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Full Length Research Paper

Institutional incentives and economic aspects of industrial relationships in the Italian agricultural sector

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Policy interventions and private initiatives undertaken in the Italian agricultural sector have registered varying degrees of impact at the local level, due to the diversity of regional characteristics. The research paper aims to conceptualize the agricultural value-chain model and sheds light on the institutional incentives for product and supply organization in one integrated and interrelated process. The economic efficiency and competitiveness of strategic partnerships in the form of producer organizations, associations and cooperatives will be analysed. The first part of the paper investigates the theoretical and methodological framework for measuring the institutional effects on contract arrangements. The second part is devoted to assessing the structure of the value-chains in the agricultural sector in Italy and to operationalizing the concept of the behavioural model of strategic participants. The third part presents results of research, utilizing the applied econometric approach based on the stochastic frontier production models.

Key words: Strategic partnerships in Italy, institutional framework, stochastic frontier production models.

INTRODUCTION

Increased concentration in the agricultural market has spurred controversial debates regarding the potential opportunities and adverse effects on the balance and distribution of market power across the value chain. The observed benefits and disadvantages are interpreted differently depending on whether this is done from an economic or political perspective. Hence, the lower costs of production, sufficient levels of aggregate efficiency and management gains are only part of the total market equation. Along with these outcomes is the prevailing dominance of a group of companies, which in principle is not in contradiction to the legal framework but it stimulates price levels that exceed the social cost of production and disrupts the equilibrium across the agri-food chain. Development of the agricultural sector in Italy is not an exception to these common findings. Still, there are some distinguishing sector characteristics that need to be emphasized. Emergence of “cluster policy” at the sub-national level in Italy is supported by strong regional governance and producer initiative (Hospers and Sjoerd, 2002). This provides for reliable legal framework and economic incentives for enterprises to integrate along the value-chain.

An intriguing question is how small-sized companies succeed in being competitive in terms of quality, production costs and price. The answer is in their ability to behave as part of a group. They bind together on the basis of the product produced or geographical region and create their common competitive advantage through specialization and cooperation. An assertion such this calls for concrete proof of how institutional support and policy interventions translate into economic efficiency and productivity at the organizational level. The general interest in measurement has opened the prospect of micro-level approaches that develop new perspectives on how to define efficiency and productivity and how to calculate benchmark technology. The advantage of functional models that both account for agricultural and non-agricultural factors is mainly grounded on the assumption that there are other resources of efficiency that could be exploited by enterprises, but not modified or changed by them. An institutional explanation dominates over the other usual approaches concerning income differences, investment activity and productivity growth. Considering that informed management decisions require accurate information, a starting point is considering how

to measure institutional effects. In Italy, the impact of the forthcoming institutional changes on producer organizations, cooperatives and associations puts forward a unique organization of the value-chain model. The common feature of these organizations is their origin as bottom-up initiatives of producers and their dependence on the collective contribution and awareness.

INSTITUTIONALIZATION OF AGRICULTURAL RELATIONS: THEORETICAL AND PRACTICAL SOLUTIONS

Considering that "closing the gap between "know what" and "know how" in institutional reform is critical for achieving sustained growth" (Sobel and Coyne, 2010), it is difficult to unilaterally estimate the impact and results from the policy interventions. The main argument in favor of this assumption is that development of the structurally weak regions could not be addressed by generally accepted support mechanisms. For this reason, agricultural policy could not be assumed as a universal approach, but rather as a common framework of the development direction. Furthermore, the economic growth and productivity in the sector is not only assessed by the achieved economic results, but also by the flexibility and manners in the way in which the external environment enters into organizations (Powell and DiMaggio, 1991). It could be inferred that one of the most distinctive characteristics of the enterprises is the change rate of their external environment. They are compelled to implement certain policy regulations, to adopt "best-practices" from their professional sector or to demonstrate leadership to ensue public interest. One trend in these adjustment activities is the isomorphic process among agricultural enterprises. They do not simply follow legal, economic, social, cultural or environmental prescripts. In order to create a stable equilibrium outcome, enterprises reflect the interests of the strongest coalition and relatively sub-coalitions that remain stable over certain periods (Aoki, 2001). This also corroborates the interpretation of the institutions as "persistent" social facts that regulate social behaviour and exert decisive influence over economic intensity.

But it took rather a long time to formulate and appraise the significance of this adaptation process. The neoclassical comprehension for a competitive market considers its own ability to efficiently allocate production resources. The exchange of property rights is performed under assumption for precisely formulated contract agreements – well-defined responsibilities and undertakings or "sharp in by clear agreement, sharp out by clear performance" (Macneil, 1974). Obviously neo-classical theory has a clear concept on market exchange relations, but completely excludes their dynamic nature and the possibility for unexpected and abrupt changes. Moreover, the market seems to efficiently substitute the role of institutions, which in the real economic situation is excessively optimistic to rely on. The philosophy of the new institutional theory takes a step forward by introducing the role of transaction costs and by broadening the concept of property rights with the view of social norms and values. In that way, even the simple institutional interpretation of legislative prescriptions is elaborated (Bromley, 1989). The property itself is disclosed as a social relation, which defines and differentiates the owner of the asset from the other participants in the market. In addition, the more the asset becomes specialized the less the market exchange mechanisms are able to allocate it efficiently. In view of characteristics of the agricultural sector, this could result in disproportionate market power across the food-chain.

One way to counteract this is through collective bargaining and competitive inter-sector relations in the form of vertically-integrated economic and social structures. The flexibility of these structures provides for further market specification, environmental and food safety improvement, as well as responses to service access issues. The integration process also changes the consumption model - consumers demand quality of the products, retailers introduce traceability of these products, processors use specific inputs to meet environmental requirements. The equilibrium between market demand and the capacity of the supply side is a matter of long-term strategy. Several studies apply the "fixed asset" principle (Williamson, 1981) to underline some of the most important benefits and potential of integrated relations in agriculture. The term "fixed asset" represents the asset, whose present marginal value is neither justified by acquisition of more of it nor by its disposition. This concept is used by Hathaway (1963) to differentiate between the individual economic agents and the forms of joint economic performance. An important peculiarity is that the salvage value of the fixed asset, which is the asset's value when it is sold instead of used in production, is substantially higher in the agricultural sector. A situation where market price falls would not necessarily lead to reduction in production quantities. A reasonable solution is to transfer assets to a more profitable type of production or activity along the value-chain. Considering the opposite situation where the marginal output value of the asset exceeds its acquisition costs due to an increase in the market price, then more of the input would be added, since it enhances total productivity. In the case of a fixed asset with low salvage value, when market prices return to their initial level, the level of the production volumes would not be able to be adjusted automatically. This is defined as a "productivity trap" (Hathaway, 1963). The immobility degree of the fixed asset complicates production decisions even more at the farm-level. This assets' characteristic is envisaged as an impediment for efficient functioning of the factor markets. It leads also to higher cost related expenditures, especially considering the cases of individual production choices.

