Milk Dispensers in Slovakia: What is behind the Recent Boom?[1]

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Abstract

We provide a possible explanation for the sudden appearance of milk dispensers throughout Slovakia between 2009 and 2010. We identify three main factors: (i) higher profits earned by selling raw milk through dispensers relative to those earned through milk processing plants, (ii) very short pay-back period of dispensers, and (iii) high cumulative discounted profits generated from dispensers after they pay back. Nonetheless, we do not expect that new milk dispensers will show up in the future; on the contrary, we expect their number will decrease. It is because the consumers demand for raw milk has been decreasing significantly recently, suggesting that the vending machines were only a consumer fad. As a result, the farms that pioneered the operation of milk dispensers (especially in larger cities) are now the ones that may have benefited most from the subsidy.

Keywords: *milk dispensers, Slovakia, dairy crisis, pay-back period, profits, subsidy*

JEL Classification: Q13, Q14

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Introduction

Since the early nineties, the Slovak dairy sector has been experiencing a dynamic market environment. The milk production per cow was significantly lacking behind the countries of Western Europe. For example, the average milk production per cow in Germany in 1995 was 5 473 liters, while in Slovakia it was only 3 345 liters. Although the Slovak production increased to 5 243 by 2009, it is still significantly lower relative to its German counterpart of 6 775 liters (Eurostat). But the relatively low milk yield has not been the only issue facing Slovak dairy producers. The volume of milk delivered to the domestic market declined as well, partly because of the foreign competition and also because of the declining per capita consumption in Slovakia. The latter was 154.5 liters per person per year in 2009 – 30 percent below the recommended consumption level (Slovak Statistical Office, 2010). As a result of declining demand for milk on the one hand and improving milk production per cow on the other, the total number of cows has been declining (Ciaian, Pokrivčák and Bartová, 2005.)

Because Slovakia is a small open economy, it is heavily dependent on the market development in other European countries. The 'Health Check' of the Common Agricultural Policy (CAP) of the European Union brought about a significant reform of the policies affecting the EU dairy sector. Among other changes, the milk quota is being gradually increased and will finally be abolished completely in 2014 which is likely to depress the milk price in the European Union (Bouamra, Réquillart and Jongeneel, 2008; Krol et al., 2010). In addition to the changes induced by the reform, the European dairy sector was severely hit by the economic crisis in 2009 (Matthews, 2010). Milk market prices dropped significantly, causing many farmers to sell the commodity under the production cost, which has negatively affected their income.

The Slovak Ministry of Agriculture attempted to partially alleviate the adverse effects of the dairy sector crisis by promoting the operation of milk dispensers.[2] A milk dispenser is a vending machine where milk is sold in its unpasteurized form. Immediately after being collected on a farm, the raw milk is cooled down to 3 – 4°C to preserve its characteristics; then it is delivered to the dispenser. The milk tank in the dispenser is recharged at least once in twenty-four hours to attain milk freshness.

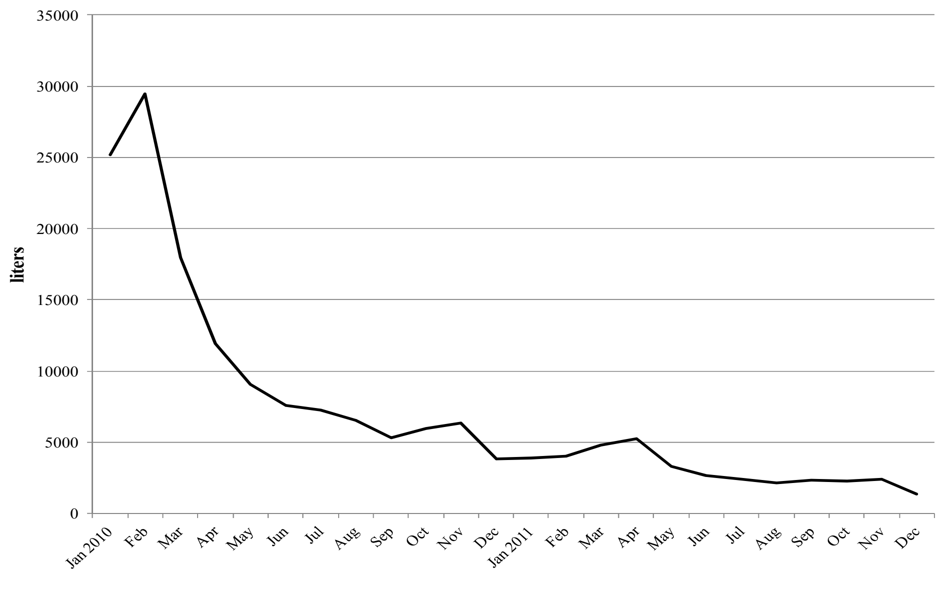
In this paper, we provide a microeconomic model of financial incentives connected with the sudden appearance of milk dispensers in Slovakia. We take

