003, there was relatively little change in the number of enterprises using spot markets as a source of supply with a slight decline in the number of processors using spot markets with larger farms in 2003 compared to 2001. These figures would suggest significant reforms are occurring in farmer – processor relationships: contracting is becoming more prevalent, especially with larger farmers; the use of spot markets as a source of supply is stagnating and the use of other agents such as intermediaries and traders increasing. One quarter of the sample was also engaged in farming in 2003 and most of this vertical ownership integration occurred recently: in 1997 only four respondents reported that their enterprise also had farming operations.

#### *b) Contract Support Measures*

Contract support measures are goods and services that are provided by a buyer to some or all of its suppliers as part of contract relationship. In agriculture, commonly found contract support measures include credit, technical assistance and the provision of physical inputs (Goodhue *et al.* 2003). Table 3 details the distribution and mean impact of contract support measures on farm performance. Measures are listed in descending order of frequency with the most popular measures applied being prompt payments, transportation and monetary credit.<sup>1</sup> One-third of the sample also provided physical inputs to at least some of the farms that supplied them. Investment loans from processors to farmers were provided infrequently.

Regarding those firms that apply a specific measure, the mean percentage of farms which received that measure in the first year of its operation, and the mean percentage of farms that had access to the measure at the time of the study is detailed in columns 4 and 5 of Table 3 respectively. Column 6 of Table 3 presents the percentage of processors that operate a minimum farm size policy in offering a particular measure. These figures give an insight into the diffusion of measures and whether small farms are being excluded. Measures such as agronomic support, guaranteed prices and prompt payments are typically applied to the vast majority of farms with which a processor deals. Only one processor that offered prompt payments reported that they discriminated against small farms in applying the measure. Support measures such as investment loans and the provision of machinery are more selectively applied – the majority of processors that offer these supports do so selectively. Around 60 per cent of processors that offer credit

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<sup>1</sup> While it may be expected that all processors say that they offer prompt payments to farmers, none of the Russian firms included in the study reported that they apply this measure.

and physical inputs also have a minimum farm size below which they do not offer these supports. Regarding diffusion, out of the 15 possible support measures listed in Table 3, in only 3 cases is the mean percentage of farms to which the measure is currently offered lower than in the first year that the measure was introduced. This suggests that measures tend to be offered to more farms over time rather than assistance becoming more selective. The three cases where the mean has fallen are: investment loans, harvesting and handling support and prompt payments. The first two are capital intensive measures and the fall in the percentage of farms to which prompt payments are offered is slight.

The last three columns of Table 3 assess the mean percentage change in farm level yields, percentage of output that reaches higher standards and the percentage change in the amount of output meeting basic standards. The support measures with the largest impact on yields are the provision of specialist storage, veterinary support and physical inputs, followed by a set of market measures (prompt payments, guaranteed prices and market access). Each of these measures is credited with increasing yields by over 10 per cent. Specialist storage in the form of on-farm cooling tanks has been particularly important in raising yields and quality in the dairy sector, a trend also noted by Dries and Swinnen (2004) for Poland. In raising standards, a major task in the region has been to preserve the quality of what is already produced. In the dairy sector the lack of effective cooling facilities rapidly decreases the value of milk produced and in the arable sector, post-harvest losses through inappropriate storage have eroded competitiveness (Striewe, 1999). Investment in farm level production will generate poor returns if the effective means to store output prior to processing are absent.

The impact of investment loans has been modest and this may explain why the number of farms to which this support is offered has been falling. The *provision of physical inputs* has had an above average (compared to other contract support measures) impact on yields and quality. The mean impact of the provision of physical inputs has been greater than credit. This may reflect that credit can be more easily diverted to other, non-farm activities and difficult to monitor (Gow *et al.* 2000). Both public and private sector support in the region has suffered from resources being diverted from the intended programs, particularly where the use of resources has been difficult to monitor. Programs that improve market access and the dissemination of veterinary and quality control advice are likely to have beneficial effects on yields and quality, and offer an additional advantage in that they should be easier to monitor and thus less likely to suffer from diversion of resources.