Another consideration is the parallel accomplishment of some of the activities in the agricultural production process. The rational producer is expected to ignore activities that are more time demanding and cost consuming and to focus his efforts on the more profitable ones. An opportunity in this direction is provided by various organizational types in the agricultural sector such as: cooperatives, second-level cooperatives (consortia) or producer organizations. This observation can be viewed as simply an application of the "equal compensation principle" in the meaning that: "if a regulated firm's allocation of effort to two different objectives cannot be monitored by the regulator, then either the power of the incentive for each objective is equal, or the objective with the lower power receives no effort" (Milgrom and Roberts, 1992).

Decision to enter into a contract relations is well-founded, only if the expected income is at least equal to that one from an alternative production decision. This could be defined as "rational restriction". In order to maximize its profit, the enterprise would try to offer a contract that satisfies 'shareholders' or 'members' conditions. Milgrom and Roberts (1992) go on to emphasize that: "the equal compensation principle imposes a serious constraint on the incentive regulation mechanisms that can be effective in practice. In particular, if a regulated firm is expected to devote some effort in the pursuit of an objective for which performance cannot be measured at all, then incentive regulation cannot be effectively used for any of the objectives that the regulator might wish to pursue. The use of straightforward rate-of-return regulation can often be justified on these grounds".

STRUCTURING THE AGRO-INDUSTRIAL RELATIONS IN THE ITALIAN REGIONS

Common agricultural policy (CAP) is a classical example of an intervention policy, considering its legal provisions and mechanisms for product support, production quotas, aid schemes and direct payments. Early retirement schemes, grants for setting up young farmers and diversification initiatives promote intra-sector structural change and enhance the mobility of production resources. Indeed, these measures are often assumed as an impediment for efficient allocation of resources because they are aimed at intervention in the primary production sectors. Even direct transfer payments are not qualified as an efficient instrument for employment promotion as they have short-term effects. The difficulty with the policy application is associated with the characteristics of members within the target group. Agricultural producers are not very receptive to significant changes in the farm development because of their age, risk aversion or insufficient capital resources. The most efficient way to maintain and develop small farms is through diversi-fication and off-farm employment.

Hence, it is necessary to improve and give publicity to the attractiveness of rural areas to the other economic sectors. One of the main concerns is how to enhance producers' positions in the supply process and to guarantee visibility of the products' quality. This issue is addressed and operationalized in the legal forms of cooperatives, producer organizations, and associations. They provide for a wide range of tools for production and crisis management, market flexibility, and simultaneously maintain close relationships among the members and coordinate their individual interests. The Italian agricultural sector is particularly dynamic in development and organization of cooperatives and associations, as well as in the concentration of production and market supply. Policy mechanisms and interventions are complicated and vary because of the heterogeneity of the Italian regions. In the first place they fall into different European funding categories. At the same time, not all regions possess the same special forms and conditions of autonomy pursuant to the special statutes adopted by Italian constitutional law[1]. Strong regional identity is preserved in fruit, wine and cheese production. Local production systems emerge in these sectors, which are based on small-scale production – the total number of the registered producer organizations all over the country is 235[2]. This is observed as an opportunity to maintain small-scale and semi-subsistence farming; and to integrate through a large set of cooperative arrangements. From one point of view, this fact could be interpreted as rather beneficial, because concentration of production and distribution processes ensures its continuity and imposes high quality standards for the final product. Nevertheless, this "modernization" process of the agricultural sector causes its restructuring in a manner less favourable for market participants in certain regions. The imbalanced relationship between small producers and their customers – processors or retailers, as well as the high level of fragmentation and low level of cooperation additionally complicates the retail system in most sectors of agricultural production.

One of the main characteristic of the Italian fruit and vegetable sector is the presence of strong concentration of production and initially well-structured and organized cooperatives and associations[3]. Producer organizations play an important role for stability of the market and

[1] Constitution of the Italian Republic, Art.116, "Friuili-Venezia Giulia, Sardinia, Sicily, Trentino-Alto Adige/ Südtirol and Valle d'Aosta/ Vallee d'Aoste have special forms and conditions of autonomy pursuant to the special statutes adopted by constitutional law.

[2] Decreto N.85/TRAV Attuazione del decreto legislativo 27 maggio 2005, n. 102, sulla regolazione dei mercati, a norma dell'art. 1, comma 2, lettera c), della legge 7 marzo 2003, n. 38, recante i requisiti minimi per il riconoscimento delle organizzazioni di produttori, le modalità per il controllo e per la vigilanza delle organizzazioni dei produttori, al fine di accertare il rispetto dei requisiti per il riconoscimento nonché le modalità per la revoca del riconoscimento.(integrato con le modifiche alla Tabella 1 introdotte dal D.M. prot. n. 121/traV del 10 marzo 2008)

[3] Terms and conditions of the scheme of aid for producer organizations in the fruit and vegetables sector (2009)

efficient relationships across the agri-food chain. Membership in these organizations is perceived as an important competitive factor and long-term strategy in improving supply chain relations through adjustment to the market criteria (logistics, quality management, financial capacity, price and cost competitiveness). Five years after the first introduction of the Council Regulation 2200/1996, 130 producer organizations were registered all over the country. These organizations concentrate approximately 20% of marketed production with significant difference in the various regions. The organizational rate in the fruit and vegetable sector is 100% in Trentino Alto Adige, 65% in Emilia Romagna, while in Sicily the organizational rate is about 7% and in Puglia 5%. The turnover of the dairy sector represents 15% of the total turnover of the food industry. The sector is represented by a group of big enterprises, and by a great number of small firms. Production of fresh milk and innovated products is very concentrated within a number of mergers and significantly vertically integrated strategic groups. The most important division of the operating structures in the sector is as follows:

1) Strategic groups – enterprises, mainly cooperatives (Abit, Lattira Soresina) that operate predominantly on the national market;
2) In Parmigiano Reggiano area there are two classification types - degree of vertical integration and type of market strategy (trade or product oriented) of organizations;
3) Assolatte (Associazione Italiana Lattiero Casearia) – represents the industries of milk transformation (fresh milk, cheese, yogurt, butter).

