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ORIGINAL ARTICLE

Do producer organizations improve trading practices and negotiation power for dairy farms? Evidence from selected EU countries

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The data that support the findings of this study are available on request from the corresponding author, [Federica Di Marcantonio]. The data are not publicly available due to restrictions applied to the availability of these data, which were used under specific contract conditions. Data are available with the permission of the Joint Research Centre of the European Commission. Any queries (other than missing material) should be directed to the corresponding author for the article.

Abstract

This article analyzes the impact of producer organizations (POs) on dairy farmers' self-assessed experiences of unfair trading practices (UTPs) and negotiation power. We employ an endogenous switching regression (ESR) model using cross-sectional survey data collected in four EU countries: France, Germany, Spain, and Poland. The results show rather mixed impacts of PO membership. PO membership reduces the likelihood of farmers reporting UTPs. On the other hand, PO membership is found to reduce the self-assessed negotiation power of PO members. The estimated impact of PO membership is found to be largest for smaller farms.

KEYWORDS
dairy farms, endogenous switching regression, EU, negotiation power, producer organizations, unfair trading practices

JEL CLASSIFICATION
Q1, Q12, Q13, Q18

1 | INTRODUCTION

The relationship between upstream and downstream actors is at the heart of the European Union's (EU) Farm to Fork strategy. In particular, the need to strengthen the position of farmers in the food supply chain and the importance of consolidating collective approaches through producer organizations (POs)[1] have received renewed interest (Bouamra-Mechemache & Zago, 2015).

In recent years, the legal framework supporting POs and protecting farmers in the EU against unfair practices has been extended. POs in the fruit and vegetable sector have been recognized under the Common Agricultural Policy since 2011 and those in the milk sector since 2012 (as part of the Milk Package). From 2013, POs in all agricultural sectors are recognized, providing exemptions to certain competition rules such as collective negotiation on behalf of members, the planning of production, and certain

supply management measures (EU, 2013). In 2017, there were around 3400 recognized POs in the EU: 52% were active in the fruit and vegetable sector and 9% in milk and dairy products (European Commission, 2018a). More recently, complaints about power imbalances and unfair trading practices (UTPs) in the agricultural sector resulted in the adoption of Directive (EU) 2019/633 on UTPs (European Commission, 2021a), which specifically focuses on imbalances in bargaining power in agricultural supply chains (EU, 2019; Swinnen et al., 2021).

The EU recognizes the key role of POs within this wider governance agenda for a more efficient and fairer food supply chain. There is a strong belief that by joining forces in the form of POs, farmers can strengthen their position in the food supply chain, contributing to fairer relationships with other actors in the chain and, ultimately, improved economic outcomes (European Commission, 2021b). In this article, we investigate whether PO membership in the European dairy sector leads to fairer trading conditions for farms and strengthens the position of producers in the chain.

The advantages of agricultural POs have been widely recognized in the literature. They allow farmers to take advantage of a wide range of benefits, including economies of scale, stronger negotiation power and negotiation services, reduced risk, better market access, better information, reduced transaction costs, and improved agro-food safety and quality control systems (Markelova et al., 2009; Valentinov, 2007). Other significant benefits of POs for members include improved access to information, new technologies, and additional services (i.e., veterinary assistance, nutritive feeds, or high-yield varieties of cows) (Chagwiza et al., 2016). Moreover, a strong cooperative sector may generate benefits beyond its members, for example, by ensuring competitive prices in an entire region (Hanisch et al., 2013). Despite these advantages, cooperation and collective action also present challenges. Especially in the case of a large and heterogeneous group of members, transaction costs and incentive problems may limit the performance of POs (Hernández-Espallardo et al., 2022).

Several empirical studies have assessed how POs affect the performance of individual farmers. Some estimate the impact of PO membership on farm productivity, efficiency, technology adoption, output prices, commercialization, or income (Bernard et al., 2008; Fischer & Qaim, 2012; Ma & Abdulai, 2016; Sauer et al., 2012; Vandeplas et al., 2013; Verhofstadt & Maertens, 2014; Ma et al., 2018; Michalek et al., 2018; Zhang et al., 2020). Other studies have investigated how POs perform compared to investor-owned firms (e.g., Martínez-Victoria et al., 2018) and the challenges typically associated with cooperation and collective action (Bouamra-Mechemache & Zago, 2015; Hernández-Espallardo et al., 2022).

However, surprisingly few studies have directly assessed whether and how POs contribute to rebalancing market power in the food chain. The horizontal organization of farmers into POs can increase the bargaining power of farmers and can facilitate services such as the preparation and negotiation of contract terms. Using firm-level data from Italy, a recent study by Lee and Van Cayseele (2022) analyzes markups and markup volatility in the dairy and fruit and vegetable sectors for producer and processor cooperatives and noncooperatives. They find higher markups and higher markup volatility only for fruit and vegetable processing cooperatives, suggesting that these cooperatives may engage in successful product differentiation and achieve income smoothing for their members. Another recent study found more stable market access but lower markups for the collective organization in the UK's dairy sector (Vigani & Curzi, 2021), suggesting a possible trade-off between increased stability and increased profits. Saitone et al. (2018) model the trade-offs of farmers in selling to a private timely solvent trader who may exercise market power or to a cooperative that promises a price premium but delays payment and carries a concomitant risk of default. Yet, these studies do not provide direct insights into how collective action can affect negotiation outcomes, including prices, or the trading practices experienced by farmers. Di Marcantonio et al. (2020) recently studied perceptions of UTPs by dairy farmers but did not study the role of cooperative action therein.

To fill this gap in the literature, this article presents the first empirical evidence regarding the impact of POs on the occurrence of UTPs and on the negotiation power of farmers over contractual elements with buyers. POs account for a large share of the EU milk product market (Bijman et al., 2012), and particularly in the Member States included in this study (France, Germany, Poland, and Spain), they maintain a strong market presence. In 2016, POs handled 74% of all milk marketed in Poland, 67% in Germany, 53% in France, and 35% in Spain (European Commission, 2016). Relying on survey data, our study provides evidence of the role of POs in strengthening the position of farmers in the dairy sector by comparing the self-reported occurrence of UTPs by farmers and their self-assessed negotiation power in their relations with upstream buyers. To assess the causal impact of PO membership, we account for self-selection bias using endogenous switching regression (ESR).