In terms of raising the quality of output, particularly the percentage of output reaching higher standards, the most beneficial measures have been quality control support, veterinary support, physical inputs, market access and prompt payments. *Premiums* are an important element in stimulating improvements in quality at the farm level. This underpins why market access, as a contract support measure, is linked to above average improvements in yields and quality with the availability of financial premiums for higher quality tied to both final demand on the domestic market and export opportunities. Improvements in yields and quality are also linked to a set of market measures particularly prompt payments and guaranteed prices. Cash flow is a major concern and

the linkage between delayed payments and falls in output has been noted elsewhere (Gow and Swinnen, 2001).

Support measures have had less impact on the amount of farm-level output that reaches basic standards, as most farm output already passes this threshold. For the latter, the most significant measures have been quality control, specialist storage and machinery.

### *c) Procurement from Small Farms*

To investigate whether small farms are being excluded from food supply chains, the survey solicited information on the share of agricultural raw materials procured from small farms by each processor during the period 1997-2003. Similar data was collected regarding the total number of small farms that each processor dealt with in the same four years. Small farms, as discussed above, were defined as producers with less than 1 hectare of land or, for the dairy sector, less than 5 animals. From these questions it is possible to analyze how the share of total agricultural raw materials sourced by processors from small farms has changed since 1997 together with an assessment of the number of small farms with which they have a relationship (Table 4). If data was not available for 1997, the assessment was made on the difference between the least recent year for which information was available and the figures for 2003. A comparison is also drawn for the years 2001-2003 only, to identify the most recent trends.

For the period 1997-2003, Table 4 indicates that in just over one third of enterprises, the share of agricultural raw materials sourced from small farms declined with an increase registered in about a quarter of respondents' businesses. Twelve firms reported no change and 11 have never dealt with small farmers. In terms of the number of small farms dealt with, however, the majority reported an increase. This increase in the number of small farms in many cases was due to political reforms (land reform and decollectivization) rather than processors' strategies. For example ten out of the twelve companies surveyed in Moldova reported an increase in the number of small farms they dealt with over the period 1997-2003. During this era, Moldova implemented a radical National Land Program that saw the break up of former state and collective farms with distribution of land and physical assets to members (Csaki and Lerman, 2002).

Only thirteen of the enterprises reported that they dealt with fewer small farms in 2003 than in 1997 and three indicated no change over this time period. This implies that there are a number of processors for which while the share of agricultural raw materials sourced from small farms is declining are nonetheless dealing with more small farms. For the 2001-2003 period slightly fewer processors recorded a growth in the number of small farm suppliers and this may reflect some consolidation. Overall, there is a lack of evidence of small farms being systematically excluded. There are no significant differences between those processors that had reduced the number of small firms they dealt with and the rest of the sample regarding their turnover, percentage of sales to the domestic market and level of foreign investment. On this measure, there is no evidence of a linkage between Foreign Direct Investment (FDI) and the exclusion of small farms.

#### *d) Product Quality*

For the years 1997, 1999, 2001 and 2003, dairies were asked to indicate the percentage of milk delivered to them that was extra class, first class, second class and rejected / unusable. Enterprises without dairy operations were asked, for the same years, to indicate the percentage of agricultural raw materials supplied to them that was of premium quality, acceptable quality and rejected / unusable. From these figures it is possible to broadly assess changes in the quality of farm produce supplied to processors. An improvement indicates that a greater proportion of produce fell into premium / extra class categories with less being deemed unusable or rejected.<sup>2</sup> Table 4 reveals that the majority of firms reported an improvement in the quality of farm level produce supplied to them; in contrast sixteen reported that quality worsened with seven enterprises indicating no change.

