ASSESSMENT OF TARGETING IN THE RURAL DEVELOPMENT PROGRAMME: A CASE STUDY OF THE AUSTRIA INVESTMENT SUPPORT MEASURE

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Abstract

Targeting is a central part of many public support schemes to increase cost-effectiveness of policy intervention. Interestingly, targeting in the Rural Development Programs (RDP) of the EU has so far not been quantitatively evaluated for investment support schemes. In this article we suggest how the effectiveness of targeting in the investment support schemes can be evaluated with routinely available data. For an Austrian case-study we find that targeting of investment support measures could be substantially increased if eligibility criteria were used more extensively, as maximum aid-intensity differentiation turns out not to be effective and selection through ranking is not selective if the budget constraint is not binding.

Keywords

Targeting-effectiveness, Rural Development Programs, Evaluation

1 Introduction

The European Union allocated 96 billion Euro (ECA, 2012) in the period 2007-2013 to improve competitiveness, the environment and the quality of life in rural areas through the rural development policy. This amount was supplemented by mandatory national public and private co-financing. The Member States developed Rural Development Programmes (RDP) at national or regional level which comply with general guidelines at EU level. A total of 97 such RDPs were approved by the European Commission. Almost all RDPs include measures to support investments. For this scheme 11.1 billion have been budgeted for the past programme period (ECA, 2012).

For investment measures, the European Commission requires member states to "ensure that support is targeted on clearly defined objectives reflecting identified structural and territorial needs and structural disadvantages" (EUROPEAN COMMISSION, 2006). The Article 43 is slightly ambiguous about the interplay of objectives and identified structural and territorial needs and disadvantages. For example, one objective of investment support is competitiveness. This objective might be best achieved by supporting investments of large-scale highly productive farms. On the other hand, supporting small-scale farms with lower profitability but no perspective on ever becoming as productive as the large-scale farms, might reflect structural needs better. In practice, investment support measures are targeted to certain beneficiaries or investment types with the objectives not explicitly liked to the targeted groups or investment types.

Even though targeting is required for investment measures, targeting is not quantitatively evaluated by the European Commission nor is there – according to our knowledge – academic literature on targeting in the context of investment support measures. This is surprising, as there is a long tradition of scientific work on targeting in the context of poverty alleviation and social policy (AZEVEDO AND ROBLES, 2013; BIBI AND DUCLOS, 2007; BLUNDELL ET AL., 1988; CURRIE, 2006; DUCLOS, 1995; HERNANDEZ ET AL., 2007; HOUSSOU AND ZELLER, 2011; MICKLEWRIGHT ET AL., 2004; SMOLENSKY ET AL., 1995), job training (HECKMAN AND SMITH, 2004) and environmental subsidies (ALLCOTT ET AL., 2015). There is even a literature strand on targeting for agri-environmental RDP measures (PIORR ET AL., 2009; UTHES ET AL., 2010; VAN DER HORST, 2007)[1]. The social science literature is closer to investment support measures as the unit of reference is a household or a person which is more similar to a farm than an "area" in the environmental targeting. Understanding targeting in a broad sense which does not limit it to income or wealth testing (SMOLENSKY ET AL., 1995) we link the existing social science literature on targeting to the practice of targeting in investment support of the EU. The purpose of this article is to introduce methods how to quantify targeting-effectiveness for RDPs of the EU and to apply the methods in a case study.

To increase cost-effectiveness through targeting it is necessary to understand how various approaches to targeting compare in transferring funds to the targeted groups. We call the assessment on how well an approach to targeting contributes to transferring funds to the targeted groups targeting-effectiveness. By cost-effectiveness we refer to the outcome (e.g. Gross Value Added) per Euro spent on the measure. In this paper we discuss targeting-effectiveness and apply our method to a RDP for investment support measures from Austria. A related question, not addressed in this paper, is the influence of targeting on cost-effectiveness ("How much would cost-effectiveness change if other groups were targeted").

Understanding targeting-effectiveness of various approaches helps to reveal how a particular group can be motivated to take-up the support, how to increase cost-effectiveness of measures, and — ultimately — how to gain better support from the society for the programs through reducing errors of inclusion and errors of exclusion.

2 Framework to quantify targeting-effectiveness in RDPs

2.1 Targeting in social policy and the EU RDPs

In social policy related research, targeting is defined as "the identification of those who will or will not be eligible for a social program" (GROSH, 1994). The identification of the targeted recipients can be achieved by at least three broad approaches (SMOLENSKY ET AL., 1995). The straight forward approach is by means testing where only those with low enough means (usually income, expenditures or wealth) are supported. This approach leads to the most accurate identification of poor households but is also costly to administer (HOUSSOU AND ZELLER, 2011). A variant of means testing with lower administrative burden is to use proxies for income or wealth instead (such as the ownership of a particular electric utility).

Targeting using indicators (sometimes also called targeting by categories) is based on identification of beneficiaries through their attributes (TIMOTHY BESLEY AND KANBUR, 1993; SMOLENSKY ET AL., 1995). These are typically attributes like disabilities, single parent families, residence in remote areas or non-participation in another support program. Administration costs are lower than means testing, if attributes are easily observable. A third approach to targeting relies on self-selection. The idea is to use differences in needs, tastes, or incomes as a device for achieving self-selection by only the poor into poverty alleviation programs or to provide products of lower quality or unfashionable free products which would only the poor use (T BESLEY AND COATE, 1991; BLACKORBY AND DONALDSON, 1988). Another variant to self-selection is to provide support only after administrative difficulties or in exchange for work (T BESLEY AND COATE, 1991).

Targeting in EU RDPs is done as part of the national programme design, but approaches to targeting are defined in a series of EU regulations (in particular No 1698/2005 and No

[1] We thank an anonymous reviewer for pointing us to this strand of literature.

1974/2006). There are three approaches to targeting at the disposal for EU Member States (ECA, 2012):

- Eligibility criteria are a form of targeting by indicators and allow targeting on a diverse range of attributes. They are used to define who or what is supported based on attributes like sector (e.g. forestry, agriculture or tourism), territory (e.g. below 500m altitude for a measure in Cyprus), investment costs (e.g. between 20,000 and 2 million Euros for a measure in Hessen), investment type (e.g. cultivation of fast growing trees for energy production for a measure in Czech Republic) or the type of beneficiary (e.g. beneficiary must be younger than 60 years for a measure in Poland).
- Aid-intensity differentiation allows maximum fund rates to differ according to attributes of beneficiaries or projects which is another form of self-selection ("self" selection because in principle everybody is funded but those funded higher select voluntary to participate). For example, in an investment support measure in Galicia (Spain) up to 25% of the eligible costs for investments by SME in the milk sector were supported while only 10% of eligible costs were supported by non-SME. In France, a top up of 15% was allowed for environmental investments in Natura 2000 environmental protection areas. In Slovakia young farmers in less favored areas were supported with up to 60% while young farmers elsewhere were supported with up to 50%.
- Selection criteria for ranking are used by managing authorities to identify beneficiaries among all eligible beneficiaries. In comparison to eligibility criteria, selection criteria have no pre-defined cut-off point as it would depend on who applies and the budget available.