Overall, the ESR estimates show rather mixed impacts of PO membership. Although PO membership reduces the likelihood of farmers reporting UTPs compared to nonmembers, it also lowers the self-assessed negotiation

power of PO members over contractual elements. The estimated impact of PO membership is found to be largest for smaller farms. The insights obtained in this study improve our understanding of the role of POs in the governance of fair agricultural supply chains, while pointing out the need for further research to inform and guide the increased interest in policies aiming to strengthen the positions of farmers vis-à-vis other supply chain actors.

The remainder of the article is structured as follows. Section 2 presents an overview of the dairy sector and POs in the four EU countries included in this study, as well as the data used and the corresponding descriptive statistics. Section 3 presents the empirical strategy and the results. Section 4 concludes and provides policy implications.

2 | BACKGROUND AND DATA

2.1 | Region selection and the presence of POs

Our analysis focuses on dairy farmers in the major milk-producing regions of four selected EU Member States: Germany (Bayern), France (Normandy[2]), Poland (Podlaskie), and Spain (Galicia). These countries and regions were selected as they represent major dairy production regions and reflect regional variation. Germany and France are the first- and second-largest dairy-producing countries in the EU. Spain and Poland are also important milk-producing countries in the EU and were selected to enlarge the geographical scope and to capture variation in terms of context and market structure across the EU. Table A1 (in the Appendix) provides additional descriptive statistics on the size of the milk sector (in terms of the number of cows and the amount of milk delivered), the share of POs in the total volume of milk collected, and the average milk price and yield in the EU and in each of these four countries. Within each country, a key dairy production region was selected. In Germany, Bayern was chosen because it is the region with the largest number of dairy farms and the largest number of dairy cows. The region of Normandy was selected because it is one of the key dairy production regions in France and because its distribution of dairy farms is similar to that at the national level. Similarly, Galicia and Podlaskie are among the largest dairy production regions in Spain and Poland, respectively. Table 1 provides the size of the milk sector in volumes and number of dairy cows, the evolution over the past decade (in percentages) and the average milk yield for each of the selected regions. In the period between 2013 and 2017, milk production volumes increased in all four regions,[3] with strong growth in Galicia and Podlaskie. The number of dairy cows declined over the same period in Bayern, Normandy, and, in particular, in Galicia. Stepping back to 2005, Podlaskie shows the greatest increase in the number of dairy cows and in the volume of milk production. These regional patterns tend to mirror national trends (see Table 1; Di Marcantonio et al., 2018).

The diversity in dairy farm structure is linked to differences in natural potential as well as the social, economic, and regulatory context. While specialized dairy farms are concentrated mainly in the north-western Member States of the EU, larger farmers (in terms of herd size) can be found in the East of Germany and in Slovakia and Denmark, while in Romania and Poland, dairy farms have, on average, fewer than 20 cows (European Commission, 2018b). These differences are also captured in our survey. Podlaskie, for example, features a large number of small dairy farms, with almost half of them owning fewer than 20 cows. In Galicia and Bayern, slightly more than 60% of the dairy farms own 20–100 cows, while in Normandy, almost 70% of dairy farms have more than 100 cows (for details, see Di Marcantonio et al., 2018). Although significant in the EU dairy sector, the relevance of POs (most being cooperatives) remains heterogeneous across Member States. More than 41,000 entities are present in the primary sector of the EU supply chain in the form of recognized POs (3505), agricultural cooperatives (21,769), or other forms of nonrecognized POs (more than 20,000) (Table A1 in the Appendix; Amat et al., 2019).

Our survey data suggest that the regions with the highest percentage of PO members are Bayern and Normandy, with 86% of surveyed farmers belonging to a PO, followed by Galicia (59%) and, finally, Podlaskie (25%). Note that not all farmers selling milk to cooperatives are cooperative members, as also pointed out by Wilkin et al. (2006) for Poland specifically. PO members can deliver milk to their PO as well as to other buyers, and non-PO members may also deliver milk to cooperative processors. For example, in Podlaskie 56% of non-PO members mainly deliver milk to POs,[4] and in Galicia, Normandy, and Bayern, a large share of the milk produced by PO members is delivered to noncooperative processing companies.

Wijnands et al. (2017) conducted a survey on the functioning of POs and on dairy farmers' motivations and expectations in joining a PO across several EU countries (Germany, France, Italy, and Spain). The main motivations for farmers to join a PO were reported as obtaining a better price (92% of farmers) and a more stable price (67%), enhancing the position of producers in the value chain (63%) and assuring that all milk is collected (49%). However, only 25% of farmers reported that the objectives of a better price, a more stable price, or a better position in the supply chain had been "largely" or "fully" realized by the PO. The assurance that all milk is collected was

TABLE 1 Dairy sector in the four selected regions

		Raw cow's milk production		Number of dairy cows		Milk yield
		Million tonnes	Share of country total (%)	Million cows	Share of country total (%)	kg/cow
Bayern	2017	8.26	25.33	1.19	28.23	6965.22
	2017/2013 (%)	4.26		−2.69		7.15
	2017/2005 (%)	n.a.		n.a.		n.a.
Galicia	2017	2.75	38.03	.35	42.01	7949.38
	2017/2013 (%)	6.37		−6.24		13.45
	2017/2005 (%)	23.51		−7.04		32.86
Normandy	2017	3.92	15.65	.57	15.99	6821.50
	2017/2013 (%)	5.85		−.03		5.88
	2017/2005 (%)	9.89		n.a.		n.a.
Podlaskie	2016	2.66	20.08	.42	19.57	6380.43
	2016/2013 (%)	9.38		−3.41		13.24
	2016/2005 (%)	58.81		6.05		49.74

Notes: Rows for 2017/2013 (%) and 2017/2005 (%) provide the growth in milk production volume and the growth in the number of cows over the period of 2013–2017 and over the period of 2005–2017, respectively. For Podlaskie, data for 2016 are provided (instead of 2017), as these were the latest available data.
Sources: Raw cow's milk production, number of dairy cows: Eurostat; milk yield: calculated based on Eurostat (2019) (raw cow's milk production divided by the number of dairy cows).

more positively evaluated by respondents, with an average of 68% stating that this objective had been "largely" or "fully" realized.[5] In terms of PO engagement in contract negotiations, POs may act as buyers themselves or may engage in contract negotiations with other buyers. Wijnands et al. (2017) document that the majority of dairy POs (between 60% and 75%) carry out negotiations that are binding for their members and/or conclude contracts on behalf of their members. Among other things, POs negotiate prices, delivery volumes, payment conditions, and information exchange. Around 30% of PO members negotiate and conclude individual contracts without interference from the PO (Wijnands et al., 2017).

