Voluntary set aside of arable land: econometric analysis for Austria

Freiwillige Flächenstilllegung: Eine ökonometrische Analyse für Österreich

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Zusammenfassung

In einem zweistufigen stochastischen Modell wird untersucht, ob landwirtschaftliche Betriebseigenschaften zur Erklärung von freiwilliger Flächenstilllegung herangezogen werden können. Es zeigt sich, dass Betriebseigenschaften die Flächenstilllegung nicht systematisch erklären können. Insbesondere hat die Bodenklimazahl und deren Streuung, der Ackerflächenumfang und die Unterscheidung zwischen Haupt- und Nebenerwerbsbetrieben keinen großen Einfluss auf die Stilllegung von Ackerfläche. Abschließend werden noch mögliche Parallelen zwischen Flächenstilllegung und Entkoppelung gezogen.
Schlagworte: Flächenstilllegung, Entkoppelung, Cragg's model

Summary

A two step stochastic model is used to determine the influence of farm characteristics on the decision to set aside farm land. The model shows that farm characteristics do not have a strong influence on the set aside decision. Such characteristics are the soil-climate index and its deviation, the size of arable land, and whether it is a full or part time farm. The results are also used to discuss how much production might be reduced under decoupling of direct payments.
Keywords: set aside, decoupling, Cragg's model

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1. Introduction

In the European Union, farmers receive direct payments for not producing food crops on their fields. That is an amazing reality for those who are not concerned with agricultural policy. Those familiar with the situation, know that direct payments for set aside land were introduced under the MacSharry Reform in 1992, when it was a measure to reduce surplus production. In the first year after the MacSharry Reform, crop farmers were required to set aside 15% of their arable land, but it became a voluntary measure a year later. It was estimated that cereal production would have been 10 million t per year less if mandatory set aside had been maintained between 1992 and 2001 (see HERMAN, 2003). Under the current regulation, which is the result of the Agenda 2000 reform, set aside of 10% became mandatory again, but voluntary set aside above 10% is still possible. In Austria, an important detail is the exemption of small scale farms from mandatory set aside. Because the majority of the Austrian farms are small scale farms, the focus of this article is to analyze which farm characteristics of small scale farms tend to increase set aside. The findings are extrapolated to the current agricultural policy discussion about decoupling direct payments. The following analysis focuses on a major production area, the "North Eastern area of plains and hills", see figure 1. It is chosen, because the share of arable land is comparatively high.

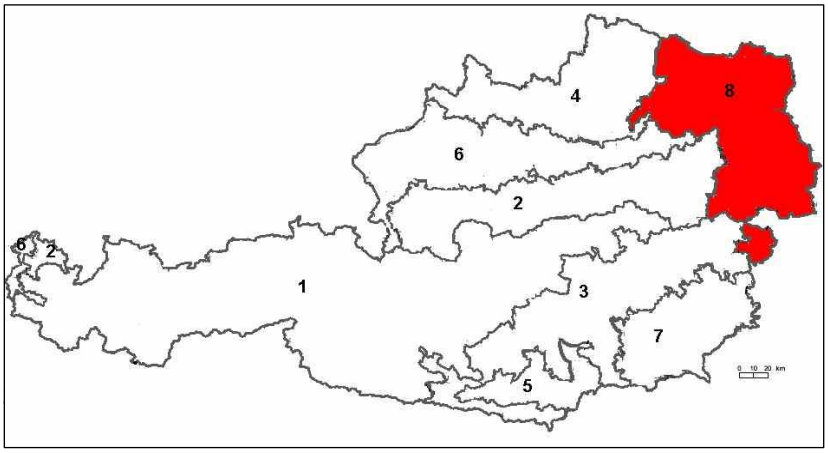

Fig. 1: Production area "North Eastern area of plains and hills"
Source: WAGNER, 1990a, 1990b (modified)

