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How do Farmers interact with Input Suppliers: Some Evidence from the Dairy Sector in Poland¹

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1 Introduction

The extensive and growing literature on food supply chain has been mainly focused on relations between farmers, processing and retail sectors. Various studies have investigated for example the determinants of supply chain relationships (e.g. Dries et al., 2014) and a situation of small-scale producers in the face of rapid supply chain restructuring (e.g. Briones, 2015; Vorley et al., 2007). However, a systematic understanding of how farmers interact with input suppliers is very scarce. In response to this, the paper aims at improving our knowledge about farmers' relations with input suppliers.

The specific example that we examine comes from the Polish dairy sector, which seems to be particularly well suited for investigating relationships within the food value chain. On the one hand, fragmented structure of local farms, and poor income situation of small agricultural holdings are frequently emphasised (Milczarek-Andrzejewska, 2014). On the other hand, Polish dairy and feed sectors have undergone a thorough modernisation (Dries et al., 2011; Piwowar 2013). Rising farmer demand (due to production technology change being necessitated by milk productivity improvement) and increased competition in the feed sector have led to new vertical relations between the farm and feed production segments. Vertical coordination took many forms, including contracting, advisory programs, financial support etc. However, the existing theoretical and empirical literature on vertical spillovers through backward linkages (i.e. from buyers to suppliers) is scarce and focused on manufacturing (Kuijpers, Swinnen, 2016; Jarzębowski, 2013).

A study on the relationship between dairy farmers and feed producers means that we examine also the relations between two agri-food chains. These two – dairy and feed – supply chains are vertically connected. The feed supply chain ends at the farm level where the feed is finally used in the milk production process, and where the dairy supply chain starts. Our study allows then to characterize the “boundary” segments of supply chains.

The contribution of this paper to the literature is twofold. First, this article addresses the question how the dynamic changes in the value chains shaped the relations of dairy farmers with input (feed) suppliers, and what is the character of these relations perceived by farmers. And secondly, we provide detailed and unique analysis of two different marketing channels, which are most common in the case of sourcing feed by farmers (feed purchases directly from feed producer or sourcing it from intermediaries). According to our knowledge there is no evidence on these relations in the literature.

The reminder of the paper is organised as follows: the next section presents our data and the main descriptive statistics. Section 3 reports our findings on farmers relations with input suppliers. In this section farmers'

¹ The reserach was conducted within the COMPETE project (the 7th EC Framework Programme). Authors would like to thank Jan Falkowski for valuable comments.

subjective opinions on their interactions with feed suppliers are confronted with more objective characteristics. Section 4 concludes.

2 Data and empirical approach

The empirical study is based on survey data gathered in Mazowieckie region, which is the largest milk producing region of Poland, located in the central part of the country. The survey was held in June 2014. In total, 300 individual dairy farms were surveyed via face to face interviews using a standardised questionnaire. The survey-data include detailed information about relations with feed suppliers including both objective and subjective approach. For example, questions asked related to the length of the relationship, intentions to maintain the relationship in the future, or potential contractors available in the neighbourhood. Moreover, and importantly from our focus in this paper, the survey included a range of questions aiming at eliciting farmers' subjective opinion on their relations with input suppliers.

The survey was designed to be representative at a regional level with respect to the farm structure according to the herd size. This is important, as our sample includes both – very small farmers (with less than 10 cows), as well as relatively large farms (with more than 50 cows). The detailed distribution of farms in our sample and in the surveyed region is reported in Table 1.²

Table 1. Distribution of sample with regard to farm size in 2013 and in Mazowieckie Region in 2011

	Number of farms	Share of farms	Distribution of farms in Mazowieckie region
5-9 cows	22	7.3%	37.2%
10-19	112	37.4%	40.2%
20-29	75	25.1%	12.3%
30-39	31	10.4%	5.7%
40-49	25	8.4%	
50 and over	34	11.4%	4.6%
Total	299	100%	100%

Source: Authors' calculations based on the survey sample and regional statistics.