It is possible to look at the linkage between product quality data and contracting in two ways. First, are there significant differences between the firms that report improved, unchanged and worsened product quality and the percentage of agricultural raw materials procured using contracts? Second, one would expect that an improvement in product quality is associated with the use of the contract assistance measures detailed in Table 3. The last two columns of Table 5 reveal that there are significant differences between firms that report improved, unchanged and worsened product quality on both these measures. Those firms that reported an improvement in the quality of agricultural raw materials supplied to them procure a greater proportion using contracts. On average those that have witnessed an improvement in farm level product quality, procure 56.5 per cent of agricultural raw materials using contracts compared to only 30.3 per cent for those that have suffered from worsening product quality. A significant difference is also apparent regarding the mean number of contract assistance measures employed (based on the fifteen possible assistance measures listed in Table 3) and product quality. The mean number of contract assistance measures employed by firms that have witnessed improved product quality is 4.24 compared against 2.00 and 1.86 for those that recorded a decline and no change respectively.

## **4. Econometric Analysis**

### *a) Models*

Given that processors that have witnessed improvements in the quality of farm level raw materials that they procure source significantly more using contracts and use a greater number of contract support measures, the determinants of the use of contracting and contract support measures have been assessed in further detail. Two models were investigated, with the dependent variable for the first (model 1.1) being  $CONTSH_{it}$  - the percentage of total supply procured via contracts with farmers for firm  $i$  in year  $t$  ( $t = 1997, \dots, 2003$ ). This percentage has been employed elsewhere (Morrison Paul *et al.* 2004; Katchova and Miranda, 2004) as a measure of the intensity of contracting. As this

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<sup>2</sup> The comparison was made for 1997 to 2003. If data for 1997 was not available, the comparison was made for 1999 with 2003.

variable is not continuous but censored at the lower and upper limits (values can take any value within a range from 0 to 100), a censored (Tobit) regression was applied (Greene, 2000). The two-limit Tobit model assumes that a latent variable  $y^*$  can be expressed as:

$$y^* = \beta'x + \varepsilon, \varepsilon \sim N(\mu, \sigma^2), \quad (1)$$

where

$$y = L_1 \text{ if } y^* \leq L_1, y = y^* \text{ if } L_1 \leq y^* \leq L_2, y = L_2 \text{ if } y^* \geq L_2.$$

In our case  $y^*$  represents the censored dependent variable (contract intensity),  $x$  is a vector of independent explanatory variables,  $L_1=0$  is the lower limit (no farm-level input bought on contract),  $L_2=100$  the upper limit (all supplies from farmers sourced via contracts), and  $\varepsilon$  the error term with mean  $\mu$  and constant variance  $\sigma^2$ . The likelihood function for the model (Greene, 2000; Kosarek *et al.*, 2001) is:

$$L(\beta, \sigma, y, x, L_1, L_2) = \prod_{y=L_1} \Phi\left(\frac{L_1 - \beta'x}{\sigma}\right) \prod_{y=y^*} \frac{1}{\sigma} \Phi\left(\frac{y - \beta'x}{\sigma}\right) \prod_{y=L_2} \left[1 - \Phi\left(\frac{L_2 - \beta'x}{\sigma}\right)\right] \quad (2)$$

The parameter estimates  $\hat{\beta}$  and  $\hat{\sigma}$ , which are derived from maximizing the logarithm of Equation 2, characterize the variability of the dependent variable.

Five independent variables were included in the model. *SIZE* is the annual turnover of the food processing enterprise, expressed in '\$000, and was expected to have a positive sign, as contracting has been associated with larger firms in Western markets (Katchova and Miranda, 2004). *FDI* is the percentage of the firm's equity owned by foreign investors and was expected to have a positive sign. Case study evidence from Central and Eastern Europe (Gow and Swinnen, 2001) and developing countries (Singh, 2002) has highlighted that foreign investors often act as catalysts for the introduction of contracting. A dummy variable was included for each *country* with Russia the reference category. Russia was selected as the reference country as it is supposed that contracting is less prominent in this particular state due to the slowness of land reform and rural privatization, and the constraints that remain on transactions (Lerman and Shagaida, 2005). Dummies were also included for *sub-sector* (liquid milk, speciality dairy, fruit and vegetables, wine and brandy, other products, with sugar set as the reference category) and *year* (1999-2003). A distinction was made between those dairies specializing in pasteurizing liquid milk and speciality dairies (ice cream, cheese etc.) as it was expected that they would have different supply relationships. Sugar was chosen as a reference category to test the hypothesis that contracting is more developed in the sugar industry (Gow *et al.* 2000).

