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Farmer – processor relationships in the CIS dairy sector: key findings from the SIDCISA research project

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Liesbeth Dries[1], Michael Dumitrashko[2], Matthew Gorton[3], Paul Hewson[4], Anatolie Ignat[2], Galina Ignat[2], Naira Mkrtchyan[5], Gagik Sardaryan[5,] Alexander Skripnik[6], Vardan Urutyan[7] Anneleen Vandeplas[1] and John White[4]

[1] Katholieke Universiteit Leuven, Belgium

[2] Institute of Management, Rural Development and Advanced Agribusiness Training, Moldova

[3] University of Newcastle, UK

[4] University of Plymouth, UK

[5] Centre for Agribusiness and Rural Development (CARD), Armenia

[6] Dnepropetrovsk University of Economics and Law, Ukraine

[7] Armenian State Agrarian University, Armenia

Corresponding author: Matthew Gorton, University of Newcastle, School of Agriculture, Food and Rural Development, Newcastle upon Tyne, NE1 7RU. UK email: matthew.gorton@ncl.ac.uk

Abstract

Key findings from survey work on dairy farmers' relationships with their main buyers in Armenia, Moldova and Ukraine are presented. The analysis reveals a varied set of supply relationships. The lowest level of satisfaction with buyer relationships is recorded by household farms in Ukraine. These farms typically have 1 or 2 cows, sell principally to milk collecting entrepreneurs without a contract and receive no support measures from buyers. Growth in herd sizes and yields has been minimal. In Armenia the majority of farmers sell on contracts, are more likely to receive additional goods and services from buyers as part of their relationship and have registered better improvements in performance. The fortunes of corporate farms in both Moldova and Ukraine have been very mixed. An ordered probit model of the determinants of farmer satisfaction with their main buyer relationship highlights the significance of trust and support measures. Trust is an important issue for the farmers in the CIS as the prevalence of opportunistic behaviour is rather high.

1. Introduction

The dairy sector is an important component of rural economies in the Commonwealth of Independent States (CIS), providing vital employment and income, in an environment of weak social security and scarce job opportunities. Dairy farming in the CIS encompasses a wide diversity of farms: from 1 and 2 cow units, selling via village collecting stations, which provide an important subsidiary income for vulnerable groups, particularly the elderly, up to 'super-large' corporate farms, some of which have witnessed significant recent investment and control thousands of hectares (Franks and Davydova, 2005; Lerman *et al.* 2004). The *Supporting the International Development of CIS Agriculture* (SIDCISA) project has sought to understand the supply chain relationships of this diverse range of commercial milk producers. In particular we seek to analyse the degree of satisfaction with supply chain relationships and analyse the linkages between procurement practices and satisfaction, growth and investment.

This paper presents key findings from survey work conducted in Armenia, Moldova and the Dnepropetrovsk region of Ukraine and is divided into seven parts. The next section presents the rationale for the study and documents the main characteristics of rural areas in the three countries studied. Section 3 presents an overview of the dataset. Results concerning the growth of dairy farms and investment, milk prices, and buyer relationships are presented in sections 4 to 6 respectively. Conclusions are drawn in the final section.

2. Milk supply chains in the CIS and Rationale for the Study

Agriculture is a sector of strategic economic importance for Armenia, Moldova and Ukraine. For example, agriculture and forestry accounts for appropriately 41.8, 43.4 and 23 per cent of total employment in Armenia, Moldova and Ukraine respectively (NSS, 2004; *Biroul Național de Statistică al Republicii Moldova*, 2007; State Statistics Committee of Ukraine, 2004).[1] In rural areas, agriculture remains the backbone of the economy. For example in Moldova 73 percent of the income of rural households comes from farming (World Bank, 2005) and this sector also accounts for over 50 per cent of gainful employment in rural Armenia and most rural regions of Ukraine. Rural welfare in the CIS is therefore inherently linked to the fortunes of agriculture. Similarly, dairy farming is an important component of agriculture in each country and during the Soviet era, milk production accounted for around 23 per cent of total agricultural output (Goskomstat, 1986) and from the early 1960s until the its dissolution the USSR was the world's largest milk producer.[2] While milk's share of total agricultural output has fallen in most of the CIS, as livestock output contracted to a greater extent than arable production in the 1990s, the dairy sector remains important, particularly to small-scale farmers, as discussed below.

The Soviet era was characterised by dualistic milk supply chains. *Formal* supply chains were 'socialised' with collective (*kolkhoz)* and state (*sovkhoz)* farms ordered to supply designated dairy processing factories (*kombinats*) by the state. Socialised farms were large by Western European and North American standards: the average size of a *sovkhoz* was approximately 2,000 hectares (ha) while *kolkhoz* farms tended

[1] Agriculture's contribution to GDP is also significant: accounting for approximately 25.5, 29.0 and 17.1 per cent of GDP in Armenia, Moldova and Ukraine respectively (World Bank, 2007).
[2] Own calculations based on Strauss (1970) and FAOSTAT (2007) data.

to be bigger (3,000 ha on average). Where cows were kept, herds were typically between 100 and 500 animals in size (Strauss, 1970). While average herd sizes were larger than in North America and Western Europe, yields and labour productivity were significantly lower. For instance, by 1979, the average yield per cow on collective farms in the USSR was approximately one half that recorded in Western Europe with five times as much labour input per 100 kg of milk produced being used in the USSR compared to US farms (Jones and Smogorzewska, 1982). The differential between the quality of milk produced in the USSR and that of Western countries also grew in the late 1980s: an evaluation conducted in 1988 indicated that 49 per cent of dairy farms and milk processing plants and 33 per cent of milk failed to meet basic state standards (Rogov and Chizhikova, 1992). These problems in part reflected the lack of competition between suppliers and buyers with the state controlling prices and distribution of output.

The socialised sector was supplemented by other *informal* arrangements, which centred on the supplementary household plots of *sovkhoz* workers and *kolkhoz* members and the gardens of urban families. For milk, households accounted for around 25 per cent of total USSR production by 1985 and this rose to 32 per cent by 1992 as the output of collectivised farms slumped. Those that kept cows would typically have one or two animals and consume the milk themselves or sell it at green markets.