Weaknesses of the dairy sector refer to: retail system, which is not visible enough in terms of participating high quality producers; imbalanced relationships between small producers and their customers – processors and retailers; high level of fragmentation and low level of cooperation among producers, especially in Southern Italy; lack of cooperation centers (mountain areas), where the link between producers and other operators is more difficult and complicated. Concentration of the wine production has created an important framework and conditions for innovation and knowledge sharing, institutional support and small-scale producers' support. The most important organizations in the "wine industry value-chain" are "Consortia Volontari di Tutela delle Denominazioni di Origine and FEDERDOC (Confederazione dei Consorzi Volontari per la tutela delle denominazioni d'origine)". Financial crisis had overall negative effects on economy, creating unemployment, cash-flow problems, and lowered consumption. For the wine sector, these consequences meant limited demand and over-supply. Current policy in the sector is focused on limitation of overproduction, requesting that wine producing countries rip out a certain amount of vineyard acreage, lowering and then gradually eliminating public subsidies for destruction of stocks, and allocating funds for promoting the consumption of wine in non-European countries. In light of these considerations, the following key-aspects were proposed by leading Italian wine organizations: promotion of wine consumption, especially in the area with concentrated tourist activity; short-term and medium-to-long-term programmes to enhance export; re-distribution of subsidies for promotion of Italian wine from domestic to foreign markets; investments aimed at professional training.

A large part of agricultural production is produced and realized through a relatively stable number of cooperatives (Table 1). Cooperatives operate in every sector of the economy – agriculture, banking, industry and services. The gross value added (GVA) of the agricultural cooperatives for 2007 represents 5% of the total GVA of the economy. As a comparison, the GVA in the industrial sector is 3.0%; in the services sector – 6.8%. The organizational process in the agricultural sector is further developed in the form of producer organizations, second degree cooperatives – consortia and associations. Development in the sector could also be described by "localization through intensified interaction and cooperation" (Brunori et al., 2002). Nevertheless, observations so far envisage that the large-scale industry is more favoured, since it receives a considerable percentage of the European funds. At the same time, administration costs are pushed up because of the minute payments to small – scale farmers. The solution is imposed by the fixed limits of the payments that farmers could receive under the single payment scheme. The policy implementation relies on more market conformity and less direct payments. But what is the consequent effect on employment, income and consumers in the sector? The marginal cost of producing goods, which use land could exceed the social cost of production. Consequently, the market prices would influence the service sector, regardless to the products' true value. Besides this, a decrease in the total employment in the agricultural sector probably cannot be avoided, as it follows the extent to which production responds to price fluctuation.

MEASURING INSTITUTIONAL INFLUENCE OVER ECONOMIC EFFICIENCY OF AGRICULTURAL ENTERPRISES

If the government policy and the factors of institutional environment possess significant and even decisive role over income accumulation and comparison (Rodriket al., 2002), how can these particular effects be measured? As it is stated: "when it comes to reforms, economists know what institutions and policies are necessary to ignite economic growth but they know much less about how to go about getting those institutions and policies" (Sobel

Table 1. Number of registered agricultural cooperatives.

Region	2006		2007		2008	
	Number	%	Number	%	Number	%
Piedmont	288	5.57	286	5.47	296	5.63
Valle d'Aosta/Vallée d'Aoste	45	0.87	44	0.84	43	0.82
Liguria	61	1.18	64	1.22	65	1.24
Lombardy	320	6.19	320	6.12	310	5.89
Trentino Alto Adige	227	4.39	220	4.21	210	3.99
Veneto	401	7.76	398	7.61	401	7.63
Friuli-Venezia Giulia	158	3.06	161	3.08	159	3.02
Emilia-Romagna	671	12.98	653	12.48	638	12.13
Tuscany	171	3.31	174	3.33	170	3.23
Umbria	111	2.15	112	2.14	113	2.15
Marches	125	2.42	128	2.45	124	2.36
Lazio	324	6.27	329	6.29	334	6.35
Abruzzo	143	2.77	145	2.77	146	2.78
Molise	52	1	48	0.92	49	0.93
Campania	420	8.12	439	8.39	447	8.5
Puglia	561	10.85	575	10.99	589	11.2
Basilicata	96	1.86	100	1.91	103	1.96
Calabria	324	6.27	337	6.44	341	6.48
Sicily	518	10	543	10.38	565	10.74
Sardinia	154	2.98	155	2.96	156	2.97
Total	5170	100	5231	100	5259	100

Source: Italian National Institute of Statistics, Istat.it.

and Coyne, 2008). Rodrik (2000) identifies 5 types of institutions that permit adequacy of the market: institutions for property rights, regulatory institutions, institutions of macroeconomic stability, institutions for social insurance, institutions for conflict management. The studied relation between aggregate efficiency and economic freedom shows that lack of economic freedom results in lower aggregate efficiency (Adkins et al., 2002). The agricultural sector, its participants and their typical features provide a fruitful research field for studying the relationships among efficient performance, market competition and policy-making. An interesting perspective is given by several studies that attempt to quantify institutional influence over economic efficiency. Stochastic frontier analysis (SFA) is applied in order to measure how divergence in quality of institutions, including: control of corruption, strength of the law, quality of the regulatory framework; explains cross-country differences in aggregate efficiency (Meon and Weill, 2004). The relationship between the foreign direct investment and the rate of growth of gross domestic product is also developed through the quantitative and comprehensive results obtained from the same analysis (Wijeweera et al., 2010). According to them, the flows of foreign direct investment exerts a positive impact over the economic growth only in the presence of a highly skilled labor force; accordingly open trade policy gains efficiency, but at the same time corruption practices have a negative impact. The aforementioned analysis' application and suggested results are only part of the existing research experience (Appendix A). Although it is not possible to describe them all, it is important to consider the opportunities that frontier methodology provides in studying the various factors that influence efficiency.

The main objective in applying stochastic frontier analysis in the present case study is to measure the efficiency levels of cooperatives, partnerships and producer organizations in the agricultural sector in the context of the influence of institutional factors on their productive choices. The formulation of the production function requires the definition of two types of variables: 1) the output of agricultural enterprises and 2) the inputs, utilized in the production process[4]. The parameters of the constructed translog production function in the present case study are represented in Table 2. Instead of the physical quantities of output, the gross margin and the gross value added are used as measurement tools. This decision is based on the fact that the higher physical output of the more intensive enterprises is not comparable to the lower output of smaller enterprises.

[4]Information about the quantitative characteristics of the output and production inputs is derived from Eurostat, Istat and the Farm accountancy data network of the European Commission for the period from 2003 to 2007.

Table 2. Parameters in translog production function.

