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Is the Full Diffusion of EU Standards Optimal for the Development of the Food Sectors in the CEEC? The Case of the Polish Dairy Sector

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Abstract. The challenge of implementing EU quality and safety standards of food production and trading is one of the main forces driving the restructuring of agro-food chains in Central and Eastern European Countries (CEEC). The progress made in the compliance process varies between sectors and countries due to differences in national policies, market structure, and the complexity of requirements in the individual sectors. We combine two approaches, diffusion models and mechanism design, to explain the current situation in the Polish milk chain. We argue that adoption and enforcement decisions in the food chain are determined by economic considerations of farmers and processors. Factors such as a changing institutional environment, control principles, pricing behaviour, screening mechanisms and market structure, all of which influence adoption of standards, are identified and discussed. The findings are used to answer the question of whether the complete diffusion of standards is optimal for the development of the Polish dairy sector. Similar results hold for other food sectors in Poland and in other CEEC.

Keywords: product quality, standards, EU enlargement, industrial organisation.

1. Introduction

Policy and the economic environment surrounding food processing in Central and Eastern European Countries (CEEC) are currently in a state of flux. Economic transition has caused immense structural changes at all stages of the agro-food chains. Additionally, the EU-membership stipulations require the applicant countries to fulfil the Copenhagen criteria, which include the adoption of the *acquis communautaire*. For food chains, this means that all mandatory EU standards concerning a particular food product, i.e., its production, processing and retailing, have to be met by the day of accession or after a granted transitional period. During the 1990s, the compliance process was relatively slow [1, 8, 17]. This has caused serious doubts regarding the food sector's ability to meet the EU standards in the pre-accession period and thereby to be a full and competitive part of the extended EU.

In this paper we argue that this assessment must be revised. Our main argument is that this view does not take into account the various determinants which affect the diffusion of standards. Particularly unaccounted for is the mutual dependence between a farmer's decision to adopt and structural changes in agriculture. In the theoretical section of this paper, we will develop this idea by using a simple model consisting of two parts. The first follows a typical principal agent approach [7] and determines a threshold for adoption. This model is extended to a multiple agent context to derive the interactions between diffusion and structural change. The main intention of the theoretical section is to provide a background against which empirical facts can be given economic meaning. Thus, we use the model more in an exploratory rather than an explanatory fashion. We then turn our theoretical consideration to the Polish dairy sector. In the first part of the empirical analysis, we will discuss the depiction of the model parameters in the dairy sector. This includes the determination of standards and control principles, pricing behaviour, etc. The second part addresses the adoption and diffusion of standards.

2. Principal agent approach and diffusion of standards

2.1 Contractual choice among agent and principals

The principal processes raw material delivered by an agent. Manufacturing a high quality consumer good requires a minimum quality of a raw material (q_{min})[1]. If the quality is below qmin, the stability of the final products cannot be guaranteed, because undesirable attributes of the raw material (sensory, microbiological attributes) and problems in the processing stage result in the inferior quality of the final products. The prices of high and low quality products are wh and wl, respectively, with $w_h \geq w_l$.

Two critical points exist for quality control: the quality of the final product and the quality of the raw material. For simplicity, we assume that the attributes of the final product are directly revealed after finishing the processing stage. The raw material can be controlled and assessed when delivered to the principal using appropriate technology based on branch-specific legislation and firm internal decisions and regulations. However, even when there is no incentive conflict between the producers and processors, bounded rationality can cause the processor to fail to recognise the true quality of the raw material. In general, the failure rate is affected by exogenous and endogenous factors. One determinant that is not the principal's choice is the availability of certified laboratories. Other factors, such as the test procedure, investment in testing equipment and the amount of human resources allocated to testing, as well as the frequency of control or the number of samples to be taken, are subject to the principal's decision. In order to keep the theoretical treatment as parsimonious as possible, we will not analytically distinguish between fixed costs caused by control-specific investment and the variable control costs. Furthermore, we assume the overall *control costs* to be fixed at c.