Eligibility criteria as well as aid-intensity differentiation are usually detailed neatly in the published programme documents. Selection criteria used by the managing authority to select among all eligible applicants, in contrary, are not always fully transparent. An example with published selection criteria is the measure "modernization of agricultural holdings" in Greece: Each application is rated according to a range of 52 weighted criteria. The weights show the preferences towards certain types of investments. Examples of the highest weighted criteria include "investments in renewable energy", "investments in water efficiency", "vertical integration of production". Examples of the lowest weighted criteria include "applicant already participating in specific other measures" or "applicant is a legal entity"....

2.1 Empirical Framework

For each of the approaches to targeting in social policy programmes, quantitative measures of targeting-effectiveness have been discussed in the literature. The concepts described there can be adopted for eligibility criteria, aid-intensity differentiation and selection criteria from RDPs.

2.2.1 Eligibility criteria

To quantify targeting-effectiveness of eligibility criteria two indicators frequently used in literature are available (BIBI AND DUCLOS, 2007). These are linked to Type I and Type II errors. Type I errors occur when an eligible potential beneficiary is not supported. Type II errors occur when non-eligible applicants are awarded support. The magnitude of these two errors have been described as non-take-up rate (BLUNDELL ET AL., 1988) and leakage rate (TIMOTHY BESLEY AND KANBUR, 1993), respectively.

The non-take-up rate is defined as the share of those who are entitled to participate in a measure but do not (BLUNDELL ET AL., 1988). Noting with B_{e+} the number of eligible farms that did get support and with B_{e-} the number of eligible farms that did not get support, the non-take-up rate can be calculated as

$R_{non\text{-}take\text{-}up}= B_{e-}/(B_{e+}+ B_{e-})$. (1)

This rate is only meaningful in case the eligible farms can be clearly identified (e.g. if the eligibility criteria is "investments below 100,000 Euro" the number of those who would fulfill the eligibility criteria is not defined).

The leakage rate is typically defined as the proportion of total transfers going to the pre-transfer non-eligible (BIBI AND DUCLOS, 2007). In comparison to the non-take-up rate, it is thus defined in terms of transfers and not in terms of number of participants. Defining T_e as the total transfers to eligible beneficiaries and T_n as the total transfers to the non-eligible, the leakage rate is defined as

$R_{leakage}= T_n/(T_e+T_n)$. (2)

Calculations of the non-take-up-rate and leakage rate hinges on the availability of a census containing enough information to calculate eligibility for each unit. In most cases this will not be possible and the non-take-up and eligibility rate need to be estimated based on a sample. If, as is the case in EU member countries, samples with strata and weights are available, they can be used to make population estimates. If the estimated population non-take-up rate is significantly larger than zero this means that there is non-take-up with respect to the eligibility criteria analyzed. This can be due to several reasons with different policy implications. First, total transfers are not sufficiently big to support all eligible applicants. This might be caused by a leakage to non-targeted beneficiaries (due to a failure in targeting). Second, obstacles to take-up funds which makes eligible beneficiaries practically not being able to take part in the measure (for a review on recent contributions to the last topic see (CURRIE, 2006)). A leakage rate significantly higher than zero means that there is leakage of transfers with respect to the analyzed eligibility criteria to non-eligible applicants. This can happen if eligibility criteria are not fully enforced. If eligibility criteria have been clearly defined before the programme start, the leakage rate can be interpreted as a measure of fraud. If the eligibility criteria are only clearly defined during the evaluation of the programme, it measures the share of funds going to those who meet these criteria. For a theoretical discussion of administrators' errors see (DUCLOS, 1995).

2.2.2 Aid-intensity differentiation

A simple comparison between funding of groups being subject to different maximum aid-intensities (e.g., those in a less favored area supported up to 50% with those outside being funded up to 40%) will be influenced by structural differences between the two groups. One way of netting out these differences is by parametric regression. For example BLUNDELL ET AL. (1988)estimate the relationship between benefit levels and take-up of housing benefits in the UK.

For a non-parametric approach a matching algorithm can be used to find comparable farms among those fulfilling the criterion for higher aid-intensity (e.g. being in a LFA) with those not fulfilling them. Based on comparable groups it is then possible to calculate what difference the aid-intensity differentiation made. In the words of causality analysis, the criterion would be the "treatment" and the aid transferred would be the "outcome". The estimate of interest is then the "average effect on the treated" (ATT) as this measures how much the average aid would have been for those who met the criterion if they had not met it. Noting the average difference in funding between those meeting the criterion and those not meeting it as Δ the average treatment effect of the treated is defined as (2008)

$\Delta ATT=E\{E[Y(1)|D=1, X] – E[Y(0)|D=0, X]\}$ (3)

where Y(1) is the outcome if the criterion is met (D=1), Y(0) the outcome if the criterion is not met (D=0), X represents the covariates to secure the unconfoundedness assumption (CALIENDO AND KOPEINIG, 2008). The unconfoundedness assumption is not testable, but a covariate matchbalance can help to detect violations of the assumptions (note, however, a balanced matchbalance does not necessarily mean unbiased estimates). A wide range of matching algorithms is readily available in software packages. Compared to the frequently applied "propensity score matching", the more general "genetic matching" method improves covariate balance, especially when the variables are not ellipsoidally distributed (DIAMOND AND SEKHON, 2013).

The suggested approach hinges on the availability of a control group. A control group is typically available if die differentiation of aid-intensity is defined on farm characteristic (e.g. being in a LFA). There is typically no control group if the aid-intensity differentiation is related to an investment type available to all farmers (e.g. investments in farm buildings). If the method can be applied, a significant difference in transfers after matching means that average transfers to those who meet the criterion differs from those who do not meet them after accounting for structural difference captured by the covariates. The only difference is thus the maximum aid transfer. If there is no significantly higher funding after matching, aid-intensity differentiation did not contribute to the allocate funds to those targeted.

2.2.3 Selection through ranking criteria

Consequently it can be expected that the selection mechanism contributes towards shifting the distribution of supported farms further towards the selection criteria when compared to the distribution of not supported farms. If there is no binding budget constraint (all eligible applicants are funded), ranking obviously will not directly contribute to selection.

Based on a survey it is possible to test on the equality of the distribution of those farms which meet eligibility criteria and are supported as opposed to those which meet eligibility criteria but are not supported. Survey design based tests on the mean and the quantiles are feasible statistical tools for comparison of the distributions in the population.

