MILK PRODUCTION STRATEGIES FOR FARMERS IN THE EU UNDER NEW POLICY REGULATIONS

Clemens Fuchs[1]

ABSTRACT

The recent reform of the agricultural policy in the EU provides totally new frame conditions for farmers. Main components of the reform are the decoupling of direct payments and particular for dairy farmers the reduction of intervention prices for milk products such as butter and SMP. The objective of this analysis is to develop strategies for dairy farmers considering the initial situation of four typical farm sizes at different productivity levels, debt-to-equity ratios and risk attitudes. The uncertainty of the price development for milk itself as well as for milk quotas will be covered using Monte Carlo simulations.

Due to decreasing intervention prices profitability of milk production is endangered in most dairy farms and the values of assets will decrease. For most low to medium efficient dairy farms it was found, that selling the cow herd and the reference quantity immediately would yield highest values for net worth. If the current favourable situation for selling the reference quantity is missed, continual production would be better.

For the remaining dairy farms it is most important to uncover all resources to improve efficiency by reducing production costs and increasing milk yields. These farmers can wait with further investments until milk quota prices have settled on the expected lower level.

Only high efficient dairy farmers, normally with higher milk yields and the advantage of econo-mies of scale can get profit from further milk production. The micro economic analysis derived from the typical farms concludes that quota is not longer limiting factor in all regions as long as there is still surplus of milk in EU and prices for dairy products on world markets are relatively low.

Keywords: CAP-Reform, milk production, optimal investment strategies, Monte Carlo simulation

1 INTRODUCTION

1.1 Situation on the milk market and the new CAP-Reform

Main components of the new reform of the Common Agricultural Policy (CAP) in the European Union (EU) are the decoupling of direct payments and the introduction of Cross compliance regulations. Particularly dairy farmers are most affected by the reduction of intervention prices for milk products such as butter and skimmed milk powder (SMP). Especially in Germany the profitability of milk production will decline for most dairy farmers due to the fact that the milk premium will be distributed to all land users, at least from the year 2013 on. Already the former Agenda 2000 CAP-Reform affected the milk market by increasing the milk reference quantities (milk quotas) by 1.5 % and deteriorating intervention conditions: declining intervention prices for butter and SMP and intervention limited in amount and period. The development of milk prices depends in fact on much more variables like the consumption of dairy products especially cheese, the world market prices of these products and the production of milk in the EU itself. All together the economic environment for milk production is much more depending on uncertainty than in the past.

Further prospects for the EU-Milk market are still higher milk quotas than consumption

[1]*University of Applied Sciences Neubrandenburg (e-mail: cfuchs@fh-nb.de)*

with the consequences that overproduction has to be sold under world market conditions and prices. Milk quotas constrain EU milk production while growing milk yields reduce dairy cow herds. Medium term perspectives appear positive for EU dairy markets due to:

– the increase in domestic demand for cheese and other value-added dairy products,

– the decrease in production of residual bulk products like butter and SMP facing lower support and market prices and,

– the increasing use of milk for the production of cheeses and other high value-added dairy products for the domestic market limits availabilities for exports (EU-Commission 2004).

But milk markets in the EU will fluctuate more in the future due to unstable world markets (Grams, 2005). According to this analysis, the reference quantity most probably remains a limit-ing factor with milk quota values above zero, but Grams (2005) also indicates situations, where prices for milk quotas tend to zero. Nevertheless the new CAP-Reform has consequences for farmers: the producer milk prices will deteriorate, the milk quota prices will decrease and the value of assets decrease also.

1.2 Objective

The objective of this analysis is to develop strategies for dairy farmers considering the initial situation of typical farm sizes and productivity levels. In the first part of the investigation, deterministic prices are assumed. In the second part, the uncertainty of the price development for milk itself as well as for milk quotas will be taken into account using Monte Carlo simulations.