The support system grants area payments based on historical average yields of the region. These payments are also called "direct payments". Austria is regarded as one region and the average yield of cereals and maize was standardized to 5.27 t/ha. The payment for cereals is 63 €/t. Hence, an Austrian producer receives 332 €/ha for certain cereals. To receive direct payments, producers have to set aside 10% of their application area. Set aside land receives the same payments as arable land that is used for food production. Only small scale farms are exempted from the obligation to set aside land. A farm is regarded as a small scale farm, if the annual production of cereals is less than 92 t. In Austria, the production of 92 t equals 17.46 ha (using the average yield of 5.27 t/ha) of CAP rewarded application area. The minimum period for which land is set aside must extend the growing season. Set aside payments are limited to a maximum of 50% of the farm application area. Fields that are set aside must not be used for any commercial purpose except for production of non-food crops. If the set aside field is also part of another programme (e.g. ÖPUL), the payment per ha must not exceed 332 €/ha.

3. Data

The data used for the estimation of the influence of farm characteristics on the likelihood to set aside arable land are taken from three different sources: administrative data from the INVEKOS Database 2003 (see HOFER, 2003), data from the Austrian Agricultural Structure Survey 1999 (STATISTIK AUSTRIA, 2003), and the land register book (IMD, 2003). In table 1, the percentiles of the variables used in the estimation are presented. The description of these variables can be found later in this chapter below table 1. The table also shows that the mean of the discrete set aside variable is 0.3, hence 70% of the farms do not set aside arable land. In figure 2, the percentage set aside of those farms that do set aside arable land is shown. The first bar indicates farms that do set aside arable land but less than 2%. The figure shows, that if arable land is set aside the shares are substantial. The data presented here is the sample used for the estimation.

Tab.1: Percentiles of variables

Variable	continuous			discrete	
	5 percentile	median	95 percentile	Variable	mean
set aside %	0.00	0.00	40.00	set aside	0.300
clim index	27.01	51.64	71.77	Oepul	0.923
st. dev.	0.00	10.82	20.92	full time	0.614
arab. land	1.00	9.00	23.00	legal	0.003
animals	0.00	0.00	34.08		
kw/ha	0.00	9.52	47.87		

The variables used in the estimation are following:
voluntary set aside: percentage of the CAP application area. Production of non-food crops is deducted. The discrete voluntary set aside variable is one if there is set aside and zero if there is not.
climate index: is the average of soil-climate indices from farm fields. The soil-climate indices are weighted by the size of the field. The range of the index is from 1 to 100.
climate index standard deviation: is the standard deviation of the soil-climate indices of farm fields. The standard deviation of a farm with only one field is set to zero.
ln(arable land): is total arable land in ha (including leased arable land and arable land that has not received direct payments). The logarithm of total arable farm land is used to increases the fit of the model. What