Output (Y)		Input (X)	
Standard gross margin	The total production in mil euro minus variable costs	B_1 - Utilized agricultural area (UAA)	In hectares per each region (cereals, vegetables in open field, industrial crop, vegetables in greenhouses)
		B_2 - Permanent crops (PC)	In hectares, in relation to the received subsidies and the impact they exert upon efficiency and productivity (fresh fruits, vineyards and wine, olive plantations)
Gross added value	Output at market prices minus intermediate consumption at purchaser prices	B_3 - Intermediate consumption (IC)	Measured by cumulative costs of raw material consumption and service procurement
		B_4 - Annual working unit (AWU)	Corresponds to the work performed by one person who is occupied on agricultural enterprises for each region on a full-time basis
		B_5 - Employed annual working unit (EAWU)	Employed on a regular basis, including group holders

Table 3. Parameters in the inefficiency model.

Group 1: General information about agricultural enterprises	C_1 - Training level	Refers to the ratio of trained managers and employees to all employees in agricultural enterprises.
	C_2 - Specialized mixed farming	Corresponds to the output orientation of the agricultural enterprises specialized in a particular activity (crop production) that provides a standard gross margin of at least 2/3 of the total standard gross margin of the enterprises.
Group 2: Characteristics of the institutional framework	C_3 - Protection of property rights	Rank provided by the component "Protection of property rights" in Area 2 "Legal structure and security of property rights" measured by Economic Freedom of the World index.
	C_4 - Legal enforcement of contracts	Rank provided by the component "Legal enforcement of contracts" in Area 2 "Legal structure and security of property rights" measured by Economic Freedom of the World index.
	C_5 - Starting a business	Rank provided by the component "Starting a business" in Area 5 "Regulation of credit, labour and business" measured by Economic Freedom of the World index.
	C_6 – Cooperatives	Number of the registered agricultural cooperatives

Additionally, the gross margin variable includes subsidies as payment received for the fixed production factors. Therefore, the area under permanent crops is also included as an input variable[5]. Three types of permanent crops are eligible to receive subsidy payments partially or completely based on area: olive trees, vineyards and more recently nuts. Decision-making units are also compared on the basis of the relationship between annual working unit and employed annual working unit. In the analysis, annual working unit corresponds to the total labour input, including family labour. Variables in the inefficiency model are grouped in two categories that attempt to explain the level of inefficiency in respect to the observed institutional influence. The first one is regarding the general information about agricultural enterprises; the second category refers to characteristics of the opportunities and restrictions of the institutional framework (Table 3).

The training level variable denotes the ratio of the professional and trained managers and employees to the

[5]Since 1992, the role of remote sensing and geomatics in the management and control of the Common Agricultural Policy has become significantly important in terms of implementation of the Land Parcel Identification System (LPIS) for identification of all parcels, for which area-based subsidies are claimed.

total number of employees[6]. The specialized mixed farming variable indicates output orientation and product diversification in the enterprises. The variables in the second group attempt to describe institutional characteristics closely related to the economic performance of the agricultural enterprises. Information about property rights protection, enforcement of contract arrangements and incentives for starting a new business is derived from the Economic Freedom of the World (EFW index)[7]. The index measures the consistency of institutions and policies within the concept of ownership and business activity. The main incentive to include these particular variables stems from the supposition that enterprises regardless of their legal forms, face the same market pressures, compete through adoption of similar strategies, and aim at higher levels of efficient business performance. Considering the impact of cooperatives' economic activity on overall regional development, an additional variable for 2007 was included: the number of agricultural cooperatives[8]. Cooperatives have the incentive to be an equivalent competitor in the market along with other investment oriented companies, as long as this position would secure their financial stability and maintain the loyalty of their members. The null hypotheses states that there is no technical inefficiency in the structured models:

$$H_0: h_i(\theta) = 0 \text{ against } H_1: h_i(\theta) \neq 0 \quad (1)$$

The vector of estimated parameters is represented by θ. In order to determine the lower and upper bounds, the Kodde and Palm's Wald test for jointly testing non-linear equality and inequality constraints either under H_0 or H_1 is used (Kodde and Palm, 1986). The null hypothesis H_0 is rejected when the estimated value of LR-tests exceeds the upper bound value, and H_0 is accepted when the LR-tests value is smaller than the lower bound value. The parameter $\gamma = \sigma_u^2 / \sigma_v^2 + \sigma_u^2$ is the variance ratio, which explains the total variation in the output from the frontier level attributed to technical efficiency. When γ=0, then there is no technical inefficiency observed in the data set and all decision-making units belong to the optimal production frontier. According to the first hypothesis, there are no inefficiency components in the constructed Cobb-Douglas function:

$$\text{Ln}(Y) = \beta_0 + \beta_1 \text{Ln}(B_1) + \beta_2 \text{Ln}(B_2) + \beta_3 \text{Ln}(B_3) + \beta_4 \text{Ln}(B_4) + \beta_5 \text{Ln}(B_5) \quad (2)$$

The "second hypothesis" also states that the value of β_i parameters is zero and the formulated translog function is:

$$\text{Ln}(Y) = \beta_0 + \beta_1 \text{Ln}(B_1) + \beta_2 \text{Ln}(B_2) + \beta_3 \text{Ln}(B_3) + \beta_4 \text{Ln}(B_4) + \beta_5 \text{Ln}(B_5) + \beta_6 \text{Ln}(B_6) + \tfrac{1}{2}[\beta_7 \text{Ln}(B_7)^2 + \beta_8 \text{Ln}(B_8)^2 + \beta_9 \text{Ln}(B_9)^2 + \beta_{10} \text{Ln}(B_{10})^2 + \beta_{11} \text{Ln}(B_{11})^2] + \beta_{12} \text{Ln}(B_{12}) + \beta_{13} \text{Ln}(B_{13}) + \beta_{14} \text{Ln}(B_{14}) + \beta_{15} \text{Ln}(B_{15}) + \beta_{16} \text{Ln}(B_{16}) + \beta_{17} \text{Ln}(B_{17}) + \beta_{18} \text{Ln}(B_{18}) + \beta_{19} \text{Ln}(B_{19}) + \beta_{20} \text{Ln}(B_{20}) + \beta_{21} \text{Ln}(B_{21}) \quad (3)$$

The "third hypothesis" states that values of δ_i parameters in the inefficiency model are zero:

$$U_{it} = \delta_0 + \delta_1 \text{Ln}(C_1) + \delta_2 \text{Ln}(C_2) + \delta_3 \text{Ln}(C_3) + \delta_4 \text{Ln}(C_4) + \delta_5 \text{Ln}(C_5) + \delta_6 \text{Ln}(C_6) \quad (4)$$

The results provided in Table 4 signify the likelihood ratio test of the three null hypotheses against the general model, which assumes that there are no inefficiency components in the structured production functions. The first null hypothesis states that the Cobb-Douglas production function is preferable to the translog production function. According to the results of the LR-test, the null hypothesis is strongly rejected at the 5% level. The second null hypothesis states that each decision-making unit in the analysis operates on the technical efficiency frontier. The LR-test results also reject this assumption and suggest that there are technical inefficiency components in the structured production function. Following this, the focus is towards the joint effect of the selected variables and the possibility for optimization in terms of cost reduction. According to the third null hypothesis, the inefficiency effect is not a function of the two groups of explanatory variables. The results also reject this hypothesis, which confirms the supposition that these variables have a considerable effect on the technical efficiency of the decision-making units.

