

# Supply chain relationships, supplier support programmes and stimulating investment: evidence from the Armenian dairy sector

*Liesbeth Dries*

Wageningen University, Wageningen, The Netherlands

*Matthew Gorton*

Newcastle University Business School, Newcastle-upon-Tyne, UK

*Vardan Urutyan*

Agribusiness Department, Armenian National Agrarian University, Yerevan, Armenia, and

*John White*

School of Management, University of Plymouth, Plymouth, UK

## Abstract

**Purpose** – The purpose of this paper is to evaluate the determinants of supply chain relationships, the provision of supplier support measures and the role that support measures play in stimulating investment by suppliers in emerging economies.

**Design/methodology/approach** – The paper draws on survey evidence for 300 commercial dairy farms in Armenia. The identification of potential determinants of supply chain relationships and support programmes is based on literature on supply chain management and transaction cost economics.

**Findings** – Positive determinants of supplier support programmes are the degree of exclusivity of the buyer-supplier relationship, initial capital of the supplier, co-operation between suppliers, and foreign ownership of the buyer. Support programmes are less likely to be offered in very competitive environments. Support measures such as loans, physical inputs and guaranteed prices facilitate supplier investments.

**Research limitations/implications** – Research is limited to cross-sectional data for a single country and further testing would help assess the generalizability of the findings.

**Practical implications** – The findings highlight the gains that can be made from openness to international firms. The negative competition effect suggests that buyers are constrained in their ability to monitor use of the provided services in an environment where a lot of buyers are competing for the same supply. Improving the enforcement capability of companies under these circumstances is an important challenge for the industry and policy makers.

**Originality/value** – The novelty of the study lies in the investigation of the relationships between the nature of supply chain linkages and suppliers' investments.

**Keywords** Dairy, Supply-chain management, Armenia, Contractual choice, Supplier investment, Supplier support programmes

**Paper type** Research paper

## 1. Introduction

Supply chain inefficiencies and disruptions are common problems inhibiting the international competitiveness of emerging and transitional economies. Buyers often face inadequacies in the quality and quantities of supplies. This has led to enhanced vertical coordination in agri-food chains. Specifically, enhanced vertical coordination involves buyers providing support measures to suppliers, such as credit and physical inputs, as part of a long-term relationship. This may

overcome market failures and provide a more conducive framework for investment by the supplier. However, the provision of such supports is often costly and there is a potential for opportunistic behaviour – for instance credit provided to enable the supplier to purchase inputs could be diverted to other activities. Curtailing opportunistic behaviour may be particularly problematic where transaction costs

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Supply Chain Management: An International Journal  
19/1 (2014) 98–107  
© Emerald Group Publishing Limited [ISSN 1359-8546]  
[DOI 10.1108/SCM-12-2012-0380]

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The data used in this paper were collected in the SIDCISA (Supporting the International Development of CIS Agriculture) research project. This project was funded by EU INTAS. The analysis described in this paper was conducted as part of the COMPETE (International comparisons of product supply chains in the agro-food sectors) research project that is funded by EU FP7.

Received 6 December 2012  
Revised 9 April 2013  
2 August 2013  
11 October 2013  
Accepted 11 October 2013

incurred in monitoring and enforcing contracts are high (Blanchard and Kremer, 1997; Gow and Swinnen, 1998; Boger *et al.*, 2001).

This paper analyses vertical coordination in the Armenian dairy sector, specifically, farm – milk processor relationships and the provision and impact of supplier support measures as part of these relationships. It addresses three important questions relating to the type of buyer-supplier relationship, which suppliers receive support measures and whether such support induces investments by suppliers. Econometric analysis thus models the determinants of: contractual choice; supplier support measures and farm level investment, drawing on a sample of 300 commercial dairy farms. The Armenian dairy sector, as in many other emerging and transitional economies, has suffered from inadequate investment in the supply base, with, by international standards, poor quality and productivity. Investment at the farm level is crucial to improving the efficiency and international competitiveness of the whole supply chain.

Recent supply chain management research emphasises the critical role of buyer-supplier relationships for supply chain management strategies in general (Tan, 2001) and, specifically, within the agri-food sector (Fischer *et al.*, 2010). This relationship may also include supplier development, defined as any effort of a buying firm to increase the capabilities of the supplier (Krause and Ellram, 1997). Although much has been written on buyer-supplier relationships and supplier development (Ellram, 1991), there is a lack of empirical models for establishing successful buyer-supplier partnerships (Tan, 2001; Fischer and Reynolds, 2010). The study is thus opportune and contributes to the wider literature on supplier development strategies as a key component of supply chain management (Monczka *et al.*, 1993; Krause and Ellram, 1997; Wagner, 2006; Rogers *et al.*, 2007). As far as we are aware, it is one of the first to assess the linkages between supplier support measures and actual investment by suppliers.