It is also important to note that our sample displays sufficient variation with respect to the feed supply channels through which our respondents purchase feed. This allows us to distinguish two main channels: a direct purchase from a feed producing company and a purchase from an intermediary operating in the animal feed sector (e.g. local shops which offer different feeds). Therefore, the analysis presented in the following sections relates to the differences between these channels.

In our sample 45% of respondents purchase feed directly from the feed producing company and 49% - source feed from the feed intermediaries. It is also possible to purchase feed through the dairy processing company, but this option was not common among respondents – only 4% of farmers used this source of feed. The reason for such a low share could be availability of such option at the dairy processor they deliver to.

The Polish feed market is characterised by dynamic increase of feed production and strong consolidation of feed companies. During the period 2005-2015 production of compound (industrial) feeds increased by 68%, sales revenues of feed producers doubled whereas the number of companies decreased by 14% (Piwowar 2013). Our respondents purchased feed from 42 different feed producing companies and from 43 feed intermediaries.³ This allows us to analyse the type of relations according to the marketing channel through which the farmers source the feed. Table 2 reports the main descriptive statistics for the sample. With this description in hand we now move to present the picture that comes out of our data, however it is worth noting at this stage that there are significant differences among farmers who purchase feed directly from feed producer and those who source it from intermediaries. Despite no significant difference in farmland size, the

² As reported, in our sample there is slight overrepresentation of farms with more than 30 cows and underrepresentation of farms with less than 10 cows. This has to be taken into account while interpreting our results.

³ There are ca. 100 companies in the feed industry in Poland (Piwowar, 2013). Therefore, our survey contains information on a sizeable share of feed producers.

first group has significantly larger milk production (both herd size and milk quota), receives significantly higher milk price and discount from the feed supplier.

Table 2. Descriptive statistics of the main variables – means and standard deviations

Variable	Total sample		Farmers purchasing feed directly from feed producers		Farmers purchasing feed from intermediaries	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Age of the farmer in years (n=300)	44.34	10.27	44.1	9.8	44.8	10.7
Education: 1=elementary, 2=vocational, 3=secondary, 4=higher (n=300)	2.56	0.76	2.55	0.73	2.60	0.80
Herd size 2004 (no. of cows) (n=297)***	17.57	13.05	19.92	12.44	14.99	13.37
Herd size 2013 (no. of cows) (n=300)***	26.95	20.62	30.58	21.53	22.78	18.46
Land 2004 (owned and leased in ha) (n=296)**	29.01	22.57	29.68	17.73	27.5	27.5
Land 2013 (owned and leased in ha) (n=299)	39.35	30.71	40.72	27.94	37.4	33.5
Milk quota 2004 (in 1000 kg) (n=296)**	79.01	89.94	84.49	86.28	72.28	97.43
Milk quota 2013 (in kg) (n=299)***	151.82	167.07	172.51	170.42	125.74	149.17
Milk price 2014 (in PLN/litre) (n=296)**	1.43	0.16	1.45	0.15	1.39	0.15
Discount from feed supplier 2014 (as a % of the official price list offered) (n=284)**	3.08	3.63	3.77	3.88	2.44	3.34

*** p<0.01, ** p<0.05, * p<0.1 significance levels calculated for a difference between farmers purchasing feed directly from feed producing company and from intermediaries.

Source: Authors' calculations based on the survey sample.

3 Farmers' relations with the feed suppliers

3.1 Farmers' subjective opinions on their interactions with the input suppliers

We start by presenting farmers' opinions on their relationship with feed suppliers (Table 3). We begin with analysing answers to the question 'How do you assess your relationship with your feed supplier'. This meant to capture the level of **farmers' satisfaction with their current contractors**. Interestingly, a great majority of our respondents perceive relationship with feed supplier as either good or very good. On average farmers assessed their relationship with feed supplier as good (1.7).⁴ 94% of farmers assess their relationship with the input supplier both as very good or good, and never as bad or very bad. There is also no significant difference in these assessments if we split the sample between farmers purchasing feed directly and those buying using intermediaries (the average score is 1.67 and 1.72 respectively).