Decision aid bases on gross margin calculation without considering decoupled premiums, as-suming that only high efficient milk production can continue with profit. The question to answer is: Should a farmer sell his operation and reference quantity even in the case, when assets are not full deprecated and debts remain? If the decision is made to quit milk production, then no doubt, this should be done before milk quota prices fall further.

From the official structural data four typical farms are derived. In addition, the analysis will be based on own data collected in 12 middle size to large dairy farms.

The options for dairy farmers are either to intensify and further specialise in milk production, and make more use of economies of scale by increasing the size of operation. Or they quit their milk production, slaughter the cows and sell the milk quotas. A third option would be to use existing facilities as long as possible or to the time of retirement of the farmer, but in this case avoid additional investments.

The goal of analysis is to derive recommendations for the use of rationalism reserves and opti-mal farm growth with respect to different farm types, debt-to-equity ratios and risk attitudes. The goal is to analyse the demand for reference quantity from a micro economic view (derived from farm level).

1.3 Dairy herd structure and milk yields in selected EU countries

The dairy herd structure in the EU (-15) differs a lot. In the EU-15, the important milk producers with more than one million cows are Germany with 4.5 million heads, France (4.1 million heads), Italy (2.2 million heads), Great Britain (2.2 million heads), the Netherlands (1.6 million heads), Spain (1.1 million heads) and Ireland with 1.1 million cows.

The countries with the most cows in larger herds (100 cows and more) are Eastern Germany and Great Britain, followed by Denmark. The average herd size is biggest also in Eastern Ger-

many, Great Britain and Denmark followed by the Netherlands. Besides the large structures there is a relatively high part of the milk cows still hold in small structures with less than 30 cows per herd in the following countries: Austria (90 %), Finland (78 %), Greece (44 %), Portugal (41 %) and Spain (38 %) even in Western Germany about 32 % of the cows are hold in this size class.

Due to the missing opportunities to benefit from economies of scale, the latter dairy operations will have more difficulties to compete in future, especially when it comes to reinvestment or to growth of a dairy operation. Another important criterion for the competitiveness of milk produc-tion is the level of efficiency and this can be measured proximal with the indicator "milk yield". Relatively high milk yields (Figure 1) together with low production costs (especially labour costs), like in the new member states Hungary and Czech Republic, seem to be a guarantee for a profitable milk production. Due to the reference quantities on national or even regional level, there is no direct competition for milk production capacities (reference quantities) on farm level between countries. To analyse the further prospects of individual dairy farms and to derive deci-sion devices, the situation in Germany is exemplarily described.

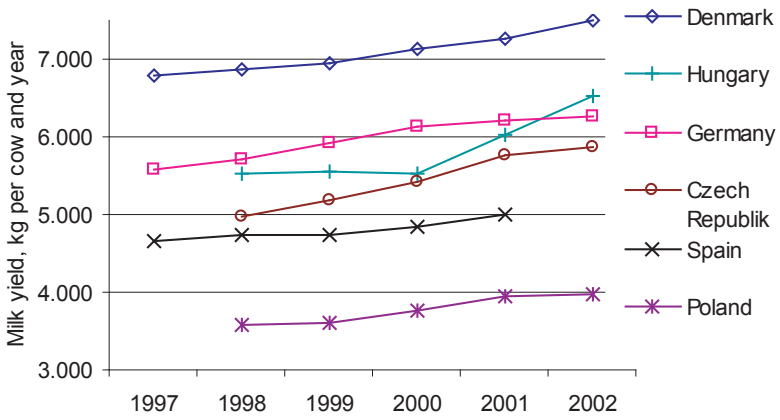

Figure 1: Average milk yields in selected European countries; Source: ZMP Bilanz Milch, 2004

2 PRICE DEVELOPMENTS ON THE MILK MARKET AND FOR MILK QUOTAS IN THE CASE OF GERMANY

In the period 2000 to 2005, producer milk prices had their maximum at 35 Centkg in October 2001 and decreased on average to 27 Cent/kg in March 2005. Milk prices in Eastern and West-ern Germany are quite near (Figure 2).

