Needs for Risk Hedging in Crop Production Exemplified for Northeast Germany[1]

Clemens Fuchs, Theodor Fock und Joachim Kasten, Neubrandenburg

Abstract

Yield fluctuations as a result of climatic influences can be a significant risk for farms. Marginal soils with a low yield potential in connection with comparatively unfavorable climatic conditions, as found in parts of Northeastern Germany, are particularly affected. The analysis of individual and field-related revenues demonstrates that fluctuations are much higher than regionalized yield averages show. Since farmers know their fields, it is assumed that typical operating strategies to avoid risk, such as rotation planning and adopted cultivation practice, already exist. This study analyzes crop insurance schemes, which currently are not offered in Germany, as an additional tool for risk management.

The results of the ex-post analysis and ex-ante simulations show that risk management crop insurance schemes may have significantly positive effects, especially on marginal sites. Such insurance could help to avoid bankruptcy. For the insurance industry crop insurance policies are quite interesting business areas. In particular a revenue insurance scheme could be offered for marginal locations with severe fluctuating yields. Agricultural policy must take into account that the yield insurance scheme discussed here, which claims a yield loss exceeding 30%, is of interest only for a few locations, because such high yield losses were rarely observed at the better sites. For the marginal sites the grant of 60% of insurance premiums is a subsidy of about 10 €/ha, which a company is not likely to refuse.

1 Introduction

Income, price fluctuations, and natural calamities such as animal diseases and natural disasters are the typical risk factors in agricultural production. The risk inherent in farming in northeast Germany (Mecklenburg-Western Pomerania, Brandenburg) is greater because of low rainfall. In Germany, neither private nor state-level risk-hedging instruments against income fluctuations are used (except hail insurance). From the perspective of the insurance industry, solutions already exist for a better risk hedge in case of income fluctuations due to natural events (AgE 2007a and Vereinigte Hagel 2007).

This analysis focuses primarily on the current level of income fluctuations for different locations at the enterprise level. The objective is to present possible individual adaptation strategies for agricultural risk management in crop production. Recommendations for the insurance industry and the policy can be derived.

The German state of Mecklenburg-Western Pomerania is selected as an example. As in the neighboring regions, particularly Brandenburg, major weather-related crop yield fluctuations were seen in recent years. Moreover, crop production is particularly important here.

The database comprises the observed yield fluctuations at the field level of farms at four different locations in the period from 1997 to 2006. The method used for risk analysis is Monte Carlo simulation. In addition to climatic influences (crop yield) and market conditions (product price), agricultural policy (CAP reform, Health Check, EU Commission 2008a) also influences the economy and the risk of crop production. Model calculations at the farm level help to identify hedging strategies such as revenue insurances or yield insurances, and their impact on operating results are presented. This study uses an ex-post analysis with ex-ante simulations.

[1] This analysis is based on a research project funded by the Edmund Rehwinkel-Foundation (Fock et al., 2008), developed further with respect to the EU CAP-Reform in 2008 (Health Check)

2 Description of the Study Sites

The extent of yield fluctuations and the impact on operating results are analyzed on the basis of farm data. For the ex-post analysis of a ten-year period (1997 to 2006), the yield data from a total of about 1,200 plots of arable land are evaluated to measure the extent of yield fluctuations. The four study sites include: the high-yield site Klützer angle; a location of middle yields, the Teterow and Malchin basin; and two locations of marginal land in the southeast of Mecklenburg-Vorpommern. These sites show different yield margins for winter wheat and rapeseed due to different soil quality and rainfall distribution (Table 1).

Table 1: Median and range for yields of wheat and rapeseed at four sites in Mecklenburg-Vorpommern (dt/ha) 1997-2006

Location	Culture	Minimum	Median	Maximum
Good location (55 soil points)	Wheat	78	83	88
	Rapeseed	34	40	47
Middle site (43 soil points)	Wheat	57	70	78
	Rapeseed	33	41	45
Marginal location 1 (32 soil points)	Wheat	38	65	75
	Rapeseed	16	34	46
Marginal location 2 (29 soil points)	Wheat	37	63	70
	Rapeseed	23	34	41

The minimum, median and maximum values are the parameters of the triangle distributions with which the ex-ante yields are simulated (see Chapter 5). Source: Analysis of data from four farms

Figure 1 is an example of the two extreme locations showing that the yield levels are expected to differ between different locations, but also that much larger yield fluctuations exist at the marginal sites. In years with less favorable weather conditions there are significant declines in yields.

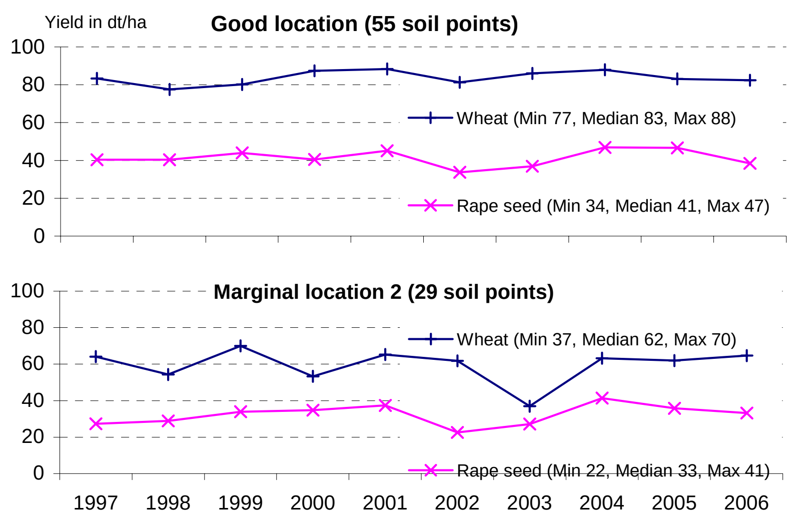

Figure 1: Development of wheat yields and rapeseed yields at extremely good or marginal investigation sites. Source: Analysis of operational data; own representation.