Following the dissolution of the USSR, most successor states have embarked on privatisation, price liberalisation and land reform programmes. During the 1990s, Moldova embarked on a programme of radical privatisation, breaking up state and collective farms and giving a share of land and assets to members and former workers. This led to a fragmentation of land ownership, with the average allocation of land being 1.4 ha, often comprised of multiple, geographically dispersed, plots. In the process of land reform many herds were slaughtered and milking parlours destroyed. Between 1993 and 2001, in Moldova total milk production and the number of milking cows fell by 42 and 43 per cent respectively (Table 1). Yields also fell in the early 1990s as the quality and quantity of feedstuffs used deteriorated. For example, in 1993 yields in Moldova were equivalent to 44 per cent of those in Germany and the UK and 33 per cent of the US rate. However by 2005, yields in Moldova were only 40 and 30 per cent of the German and US levels respectively (Table 1). While the falls in output and yields were caused by a number of factors: such as price liberalisation and a decline in real protection to farmers, dislocation of supply chains was also important (Macours and Swinnen, 2000; Dries and Swinnen, 2004). For example, the break up of the collective farms meant that dairy processors became more dependent on small-scale producers for sourcing milk which significantly increased their transaction costs (Gorton *et al.* 2006). Several dairy processors in Moldova have therefore pursued strategies to increase the quantity and quality of milk coming from the remaining agricultural companies (Gorton *et al.* 2006).

Ukraine also witnessed a substantial decline in milk production during the 1990s: between 1993 and 2001 output and the number of cows fell by 26 and 50 per cent respectively (Table 1). Yields also fell in the early 1990s although they have subsequently recovered so that they are currently significantly above those recorded for Moldova but are still only equivalent to 50 per cent of the German average. The substantial contractions of the early 1990s reflected how dairy farming became deeply unprofitable following the dissolution of the USSR. Many of the dairy facilities

of former kolkhoz and sovkhoz farms (milking parlours, cooling tanks) were scrapped or destroyed. As the fortunes of agriculture plummeted in rural Ukraine, poverty dramatically increased. Substantial depopulation, through out-migration and failing life-expectancy, has been witnessed: the rural population fell from 16.9 million in 1990 to 14.9 million at the beginning of 2007 (State Statistics Committee of Ukraine, 2007). However, corporate farms remain important land users in Ukraine. Corporate farms in Ukraine are typically agricultural companies which operate on the land of the former kolkhoz or sovkhov farms. Some of these firms are subsidiaries of larger groups for which agriculture is not their primary focus. Where investment has come from outside of agriculture, they tend to be managed very differently compared to the former collective farms. However there are some corporate farms which inherited not only the land but also the management styles and mentality of the collective farms. In the milk sector, State Statistics Committee of Ukraine (2003) data indicate that agricultural enterprises account for approximately 21 per cent of milk production with the remainder accounted for by households. Household milk production is very fragmented, typically comprised of 1 or 2 cows per family, which provides supplementary income to those in remote villages and pensioners.

In contrast to Moldova and Ukraine, the Armenian dairy sector did not witness falls in output during the mid and late 1990s: between 1993 and 2005 milk production and the number of cows rose by 43 and 13 per cent respectively (Table 1). Land reform and privatisation occurred comparatively early in Armenia, with a substantial contraction occurring in 1991-2. Privatization in 1991 favoured insiders (such as former state farm directors and leading party members) who received large herds which they could not manage (Lerman and Mirzakhanyan, 2001). These animals were either slaughtered or sold to small scale farmers. As a result of this process of fragmentation, yields were particularly low in the mid-1990s. However as the milk market has recovered modest but steady increases in yields, number of milking cows and total production have been witnessed.

Household milk production is both widespread and of economic significance in many parts of the CIS. For example, Dumitrashko (2003) estimated that more than 40 per cent of rural households in Moldova kept at least one cow. While fewer than 6 per cent of households surveyed by Dumitrashko (2003) had 3 or more cows, the economic impact of small-scale dairy farming cannot be discounted. For example, Keyser (2004) calculated that a two cow herd in Moldova produced a profit of €90 per annum in 2003. While this figure may appear small, when compared for the same year against an average monthly salary in agriculture of €32 and an average pension of just €15 per month (National Statistical Bureau of the Republic of Moldova, 2007), it is apparent that milk production can represent an important source of rural income.[3] Rural incomes and social security are similarly constrained in Ukraine and Armenia. For example, the average monthly income per capita in rural Armenia in 2005 was €33.38 (ILCS, 2005). The average salary in Ukrainian agriculture in early 2007 was equivalent to €90.90 per month (State Statistics Committee of Ukraine, 2007). These averages however disguise large income inequalities and 47.5 per cent of the rural population of Armenia were estimated to be living in poverty in 2003 (NSS, 2004) with average pensions being insufficient to guarantee consumption of even the minimum food basket (IMF, 2003). Therefore while the incomes generated from small-scale dairy farming are low, in an environment of impoverished social security and a weak non-farm rural economy, such activities provide a vital lifeline. The benefits of such

[3] For larger herds of 5 and 10 cows, Keyser (2004) reports significantly higher returns, with profits of €565 and €768 respectively.

activities are not restricted to rural households however they have also provided a buffer against absolute poverty for urban relatives who became unemployed during transition. The welfare function of small-scale agriculture therefore means that the relationships between farmers and the buyers of their produce are therefore critical. For example, if small-scale producers lost market access, leading to a sharp fall in prices or complete loss of revenue, the welfare implications would be momentous.