The two main factors, which force it to distinguish between regions, are the dairy herd structure and the prices for milk quotas. According to these selection criteria's two regions are identified: Eastern-Germany with large dairy herds and lower milk quota prices and Western-Germany with smaller dairy structures and higher prices for milk quota.

Since the introduction of the bourse for milk quotas in October 2000, up to the auction in April 2005, the average price for reference quantities of 0.33 €/kg milk quota in Eastern Germany is about half of the corresponding prices in Western Germany with 0.60 €/kg.

A strong dependency between producer milk prices and the prices for milk quota exists (Fig-ure 3). The result of regression analysis is, that R^2 proofs a strong relationship between the dependent variable "milk quota price" and the independent "producer milk price" at a level of

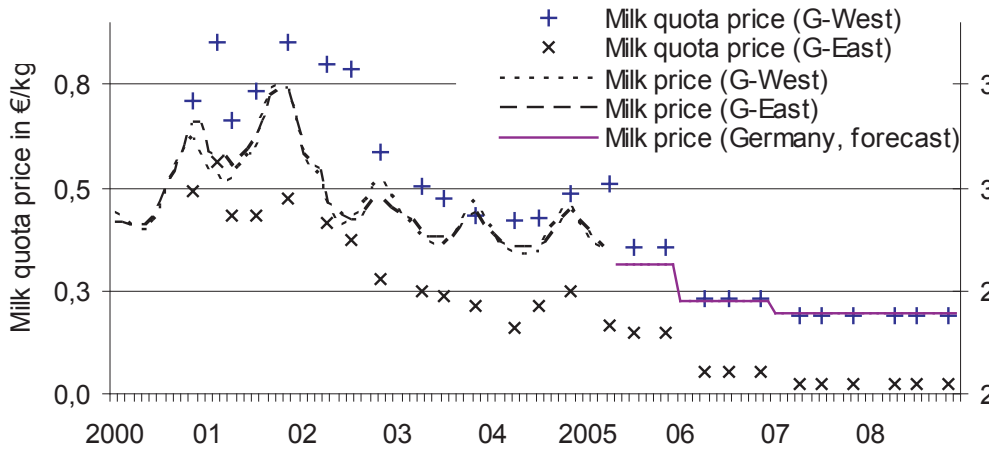

Figure 2: Development of the monthly producer milk prices and the milk quota prices in Germany (2000 to 2005) and, deterministic forecast of producer milk prices and derived milk quota prices for the years 2006 upwards
Source: ZMP, Deutscher Bauernverband, EU-Commission and own calculations

74 % to 80 %.

Due to the new CAP-Reform, further decreases of milk prices of 6 % in 2005 and in 2006 and of 2 % in 2007 are assumed. From 2007 onwards, average producer milk prices of 0.24 Cent/kg could be expected. The comparable milk price derived from the intervention prices for the milk products butter and SMP would be even lower at 0,22 Cent/kg milk (Gerlach, 2005, p. 39).

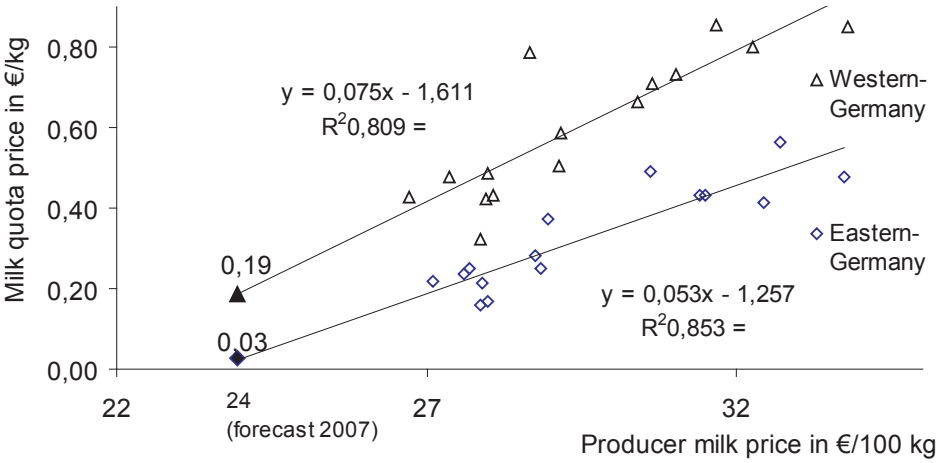

Figure 3: Dependencies between producer milk price and prices for milk quotas -2000 to 2005, forecast 2007 and up-coming years; Source: Own calculations