We also asked farmers what are the **main features of the relation** with the feed supplier. Farmers could choose three main characteristics of the relation (out of nine available). Not surprisingly price and the quality of the feed were the most often chosen as the most important aspect of the relation. Price level was indicated as the first important feature by 38.9% of farmers (and as one of three main characteristics by 64%). The feed quality was chosen as the first important aspect by 29.6% of farmers (as one of three main important features by

⁴ When answering this question farmers could have selected one out of five answers ordered according to a Likert scale: 1 – very good, 2 – good, 3 – neither good nor bad, 4 – bad, 5 – very bad.

65%). Other important aspects were: wide feed assortment (13.8% and 46%), timely deliveries (13.8% and 44%) and price stability (9.3% and 39.6%). It is interesting to observe that there are differences of choices between farmers sourcing feed from different channels. Our results show that farmers purchasing feed directly from the feed producer evaluated feed quality as the most important feature (39%) and feed price as the second important one (34%). Whereas in the case of farmers buying feed from intermediaries, the relation was opposite (51% of farmers chosen feed price on the first place and 24% the feed quality). In the case of other features the differences were not substantial.

Table 3. Farmers' opinions on their relationship with input suppliers

	Total sample	Farmers purchasing feed directly from feed producers	Farmers purchasing feed from intermediaries
How do you assess your relationship with your contracting party?			
Very good	35.7	38.0	33.1
Good	58.3	56.6	61.2
Average	6.0	5.4	5.7
Bad	0.0	0.0	0.0
Very bad	0.0	0.0	0.0
Do you consider changing your contracting party?			
No	60.5	54.3	64.3
From time to time	35.6	41.1	32.1
Yes, for a long time	3.9	4.6	3.6
How many potential suppliers you think you can contract with?***			
1 potential contractor	22.5	14.4	30.5
2 potential contractor	31.8	34.8	32.6
3 potential contractor	19.0	27.3	15.6
4 potential contractor	4.5	8.3	2.3
5 potential contractor	1.0	0.8	1.4
No answer	21.2	14.4	17.7

Source: Authors' calculations based on the survey sample.

Clearly, these are farmers' subjective opinions. Further, one may argue that they may not necessarily reflect all the associations farmers make with the term 'relationship with a contractor'. To get some more insights on this, it seems worthwhile having a closer look at **farmers' intentions to change their contractors** (Table 3). This would allow to see to what extent the abovementioned statistics showing farmers' satisfaction with their relations with feed suppliers are reflected in farmers' plans to continue their current relationships. Consistent with previous answers, only a marginal fraction of our respondents has been intending to change their contractors already for a long time (3.9% intends to change feed supplier). It should be added though that about one-third of farmers in our sample has been thinking about it from time to time. Nevertheless, these responses seem to contrast with the common view of farmers being at disadvantage when dealing with other stages in the food industry. Otherwise we would see the share of farmers wishing to change their contractors to be higher than that observed in our sample. It is also interesting to observe that farmers purchasing feed directly from the feed producers more often consider changing their supplier, despite the fact that they are satisfied with the relation, which they have with contractor. It might potentially indicate the self-perceived power of those farmers versus their contractors.

Clearly, the abovementioned responses (especially those related to the intention to change the contractor) may be simply a result of no options for a change. One may therefore argue that farmers are satisfied and do not want to change as they simply have no other alternative to source feed from. In other words, their responses would have looked differently if they had more freedom to choose their potential contractors. Let us then have a look at farmers' responses with regard to the **number of contractors** they could potentially source inputs from. This should, at least partly, give us a feeling to what extent the argument about no 'outside options' which was just discussed might have played a role in our case. The relevant statistics illustrating these issues are presented in Table 3. As shown, in the case of feed suppliers 21% of farmers do not provide any answer, which allows to suspect that these respondents have no alternative in choosing their contractors.