If there is no significant difference, either there was no budget constraint (all applicants were supported), those who do perform better in terms of selection criteria did not apply, or the selection process through ranking did not work properly. If there is a significant difference of the distributions, either the selection process through ranking worked properly or only those who perform better in terms of the selection criteria did apply in the first place. Thus, unless data on who applied and who was rejected are available, it is not possible to come to a final conclusion whether the selection by ranking worked. One example where this kind of data was available is elaborated by COADY AND PARKER (2009).

3. Case study: targeting-effectiveness in an Austrian RDP investment support measure

The Austrian version of the investment support measure "modernization of agricultural holdings" (which is the investment support measure with the highest funds in most RDPs) has a complex set of targeting approaches and can therefore serve as an example how indicators to measure targeting-effectiveness can be applied. The eligibility criteria of the measure are designed to exclude inactive farmer: a minimum of 0.3 agricultural working units per farm, at least 3 ha cultivated land or 2 livestock units are required (exceptions apply for fruits-, wine-, honey- and hop producers). In addition, the applicant needs to be a qualified craftsman or must have at least 5 years experience in farming. These indicator based eligibility criteria do not deter any active farmer from applying but prevent certain forms of misuse.

Table 1: Overview of the supported measures, intensity and objective.

Investments in:	**Support** % of eligible costs	% of interest	**RDP objectives** Competit-iveness	Environ-ment	Quality of life	Structural dis-advantages
Replacment of existing capital	0	0				
Not-specified investments (e.g. tractors)	0	0				
Farm buildings incl. (technical) equipment	20	36	x			
In-farm road construction	20	36	x			
Honey bee farming equipment	20	36		x		
Machinery & technical in-farm equipment	20	36	x			
Permanent crops & protection investment	20	36		x	x	
Harvester & manure trailer if jointly bought	20	36	x	x	x	
Biomass heating plant	25	50	x	x		
Regional/sectoral innovations	25	50	x			
Processing & marketing related construction	25	50	x			
Horticulture constructions	25	50	x			
Stable constructions	25	36	x			
Irrigation in fruit-cultivation	30	50	x			
Animal welfare increasing stable investments	30	36		x		
Agriculture on alpine pastures	50	50		x	x	x
Stables for organic farms	additional 5	--		x		
Beneficiary in LFA	--	50				x
Max total aid intensity: in LFAs: 50.00%, other areas: 40.00%						x

Notes: If a business plan is provided, 1.000 Euro are added. LFA = Less Favored Area.

Not all investments are supported as part of this measure. The supported investments are listed in the programme document. The list is rather exhaustive list, but does not mention tractors and restricts specialized tractors (e.g. harvesters or environmentally less harmful manure distribution trailers) to joint investments by several farmers. Excluded are also pure replacement investments. In Table 1 the investments and the respective aid-intensity are listed. We also added an estimation of which RDP objective might be intended with the investment support.

3.1. Description of data and empirical specifications

The analysis of the case study is based on the raw data used for the FADN book keeping by Austria for the years 2003-2013. The data are organized as unbalanced panel with a total of 3,436 different farms, in each year around 2100 farms. The sampling of the farms is based on strata (types of farming, economic size) and each farm represents between 13 and 327 farms of the population. The FADN bookkeeping data is supplemented by administrative data which detail support per farmer for the measure "modernization of agricultural holdings". The merged data allow the three empirical assessment of targeting approaches described above. Data from the first period (2003-2006) are used as reference, where the analysis requires. As exact derivation of the variables from the raw book keeping data is not provided here, but available from the authors upon request.

3.1.1 Estimation method: eligibility criteria

First, for eligibility criteria, the data provide details on agricultural working units, cultivated area and livestock units. Thus, the leakage rate with respect to all criteria but the farming experience can be estimated. The 2,114 observations from the year before the start of the programme periode (2006) were used for to estimate the leakage rate (design based estimations have to be restricted to a single year in case of an unbalanced panel data as the participants and weights change between years).

3.1.2 Estimation method: aid-intensity differentiation

For the second approach to targeting, aid-intensity differentiation, a slightly more demanding empirical analysis is necessary. The idea of the analysis is to compare the average funding between a treatment group (e.g. those within LFAs) and a control group (those outside the LFA) where those treated and the control group differ only by the aid-intensity (e.g. up to 50% for those in LFA and up to 40% for those outside). To find comparable pairs we need to find covariates which influence our "outcome" (the level of support during the programme period 2007-2013) to control for all confounding covariates which influence the level of support. We use covariates based on the average values of 2005 and 2006, thus before the programme period started (using the average over more than two years would be possible, but given that the panel is unbalanced this reduces the number of available observations). These covariates should explain the level of eligible investments which in turn influence the level of funding.

The investment decision can be seen as two interconnected decisions (MERTON, 1982). First, the decision to consume now or to invest and consume later. Second, deciding on the investment portfolio. The first decision is likely to be systematically influenced by age of the holder of the farm. Those older would be expected not to invest as much as the younger farmers (KIRCHWEGER ET AL., FORTHCOMMING). Other covariates which influence the consumption vs. investment decision (e.g. expectations about future prices, risk aversion or available information) are not available in our data and cannot be included as covariates.

The second part of an investment decision is systematically influenced by the investment opportunities available for a particular farm. This would, first and most importantly, be determined by the farming type. Farms of different types will have different investment opportunities, given future expectations and technological developments during a given time. Table 2 summarizes the substantial differences of investments between different farm types. The first column shows total average gross investments (including also investments not supported like replace investments or tractors) and the second the total average support. Investments as well as support are highest for farms with livestock (granivore farms, mixed farms and cattle farms) and lower for crop farms (cash crop farms and permanent crop farms). Because the farming type seems particularly important in the investment decision, in a first model we compare only farms of the same farming type (through "exact matching") controlling only for age as additional covariate. For some investment goods we even reduce the sample to a single farm type as only in this farm type alpine pastures and organic production methods are frequent.

Table 2: Estimated average aggregated gross investments and investment support over the period 2007-2013

	Mean aggregated gross investments 2007-2013 (Euro)	St. Error	Mean aggregated investment support 2007-2013 (Euro)	St. Error
Cash crop farms	127,878	7,469	1,780	291
Permanent crop farms	95,529	12,638	3,825	810
Cattle farms	145,664	4,486	7,960	510
Granivore farms	184,893	17,313	8,806	1,259
Mixed farms	156,895	10,248	5,244	658

Note: Investments include also investments not supported under the investment support measure (e.g. replacement investments). Survey design based estimates based on population figures and farming categories in the year 2006. Unweighted number of observations: 2,114.