At operating level, the average yield for individual crops, e.g. wheat and rapeseed, is calculated. This aggregation considers that at the farm level, differences between individual fields can be offset and therefore the risk of yield fluctuations between fields will not be further investigated. The scatter diagrams show that there are only small correlations between the yield levels for cereals (wheat) and rapeseed, and these will largely occur independently. Thus through diversification within the rotation, the risk may already be reduced. Figure 2 illustrates this relationship for the two extreme locations.

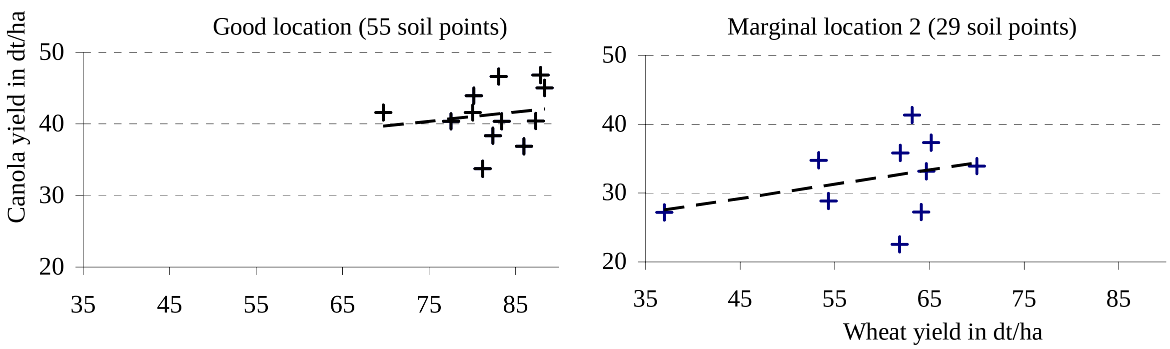

Figure 2: Scatter plots of wheat yields and rapeseed yields at the good location and the marginal location 2. Source: Analysis of operational data; own representation.

3 Operating Model

All four sites assume the same operating model in relation to the equipment factors.[2] In comparing sites with regard to the weather risk, only crop yields and their variations are taken from the investigation sites. Other farm specific factors, such as size or livestock, which are not primarily weather related are excluded. The model farm operates 300 hectares of arable land, which is rented. The rotation consists of two-thirds cereals (200 ha of wheat) and one-third rapeseed (100 ha). As yield data over a period of ten years is available for all four sites, an ex-post analysis of the economic development considering the effects of revenue insurance and yield insurance is investigated first. In the subsequent ex-post simulation, the economic development over a period of ten years is also analyzed.

The planning method is a full financing model based on expenditure and revenue time series, including investment and private withdrawals. The business analysis includes the development of profit, taxes and equity. At the beginning of the planning period machinery in the amount of € 600,000 is invested. The machines are depreciated within 10 years and must be replaced.

The initial conditions consider own funds in the amount of € 150,000 (25% equity). In addition, the investment can be covered by a 10-year loan at 8% interest. Liquidity constraints eliminate a current account at an interest rate of 12% up to a maximum of € 50,000 or more to an overdraft interest rate of 5% per annum. Savings are possible at an interest rate of 2% per annum. The profit and shareholders' equity are calculated considering income taxes, while an average tax rate of 25% is assumed. Figure 3 shows the development of the property and financial assets in the planning period of ten years for the two extreme locations.

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[2] Sources for the farm model and gross margin calculation for crop production: Statistical Yearbook on Food, Agriculture and Forestry and ZMP (various years); Farm data from four sites; Agricultural Report of Mecklenburg-Vorpommern 2006 (crop production) and official data base of Brandenburg (2005)

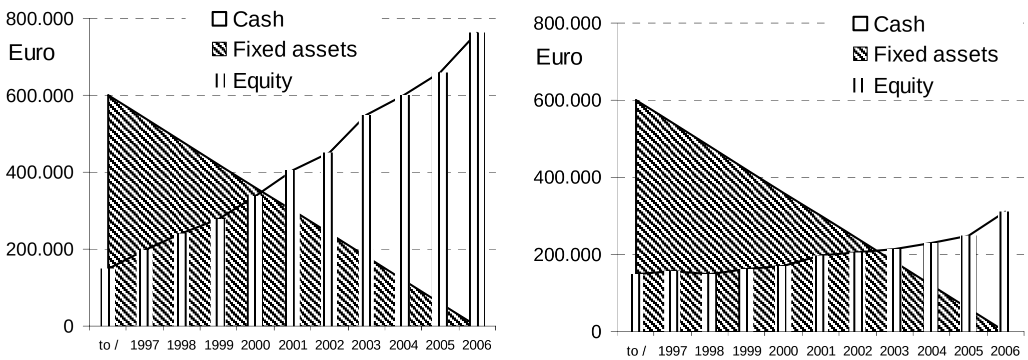

Figure 3: The development of the property and financial assets - ex-post analysis, without insurance (left: good location; right: marginal location 2)

There are four criteria for assessment of economic efficiency, profitability, and risk:

a) the average profit after taxes in the ten-year planning period
b) the distribution of profit after taxes and its standard deviation
c) the equity at the end of planning period ($_{t10\ =\ 2006}$)
d) the likelihood that the company would have to file for bankruptcy due to insolvency when equity drops below zero.

Profits and equity tend in the same direction; profit after tax shows an increase in equity, while losses melt the equity. Therefore, it would be sufficient to indicate the average profit after tax and its fluctuation (standard deviation) in the following tables.