The further severe price reduction is also a value loss. At this point of discussion one can see a considerable advance if selling options are put in time to avoid net worth losses.

In Germany, supply and demand for milk quotas meet at the quota bourse, where the prices are building. If there is enough demand for milk quotas then the reverence quantity will be still the limiting factor, otherwise prices for milk quota will approach zero, at least in some regions. At least for Eastern-Germany, the forecast for this region are near null.

In a deterministic approach it is assumed producer milk prices decrease to 24 €/100 kg milk (Figure 2 and 3). Applying the regression equations of Figure 3 for the period 2007 onwards, the prices for milk quota would be estimated at 0.03 €/kg in Eastern-Germany and at 0.19 €/kg in Western-Germany. First analysis and decision advice is done for typical farms under the as-sumption of deterministic prices for the described typical farms. New advantages for dairy farm-ers are open due to cheaper growth options, but this is override by the disadvantage of pro-ducer milk prices.

3 FARM MODELS FOR DIFFERENT REGIONS AND INDIVIDUAL SITUATIONS

3.1 Four farm models

Four farm models have been selected to take into account variability in farm structure and re-gional differences of milk quota prices described above (Table 1). Farm I has 50 cows and is financed total with owners' capital (net worth 100 %). The production facilities are about 20 years old and could therefore be used for 10 more years. Family labour salary is calculated at a level of 10 €/hour. Farm II and Farm III hold 100 cows and are identical except that Farm II is located in a region with high prices for reference quantity (Western-Germany) and Farm III in a region with lower milk quota prices (Eastern-Germany). Farm IV has a larger cow herd of 250 cows. Its buildings are relatively new (10 years old) and the investment is financed half with bank loans (Table 1).

Table1: Typical farm models; initial conditions in 2005

Model	herd size	debt-to-equity ratios	age of stables*	labour wages	region
Farm I	50 cows	100 % net worth	20 years	10 €/h; family labour	high milk quota prices (W-Germany)
Farm II	100 cows	75 % net worth	15 years	13 €/h; hired labour	
Farm III	100 cows	75 % net worth	15 years	13 €/h; "-"	low milk quota prices (E-Germany)
Farm IV	250 cows	50 % net worth	10 years	13 €/h; "-"	

* maximal use 30 years. Source: Own assumptions

Economies of scale apply for labour and investment capital depending on the herd size (Figure 4). A cow herd of 40 cows up to 480 cows would need 54 hours down to 40 hours per cow and year, while the investment capital could vary from 5,000 € down to 3,000 € per stable place. The variable cost of milk production for replacement, feed, energy, veterinary etc. are mostly depending on the milk yields and increase from 1,478 € for a 6,000-kg-dairy cow to 1,826 € in the case of a 10,000-kg-dairy cow.

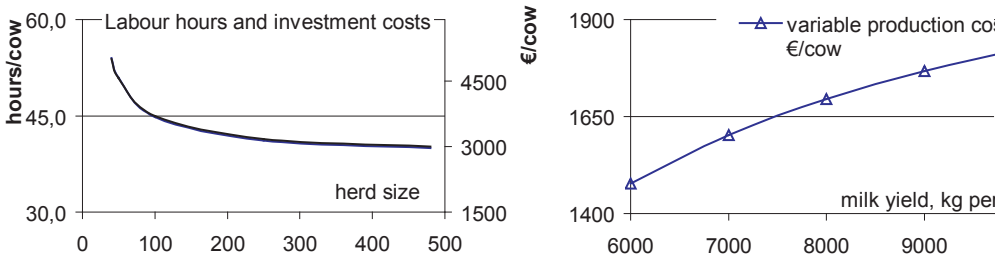

Figure 4: Labour hours and investment costs depending on herd size (left) and variable production costs depending on milk yields (right); Source: KTBL-Taschenbuch, 2002 and Datensammlung Brandenburg, 2005; own calculations

