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Title:

Are on-farm investment decisions dependent on the life-cycle stage of the owners?

Key Words: renewable energies, biogas plants,multinomial logit analysis, life-cycle-stage

Abstract

Investment decisions of farmers can be assumed to be mainly profitability driven. However, farmers are not only neo-classical entrepreneurs but are also social beings with families, a social network and surrounding which influences their decisions to invest or not. We have interviewed 254 farmers face-to-face at an agricultural exhibition in Germany in order to clarify why some farmers chose not to invest into biogas plants although the conditions were favourable with fixed prices and average annual returns on investment of about 10 %. The analysis has been done by using the logit analysis for three different regions in Germany. The results indicate that also socio-demographic factors are not significant at a 95 % level marital status as well as age in the different chosen regions seem to have had an influence on the investment decision. The paper concludes with a discussion of the results.

Introduction

Investment decisions of farmers can be assumed to be mainly profitability driven. However, farmers are not only entrepreneurs but are also social beings with families, a social network and surrounding which influences their decisions to invest. In order to clarify whether factors other than only economic ones, e.g. socio-demographics or society, etc. have a significant influence we conducted this study. As an example we have chosen the investment into biogas plants as this was one of the most profitable ones in the period 2008 to 2012 with guaranteed profits and prices for farmers.

Method and Materials:

In November, during EuroTier 2012, an exhibition for farmers taking place every two years in Northern Germany, Hanover, with about 160,000 visitors, we interviewed German farmers and entrepreneurs. The survey was focussed on German farmers because of a special support program for biogas plants. The German Renewables Energy Law (Erneuerbare Energien Gesetz) supports specifically to pay bonuses if manure and/or agricultural commodities are used as factors in biogas plants. Face-to-face interviews were executed by four persons at several places during the first two days of the exhibition. 254 farmers and farm managers were interviewed.

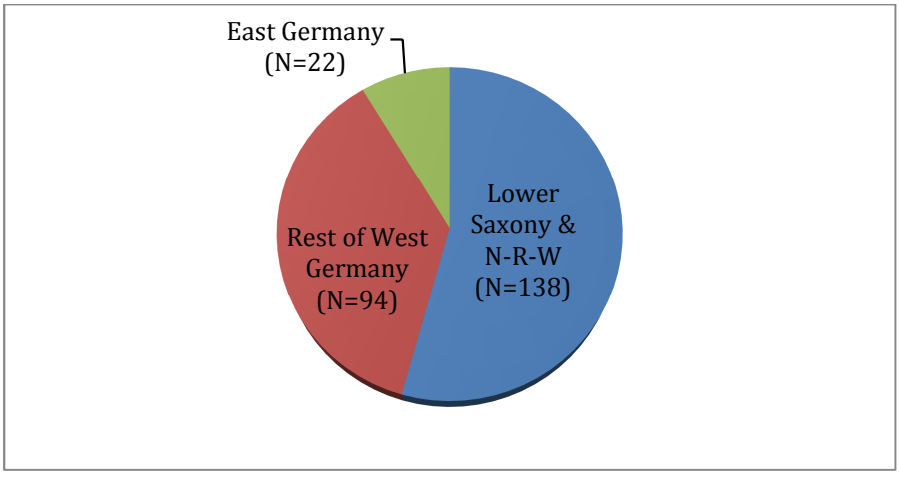


Figure 1: Share of participating farmers and farm managers in three different regions of Germany.

The questionnaire was devised for an interview that took at most 5 minutes to achieve a high willingness to participate. The exhibition halls as place of the

interviews were separated by the different types of agricultural production. The interviewers asked farmers being in the exhibition halls for pig producers, dairy farmers, poultry production and renewable energies to catch all type of farms.

We used face-to-face interviews to gather data about A: farm size and specialisation, B: past investments, C: production of renewable energies, D: the wider investment framework and E: socio-demographics.