Overall however, numbers presented in Table 3 again tend to show that our respondents have, on average, some options to switch from one contractor to the other. Thus, their situation may not be as bad as it might have looked like based on common opinions. About 58% of farmers have 2 or more alternative feed suppliers from which they could potentially purchase feed. This is even more (71.2%) in the case of farmers buying feed from feed producers (versus 52% in the case of farmers buying at intermediaries). This result goes in line with considerations of changing the contractor discussed before. The farmers purchasing feed from producers seems to have significantly larger opportunities and more alternatives in choosing the contractor than those who cooperate with intermediaries. To get additional insights on this relation, we also looked at farmers' outside options from yet another perspective. More specifically, we asked the respondents the question whether it would be easy or difficult for them to **find a new contractor** (Table 4 – upper panel). Interestingly, only 2% of farmers perceive finding a substitute for their feed supplier as difficult or very difficult. There is also no significant difference between analysed two groups of farms. Overall then, and importantly from our perspective, the picture that comes out of these statistics inclines to assume that farmers from our sample are not left without any outside options and do have opportunities to change their contractors.

Having the presented above opinions in mind, it is interesting to investigate why farmers do not want to change the contractors, while having such opportunists on the market. Therefore, we asked our respondents what are the **main barriers to change** the feed supplier. For 65% of them the most important barrier to change the feed supplier is that cows are accustomed to the feed offered by supplier. Secondly, 64% of farmers mentioned the risk of cooperation with the new contractor. 36% of farmers indicated the price-quality ratio and 27% - a lack of a better offer. Only 14% of farmers mentioned the written contract as the barrier to change the feed supplier. This can be explained by the fact that 90% of farmers do not have the contract with the feed supplier.

Table 4. Farmers' opinion on their position vis-à-vis feed suppliers (% of responses)

	Total sample (% of responses)	Farmers purchasing feed directly from feed producers	Farmers purchasing feed from intermediaries
Do you think you could find a substitute for your current contracting party?			
Very easy	64.1	67.2	63.1
Rather easy	29.6	29.0	30.5
Neither easy nor difficult	4.9	3.0	5.0
Rather difficult	0.7	0.0	0.7
Very difficult	0.7	0.8	0.7
How easy it would be for your feed supplier to find a substitute for your feed purchases?			
Very easy	17.4	14.5	21.3
Rather easy	27.9	29.8	27.7
Neither easy nor difficult	27.9	26.7	27.7
Rather difficult	25.4	26.7	23.4
Very difficult	1.4	2.3	0.0

Source: Authors' calculations based on the survey sample.

On the other hand it is also interesting to see, how farmers perceive the possibility of their contractor **finding the substitute** for their feed purchases. Therefore, we also collected the answers to the following question: „how easy it would be for your feed supplier to find substitute for your feed purchases?“. In a sense, this question allows to elicit how confident farmers feel about their position in this relation. Importantly, we should be able to capture with it not only the strength which results from farmers' own assets, but also the strength which results from the weakness of other farmers who may potentially purchase feed from the suppliers. The distribution of answers to this question in our sample is depicted in the bottom panel of Table 4. Ca. 45% of our respondents are of the opinion that it should be very easy or easy for their contractors to find a substitute for their purchases. About 27% of our respondents respectively were of the opposite opinion and assess this shift would be either difficult or very difficult for their contractors. Taken together, this shows that, even though

farmers consider themselves to have opportunities to change their contractors, they are also aware of strong market position of feed companies.

3.2 Farmers relations with feed suppliers – a more objective picture

Below we try to complement these subjective opinions and hypothetical situations with some more tangible and more objective data. To this end we have a closer look at the facts and actual behaviour of our respondents in the period of 2004-2013 (sometimes we even investigate longer time period). What should be noted is that this is the period of very dynamic changes in the Polish dairy sector, including the accession to the EU and milk quota introduction (May 2004), important adjustments at the farm level (e.g. addressing the issue of milk quality and/or animal welfare), and rapid consolidation of the processing segment (Dries et al., 2011).

Let us first have a look at some more detailed features characterising farmers-input suppliers relationships. First, farmers have on average a **long and stable cooperation** with feed suppliers (6.5 years). This result does not differ significantly in the case of farmers purchasing feed directly from feed producers and those buying through intermediaries (6.2 versus 6.8 years). They also replace feed suppliers quite rarely - within the last 10 years average number of **changes of feed suppliers** equalled 1.1. Further, over the last 10 years, roughly 45% have not changed their feed supplier. As the main reason of changes farmers declared lower prices and better quality of feed, offered by the new contractor. The changes of feed supplier are not significantly different between the supply channels, but they are correlated with the size of the farm (measured by number of cows).