The size of the farm will also influence the level of investments in absolute terms (KIRCHWEGER ET AL., FORTHCOMMING). The size can be measured by a variety of indicators (e.g. cultivated area, total output or labor input). Cultivated area will be farm type specific, but since we only compare farms of the same type through exact matching we consider the cultivated area as a well suited measure for measuring the influence of the size of the farm. To measure the cultivated area we weight alpine pastures lower to correct for their reduced potential. To control for differing technology levels we add assets per cultivated area as covariates. Obviously, economies of size will make smaller farms more capital intensive but given we compare farms of similar size, this is not an issue in our analysis.

Another farm characteristic which potentially influences the investment decision is the level of liabilities. Farms with high liabilities might face higher opportunity costs as their future flexibility is reduced (ANASTASSIADIS AND MUSSHOFF, 2014). To control for this effect we include financial leverage measured as debt to equity ratio as covariate. In applying the method, we assume that the described covariates explain the investment decision to control for confounding influences which would bias our estimated effect of aid-intensity differentiation. To control for non-linearities we add squared terms in the matching process if they are unbalanced otherwise.

We use three models which differ in the number of covariates (model 1 and model 2) and the number of observations (model 2 and model 3). In model 1 only the age of the farmer and the type of farming is accounted for (where the analysis is based on different farm types). In model 2 the other covariates discussed above which might influence the investment portfolio are added. In model 3 those observations which are likely to hamper fulfilling the common support assumption are dropped. To decide which farms to drop we use a procedure developed by CRUMP ETA AL. (2009).

Obviously the unbiasedness of the estimated difference hinges on the assumption that the treatment and the control group is comparable with respect to their likelihood to invest. With respect to the observable farm characteristics a matchbalance can be used to check how well the distribution of the two groups match. For comparison we use a matchbalance consisting of standardized differences (Std. Diff.) as recommended by ROSENBAUM AND RUBIN (1985) which should not exceed the value of 20 as a rule of thumb. Similarly, we use the ratio of variance (Var. Ratio) which should be approximate to the value of 1, as another rule of thumb (RUBIN, 2001). The debate on which is the most useful matchbalance measure and if it should be used as a stopping rule (if the rules of thumbs mentioned above are not fulfilled) or maximized is still ongoing (LEE, 2011). Though, there is a broad consensus that checking for balance is important in matching studies.

To assess the sensitivity of the estimated difference with regard to the assumption of no confounding unobservable covariates, we apply Wilcoxon's Sign-Rank ("Rosenbaum bounds") (ROSENBAUM, 2002, P. 114).

As can be seen from Table 1, the aid intensity for the majority of investments are 20% of eligible costs and 36% of interest payments. Though, some investments are supported more, like investments in animal welfare increasing stables (30% of eligible costs and 36% of interest payments) or investments in alpine pasture infrastructure (50% of eligible costs and 50% of interest payments). Most of the investments can be done by any farm (e.g. animal welfare increasing investment) which makes it impossible to find control groups (at least as long as comparisons are confined within farming types). But for three of the aid-intensity differentiations control groups are available. First, only those farms which have alpine pastures can invest in alpine pasture infrastructure. Such investments are supported by up to 50% of eligible investment costs. The control group are farms which do not have alpine pastures and therefore have only access to investment support of 20 to 30% of eligible costs. For comparability we confine our analysis to types of farms where alpine pastures are frequent (mainly cattle farms and farms with a share of at least 25% of forestry). Second, organic farms which invest in stables are supported by 5% points more than conventional farms. Our control group are conventional farms. Again we limit the sample to cattle farms as the sample does not contain sufficient organic farms of other categories. Third, there is a maximum investment support cap. This cap is 50% for farms in LFAs and 40% for farms in other areas. Even though this cap will hardly be binding, the differentiation can readily be evaluated using our framework. Our control group are farms located outside LFAs.

3.1.3 Estimation method: selection through ranking

The third empirical approach is on the assessment of ranking by the managing authorities. Data limitations reduce it to a comparison of the distribution of the selection criteria (in our case "economic viability") between supported and non-supported farms. This requires a definition of economic viability. For the purpose of this analysis "economic viability" was measured as average profit over the years 2003-2006. Specifically, we use agricultural profit defined as farm income (including CAP payments) minus capital and labor (opportunity) costs as available in the FADN data.

All estimations were done with the statistical software R (R DEVELOPMENT CORE TEAM, 2015) and the packages "Matching" v4.8-3.4 (SEKHON, 2011) and "survey" v3.30-3 (LUMLEY, 2004). The code for replication will be made available after publication at www.wiso.boku.ac.at/ulrichmorawetz.html.

3.2 Empirical results

3.2.1 Results for eligibility criteria

The eligibility criteria used for the Austrian investment support measure "modernization of agricultural holdings" are designed to secure that only actual agricultural holdings can participate. Since only active farmers are covered by the FADN survey, practically all farms in our sample fulfill the eligibility criterion. The non-take-up rate is thus trivially reduced to the rate of all farms not participating in the investment support measure (as all farms in the sample are eligible). Estimated from the FADN data using a sampling design based mean this results in a non-take-up rate of 0.69 (see Table 3).

Table 3: Estimated targeting-effectiveness: eligibility criteria

	Minimum criteria: 0.3 working units AND (3 ha cultivated land OR 2 livestock units)
Non-take-up rate:	0.69
Leakage rate:	0.03

Note: Estimated population values based on FADN provided weights.

The leakage rate, which measures the share of funds diverted to non-eligible applicants, is estimated to be 0.03 with respect to the combined criterion "at least 0.3 agricultural working units" and "3 ha cultivated area" or "2 livestock units". This means that according to our estimates 3% of the funds were provided to farms not meeting this criterion. This deviation from zero is most likely related to the exemptions for fruits-, wine-, honey- and hop farmers, which we could not account for.

3.3.2. Results for aid-intensity differentiation

The sample used to analyze the effect of aid-intensity differentiation with respect to alpine pastures consists of 1,248 cattle farms and forest holdings (Table 4). Design based estimates based on these observations, suggest that 27% of these farms have alpine pastures (they are thus our treatment group). Of those having an alpine pasture (and thus being able to benefit from the higher support share) an estimated 32% took part in the measure "modernization of agricultural holdings" and were supported on average by 7,150 Euro. Of those not having an alpine pasture an estimated 34% took part in the measure and were supported by 7,862 Euro. The difference between the average support is estimated not to be statistically significant.

Accounting for potential counfounders, the bottom panel of Table 4 reveals that for all thre model specifications the average funding is not significantly different between those farms which have the option to invest in infrastructure on alpine pastures and those which do not have this option. From the matchbalances for the three models it can be concluded that the distribution of covariates is more balanced in model 2 than in model 1 (Table A1, A2, A3 in the appendix). Model 2 and 3 are generally acceptably balanced, except for the covariate "assets per cultivated area" which is higher for farms without alpine pasture (the average is 1% higher in model 2 and 25% higher in model 3). Since no significant difference is found, the influence of unobserved confounders (Rosenbaum bounds) is of limited importance (for the results see Table A10 in the appendix).