4 Insurance Models

Crop insurances are discussed here as a supplement to existing insurance against hail and fire (Vereinigte Hagel 2007). In view of the current debate on climate change and its consequences primary weather-related damage should be covered, such as drought, frost and flood (similar to crop insurances in Spain and the United States). Two insurance models are analyzed here: revenue insurance and crop yield insurance according to EU guidelines[3] (European Commission 2008b):

a) Insurance of the average revenue of a crop, while the compensation will be the difference between the insured and the (lesser) actual revenue. However, there is no economic damage if rising product prices compensate for the income loss. Compared to good locations, marginal sites have lower natural yields and therefore lower insurance values (Table 2).

b) Insurance of crop yields caused by adverse weather conditions such as frost, hail, ice, rain or drought, but not a total failure due to hail (hail insurance) or fire (fire insurance). The possible variation of the revenue will be derived from the observations of the ten-year period (1997 - 2006) (Table 3). The conditions for the profitability of insurance are in line with the EU proposal (European Commission 2008b) defining the insurance case for yield losses above 30% of average yields. Two cases are considered:

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[3] Article 69 - Crop Insurance:
(1) ... ... adverse weather conditions such as frost, hail, ice, rain or drought, under which more than 30% of average annual production ... were destroyed.
(2) The per-farmer granted financial contribution is fixed at 60% of the amount of insurance premiums. (European Commission 2008b)
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b1) without government subsidies
b2) with 60% subsidy to the insurance premiums (for modulation).

Compensation is calculated 89 the yield difference (average minus actual yield) times the average crop price. The threshold for compensation is a loss of at least 30% of the average yield. Fair insurance premiums are defined by the balance of deposit and payout; for all four sites they are shown for the revenue insurance in Table 2 and for the yield insurance in Table 3. The revenue insurance proceeds in all cases, once the actual revenue falls under the insured value. This occurs quite often in the case of revenue insurance. In all cases this happens at least in half of the years and for the marginal location 2 up to 60% of the years (Table 2).
The fair net premium amount is between 20 €/ha and 35 €/ha. Per definition, farmers spend just as much as they get paid back over the years. The clear benefit of this zero-sum game is the liquidity effect: Deposits in good years offset liquidity constraints in bad years.
In reality, there is a second aspect as well, which can be termed the solidarity effect: The assistance is not limited by the payment of the individual, but extreme individual losses can offset solidarity. The latter effect, however, is not explicitly mapped in this study.

Table 2: Revenue insurance model and fair insurance premium, ex-post

		Location			
		Good	Medium	Marginal 1	Marginal 2
Insurance sum [1)] in €/ha	Wheat	948	787	682	674
	Rapeseed	870	830	695	680
Insurance claims	Revenue loss	5% - 11%	1% - 13%	5% - 33%	2% - 19%
	Number of years	5 of 10 years	5 of 10 years	5 of 10 years	6 of 10 years
Fair net insurance premium	€/ha	33	21	34	25
	in %[2)]	3.6%	2.6%	5.0%	3.7%
Gross insurance premium [3)]	€/ha	43	27	44	33
	in %[2)]	4.7%	3.4%	6.5%	4.8%

1) Revenue = average revenue yield at each location x average price, with wheat prices of 11,3 €/dt and rapeseed prices of 21,1 €/dt
2) of the weighted insurance sum
3) Surcharge to the net insurance premium: factor 1,3 (Berg, 2002, p. 123)

Basically there are many different variants of insurance model designs, which may differ in relation to data requirements and administrative expenses (Mußhoff, 2008). If, based on the above case of revenue insurance, the insurance claim were more limited, for example by the introduction of a deductible, then frequency of insurance claims and the payout amount would lessen, as noted below for the yield insurance without grants.
With a rigid yield insurance, which restricts claims to natural losses over 30% of the average yield, claims are relatively rare. At the marginal location 1, in only one of ten years, in 2003, yields were lower by 33% for rapeseed and 38% for wheat. At the marginal location 2, yields fell in two of ten years, once by 30% for rapeseed (in 2002) and the other by 38% for wheat (in 2003). The fair net premium is between 24 €/ha and 29 €/ha (Table 3).

Table 3: Yield insurance model (EU model, compensation from 30% by average income compared to income and 60% subsidy to the insurance premiums from the state) and the fair premium, ex-post

		Location			
		good	medium	marginal 1	marginal 2
Average yield	Wheat	84	70	60	60
	Rapeseed	41	39	33	32
Insurance claims [1)]	Number of years	0	0	1 of 10 years	2 of 10 years
Fair net insurance premium	€/ha in %[2)]	0	0	29 4.2%	24 3.5%
gross insurance pre-mium [3)]	€/ha in %[2)]	0	0	37 5.4%	31 4.6%

[1)] Yield loss > 30%
2) of the weighted insurance sum
3) Surcharge to the net insurance premium: factor 1,3 (Berg, 2002, p. 123)

5 Ex-post analysis of the reference time period

In the ex-post analysis yields and prices of the years 1997 to 2006 (10 years) are considered. Direct payments in the initial situation are 300 €/ha. An equity share of 25% is assumed. It is possible to achieve relatively safe gains in crop production. In the planning period, dynamic effects, particularly with the liquidity and capital development will be displayed. The model farm is a farming operation with 300 ha. The rotation consists of two-thirds cereals (wheat) and one-third rapeseed. Figure 4 shows the effect of the various insurance schemes: In a year with no insurance case, the profit (after tax) is lower with than without insurance. In a year with an insurance claim and an insurance compensation, profit rises comparatively.
Revenue insurance pays out more frequently, because minor damage is compensated already. Thus e.g. for marginal location 1 in 2000 and 2003, a loss could be avoided.
In the case of yield insurance, compensation payments would have to be made only once, in 2003, for marginal location 1 and only in 2 of 10 years (2002 and 2003) for marginal location 2, because only in those cases was the yield loss over 30% (EU model).