The questions about farm size and specialisation (A) gave us an overview about the distribution of different types of specialisation. About 33 % of the interviewees were pig producers. Nearly 40 % of the sample were dairy farmers, 14 % were specialised arable farmers and only 2.3 % were poultry farmers. Diversified farms producing pork as well as milk were widespread in the sample contradicting the common paradigm that specialisation means to concentrate on-farm on one production system.

In part (B) we asked for the past investments. Only 20 % of the interviewed farmers have invested into biogas on their farm. The most important reasons not to invest into biogas were:

- There is no free labor capacity for a biogas plant (24 %).
- The capital costs are too high (18 %).
- The farms don't have enough agricultural area (11 %).

Instead of investing into a biogas plant those farms invested during the last 5 years into new/more buildings for livestock (45 %), new machines (41 %) and bought agricultural land (22 %).

Part (C) in our questionnaire illustrates the production of renewable energies on the farm.

The questions about the wider investment framework (D) illustrate further specialization in producing renewable energies but also clarify the limit that is reached e.g. in investing into solar power. The interviews illustrated that 65 % of the farmers already produce renewable energies on their farms and 62 % of all farmers

invested into solar power on roofs as this is one of the few factors that farms across Germany are not scare off.

Part (E) about socio-demographics demonstrates the relationship between investment strategies and life cycle stage of the farm owners. More details are discussed in the following chapter “results”.

As indicated in the above mentioned structure of the questionnaire, we assumed that the decision to **invest into a biogas plant** under German conditions was strongly influenced by the

1) size of the farm measured in hectares,
2) availability of manure on-farm,
3) socio-economic conditions (mainly place of work of a spouse and the availability of a successor (identified)).

The profitability of the biogas plant investment was not to be considered (nor was it for other renewable energies) as until recently these investments on average have a very high profitability (with an annual return of investment bigger than at least 10 %).

Multinomial Logit Analysis:

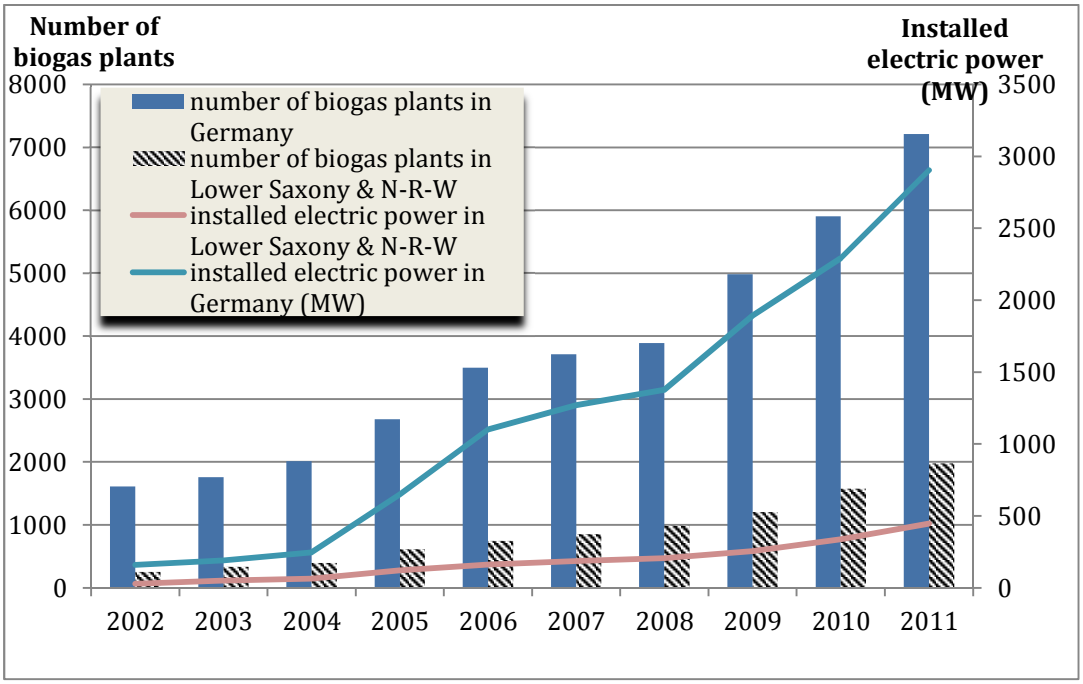
In order to analyse the above mentioned hypothesis we choose the multinomial logit analysis as a method. The sample was differentiated into three different regions:

1) the western German husbandry region (Lower Saxony and North Rhine Westphalia), 2) the rest of Western Germany and 3) East Germany.