2.2 | Survey design

The present study uses cross-sectional data from a dairy farm household survey conducted in the four selected regions from April to August 2017. The survey implemented a stratified multistage sampling procedure with a random selection of final sample units (i.e., dairy farms). The sample was drawn from the population of farmers who managed a dairy farm in 2016/2017 and in the 2 previous years. Sample stratification was based on farm size: in each region, dairy farms were divided into four strata based on the number of dairy cows per farm. The sample size within each stratum was identified based on the total number of cows (the number of cows per stratum as a proportion of the total number of cows in the region) and the number of dairy farmers (the number of dairy farmers in the stratum as a proportion of the total dairy farm population in the region). Within each stratum, dairy farms were randomly selected for face-to-face interviews using lists of farmers obtained by local agricultural offices and administrative data.[6] The nonresponse rate of farmers was around 1%. This ensured a representative dairy sample for the four regions. A total of 1148 farmers were interviewed. Since our analysis focuses specifically on contractual relations and UTPs, we excluded from our analysis farmers who did not engage in any oral or written agreement with a buyer in the year 2016, resulting in a final sample of 1061 dairy farms. The sample breaks down as follows: 194 farmers in Bayern (Germany), 173 in Normandy (France), 329 in Podlaskie (Poland), and 365 in Galicia (Spain).

The questionnaire covered a wide range of information including household and farm-level characteristics (e.g., age, education, farm size, and asset ownership), information on dairy production and marketing (e.g., yield, output price, input costs, types of buyers), as well as details on the characteristics and terms of the contract with their main buyer (e.g., types of elements set out in the contract, number of negotiated elements, UTPs and information on membership to different organizations, including POs, cooperatives,[7] and farmer associations). The survey data focused on the relationship with upstream buyers and did not include detailed information on relationships with input providers. The questionnaire collected information for the year 2016, and for some variables, recall data for 2 years (2014) and 10 years earlier (2006) was also gathered.

2.3 | Variable selection

The detailed definition of the treatment, outcome, and explanatory variables used to estimate the impact of PO membership on self-reported UTPs and self-assessed negotiation power are presented in Table A2 in the Appendix, while Table 2 provides descriptive statistics for the outcomes of interest and for the treatment and explanatory variables.

The treatment variable (PO membership) is a binary indicator taking a value of one if the farmer was a member of a PO in 2016 and zero otherwise. Of the farmers surveyed across the four regions, 56% were members of a dairy PO.

To assess whether PO members benefit from improved contract negotiation and increased bargaining power, resulting in better contract conditions and trading practices, the following two outcome indicators were used: (i) the number of UTPs as reported (perceived) by the farmer (*self-reported UTPs*) and (ii) *self-assessed negotiation power*.

Self-reported UTPs: The questionnaire included a series of questions about the establishment and respect of different contract elements with the main buyer in the course of the year 2016. Based on these, we identified five UTPs that are considered among the 10 prohibited ("blacklisted") practices in the UTP Directive, namely, (i) delay in payment; (ii) short-notice cancellation; (iii) unilateral changes in contract terms by buyer (e.g., price, quality);[8] (iv) payment not related to sale required by buyer; and (v) commercial retaliation by the buyer.[9] The occurrence of unilateral changes in contract terms over the course of contract execution was the most frequently reported practice: 22% of farmers in the sample reported experiencing this UTP. Payment required by the buyer but not related to sale was reported by 16% of the surveyed farmers, while short-notice cancellation was reported by 9.5%, commercial retaliation by the buyer was experienced by 3.7%, and delay in payment from the buyer by .5%. Significant differences between PO members and nonmembers were observed in the case of unilateral contract changes and payments not related to sales: the share of PO members that reported these UTPs was higher compared to nonmembers. Based on the number of reported UTPs, a dummy variable, *self-reported UTPs*, was constructed, which took a value of 1 if the farmer reported having experienced at least one of the five identified UTPs. As reported in Table 2, 40% of farmers report having experienced at least one UTP, and the share is higher for PO members (45%) compared to nonmembers (33%).

Self-assessed negotiation power: The self-assessed ability to negotiate certain aspects of the contract with the main buyer over the previous year (2016) was used as a proxy of a farmer's bargaining position. Of all farmers in the sample with a contract, 31% reported that they had negotiated elements of their contract. This share was 37% for PO members and 23% for nonmembers. The remaining farmers had accepted the contract as take-it-or-leave-it, without the (perceived) option to negotiate (Table 2). Note that we need to be careful when interpreting this outcome. POs may enhance farmers' bargaining positions with respect to buyers and increase their ability to negotiate certain elements of the contract in their favor. On the other hand, POs may also negotiate on behalf of the farmer or act as the buyer themselves, which means that the farmer's individual ability to negotiate—as measured here—may not improve even though his contractual conditions may be better thanks to the PO.[10] This is discussed in more detail below.

These results only compare averages for members and nonmembers, and additional estimations are necessary to account for selection into PO membership before we can draw any conclusions about how PO membership may impact the occurrence of UTPs and negotiation power. Indeed, the theoretical and empirical literature suggests that farmers' experiences of UTPs, their negotiation power, and their decision to join a PO can be affected by various factors such as farmer heterogeneity (e.g., farm size, household characteristics), human and social capital (e.g., education, farming experience, access to social networks), sector and structural characteristics (e.g., regional factors, production characteristics, access to capital), and information and institutional conditions (e.g., Kumar et al., 1995; Fulton, 1999; Kenis and Oerlemans, 2008; Gorton et al., 2017; Hellin et al., 2009; Pascucci et al., 2012; Renda et al., 2014; Fałkowski et al., 2017; Di Marcantonio et al., 2020). Based on this literature, we consider a number of explanatory variables that may affect the decision to become a member of a PO and, in turn, farmers' self-reported UTPs and negotiation power. These variables are grouped into four categories: farmer/household characteristics, production characteristics, contractual relationships, and regional dummies (Table A2 in the Appendix).

The first category, farmer/household characteristics, includes four variables: *age of farmer, gender*, *higher education*, and *experience in dairy farming*. As shown in Table 2, the average farmer is 47 years old, with 22% having achieved higher education. Women managing farms represent one-fifth of the farmers surveyed.