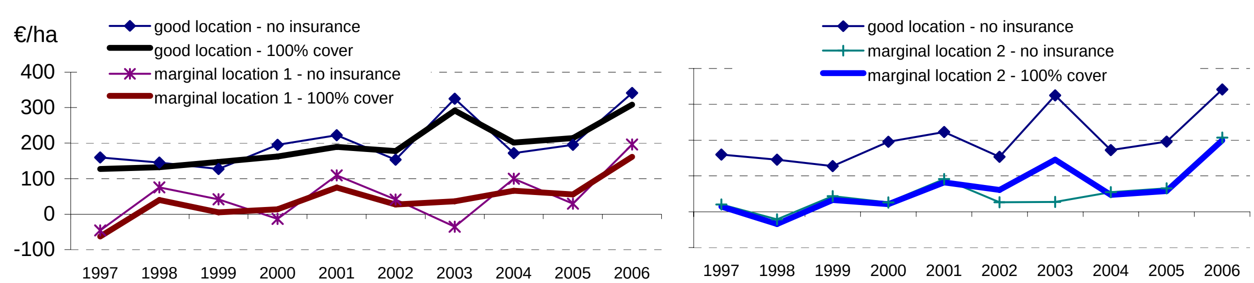

Figure 4: Profit after tax (ex-post) - Revenue hedge (left) and yield insurance (right)
Source: own presentation.

Because no danger of bankruptcy cases could be detected in the past (ex-ante analysis), this criterion cannot be regarded as decision support. This approach is expanded in Chapter 6, Ex-ante Simulations). Results of the ex-ante analysis are presented here.
With revenue insurance, risk and profit decline with increasing coverage. Figure 5 reflects this in the curve from the upper right (100% coverage) to the lower left (no insurance). Companies pay the insurance premium for the risk reduction, because the insurance premium represents
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the cost of risk reduction. The average profits decline about 5 to 10 €/ha, while the standard deviation decreases by amounts from 500 € (medium site) to 4,900 € (marginal location 1) (Table 5).

What insurance coverage is sought will depend on the risk aversion of the farmer. First, ex-post, there is no risk of insolvency due to the direct payments (300 €/ha) and always sufficient equity. In one case (medium site), the least risk is achieved if coverage reaches 75%. At 100% coverage standard deviation increases again.

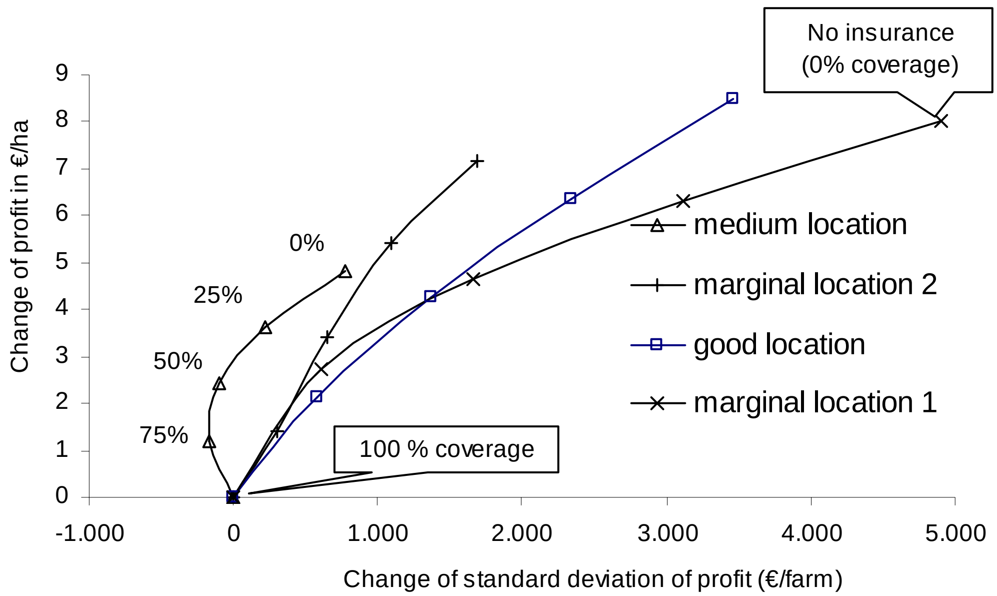

Figure 5: Change of profit and change of standard deviation in the ex-post analysis of a revenue insurance for four locations, direct payment of 300 €/ha and coverage-dependent (100%, 75%, 50%, 25% and without insurance)

The yield insurance without state subsidies shows a decline in profit as coverage increases; in other words, the insurance costs money. With increasing coverage (25% to 50%) the standard deviation of profit decreases initially, but increases again until, at 100% coverage, it is even higher than without insurance.

The yield insurance with subsidies, the curve is to interpret reversed. With increasing coverage the profit rises due to the state subsidy to the insurance payment (Fig. 6, from lower left to upper right). At the same time, fluctuations increase. The transfer of income through the yield insurance according to the EU scheme is ex-post about 10 to 12 €/ha, as compared to the situation without insurance.

The yield insurance (EU scheme without subsidy) is not of interest for farmers, since yield loss over 30% occurred in only a few years. Profitability declines (due to insurance costs) and risk increases (higher variance).