Table 1: Milk production performance (1993-2005)

		1993	1995	1997	1999	2001	2003	2005
Milk production (cows), tonnes	**Armenia**	388,600	418,280	425,000	443,800	450,805	498,100	557,300
	Moldova	966,718	825,826	646,079	569,001	560,597	570,248	630,000
	Ukraine	18,199,008	17,060,300	13,539,600	13,140,000	13,153,500	13,350,640	13,423,753
Number of milking cows	**Armenia**	257,486	276,000	277,840	256,200	264,920	280,000	290,069
	Moldova	403,173	399,400	355,480	279,500	229,095	279,219	231,000
	Ukraine	8,004,000	7,738,000	6,810,660	5,572,000	4,855,200	4,620,600	3,926,000
Yield (kg per cow per annum)	**Armenia**	1,509	1,516	1,530	1,732	1,702	1,779	1,921
	Moldova	2,398	2,068	1,817	2,036	2,447	2,042	2,727
	Ukraine	2,274	2,205	1,988	2,358	2,709	2,889	3,419
	Germany	5,301	5,424	5,525	5,909	6,212	6,526	6,717
	UK	5,558	5,703	5,989	6,153	6,534	6,817	6,975
	USA	7,132	7,441	7,653	8,061	8,228	8,508	8,878
Producer price (US$) per tonne	**Armenia**	82	203	237	204	183	175	
	Moldova	16	106	174	118	142	149	
	Ukraine	104	85	129	87	112	131	

Source: FAOSTAT (2007)

3. Data Set

The objective of the study was to understand the supply chain relationships (SCR) of commercial milk producers in the CIS, paying particular attention to the linkages between SCR, growth and farmer satisfaction. Given this objective, the population of interest was defined as primary producers which sold cows' milk to another supply chain actor. Therefore farmers without dairy cows, those who did not sell any of the milk produced or who processed all milk into cheese or other dairy products (i.e. did not sell any raw milk) were excluded from the study. While given the objective of the study these restrictions are justified it means that our sample cannot be directly compared to official data on the structure of milk production.

To obtain the sample a quota of 300 responses was set per country with the intention of including a representative cross-section of commercial dairy farms, including both household producers if they marketed their output and agricultural companies. The geographical focus of Moldovan sample was set as all regions excluding the left side of the river Nistru, with a representative split (based on contribution to total milk production) between the northern, central and southern regions. For Ukraine, given that it is largest country solely within Europe, data collection focused on the Dnepropetrovsk region, with sampling weighted to five *rayons* (*Solonyanskiy, Sinelnikovskiy, Magdalinovskiy, Dnepropetrovskiy, Novomoskovskiy*) which have significant commercial dairy production. Dnepropetrovsk is the third largest city in Ukraine with the Dnepropetrovsk region having a mean wage and living standard close to the national average (State Statistics Committee of Ukraine, 2007). In Armenia respondents were drawn from all regions (*Marzes*) which have significant commercial milk production, based on proportions given from statistical data on milk production. The population and geographical area of Armenia, Moldova and the Dnepropetrovsk region of Ukraine are similar (populations of 3.2, 3.6 and 3.5 million respectively and geographical area of 27,743; 33,843 and 31,900 km^2 respectively), so a common sample size was deemed reasonable, with a slightly higher figure for Ukraine to accommodate greater numbers of larger agricultural enterprises, which were absent in the other two countries. The cross-section of farm respondents for each country was identified from contacts with national statistical agencies, local and regional authorities, village majors, local livestock experts and agricultural agencies. Data were collected concerning: farm growth, prices, yields, investment, collaboration with other farmers, the nature of and satisfaction with relationships with their main buyer and non-price aspects of contracts. However it should be noted that household farms in the CIS tend not to keep detailed records of their activities and therefore the data for these operations should be treated as estimates rather than verified results. The data set by country and herd size is presented in Table 2.

The standard deviation of farm size, when measured by number of milking cows, is far greater in Ukraine, with a huge disparity between 'household' farms, with 1 to 2 cows each, and corporate farms, of which 6 farms have in excess of 500 cows each. While households with 1 or 2 cows are often dismissed as subsistence producers, this is not the case in Ukraine. For example our data indicate, only 10.5 per cent of the milk produced from 1 cow units is actually consumed within the household or wider family (non-marketed output), the rest is sold. Similarly for 2 to 3 cow units only 6.7 per cent of the total milk produced is not-marketed. For Ukraine, therefore 1 to 2 cow producers should be seen as commercial operators and a similar conclusion can

also be drawn for Moldova.[4] At the other end of the size spectrum, corporate farms with herds of more than 200 milking cows are absent from Armenia but present in Ukraine and, to a lesser extent, Moldova. The Ukrainian sample includes 6 farms with more than 500 milking cows each with the largest farm possessing 1,500 animals. This makes any discussion of the 'average farm' in Ukraine problematic. However while Ukraine has a dualistic farm structure this is of a different nature to the Soviet era as the majority of corporate farms operate in a very different manner to the former *kolkhoz* and *sovkhoz* farms. In Armenia disparities in farm size are less marked.

Table 2: Number of milking cows per commercial farm by country

No of milking cows	Ukraine	Moldova	Armenia	Total
1	185	34	0	219
2	78	212	0	290
3	12	27	4	43
4	7	6	16	29
5	4	3	50	57
6 to 9	2	5	111	118
10 to 19		3	77	80
20 to 49	2	3	29	34
50 to 99	1	2	8	11
100 to 199	8	3	5	16
200 to 499	11	2	0	13
500+	6	0	0	6
Total	316	300	300	916
Mean	31.3	6.2	13.4	17.2
Standard Deviation	138.4	27.3	18.5	84.0

4. Growth and Investment

For the total sample, significant growth was recorded in both average herd sizes and yields for the period 2001-2005 (Table 3). Considering all countries and farm types between 2001 and 2005, the mean herd size rose from 14.5 cows to 17.2 and yields increased from 3,057 litres per cow per year to 3,342 litres. These aggregated figures however disguise important variations between countries and farm types. For Ukraine and Moldova a distinction is therefore drawn between household and corporate farms. However this distinction cannot be made for Armenia because none of the sampled farms in Armenia were registered entities and all legally are classified as individual farmers.[5] Comparing the data in Table 3 on a country by country basis, Armenia witnessed the sharpest growth, with increases of 58 and 18 per cent in mean herd size and yield respectively. In contrast, in Ukraine the mean herd size grew by less than 10 per cent and yields were almost unchanged. The data for Ukraine and Moldova however reveals significant variations between corporate and household farms. In Ukraine the growth in average herd size was entirely accounted for by corporate farms as households recorded no overall change. Similarly while yields were almost unchanged for household farms, they grew by 9 per cent on corporate farms. In Moldova, however, the number of cows kept by corporate farms

[4] In Armenia, no 1 or 2 cow units are present in the sample.
[5] Commencing from 2009, Armenian farms will have to be registered and thus taxed on their activities.

declined while household farms witnessed a net increase of 1 cow on average. Likewise, the rate of growth in yields was almost twice as high on Moldovan household farms compared to their corporate counterparts. Another contrast between Moldova and Ukraine is that while absolute yields are higher on household farms, compared to corporate farms, in Ukraine the reverse is apparent in Moldova. Finally comparing the data in Table 3 with the official statistics on yields reported in Table 1, it is noticeable that the ranking of countries by mean yield is identical but that the reported average yield for each country is significantly higher in the sample. This may reflect how the survey focuses only on commercial producers and discounts purely subsistence farmers.