The second set of variables aims to account for differences in production characteristics across farmers. To do this, we include the following production-related variables: *herd size*, *share of fodder area*, *innovation* adopted for dairy farming, *certified organic milk*, *total labor*, use of *milking robot*, *cooling machine*, *distance to the main buyer*, *neighboring dairy farmers*, and *neighboring PO members*. The average herd size of sampled farmers is 54 cows, 39% of their land is fodder area and they operate with

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TABLE 2 Descriptive statistics

	Obs.	Mean (%)	Std. dev.	Min.	Max.	PO member	Nonmember	*p*-value*
Outcome variables								
Self-reported UTPs	1061	40	.49	0	1	45	33	.001
Self-assessed negotiation power	1061	31	0	0	1	37	23	.000
Treatment								
PO membership	1061	56.3	.50	0	1	56.3	43.70	.000
Explanatory variables								
Farmer/household characteristics								
Age of farmer	1051	47	11.03	19	100	48	47	.030
Gender	1061	20	40.15	0	1	17	25	.001
Higher education	1061	22	41.73	0	1	29	13	.000
Experience in dairy farming	1061	53	46.07	0	316	64	40	.000
Farm production characteristics								
Herd size	1061	54	48.23	3	750	62	43	.000
Distance to the main buyer	1044	2.4	.64	1	3	2.4	2.30	.084
1–9.9 km	*97*	*9.3*				*10.1*	*8.2*	
10–50 km	*479*	*45.9*				*42.9*	*49.7*	
More than 50 km	*468*	*44.8*				*47.0*	*42.1*	
Share of fodder area	1056	39	.26	0	1	.36	.43	.000
Certified organic milk	1051	10	.30	0	1	6	13	.000
Innovation	1051	57	.50	0	1	62	49	.000
Total labor	1061	3	1.74	0	31	3	3	.910
Milking robot	1055	3	1.31	0	9	3	2	.000

(Continues)

TABLE 2 (Continued)

	Obs.	Mean (%)	Std. dev.	Min.	Max.	PO member	Nonmember	*p*-value*
Cooling machine	1052	2.9	.94	1	5	3.13	2.67	.000
Less than 500L	*74*	*7*				*3*	*12.39*	
500–1000 L	*207*	*20*				*13*	*28.26*	
1001–5000 L	*565*	*54*				*61*	*44.57*	
5001–8000 L	*133*	*13*				*15*	*9.13*	
More than 8000 L	*73*	7				*7.94*	*5.65*	
Neighboring dairy farmers	1061	2	.80	1	4	2	2	.000
Neighboring PO members	1061	.57	.26	.26	1	.69	.41	.000
Contractual relationships								
Relationship with buyer	1061	73	.44	0	1	*74*	*73*	.595
Type of contract continuity	1044	1.9	.71	1	3	1.94	1.93	.456
All different between 2016, 2014, and 2006	*302*	*29*				*30*	*28*	
All the same during 2016, 2014, and 2006	*507*	*49*				*47*	*51*	
In 2016 the same as either 2014 or 2006	*235*	*23*				*23*	*21*	
Relationship duration	1061	23	21.29	1	217	25	20	.000
Contract with POs in 2014	1044	*29*	.46	0	1	*40*	*16*	.000
Regions								
Galicia	*365*	*34*				*32*	*36*	
Normandy	*173*	*16*				*25*	*5*	
Bayern	*194*	*18*				*28*	*6*	
Podlaskie	*329*	*30*				*14*	*53*	

Notes: Percentages are reported in italics.

*For dummy and categorical variables, the *p*-value is from chi^2 and Fisher tests, respectively.

Source: Authors' elaboration.

three full-time workers, on average. Around 57% of the surveyed farmers have adopted innovation in their dairy farming (e.g., bought a new breed of dairy cow or new dairy machinery, or adopted new feeding techniques or any other specific innovation related to dairy farm activities). On average, surveyed farmers use three milking robots, and 13% have a cooling machine with a capacity of more than 5000 L. Around 10% of farmers produce certified organic milk, and these are mainly located in Poland. Around 9% of the farmers surveyed are located in close proximity to their main buyer (less than 10 km), 46% are located more than 10 km away, and 45% are more than 50 km away. On average, farmers are within 3 km of another dairy farm, and the average share of neighboring dairy farmers (at the NUTS-3 level) that are PO members is 57% (Table 2).

The contractual relationship variables considered in the estimations include the *relationship with buyer*, *type of contract continuity*, *relationship duration*, and *contract with POs in 2014*. The mean duration of a relationship with a main buyer is around 23 years, indicating that many of the surveyed farmers have a long relationship with their main buyer. Farmers were asked whether the contractual arrangements with their buyers in 2016 differed from those they had 2 years earlier (2014) and/or 10 years earlier (2006). The results reveal that the majority of farmers (49%) experienced no change in contract elements across the three different periods. The percentage of farmers reporting that they had different contracts in each of the three years considered (2016, 2014, 2006) is 29%. The majority of surveyed farmers (73%) reported having a quite good or very good relationship with their main buyer, and 29% of surveyed farmers had a contract with POs in 2014 (Table 2).

Finally, regional dummies are included to capture region-specific and fixed effects. This is expected to capture, for example, the regional heterogeneity of the dairy sector and structural and institutional factors influencing the development of the structure of local farms and the dairy processing sector and potentially impacting contracting practices and POs.

Table 2 shows that PO members have more years of experience in dairy farming compared to non-PO members and are more likely to have attained higher education. They also use more milking robots and innovate more in terms of new breeds of dairy cow and feeding techniques. The majority also have a cooling machine with a capacity of more than 1000 L. They have longer relationships with their main buyers compared to nonmembers, and 40% were already PO members in 2014. These differences are statistically significant at the 1% level. In contrast, PO members are less likely to produce organically certified milk and devote a lower proportion of their land to the cultivation of fodder than nonmembers, with differences in both variables being statistically significant. For the other explanatory variables, differences between PO members and nonmembers are statistically insignificant (Table 2).

Although the results in Table 2 highlight significant differences in outcome variables between members and nonmembers of POs, this does not necessarily indicate a causal impact of PO membership on trading practices or farmer negotiation power. The next sections of the article attempt to examine this issue.

3 | EMPIRICAL STRATEGY

Assessing the causal impact of PO membership on the performance of farmers is difficult due to possible endogeneity bias resulting from farmers self-selecting into POs. If selection into treatment can be fully captured by observables, matching techniques such as propensity score matching (PSM) represent a valid empirical strategy to compare the outcome value of a treated unit (in this case, a PO member) with the outcome value of a control unit (in this case, a nonmember). In this case, and under certain assumptions, the effect of PO membership on UTPs and negotiation power can be estimated by identifying the average treatment effect on the treated (ATT).

These assumptions may be too strong in some cases (Abadie & Imbens, 2016). For example, if there is no extensive information on observable characteristics, it might be expected that some unobservable confounders (e.g., motivation or ability) that could potentially affect both the decision to become a PO member as well as the outcome of interest are omitted. Thus, we rely on the ESR method, which accounts for the presence of such unobserved characteristics and allows PO membership effects for both the treated and untreated group of farmers to be estimated.