The remainder of this paper is organised as follows. We first provide an overview of the potential nature of buyer-supplier relationships and the rationale for the choice of contract and the provision of supplier support programmes. This is followed by a description of the Armenian dairy supply chain and the rural finance sector to provide context for our study. We then discuss the dataset and the data collection process. Next, we present descriptive statistics before introducing an investment model and analysing the determinants of contractual choice, supplier support and investment. Relevant conclusions are drawn in the final section.

## 2. Supply chain relationships and supplier support programmes

### 2.1 Governance of exchange relationships

Exchange relationships have been conceptualised as a continuum, differing in their degree of interaction, from spot markets at one extreme to vertical ownership integration at the other (Anderson *et al.*, 1994). Spot markets, as a governance mechanism, involve immediate market transactions with no prior or post purchase commitments beyond fulfilling the given exchange. They provide buyers with flexibility but limit their ability to control the quality and quantity of goods available for sale. Vertical integration, by

incorporating two stages of the supply chain within a single firm, should lower procurement risks and increase control over quality. However, the dissipation of resources in vertical ownership integration places a relatively high demand on capital and may dull managerial incentives (Bhuyan, 2002). Firms may possess core competencies in one stage of the supply chain, but lack the knowhow and skills to be effective in another. As a result, intermediate or hybrid arrangements, where autonomous firms maintain contracting/partnership arrangements, have become increasingly common (Sporleder, 1992; Hobbs and Young, 2000). When working effectively, hybrid forms should give downstream agents improved control over product quality and quantity, without dissipating managerial efforts.

For simplicity, and following the approach of Fischer *et al.* (2009), we group the different types of exchange relationships into two major contract types: spot markets and informal or relational contracts are referred to as implicit contracts,<sup>1</sup> while written contracts and cross-shareholding arrangements are referred to as explicit contracts. The degree of vertical coordination or integration is higher for explicit, compared to implicit, contracting relationships.

### 2.2 Determinants of exchange relationships and supplier support

Tighter vertical coordination can help reduce business uncertainty, improve access to essential resources and result in higher business productivity (Dyer and Singh, 1998). In emerging and transition countries, improved access to resources is crucial to overcome problems of quality and volume of supplies (Sahay *et al.*, 2003). Providing access to resources can be part of supplier development programmes, which may include a range of “activities undertaken by a buying firm to improve either supplier performance, or supplier capabilities, or both, and to meet the buying firm’s short- and/or long term supply needs” (Krause *et al.*, 2007, p.34). The most common support tools included in supplier development programmes are: credit, loan guarantees, physical inputs, guaranteed prices and prompt payments (Gow and Swinnen, 2001; Krause *et al.*, 2000; Krause *et al.*, 2007; Wagner, 2006):

- H1a.* Improving access to resources requires tight vertical coordination and therefore more explicit contracts. Access to resources is more problematic for resource-restricted suppliers so we expect these suppliers to have more explicit contracts.
- H1b.* Supplier support programmes are provided to overcome market failures and restrictions faced by suppliers in fulfilling buyers’ requirements in terms of quantity and quality of products. Therefore, more resource-restricted suppliers are more likely to benefit from supplier support programmes.

Market competition represents environmental uncertainty because it increases the opportunities for suppliers (or buyers) to switch to another buyer (supplier). Under such circumstances, the use of more explicit contracts becomes attractive as it lowers the risk of losing a trading partner (McCluskey and O’Rourke, 2000; Reynolds *et al.*, 2009). Supplier development programmes may also generate greater scope for opportunistic behaviour: suppliers may divert support measures to unintended uses or they may switch buyers after having received support. However, in some cases

tangible incentives – such as supplier support – may also be used to protect against violations of contractual agreements (Klein *et al.*, 1978; Zaharieva *et al.*, 2003). For example, if input markets are inefficient, access to credit through a particular contract with a buyer acts as a powerful incentive not to break an agreed arrangement. Furthermore, supplier support programmes may also emerge in a reactive manner – a buyer may seek to prevent suppliers from switching to a competing firm which has introduced such measures. In this case, the competition effect actually works in favour of the spread of supplier support programmes. The spill over effects of one firm offering supplier support measures may be considerable (Gow *et al.*, 2000):

- H2a.* Greater uncertainty in the buyer-supplier relationship due to the possibility of opportunistic behaviour, increases the use of explicit contracts.
- H2b.* Self-enforcement of the buyer-supplier agreement is an important prerequisite for the sustainability of supplier support programmes. A higher likelihood of opportunistic behaviour by suppliers decreases the availability of supplier support programmes. On the other hand, competition between buyers may also increase the availability of supplier support programmes through spill over effects.