The results obtained for the variance parameter γ indicate the proportion of the one-sided error component in the total variance of the composed error term (Appendix B). The average variation of the estimated output from the optimal frontier level, which is attributed to technical inefficiency is 0.6509. According to the estimated variances, output variability is mainly due to technical inefficiency rather than to statistical noise. For the period 2003 to 2007, 13 coefficients out of 21 total coefficients in the translog function are statistically significant at the 5% level. This leads to the conclusion for interaction and non-linearity among the included variables. The parameter β_1 that corresponds to the utilized agricultural area (UAA) appears to be significant at the 5% level for the last 2 years. This confirms that the larger size of the enterprises entails better labour and capital endowments; they obtain higher efficiency levels and achieve better economic performance. The following is supported by the positive effect of the interaction

[6]The training levels of farm holders are indicated by: IRENA 06, the level of agricultural training of managers of agricultural holdings; IRENA 06a, the training in agri environmental issues; IRENA 01, the area under agri-environment support; IRENA 02, regional levels of good farming practice; IRENA 13, cropping/livestock patterns; IRENA 14, farm management practices; IRENA 15, intensification/ Eextensification; IRENA 16, diversification/specialization

[7]Economic Freedom of the World: 2010 Annual Report, p.1

[8] The information about the number of cooperative is taken from the cooperative register of the Economic Development Ministry

Table 4. LR-test results.

Test	Null hypothesis	Loglikelihood function	Value λ*	Critical value**	Decision
		2003			
1	$H_0 : \beta_i = 0$	-16,0378	70,0171	25,689	Reject H_0
2	$H_0 : \beta_{ij} = 0$	-6,1317	3,1885	2,706	Reject H_0
3	$H_0 : \gamma = \delta_i = 0$	28,1062	20,0499	17,670	Reject H_0
		2005			
1	$H_0 : \beta_i = 0$	-11,9286	92,059	25,689	Reject H_0
2	$H_0 : \beta_{ij} = 0$	18,8789	8,1042	2,706	Reject H_0
3	$H_0 : \gamma = \delta_i = 0$	23,6858	17,7180	17,670	Reject H_0
		2007			
1	$H_0 : \beta_i = 0$	-6,7947	75,821	25,689	Reject H_0
2	$H_0 : \beta_{ij} = 0$	25,0111	19,2112	2,706	Reject H_0
3	$H_0 : \gamma = \delta_i = 0$	17,0140	32,169	17,670	Reject H_0

*λ – is the value of the likelihood ratio test of the null hypothesis associated with each of the three models against the alternative general model. This test has 16 degree of freedom. **0.005 significance level. Source: Own calculations.

between utilized land and the variables: permanent crops (β_{12}), intermediate consumption (β_{13}), annual working unit (β_{14}) and employed annual working unit (β_{15}). The coefficients obtained for the period suggests theexistence of scale economies. Since in the analysis the agricultural enterprises vary in terms of land size, it is reasonable to consider what is the relationship between utilized area and permanent crops? From the results, it could be assumed that a specialization in permanent crops is preferable in small-sized enterprises, especially if there are insufficient investment funds and capital. The variable annual working unit (AWU) refers to the total labour input in the enterprise.

Furthermore, the variable employed annual working unit (EAWU) is included in the analysis, which represents employees on a regular basis. The first reason for that choice is that it is difficult to obtain information about the family labour component or the “implicit costs”. These costs include non-distributed income from own labour in the farm, entrepreneurs income, income from own land and from own capital included in production. The second reason is that even evaluated, implicit costs do not account for market demand conditions. Finally, when family labour is to be considered, it is better to be described as a distinct input variable and not to be included in the hired labour variable. The results from translog function calculation show that utilization of the two variables (AWU, EAWU) in production process has reached satisfactory levels for 2005 and 2007. The most efficient enterprises use labour more rationally due to the more intensive use of other production resources, such as machinery or any technology equipment. Based on the differences in the obtained parameters’ coefficients, it is appropriate to focus on the extent to which institutional framework may influence some enterprises and their respective regions to achieve relatively high efficiency scores compared to other apparently less efficient enterprises and regions. The inefficiency function provides some explanations of this effect (Figure 1). The results vary over the period analyzed. In 2003, the variables training level (δ_1), specialized mixed farming (δ_2) and starting new business (δ_5) possess negative signs. The training level coefficient is statistically significant with a value different from 0, and a negative sign. This suggests that the higher education and training of managers and employees has a positive effect over the technical efficiency of agricultural enterprises. Another possible conclusion is related to the age of farmers, which is not considered as a variable in this analysis. The age of producers has increased over the years; they have many years of experience in the agricultural sector with satisfactory production results. By choosing to be a member of a cooperative or producer organization, they become involved in new production technologies and methods, and this decision keeps them in step with other, more innovative enterprises.

There is also a significant relationship between production specialization and the obtained efficiency levels. Specialized strategies contribute to better allocation of production resources and their appropriate utilization in the production process. The results are also consistent with the estimated significant relationship between the agricultural area and the cumulative costs of raw material consumption and service procurement. Although specialization differs over the regions studied, it infers that most enterprises have managed to exploit the benefits of their particular locations.