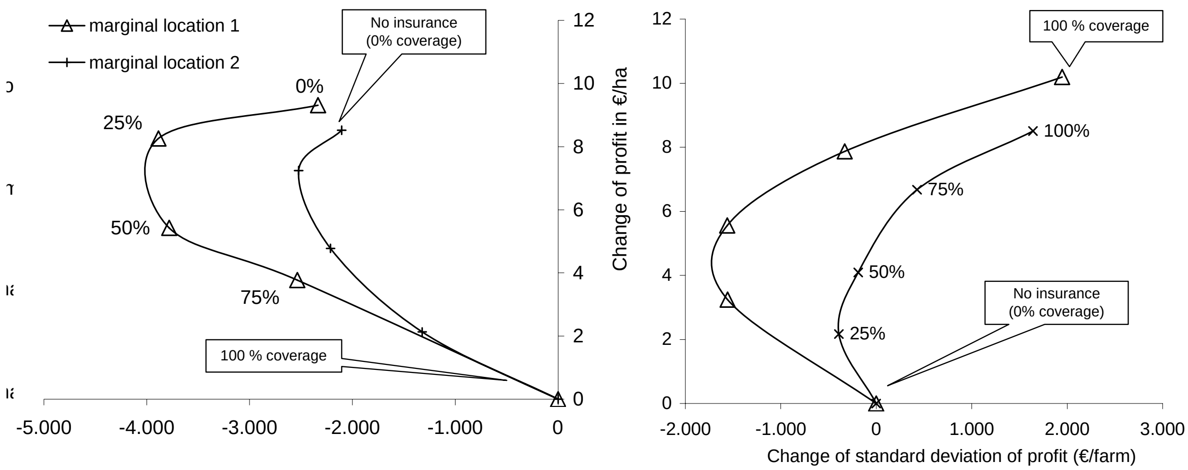

Figure 6: Change of profit and change of standard deviation in the ex-post analysis of a yield insurance for four locations, direct payment of 300 €/ha and depending on the coverage (100%, 75%, 50%, 25% and without insurance); left without a government subsidy to the insurance premiums, right with 60% subsidy, where profit growth by income transfer

Table 4 shows the average profit per hectare and the standard deviation as a result of the ex-post analysis for the period 1997 to 2006 for the four locations, with and without crop insurance for the revenue and yield-based insurance variants, the latter with and without government subsidy.

Table 4: Comparison of profit levels after tax (€/ha), and risk (standard deviation of the profit in €/year and farm) in different insurance solutions, ex-post analysis for the period 1997 to 2006

		Without insurance	Revenue insurance	Yield insurance without subsidy	Yield insurance (60% subsidy)
			100 % coverage		
Good location (55 soil points)	Profit after taxes	204	195	---	---
	standard deviation	22,104	18,642	---	---
Medium location (43 soil points)	Profit after taxes	130	124	---	---
	standard deviation	18,448	17,630	---	---
Marginal location 1 (32 soil points)	Profit after taxes	50	42	41	60
	standard deviation	22,104	17,200	24,439	24,052
Marginal location 2 (29 soil points)	Profit after taxes	54	47	45	62
	standard deviation	18,481	16,796	20,586	20,122

--- Not relevant: Yield fluctuations are lower than 30% and thus irrelevant for the yield insurance scheme

6 Ex-ante Simulation

Unlike the past, much greater volatility and economic impact is expected in future. The limited observation period, as well as climate change, globalization and the resulting volatility in commodity markets all contribute to increased risk. Myriad possible situations are considered using simulations. The advantage of the Monte Carlo simulation applied here and the subsequent analysis is that both the range of potential benefits and the unfavorable price-cost combinations in individual years can be portrayed with corresponding probabilities.

Crop production risk consists of yield risk and market risk. While the yield risk is highly location-dependent and therefore must be judged locally, the market risk, or more accurately the price risk is determined by global developments. The first step is identifying the price fluctuations of wheat and rapeseed.

The prices for these crops are regulated by national, EU and international forces of supply and demand. As a first indicator, the historic price development in Germany is used. Producer prices fall with rising yields and vice versa. This opposing motion reduces the economic risk for the farms.

Producer prices are derived from the ZMP database for 2000 to 2006 (rapeseed, wheat) and 1995 to 2006 (quality wheat) (Fig. 7). Yield variation explains about 30 to 50% of the price variation in these years.

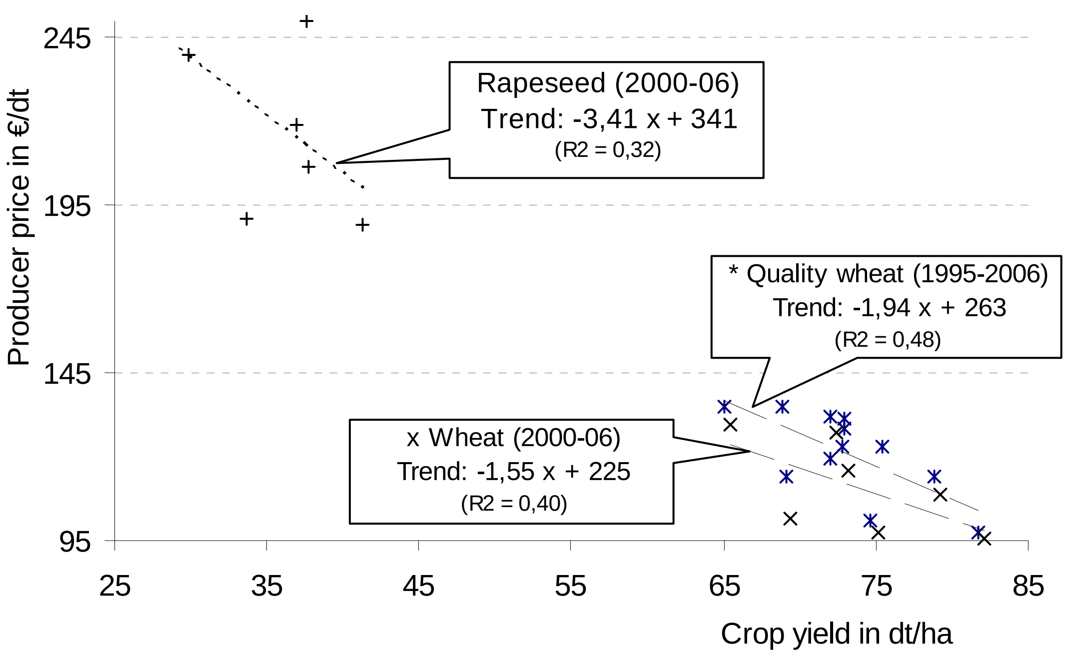

Figure 7: Correlation between crop yield and producer price for wheat and rapeseed in Germany. Source: ZMP, various years; own calculations.