Agri-food supply chains are especially prone to problems of information asymmetry between buyers and suppliers because many food quality characteristics are credence attributes (Gorton *et al.*, 2006; Young and Hobbs, 2002). To overcome the problem of information asymmetry, companies are increasingly using explicit contracts and ownership integration (Fischer *et al.*, 2009). An example of information asymmetry in the case of supplier development programmes is that buyers cannot easily observe if supplier support measures are used in ways intended by the principal. This information asymmetry may deter the buyer from providing supplier support (Gow and Swinnen, 2001).

- H3a.* Information asymmetries lead to greater use of explicit contracts. Conversely, initiatives that help to overcome the problem of asymmetric information may reduce the need for explicit contracts.
- H3b.* Asymmetric information between the buyer and the supplier decreases the likelihood of support programmes. Initiatives that help to overcome the problem of asymmetric information increase the likelihood of supplier development.

### 3. Background on the Armenian dairy and rural finance sector

#### 3.1 The Armenian dairy supply chain

Animal husbandry is one of the main branches of Armenian agriculture and is of critical importance for small-scale farms. The vast majority of producers own fewer than eight cows (see Table I). Livestock farms face a number of obstacles, hampering their operational efficiency. The absence of affordable, high quality feeds, expensive veterinary services, a lack of artificial insemination and ineffective management practices make the industry highly volatile and seasonal. This negatively affects productivity and the competitiveness of locally produced milk compared to imported milk powder.

**Table I** Size distribution in the Armenian dairy sector

Size class	<8 cows	8-14 cows	15-99 cows	>99 cows	Total
Number of farms	167,134	4,057	2,476	49	173,716
% of farms	96.2	2.3	1.4	0.0	100

Source: Hovhannisyanyan (2008)

Typically, less than one half of produced milk is sold to dairy processing companies. The remainder is used to feed calves, sold unofficially to consumers or consumed by farm households (Avetisyan, 2008).

The dairy processing industry in Armenia is comprised of about 250 companies. In order to overcome the problems related to the seasonality of local milk supply, most processors rely heavily on imported milk powder to stabilize their production levels year-round. While official data suggest that during recent years milk powder comprised only about 8-12 per cent of total milk procured by the dairy companies, other studies show that there is also an important additional share of shadow imports of milk powder into the country (Asatryan and Eroyants, 2010).

#### 3.2 The rural finance sector

Although the financial and banking sector has experienced steady growth in Armenia, options for agriculture are more limited. The vast majority of Armenian banks refrain from financing agriculture. By the end of 2012 there were 21 commercial banks with 467 branches operating in Armenia. Only about 5.5 per cent of total credit investments of these commercial banks went to agriculture in 2012. Banks consider agriculture a high risk sector and impose higher rates and shorter repayment periods for provided loans. On average the interest rates on agricultural loans provided to farmers by commercial banks and credit organisations vary between 8 and 22 per cent (Urutyanyan, 2012).

The overall level of institutional development in Armenia is an important limiting factor when it comes to establishing business relationships between agricultural producers who require funds and banks which have those funds. These institutional failures include limitations in the use of real estate as collateral due to the lack of properly functioning land registry offices, the lack of regulations regarding other forms of loan security and uncertainty regarding the enforceability of claims on borrowers in default. In addition, a market for agricultural insurance does not exist in Armenia. As a result, local producers must contend not only with the risks inherent in the fluctuation of prices on the market but also the specific risks inherent in extensive agricultural production and a low level of productivity. Hence, farmers who are considering taking out loans face huge uncertainty regarding the profitability of planned projects if these projects have to be financed with funds obtained at high interest rates (Urutyanyan, 2012).

Despite some signs of improvement in recent years –, e.g. in the period 2005-2012 total agricultural credits grew at approximately 35 per cent per annum – important credit constraints remain. This is especially true for the majority of Armenian farm households, which are small-scale, poorly capitalized and face fluctuating and uncertain cash flows throughout the year. These conditions put a strain on the restructuring and upgrading – in terms of quality production

and volumes – of the agricultural sector. With the formal rural finance sector offering few opportunities to small Armenian milk producers, it is crucial to improve comprehension of the role of supply chain relationships in overcoming credit constraints in the sector (Urutyun, 2012).

#### 4. Data and data collection methodology

To gain a better understanding of commercial milk buyer-supplier relationships, a survey was conducted in 2006. 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. To obtain the sample, a quota of 300 responses was set with the intention of including a representative cross-section of commercial dairy farms, including both household producers that marketed at least part of their output and agricultural companies. Respondents were drawn from all regions (*Marzes*) which have significant commercial milk production, based on proportions drawn from statistical data on milk production. A stratified random sample was employed with quotas for each region based on statistical data from Milk Production in the Marzes of Armenia (NSSA, 2004). Regions where milk production was not developed commercially were excluded from the sample. On the other hand, visits to the villages revealed that there are regions with highly commercialized farmers working with many dairy processors. In this case, it was decided to increase the number of farmers to be surveyed from such regions. Table II details the sampling plan.