During the last years the number of biogas plants increased due to the Renewable Energy Law (EEG). The installed electrical capacity from biogas plants increased from 190 megawatt in 2003 to 2,900 megawatt in 2011. Figure 2 shows the constant growth of the number of biogas plants in Germany and the first group of our analysis, Lower Saxony and N-R-W. The original law was passed in 2000 and afterwards was some modifications. The annual increase of biogas plants in Germany since 2004 illustrates the importance of the energy crop bonus. In Lower

Saxony & N-R-W for example, the number of biogas plants was growing fast from 390 (in 2004) to 610 (in 2005).

Figure 2: Growth of Biogas Plants in Germany



Source: Own calculation based on data from Landwirtschaftskammer NRW (2012), FNR (2012) and 3N Kompetenzzentrum Niedersachsen Netzwerk Nachwachsende Rohstoffe e.V. (2012).

During the last 20 years, Germany supported the biogas production with substantial amounts to facilitate the production of renewable energies. Management analysis points out the key benefits for farms that invest into biogas plants. In literature there are many articles and analyses about farms that invested into biogas plants (Emman et al. 2010/2011), (Rau et al. 2007), (Schaper, C. et al. 2008), (Walla, C. and Schneeberger, W. 2008), (Granoszewski et al. 2009). Until today there is a lack of information about the relationship between investments into biogas plants and the socio demographics on the farm families. And there are no studies about the question, why some farmers NOT invest into biogas. What are the reasons for non-investments? What were the alternatives for these farms? It is possible, that many non-biogas-plant-farms produce energy crops as well and supply energy crops like maize to neighboring biogas plants. All these questions were asked in our

questionnaire to get detailed information about the farmers that did NOT invest into biogas.

The decision for farmers to invest into biogas plants was hypothesised to be a function of the seven variables: [cultivated] farm area, livestock units, spouse on-farm employed, spouse off-farm employed, no spouse, successor identified and birth year [of the farm owner].

The dependent (binary) variable was based on the question: "*Did you build a biogas plant?"* The listed seven independent variables were hypothesized to influence the farmer's decision to invest into biogas.

Results:

For this analysis we evaluate N=254 farmers from all regions in Germany. Nearly 85 % are livestock farms and 33 % pig producing farms, 40 % are dairy cattle farms. 65 % are having children, 62 % are having a successor for the farm and 36 % of the spouses of the farm owners are working off the farm in other businesses. Only 20 % of the farm owners invested into a biogas plant, 62 % installed photovoltaic panels[1] and 6 % invested into wind engine.

The first results of the multinomial logit regression are presented in Table 1.

We conducted a multinomial logistic regression analysis to explore the influence for farmers to invest into a biogas plant. These first results in table 1 show a number of robust results that are also supported by the high Nagelkerkes r-squares presented at least for the interviewees from formerly West German farms. The results for the subgroup East Germany are presented although the sample size for a valid and reliable estimation is far too small.

[1] Investments into solar panels were even more profitable than into biogas plants until summer 2012.