[2] 'School Milk Program' is another project aimed at increasing the consumption of dairy products in schools. See Kapsdorferová, Ubrežiová, and Pogranová (2011) for details on this program.

a ‘retrospective approach’, i.e., we simulate the options farms could have possibly faced when making decisions about entering the milk dispenser business, using the historical data of a representative farm. We identify three possible factors behind the occurrence of milk dispensers: higher profits earned by selling raw milk through dispensers relative to those earned through milk processing plants; very short pay-back period of dispensers (for the pioneering farms); and high cumulative discounted profits generated from dispensers after they pay back. Figure 1 suggests milk dispensers are an example of a consumer fad (Bikhchandani, Hirshleifer and Welch, 1992; 1998) – milk sales skyrocketed in the first two months of milk dispensers operation, but then faded out quickly.

F i g u r e 1

Monthly Sales of Raw Milk from a Selected Milk Dispenser



Source: Based on data provided by an anonymous farm.

The analyzed topic raises a number of questions that we do not address in the present paper; thus, we defer them for further research. For example, we do not investigate the pricing of milk in the milk dispensers, the role of marketing, or the quality choice and consumers perception (Banterle et al., 2011; Horská, Ürgeová and Prokeinová, 2011). A very important issue that deserves a more detailed analysis is the demand for milk, especially its price elasticity, as well as the explicit consideration of possible substitution both among the beverages and other sources of animal-based proteins. To our knowledge, these topics have not received attention in the literature studying the Slovak milk market. However, some work has been done for markets culturally and economically similar, such as the Czech Republic (Brosig and Ratinger, 1999; Janda, Mikolášek and Netuka, 2010), Lithuania (Frohberg and Winter, 2001), Latvia (Hossain, Jensen and Snuka, 2001), and Slovenia (Turk and Erjavec, 2001). These studies find that the demand for milk and dairy products is price inelastic. A comprehensive discussion of demand elasticities with respect to related Czech food consumers is provided by Janda, McCluskey and Rausser (2000). A problem with any empirical analysis of milk is its dual perception as both a dairy product and beverage; this influences its inclusion to estimated demand systems.[3]

The remainder of the paper is organized as follows. The next section provides a brief overview of the policy introducing the milk dispensers. In Section 2, we theoretically model the pay-back period under alternative scenarios of the daily milk sales. The data used are presented in Section 3, proceeded by a presentation of simulations under various scenarios in Section 4. The final section provides some concluding remarks.

1. The Policy Background

One of the responses of the European Commission to the unfavorable situation in the dairy sector was an extension on October 28, 2009 of the Temporary Crisis Framework (first adopted in January 2009). Within this framework, farmers could apply, one time only, for up to 15,000 euros of state assistance by the end of 2010 (Rapid, 2009). Legislation was passed quickly in Slovakia to enable farmers to use the available financial aid to market part of their milk production through milk dispensers. The Slovak Agricultural Paying Agency, responsible for the administration of the subsidy, accepted applications by the end of April 2010. In June 2010, there were a hundred or so milk vending machines located all over Slovakia (Poľnoinfo, 2010).[4] Granting of the subsidy depended, among other things, on a commitment that the farm would run the dispenser for at least two years. Each farm could receive the subsidy for one dispenser only. The pricing of the milk at a dispenser lies solely with the farm, but typically prices vary between 50 and 60 euro cents per liter.[5] The State Veterinary and Food Administration of the Slovak Republic regularly checks the qualitative parameters of the fresh milk sold at the dispenser.

[3] We are grateful to an anonymous reviewer for pointing this out to us.

[4] First dispensers also appeared in the Czech Republic and Slovenia in 2009.

[5] After an increase in the value added tax on milk from a dispenser from 6 to 20 percent (in January 2011), many farmers increased the milk price from 50 to 60 euro cents per liter.