A planning farm model simulates cash and material flows on a yearly base. The net value is calculated from the variables material assets (buildings and cow herd) plus the value of the

reference quantity plus the financial assets minus the debts. Interest rates for savings are 2 % p.a., for long term loans 6 %, for short term loans 10 % and the income tax rate is calcu-lated at 20 % p.a. Further assumptions for the multi-period planning from 2005 to 2025 are in-creasing yields and increasing cost at the following levels: milk yields at +1 % p.a., labour costs and machinery costs +0.25 % p.a. and, decoupled direct payments decrease with 1 % p.a. In-creasing milk yields need compensation by quota purchase to keep cow herd size. The objec-tive is to find the optimal strategy for a certain farm type, which maximizes the end value of net worth in the year 2025.

3.2 Reserves in the production technique

The analysis is based on own data collected in middle size to large dairy farms (Fuchs et al. 2005). The investigation showed that most farms have an enormous potential to increase effi-ciency, for example by a longer operating use life of the cows. Own calculations show, that the optimal use time of a cow, considering technical-biological progress (yield difference between old and new cows 1,000 kg/dairy cow) is about 5 lactations for cows.

It is assumed that the reproduction rate at the beginning of the planning process is initially 38 %, which means that the cows are used in average for 2.63 lactations. Due to better extension service and better management practise the production efficiency could be improved, the repro-duction rate could be reduced by 1 % p.a. and the numbers of lactations could then increase to 3.33 years per cow. This would save about 100 € of reproduction costs per cow and year.

4 Profitability of milk production under deterministic price assumptions

4.1 Decision advice for farmers ready to quit milk production

In April 2005, the milk quota price was 0.36 €/kg reference quantity in Western Germany and 0.15 €/kg in Eastern Germany. If the profitability of the dairy operation would be higher in the case of selling the cow herd and the milk quotas than by continuing with milk produc-tion, then milk production should be stopped. The measure for the decision is in this analysis the value of net worth in the year 2025. The assumptions for quitting milk production are that dairy buildings would be further depreciated, but workers are assumed to find other jobs. In this cases loans run 10 more years and liquid cash would be saved on an interest rate of 2 % p.a. Additional revenue from selling of the not longer needed stables and buildings or finding other uses for them would further improve the here calculated economic values.

Farm I, with a herd size of 50 cows, should surpass an initial milk yield of 9,250 kg/dairy cow and year to keep the cows, otherwise should sell the dairy operation (cows and milk quo-tas). The threshold for Farm II and Farm III (each 100 cows) stays at more than 9,500 kg milk yield and, for Farm IV (250 cows) should reach at least 9,000 kg (Figure 5).

If a farmer would get a special offer (higher prices for selling) to sell his dairy operation, he even would sell the cow herd at a higher milk yield. On the other side, for farmers with higher milk yields it would be profitable to buy reference quantity at a higher price level than the equi-librium price of the quota bourse.