Competitive pressure intensifies in crop production, for example due to declining future direct payments under the reform of EU agricultural policy and increasing price fluctuations caused by volatile global commodity markets, if external protection is further reduced. The 2007/08 marketing year was particularly volatile, with producer prices ranging from 25 to 30 €/dt for wheat and 45 to 50 €/dt for rapeseed. These examples show that new insurances could be of interest, and even necessary.

In the simulations yield fluctuations are assumes as shown in Figure 1 and the spreading of the producer prices as shown in Figure 7. The calculation procedure is as follows:

1) First, in a Monte Carlo simulation the crop yields for the site are simulated, using triangle distributions (Table 1).

2) However, not local revenues for the subsequent price finding process is crucial, but the supra regional supply. In a second step the relationship between average local crop yield and average nationwide crop yield, taking into account the in the past observed variations of both averages, an "average yield for the region Germany" will be calculated.

3) The third step is to estimate the producer price on the basis regression analysis between yields and prices (Fig. 7). Again, past observations of the variations in individual years are known and can be applied. This range is put in a triangle distribution. For example, on the marginal location 2 wheat prices could fluctuate in the extreme between € 6.50 and 18 €/dt and rapeseed prices between 11 and 34 €/dt.

The simulation covers a much broader risk, so that for example several bad years could occur in sequence and thus both the liquidity of the enterprises and the burden on the insurance company would be larger than previously seen. Criteria for assessing the economic effects on a farm are:

a) the shareholders' equity after the 10 years planning period
b) the standard deviation of this size and final values
c) the frequency that a company become insolvent and therefore could declare bankruptcy

The economics of agriculture change with the ex-post simulations because of the greater price volatility, especially if further CAP reforms continue to reduce direct payments. The increasing volatility of markets in otherwise identical conditions (direct payments 300 €/ha, 25% equity share in t_0) leads to low profits and higher risks apparent in the rising standard deviation, and the smaller end value in equity at the end of the planning period. The shrinkage of equity can lead in 11% of cases to bankruptcy at the two marginal locations (Table 6). Here, if nowhere else, insurance solutions come into play since insurance contracting should prevent existence-threatening situations. To what extent revenue insurance schemes or yield insurance schemes could be a solution is then explained. First, however, a brief mention of possible political and structural changes is given.

With a reduction of direct payments by 25%, from 300 €/ha to 225 €/ha, the average profit at the good location would decrease from 204 €/ha to 126 €/ha, a difference of 78 €/ha, while for the other locations the loss would be even greater: 94 €/ha for the medium site, and 156 €/ha, or 185 €/ha for the two marginal locations (Table 5).

The difference in the final value of the equity would be considerable. The losses vary between about € 230,000 at the good location and about € 550,000 at the marginal location 2. The companies at the two marginal sites would be endangered, because in 78% and 91% of cases they would use up their equity and would have to declare bankruptcy. These high losses may not be covered by insurance. Structural adjustments would become necessary, to integrate technological progress or make organizational changes in the farm structure. The last column in Table 6 illustrates such a situation, with the higher equity share due to lower private withdrawals or the investments of other firms. In very practically terms, it is not unlikely that capital is accumulated in the first decade with high direct payments, as in the ex-post analysis (Fig. 3), and can be used in the next decade for reinvestment. As explained above, it would be possible to achieve an equity share of slightly over 50% even at the marginal sites (see Chapter 3).

Table 5: Comparison of economic variables of simulation runs without insurance at reduced direct payments and changes in capital structure

		Ex-post 1997-2006	Ex-ante Simulation (10 year planning horizon)		
		Direct area payments			
		initial 300 €/ha		reduced 255 €/ha	
Location	Variable	equity share in t_0: 25%			50%
Good location (55 soil points)	Profit after taxes, €/ha	204	187	126	145
	Standard deviation, €	22,104	21,367	21,133	19,770
	Shareholder equity, € in t_{10}	760,929	711,040	526,510	735,499
	Bankruptcy risk in %	0	0%	0%	0%
Medium location (43 soil points)	Profit after taxes, €/ha	130	104	36	62
	Standard deviation, €	18,448	19,885	20,959	18,209
	Shareholder equity, € in t_{10}	540,089	460,595	259,381	486,919
	Bankruptcy risk in %	0	0%	1%	0%
Marginal location 1 (32 soil points)	Profit after taxes, €/ha	50	10	-106	-27
	Standard deviation, €	22,104	26,067	26,227	26,414
	Shareholder equity, € in t_{10}	299,631	180,863	-166,865	218,932
	Bankruptcy risk in %	0	11%	78%	2%
Marginal location 2 (29 soil points)	Profit after taxes, €/ha	54	-2	-131	-39
	Standard deviation, €	18,481	22,708	21,178	22,364
	Shareholder equity, € in t_{10}	311,737	143,906	-242,002	183,217
	Bankruptcy risk in %	0	11%	91%	2%

Assumptions: Equity share in t_0: 25% € 150 t and 50% correspond to € 300,000.

The fair premiums increase for the yield insurance scheme by 7 € up to 17 €/ha due to the higher volatility of the variables compared to the ex-post analysis. For the yield insurance scheme the fair premiums decrease by up to 20 €/ha due to the strong restriction on filing a claim.

Figure 8 shows the relationship between costs and benefits for the revenue insurance. For the marginal location 1, the risk is considerably diminished if a farm at this site takes out such an insurance policy.