2. The Pay-back Period

Farms have to take into account the profits forgone by not selling all raw milk directly to a processing plant. Let us assume that the cost of production of one liter of milk is constant (at least for a certain range of production). This cost is the same irrespective of where the milk is sold. We assume zero operating cost associated with milk sold to a processing plant.[6]

However, if distributed via a dispenser, a farm faces an operating cost of a euros per liter of milk (e.g., transportation to the dispenser). Finally, at a dispenser milk is sold for p_1 euros per liter, whereas the price received from a processing plant is p_2 (currently $p_1 > p_2$).[7] A farm will have an incentive to distribute as much of its milk via dispenser as demanded as long as $p_1 - p_2 - a > 0$. This means that a farm will invest in a milk dispenser if it expects that the price differential between a milk dispenser and delivery to a processing plant less the processing cost per liter will be positive. In the event that the price paid by a milk processor is high enough (i.e., $p_2 > p_1 - a$), then a dispenser is less profitable compared to sales to the processing plant. However, when milk dispensers first appeared in Slovakia, they were seen as much wanted alternatives because their price premium relative to sales to processing plants in 2009 was 15 euro cents per liter. With an increase in raw milk prices in the EU market, this premium decreased to 8.9 euro cents in 2010 (ATIS 2009; 2010).

A higher sale price has been one reason why many Slovak farms in 2009 opted for a milk dispenser. We will now turn our attention to another one – a short pay-back period. The pay-back period is frequently defined as the time it takes to recover the initial outlay from the earnings generated by the investment (Boehlje and Eidman, 1984). In other words, it is the time necessary for an investment to break even. Although very intuitive, the above definition does not take into consideration the time value of money. In our analysis, we take into account this phenomenon and calculate when the discounted costs associated with milk dispensers equilibrate with the discounted stream of revenues. More specifically, we seek to find such $\tilde{n}$ (pay-back period) that the following inequality is satisfied as equality

[6] Milk processing plants typically collect the milk with their specialized vehicles (to preserve hygienic standards); therefore, they bear the cost of collection, not the farm. If the plant charged the farm for the collection, this would get reflected in the price of milk paid by the processing plant, not as a direct operating cost. Our assumption is thus driven by the existing market structure and would have to be relaxed if the farm had to deliver the milk to the plant directly.

[7] Although the milk price is likely to vary spatially (both at a dispenser and processing plant), we do not analyze this because we model the pay-back period for a representative farm.

$$F + C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n} \leq P_0 Q_0 + \frac{P_1 Q_1}{1+r} + \frac{P_2 Q_2}{(1+r)^2} + \ldots + \frac{P_n Q_n}{(1+r)^n} \quad (1)$$

where

n – the number of months for which the investment is in operation ($n \geq \tilde{n}$);

F – fixed costs incurred during period $n = 0$, such as purchase of a milk dispenser and a special cooling vehicle for transportation of milk;

C_i ($i = 0, 1, \ldots n$) – the total monthly operating costs (e.g., production cost of milk, transportation of milk to the dispenser, wages for operating personnel);

P_i – monthly price charged per liter of raw milk;

Q_i – quantity of milk sold per month;

r – a monthly discount rate.

In words, equation (1) says that for a large enough *n* the investment will generate positive profits, i.e., the difference between the right- and left-hand sides of equation (1) will be positive. Typically, this analysis is (should be) done prior to investing and so the farmer cannot be completely sure about the values of all the variables in equation (1). Yet, the left-hand side of (1) is likely to be more certain relative to the right-hand side, because at time $n = 0$ the prices of a dispenser and a cooling vehicle are known, and the farmer has substantial control over the monthly operating costs. For simplicity, let us assume that the nominal operating costs do not change (thus simulating a conservative scenario for the pay-back period, as a rational farmer will try to lower the costs in every period) and are equal to *C* every month.

There is much more uncertainty on the right-hand side of equation (1). We have shown that, so far, the farms have not responded to a decrease in their sales by adjusting the price. This makes it possible to model the development of the price and quantity separately. We assume the same milk price each month (which has been the case so far) and denote it by *P*.[8] However, we shall also assume a pattern as regards the quantity of sold milk – without putting some structure on milk sales it is not possible to compute the break-even $\tilde{n}$.

To reflect reality, we model the milk sales as increasing initially, reaching a maximum, and decreasing subsequently. It is reasonable to assume that a farm

[8] The time invariability of the milk price is a simplifying assumption enabling us to derive the pay-back period in a closed form. Our approach is analogous, for example, to the one used to determine the optimal rotation for an evenly aged forest – Faustmann rotation. Although allowing the milk price to vary over time would make the model more realistic, some structure would have to be put on the price development to be able to compute the pay-back period.

Regarding the space uniformity, we do not rule out a possibility that the price varies spatially. Since we model only the decision of a representative farm (and hence for one milk dispenser), the spatial variation of the price does not play a significant role in our case.

will not be able to predict the initial growth pattern, especially if it is a pioneer in the market. However, the farm might have some expectations regarding (*i*) the quantity sold in the period $n = 0$, (*ii*) when and how much the maximal sale will be, and (*iii*) what the long term (i.e., when the market is stabilized) monthly sales will be. We take these provisions into account in modeling the development of milk sales. In particular, we assume the milk sales (Q) follow a piecewise function (*Model 2*, henceforth)

$$Q = \begin{cases} Q_0 + \frac{(Q_{\max} - Q_0)}{n_{\max}} n, \text{ for } n \in [0, n_{\max}] \\ \frac{k}{n} + Q_{LR}, \text{ for } n \in [n_{\max}, \infty) \end{cases} \tag{2}$$

where

Q_0 – the milk sale at $n = 0$,
Q_{max} – the maximum sale occurring at n_{max},
Q_{LR} – the long-term sale of raw milk.