Prices received by the agent depend on product quality. High quality raw materials are remunerated by v_h, while the price for low quality raw material is v_l, with $v_h \geq v_l$. Corresponding to the choice of *production techniques*, the agents can be of two different types: low (t_l) or high (t_h) quality producers. The distribution of raw product quality differs with respect to the applied technique. We assume that technique th stochastically dominates t_l to the first order, i.e., $F_h(q) < F_l(q)$,. q; Additionally, the choice of q_{min} does not allow the exact identification of the production technique, i.e., $F_h(q_{min}) > 0$ and $F_l(q_{min}) < 1$.

Ex ante, the type of agent is his private knowledge. The principal forms prior beliefs about an agent's type in order to estimate his expected profits. In the empirical part we will present some mechanisms for forming these beliefs, but in this section we take them as exogenous. We assume that the principal assigns a probability s (1-s) to the possibility that the agent type is t_h (t_l).

[1] We use the terms "minimum standards" and "minimal quality" synonymously and treat quality as a one-dimensional variable. In general, quality has to be characterised in a multidimensional fashion. However, this would have increased the complexity of the discussion since hedonic pricing would have had to be introduced in our model [19].

Technique t_h requires additional resources like special animal feed, additional sanitary measures, and investment in building and equipment[2]. Again, in the model, we do not distinguish between fixed and variable costs and assume for simplicity that the overall compliance costs are constant for an individual agent at k. Thus, the additional average cost of technique th decreases with an increase in the amount of raw material production (x).

Given the basic assumptions about the distribution of raw material quality (F_l and F_h) and prior beliefs (s) four situations regarding quality of the procured raw materials must be distinguished (Table 1)[3].

Table 1. Probability matrix for quality output at the procurement stage

		Type of agent	
		High	Low
Quality of raw material	High	$p_{hh} = s\ (1\text{-}F_h)$	$p_{hl} = (1\text{-}s)\ (1\text{-}Fl)$
	Low	$p_{lh} = s\ F_h$	$p_{ll} = (1\text{-}s)\ Fl$

Based on these probabilities different equilibrium strategies can be considered. If the principal performs no quality control, the agent receives vl for every unit of raw material. In this case the profits received by a principal are $\pi = x\ (w_l - v_l)$[4]. A risk-neutral decision-maker is willing to implement a quality-dependent payment scheme and pay v_h for high quality raw material only when expected profits are at least as high as profits without quality control, i.e., $E\pi^p - \pi \geq 0$. Using the probabilities in Table 1, $E\pi^p$ is given by:

$$E\pi^p = x\,[(p_{hh} + p_{hl})\,(w_h - v_h) + (p_{lh} + p_{ll})\,(w_l - v_l)] - c \geq 0 \tag{1}$$

Subtracting π and collecting terms provides:

$$E\pi^p - \pi = x\,[(p_{hh} + p_{hl})\,\{(w_h - v_h) - (w_l - v_l)\}] - c \geq 0 \tag{2}$$

This inequality consists of two parts. First, with a probability of (p_{hh}+p_{hl}) the principal receives the difference of the profit margins associated with the two qualities of the raw material. The second component consists of control costs. The inequality requirement follows from the restriction that providing high quality consumer goods must be profitable in comparison to the provision of low quality products. In the following we assume that the inequality in (1) holds.

In a **pooling equilibrium** with expected profits $E\pi^p$, the principal does not distinguish between the two types of agents. Since expected profits decrease in v_h, the price for high quality raw material is given by its lower boundary v_l and there will be no price differentiation between high and low quality raw materials. Thus, the price for both qualities will be v_l and expected profits are given by:

$$E\pi^p = x\,[(p_{hh} + p_{hl})\,(w_h - v_l) + (p_{lh} + p_{ll})\,(w_l - v_l)] - c \tag{3}$$

Quality control at the procurement stage is only used to decide whether the raw material will be processed to high or low quality final products. Thus, the agent has no incentives to put additional resources towards producing high quality raw material.

2 In the following, the terms "compliance cost" and "additional production cost" are used synonymously.

3 The assumptions discussed so far imply that we are analyzing Bayes-Nash-Equilibriums, see [2].

4 Because we focus on optimal contractual arrangements among a farmer and a principal, we assume processing and production technologies which are as simple as possible.