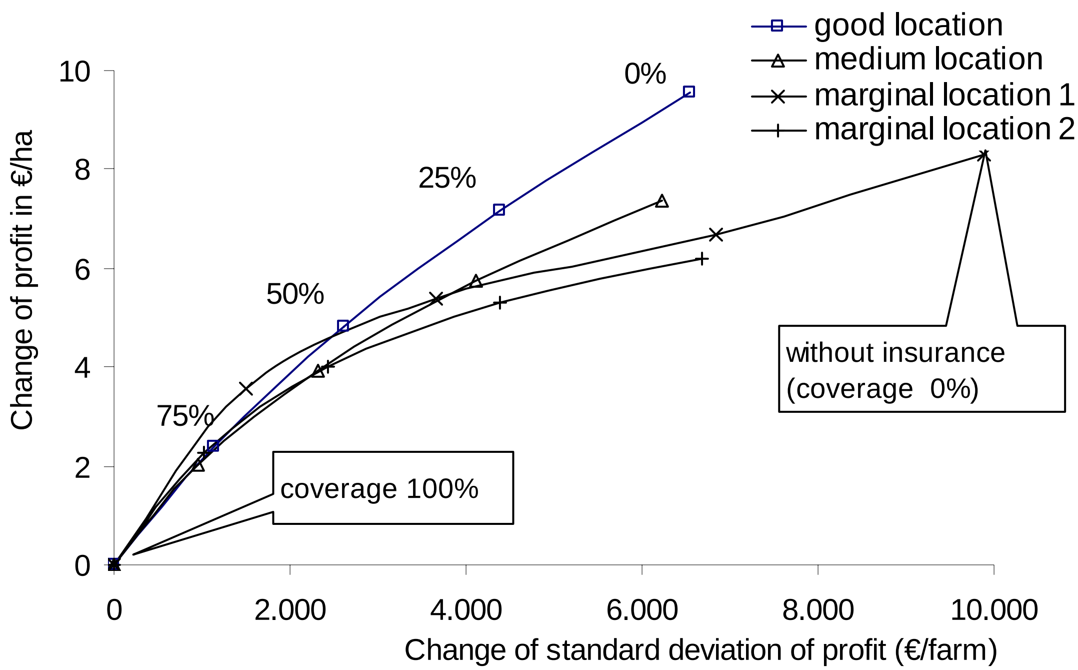

Figure 8: Change of profit and change of standard deviation of a revenue insurance for four locations, direct payments of 300 €/ha and depending on the coverage (100%, 75%, 50%, 25% and without insurance); in the ex-ante analysis for a 10-year period, with 1,000 simulation runs a year

Due to the much greater volatility of prices compared to the past, the risk of losses rises for the two marginal locations. In the worst combinations, e.g. low yields and low prices, the equity is exhausted, debts grow and the risk of bankruptcy increases. Without insurance, model farms on the two marginal locations have to go into liquidation in 11% of the cases, as already mentioned. The capital loss cannot be prevented through an insurance policy - the insurance itself costs already money - but extreme economic shocks could be avoided. By contracting insurance, the risk of bankruptcy can largely be avoided (Fig. 9). The demand for insurance contracts at marginal locations should no longer depend solely on the risk attitudes of the farmer, but must be considered a matter of economic survival.

Yield insurance can hardly reduce the risk of insolvency. Only structural changes, as presented in Chapter 7, "CAP Reform," can significantly reduce the risk of bankruptcy.

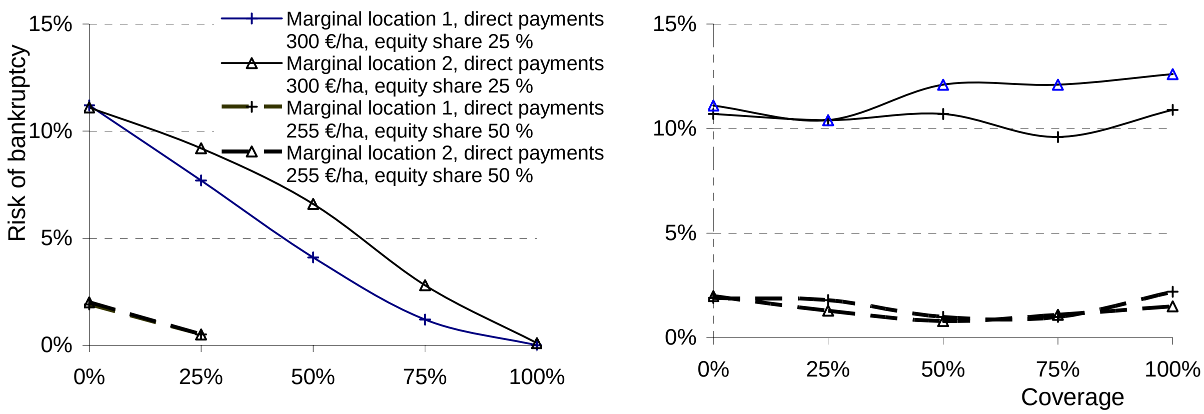

Figure 9: Risk of bankruptcy (negative equity), dependent on coverage, amount of direct area payments and equity share (EK in%) for the two marginal sites for revenue insurance (left) and yield insurance with 60% of government subsidies (right), ex-ante simulation

For the ex-ante simulation of a yield insurance scheme the above results can also be confirmed: Yield insurance without government subsidies remains unattractive because under the assumed conditions (e.g. claims, if yields below 30% of average) it fails to reduce the risk. Yield insurance with government subsidies (60% grant) mutates to a subsidization instrument through agricultural policy and would be profitable for farmers.
Table 6 shows again the difficult economic situation for the marginal locations. Even if the revenue insurance scheme could play a key role in stabilizing the farms or a yield insurance scheme would allow the transfer of income, further changes in the framework and economic environment through CAP reform is to be expected.