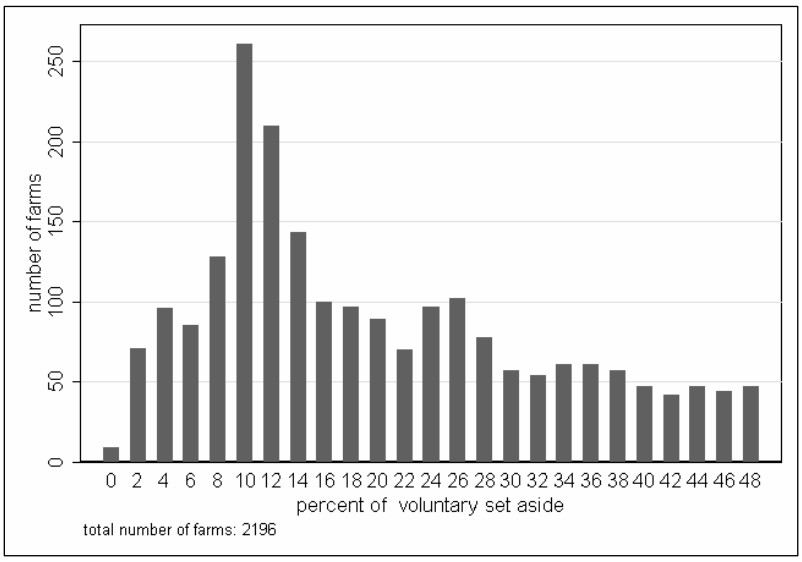

Fig. 2: Voluntary set aside of small scale farms in production area eight

should be kept in mind is that farms that produce more than 92 t of cereals and maize are not included in the estimation.
ln(kw/ha): is the logarithm of the aggregated kilowatt of tractors per ha application area. For numerical reasons values lower than one are set to 1 kw/ha.
ln(animals): is the logarithm of the aggregated livestock units per farm. For numerical reasons farms with no livestock were set to one.
Oepul: is a dummy variable if a farm participates in the ÖPUL programme (one), and if not it is zero.
full time: is a dummy variable if the farmer is a full time farmer (one) and zero if the farmer is either a part time farmer or if the farm is a legal entity.
legal: is a dummy variable if the farm is a legal entity (one) and zero if it is a full time or part time farm.
The influence of the average climate-soil index is expected to be negative as more productive fields have higher expected yields. But, the more climate-soil indices of a farm deviate, the more likely land is set aside. The influence of the standard deviation of the climate-soil index is expected to be positive. The coefficient of the dummy for full time farmers is also expected to have a negative sign as the opportunity costs of not producing are higher. A positive sign of the Oepul coefficient can be interpreted as a general unwillingness to participate. Small farmers with comparatively much arable land will be more likely to set aside arable land, but they also will be likely to set aside only a small share of it. More kw/ha and therefore more investments would make it less attractive to set aside land. Since animals are often fed with cereals, an increasing number of livestock heads is expected to reduce the share of set aside land.

4. Model

The two limit Tobit model assumes for a censored sample that the value of the dependent variable can not be observed below and above certain limits. One of the assumptions of the Tobit model is that the effects are identical for censored and uncensored observations. Using the above variables to explain set aside decisions with the Tobit model, it turns out that this assumption does not hold according to the Cragg/Greene test (see GREENE, 2003). Therefore, Cragg's model is

estimated, which consists of a probit model for the binary decision and a truncated model for the continuous observations (CRAGG, 1971). In the probit model only the binary decision (set aside or no set aside) is used for the estimation, but it is still assumed that there is an underlying latent variable: some of the farmers are very sure not to set aside land, while others are much more likely to set land aside. This different likelihood results in different values of the latent variable. But, if the latent variable cannot be observed, an ordinary least square regression cannot be used. Instead, a model can be estimated using the maximum likelihood method with specific assumptions about the distribution of the error terms. In this case, it is assumed that the errors are normally distributed and hence a probit model is estimated. In the truncated model, the explained variable is truncated. Hence, it is impossible to observe the variable values below or above a certain threshold. In this case, those farm observations are used that do set aside land, and which set aside less than 50% of their application area. The percentage of set aside land is the explained variable.

The results of the estimations are shown in table 2. For the probit model, the marginal change in probability at the median is shown for the continuous variables and the discrete change for the dummy variables. For the truncated model marginal changes are reported for the continuous variables, and discrete changes for the dummy variables.

The results show that in the probit model almost all and in the truncated model almost half of the variables are significant at the 1% level. In addition, ln(arab land) increases the probability to set aside, but reduce the set aside area significantly.

The effect of the climate-soil index is weak, as a 10 point increase leads only to a 0.05% lower probability to set aside, and to 2.8% less set aside land. The effect of the standard deviation is even weaker but has a positive sign in the probit model and meets our expectations. The negative sign in the truncated model is not significant. The three logarithm variables capture the farm characteristics. The impact on the probability is once again minimal. Most interesting is that the greater the share of arable land, the less will be set aside. If the median farmer with 10 ha arable land has one more hectare land, the area set aside will be 1.37% less. The set aside of a farm with 10 livestock units is expected to be 5.3% less than for one without livestock. Apart from the

full time variable in the truncated model, the influence of the dummy variables is rather limited. The sign of Oepul is positive, as expected. In contrast to what was presumed, the full time farmers are more likely to set aside. An explanation could be that set aside is not used to reduce field work.