The maximum price for milk quotas depends also very much on the individual situation with respect of free capacities. If there are free stable capacities, due to increasing milk yields in the past, a marginal calculation based on investments only for cows and reference quantity would be appropriate. In these cases, the maximum prices for quota that dairy farmers can spend should be higher, or farmers with a lower efficiency (lower yields) should be able to com-pete. At present, when prices for milk quotas are expected to decrease, the dynamic component has to be considered and therefore it is not recommended to buy milk quotas immediately (in 2005), but to wait for lower quota prices and reduce free capacities by investing in 2007 and

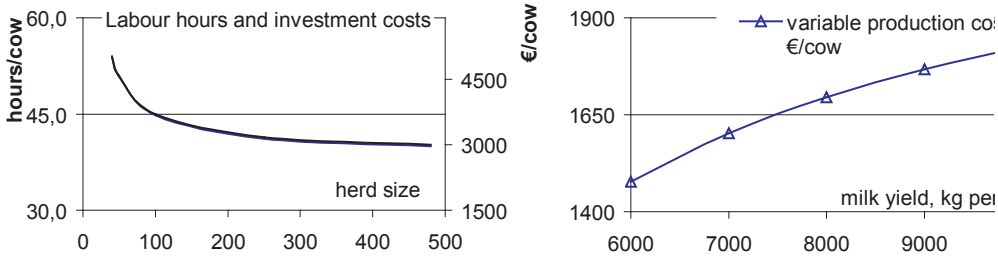

Figure 4: Labour hours and investment costs depending on herd size (left) and variable production costs depending on milk yields (right); Source: KTBL-Taschenbuch, 2002 and Datensammlung Brandenburg, 2005; own calculations

following years. The decision advice for low productivity dairy farms to sell immediately and for high prof-itable farms to delay further investments would put the more pressure the more it is followed on the prices for reference quantity.

4.2 Strategies, when optimal decision time is missed

As described before, prices for milk quotas could drop soon and fast. Then, farmers should rethink their plans to sell their dairy operation. The following analysis for Farm II compares two situations: first, continual production and second, selling delayed in a certain year. In 2005, at the beginning of the planning period, for all three considered milk yield levels (8,500, 9,000 and 9,500 kg/cow) it is recommended to sell the dairy operation and,

a) when the initial milk yield in 2005 is 9,500 kg/dairy cow, the end value reaches an amount of 604 T€ by 2025. Only in the first year it is recommended to stop milk produc-tion and sell quota and cows. This is because the prices for milk quota are still quite high in 2005. If this decision is not made in time, the farmer would be better off to con-tinue milk production.

b) an initial milk yield of 9,000 kg/dairy cow leads to an end value of 392 T€. The recom-mendation is to sell the dairy operation as fast as possible within the time frame of 3 years. After the year 2007, selling is not longer profitable and continuous milk produc-tion would be recommended by then.

c) with lower initial milk yields, there is no other choice but selling the cows. 8,500 kg milk yield generate only 43 T€ of net worth by 2025, while the selling option has far higher end values. The longer the decision is delayed, the higher the loss.

Similar results as shown here for Farm II exist for all the investigated 4 dairy farm types. In gen-eral, as long as selling the cow herd and the reference quantity in a certain year yields a higher end value (net worth in the year 2025) than the base scenario of continual production, it is rec-ommended to sell (Table 2). The higher efficiency (indicator milk yields), the more it is recom-mended to continue with milk production and not to sell the cow herd and the reference quan-tity.

4.3 Optimal investment strategies

The analysis so far considered relatively conservative strategies of selling the cows and the milk quota, continual production or marginal growth using idle production capacities. Without any doubt, profitable dairy farmers will take over reference quantities for sale and increase produc-tion. The individual optimal strategy is derived using the Solver procedure of Excel. Changeable variables are the size of the cow herd. The number of cows can be increased as