Table 1: Multinomial logistic regression results – factors influencing investments into biogas plants across Germany (N= 254)

	Lower Saxony & N-R-W N= 138		Rest of West Germany N = 94		East Germany N = 22	
	B	Exp(B)	B	Exp(B)	B	Exp(B)
Spouse on-farm employed	-0.381	0.683	0.348	1.417	11.638	113276.32
Spouse off-farm employed	0.484	1.622	-0.513	0.599	5.694	297.207
No spouse	0.777	2.174	-20.18	0	n/a	n/a
Successor identified	0.155	1.167	-0.364	0.695	4.762	116.927
Livestock units	0.002*	1.002	0.005*	1.005	0.011*	1.011
Farm area	0.007***	1.007	0.009**	1.009	-0.002	0.998
Birth year	-0.036*	0.965	0.087***	1.091	0.013	1.013
Constant	68.086	n/a	-175.057	0	-35.909	0
-2 Log likelihood	119.212		42.992		9.039	
Cox & Snell R Square	0.115		0.265		0.582	
Nagelkerke R Square	0.177		0.483		0.779	
* - 85% significant; ** - 90%, *** - 95%						

Source: Own calculation with SPSS 20

Results indicate that larger farms (farmed area as well as livestock units' possession) are more likely to have invested into biogas plants. This relationship can be seen for all three groups. In group 1 and 2 the farm size affects the biogas plants investments, but this cannot be seen in group 3. Group 3 includes only 22 interviewed farmers and the results in group 3 can only be interpreted carefully but they give some important hints.

Interestingly, neither the marital status nor the existence of children in the family, indicators of the planning horizon of the farm decision maker, have a significant influence. An identified successor increases the probability of biogas plant investments. However, by analyzing the results we find that having a spouse working on-farm in the husbandry concentration region decreases the likelihood to invest

into a biogas plant, whereas in the rest of the country it is more unlikely to invest if the spouse works mainly off-farm. This behavior in opposite directions should be analyzed more detailed to get more information about the economic significance for family farms. Is the investment into biogas plants a substantial entrepreneurial risk that can only be borne if the spouse earns some salary off-farm as a type of risk spreading? At least 18 % of the interviewees indicated high investment costs as reason not to invest into a biogas plant. Or is there a correlation between investments and the lack of labor capacity that can be improved when the spouse works on farm and this enables the family farm to build a biogas plant? A biogas plant does not create a new job but it could be a tolerable job in combination with family and child care. There must be reasons to find for the behavior in opposite directions between group 1 and group 2.

The age of the farmer is significantly influential. Interestingly, in the main centers of husbandry: the older a farmer is the more likely s/he is to invest whereas outside in the Rest of Western and Eastern Germany the younger the farmer is, the more likely the investment was. There is evidence that for the first group the age of the farmer or farm manager was higher because of the location of the interviews. In the first group we interviewed farmers from Lower Saxony and N-R-W – both are regions very close to the exhibition place Hanover. This closeness enables that father and son (farm manager and successor) could leave the farm for one day to participate at the exhibition. We often interviewed couples of father and son, in which the father gave us his socio economic details and mentioned his age. Farmers from the other regions in group 2 or group 3 had a longer journey and for this reason especially farmers with cattle or pigs travelled without family. The average age of the farmer or farm manager in group 1 is 56 years and in group 2 41years. This could be the reason for the inconsistent influence of age to invest or not invest into biogas. The interviews took place at a popular exhibition for farmers and we got many interviews from different regions in Germany. Hence it seems to be necessary to repeat the interviews to increase the total quantity N for group 2 and 3 to analyse the influence of the age to the willingness to invest.

Discussion and Conclusion

In Germany, biogas production has increased rapidly over the last 15 years. As expected we see that farm area and livestock units are definitely influencing the likelihood to invest into biogas plants. This paper provides some insights into the social background of farmers who have chosen to invest as well as of those who do not invest into biogas plants. Surprisingly, we did not find much socio-economic influence on this investment. However first results indicate that in the main husbandry concentration areas with on-going structural changes farm families in which the whole family is involved into the business are less likely to invest into biogas plants (and renewable energies).

The results make indirectly clear that support of renewable energy in Germany is largely another agricultural income support system as was fixed guaranteed prices for commodities. In this respect we also found that opposite to political rhetoric's indeed most of the regulations supporting biogas plants favour large and largest enterprises. Current on-going discussions in Germany indicate that policy and decision makers seem to have identified this tendency and as a consequence has considerably reduced attractiveness of the support program in recent years.

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