The parameter k is calibrated to ensure that the two functions obtain the same value at n_{max}, therefore $k = (Q_{\max} - Q_{LR}) n_{\max}$. We can combine equations (1) and (2) to determine the pay-back period. In general, this must be done numerically as it is not possible to find an analytical solution to equation (1). However, assuming that sales are the same each month (*Model 1*, henceforth), i.e., $Q_0 = Q_{\max} = Q_{LR} = Q$, we can reduce equation (1) to

$$F = (PQ - C)\left(\frac{1+r}{r} - \frac{1}{r(1+r)^{\tilde{n}}}\right) \tag{3}$$

where use has been made of the fact that $\sum_{n=0}^{N}(1+r)^{-n} = \frac{1+r}{r} - \frac{1}{r(1+r)^N}$.

Solving equation (3) for $\tilde{n}$, we get the pay-back period

$$\tilde{n} = -\frac{\ln\left(1 + r - \frac{rF}{PQ - C}\right)}{\ln(1+r)} \tag{4}$$

For a pay-back period to exist, it is required that $1 + r - \frac{rF}{PQ - C} > 0$.

In both models, we use a monthly discount (interest) rate r to calculate the discounted value of a stream of net profits. However, a farm usually deposits money at an interest rate that is specified *per annum*, not per month. Therefore, we convert an annual interest rate into a monthly interest rate, r. Under the assumption of a compound interest, the following condition must hold

$$a_0 (1+r)^{12} = a_0 (1+\rho) \tag{5}$$

where a_0 denotes an amount deposited at time $n = 0$.

From equation (5) we obtain

$$r = (1+\rho)^{\frac{1}{12}} - 1 \tag{6}$$

What Is the Value of a Dispenser after It Pays-back?

An intuitive interpretation of the pay-back period is that after that time the dispenser starts to produce a net positive stream of profits (provided that monthly revenue exceeds the respective operating costs in the future). Let us define the value of a dispenser as the sum of discounted monthly profits starting in the month when the machine pays back and ending at a point when the farm expects that it will stop using it.[9] We therefore seek to calculate

$$V = \sum_{\underline{n}}^{N} \frac{PQ - C}{(1+r)^n} \tag{7}$$

where $\underline{n} = [\tilde{n}] + 1$ denotes the month when a positive profit is made for the first time and $[\tilde{n}]$ denotes the integer part of the pay-back period, i.e., such an integer that $[\tilde{n}] \le \tilde{n} < [\tilde{n}] + 1$. For simplicity, we assume that each month the same quantity of milk is sold at the same price as it was the case before the break-even point and that the interest rate does not change either.

The expression (7) can then be rewritten as

$$V = (PQ - C)\left(\frac{1}{r(1+r)^{\underline{n}-1}} - \frac{1}{r(1+r)^N} \right) \tag{8}$$

Assuming that the dispenser will be in operation in perpetuity, i.e., $N \to \infty$, expression (8) reduces to

$$V = \frac{PQ - C}{r(1+r)^{\underline{n}-1}} \tag{9}$$

[9] For simplicity, we assume a dispenser can be disposed at no cost when stopped to be used.

From equation (8) it follows that expression (9) is an upper bound for the value of a dispenser. Also note that the later the dispenser pays back, the lower the sum of discounted future profits, a fact which makes intuitive sense.

3. Data

The data used in the empirical part of the paper have been provided by a Slovak farm on the condition that they remain anonymous (we call it Farm A). Farm A is representative of other farms producing milk; consequently, the data for this farm serve as the foundation for our simulations. Later, we alter the levels of operating costs and fixed costs that appear in the above formulae in order to reflect possible heterogeneity among farms in these categories.