3.1 | Endogenous switching regression

ESR can account for both endogeneity due to unobserved variables and sample selection, and so produces unbiased estimates (Lokshin & Sajaia, 2004). Modeling the impact of PO membership on the two outcome variables under the ESR framework consists of two stages (e.g., Di Falco et al., 2011; Shiferaw et al., 2014).

In the first stage, the decision to become a PO member can be expressed as

$$M_i^* = \gamma X_i + \upsilon_i \; with \; M_i = \begin{cases} 1 \; if \; M_i^* > 0 \\ 0 \; if \; M_i^* \leq 0 \end{cases}, \qquad (1)$$

where M_i^* is the latent variable for joining a PO. A dairy farmer will decide to become a PO member ($M_i = 1$) if the expected benefits of being a member are positive ($M_i^* >$

0). $\boldsymbol{X}$ is a vector of observed characteristics determining PO membership, which include age, gender, higher education, experience in dairy farming, herd size, distance from the main buyer, certified organic milk, innovation in dairy farming, use of milking robots, type of contract and relationship with the main buyer, a contract with a PO in the past, dairy farmer neighbors, and regional dummies. u_i is the random error associated with selection into dairy PO membership.

In the second stage, the relationship between the outcome of interest (i.e., self-reported UTPs and self-assessed negotiation power) and PO membership, alongside the set of explanatory variables, is estimated by using the OLS model with selectivity correction. Specifically, the outcome function conditional on treatment is stated as an ESR model composed of two regimes identifying membership or nonmembership to a PO as follows:

$$\text{Regime 1}: \; Y_{1i} = \alpha_1 Z_i + \varepsilon_{1i} \; if \;\; M_i = 1, \qquad (2)$$

$$\text{Regime 2}: \; Y_{2i} = \alpha_2 Z_i + \varepsilon_{2i} \; if \;\; M_i = 0, \qquad (3)$$

where Y_{1i} represents the outcome indicator of the PO members and Y_{2i} that of nonmembers, while Z_i represents a vector of the explanatory variables discussed above. ε_i is the error term of the outcome variable.

An efficient method to estimate ESR models is full information maximum likelihood (FIML) estimation (Lee & Trost, 1978; Lokshin & Sajaia, 2004).[11] The sign and significance of the correlation coefficients (ρ) obtained from FIML estimation have economic interpretations: if ρ is significantly different from zero, this indicates the presence of selection bias. If the correlation coefficient ρ_1 corresponding to PO members and the correlation coefficient ρ_2 corresponding to non-PO members present opposite signs, then the decision for each regime is based on comparative advantages: farmers who decide to become PO members have an above-average outcome from being a member, and those who chose not to be members have a below-average outcome from membership. When the correlation coefficients have the same sign, this points to hierarchical sorting: farmers who choose to become PO members have above-average outcomes compared to nonmembers, irrespective of whether they are a member or not. In addition, $\rho_1 > 0$ implies a negative selection bias into PO membership (i.e., farmers with values of the outcome variables below the average are more likely to be PO members) and $\rho_1 < 0$ suggests a positive selection bias (Ma & Abdulai, 2016).

Furthermore, both conditional and unconditional potential outcomes can be determined once the parameters have been estimated. Following Lokshin and Sajaia (2004), the average treatment effect on the treated (ATT) and untreated (ATU) can be computed using the estimates from the ESR and comparing the expected values of the outcomes in the real and counterfactual scenarios, as summarized in Table 3.

Using these conditional expectations, the effect of treatment on the treated (ATT) can be defined as the difference between cells (a) and (c). Similarly, the effect of treatment on the untreated (ATU) is the difference between cells (b) and (d), as provided in these equations (Table 3):

$$ATT = E(Y_{1i} | M_i = 1) - E(Y_{2i} | M_i = 1) \qquad (4)$$

$$ATU = E(Y_{1i} | M_i = 0) - E(Y_{2i} | M_i = 0) \qquad (5)$$

Besides the ATT and ATU, the transitional heterogeneity can also be calculated, which represents the difference in the effect of PO membership on the outcome variable between PO members and nonmembers (ATT – ATU).

Correct identification of the ESR model requires at least one additional variable as an instrument in X_i (Equation 1) that does not appear in Z_i (outcome of Equations 2 and 3). For the instrument to be valid, it should influence the decision of farmers to become PO members or not (relevance assumption) but should not have an effect on the outcomes of interest (exogeneity assumption). As an instrument for the decision to become a member of a PO, we use the share of farmers' neighbors at the NUTS-3 level who are PO members (*neighboring PO members*). Earlier studies (e.g., Ma & Abdulai, 2016; Zhang et al., 2020) have used the same instrument and have shown that PO membership is positively influenced by the membership of neighboring farmers (Ito et al., 2012). Yet, we expect the membership of a neighbor to not affect a farmer's negotiation power or likelihood of reporting UTPs. If a large share of neighboring PO members in a region has market-level effects (Hanisch et al., 2013), this would cast doubt on the validity of our instrument and would lead us to underestimate the benefits of PO membership. Using a simple falsification test (as in Di Falco et al., 2011) confirms that the instrument (i.e., *neighboring PO members*) significantly and positively affects the decision of farmers to be PO members, while it does not have a significant direct impact on the outcome of interest. Following these studies, we, therefore, run a simple probit model for the selection equation, including the instrument, and OLS regression for each of our outcome variables.

4 | RESULTS AND DISCUSSION

Tables 4 and 5 report the FIML estimates of the ESR model for each of the two outcome variables. The second

TABLE 3 Treatment and heterogeneity effects

	Decision stage		
	Member	**Nonmember**	**Treatment effects**
Member	(a) $E(Y_{1i} \mid M_i = 1)$	(c) $E(Y_{2i} \mid M_i = 1)$	ATT
Nonmember	(b) $E(Y_{1i} \mid M_i = 0)$	(d) $E(Y_{2i} \mid M_i = 0)$	ATU
Heterogeneity effects	BH^1	BH^2	TH

Note: (a) and (d) represent observed expected outcome indicators; (c) and (b) represent counterfactual expected outcome indicators. ATT = (a–c): the effect of the treatment (i.e., PO membership) on the treated (i.e., PO members). ATU = (b–d): the effect of the treatment (i.e., PO membership) on the untreated (i.e., PO nonmembers). BH^i: the effect of base heterogeneity for dairy farmers who are PO members ($i = 1$) or PO nonmembers ($i = 2$). TH = (ATT − ATU) (i.e., transitional heterogeneity).

column in each table reports the results for the selection equation that represents the factors influencing the decision of dairy farmers to belong to a PO or not. The outcome equations indicating the impact of PO membership on self-reported UTPs and negotiation power are provided in the third column for PO members and the fourth column for nonmembers. Due to missing observations for some of the control variables (see Table 2), the final sample in the ESR model contains 989 dairy farms. For both models, the correlation coefficients (ρ) between the residuals of the PO membership selection equation (1) and outcome equations (2) and (3) are significantly different from zero according to the results of the likelihood ratio test $\rho_1 = \rho_2 = 0$. Statistically, significant correlation coefficients suggest that the joint estimate based on ESR was more efficient than separate regressions, implying that the two equations regarding the choice of becoming a PO member are not independent and that the two models cannot be estimated separately. Insignificant correlation coefficients imply that the estimation results of the ESR model are not significantly better than the separate estimates.