To evaluate the determinants of the use of contract support measures a second regression model (1.2) was estimated with the dependent variable being  $CONTSUP_{it}$ . the number of contract support measures offered to farmers by firm  $i$  in year  $t$  ( $t = 1997, \dots, 2003$ ). As the lower tail of the number of contract support measures employed is bounded by 0,

Tobit was also applied in this case. The same independent variables were included in the model as in the case of  $CONTSH_{it}$ .

Given a total of 60 firms with data for four years, 240 data points were potentially available for analysis. However due to missing data, there were 196 useable observations. The software package LIMDEP was employed in undertaking the analysis. The Tobit maximum likelihood estimates and their corresponding marginal effects are presented in Table 6 for both models. The marginal effects measure the effects of a one-unit change in the independent variables on the dependent (i.e. the percentage of farm level input bought on contract), given the censoring of the dependent variable.

#### *b) Results*

Reviewing the regression results presented in Table 6, *SIZE* has a positive effect on both contract intensity (the percentage of supply secured via contracts) and the number of contract support measures employed. The positive relationship between *SIZE* and contract intensity is in line with expectations based on studies of Western agri-food markets (Katchova and Miranda, 2004). *FDI* is positively related to the number of contract support measures employed but has no significant effect on contract intensity. The level of contracting is significantly lower in the Ukraine. The dummies for Armenia, Georgia and Moldova for the contract intensity model are not significant. However, the dummies for the latter three countries are significant and positive for the model of number of contract support measures employed. In contrast, the dummy for the Ukraine is significantly negative. In other words, the use of contract support measures is significantly more developed in Armenia, Georgia and Moldova compared to Russia and Ukraine. The use of contracting and contract support measures is least well developed in Ukraine.

Regarding the sub-sectors, contract intensity is significantly higher for liquid milk. This may be as expected given that regular deliveries of milk on a daily basis are critical for these companies. Differences between the coefficients for liquid milk and speciality dairies, regarding contract intensity, justify their separation in the analysis. Contract intensity is significantly lower, albeit at a 10 percent level of significance, in the fruit and vegetables and other sub-sectors. The use of contract support measures is most developed in the sugar industry and, as with contract intensity, least used in the other sub-sector. The use of contract support measures is also relatively low in the wine and brandy and fruit and vegetables sub-sectors.

Analysing the year coefficients, it is evident that both contract intensity and the number of contract enforcement measures employed grew strongly during the period 1997-2003. All but one of the year coefficients are significant at the 1 per cent level. This provides clear evidence that contract intensity and the use of contract support measures have grown significantly.

## 5. Conclusions

Based on the survey findings of key food processors in the CIS, both farm-processor contracting and the use of contract support measures have become more prevalent. While it is recognised that the sample is relatively small and excludes micro-businesses and very recent start-ups, it does capture some of the largest food processors in the region, which are major players in the markets in which they operate. What these companies are doing matters greatly for understanding industry dynamics, and our knowledge of how agriculture-foods processor relationships are evolving in the CIS has to date been severely limited.

Firms that have witnessed improvements in the quality of the farm level raw materials that they procure source significantly more using contracts and use a greater number of contract support measures. This is important finding because product quality has been widely seen as major problem in the agri-food sectors of the CIS, inhibiting international competitiveness (Strokov and Meyers, 1996; Keyser, 2004).