The fixed costs associated with the project amounted to 61,034 euros for Farm A and comprise of the purchase of a milk dispenser and a cooling vehicle. The operating cost is 0.349 euros per liter. This figure was calculated as an average of the operating cost for Farm A between January and May 2010. Included in the operating cost are: production cost of milk, labor, fuel, electricity, cost of germicide of the milk containers, and bills for calls made in relation to distribution of raw milk. Milk is sold at 0.50 euros per liter and we assume 30 days in a month. The interest rate of 2.95 percent *per annum* was obtained by averaging the three highest interest rates in 2009 on money deposited for two to three years.[10]

4. Simulations

Following the theoretical part of the paper, we run simulations for two models. Model 1 assumes a constant quantity of milk sold every day (month), while Model 2 allows for a non-linear development of milk sales, as described by (2). In order to investigate how different starting values of milk sales might affect the pay-back period, under Model 2 we model two different pairs of values for Q_0 (milk sales in the first month) and $Q_{\max}$ (maximal milk sales). In Model 2a, we assume that $Q_0 = 1\ 000$ and $Q_{\max} = 1\ 100,$ whereas in Model 2b we assume $Q_0 = 500$ and $Q_{\max} = 700.$ The former set of values is more representative of the farms that started operating milk dispensers earlier or in bigger cities, while the latter is a good proxy for the farms doing business in smaller towns and villages. Irrespective of the location of a machine, the peak of milk sales usually occurred in the second month after launching a dispenser (i.e., $n = 1$ in our notation).

[10] The banks considered are OTP Bank, mBank, and Poštová banka.

For each model, we run a baseline simulation and four scenarios to determine how sensitive the pay-back period is to changes in the variables' values. The baseline simulations use the data presented in the previous section. In *Scenario 1*, we assume the operating cost increases by 20 percent, and in *Scenario 2* the operating cost decreases by 20 percent. *Scenarios 3* and *4* assume a farm is able to lower the fixed cost of initial investment by 7,500 euros and 15,000 euros (relative to baseline), respectively. Scenarios 3 and 4 reflect the maximal financial subsidies provided by the Agricultural Paying Agency in the Slovak Republic.[11]

T a b l e 1

Sensitivity Analysis for the Legth of the Pay-back Period (in months)

Model 1							
	Daily sales (liters)	100	300	500	700	900	1 100
Scenario	Baseline	161.5	46.4	25.8	18.6	14.2	11.4
	Operating costs higher by 20%	381.0	91.7	52.1	36.2	27.7	22.3
	Operating costs lower by 20%	103.0	30.8	17.8	12.3	9.3	7.4
	Fixed costs lowered by 7 500 euros	137.7	40.3	23.3	16.2	12.3	9.9
	Fixed costs lowered by 15 000 euros	115.2	34.2	19.8	13.7	10.4	8.3
Model 2a: Q_0 = 30*1 000 liters, Qmax = 30* 1 100 liters							
	Daily sales in the long run = Q_{LR}/30 (liters)	100	300	500	700	900	1 100
Scenario	Baseline	84.4	32.1	21.1	16.2	13.4	11.5
	Operating costs higher by 20%	243.7	73.5	15.2	33.3	26.6	22.4
	Operating costs lower by 20%	41.9	18.5	12.9	10.2	8.6	7.5
	Fixed costs lowered by 7 500 euros	66.8	26.7	17.9	13.8	11.5	9.9
	Fixed costs lowered by 15 000 euros	50.5	21.4	14.7	11.5	9.6	8.4
Model 2b: Q_0 = 30*500 liters, Qmax = 30* 700 liters							
	Daily sales in the long run = Q_{LR}/30 (liters)	100	300	500	700	900	1 100
Scenario	Baseline	113.5	39.5	25.2	19.0	15.4	13.1
	Operating costs higher by 20%	294.9	83.0	50.1	36.5	29.1	24.3
	Operating costs lower by 20%	64.3	24.8	16.4	12.6	10.5	9.0
	Fixed costs lowered by 7 500 euros	93.4	33.7	21.7	16.5	13.5	11.6
	Fixed costs lowered by 15 000 euros	74.5	28.0	18.3	14.0	11.6	10.0

Baseline parameters' values: annual interest rate = 2.95%; number of days in a month = 30; fixed costs = 61,034 euros; selling price of milk = 0.50 euros/liter; operating costs of the milk dispenser = 0.394 euros/liter.

Note: Changes in each scenario are relative to the baseline.

Source: Own calculated.