The coefficients in the inefficiency model acknowledge

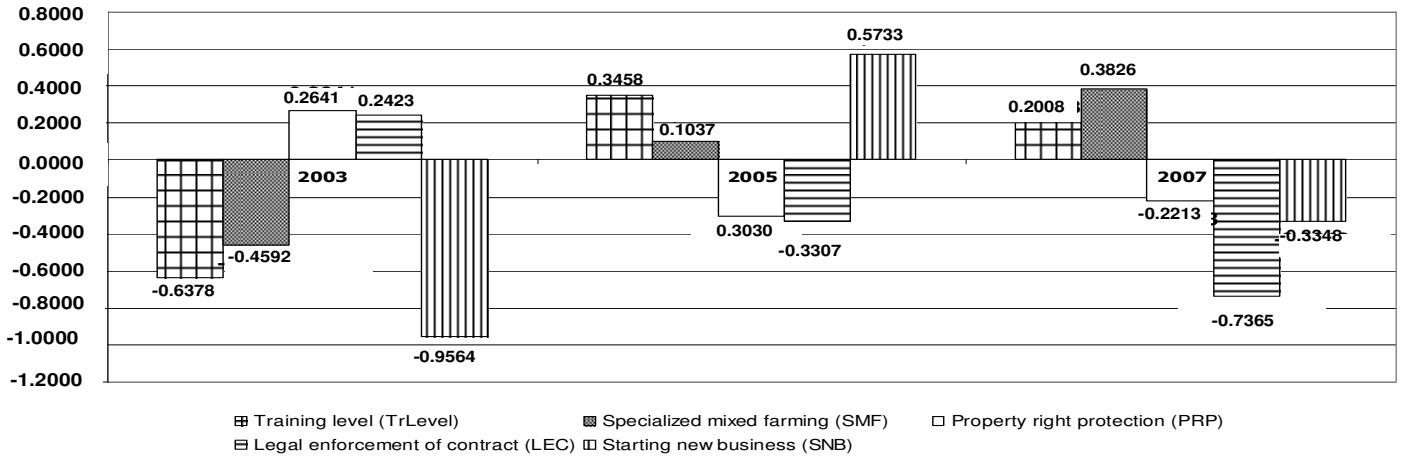

Figure 1. Efficiency determinants patterns (source: Own calculations).

Table 5. Estimates of elasticity of complementarity and substitution between pairs of inputs*.

Year	b_{12}	b_{13}	b_{14}	b_{15}	b_{23}	b_{24}	b_{25}	b_{34}	b_{35}	b_{45}	SCE
	p-complements > 0; p-substitutes < 0										
2003	0.204	-0.743	0.000	0.238	0.569	0.673	0.279	0.668	-0.537	0.403	0.429
2005	-0.476	-0.241	0.209	0.000	0.563	-0.469	0.667	-0.220	-0.726	0.216	2.444
2007	-0.927	-0.280	0.390	0.000	0.232	-0.120	0.523	-0.973	-0.221	0.378	2.002
Sample mean	-0.400	-0.421	0.299	0.079	0.455	0.028	0.489	-0.175	-0.495	0.332	1.625

b_{12} is elasticity of substitution between AUU and PC, b_{13} is elasticity of substitution between UAA and IC, b_{14} is elasticity of substitution between UAA and AWU, b_{15} is elasticity of substitution between UAA and EAWU, b_{23} is elasticity of substitution between PC and IC, b_{24} is elasticity of substitution between PC and AWU, b_{25} is elasticity of substitution between PC and EAWU, b_{34} is elasticity of substitution between IC and AWU, b_{35} is elasticity of substitution between IC and EAWU, b_{45} is elasticity of substitution between AWU and EAWU. Source: Own calculation.

that institutions and institutional arrangements have a direct and positive influence over the economic efficiency of the observed units. During the first period, institutional incentives and legislative provisions have stimulated new enterprises to enter the agricultural sector. This result is supported by the statistical data that in 2005 the total number of registered agricultural enterprises was about four times more than their primary number at the beginning of the period in 2003[10].

After 2005, the coefficients of the variables property rights protection (δ_3) and legal enforcement of the contracts (δ_4) confirm the positive effect of contractual arrangements over the efficiency level of decision-making units. In 2007, the effect of legal initiatives for starting business activity also contributed to attained efficiency levels. The coefficient of the variable of the total number of registered cooperatives by regions (δ_6) is statistically significant and possesses a negative sign. Cooperatives significantly influence the overall sector performance.

A substantial source of the cooperatives' impact is found in the common organization of production in terms of quality standards and demand-based quantities, as well as cost minimization and scale economies.

The pairwise elasticity of inputs substitution is calculated for further interpretation of the results and in order to isolate each input's effect on the output (Table 5). The theoretical explanation in the case of pairs of inputs considers that "there is a simple correspondence between the cost function setting and the production function setting, since the elasticity of substitution is then equal to the inverse of the elasticity of complementarity"[9](Kohli, 2011). If the elasticity of complementarity between pairs of inputs is positive, then the conclusion is that these inputs both contribute to the increase of the output level. In case the estimated value is negative the two inputs are substitutes. The values of the elasticity between inputs for utilized agricultural area and annual working unit (b_{14}), permanent crops and intermediate consumption (b_{23}), permanent crops and employed annual working unit (b_{25}), and annual working unit and employed annual working unit (b_{45}) are calculated to be higher than 0 and suggest positive cross elasticity of

[9] Kohli, Ul. (2010), "Labour productivity: Average versus Marginal", Ch. 6, pp. 103-132 in W.E. Diewert; B.M. Balk, D. Fixler, K. J. Fox and A. O. Nakamura (2010), "Price and productivity measurement", vol. 6, Trafford Press

Table 6. Mean efficiency value (2003 – 2007).

Regions	Efficiency results					
	Cobb-Douglas		Translog		Inefficiency model	
	Average	Std.dev	Average	Std.dev	Average	Std.dev
Piemond	0.689	0.059	0.924	0.038	0.638	0.408
Valle d'Aosta	0.596	0.209	0.875	0.119	0.559	0.143
Liguria	0.783	0.188	0.925	0.071	0.403	0.232
Lombardy	0.856	0.124	0.969	0.036	0.972	0.023
Provincia Autonoma Bolzano	0.795	0.106	0.881	0.085	0.512	0.147
Provincia Autonoma Trento	0.549	0.240	0.878	0.077	0.551	0.085
Veneto	0.801	0.209	0.974	0.003	0.765	0.320
Friuli-Venezia Giulia	0.865	0.031	0.958	0.047	0.361	0.420
Emilia-Romagna	0.682	0.187	0.958	0.034	0.926	0.086
Tuscany	0.721	0.184	0.812	0.024	0.631	0.145
Umbria	0.545	0.291	0.966	0.025	0.613	0.399
Marches	0.576	0.268	0.947	0.055	0.531	0.355
Lazio	0.704	0.128	0.828	0.142	0.590	0.359
Abruzzo	0.681	0.209	0.958	0.053	0.871	0.177
Molise	0.667	0.210	0.802	0.247	0.552	0.411
Campania	0.902	0.082	0.909	0.140	0.626	0.326
Puglia	0.597	0.229	0.906	0.098	0.689	0.436
Basilicata	0.588	0.268	0.858	0.113	0.513	0.148
Calabria	0.690	0.024	0.869	0.131	0.567	0.433
Sicily	0.754	0.132	0.889	0.121	0.694	0.284
Sardinia	0.594	0.198	0.917	0.112	0.594	0.415

Source: Own calculations.