Table 4: Estimated targeting-effectiveness: aid-intensity differentiation with respect to alpine pasture

	Number of obs. (un-weighted)	Farms with alpine pastures	Farms without alpine pastuers	Diff erence
Aid-intensity for alpine pasture infrastructure:				
eligible costs		50%	--	
interest		50%	--	
Aid intensity for other supported investments:				
eligible costs		20 to 30%	20 to 30%	
interest		36 to 50%	36 to 50%	
Estimated share of farms	1,248	0.27	0.73	
		(0.02)	(0.02)	
Estimated participation in measure	1,248	0.32	0.34	-0.02
		(0.03)	(0.02)	(0.03)
Estimated mean funding (Euro)	1,248	7,150	7,862	-712
		(999)	(550)	(1,162)
Estimated difference (ATT) of support between farms with alpine pasture and without after matching (Euro)				
Model 1: Comparison within farming type (exact matching) and age only	1,152	7,074	8,202	-1,127
				(936)
Model 2: Comparison within farming types, age and investment relevant vars. (see Note)	1,152	7,074	7,213	-138
				(1,490)
Model 3: Comparison within farming types, age and investment portfolio relevant vars. after dropping farms unique to treatment	1,151	7,069	7,734	-666
				(1,573)

Notes: Survey design based estimated values based on population figures in 2006. Only farm types where alpine pastures are observed used (cattle farms and forest-agri farms). Standard errors in brackets (Abadie-Imbens standard errors for matching results). Other relevant variables: area cultivated, area cultivated squared, assets per area cultivated, debt to equity ratio, debt to equity ratio squared. Significance level: *** = 1%, ** = 5%, * 10%

The sample used to analyze the effect of aid-intensity differentiation with respect to organic farming consists of 971 cattle farms (Table 5). Design based estimates based on these observations suggest that 29% of these farms are organic (and are thus our treatment group). Among the organic farms (and therefore receiving a 5% points higher support for investments in stable) an estimated 35% took part in the measure “modernization of agricultural holdings” and were supported on average by 7,774 Euro. Among the conventional farms an estimated 37% took part in the measure and were supported by 9,446 Euro. The difference between the average support is estimated not to be statistically significant.

Accounting for potential counfounders, the bottom panel of Table 5 reveals that for all model specification the average funding is not significantly different between organic and conventional farms. From the matchbalances we find in particular model 3 to be well balanced (see Table A4, A5 and A6 in the appendix).

Table 5: Estimated targeting-effectiveness: aid-intensity differentiation with respect to organic agriculture

	Number of obs. (un-weighted)	Organic farms	Convent. farms	Diff-erence
Aid-intensity for investments in stables:				
eligible costs		30 to 35%	25% to 30%	5%
interest		36%	36%	
Aid intensity for other supported investments:				
eligible costs		20 to 30%	20% to 30%	
interest		36 to 50%	36% to 50%	
Estimated share of farms	971	0.29	0.71	
		(0.02)	(0.02)	
Estimated participation in measure	971	0.35	0.37	0.0
		(0.03)	(0.02)	(0.02)
Estimated mean funding (Euro)	971	7,774	9,446	-1,672
		(1,218)	(684)	(1,427)
Estimated difference (ATT) of support between organic and conventional after matching (Euro)				
Model 1: Comparison within	836	8,154	9,821	-1,667
farming types (exact matching) and age only				(1,155)
Model 2: Comparison within farm types,	836	8,154	8,876	-722
age and investment portfolio relev. variabl. (see Note)				(2,104)
Model 3: Comparison within farm types,	836	8,154	8,876	-722
age and investment portfolio relevant variables				(2,104)
after dropping LFA unique farms				

Notes: Survey design based estimated values based on population figures in 2006. Standard errors in brackets (Abadie-Imbens standard errors for matching results). Other relevant variables: area cultivated, area cultivated squared, assets per area cultivated, debt to equity ratio, debt to equity ratio squared. Significance level: *** = 1%, ** = 5%, * 10%

The sample used to analyze the effect of higher maximum aid-intensity for farms located in LFA consisted of 2,114 farms (Table 6). Design based estimates suggest that 45% of the farms are located in LFA (and are therefore our treatment group). Among the farms located in LFA an estimated 33% took part in the measure "modernization of agricultural holdings" and were supported on average by 7,222 Euro. Among the farms located outside of LFA an estimated 27% took part in the measure and were supported by 5,380 Euro. The difference of 1,842 Euro higher funding in LFA is statistically significant on a 1% level (sampling design based standard errors).

After accounting for potential counfounders, the bottom panel of Table 6 reveals that for all three model specification the average funding is not significantly different between farms within and outside of LFAs. From the matchbalances we find in particular model 3 to be well balanced (see Table A7, A8 and A9 in the appendix).

Table 6: Estimated targeting-effectiveness: aid-intensity differentiation with respect to location in Least Favored Area (LFA).

	Number of obs. (un-weighted)	LFA	Other areas	Diff-erence	
Maximum aid-intensity: eligible costs + interest		50%	40%	10%	
Estimated share of farms	2,114	0.54	0.46		
		(0.01)	(0.01)		
Estimated participation in measure	2,114	0.33	0.27	0.06	***
		(0.02)	(0.01)	(0.02)	
Estimated mean funding (Euro)	2,114	7,222	5,380	1,842	***
		(511)	(390)	(657)	
Estimated difference (ATT) of support between LFA and others after matching (Euro)					
Model 1: Comparison within	2,036	7,011	8,407	-1,396	
farm types (exact matching) and age only				(1,314)	
Model 2: Comparison within farm types,	2,036	7,011	9,346	-2,335	
age and investment relev. variab. (see Note)				(2,170)	
Model 3: Coparision within farm types,	1,868	6,995	9,924	-2,930	
age and investment portfolio relev. variables				(2,215)	
after dropping LFA unique farms					

Notes: Survey design based estimated values based on population figures in 2006. Standard errors in brackets (Abadie-Imbens standard errors for matching results). Other relevant variables: organic management, area cultivated, area cultivated squared, assets per area cultivated, debt to equity ratio, debt to equity ratio squared. Significance level: *** = 1%, ** = 5%, * 10%

3.2.3. Results for selection by ranking

Comparison of the distribution of the profitability of farms supported and those not supported can give some insight into which role the selection through ranking played. The design based estimated average profitability of those not supported is -6,309 Euro/year and those supported 3,586 Euro/year. The 95% confidence intervals reveal that the difference is statistically significant. Since outliers might influence average profits the more robust quantiles are also shown in Table 7. They confirms that for each of the three quantiles the supported farms have higher profits (or lower losses) with the 95% confidence intervals showing that these differences are significant.