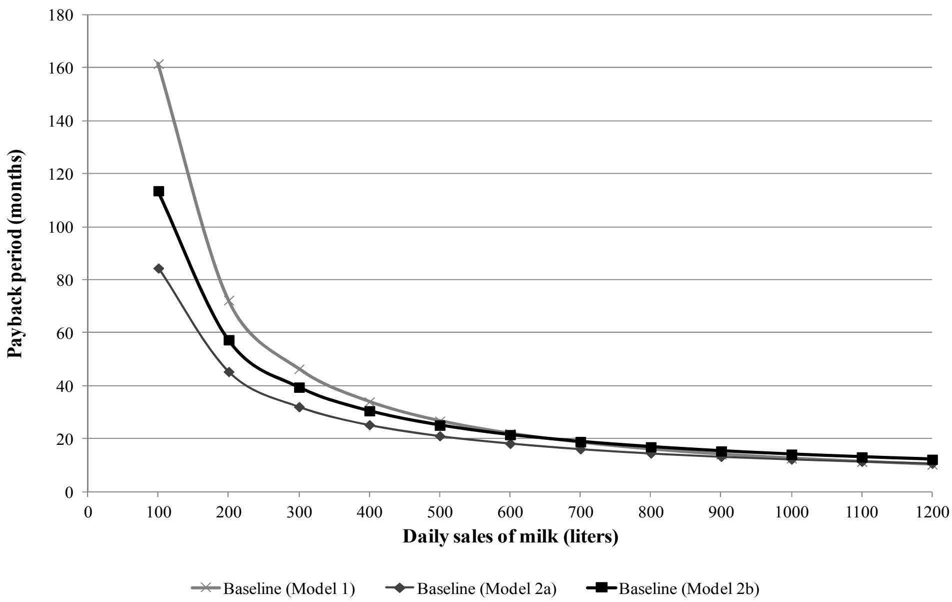
The baseline simulations for all three models confirm intuitive expectancies (Table 1): the higher the daily sales of milk, the shorter the pay-back period.[12] Higher milk sales in the initial stage of a dispenser's operation shorten the pay-back period. This is depicted in Figure 2, where we plot the expected daily sales of milk (horizontal axis) and the respective pay-back period (vertical axis). For

[11] Prior to the extension of the Temporary Crisis Framework on October 28, 2009 by the Commission, the maximum state aid in Slovakia was 7,500 euros.

[12] For Model 2a and 2b by daily sales we mean the long-term sales.

very low sales (e.g., 100 liters), the pay-back periods differ significantly. However, the differences diminish rather quickly as the expected daily sales of milk increase. For daily sales above 800 liters the differences are negligible. This implies that, for the length of the pay-back period, higher long-term sales matter more than do the high initial sales (as in Model 2), which typically last for only a short period. Another finding readily observable in Figure 2 is that the pay-back period is non-linear in long-term sales. This means that efforts to increase the sales will result in significant lowering of the pay-back period only when the initial sales are relatively low (less than 400 liters per day, as per Figure 2).

F i g u r e 2
Pay-back Period *vs* Expected Daily Sales of Milk



Source: Own calculations.

A 20 percent increase in the operating cost, relative to the baseline, doubles the pay-back period in each model, while a 20 percent decrease contracts the pay-back period only by one third on average. This experiment indicates non-linearity of the pay-back period in the operating costs. But more importantly, it illustrates that if one farm delivers milk to a longer distance than the other, or if it is not able to produce milk as cost-effectively as the other, *ceteris paribus*, the pay-back period for the dispenser of that farm can be adversely affected compared to the competition.

The impact of a subsidy on the length of the pay-back period is illustrated in Scenarios 3 and 4. A higher subsidy enables the dispenser to pay back faster, especially when a very low sale is expected in the long run. On the other hand, if the sales are high, then the subsidy does not make much of a difference as the pay-back period is driven mostly by high daily sales. This raises the question of whether it was worth it (for the Agricultural Paying Agency) to spend additional 7,500 euro per dispenser project to help shorten the pay-back period by three months or less (for a daily sale above 500 liters).

We have defined the value of a dispenser as the sum of a discounted stream of future profits after the dispenser pays back. These values are presented in Table 2 for various scenarios and models. The commonalities can be summarized as follows: the value of a dispenser increases with a shorter pay-back period. This is because the dispenser can start producing net profits earlier. For a given quantity of milk sold, there is not much of a difference between values of a dispenser for the same scenario in different models, especially given that the value of a dispenser is essentially the same for the baseline and when fixed costs are lowered as a result of a subsidy. The explanation is that once the machine has paid back, the fixed costs are irrelevant for the determination of future profits. However, this is not true for operating costs, which will be incurred in every period, hence the deviation of dispenser values for Scenarios 2 and 3 as compared to the baseline.