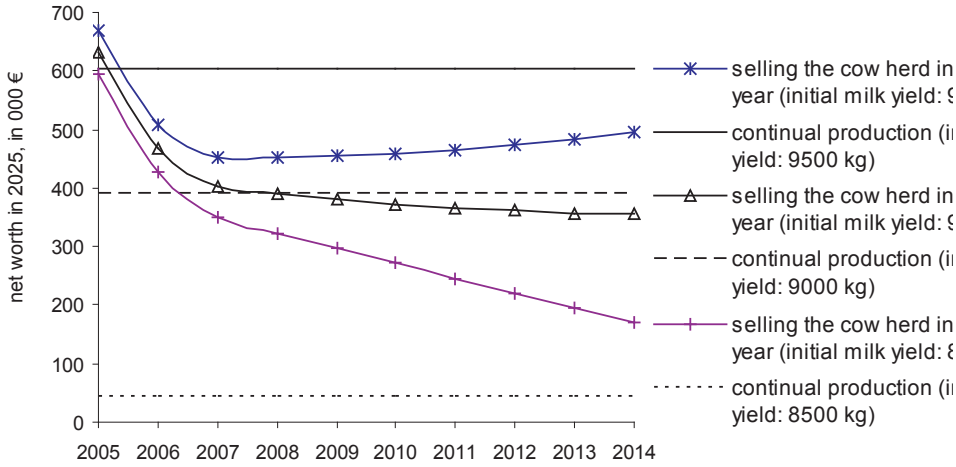

Figure 6: Thresholds for continuous production or selling option for **Farm II**; Source: Own calculations

Table 2: Comparison of net worth (end value 2025) between selling the cow herd and milk quota or continual production, depending on farm type, initial milk yields and time of selling

	initial milk yield in 2005 kg/dairy cow	net worth with continual production …* end value 2025 in T€	advantage of selling the cow herd (and quota) in a certain year – difference of the net worth (end value in 2025) compared with continual production 2005	2006	2007	2008	2009	2010
Farm I	9000	379.6	**22.0%**	**1.8%**	-5.3%	-5.5%	-5.4%	-5.1%
	8500	312.0	**40.8%**	**15.8%**	**5.7%**	**3.9%**	**2.5%**	**1.3%**
Farm II**	9500	604.1	**10.6%**	-16.0%	-25.3%	-25.2%	-24.8%	-24.0%
	9000	391.7	**61.3%**	**19.3%**	**2.4%**	-0.4%	-2.9%	-4.9%
	8500	43.3	**1275.7%**	**886.0%**	**707.9%**	**646.9%**	**586.9%**	**527.8%**
Farm III	9000	369.8	**26.7%**	-5.1%	-17.7%	-19.3%	-20.5%	-21.0%
	8500	136.8	**222.2%**	**131.8%**	**90.0%**	**75.6%**	**62.2%**	**50.0%**
Farm IV	8750	116.5	**431.8%**	**169.0%**	-13.2%	-80.7%	-158.9%	-250.2%

* with continual production and saving (interest 2 % p.a.) after the assumed remaining life time of the stables (10 to 20 years, see Tab. 1: Farm models); ** see Figure 6; Source: Own calculations

long free ca-pacities are available, otherwise investment in buildings are necessary. According to need or surplus of milk quota, reference quantities could be sold or have to be purchased.

If a Farm from type I wants to continue with milk production and has idle capacities (20 % as-sumed), then the additional 10 cows should not be purchased before the year 2007 (Figure 7). The reason for the delay is that milk quota prices assumed to decline due to producer milk price fall. Nevertheless, selling the dairy operation in time would be the first choice (see chapter 4.1).

Assets and net worth decline strong due to depreciation of milk quota values and due to linear depreciation of buildings. Linear depreciation of buildings continues between the years 2005 up to the end of remaining use time. For Farm IV, the debt-ratio is initial 50 %. After the debts have been cleared in 2015, cow herd growth is recommended. The optimal growth path is according to the increase in net worth. By the year 2020 the herd size would increase to 355 cows and by 2025 to 511 cows. The different farm types have their optimal investment strategies depending on the initial yield level (Table 3).