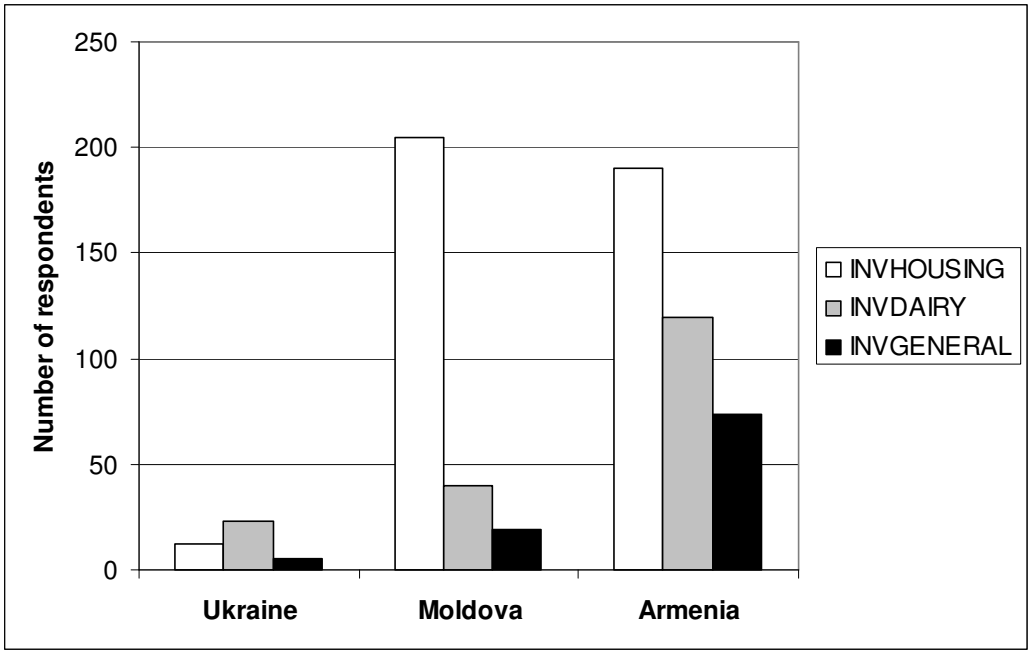
Table 3: Evolution of Mean Herd Size and Milk Yield per Cow (years 2001-2005)

			Mean Number of milking cows per farm			Mean yields (litres per cow)		
		Number	**2001**	**2003**	**2005**	**2001**	**2003**	**2005**
Armenia	Total	300	8.5	10.7	13.4	1905	2108	2246
Moldova	Households	289	1.6	1.9	2.2	3016	3055	3447
	Corporate farms	11	116.3	103.1	111.2	3293	3406	3529
	Total	300	5.2	5.6	6.2	3024	3068	3450
Ukraine	Households	288	1.5	1.5	1.5	4265	4261	4314
	Corporate farms	28	317.1	310	338.8	3583	3781	3924
	Total	316	28.6	28.8	31.3	4210	4218	4280
All countries		916	14.5	15.3	17.2	3057	3148	3342

Source: own calculations based on survey data

Figure 1 provides evidence of the investments activities of the farms that are included in the sample. The survey reveals important differences in investment behaviour between the three countries. The level of investments in the Ukrainian dairy sector is relatively low with less than 10 per cent of respondents making any investment in their farming operation in the past five years. Moldovan and Armenian farmers are investing more, especially in animal housing. Dairy specific investments are made mainly by Armenian farmers, with a total of 120 respondents out of 300 claiming investments in cooling tanks, milk lines, cows and so on.

Figure 1: Investments in the past five years on surveyed farms*

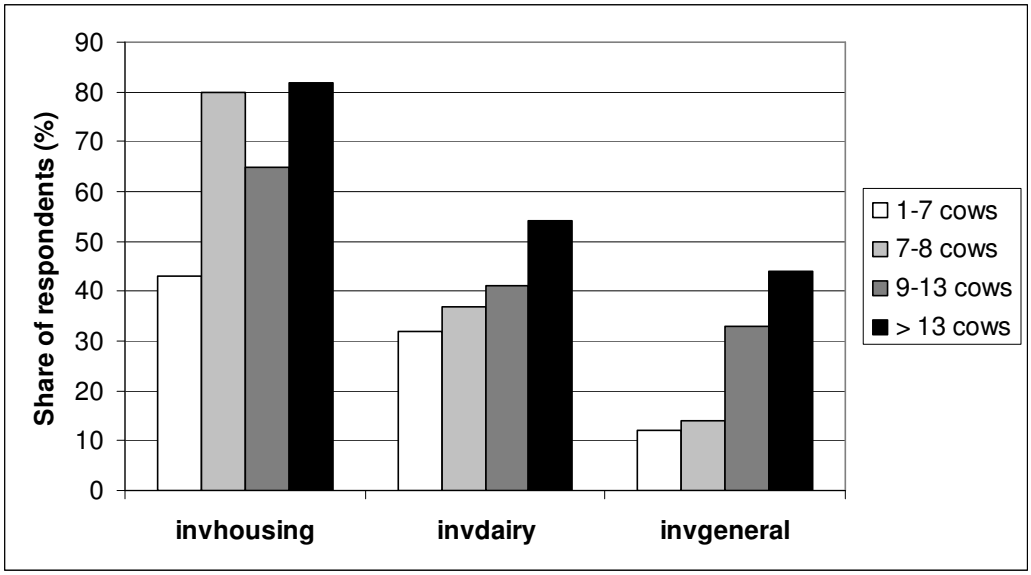


* INVHOUSING includes investments in animal housing facilities: building, enlarging or modernizing stalls sheds and herdsman's camps. INVDAIRY includes dairy specific investments in new calves and cows, milk lines, cooling tanks and fodder mixers. INVGENERAL are investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment.
Source: Survey data

An interesting issue is whether there exists a link between investment behaviour and size of the farm. Since the vast majority of farms tend to differ very little in terms of herd size in Ukraine and Moldova (more than 75 per cent of all farms in the sample hold only 1-2 cows), Figure 2 presents data on investments by herd size for Armenia only. In general we notice a positive correlation between farm size and propensity to invest, meaning that larger farms have made relatively more investments in the past five years than small farms (with a small farm being defined as having less than 7 cows).