Suitable farms were identified from contacts with national statistical agencies, local and regional authorities, village mayors, local livestock experts and agricultural agencies. Data were collected through face-to-face interviews. The dataset by herd size is presented in Table III, with the typical commercial dairy farm in Armenia having between five and 20 milking cows. Comparing the size distribution of farmers in the sample (see Table III) with the overall size distribution of Armenian milk producers (see Table I), we observe that the sample is not representative of the total sector. Small farms have been underrepresented in the sample: more than 50 per cent of the farms in our sample have a herd size of eight cows

Table II Sampling plan

Milk production in Marzes	In tsd tonnes	Per cent in total	Proportional	Final sample
Yerevan	3.6	1	3	0
Aragatsotn	64.1	12	36	20
Ararat	41.4	7	21	23
Armavir	35.9	6	18	0
Gegharkunik	98.7	18	54	57
Lori	65.4	12	36	39
Kotayk	56.9	10	30	20
Shirak	83	15	45	71
Syunik	47.1	8	24	60
Vayots Dzor	21	4	12	0
Tavush	38.1	7	21	10
Total	555.2	100	300	300

Source: National Statistics Year Book 2004 and INTAS Survey Guidelines

Table III Number of milking cows per commercial farm

No. of milking cows	No. of farms in the sample	Share of farms in total sample (%)
< 4	4	1.3
4-5	66	22
6-7	72	24
8-9	39	13
10 to 19	77	25.7
20 to 49	29	9.7
50 to 99	8	2.7
100 +	5	1.7
Total	300	100
Mean	13.4	–
SD	18.5	–

Source: Survey data

or more, while this is the case for less than 4 per cent of the total Armenian dairy sector. Given our sampling strategy – specifically excluding non-commercial dairy farms in line with the objectives of our research question – this is, however, unsurprising.

#### 5. Supply chain relationships and on-farm investments in the Armenian dairy sector

##### 5.1 Description of milk buyer-supplier relationships

Before presenting the econometric analysis related to supplier investment, we briefly describe the vertical relationships between milk producers and buyers in the Armenian dairy supply chain. Dairy processors are the most common main buyers of milk from farmers. Over three quarters of sampled farms sell directly to dairy processors. Another 20 per cent of dairy farms sell through a co-operative. The remainder of milk is collected by intermediaries: dairy logistics or collecting firms. The majority of sampled farms sell milk based on a contractual arrangement: 38 per cent have signed a written contract with the milk buyer; 36 per cent sell milk based on an oral contract; and only a quarter of the sampled farms have not entered into a contractual agreement.

The relationships that exist between buyers and sellers are often much more extensive than simple agreements on price, volumes and delivery conditions. Table IV shows that supply chain relationships in the Armenian dairy sector also involve a wide range of support measures. The most prevalent types of support are prompt payments and quality control, which are received by over 80 per cent of sampled farms. Around 30 per cent also receive credit from their main buyer.

Considering the investment activities of the sampled farms reveals that the majority of respondents had made on-farm investments in the previous five years (period 2001-2006). Almost 50 per cent of the sampled farms have invested in animal housing, 31 per cent reported purchasing cooling tanks, milk lines, cows and other dairy-specific investments and 19 per cent have made general investments related to land and non-dairy specific agricultural equipment.

### 5.2 Determinants of supply chain relationships and supplier support programmes

Firstly, the analysis considers the determinants of the supply chain relationship and the elements that determine access to support programmes. The explanatory variables in these models are directly related to the three hypotheses that were derived in section 2. The relationships that we estimate are the following:

$$EXPLICIT_i = \beta_0 + \beta_1 RESOURCES_i + \beta_2 OPPORTUNISM_i + \beta_3 INFORMATION_i + \beta_4 BUYER_i + \varepsilon_i \quad (1)$$

$$SUPPORT_i = \beta'_0 + \beta'_1 RESOURCES_i + \beta'_2 OPPORTUNISM_i + \beta'_3 INFORMATION_i + \beta'_4 BUYER_i + \varepsilon_i \quad (2)$$

where EXPLICIT is a measure of the contractual relationship between buyer and supplier; SUPPORT is a measure of access to farm support programmes; RESOURCES characterises how resource-restricted the milk producer is; OPPORTUNISM is a measure of the potential for opportunistic behaviour; INFORMATION identifies the level of information asymmetry between buyer and supplier;

**Table IV** Percentage of suppliers receiving support from their main buyer

Support measure	Percentage of suppliers receiving support
Prompt payments	87.7
Quality control	82.7
Guaranteed prices	46.7
Market access	40.0
Credit	30.7
Veterinary support	23.7
Transportation	20.3
Physical inputs	16.3
Business and financial management support	4.0
Farm loan guarantees	4.0
Specialist storage	2.0
Investment loans	1.7
Machinery	1.7

Source: Survey data

BUYER includes additional variables that relate to the characteristics of the buyer company; and finally  $\varepsilon$  is the error term.