Table 7: Estimated targeting-effectiveness: ranking by administrative authority

		Mean	Quantiles		
			0.25	0.5	0.75
Not Supported	Profit 2003-2006 (Euro)	-6,309	-19,227	-9,635	1,045
	5% confidence bound	-7,550	-20,119	-11,060	-919
	95% confidence bound	-5,068	-17,844	-8,469	2,373
Supported	Profit 2003-2006 (Euro)	3,586	-13,568	-2,872	14,116
	5% confidence bound	1,534	-16,629	-4,222	10,896
	95% confidence bound	5,637	-12,413	-864	17,730

Note: Survey design based estimates based on population figures in the year 2006.

4. Conclusions

In contrast to social policy, targeting has hardly been evaluated quantitatively in investment support measures of the rural development programmes. This is surprising as targeting-efficiency is important to identify those approaches to targeting that work well. Only if targeting-effectiveness is understood, it is possible to use it to increase the cost-effectiveness of RDPs. According to our knowledge, this article measures targeting-effectiveness for RDPs for the first time quantitatively.

We show that an empirical evaluation of the targeting approach is possible based on book keeping data of farms (FADN) which are available in all EU Member States. Such data were used to evaluate, as a case study, the targeting-effectiveness of the Austrian investment support measure "modernization of agricultural holdings".

The eligibility criteria of this Austrian investment support measure are designed to prevent participation of non-farmers. The criteria are fulfilled almost by definition by the farms of our sample. An estimated 29% of the farms participated in this investment support measure. As the eligibility criteria are easy to check the leakage rate is negligible. Even though this result is trivial in our case study, it reveals that 1) the eligibility criteria used here are easy to check but 2) hardly contribute to targeting. Targeting could be increased by choosing eligibility criteria which are not fulfilled by practically all farms.

Depending on the type of investment, type of farm and location of the farm the aid-intensity can differ. We use these differences, where possible, to test if these differences in aid-intensity make a difference in the average funding. Eligible costs are supported between 20% and 35%, depending on the kind of investment. But investments in infrastructure for alpine pastures are supported with 50% of eligible costs. We thus could expect that farms which have alpine pastures and therefore have the option to invest in alpine pasture infrastructure receive on average higher investment support than comparable farms without alpine pastures. Our analysis shows that this is not the case, even after controlling for confounding factors. This can be either because 1) farms with alpine pastures do not invest in alpine pasture infrastructure because even with the 50% support the investments are not profitable, or 2) because farms with alpine pasture do invest in alpine pastures infrastructure but invest less otherwise. Unless there is a credit or time constraint, explanation 2) is not rational.

We also compared investment subsidies for organic cattle farms and conventional cattle farms. Organic cattle farms receive 30 to 35% investment support if they invest in stables while conventional farms receive 25to 30%. We did not find a significant difference in the investment subsidies between organic and conventional farms even after controlling for confounding factors. We thus conclude that the 5% points higher investment support for organic farmers did not make a difference in the funding and hence in the investments.

There is also a differentiation with respect to the location of the farm. Farms located in Less Favored Areas (LFAs) can receive up to 50% of eligible costs while farms located elsewhere can receive up to 40% of eligible costs. Given that the majority of investment support is well below 40% it is not surprising that we did not find a significant difference in average funding after controlling for confounding factors.

The main conclusion is thus that none of the aid-intensity differentiations did contribute to allocate funds towards those with higher aid-intensity. RDP objectives (like support for structural disadvantaged areas through a higher aid-intensity maximum in LFAs, or like environmental improvement through higher investment support of organic farming) are not achieved through aid-intensity differentiation. The biggest influence on the allocation of transfers probably has the choice of what is supported (e.g. support of biomass heating plants) and what is not supported (e.g. tractors). From a list of possible investments not supported one might get an idea of how the choice of supported investments relates to the objectives of the

RDPs. But as we do not know what farmers would invest in if there was no investment support, we cannot quantify this effect.

The third method to allocate investment support is by ranking. One of the criteria for ranking the eligible applicants for support is economic viability. Using a definition developed in this paper (average profit), supported farms should have higher profits before they are supported. This is actually found in the data analyzed. It is not clear, though, if profitability is part of the selection process by the administrative authority. It might equally well be because the design of the programme attracts to a larger extent those farms which are more profitable (e.g., it is necessary to write a project plan which might be easier for those generally working more profit oriented) or because a pre-selection by agricultural extension service takes place. To better understand the selection process by administrative authorities would require data on the details provided as part of the application as well as the decision of the authority. Such data were not available for this analysis. Alternatively such data could be collected in a survey to get at least some evidence.

Summarizing the assessment of the targeting efficiency for the case study of the Austrian measure "modernization of agricultural holdings" we find that 1) eligibility criteria were hardly used for targeting 2) maximum-aid intensity differentiation did not contribute to targeting 3) selection by ranking maybe worked but cannot be evaluated because data are not available. What likely influenced targeting is the choice of supported investments. Unfortunately this is not easy to evaluate as no control group is available. Targeting could be improved by 1) defining more selective eligibility criteria and 2) increasing the aid-intensity differences. One possible reason why this was not done is a lack of empirical evidence which farms to focus on to achieve key objectives. If this is the case, agricultural economists should analyze how well different groups of farms or investment types contributed to achieving the objectives. Combined with insights from analysis similar to this one cost-effectiveness gains through targeting should be feasible.

6. Literature

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Appendix

Table A1: Matching balance aid-intensification with respect to alpine pasture cultivation for model 1

	Before Matching					After Matching				
	mean: alpine pasture	mean: no alp. pasture	p-Value	St.Diff.	Var. Ratio	mean: alpine pasture	mean: no alp. pasture	p-Value	St.Diff.	Var. Ratio
Year of birth*	1960	1961	0.00	-6.56	1.46	1960	1960	0.00	-0.14	1.01
Year of birth squared*	3,841,380	3,844,196	0.00	-6.49	1.46	3,841,380	3,841,441	0.00	-0.14	1.01
Area cultivated (ha)	19	20	0.00	-9.10	0.78	19	20	0.00	-15.77	0.71
Area cultivated squared	463	535	0.00	-11.49	0.53	463	579	0.00	-18.55	0.48
Assets per area cultivated	19,893	16,286	0.00	10.63	2.18	19,893	15,474	0.00	13.02	2.14
Assets per area cultivated squared	1,547,911,492	793,105,005	0.00	6.12	1.57	1,547,911,492	778,418,298	0.00	6.24	1.42
Debt to equity ratio	0.01	0.01	0.00	4.19	0.39	0.01	0.01	0.10	2.25	0.40
Debt to equity ratio squared	0.00	0.00	0.00	-11.39	0.20	0.00	0.00	0.00	-11.30	0.17

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance.
*If several farm holders are present the average age was used.