Table 7. Mean efficiency coefficients.

Production function	2003	2005	2007	Average	Std.dev
Cobb-Douglas	0.782	0.667	0.642	0.697	0.075
Translog	0.942	0.928	0.862	0.905	0.035
Inefficiency model	0.37	0.731	0.779	0.627	0.07

Source: Own calculations.

demand. It should be noted that the estimated results are positive but less than unity. This means that increase in the quantity of the first input would increase utility of the other input in the pair and thereby improve the marginal product of the decision-making unit. According to the calculations, the positive joint contribution of the inputs utilized area and annual working units is represent by the 0.29% increase of the final outputs. In the case of permanent crops and intermediate consumption - their pair would increase the output level by 0.45%. The same relationship is estimated for the joint contribution of permanent crops and employed annual working unit, and annual working unit and employed annual working unit, which contribute for the output increase – 0.49 and 0.33% respectively. The values of the elasticity between the utilized agricultural area and permanent crops (b_{12}), utilized agricultural area and intermediate consumption (b_{13}), intermediate consumption and annual working unit (b_{34}) are less than 0, which suggests that they are substitute inputs. The mean technical efficiency of the 21 regions in Italy is estimated to be 69.7% (Table 6).

During the observed period, agricultural enterprises produced 70% of the maximum attainable output. Estimates of technical efficiencies based on the frontier production function show a relatively high efficiency level (Table 7). The results imply that more than 90% of agricultural enterprises operate close to the efficient production frontier. Taking into consideration institutional influence and included variables in the inefficiency model, the mean efficiency results have also undergone positive trends from the lowest level in 2003 (0.370) to the highest level in 2007 (0.779). The contribution of efficiency changes to total factor productivity results in increased productivity growth.

SUMMARY AND RECOMMENDATIONS

Two-sectored models that distinguish between agricultural and non-agricultural production functions was developed in the present analysis. Variables included in the first production function represent inputs that are related directly to the final product and are utilized during the production process. Non-agricultural production function includes institutional factors that exert different effects over technical efficiency coefficients of enterprises in the data set. Production functions are structured under the assumption for non-linear relation among their value and the value of the technical efficiency. The equilibrium occurs when:

1) Prices solve enterprises' profit optimization problem;
2) Prices and profits solve enterprises' shareholders or members utility optimization problem;
3) Shareholders or members are indifferent in quitting their enterprise and starting new business activity.

The main results from the performed stochastic frontier analysis lead to several conclusions regarding the organization of the production process. Balanced productivity growth in the 21 regions is supported by the contribution of efficiency change to the total factor productivity. Specialization in the agricultural sector appears to reduce production costs and specialized mixed farming improves land utilization. Geographical clustering additionally enhances relationships between producers, their cooperatives, and the final customer. Distribution of the labor input also has an underlying effect on efficiency growth. Nevertheless, there are some internal organizational lapses towards employment on a regular basis. The allocation of the labor in specialized production is not entirely consistent with the inter-firm utilization.

One possible solution is a combination between individual responsibility and division of labor for each performed operation or task. The results allow for some generalizations towards the salary expenditures. The level of wages is sufficient enough to eliminate the incentive for the employee to leave enterprise for another employment opportunity. Consequently, it could be inferred that the average wage is responsive to market wage. Considering specific qualifications which work in the agricultural sector, requires the last assumption which provides that offered wages stimulate a flow of seasonal workers from regions with lower income. Legal enforcement of contracts contributes to enterprises' empowerment and collective action. However, this result should be taken with precaution in relation to land input. Contract farming does not benefit the poorest part of the rural population, but rather absentee landlords and large-scale producers. Cooperatives prove to be dynamic and influential organizational structures with stable relative share among the other legal entities in the agricultural sector. Their contribution to the overall technical efficiency is through the balancing of market demand and producers' production choice, by implementing fair pricing and quality standards.

Conclusion

This paper draws attention to the opportunity to evaluate the influence of certain institutional factors and their contribution to economic efficiency. Two main conclusions are reached from the analysis. The first one focuses on those efficiency resources that could be exploited by the enterprises, but not modified or changed by them. They refer to the institutional environment and its attributes – legislation, enforcement regimes and ensuing contracts arrangements, and the social characteristics of the informal relations. To this effect, the second conclusion suggests that the interaction between the actors of this bilateral process "strategic partnerships-institutions" has a broader impact, in addition to improving and benefiting economic performance of the agricultural enterprises. Cooperatives and producer organizations contribute to sustainability of the region in which they are established. They influence various aspects of the agricultural value chain through balanced and competitive relationships; concentration of the primary agricultural production, higher economic efficiency, and development of rural areas.

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APPENDIX

Appendix A. Application of frontier models in studying institutional influence over economic development.

Author	Analysis and Results
Johnson (2006)	Foreign direct investment should exert positive effects on economic growth in developing countries which suffer from low productivity and capital stock deficiencies.
Blonigen (2005)	Foreign direct investments (FDI) lead to an increase rate of economic growth.
Meon and Weill (2005)	Applied Stochastic Frontier Analysis (SFA) to study how difference in quality of institutions (control of corruption, strength of the law, quality of the regulatory framework) may explain cross-country differences in aggregate efficiency.
Wijeweera et al. (2004)	Applied SFA to study the relationship between FDI and the rate of growth of GDP. The result show that FDI inflows exert a positive impact on economic growth only in presence of a highly skilled labor force, corruption has negative impact; trade openness gains efficiency.
Fulginiti et al. (2004)	Used panel data on output and conventional agricultural inputs for 41 SSA countries to study productivity during political conflicts and wars for the period 1961-1999. The used institutional variables are: colonial heritage, independence; armed conflict; political rights/civil liberties.
Adkins et al. (2002)	Estimate production frontier and study to extend economical and political institutions contribute to the technical inefficiency, output growth, TFP growth.
Rodric (2000)	Identified 5 types of institutions that permit adequacy of the market: institutions for property rights; regulatory institutions; institutions of macroeconomic stability; institutions for social insurance; institutions for conflict management.
Sedik et al. (1999)	Took different approach to study farm restructuring in Russia for the period 1991-1995 by concentrating on technical efficiency. Efficiency scores are explained by economic and institutional factors: farm size, softness of budget constraint; deterioration in terms of trade and region level specialization.
De Mello (1999)	Foreign direct investments' (FDI) contribution depends on host country characteristics (skilled labor).
Bauer et al. (1998)	Set consistency conditions for regulatory analysis of financial institutions which include: efficiency levels, ranking, and identification of best and worst firms, time, competitive market conditions, and standard non-frontier measures of performance. Applied four approaches – DEA, SFA, TFA and DFA
Borensztein et al. (1998)	Foreign direct investment (FDI) has positive impact on GDP and is a function of the human capital.
Dowson (1998)	Economic growth is associated with economic freedom, because the latter has positive effect on investment and total factor productivity (TFP).
Edwards (1998)	Determinants of the TFP growth are the initial per capital GDP, the initial level of human capital and the degree of openness.
Rodric (1997)	Political factors affect economic performance, democracy is associated with stable long-run growth rates; better short-run stability; ability to deal with adverse shock; higher wages.
Moroney and Lovel (1997)	First applied SFA to compare productive performance of planned and market economies. EE Countries were no more that 76% as efficient as the western European economies during 1978-1980.
Bergson (1987, 1989, 1991)	Planned economic tend to use capital and land less efficiently (CRS, dummy variable technical efficiency)