Finally, we present data on expected future investments by farmers in Armenia and Moldova (Figure 3). The main categories in which respondents are planning to invest are: animal housing, buying new land, buying new cows and improving pastures. The latter investment category seems to be especially important for Moldovan farmers with more than 60 per cent of respondents indicating expected investments in pastures.

Figure 2: Investments and farm size distribution in Armenia*



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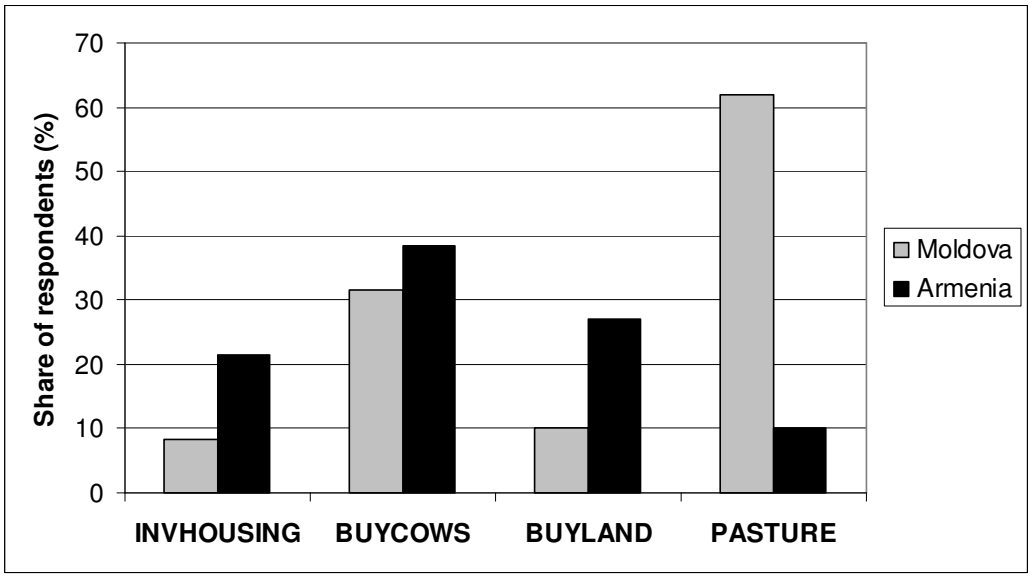
Source: Survey data

Figure 3: Expected future investments, Armenia and Moldova*



* INVHOUSING includes investments in animal housing facilities: building, enlarging or modernizing stalls sheds and herdsman's camps.
Source: Survey data

5. Milk Prices

Table 4 indicates that the mean milk prices received by farmers from their main buyer for each country. Data have been converted into euros per litre for ease of comparison and we have excluded those farmers who sell directly to final consumers, so that prices reflect what is offered by intermediaries in the dairy supply chain. The mean price does vary significantly between countries with the highest figure recorded for Ukraine (€0.1928 euros per litre) and lowest in Moldova (€0.153). The degree of variation in prices also varies significantly between countries: the standard deviations for Moldova and Armenia are far greater than the comparable figure for Ukraine. Evaluating household and corporate farms, the latter do receive a price premium, equivalent to approximately 1 euro cent per litre in Ukraine and 1.6 cents in Moldova.

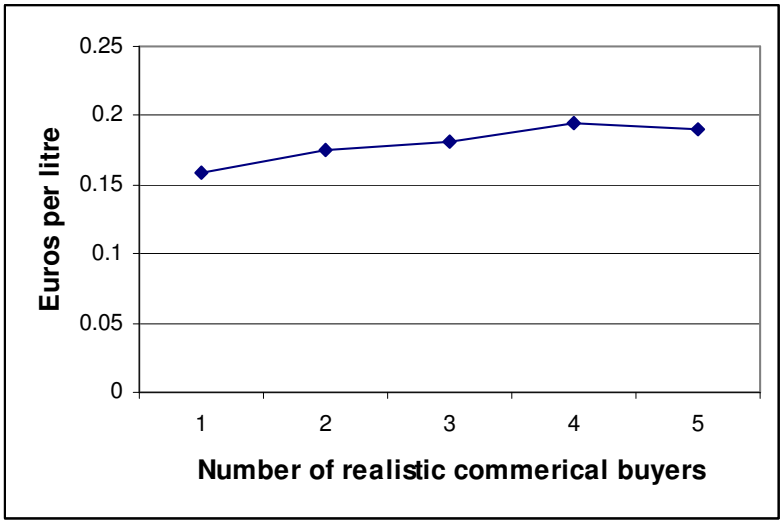
Table 4: Price received from main buyer in previous month per litre of milk (euros)

		Mean Price	Std. Deviation
Armenia	Total	0.1750	0.041
Moldova	Households	0.1524	0.047
	Corporate farms	0.1684	0.023
	Total	0.1531	0.046
Ukraine	Households	0.1919	0.011
	Corporate farms	0.2022	0.020
	Total	0.1928	0.012
All countries		0.1753	0.039

Source: own calculations based on survey data

In explaining the variation in prices, competition plays an important part. Farmers were asked to estimate the number of realistic commercial buyers they had for their milk. Figure 4 indicates that those farmers who had only 1 potential buyer received the lowest mean price, around €0.158 per litre. This figure rises to a mean price of €0.175 for two potential buyers, €0.180 for three potential buyers and over €0.19 for four or five potential buyers. This suggests that policy initiatives to improve farm welfare will have limited success where there is a lack of competition.