Tab. 2: Range of variables and estimation of coefficients

Variable	**min**	**max**	**median**	**probit** Pr(sa=1)		**truncated** % sa	
clim index	2.00	91.00	51.64	-0.0048	**	-0.277	**
st. dev.	0.00	53.74	10.82	0.0030	**	-0.040	
ln(arab land)	0.00	4.11	2.20	0.0506	**	-14.368	**
ln(animals)	0.00	7.43	0.00	-0.0907	**	-2.319	**
ln(kw/ha)	0.00	6.70	2.25	-0.0414	**	0.065	
Oepul	0.00	1	1	0.3045	**	0.009	
full time	0.00	1	0	0.0747	**	2.520	**
legal	0.00	1	0	0.1712	#	-1.027	
pseudo R^2				0.08		--	
sigma				--		13.799	
obs.				5223		2153	

Significance levels: #:10% *:5% **:1%

5. Application to decoupling

Set aside is a significant part of the Common Agricultural Policy. Currently, much more discussed is decoupling of direct payments. All CAP direct payments will be (at least partially) decoupled from 2005 on. An often publicly announced fear of representatives of farmers is that decoupling will lead to a reduction of crop production. But a closer look at the current regulation for certain arable crops reveals substantial similarities. Under the current regulation, if a farmer decides to set aside 50% of his application area, he will still receive direct payments for all of it, even though production is reduced to 50%. If a farmer reduces production by 50% under the current regulation, this would have no implication on payments. He receives direct payments for all the area under the old and new regulation. However, in both cases, he has to keep arable land in good agricultural condition (cross compliance). These similarities might allow to draw conclusions from the experience with set aside to the recent regulation. For the individual farmer there are only small differences between set aside

and reduced production under decoupled direct payments. But there are some differences: set aside can only be applied to 50% of the application area, set aside is only possible for arable land, and set aside must be declared in advance. These differences are important but if we keep them in mind and assume that the other circumstances remain the same, it could still be possible to find out if farms with common characteristics are more likely to set aside. If this is not the case, we can conclude that no specific group of arable land farmers will reduce production when payments are decoupled.

One way to show is to calculate the probability of a farmer to set aside by using the probit model and then multiply this probability by the expected value according to the truncated model. The expected set aside is calculated and, if the assumption from above are permissible, it can also be seen as the expected reduction of production under a decoupled support scheme. Table 3 shows the expected reduction of production of full and part time farmers with different climate-soil indices, keeping all other factors constant.

Tab. 3: Expected reduction of production in %

Variables	**full time farmers**								
clim. ind.	19	19	19	42	42	42	64	64	64
st. dev. clim.	0	11	21	0	11	21	0	11	21
fitted probit	0.65	0.68	0.71	0.54	0.57	0.60	0.43	0.46	0.49
fitted trunc.	28.25	27.81	27.41	21.88	21.44	21.04	15.78	15.34	14.94
exp. reduc.	18.30	18.86	19.33	11.75	12.22	12.62	6.76	7.08	7.35
	part time farmers								
clim. ind.	19	19	19	42	42	42	64	64	64
st dev clim.	0	11	21	0	11	21	0	11	21
fitted probit	0.57	0.61	0.64	0.46	0.49	0.52	0.35	0.39	0.42
fitted trunc.	25.73	25.29	24.89	19.36	18.92	18.52	13.26	12.82	12.42
exp. reduc.	14.77	15.34	15.82	8.91	9.34	9.70	4.70	4.95	5.16

other variables: arab land=9, animals=0, kw/ha=15.7, Oepul=1

According to the coefficients, full time farmers with the same characteristics as part time farmers have a higher expected reduced area. The higher the average climate-soil index of a farm is, the less production will be reduced. The expected reduction of production is higher if the soil quality is more homogeneous. This result indicates that farm level

slippage (for a definition see HOAG et al., 1993) does not occur on average[2].