Contract support measures have stimulated improvements in yields and the quality of output but their impact has been far from uniform. Investment loans and machinery grants have been mainstays of many development projects, yet their impact on yields and product quality have been modest. The provision of specialist storage (especially cooling tanks in the dairy sector), veterinary support, prompt payments, guaranteed prices and physical inputs have had the highest mean impact on average yields.

The Tobit analysis reveals that the use of contracting and contract support measures varies significantly between states and sub-sectors. Contracting is least developed in Ukraine and for fruit and vegetables and the 'other sub-sector'. Contract support measures are most widely used in the sugar industry and contract intensity is highest in the liquid milk supply chain. Foreign investors use significantly more contract support measures than their domestic counterparts and this relationship holds even when size and sub-sector are accounted for. In this regard foreign investors are important catalysts but they are not significantly more likely to source a higher proportion of raw materials via contracting.

One often-expressed concern of contracting is that it can lead to the marginalization of small farms (Escobal *et al.* 2000). The marginalization of small farms can be considered in two main regards. First, marginalization can be defined in terms of an exclusion of small farms from formal food supply chains and, secondly, small farms may, although not formally excluded, receive significantly worse terms and conditions. In terms of the former, there is little evidence that small farms are being excluded but there is some evidence regarding the latter, particularly concerning access to contract support measures. For example, around 60 per cent of processors that offer credit and physical inputs to farmers do have a minimum farm size below which this contract support measure is not offered. However, contract support measures have, overall, become available to an increasing number of farmers after their introduction rather than support becoming

progressively more selective. There is thus little indication that the introduction of contract support measures *per se* reduces overall farm access to inputs and technical advice.

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## **TABLES**

**Table 1: Sample Characteristics by Country**

Country	Sample size	Mean employment (2003)	Mean turnover (2003)
Armenia	12	134	3,305,602
Georgia	12	527	1,460,057
Moldova	12	259	3,678,057
Russia	12	218	1,808,042
Ukraine	12	409	7,712,667
Total	60	309	3,592,885

**Table 2: Use of potential supply relationships in sourcing agricultural raw materials (1997-2003)**

	1997		1999		2001		2003	
	No.	Valid %	No.	Valid %	No.	Valid %	No.	Valid %
<b>Spot markets</b>								
- all	22	44.0	24	46.2	28	48.2	31	52.5
- with small farmers	23	44.2	23	44.2	27	45.8	30	50.0
- with larger farmers	10	19.6	15	28.3	16	27.6	15	25.4
<b>Contracts</b>								
- all	24	46.2	35	66.0	44	74.6	47	78.4
- with small farmers	19	35.8	22	40.7	25	42.4	27	45.0
- with larger farmers	22	42.3	34	63.0	42	71.2	45	75.0
<b>Own farms</b>	4	7.5	5	9.3	10	17.2	15	25.0
<b>Other agents</b>	10	18.5	18	32.7	29	49.2	30	50.0

**Table 3: Distribution and Impact of Contract Support Measures**

Measure	Distribution of support measure to farms					Impacts of specific contract support measure on farms		
	No of firms offering support measure	% of sample offering support	Mean % of farms offered to in 1 <sup>st</sup> year	Mean % of farms offered at time of study (2004)	% of firms operate min. farm size for measure	Mean % change in farm yields due to measure	% change in farm output reaching higher standard	% change in farm output reaching basic standard
Prompt payments	28	46.7	88.0	84.5	3.7	11.4	12.0	2.1
Transportation	27	45.0	64.2	69.6	46.2	6.8	5.7	3.5
Credit	23	38.3	39.8	50.9	60.8	9.3	8.8	3.0
Physical inputs	20	33.3	48.2	51.2	57.9	12.4	14.2	3.5
Quality control	19	31.7	76.8	79.4	15.8	7.6	17.2	5.6
Guaranteed prices	14	23.3	86.7	91.7	14.3	11.1	8.9	1.1
Agronomic Support	13	21.7	82.0	84.5	8.3	6.5	5.0	1.4
Farm loan guarantees	11	18.3	7.0	15.1	27.3	6.8	6.0	0.0
Machinery	10	16.7	19.4	30.5	60.0	5.0	4.0	5.2
Specialist storage	9	15.0	32.8	32.9	33.0	10.0	8.3	4.4
Harvest / handling	7	11.8	30.6	18.6	71.4	9.3	5.4	2.6
Market access	6	10.0	68.3	69.7	0.0	11.2	14.2	2.0
Business / fin. management	6	10.0	45.8	47.5	50.0	6.2	4.2	2.5
Veterinary support	5	8.3	58.0	66.0	40.0	17.0	17.0	0.0
Investment loans	4	6.7	4.0	0.3	75.0	5.5	5.0	2.5
Average						9.1	9.5	2.9