4.1 | Determinants of dairy PO membership

The results of the PO membership selection equations presented in the first columns of Tables 4 and 5 confirm that a greater proportion of PO members in the surrounding neighborhood is strongly associated with farmer PO membership. In addition, the estimates suggest that PO membership is positively related to herd size, the use of more milking robots, a good and long relationship with the main buyer, the presence of other dairy farmers in the neighborhood, regional dummies, and having had a previous contract with a PO (in 2014). On the other hand, other farmer characteristics, production characteristics, and contractual relationships are not significantly related to the probability of becoming a member of a dairy PO.

4.2 | Effect on outcomes: Self-reported UTPs and negotiation power

Tables 5 and 6 present the results of the endogenous switching probit regression with self-reported UTPs and self-assessed negotiation power as outcome variables, respectively. The likelihood ratio tests of joint independence show that Equations (2) and (3) are not independent in the models, confirming the need to use endogenous switching probit regression for both the UTP and negotiation-power estimations. Furthermore, the correlation coefficients are statistically significant for PO members in the UTP estimations (Table 4) and for both PO members and nonmembers in the negotiation-power estimations (Table 5). The correlation coefficients in the UTP estimation have a positive sign ($\rho_1 = .83$), implying a negative selection bias and indicating that farmers with below-average experiences of UTPs are more likely to be members of POs. For the self-assessed negotiation-power estimation, both correlation coefficients are negative, $\rho_1 = -.97$ and $\rho_2 = -1.11$, suggesting a positive selection bias pertaining to PO membership. This selection bias problem tends to skew the impact of membership in POs on self-assessed negotiation power in a positive direction. That is, farmers with above-average self-assessed negotiation power are more likely to be members of POs. Not accounting for this issue will cause the estimates for the impact of PO membership on self-reported UTPs and higher self-assessed negotiation power to be biased.

The coefficients for the UTP estimations shown in Table 4 (column 3) suggest that PO members reporting a good relationship with their main buyer are less likely to report UTPs. Nevertheless, if they previously had a contract with a PO, the likelihood of reporting UTPs increases, which may indicate that these farmers' contracts are rarely revised and thus subject to a greater number of unilateral changes throughout contract execution. Similarly, nonmembers are more likely to report UTPs if they had different contracts across the considered period. In contrast, female non-PO members report fewer UTPs compared to their male counterparts. The dummy variable

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TABLE 4 Impact of dairy POs on self-reported UTPs

Independent variables	Selection eq.	Member	Nonmember
Age of farmer	.003	−.006	−.012
	(.005)	(.006)	(.007)
Gender	−.086	−.314	−.541**
	(.122)	(.175)	(.170)
Higher education	−.13	−.235	−.098
	(.161)	(.209)	(.215)
Experience in dairy farming	.003	.003	.004
	(.002)	(.002)	(.003)
Herd size	.004*	.003	.002
	(.002)	(.002)	(.002)
Distance to main buyer (reference: between 1 and 9.9 km)			
Between 10 and 50 km	−.142	−.179	−.291
	(.197)	(.211)	(.262)
More than 50 km	.097	−.167	.075
	(.203)	(.224)	(.270)
Certified organic milk	.209	.034	−.522
	(.196)	(.226)	(.294)
Innovation	.079	−.147	.058
	(.109)	(.139)	(.160)
Milking robots	.159***	.030	−.113
	(.046)	(.064)	(.087)
Neighboring dairy farmers	.140*	−.01	.029
	(.067)	(.077)	(.112)
Neighboring PO members	3.899***		
	(.573)		
Relationship with buyer	.242*	−.530**	−.017
	(.119)	(.166)	(.169)
Type of contract continuity (reference: the same across all periods)			
All different between 2016, 2014, and 2006	.044	.337	.621*
	(.158)	(.202)	(.252)
In 2016 the same as either 2014 or 2006	−.279	−.084	.109
	(.147)	(.219)	(.222)
Relationship duration	.007*	−.003	−.008
	(.004)	(.003)	(.006)
Contract with PO in 2014	.977***	.364*	.433
	(.128)	(.173)	(.244)
Regions (reference: Galicia)			
Normandy	.557	.346	.386
	(.306)	(.286)	(.555)
Bayern	−.916**	.659*	.498
	(.310)	(.280)	(.439)
Podlaskie	.48	−.989***	−.48
	(.246)	(.285)	(.275)
Constant	−3.738***	−.228	.687
	(.549)	(.520)	(.554)

(Continues)

TABLE 4 (Continued)

Type of contract continuity (reference: the same across all periods)			
Observations	989	989	989
ρj		.829*	.432
		(.334)	(.338)
Wald test of indep. eqns. (rho1 = rho0 = 0)	$chi^2(2) = 9.05$ $Prob > chi^2 = .0108$		

Note: Significant at the *10%, **5%, and ***1% level.
Source: Authors' elaboration.

for the German region suggests a higher likelihood of perceived UTPs for PO members there compared to the reference Spanish region. The opposite is observed for PO members in Podlaskie.

As shown in Table 5, PO members located farther away from their main buyer and those with a good relationship with the buyer are more likely to perceive having a stronger contract-negotiation position. The more frequently contracts are changed, the higher the self-assessed negotiation power of PO members. A larger herd size and an additional milking robot reduce the perceived negotiation power of PO members. For non-PO members, having had a contract with a PO in the past or having a long-established relationship with their main buyer negatively impacts their perceived negotiation power. A possible explanation for this result is that a long relationship may reflect a difficulty in switching buyers, resulting in lower negotiation power. However, nonmembers are more likely to report higher self-assessed negotiation power if they had the same contract in at least two different periods. Regarding the regional dummy variables, a significant and negative effect is observed only for Normandy: both PO members and nonmembers in this region report lower self-assessed negotiation power compared to their counterparts in Galicia.