EXPLICIT is a dummy taking the value of one if the buyer-supplier relationship is based on a written contract and it is zero in the case of an oral contract or a spot market relationship. SUPPORT is a dummy taking the value of one if the farm received support from the main buyer of milk. The support categories included are: credit; investment loans; farm loan guarantees; physical inputs. RESOURCES is measured by the existing capital stock of the farm. Since the main capital assets in Armenian dairy farms are the cattle, we follow the approach of Petrick (2004) by using the number of cows on the farm in the year 2001 as an indicator. It is expected that smaller, hence more resource-restricted, farms are more likely to have explicit contracts and have greater need for supplier support measures.

OPPORTUNISM is a vector of variables (COMPETITION and SHARE). COMPETITION measures the number of potential buyers of milk that a farmer has access to and hence characterises the degree of competition between buyers in the market. More competition in the market creates greater uncertainty for the buyer who will be more inclined to engage in explicit contracts with suppliers. On the other hand, contracts are more difficult to enforce in a competitive market and hence providing support is more risky (Poulton *et al.*, 2004). The expected effect of COMPETITION on the likelihood of support is negative. SHARE refers to the share of the farm's total milk production that is sold to the main buyer. We expect that a more exclusive relationship with the main buyer (i.e. a higher share of milk sold to this trading partner) leads to a higher degree of dependence and commitment and hence a lower probability of opportunistic behaviour (Krause *et al.*, 2000). An implicit contract may suffice for governing the relationship under these circumstances. On the other hand, an explicit contract can formalise the dependence and commitment within the relationship. We expect SHARE to increase the likelihood of the supplier receiving support. The effect on contract choice is ambiguous.

INFORMATION is a vector of variables (COLLECT and CO-OPERATE) that relate to the asymmetry of information in the buyer-supplier relationship. COLLECT is a dummy that takes the value of 1 if milk is collected by the buyer from the farm instead of through a village collection centre. On-farm collection should provide better opportunities for the buyer to monitor and check up on the supplier. This should increase the likelihood of support measures but decrease the need for explicit contracting. CO-OPERATE is a dummy that takes the value of one if the farmer indicates that he/she is co-operating with other farmers to store, market or process milk, to buy inputs, or to engage in lobbying activities. Greater co-operation between farmers may lead to greater discipline among farmers, the development of good practices and a denser network in which information flows more fluently. This may also have a positive impact on the likelihood of receiving support.

Finally, BUYER includes two indicators of the characteristics of the buyer (TYPE and FDI). Buyer type (TYPE) is a dummy that takes the value of one if the buyer is a corporate dairy processor and zero if the buyer is a co-operative or an intermediary milk collecting company. FDI is a dummy that takes the value of one if the buyer is a foreign

owned company or if the buyer is exporting dairy products. In both instances we expect that internationally focused buyers are better resourced, having the necessary financial means to provide support programmes (Dries and Swinnen, 2004; Dries *et al.*, 2009). Furthermore, foreign companies may be more inclined to use explicit contracts because local market and business uncertainty may be higher for them. FDI is expected to have a positive effect on the likelihood of explicit contracts and support. Table V provides summary statistics of the variables included in models (1) and (2). Tests show that correlation between the explanatory variables is limited with a maximum correlation coefficient between TYPE and CO-OPERATE of 31 per cent.

### 5.3 Determinants of on-farm investment

The model that we employ to analyse the determinants of on-farm investment is based on Elhorst (1993) and Petrick (2004). The model was adapted in keeping with Dries and Swinnen (2010) to answer the specific research question related to the impact of support programmes on investments and to deal with a number of data limitations. We estimate the following empirical model:

$$INVEST_i = \beta_0 + \beta_1 SUPPORT_i + \beta_2 CONTROL_i + \varepsilon_i \quad (3)$$

where INVEST measures farm investment, SUPPORT is a vector of variables measuring support programmes from the dairy; CONTROL is a vector of control variables; and  $\varepsilon$  is the error term.

INVEST is a dummy taking the value of one if the milk supplier made an investment in farm assets<sup>2</sup> over the five year period of study (years 2001 to 2006) and it takes the value of zero if no investment was made in the specified period.<sup>3</sup>

The first set of variables (SUPPORT) includes several indicators of dairy assistance programmes. PLOAN is a dummy that takes the value of one if a supplier is delivering to a dairy company that offers financial assistance, in other

words, if the supplier has access to dairy processor loans, credit or bank loan guarantee programmes that improve access to external financial resources. INPUTS is a dummy that takes the value of one if the supplier receives physical inputs from the buyer and is zero in the other case. Apart from the direct impact on investments through processor loans, dairy input supply programmes are likely to have an indirect impact on suppliers' investments by enhancing the profitability of the farm by lowering input costs, or reducing transaction costs in accessing inputs. We expect, therefore, PLOAN and INPUTS to have a positive effect on INVEST. Other factors that may cause an indirect impact on the likelihood to invest are the provision of guaranteed prices (PRICE) and prompt payments (PAYMENT). Price guarantees and the absence of payment delays reduce the riskiness of the business environment for the supplier. As a result, farms may be more inclined to invest than in more uncertain situations.