Figure 4: Average price received from main buyer (euros per litre) compared to number of potential buyers



Source: own construction based on survey data

6. Buyer Relationships: Type and Satisfaction

Dairy processors are the most common main buyers of milk from farmers (Table 5). However there are significant variations between countries. In Armenia over three quarters of farms sampled sell directly to dairy processors while the comparative figure for Ukraine is just 11 per cent. In Ukraine over 90 per cent of household farms sell to dairy logistics / milk collecting firms. These firms, which are typically small-scale entrepreneurs, specialise in collecting milk from household farms. As a result few Ukrainian household farms know which dairy processor is the eventual purchaser of their milk. Such intermediaries are required in Ukraine to deal with the extremely fragmented small-scale producers. In contrast, the majority of corporate farms (71.4 per cent) deal directly with dairy processors. In Moldova the majority of both household and corporate farms deal directly with dairy processors albeit with the latter category more likely to do so. Milk marketing co-operatives are important for household farms in Moldova and 'others' account for approximately one quarter of the main buyers for this group. Regarding the 'others' category, 96 per cent were classified as agricultural markets. Other cases cited were another farm, canteen, kindergarten and schools. In Moldova none of the corporate farms sold via a co-operative but dealt with dairy processors directly.

Table 5: Type of main buyer by Country (2005), %

		Dairy processor	Dairy logistics / collecting firm	Co-operative	Other
Armenia	Total	76.0	2.3	20.7	1.0
Moldova	Households	51.2	1.4	22.1	25.3
	Corporate farms	72.7	9.1	0.0	18.2
	Total	52.0	1.7	21.3	25.0
Ukraine	Households	5.6	91.3	0.0	3.1
	Corporate farms	71.4	25.0	0.0	3.6
	Total	11.4	85.4	0.0	3.2
All countries		45.9	45.9	30.8	13.8

Source: survey data

The vast majority of small-scale household farms in Ukraine sell to intermediary entrepreneurs without any form of written or oral contract (Table 6).[6] Prices are not set in advance but depend on current market rates and the intermediary makes no long-term guarantees to purchase milk. As a result household farmers in the Ukraine receive no *support measures*, where the latter can be defined as goods and / or services provided by buyers to farmers as part of their relationship. The prevalence of particular support measures in each country is detailed in Table 7.

[6] These intermediaries are sometimes attached to a particular dairy processor but not in all cases.

Table 6: Type of Contractual Relationship between farmers and their main buyer (2005), %

		Written contract	Oral contract	No contract
Armenia	Total	38.0	36.0	26.0
Moldova	Households	19.0	52.9	28.1
	Corporate farms	90.9	9.1	0.0
	Total	21.7	51.3	27.0
Ukraine	Households	0.0	0.0	100.0
	Corporate farms	78.6	10.7	10.7
	Total	7.0	0.9	92.1
All countries	Total	21.9	28.9	49.1

Source: survey data

Support measures are far more extensive in Armenia and Moldova than Ukraine. The most prevent types of support are prompt payments and quality control, which are received by over 80 per cent of farms in each country. Specialist storage (e.g. the provision of cooling tanks) is also important in Moldova. Around 30 per cent of farmers in Armenia also receive credit from their main buyer but this is untypical in Moldova. Farm loan guarantees (to enable a farmer to obtain bank credit) and investment loans are uncommon. Over forty per cent of farmers in both Armenia and Moldova receive a guaranteed price for their milk as stipulated in their contract. Overall, Ukrainian farms received a mean of 0.1 support measures compared to averages of 3.6 and 4.2 for Armenia and Moldova respectively.

Table 7: Percentage of farms in each country receiving a particular support measure from their main buyer

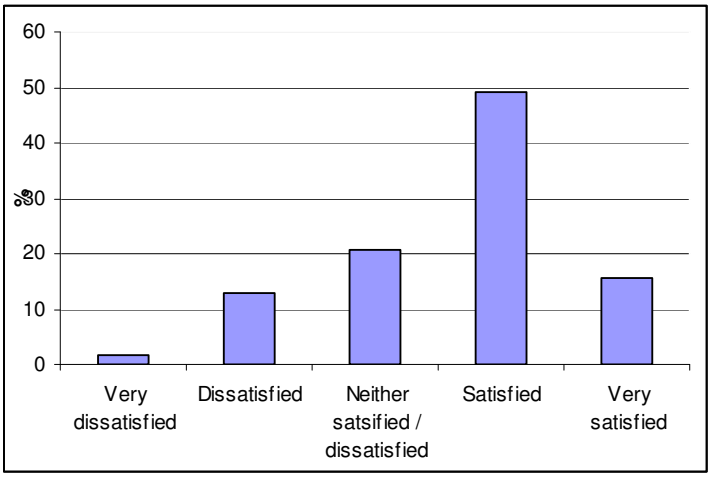
Support measure	**Ukraine**	**Moldova**	**Armenia**
Credit	0.0	0.7	30.7
Physical Inputs	2.2	9.3	16.3
Machinery	0.0	0.7	1.7
Transportation	0.0	61.7	20.3
Specialist storage	0.3	48.7	2.0
Guaranteed prices	0.3	43.7	46.7
Veterinary support	0.0	10.0	23.7
Business and financial management support	0.0	18.0	4.0
Farm loan guarantees	0.0	0.3	4.0
Investment loans	0.0	0.7	1.7
Quality Control	4.4	84.7	82.7
Prompt payments	1.9	81.0	87.7
Market access	0.0	53.7	40.0
Mean number of support measures	0.1	4.2	3.6

Source: survey data

The satisfaction of farmers with their relationships with their main buyer was measured according to a 5 point Likert scale, ranging from ‘very dissatisfied’ to ‘very satisfied’. On this measure, around 14 per cent of farmers were either ‘dissatisfied’ or ‘very dissatisfied’, 49 per cent were ‘satisfied’ and 16 per cent ‘very satisfied’ (the remainder were ‘neither satisfied or dissatisfied’) (Figure 5). The mean level of satisfaction in Armenia, Moldova and Ukraine was 4.02, 3.7 and 3.24 respectively,

with the differences in variance between countries (ANOVA, F-test) significant at the 1 per cent level.

Figure 5: Degree of Farmer Satisfaction with the Relationship with Main Buyer (%)



Considering the association between type of contract and relationship satisfaction, significant differences are apparent. The mean levels of satisfaction as measured on the 5 point Likert scale, displayed in Figure 2 were 3.81 for written contracts, 3.91 for oral contracts and 3.42 for those with no contract. An ANOVA *F test* confirms that the differences between the three groups are significant at the 1 per cent level.