We asked also if it happened in the recent years that contractors have not met their obligations. In general, according to respondents, their contractors are fulfilling the contracts. Only ca. 5% of farmers experienced some problems in contacts with feed supplier. Taken together, these figures are quite consistent with the view presented earlier suggesting that farmers are on average satisfied with their relationships with contractors.

Surprisingly, the relation of a farmer with feed supplier is usually not strengthened by having a written contract. In fact, over **90% of farmers do not have a contract** with feed suppliers (87,7% in the case of farmers purchasing feed directly from feed producer and 96% in the case of farmers buying from intermediaries). Taken together, this may explain the farmers' perception about the easiness to change the feed supplier. As presented before, ca. 94% of our respondents find it 'easy' to change a feed supplier (Table 4).

Since our respondents assess price levels as (one of) the most important aspects in their relationship with feed suppliers, it seems interesting to look at the **discount which farmers receive** when purchasing feed, and factors which are influencing its level. It is likely to assume that farmers should use their bargaining power precisely to get favourable conditions regarding (prices) discount. The average discount received by farmers in our sample (as presented in Table 3) amounts to 3.08% comparing to prices from the official pricelist. The discount level differs significantly between the marketing channels. Farmers who purchase feed from the producers receive on average 3.88%, whereas those cooperating with intermediaries only 2.44%. However, about 46% of respondents do not receive any discount from their suppliers (37.9% in the case of those sourcing feed from producers and 54.6% in the case of farmers buying feed from intermediaries). In the case of both groups, there is correlation (0.31; $p < 0.01$) of discount with the size of the dairy herd. This observation seems to be supported by opinion of farmers, that the discount mainly depends on the size of feed purchases (60% of farmers declared this) and being a loyal client (36%). It is also worth noting that discount level is correlated with the frequency of price negotiations (0.3, $p < 0.01$). Farmers who negotiate prices more often (once a month to few times a year) receive higher discounts.

Regarding **price negotiations** which seems be an important part of the pricing policy of feed suppliers, 59% of farmers answered that they negotiate the prices for the feed. Significantly more farmers negotiate prices in the case of purchasing feed from producers (71.7%) than from intermediaries (47.3%). The frequency of negotiations is positively correlated with the farm size and the discount level (in both supply channels), which means that larger farms more often negotiate the prices. The general picture that emerges from these statistics inclines to assume that farmers from our sample are not in the disadvantageous position versus feed suppliers, they can negotiate prices and receive discounts, even though they do not have a written contract with suppliers.

4 Summary

The article uses a unique micro-data on dairy sector in Poland to study farmers' relations with input suppliers. It tries to elicit farmers' opinions on their cooperation with feed suppliers and confront them with farmers' actual behaviours. The analysis takes into account differences between the two main channels through which the surveyed farmers purchase feed i.e.: a direct purchase from a feed producing company and a purchase from an intermediary operating in the animal feed sector (e.g. local shops which offer different feeds).

A great majority of the respondents perceive their relationship with feed supplier as either good or very good. Farmers in our sample have, on average a long and stable cooperation with feed suppliers and majority of them do not plan to change their contractors. It is also interesting that the relation between farmer and feed supplier is usually not formal, over 90% of farmers do not have any written contract. As the most important feature of the relation, farmers mentioned price level and the quality of feed.

It is also interesting to observe the significant differences in the farm characteristics, obtained discounts, possibilities of the price negotiations depending on the channel of the feed supply. Despite no significant difference in farmland size, farmers who purchase feed directly from feed producer have a significantly larger milk production (both herd size and milk quota), receive significantly higher milk price and discount from the feed supplier. This group of farmers is more active in price negotiations, more often considers changing their supplier, despite the fact that they are satisfied with the relation, which they have with contractor.

With this results, we contribute to the debate and better understanding of the backward vertical spillovers between the "boundary" chains (feed and dairy), which are not frequently analyzed in the literature. Understanding of these relations is especially important for the research of the dynamic changes within food value chains. Our results, especially differences between the input supply channels, encourage further studies on the relations between the input suppliers and primary food production sector.

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