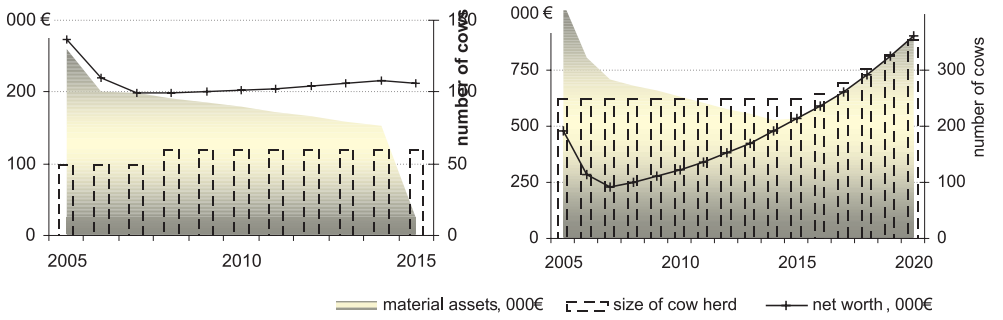

Figure 7: Optimal investment strategies for **Farm I** (left, 20 % free capacities, 8,500 kg milk/cow) and **Farm IV** (right, 9,500 kg milk/cow); Source: Own calculations

4.4 Risk Analysis

In the future, milk prices (and most other costs of production factors) could vary from the deter-ministic price average assumption used in this analysis before. Grams (2005) finds in his analy-sis, that due to world market influence, the milk price variation in the EU could be plus/ minus 0.30 Cent per kg milk. Here, in a Monte-Carlo analysis with 10.000 simulations, the milk prices are randomly calculated according to a triangle distribution. In the year 2007 and follow-ing, the producer milk prices vary then from 0.21 to 0.27 €/kg. The respecting prices for milk quota are derived applying the before estimated regression equations (Figure 4). Milk quota prices are then determined between 0 and 0.41 €/kg reference quantity in Western Germany and between 0 and 0.19 €/kg in Eastern Germany.

Here again a decision about the prospects of the individual dairy operation should be made by comparing the selling option with a further milk production. If the end value of net worth for the scenario of selling is higher than most other end values, which could be derived when the milk production would be continued, then selling is recommended. In Figure 8, there is only one real good situation, where even when lower milk prices are expected, a continual produc-tion yields a higher end value. This is for Farm III, with an initial milk yield of 10.000 kg.

Farmers, who expect more favourable conditions (higher milk prices, more efficient pro-duction at lower production costs), which results are represented by the right side of the distri-butions, should stay with milk production. The probability that such favourable situations could occur are zero for a farm with initial milk yields of about 8,000 kg, 4 % (Farm I) and 7 % (Farm III) for 9,000 kg yield level and 36 % (Farm I) and 98 % (Farm III) for 10,000 kg/cow.

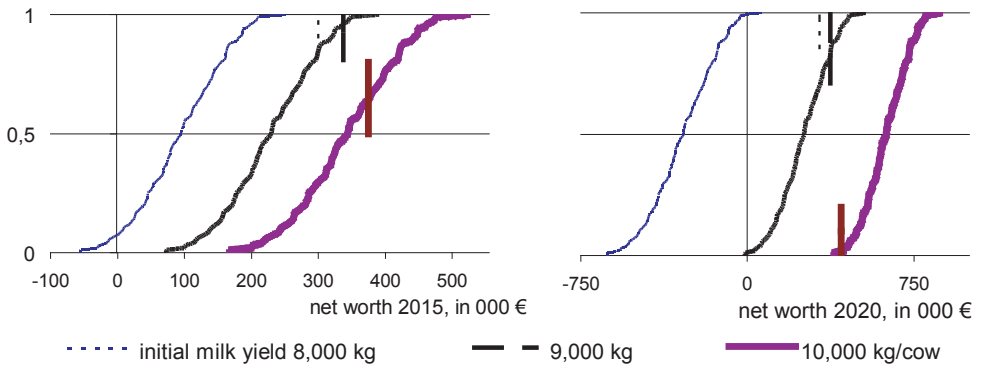

Figure 8: End value of net worth for **Farm I** (left) and for **Farm III** (right) with continual production (distribution curves) or when selling the cow herd (vertical lines); Source: Own calculations

Assessing the further development, it could be concluded, that the economic situation for dairy farmers are not favourable due to the expected decline of producer milk prices. Reverence quantity could become a surplus, at least in some regions.

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