Table 6: Comparison of height of the profit after tax (€/ha), and the risk (standard deviation of the profit in €/year and farm) in the comparison of different insurance solutions, ex-ante simulations 10-year planning period, 1,000 simulation runs each year; direct payment 300 €/ha

		Without insurance	Revenue insurance	Yield insurance without subsidy	Yield insurance (60% subsidy)
			100 % coverage		
Good location (55 soil points)	Profit after taxes	187	177	---	---
	standard deviation	21,367	14,825	---	---
Medium location (43 soil points)	Profit after taxes	104	96	---	---
	standard deviation	19,885	13,660	---	---
Marginal location 1 (32 soil points)	Profit after taxes	10	3	7	15
	standard deviation	26,067	16,244	27,170	26,780
Marginal location 2 (29 soil points)	Profit after taxes	-2	-8	-4	-1
	standard deviation	22,708	16,027	23,604	23,699

Not relevant: Yield fluctuations are lower than 30% and thus irrelevant for the yield insurance scheme

7 CAP Reform - Health Check

As indicated above, the CAP is continuously under reform. Recent decisions on the Health Check in relation to modulation and degression have reduced direct payments (EU Commission 2008a). This process is expected to continue in the future. At this point, in view of expected further redeployments and reductions in the agricultural budget for the period of the next programming period (2013-2020) a reduction in the area payments in the amount of 25% shall be assumed. This a decrease in direct payments from 300 €/ha to 255 €/ha.

Compared to the above, in the following analysis no change in yield or price fluctuations is assumed. As stated in Table 6, profits could drop severely (by up to 50%) could take place. Companies with medium to good locations could still accumulate capital and increase equity, while for farms on marginal locations, structural adjustments are inevitable. These adjustments could be e.g.:

- a higher equity ratio, either from the accumulation in the previous decade due to the higher subsidies or through the participation of new partners who increase shareholders' equity, or
- the course of structural change, through a merger with other companies to further exploit economies of scale.

The list of options is not exhaustive, but are not discussed in detail here. Rather, the combination of reduced direct payments (25%) and increased equity share (25%) may mean that the instrument of crop insurance would not offset difficult framework conditions or even structural shortcomings. Even 60% subsidy of a yield insurance scheme, which would claim yield losses over 30%, in combination with a higher equity share, is not sufficient for marginal locations to remain profitable (Table 7).

Table 7: Comparison of height of the profit after tax (€/ha), and the risk (standard deviation of the profit in €/year and farm) in the comparison of different insurance solutions, ex-ante simulations, 10-year planning period, 1,000 simulation runs each year; reduced direct payments (225 €/ha) and adapted shareholders' equity

		Without insurance	Revenue insurance	Yield insurance without subsidy	Yield insurance (60% subsidy)
			100 % coverage		
Good location	Profit after taxes	126	116	---	---
Equity share in t_0: 25%	standard deviation	21,133	14,489	---	---
Medium location	Profit after taxes	36	31	---	---
Equity share in t_0: 25%	standard deviation	21,009	14,534	---	---
Marginal location 1	Profit after taxes	-27	-37	-30	-23
Equity share in t_0: 50%	standard deviation	26,414	13,229	27,277	26,927
Marginal location 2	Profit after taxes	-39	-47	-40	-38
Equity share in t_0: 50%	standard deviation	22,364	12,544	23,350	22,942

Not relevant: Yield fluctuations are lower than 30% and thus irrelevant for the yield insurance scheme

A revenue insurance scheme related to the distribution of equity at the planning end (t_{10}) significantly reduces the spread. For the companies' stability, it is essential that the lower left-hand corner (low equity end values) be avoided (Fig. 10). The farm at the medium location could increase equity in every case compared to the initial equity value of 150,000 € (25%) at the beginning of the planning period. For farms on marginal land this will not hold.

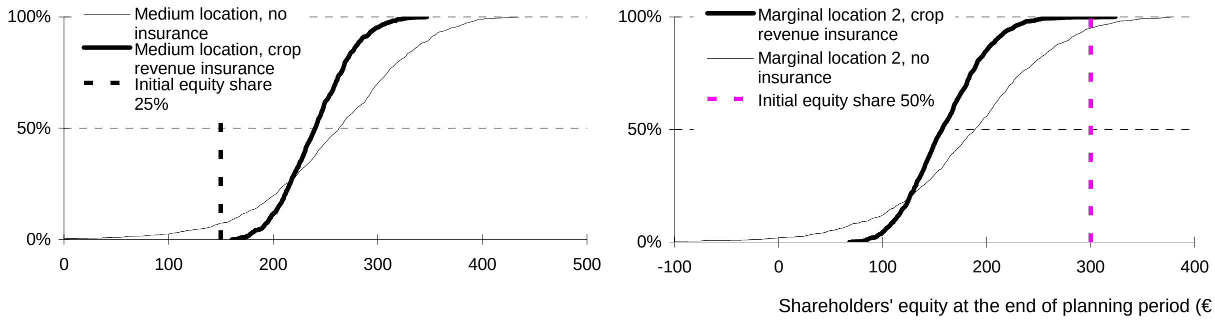

Figure 10: Distribution of the shareholders' equity without insurance (thin line) and with crop insurance (thick line) for the medium location (left) with low equity share (25%) and the marginal location 2 (right) with a higher equity share (50%) in the case of reduced direct payments (225 €/ha)

This stabilization is also observed at marginal locations, because the equity no longer falls below zero. To avoid bankruptcy, marginal locations should take coverage of at least 50% in the insurance contracts (Fig. 9).

However, even a higher equity ratio of 50% is not enough to avoid equity melting away. As indicated earlier, crop insurance schemes are not built to compensate deteriorating economic conditions and long-term negative trends. On the contrary, they create short-term compensation for cooperative use in solidarity with all participants.

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Address of the Authors
University of Applied Sciences Neubrandenburg, D-17033 Neubrandenburg, Germany

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