4.3 | Estimation of treatment effects

The estimates for the ATT, which show the effect of PO membership on farmer perceptions of UTPs and negotiation power, are presented in Table 6. Compared to the sample means presented in Table 2, the ATTs account for selection bias resulting from both observable and unobservable factors. As described above, cells (a) and (d) in Table 6 represent the expected values of outcome variables predicted by the model for PO members and nonmembers, respectively. Cells (c) and (b) represent counterfactual expected values of outcome variables for PO members and nonmembers, respectively. As illustrated in Table 3, this allows us to calculate the impact of farmer PO membership on outcome variables for both members and nonmembers.

The impact of the ATT on farmers' perceptions of UTPs is negative and significant, showing that PO members have a 17% lower probability of reporting UTPs than in a counterfactual situation of nonmembership. For nonmembers, the result of the average treatment effect on the untreated (ATU) suggests that if a nonmember became a member, the likelihood of reporting UTPs would increase. This may suggest that nonmembers find themselves in a stronger position when operating individually than they would under PO membership, for example, because of their negotiation skills or personal relationship with buyers.

Regarding the second outcome variable, the results in Table 6 show that PO membership reduces the probability of members reporting having engaged in negotiations over their contract (by 42%). The results also suggest that PO members have been less involved in contract negotiations than they would have been as nonmembers. The ATU results suggest that if a nonmember became a member, their self-assessed negotiation power over contractual elements would increase. This could stem from the fact that once one is a PO member, the PO takes over the negotiation of some contractual aspects with buyers. Indeed, the results of Wijnands et al. (2017) based on dairy PO surveys conducted in different EU countries document that the majority of POs carry out negotiations that are binding for their members and/or conclude contracts on behalf of their members.

To gain additional insights into the impact of PO membership, Table 7 shows the estimated ATT results by farm size (number of dairy cows). In terms of UTPs, the results show that small farmers benefit the most from being PO members (i.e., they have a lower likelihood of facing UTPs than if they were nonmembers), whereas large farms seem to lose (i.e., they have a higher likelihood of facing UTPs than if they were nonmembers). The results for UTPs are in line with the findings of Ma and Abdulai (2016), who show that small-scale farmers tend to benefit more from agriculture cooperatives. The results regarding self-assessed negotiation power across farm sizes show that the reducing effect of PO membership on farmers' engagement in the negotiation of contractual elements is greater for small and medium-sized farms than for large farms. This

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TABLE 5 Impact of dairy POs on self-assessed negotiation power

Independent variables	Selection eq.	Member	Nonmember
Age of farmer	.003	−.004	.002
	(.005)	(.006)	(.007)
Gender	−.022	.147	−.294
	(.121)	(.161)	(.163)
Higher education	−.119	−.086	.165
	(.163)	(.181)	(.206)
Experience in dairy farming	.003	.001	−.007
	(.002)	(.001)	(.005)
Herd size	.005**	−.004*	.001
	(.002)	(.002)	(.002)
Distance to main buyer (Reference: between 1 and 9.9 km)			
Between 10 and 50 km	−.106	.503*	.355
	(.190)	(.223)	(.298)
More than 50 km	.143	.636**	.116
	(.195)	(.231)	(.298)
Certified organic milk	.303	−.073	−.096
	(.213)	(.286)	(.250)
Milking robot	.160***	−.211***	−.018
	(.046)	(.063)	(.064)
Neighboring PO members	4.243***		
	(.540)		
Relationship with buyer	.238*	.536***	−.024
	(.117)	(.162)	(.164)
Type of contract continuity (reference: the same across all periods)			
All different between 2016, 2014, and 2006	.049	.651***	−.036
	(.157)	(.197)	(.240)
In 2016 the same as either 2014 or 2006	−.253	.828***	.483**
	(.142)	(.212)	(.176)
Relationship duration	.007*	−.001	−.023***
	(.003)	(.003)	(.006)
Contract with PO in 2014	1.028***	−.086	−.648**
	(.130)	(.176)	(.200)
Regions (reference: Galicia)			
Normandy	.494	−.845**	−1.200***
	(.298)	(.296)	(.337)
Bayern	−1.094***	.426	.262
	(.296)	(.277)	(.493)
Podlaskie	.596*	−.274	0.227
	(.246)	(.320)	(.257)
Constant	−4.058***	−.454	−.94
	(.516)	(.515)	(.496)
Observations	989	989	989
ρj		−.974**	−1.109**
		(.300)	(.352)
Wald test of indep. eqns. (rho1 = rho0 = 0)	$chi^2(2) = 14.41$	Prob > chi^2 = .0007	

Note: Significant at the *10%, **5%, and ***1% level.
Source: Authors' elaboration.

TABLE 6 Treatment and heterogeneity effects, ESR

	Member		Nonmember		Difference			% change
Self-reported UTPs								
Member	(a)	.24	(c)	.29	A TT=	−.04	***	−17
Nonmember	(b)	.33	(d)	.14	A TU=	.19	***	
Heterogeneity effects	**B H_1=**	−.32	**B H_2=**	.16	**T H=**	−.48	***	
Self-assessed negotiation power								
Member	(a)	.19	(c)	.33	A TT=	−.13	***	−42
Nonmember	(b)	.38	(d)	.10	A TU=	.28	***	
Heterogeneity effects	**B H_1=**	−.38	**B H_2=**	.06	**T H=**	−.45	***	

Note: Differences in means were derived from *t*-test statistics. Significant at the *10%, **5%, and ***1% level.
Source: Authors' elaboration.

TABLE 7 Heterogeneous treatment effects by herd size, ESR

		Mean outcome				
Outcome	**Category**	**Members**	**Nonmembers**	**ATT**		**% change**
Self-reported UTPs						
	Small-scale farmers	.12	.45	−.33	***	−73
	Medium-scale farmers	.26	.26	−.01		−0
	Large-scale farmers	.36	.16	.19	***	125
Self-assessed negotiation power						
	Small-scale farmers	.13	.51	−.38	***	−75
	Medium-scale farmers	.20	.30	−.09	***	−33
	Large-scale farmers	.23	.19	.04		21

Note: Significant at the *10%, **5%, and ***1% level.
Source: Authors' elaboration.

could suggest lower negotiation power but could also mean that for small farmers most or all contractual negotiations take place at the level of the PO. Whether or not this generates more beneficial outcomes for small farmers remains ambiguous.