The control variables (CONTROL) are related to the farm and the farmer. The expected sign of the variable RESOURCES depends on the optimal size of the capital stock. A negative sign implies that larger farms are less likely to invest than small farms and consequently, that farm sizes are likely to converge. A positive sign would lead to the opposite conclusion and farm sizes diverge. Apart from efforts to achieve the optimal capital stock, RESOURCES may also capture a different effect on investment decisions. Larger farms may benefit from reputation effects and the availability of more collateral. Furthermore, larger farms may benefit from more frequent interactions with the dairy company (Fafchamps, 1997; Johnson *et al.*, 2002; McMillan and Woodruff, 1999). This second effect suggests that RESOURCES has a positive effect on the likelihood to invest. CO-OPERATE is a dummy that takes the value of one if the farmer indicates that he/she is cooperating with other farmers to store, market or process milk, to buy inputs, or to engage in

Table V Descriptive statistics for variables included in the regression models

Variable	Variable description	Percentage sample (dummy) or average	Std dev.
EXPLICIT	1 if written contract	38.0	–
SUPPORT	1 if support provided by buyer	37.3	–
o.w. PLOAN	1 if credit, investment loan or loan guarantee provided by buyer	35.0	–
o.w. INPUTS	1 if inputs provided by buyer	16.3	–
o.w. PRICE	1 if guaranteed prices provided	46.7	–
o.w. PAYMENT	1 if no payment delays	87.7	–
INVEST	1 if on-farm investment in five years	72.7	–
INVESTd	1 if dairy-specific investment in five years	40.0	–
<i>Hypothesis 1</i>	<i>Resource-restricted suppliers</i>		
RESOURCES	Number of dairy cows	8.5	13.2
<i>Hypothesis 2</i>	<i>Competition/opportunistic behaviour</i>		
COMPETITION	Number of potential milk buyers for the farmer's milk	2.0	1.9
SHARE	Share of total milk production delivered to the main buyer	86.4	18.3
<i>Hypothesis 3</i>	<i>Information asymmetry</i>		
COLLECT	1 if on-farm milk collection	70.0	–
COOPERATE	1 if farmer co-operates with other farmers to store, market or process milk, to buy inputs, or to lobby	29.3	–
TYPE	1 if buyer is a corporate dairy	76.0	–
FDI	1 if buyer is foreign-owned dairy or exporter of dairy products	22.0	–

Source: Survey data

lobbying activities. We expect that more co-operation generates countervailing power and leads to a denser network that creates more social capital, which facilitates investment. Table V provides summary statistics of the variables included in Model (3).

#### 5.4 Regression results

Equations (1), (2) and (3) are estimated using logit regression models. The results for the determinants of the supply chain relationship are presented in Table VI. Results for the provision of supplier support programmes are shown in Table VII. Results of the investment model are presented in Table VIII.

Table VI shows that the use of explicit contracts is less likely in an environment with greater competition between buyers (COMPETITION). This result rejects *H2a* which claimed that explicit contracts are more likely to occur in competitive environments because they help to lower the risk of losing

Table VI Determinants of supply chain relationship

EXPLICIT	Coefficient	Standard Error	Significance <sup>a</sup>
<i>Hypothesis 1a</i>			
RESOURCES	-0.001	0.010	
<i>Hypothesis 2a</i>			
COMPETITION	-0.186	0.085	**
SHARE	0.014	0.008	*
<i>Hypothesis 3a</i>			
COLLECT COOPERATE	-0.347	0.282	
	-0.400	0.295	
TYPE	0.533	0.334	
FDI	1.156	0.312	***
Constant	-1.287	0.732	*
Observations: 300			
Pseudo R <sup>2</sup> : 0.06			

Notes: <sup>a</sup>The significance level is indicated as follows: \*\*\* 1%; \*\* 5%; \* 10%

Source: Own calculations based on survey data

Table VII Determinants of farm support programmes

SUPPORT	Coefficient	Standard Error	Significance <sup>a</sup>
<i>Hypothesis 1b</i>			
RESOURCES	0.032	0.012	***
<i>Hypothesis 2b</i>			
COMPETITION	-0.170	0.085	**
SHARE	0.030	0.010	***
<i>Hypothesis 3b</i>			
COLLECT	-1.054	0.332	***
COOPERATE	0.711	0.317	**
TYPE	-2.376	0.373	***
FDI	1.920	0.367	***
Constant	-1.335	0.847	
Observations: 300			
Pseudo R <sup>2</sup> : 0.24			

Notes: <sup>a</sup>The significance level is indicated as follows: \*\*\* 1%; \*\* 5%; \* 10%