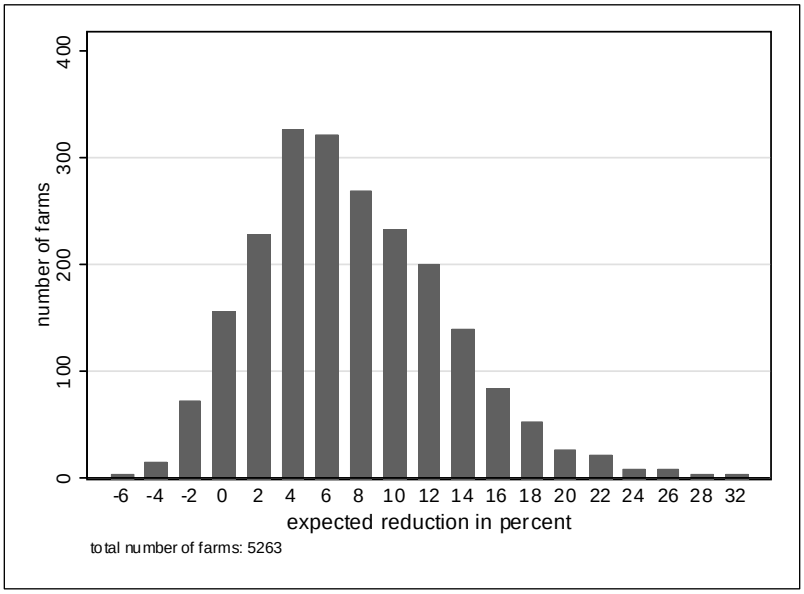

Fig. 3: Expected reduction of production on arable land

Fig. 3 shows the predictions of set aside for all the farms in the sample. It shows that most of the farms will reduce the production area, but almost no farms will reduce it substantially. It might be irritating that the prediction for some of the farms is negative. But this has a straightforward interpretation: farms that would be willing to produce more intensively on their fields than they actually do (due to technical and environmental restriction) have a negative prediction value.

The predictions are regressed against observed values to test how much the farm characteristics used in the regression model explain the set aside behavior of farmers. The intercept is 11.2% points and the coefficient for the fitted values is 0.92. The R square value is only 0.11

[2] Slippage is an often observed phenomena associated with set aside programmes where increased per hectares yields are observed and the commodity's total supply is reduced proportionally less than the programme induced reduction in the number of hectares devoted to the crop.

and therefore the explaining capabilities of this model must be regarded as limited. This can mean that the model is lacking important information that determines how much arable land a farmer sets aside. In this case, the work on this model should be continued. But it can also mean that the analyzed farm characteristics cannot explain set aside.

6. Conclusions

None of the parameters that are used to describe farm characteristic could explain set aside decisions of farms. In other words, neither field quality, nor the standard deviation of field quality, nor the size of arable land, nor being a full time farmer have a strong influence on set aside decisions. Consequently, the chosen farm characteristics cannot be used to identify farms that systematically set aside land.

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References

CRAGG, J. (1971): Some statistical models for limited dependent variables with application to the demand for durable goods. Econometrica, 39, p. 829–844.

GREENE, W. H., (2003): Econometric Analysis. Prentice Hall, fifth edition.

HERMAN, P. and KUPER, R. (2003): Food For Thought. London: Pluto Press.

HOAG, D. L., BABCOCK, B. A. and FOSTER, W. E., (1993): Field-level measurement of land productivity and program slippage. American Journal of Agricultural Economics, 75, 1, p. 181–189.

HOFER, O., FAHRNER, W. and LINDER, W., (2003): INVEKOS-Datenpool des Bundesministeriums für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft, Abteilung II 5 und Bundesanstalt für Agrarwirtschaft, Abteilung II 10.

IMD – INFORMATION, MEDIEN, DATENVERARBEITUNG (2003): Bezugstelle der Republik Österreich für Grundstückdatenbanken.

ROSETT, R.N. and NELSON, F.D. (1975): Estimation of the two-limit probit regression model. Econometrica, 43, 1, p. 141–146.

STATISTIK AUSTRIA (2001). Agrarstrukturerhebung 1999, Gesamtergebnisse.

WAGNER, K., (1990a): Neuabgrenzung landwirtschaftlicher Produktionsgebiete in Osterreich Teil I, Vol. 61. Bundesanstalt für Agrarwirtschaft

WAGNER, K., (1990b): Neuabgrenzung landwirtschaftlicher Produktionsgebiete in Osterreich Teil II, Vol. 62. Bundesanstalt für Agrarwirtschaft.

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