To analyse the determinants of satisfaction in further detail, we apply an ordered probit model with the five point Likert scale as the dependent variable. Ignoring the ordered nature of the satisfaction scale, and using an OLS or a multi-nominal probit or logit model for analysis, would present a strong danger of misspecification and making erroneous inferences about what determines the values of the dependent variable (Becker and Kennedy, 1992). The ordered probit model was first presented by McKelvey and Zavoina (1975) and assumes that the e_{ij} values are distributed normally and that the observed variable (Y_{ij}, the ranks for the J alternatives) is related to the true unobserved utilities (U_{ij}) in the following way:

$$Y_{ij}=0 \text{ if } U_{ij}<\mu_{i1},\ Y_{ij}=1 \text{ if } \mu_{i1}<U_{ij}\leq\mu_{i2},\ \ldots\ Y_{ij}=J-1 \text{ if } U_{ij}>\mu_{iJ-1} \qquad (1)$$

The μ_{ik} values define the boundaries of the intervals for the unobserved utilities that correspond to the observed ordinal response. Since the μ are free parameters, there is no significance to the unit distance between the set of observed values of Y; they merely provide the ranking (Dennis, 2000).

Estimates are obtained by maximum likelihood, and the probabilities entering the log-likelihood function are the probabilities that the observed ranks (Y_{ij} values) fall within the J ranges defined by $J+1$ μ values. The parameters to be estimated are $J-2$ μ values plus the $\boldsymbol{\beta}$ vector; μ_0 and μ_J are assumed to be negative and positive infinity, respectively, and μ_1 is normalized to 0.

The estimated parameters may be used to calculate the probability that a particular alternative will fall within each response category or rank in the case under consideration:

$$\Pr\left(Y_j = k-1\right) = \Pr\left(U_j \text{ is in the } k\text{th range}\right) = F\left(\mu_k - \mathbf{X'}_j\beta\right) - F\left(\mu_{k-1} - \mathbf{X'}_j\beta\right) \quad (2)$$

where *k* indexes the rankings and *F*(…) is the cumulative distribution function, which is assumed to be normally distributed. Thus, the effect of a discrete change in the level of the *n*th independent variable (x_{nj}) on the estimated probability that a response will fall within each of the categories (ranks) can be calculated by substituting the estimated parameters (β and μ values) into Equation 2 (Dennis, 2000). The magnitude of that change will depend on the values for all the estimated parameters and associated variables, as indicated by Equation 2.

At the outset, four independent variables were included in the analysis. *Trust* is a composite variable based on responses to seven Likert scale questions concerning the degree to which the main buyer kept their promises and refrained from opportunistic behaviour. These questions were derived from the verified scales for trust developed by Morgan and Hunt (1994) and Doney and Cannon (1997) and are listed in Appendix 1. It was expected that there would be a positive relationship between *trust* and satisfaction with the main buyer relationship. *Price* is the average amount received per litre of milk from the farmer's main buyer, which was converted into euros for cross-national analysis. *Payment date* is measured as the number of days on average farmers had to wait for payment after supplying their milk. *SMtotal* refers to the total number of support measures received by the farmer from their main buyer. The results for the model including all four independent variables are presented in Table 8.

Table 8: Results for Ordered Probit Model for Relationship Satisfaction, evaluation with 4 independent variables

	Value	Standard error	t value
Trust	0.3568	0.0370	9.6489
Price	1.7775	1.5685	1.1314
Payment date	-0.0276	0.0652	-0.4232
SMtotal	0.1078	0.0347	3.1093

Intercepts:

	Value	Standard error	t value
1|2	-2.602	0.387	-6.819
2|3	-0.956	0.317	-3.017
3|4	-0.020	0.313	-0.063
4|5	2.029	0.328	6.185

Residual Deviance: 1072.732
AIC: 1088.732

Table 8 reveals significant positive associations for *trust* and *SMtotal* with relationship satisfaction. The negative sign for the *payment date* coefficient is as expected (the longer farmers have to wait for payment, the lower the level of satisfaction) but the variable is not a significant determinant of satisfaction. Similarly while the price

coefficient is positive it is not a significant determinant. These results may appear surprising but reflect the lack of variation in price and payment dates, particularly in Ukraine. As farmers lack contracts in the Ukraine with milk collected by intermediary agents, payments are immediate with little variance in price between household farms (Table 4). The results of the model, excluding the variables *price* and *payment date* are presented in Table 9.

Table 9: Results for Ordered Probit Model for Relationship Satisfaction, trust and SMtotal variables only

	Value	Standard error	t value
Trust	0.3740	0.0344	10.8660
CSMtotal	0.0850	0.0287	2.9629

Intercepts:

	Value	Standard error	t value
1|2	-2.988	0.230	-12.995
2|3	-1.337	0.095	-14.101
3|4	-0.399	0.079	-5.030
4|5	1.623	0.106	15.379

Residual Deviance: 1138.326
AIC: 1150.326

While trust has long been regarded as a cornerstone of relationship satisfaction, and as a consequence, of supply chain performance (Morgan and Hunt, 1994), empirical testing has been limited, particularly in the CIS context. Our analysis validates the importance given to it in the literature, particularly for transitional markets which are characterised by rapid structural change and often poor legal recourse to punish opportunistic behaviour. Table 10, gives an insight into the prevalence of opportunistic behaviour on the part of main buyers. Considering only those farmers with a contract, approximately 10 per cent of farmers reported that their main buyer often or always did not respect the terms of their arrangement. 63 per cent report that their main buyer never disrespected the terms of their arrangement and around one quarter reported that this occurred seldom. There is a clear relationship between the occurrence of opportunistic behaviour and the mean score for relationship satisfaction, as measured by the 5 point Likert scale (final column of Table 10). This analysis again highlights the importance of trust.

Table 10: Occurrence of a main buyer not respecting the terms of the contract

Frequency with which terms no respected by main buyer	No of responses	% of those with a contract	Mean score for relationship satisfaction
Always	4	0.87	1.75
Often	44	9.52	2.59
Seldom	122	26.41	3.52
Never	292	63.20	4.23

Source: survey data

7. Conclusions

The analysis reveals a varied set of supply relationships in the CIS. In Ukraine the dualistic farm structure, that characterised the Soviet era, remains. Household farms in the Ukraine have 1 or 2 cows and sell principally to milk collecting entrepreneurs. They have neither contracts nor receive support measures. For these farms, growth in herd size and yields for the period 2001 to 2005 was minimal. This group has the lowest relative satisfaction with the main buyer relationships.