Table A2: Matching balance aid-intensification with respect to alpine pasture cultivation for model 2

	Before Matching					After Matching				
	mean: alpine pasture	mean: no alp. pasture	p-Value	St.Diff.	Var. Ratio	mean: alpine pasture	mean: no apl. pasture	p-Value	St.Diff.	Var. Ratio
Year of birth*	1960	1961	0.00	-6.56	1.46	1960	1960	0.90	-0.04	1.30
Year of birth squared*	3,841,380	3,844,196	0.00	-6.49	1.46	3,841,380	3,841,370	0.95	0.02	1.30
Area cultivated (ha)	19	20	0.00	-9.10	0.78	19	19	0.00	-0.99	1.08
Area cultivated squared	463	535	0.00	-11.49	0.53	463	459	0.00	0.71	1.05
Assets per area cultivated	19,893	16,286	0.00	10.63	2.18	19,893	20,135	0.00	-0.71	0.60
Assets per area cultivated squared	1,547,911,492	793,105,005	0.00	6.12	1.57	1,547,911,492	2,333,311,317	0.00	-6.37	0.34
Debt to equity ratio	0.01	0.01	0.00	4.19	0.39	0.01	0.01	0.00	4.26	1.07
Debt to equity ratio squared	0.00	0.00	0.00	-11.39	0.20	0.00	0.00	0.00	0.68	0.70

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance.
*If several farm holders are present the average age was used.

Table A3: Matching balance aid-intensification with respect to alpine pasture cultivationfor model 3

	Before Matching					After Matching				
	mean: alpine pasture	mean: no alp. pasture	p-Value	St.Diff.	Var. Ratio	mean: alpine pasture	mean: no alp.pasture	p-Value	St.Diff.	Var. Ratio
Year of birth*	1960	1961	0.00	-6.78	1.46	1960	1960	0.28	-0.40	1.26
Year of birth squared*	3,841,375	3,844,284	0.00	-6.70	1.46	3,841,375	3,841,526	0.36	-0.35	1.26
Area cultivated (ha)	19	20	0.00	-9.33	0.78	19	19	0.00	-0.57	1.03
Area cultivated squared	463	536	0.00	-11.60	0.53	463	462	0.08	0.14	1.00
Assets per area cultivated	19,891	15,469	0.00	13.03	8.24	19,891	15,005	0.00	14.40	14.33
Assets per area cultivated squared	1,546,636,239	378,881,559	0.00	9.48	128.52	1,546,636,239	305,453,065	0.00	10.07	964.44
Debt to equity ratio	0.01	0.01	0.00	4.16	0.39	0.01	0.01	0.00	1.73	1.17
Debt to equity ratio squared	0.00	0.00	0.00	-11.41	0.20	0.00	0.00	0.00	1.19	0.70

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A4: Matching balance aid-intensification with respect to organic farms for model 1

	Before Matching					After Matching				
	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio
Year of birth*	1959	1961	0.00	-18.39	0.83	1959	1959	1.00	0.00	1.00
Year of birth squared*	3,838,505	3,845,225	0.00	-18.44	0.83	3,838,505	3,838,505	1.00	0.00	1.00
Area cultivated (ha)	20	20	0.62	0.53	0.76	20	21	0.00	-5.16	0.76
Area cultivated squared	528	566	0.00	-5.21	0.66	528	592	0.00	-8.77	0.66
Assets per area cultivated	13,651	13,373	0.00	4.22	0.71	13,651	13,375	0.00	4.19	0.75
Assets per area cultivated squared	229,849,543	240,056,433	0.00	-4.41	0.26	229,849,543	237,208,089	0.10	-3.18	0.25
Debt to equity ratio	0.01	0.01	0.02	3.14	0.27	0.01	0.01	0.00	5.03	0.32
Debt to equity ratio squared	0.00	0.00	0.00	-34.54	0.04	0.00	0.00	0.00	-26.68	0.05

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A5: Matching balance aid-intensification with respect to organic farms for model 2

	Before Matching					After Matching				
	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio
Year of birth*	1959	1961	0.00	-18.39	0.83	1959	1959	0.00	1.01	1.19
Year of birth squared*	3,838,505	3,845,225	0.00	-18.44	0.83	3,838,505	3,838,121	0.00	1.05	1.19
Area cultivated (ha)	20	20	0.62	0.53	0.76	20	20	0.00	-0.57	1.01
Area cultivated squared	528	566	0.00	-5.21	0.66	528	530	0.28	-0.21	1.05
Assets per area cultivated	13,651	13,373	0.00	4.22	0.71	13,651	12,643	0.00	15.30	1.46
Assets per area cultivated squared	229,849,543	240,056,433	0.00	-4.41	0.26	229,849,543	189,613,315	0.00	17.38	1.80
Debt to equity ratio	0.01	0.01	0.02	3.14	0.27	0.01	0.01	0.00	1.57	1.03
Debt to equity ratio squared	0.00	0.00	0.00	-34.54	0.04	0.00	0.00	0.18	0.43	0.63

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A6: Matching balance aid-intensification with respect to organic farms for model 3

	Before Matching					After Matching				
	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio	mean: organic	mean: conventional	p-Value	St.Diff.	Var. Ratio
Year of birth*	1959	1961	0.00	-18.39	0.83	1959	1959	0.00	1.01	1.19
Year of birth squared*	3,838,505	3,845,225	0.00	-18.44	0.83	3,838,505	3,838,121	0.00	1.05	1.19
Area cultivated (ha)	20	20	0.62	0.53	0.76	20	20	0.00	-0.57	1.01
Area cultivated squared	528	566	0.00	-5.21	0.66	528	530	0.28	-0.21	1.05
Assets per area cultivated	13,651	13,373	0.00	4.22	0.71	13,651	12,643	0.00	15.30	1.46
Assets per area cultivated squared	229,849,543	240,056,433	0.00	-4.41	0.26	229,849,543	189,613,315	0.00	17.38	1.80
Debt to equity ratio	0.01	0.01	0.02	3.14	0.27	0.01	0.01	0.00	1.57	1.03
Debt to equity ratio squared	0.00	0.00	0.00	-34.54	0.04	0.00	0.00	0.18	0.43	0.63

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A7: Matching balance aid-intensification with respect to LFA for model 1