T a b l e 2

Sensitivity Analysis for the Legth of the Pay-back Period (in months)

Model 1							
	Daily sales (liters)	100	300	500	700	900	1 100
Scenario	Baseline	0.13	0.50	0.88	1.25	1.63	2.01
	Operating costs higher by 20%	0.04	0.24	0.45	0.65	0.85	1.05
	Operating costs lower by 20%	0.21	0.76	1.31	1.86	2.41	2.96
	Fixed costs lowered by 7 500 euros	0.13	0.51	0.89	1.26	1.64	2.01
	Fixed costs lowered by 15 000 euros	0.14	0.52	0.89	1.27	1.65	2.02
Model 2a							
	Daily sales in the long run = Q_{LR}/30 (liters)	100	300	500	700	900	1 100
Scenario	Baseline	0.15	0.52	0.89	1.26	1.63	2.01
	Operating costs higher by 20%	0.06	0.25	0.45	0.65	0.85	1.05
	Operating costs lower by 20%	0.25	0.79	1.33	1.87	2.42	2.96
	Fixed costs lowered by 7 500 euros	0.16	0.53	0.90	1.27	1.64	2.01
	Fixed costs lowered by 15 000 euros	0.17	0.53	0.91	1.28	1.65	2.02
Model 2b							
	Daily sales in the long run = Q_{LR}/30 (liters)	100	300	500	700	900	1 100
Scenario	Baseline	0.14	0.51	0.88	1.25	1.63	2.00
	Operating costs higher by 20%	0.05	0.25	0.45	0.65	0.85	1.05
	Operating costs lower by 20%	0.23	0.77	1.32	1.86	2.40	2.95
	Fixed costs lowered by 7 500 euros	0.15	0.52	0.89	1.26	1.63	2.01
	Fixed costs lowered by 15 000 euros	0.16	0.53	0.90	1.27	1.64	2.01

Note: We assume the dispenser will be in operation in perpetuity.

Source: Own calculated.

So how does the foregoing help to account for the abrupt emergence of milk dispensers in Slovakia? This emergence can partially be explained by the desire for long-term profits on the part of farmers, especially if they originally assumed high daily sales of milk. In the best case considered in our analysis, in which we posit that 1 200 liters of milk is sold daily, the expected lifelong net profits amount to 2.2 million euros. However, the reality so far suggests that this will hardly be the case, especially in view of the recent gradual fall in daily sales.

Concluding Remarks

This paper has analyzed financial incentives related to a sudden appearance of milk dispensers in Slovakia. Creation of better price conditions for milk sales, promotion of unadulterated milk among the population, and an increase in consumption of dairy products appear to be the key objectives of a one-shot subsidy provided by the Slovak Ministry of Agriculture in the second half of 2009 as a response to the enduring dairy crisis. We have identified three possible factors of the fast emergence of milk dispensers in Slovakia. First, the sale of raw milk directly to the consumer is preferable to selling the product to a processing plant because the final price is much higher with the dispenser. Second, we find a short pay-back period for milk dispensers (given the initially high milk sales), thereby suggesting that pioneering farms might have been led by this in making their decisions as to whether or not to start running a dispenser. The relatively high future discounted profits from the milk dispenser (in comparison to other activities of a farm) are the third factor for the emergence of milk dispensers.

While at the beginning of this research some farms were still opening new dispensers, the situation has changed significantly in the meantime. Not only do new vending machines not show up, but some farms have already decided to shut the existing ones. We have pointed to this possibility earlier (Drabik and Adame, 2011). The main reason for such a development is a sharp decrease in direct milk sales to the consumer (see Figure 1). Another reason is that milk dispensers have already been installed in all of Slovakia's major cities that have had potential for high sales (Pokrivčák, Drabik, and Rajčániová, 2011). A third contributing factor is the fact that the applications for the one-shot subsidy were accepted only up to the end of April 2010, leaving the farms seeking to open a dispenser after that date in a position of a financial disadvantage.

A lesson learned from the phenomenon analyzed herein is that policymakers should carefully consider the implications of their decisions – provision of the subsidy in this particular case – not only in the immediate future, but also from the medium and long term perspective. Otherwise, their market interventions may result in a waste of financial resources.

References

ATIS (Agricultural Market Information of Slovakia) (2009 and 2010): <http://www.apa.sk/index.php?navID=100>. Accessed: August 12, 2010.

BANTERLE, A. – CAVALIERE, A. – CARRARESI, L. – STRANIERI, S. (2011): Innovativeness in Food Small Business: What is its Relationship with Marketing? Agricultural Economics – Czech, *57*, No. 10, pp. 474 – 483.

BIKHCHANDANI, S. – HIRSHLEIFER, D. – WELCH, I. (1992): A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades. Journal of Political Economy, *100*, No. 5, pp. 992 – 1026.

BIKHCHANDANI, S. – HIRSHLEIFER, D. – WELCH, I. (1998): Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades. Journal of Economic Perspectives, *12*, No. 3, pp. 151 – 170.

BOEHLJE, M. D. – EIDMAN, V. (1984): Farm Management. First edition. New York: John Wiley & Sons, Inc. ISBN 0-471-04688-4.