5 | CONCLUSIONS

This article provides empirical evidence of the impact of PO membership on dairy farmers' experiences of UTPs and their self-assessed negotiation power. To our knowledge, this is the first study to investigate whether POs contribute to improving the negotiation position and contract conditions of farmers in the food supply chain. The analysis is based on cross-sectional survey data collected in four EU regions in 2017—Bayern (Germany), Normandy (France), Podlaskie (Poland), and Galicia (Spain)—from a randomly selected sample of 1061 dairy farmers. We apply an ESR model, which allows us to account for the role of both observable and unobservable factors in addressing selection bias, to evaluate the effect of PO membership on outcome variables for both members and nonmembers.

The results suggest that PO membership makes farmers less likely to report UTPs. However, we also find that the effect of membership would have been different for nonmembers: they would have a higher likelihood of reporting UTPs if they were members. Regarding farmers' self-assessed negotiation power—measured in terms of them having negotiated certain elements of their contract—the results show that PO members have less self-assessed negotiation power compared to the situation in which they would have been nonmembers, while for nonmembers, we find that PO membership would have improved their perceived negotiation power. Interesting results come from the disaggregated estimations of the impact of PO membership by farm size. The beneficial effects of PO membership on UTPs are strongest for small farmers, and the reducing effect of PO membership on farmer engagement in the negotiation of contract elements is greater for small- and medium-sized farms than for large farms. These rather complex results could be explained by the fact that POs often carry out contractual negotiations on behalf of their members and also collect the milk from farmers. Thus, small farmers lose individual negotiation power when joining a PO and may be less engaged in the negotiation of contract elements, while at the same time becoming less likely to incur UTPs.

Our findings have important policy implications. The results show that POs may deliver benefits to dairy

farmers in terms of reducing the (perceived) UTPs that they face from buyers, as well as potentially improving the perceived negotiation position of farmers. This seems to provide some support for EU policies aimed at rebalancing the bargaining power of farmers in the supply chain, such as the Farm to Fork strategy and the UTP Directive. Furthermore, the analysis provides some evidence that POs could help alleviate UTP problems, thus reinforcing the intended aims of the UTP Directive.

However, our findings also show that for some farmers, perceived UTPs and negotiation positions may not necessarily improve as a result of PO membership. One caveat of our analysis that may contribute to this result is that our measures of UTPs and negotiation position are based on self-reported assessments of farmers' trading practices and contractual relationships with buyers. These measures do not account for the fact that contract arrangements and bargaining positions can be perceived differently by buyers or third-party observers. Second, we do not account for the type of buyer a farmer sells to or to the various governance structures and typologies of POs (e.g., in terms of the services they offer to their members), or the market structure of the region in which they operate. Although our sample does not allow for region-specific estimations, we acknowledge that the functioning and efficiency of POs are heterogeneous across regions (e.g., Hirsch et al., 2020). This may also affect the degree to which POs engage in contractual negotiations, the UTPs they face and the negotiation positions of their members. Finally, our analysis focuses on contractual relationships and trading practices with buyers only and does not analyze other channels or services through which POs may generate benefits for farmers.

These shortcomings suggest the need for further research. It would be very helpful to use alternative measures of UTPs and the negotiation positions of farmers to further test the issues investigated in this article. Similarly, conducting analyses of the implications of POs for UTPs and bargaining power for other market agents along the food supply chain could also help address the issues related to the measurement of our outcome variables. Extending the analysis to take into account the governance structures and types of POs is another area for future investigation. Additionally, analyses of sectors other than dairy will shed light on whether our findings can be generalized beyond the context studied here.

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DISCLAIMER

The authors are solely responsible for the content of the paper. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

NOTES

[1] In the current paper, POs refer to all forms of horizontal organizations involving producers. Cooperatives are the most common legal form that POs take (see Bijman et al., 2012).

[2] Normandy includes the regions of Lower Normandy and Upper Normandy.

[3] For Bayern, only more recent data (since 2013) are available, but data for the whole of Germany (see Table A1 in the Appendix) suggest that a similar trend was present also during earlier years.

[4] Hence, across all farmers in Podlaskie (both PO members and nonmembers), about 62% deliver primarily to a PO. This number is very much in line with the 70% of farmers delivering to POs reported in Dries and Swinnen (2004) and the 80% (70%) of market share in terms of milk purchases (sales value) of cooperatives in Poland (Wilkin et al., 2006; Fałkowski, 2012).

[5] The objective of all milk being collected seems to be evaluated very positively, especially in France (92%) and Germany (77%).

[6] The main source of regional data on the number of dairy cows and farmers used for the stratification of the sample was Eurostat (2019) (Di Marcantonio et al., 2018).

[7] The survey distinguished dairy cooperatives and other producer organizations. For the purposes of this analysis, both types of organizations are considered to be producer organizations, without distinguishing between them based on their legal form. As pointed out above, the legal establishment of a cooperative falls under the legal framework of POs, meaning that recognized cooperatives are POs but not all POs are cooperatives in their legal form.

[8] This variable was constructed based on a set of questions in the survey. It was coded as 1 if the price was changed unilaterally, the required quality was changed unilaterally, other terms in the contract (e.g., credit, information provision, milk collection, or sanitary/veterinary services) were changed unilaterally or the contract was ended by the purchaser; it was coded 0 otherwise.

[9] This practice refers to the case where the buyer threatens to carry out or actually carries out acts of commercial retaliation against the supplier if the supplier exercises his contractual or legal rights, including filing a complaint or cooperating with enforcement authorities.

[10] Under Article 149 of Regulation No. 1308/2013 headed "Contractual negotiations in the milk and milk products sector," "1. A producer organization in the milk and milk products sector, which is recognized under Article 152(3) may negotiate on behalf of its farmer members, with respect to part or all of their joint production, contracts for the delivery of raw milk by a farmer to a processor of raw milk, or to a collector within the meaning of the third subparagraph of Article 148(1); 2. The negotiations by the producer organization may take place: (a) whether or not there is a transfer of ownership of the raw milk by the farmers to the producer organization; (b) whether or not the price negotiated is the same as regards the joint production of some or all of the farmer members" (EU, 2013).

[11] Adopting the two-step estimation procedure proposed by Maddala (1986) would have implied making additional adjustments to derive consistent standard errors, so the full information maximum likelihood (FIML) estimation procedure is preferred. The FIML estimates of the parameters of the endogenous switching regression model can be obtained using the switch_probit (Lokshin and Sajaia, 2011) command in STATA for continuous and binary data, respectively.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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