Source: Own calculations based on survey data

Table VIII Determinants of on-farm investment

INVEST	Coefficient	Standard Error	Significance <sup>a</sup>
PLOAN	1.126	0.402	***
INPUTS	1.682	0.783	**
PRICE	0.959	0.302	***
PAYMENT	0.363	0.408	
RESOURCES	0.038	0.022	*
COOPERATE	1.059	0.377	***
Constant	-0.696	0.423	
Observations: 300			
Pseudo R <sup>2</sup> : 0.169			

Notes: <sup>a</sup>The significance level is indicated as follows: \*\*\* 1%; \*\* 5%; \* 10%

Source: Own calculations based on survey data

trading partners to competitors. The hypothesis, however, assumes the enforceability of explicit contracts. In emerging and transition countries, public contract enforcement institutions may not be adequately developed or may function inefficiently (Gow and Swinnen, 2001). This can explain our result. SHARE has a positive and significant coefficient and indicates that suppliers that are more dependent on their main buyer of milk are more likely to have an explicit contract. In other words, explicit contracts formalise the dependence and commitment that is present in the buyer-supplier relationship.

In line with our expectations, export-oriented firms and companies with foreign direct investments are more likely to use explicit contracts than locally oriented companies (FDI). This may be because foreign firms are more vulnerable to uncertainties about local business and market conditions, or foreign firms may just adopt explicit contracts as it is the way of doing business in the home market. Another reason may be that foreign firms are more demanding in terms of quality and reliability and explicit contracts are offered to reward compliant suppliers.

Table VII shows that larger suppliers (RESOURCES) have better access to support from the buyer. This result rejects *H1b* which claims that support programmes are provided to more resource-restricted suppliers to allow them to fulfil the buyer's requirements in terms of quality and quantity. One explanation for this result may be that 'large suppliers' in the context of the Armenian dairy sector are still relatively small and hence resource-restricted. Another explanation may be that relatively large suppliers benefit from a stronger bargaining position *vis-à-vis* the buyer and are able to negotiate more favourable contract terms. Furthermore, transaction costs will be lower if support is given to a small number of larger suppliers compared against dealing with a mass of small suppliers.

With respect to *H2b*, COMPETITION has a significantly negative sign which suggests that milk buyers that operate in a more competitive environment are less likely to offer farm support to their suppliers. This result is in line with our hypothesis. The risk of losing suppliers to competitors after support has been provided may be a genuine deterrent for buyers to implement assistance programmes. This finding is also confirmed by Poulton *et al.* (2004) who report a negative effect of a competitive buying market on supplier support in the African cotton sector. Furthermore, we find that suppliers

that have a more exclusive relationship with the buyer (i.e. a higher share of milk being sold to the main buyer, SHARE) have a higher likelihood of receiving support. This confirms the hypothesis that a more dependent relationship decreases the chance of opportunistic behaviour and hence improves the possibilities for support.

H3b is confirmed by the significantly positive impact of CO-OPERATE on the likelihood of receiving supplier support. The positive effect of co-operation points to the value of being part of an extensive network which might help to overcome information problems. Another reason might be improved discipline among group members and the higher collective volume of output makes them more attractive recipients of support. COLLECT, on the other hand, has a significantly negative coefficient. Collecting milk from the farm lowers the likelihood of receiving support. The improvement in monitoring capabilities of the buyer appears to be negligible for explaining better support opportunities.

Finally, the results show that corporate dairy companies (TYPE) are less inclined to offer support to their suppliers. In other words, farmers supplying co-operative buyers are more likely to benefit from farm assistance. As expected, export-oriented firms and buyers with foreign direct investments (FDI) offer more farm support to their suppliers than domestic firms. This finding is in line with the hypothesis that international firms have easier access to the financial resources that are necessary to provide these programmes.

Table VIII presents the estimations of the determinants of supplier investment. We are particularly interested in the effect that different buyer support programmes have on the likelihood of suppliers to invest. First, access to dairy loans, credit and bank loan guarantees plays a significant role in improving the probability of investments by suppliers. This indicates that access to credit through formal channels (rural finance sector) may be restricted and that dairy loans are crucial to overcome this market imperfection and the sector's financial constraints.

Apart from the direct impact of investments through loans and credit, buyers' input supply programmes increase the propensity to invest indirectly by enhancing the profitability of the farm by lowering input costs, or reducing transaction costs in accessing inputs. As discussed previously, the Armenian dairy sector faces serious obstacles with respect to access to quality inputs such as animal feed, veterinary services and insemination material. This lowers productivity and the profitability of dairy farms. Overcoming input constraints through supplier development programmes is therefore crucial to improve profitability and consequently investment opportunities.