In both Moldova and Ukraine corporate farms receive a price premium over their household farm counterparts of 1.6 euro cents and 1 euro cent per litre respectively. The majority of corporate farms in both countries have written contracts with their main buyer. Corporate farms in both countries increased their yields during the period 2001 to 2005 but herd sizes were rather unstable, reflecting wider market volatilities. The standard deviation of herd size is substantially lower in Armenia than the other two countries studied, with the growth in yields and cow numbers being smoother and substantial. In Armenia only 26 per cent of farmers have no contract with their main buyer and this country registered the highest mean level of satisfaction with main buyer relationship.

An analysis of the determinants of farmer satisfaction with their main buyer relationship highlights the significance of trust and support measures. Research with dairy processors has identified the importance of such support measures in stimulating farm yields and improvements in quality (Gorton and White, 2007) and our analysis shows that such support measures are valued by farmers. Trust is an important issue for the farmers studied as the prevalence of opportunistic behaviour is rather high: 10 per cent report that their main buyer often or always fails to respect the terms of their contract and over a quarter of those farmers with contracts report that opportunistic behaviour has occurred, albeit seldom.

References

Becker, W.E. and Kennedy, P.E., (1992). A graphical exposition of the ordered probit. *Econometric theory*, Vol.8, pp. 127–131.

Biroul Național de Statistică al Republicii Moldova (2007*), Moldova in Figures***,** Chişinău.

Dennis, D.F. (2000), An ordered probit analysis of public values for use in multiple objective decision-making, *Computers and Electronics in Agriculture*, Vol.27 (nos.1-3), pp.127-137.

Doney, P.M. and Cannon, J. P. (1997), An examination of the nature of trust in buyer-seller relationships, *Journal of Marketing*, Vol.61(2), pp. 35-51.

Dries, L. and Swinnen, J.F.M. (2004), Foreign Direct Investment, Vertical Integration, and Local Suppliers: Evidence from the Polish Dairy Sector, World Development, Vol32(9), pp.1525-1544.

Dumitrashko, M. (2003), Survey of rural households. Institute of Management and Advanced Training in Agribusiness (IMATA), Chişinău.

FAOSTAT (2007), Online database

Franks, J.R and Davydova, I. (2005), 'Reforming the farming sector in Russia: new options for old problems', Outlook on Agriculture, Vol 34, No 2, pp 97-110.

Gorton, M., Dumitrashko, M. and White, J. (2006), 'Overcoming supply chain failure in the agri-food sector: A case study from Moldova', *Food Policy*, Vol.31, No.1, pp.90-103.

Gorton. M. and White J. (2007), Transformation and contracting in the supply chains of the former Soviet Union: Evidence from Armenia, Georgia, Moldova, Ukraine, and Russia. In J.F.M. Swinnen (ed.), *Global supply chains standards and the poor: how the globalisation of food system and the standards affects rural development and poverty*, Wallingford: CABI, pp.175-187

Goskomstat (1986). Statistical yearbook of the USSR**.** Moscow: Goskomstat, State Statistical Agency**.**

IMF, (2003). Republic of Armenia: Poverty Reduction Strategy Paper, IMF Country Report No. 03/362.

Jones, D. and Smogorzewska, J. (1982), Dairy farming in the USSR: policy and reality**,** *Soviet Studies*, Vol.34(2), pp. 254-269.

Keyser, J.C., (2004), Thematic Study on Comparative Advantage and Agricultural Marketing: Phase 1 Synthesis Report, Rome: The International Fund for Agriculture Development (IFAD).

Lerman, Z., Csaki, Cs. And Feder, G. (2004). *Agriculture in Transition: Land Policies and Evolving Farm Structures in Post-Soviet Countries*, Lanham: Lexington.

Lerman, Z. and Mirzakhanyan, A. (2001), *Private Agriculture in Armenia,* Lanham: Lexington Books.

Macours, K. and Swinnen, J.F.M., (2000). Causes of Output Decline in Economic Transition: The Case of Central and Eastern European Agriculture, *Journal of Comparative Economics*, Vol.28(1), pp.172-206.

McKelvey, R.D. and Zavoina, W., (1975). A statistical model for the analysis of ordinal level dependent variables. *Journal of Mathematical Sociology*, Vol.4, pp. 103–120.

Morgan, R.M. and Hunt, S. (1994), The commitment-trust theory of relationship marketing, *Journal of Marketing*, Vol.58, pp.20-38.

NSS (2003), The socio-economic situation of the Republic of Armenia, Yerevan: NSS.

Rogov, I. A. and Chizhikova, T. V. (1992), The problem of improving the quality and safety of meat and milk products [in Russian], *Vestnik Sel'skokhozyaistvennoi Nauki*. No.2, 26-32.

State Statistics Committee of Ukraine, (2004), *Statystychnij shhorychnyk Ukrainy* 2003, Kyiv.

State Statistics Committee of Ukraine, (2007), Statistical database, http://www.ukrstat.gov.ua/

Strauss, E. (1970), The Soviet Dairy Economy, *Soviet Studies*. Vol. 21(3), pp. 269-296

World Bank (2005). Moldova: opportunities for accelerated growth. A country economic memorandum for the Republic of Moldova, Washington D.C., Report No. 32876-MD.

World Bank (2007). Statistics Database, http://www.worldbank.org/

Appendix 1: Likert Scale Questions used for Composite Trust Variable

Please rate the degree to which you agree with the following statements	Strongly disagree	Disagree	Neither agree / disagree	Agree	Strongly agree
1) My main buyer keeps the promises it makes to us	❑1	❑2	❑3	❑4	❑5
2) My main buyer is not always honest with us	❑1	❑2	❑3	❑4	❑5
3) My main buyer is genuinely concerned that our business succeeds	❑1	❑2	❑3	❑4	❑5
4) When making important decisions, my main buyer considers our welfare as well as its own	❑1	❑2	❑3	❑4	❑5
5) Our main buyer is trustworthy	❑1	❑2	❑3	❑4	❑5
6) We find it necessary to be cautious with our main buyer	❑1	❑2	❑3	❑4	❑5
7) Our main buyer sometimes alters the facts slightly	❑1	❑2	❑3	❑4	❑5