BOUAMARA, M. Z. – RÉQUILLART, V. – JONGENEEL, R. (2008): Impact of a Gradual Increase in Milk Quotas on the EU Dairy Sector. European Review of Agricultural Economics, *35*, No. 4, pp. 461 – 491.

BROSIG, S. – RATINGER, T. (1999): Shifts in Food Demand of Czech Households during Transition. [IX European Congress of Agricultural Economists *European Agriculture Facing the 21st Century in a Global Context.*] Warsaw, Poland: The European Association of Agricultural Economists.

CIAIAN, P. – POKRIVČÁK, J. – BARTOVÁ, L. (2005): Slovak Agriculture in the European Union. Ekonomický časopis/Journal of Economics, *53*, No. 7, pp. 736 – 752.

DRABIK, D. – ADAME, M. (2011): Mliečne Stratomaty. SME, July 7, 2011.

FROHBERG, K. – WINTER, E. (2001): Functional Forms in Complete Demand Systems – Do They Matter for Policy Analysis? In: BROSIG, S. and HARTMANN, M. (eds): Analysis of Food Consumption in Central and Eastern Europe: Relevance and Empirical Methods. Halle Saale, Germany: Institute of Agricultural Development in Central and Eastern Europe (IAMO).

HORSKÁ, E. – ÜRGEOVÁ, J. – PROKEINOVÁ, R. (2011): Consumers' Food Choice and Quality Perception: Comparative Analysis of Selected Central European Countries. Agricultural Economics – Czech, *57,* No. 10, pp. 493 – 499.

HOSSAIN, F. – JENSEN, H. H. – SNUKA, R. (2001): Food Demand Pattern in Latvia: Evidence from Household Budget Survey. In: BROSIG, S. and HARTMANN, M. (eds): Analysis of Food Consumption in Central and Eastern Europe: Relevance and Empirical Methods. Halle Saale, Germany: Institute of Agricultural Development in Central and Eastern Europe (IAMO).

JANDA, K. – McCLUSKEY, J. – RAUSSER, G. (2000): Food Import Demand in the Czech Republic. Journal of Agricultural Economics, *51*, No. 1, pp. 22 – 44.

JANDA, K. – MIKOLÁŠEK, J. – NETUKA M. (2010): Complete Almost Ideal Demand System Approach to the Czech Alcohol Demand. Agricultural Economics – Czech, *56*, No. 9, pp. 421 – 434.

KAPSDORFEROVÁ, Z. – UBREŽIOVÁ, I. – POGRANOVÁ, Z. (2011): Analýza školského mliečneho programu. Acta Oeconomica et Informatica, *14*, No. 1, pp. 18 – 24.

KROL, N. – POLMAN, N. – PEERLINGS, J. – NIKOLOV, D. (2010): Changing Governance in the EU Milk Supply Chain. [Paper presented at IAMO Forum 2010: Institutions in Transition – Challenges for New Modes of Governance.] Halle Saale, Germany: Leibniz Institute of Agricultural Development in Central & Eastern Europe (IAMO), June 16 – 18, 2010.

MATTHEWS, A. (2010): Lessons from the 2009 EU Dairy Market Crisis. <http://capreform.eu/lessons-from-the-2009-eu-dairy-market-crisis/>. Accessed: September 11, 2010.

POĽNOINFO (2010): Mapa rozmiestnenia mliečnych automatov v SR. <http://www.polnoinfo.sk/zoznam-mliecnych-automatov-v-sr/>. Accessed: September 11, 2010.

POKRIVČÁK, J. – DRABIK, D. – RAJČÁNIOVÁ, M. (2011): Kto kupuje mlieko z automatu? Agromagazín, *8*, No. 1, p. 11.

RAPID (2009): Milk: Commission Temporarily Allows Member States to Pay Farmers up to €15,000 in State Aid. [Press release No. IP/09/1599.] October 28. <http://europa.eu/rapid/pressReleases Action.do?reference=IP/09/1599&format=HTML&aged=0&language=EN&guiLanguage=en>. Accessed: September 11, 2010.

SLOVAK STATISTICAL OFFICE (2010): Table: Spotreba vybraných druhov potravín na 1 obyvateľa. <http://www.statistics.sk/pls/elisw/casovy_Rad.procDlg>. Accessed: December 16, 2010

TURK, J. – ERJAVEC, E. (2001): Ascertaining Changes in Food Consumption Habits during Transition: The Case of Slovenia. In: BROSIG, S. and HARTMANN, M. (eds): Analysis of Food Consumption in Central and Eastern Europe: Relevance and Empirical Methods. Halle Saale, Germany: Institute of Agricultural Development in Central and Eastern Europe (IAMO).