	Before Matching					After Matching				
	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio
Year of birth*	1961	1941	0.00	206.32	0.00	1961	1961	0.00	-0.25	1.06
Year of birth squared*	3,843,683	3,799,501	0.00	116.97	0.01	3,843,683	3,843,773	0.01	-0.24	1.06
Cash crop farms	0.04	0.26	0.00	-111.01	0.20	0.04	0.04	1.00	0.00	1.00
Permanent crop farms	0.02	0.17	0.00	-95.01	0.17	0.02	0.02	1.00	0.00	1.00
Cattle farms	0.86	0.25	0.00	171.97	0.66	0.86	0.86	1.00	0.00	1.00
Granivore farms	0.02	0.08	0.00	-35.44	0.33	0.02	0.02	1.00	0.00	1.00
Mixed farms	0.06	0.24	0.00	-81.24	0.29	0.06	0.06	1.00	0.00	1.00
Organic management	0.35	0.13	0.00	46.70	2.04	0.35	0.15	0.00	41.81	1.77
Area cultivated (ha)	50	31	0.00	43.08	2.93	50	27	0.00	52.31	5.05
Area cultivated squared	4,271	1,599	0.00	25.77	11.38	4,271	1,112	0.00	30.48	29.04
Assets per area cultivated	7,174	9,349	0.00	-48.42	0.22	7,174	9,543	0.00	-52.75	0.88
Assets per area cultivated squared	71,643,925	178,487,582	0.00	-100.64	0.02	71,643,925	113,934,031	0.00	-39.84	0.50
Debt to equity ratio	0.01	0.02	0.00	-18.40	0.08	0.01	0.01	0.38	0.82	0.27
Debt to equity ratio squared	0.00	0.04	0.00	-30.76	0.04	0.00	0.01	0.00	-7.57	0.20

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A8: Matching balance aid-intensification with respect to LFA for model 2

	Before Matching					After Matching				
	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio
Year of birth*	1961	1941	0.00	206.32	0.00	1961	1961	0.00	-2.96	1.30
Year of birth squared*	3,843,683	3,799,501	0.00	116.97	0.01	3,843,683	3,844,782	0.00	-2.91	1.30
Cash crop farms	0.04	0.26	0.00	-111.01	0.20	0.04	0.04	1.00	0.00	1.00
Permanent crop farms	0.02	0.17	0.00	-95.01	0.17	0.02	0.02	1.00	0.00	1.00
Cattle farms	0.86	0.25	0.00	171.97	0.66	0.86	0.86	1.00	0.00	1.00
Granivore farms	0.02	0.08	0.00	-35.44	0.33	0.02	0.02	1.00	0.00	1.00
Mixed farms	0.06	0.24	0.00	-81.24	0.29	0.06	0.06	1.00	0.00	1.00
Organic management	0.35	0.13	0.00	46.70	2.04	0.35	0.35	0.00	0.09	1.00
Area cultivated (ha)	50	31	0.00	43.08	2.93	19	19	0.00	-1.04	1.05
Area cultivated squared	4,271	1,599	0.00	25.77	11.38	496	493	0.02	0.32	1.02
Assets per area cultivated	7,174	9,349	0.00	-48.42	0.22	18,895	13,776	0.00	17.71	13.86
Assets per area cultivated squared	71,643,925	178,487,582	0.00	-100.64	0.02	1,192,147,674	250,046,553	0.00	8.25	589.21
Debt to equity ratio	0.01	0.02	0.00	-18.40	0.08	0.01	0.01	0.00	5.66	0.74
Debt to equity ratio squared	0.00	0.04	0.00	-30.76	0.04	0.00	0.00	0.00	-0.93	0.36

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A9: Matching balance aid-intensification with respect to LFA for model 3

	Before Matching					After Matching				
	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio	Mean: LFA	Mean: outside LFA	p-Value	St.Diff.	Var. Ratio
Year of birth*	1960	1941	0.00	189.54	0.00	1960	1960	0.00	-2.44	1.13
Year of birth squared*	3,841,963	3,800,517	0.00	105.50	0.01	3,841,963	3,842,910	0.00	-2.41	1.13
Cash crop farms	0.04	0.25	0.00	-103.71	0.22	0.04	0.04	1.00	0.00	1.00
Permanent crop farms	0.03	0.17	0.00	-89.99	0.18	0.03	0.03	1.00	0.00	1.00
Cattle farms	0.85	0.26	0.00	164.46	0.67	0.85	0.85	1.00	0.00	1.00
Granivore farms	0.02	0.08	0.00	-40.34	0.28	0.02	0.02	1.00	0.00	1.00
Mixed farms	0.06	0.25	0.00	-74.81	0.32	0.06	0.06	1.00	0.00	1.00
Organic management	0.27	0.12	0.00	33.22	1.82	0.27	0.27	0.00	0.10	1.00
Area cultivated (ha)	20	27	0.00	-60.00	0.26	20	20	0.00	-2.20	1.05
Area cultivated squared	530	1,275	0.00	-88.46	0.10	530.80	534.38	0.00	-0.42	1.01
Assets per area cultivated	13,661	11,884	0.00	21.55	0.52	13,661	12,990.82	0.00	8.13	1.41
Assets per area cultivated squared	254,623,298	271,469,605	0.00	-3.66	0.32	254,623,298	217,115,861.87	0.00	8.15	1.61
Debt to equity ratio	0.01	0.02	0.00	-18.84	0.09	0.01	0.01	0.00	4.14	0.74
Debt to equity ratio squared	0.00	0.04	0.00	-29.98	0.04	0.00	0.00	0.00	-0.96	0.36

Notes: Survey design based estimated population values based on population figures in 2006. St.Diff. = standardized difference, Var. Ratio = ratio of variance. *If several farm holders are present the average age was used.

Table A10: Sensitivity analysis for aid-intensity differentiation

		Wilcoxon's sign-rank test upper bound (p-value)		
	Gamma	Alpine pastures	Organic	LFA
Model 1	1.0	0.0000	0.7928	0.0000
	1.1	0.0008	0.9994	0.0000
	1.2	0.4456	1.0000	0.0289
	1.3	0.9957	1.0000	1.0000
	1.4	1.0000	1.0000	1.0000
	1.5	1.0000	1.0000	1.0000
Model 2	1.0	0.1045	0.2782	0.1018
	1.1	0.2541	0.4672	0.4093
	1.2	0.4522	0.6477	0.7646
	1.3	0.6472	0.7894	0.9448
	1.4	0.7994	0.8848	0.9920
	1.5	0.8980	0.9416	0.9992
Model 3	1.0	0.0545	0.2782	0.0334
	1.1	0.1579	0.4672	0.1986
	1.2	0.3237	0.6477	0.5209
	1.3	0.5175	0.7894	0.8104
	1.4	0.6943	0.8848	0.9502
	1.5	0.8266	0.9416	0.9909

Note: A Gamma of 1.0 means unconfounded results. A Gamma of 1.1 means a confounded by 10%. Differences to the standard errors in Table 4 result from weighting and the use of Abadie-Imbens standard errors.