**Table 4: Change in share of agricultural raw materials sourced from small farms and number of small farms dealt with by processors**

	Change in share of agricultural raw material sourced from small farms				Change in number of small farms dealt with			
	1997-2003		2001-2003		1997-2003		2001-2003	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Decrease	22	36.7	18	30.0	13	21.7	11	18.3
No change	12	20.0	20	33.3	3	5.0	8	13.3
Increase	15	25.0	9	15.0	33	55.0	28	46.7
Never deal with small farmers	11	18.3	13	21.7	11	18.3	13	21.7
Total	60	100.0	60	100.0	60	100.0	60	100.0

**Table 5: Relationship between contracting and product quality**

Change in product quality supplied	No.	%	Percentage of raw material bought using contracts in 2003	Mean number of contract support measures used
Worse	16	26.7	30.3	2.00
No change	7	11.7	37.9	1.86
Improvement	37	61.7	56.5	4.24
Total	60	100.0	47.4	3.37
<i>F</i> -test (ANOVA comparison of means)			3.014*	6.195***

\*\*\* 1% level of significance, \* 10% level of significance

**Table 6: Tobit analysis of contracting intensity and number of contract support measures employed**

Variable	Model 1.1 (Contract intensity)			Model 1.2 (No. of contract support measures)		
	$\beta$	Std. Err.	Marginal effects	$\beta$	Std. Err.	Marginal effects
Intercept	24.6165	12.2954		-.23785	0.1149	
SIZE	0.0035***	0.0012	0.0018	0.0002***	0.0000	0.0001
FDI	0.2072	0.2020	0.1060	0.3412***	0.0087	0.0227
Armenia	19.4066	16.1051	9.9315	2.4709***	0.6642	1.6413
Georgia	-11.3680	15.5834	-5.8177	3.3581***	0.6902	2.2306
Moldova	13.0318	15.1995	6.6691	3.7876***	0.6547	2.5159
Ukraine	-65.7150***	16.3210	-33.6303	-2.4294***	0.6828	-1.6137
Liquid Milk	25.1111**	12.2396	12.8509	-1.4799**	0.5372	-0.9830
Speciality Dairy	-11.9081	18.1559	-6.0941	-1.7632*	0.7743	-1.1712
Wine and brandy	-18.9095	17.4844	-9.6771	-3.4165***	0.7598	-2.2694
Fruit and Vegetables	-33.6616*	18.1862	-17.2267	-3.2211***	0.7822	-2.1396
Other sub-sector	-31.8120*	12.3710	-16.2801	-6.5632***	0.9616	-4.3595
Year99	28.7244**	13.4275	14.7000	2.1758***	0.5862	1.4453
Year01	43.4155***	13.6624	20.2889	3.4097***	0.5912	2.2649
Year03	49.2256***	13.8940	25.1917	4.0034***	0.6014	2.6592
Log-likelihood	-725.52			-408.36		

Note: Statistical significance indicated by stars: \* for the 10% significance level, \*\* for the 5% significance level, and \*\*\* for the 1% significance level.

Source: authors' calculations