Appendix B. Loglikelihood results of translog production function and inefficiency model.

Variable	Parameter	2003			2005			2007		
		Coefficient	St. error	T-ratio	Coefficient	St. error	T-ratio	Coefficient	St. error	T-ratio
Stochastic frontier model										
Constant	β_0	-0.7908*	1.0000	-0.7908	0.6725	0.8839	0.7608	-0.2029*	0.6432	-0.3155
Utilized agricultural area (UAA)	β_1	0.0000	0.2298	0.0000	-0.1172*	0.1206	-0.9722	-0.1238*	0.1809	-0.6845
Permanent Crops (PC)	β_2	0.8247	1.0000	0.8247	0.9692	0.1595	0.6075	0.1031	0.9108	0.1132
Intermediate consumption (IC)	β_3	0.8303	0.3969	0.2091	0.9025	0.4833	0.1867	0.8123	0.4748	0.1710
Annual Working Unit (AWU)	β_4	0.2616	0.1000	0.2616	0.9134	0.2588	0.3528	0.3913	0.1208	0.3236
Emloyed annual working unit (EAWU)	β_5	0.2589	0.2721	0.9515	0.1012	0.2633	0.3844	-0.7683*	0.3692	-0.2080
Time	β_6	0.1466	0.1000	0.1466	0.5647	0.1176	0.4801	-0.8315*	0.7819	-0.1063
$0,5*(UAA)^2$	β_7	0.4705	0.8233	0.5715	0.3828	0.1189	0.3218	-0.9134*	0.1243	-0.7346
$0,5*(PM)^2$	β_8	0.1815	0,1000	0.1815	0.2735	0.2323	0.1177	0.1151	0.5962	0.1931
$0,5*(IC)^2$	β_9	-0.1377*	0.9337	-0.1475	0.4670	0.2609	0.1789	0.9566	0.7573	0.1263
$0,5*(AWU)^2$	β_{10}	0.1335	0.1000	0.1335	-0.1071*	0.2022	-0.5298	-0.5040*	0.4867	-0.1035
$0,5*(EAWU)^2$	β_{11}	0.3775	0.3999	0.9438	-0.8212*	0.2204	-0.3725	-0.6061*	0.8856	-0.6843
(UAA)*(PC)	β_{12}	0.2043	0.1000	0.2043	-0.4764*	0.5137	-0.9273	-0.5889*	0.1021	-0.5767
(UAA)*(IC)	β_{13}	-0.7427*	0.5337	-0.1391	-0,2406*	0.8597	-0.2798	-0.1773*	0.4611	-0.3846
(UAA)*(AWU)	β_{14}	0.0000	0.1000	0.0000	0,2093	0.5368	0.3899	0.0000	0.1000	0.0000
(UAA)*(EAWU)	β_{15}	0.2376	0.1000	0.2376	0,0000	0.1000	0.0000	-0.2910*	0.5672	-0.5130
(PC)*(IC)	β_{16}	0.5685	0.7191	0.7905	0,5632	0.2423	0,2324	-0.2454*	0.2914	-0.8421
(PC)*(AWU)	β_{17}	0.6730	0.1000	0.6730	-0,4686*	0.3908	-0,1199	0.7666	0.1292	0.5932
(PC)*(EAWU)	β_{18}	0.2785	0.6693	0.4161	0,6672	0,1276	0,5227	0.1459	0.1341	0.1087
(IC)*(AWU)	β_{19}	0.6684	0.1000	0.6684	-0,2201*	0,2263	-0,9729	-0.9165*	0.5501	-0.1665
(IC)*(EAWU)	β_{20}	-0.5370*	0.9312	-0.5766	-0,7264*	0,3292	-0,2206	-0.2433*	0.3078	-0.7903
(AWU)*(EAWU)	β_{21}	0.4032	0.1000	0.4032	0,2157	0,5706	0.3780	0.6075	0.5817	0.1044
Variance parameters										
	s^2	0.1262	1.0000	0.1262	0.0128	0.0474	0.2693	0.0063	0.0566	0.1114
	γ	0.5000	1.0000	0.0500	0.7348*	0.1030	1.3086	0.7181	1.5305	0.1163
Loglikelihood function			3.1885			8,1042			19.2112	
Inefficiency effects model										
Training level (TrLevel)	δ_1	-0.6378*	0.5959	-0.1070	0,3458	0.6609	0.5232	0.2008	0.1421	0.1412
Specialized mixed farming (SMF)	δ_2	-0.4592*	0.1594	-0.2879	0,1037	0.1241	0.8360	0.3826	0.1144	0.3344
Property right protection (PRP)	δ_3	0.2641	0.8656	0.3051	-0.3030*	0.6375	-0.4753	-0.2213*	0.1734	-0.1276
Legal enforcement of contract (LEC)	δ_4	0.2423	0.1403	0.1727	-0.3307*	0.1132	-0.2921	-0.7365*	0.1230	-0.5987

Appendix B. Contd.

Starting new business (SNB)	δ_5	-0.9564*	0.1386	-0.6899	0.5733	0.5134	0.1116	-0.3348*	0,2461	-0.1360
Number of cooperatives (C)	δ_6	-	-	-	-	-	-	-0.1872*	0.8617	-0.2173
Variance parameters										
	s^2	0.0106	0.0036	2.9043	0,0078	0.0024	3.2043	0.0134	0,0041	3.2485
	γ	1.0000	0.0147	67.8640	1,0000	0.0293	34.1114	0.8354	0,0005	0.6465
Loglikelihood function			20.0499			17.7180			3.2169	

*Signifies that the estimated parameters in bold can be accepted at 5% significance level (Source: Own calculations).