Table VIII also provides evidence of the importance of reducing the riskiness of the business environment to stimulate supplier investment. Providing guaranteed prices significantly increases the farmer's likelihood to invest. As was shown in section 3, credit constraints are significant in the Armenian agricultural sector and the dairy sector may suffer even more as a result of the lumpy nature of dairy farming investments. Fluctuating prices add to the uncertainty of farm cash flows and significantly hamper investments. Finally, farm size (RESOURCES) plays only a minor role in explaining on-farm investment, while co-operation between suppliers increases the likelihood to invest significantly.

## 6. Conclusion

This study contributes to the supply chain literature by analysing the determinants of supply chain relationships, the provision of supplier support measures and their impact on supplier investment. A study of supplier development programmes in the Armenian dairy sector is relevant because the sector suffers from a number of challenges. On the one hand, productivity and the quality of primary production is low which puts the sector at a competitive disadvantage and leads to imports of milk powder and a deteriorating self-sufficiency rate. On the other hand, upgrading of the supplier base is hampered by a number of institutional failures –, e.g. affecting the use of collateral and access to external (bank) capital. Supplier support measures as a component of buyer-supplier relationships therefore play a crucial role in the dairy sector restructuring process and in improving the sector's long-term prospects.

The evidence suggests that the provision of supplier support measures is significant but that buyers discriminate in terms of who receives them, with the more costly the measure, the fewer the number of suppliers that benefit. Analysis of the determinants of the provision of supplier support measures indicates that suppliers that have a more exclusive relationship with the buyer and those that deliver to more internationally oriented buyers (be it exporters or FDI firms) are more likely to receive support. In contrast, buyers that operate in a more competitive market are less likely to provide support to their suppliers. These results provide support for the theoretical underpinnings of the study, namely that restricting opportunistic behaviour of suppliers is crucial for enforcing supplier development programmes as part of the contractual agreement.

The findings generate implications of wider importance for practitioners and policymakers. On the one hand, our results seem to point to the gains that can be derived from openness to international firms – which bring in the financial means and experience to provide supplier support programmes. On the other hand, the negative competition effect may indicate that buyers are limited in their ability to enforce repayment of the provided services in an environment where many buyers are competing for the same supply. To improve the functioning of supply chains, policy makers should improve the enforcement capability of buyers under these circumstances. Better legal enforcement would reduce the prevalence of opportunism (Johnson *et al.*, 2002). The latter is likely to induce significant positive spill over effects, given that lower opportunism improves the probability of supplier development. Evidence from other studies also indicates that private initiatives can stimulate sustainable supplier development programmes, in competitive markets, through special institutional arrangements such as frequent monitoring, buyer coordination, or local information networks (Swinnen and Maertens, 2007).

The second set of results extends knowledge on the relationship between the provision of supplier support programmes and supplier investment. The study finds that supplier support programmes play an important role in stimulating investment by suppliers. However, the results point to a rather nuanced view recognising that supplier assistance programmes affect investment decisions in several ways. First, dairy loans, credit and loan guarantee programmes directly improve suppliers' access to financial

resources. Second, buyers' physical input supply programmes increase the propensity to invest indirectly by enhancing the profitability of the supplier by lowering input costs and by reducing transaction costs in accessing inputs. Finally, support programmes reduce uncertainty and the riskiness of the business environment by providing guaranteed prices and prompt payments. All these elements have an important effect on the likelihood of investment by suppliers. This is of critical importance given the structural problems that affect the Armenian dairy sector, which are common to many industries in transitional economies.

The findings point to future research possibilities. For instance, the results regarding the inadequacy of contract enforcement in competitive or uncertain environments merits further investigation. In emerging economies, the legal framework for contract enforcement is only slowly developing. Undertaking in-depth, case study based analysis of the conditions under which contract enforcement is successful in Armenia or extending the analysis to a cross-country survey of this issue can improve our understanding of the private solutions that may exist to overcome public failure in providing contract enforcement institutions. This would be an interesting extension to the current study that has focused on private solutions to input and credit market failure.

## Notes

- 1 There is an extensive literature on relational and implicit contracts that instead of using formal, written agreements rely on reputation, trust and unwritten codes of conduct as a means of coordination. Many observers, from Barnard (1938) and Simon (1947) onwards, have emphasized the importance of such informal agreements.
- 2 Farm assets include investments in animal housing facilities (building, enlarging or modernizing stalls, sheds and herdsman's camps); dairy-specific investments (buying new calves and cows, milk lines, cooling tanks and fodder mixers); and general investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment.
- 3 Dries and Swinnen (2010) show that dairy-specific investments are more likely to be financed through supplier support programmes because the interdependency between buyer and supplier is higher in the situation of transaction-specific investments. We therefore also estimated an investment model with the dependent variable being a dummy that takes the value of one if an investment was made in a dairy-specific asset. However, this did not lead to interesting, new insights and we do not report these results here.

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### Corresponding author

Liesbeth Dries can be contacted at: [liesbeth.dries@wur.nl](mailto:liesbeth.dries@wur.nl)