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The dynamic effects of government-supported farm-investment activities on structural change in Austrian agriculture

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ABSTRACT

The objective of our paper is to analyse the effects of government-supported farm-investment activities on structural change in agriculture. Our method comprises combining direct covariate *matching* with a *difference-in-difference* (DiD) *estimator*. In order to capture the dynamics and the heterogeneity of structural effects, we have developed time and farm-group specific models. We apply our model in Austria, where we analyse the Integrated Administration and Control System (IACS) data of 98,000 farms within the time period of 2000–2011. Our results show that farms adapt their numbers of livestock very quickly, whereas, the increase in agricultural area seems to be fairly decoupled from the investment activity itself. Effects tend to be farm-group specific; e.g. farm size initially increases (and drops) on pig farms to a greater extent than on cattle farms. Furthermore, government-supported farm-investment activities not only influence structural change but also tend to increase production intensity and reduce diversification on arable land – perhaps counteracting, therefore, the goals of agri-environmental schemes. However, our results indicate that investing (cattle) farmers are more likely to enter the organic farming programme and tend rather to remain in animal husbandry.

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1. Introduction

Structural change in agriculture is the adjustment of the agricultural sector to the changing conditions of demand and supply. This complex and dynamic process constitutes a reallocation of farms, as well as a re-positioning of the agricultural sector as compared to other sectors of the economy (Blandford, 2006; Happe et al., 2011; OECD, 1994). Structural adjustments which take place as a consequence are farm growth (Bartolini and Viaggi, 2013; Mann, 2005; Weiss, 1999), specialisation or diversification of farms (OECD, 1994; Weiss and Thiele, 2002) and increase or decrease in capital-intensive farming methods (OECD, 1994), as well as farms entering and exiting the agricultural sector (Mann, 2003; Weiss, 1999).

The determinants of structural change have been studied by numerous authors, who have detected manifold farm-external and farm-internal factors (Breustedt and Glauben, 2007; Happe et al., 2011; Weiss, 1999; Zimmermann et al., 2009). Of particular relevance in this context are investment activities (Zimmermann et al., 2009). Appropriate investment decisions are pertinent to farms in general, since a non-adequate endowment with modern investments restricts production efficiency. However, investment decisions are of particular importance for livestock farms, since these extensively require costly facilities, such as stables and machinery for fodder harvesting and limited alternative usability of former investments may hinder farm development.

In Europe, agricultural investments are widely supported within the European Rural Development Programme (RDP), within which farm investment claims 11.5% of the total RDP budget (EC, 2011). Major goals in the programme include improving the economic performance of farm holdings, enhancing technologies and promoting innovations. However, the programme also highlights the presence of external effects of agricultural investments by formulating such public welfare goals as the promotion of organic production and the improvement of the environmental and animal-welfare status of the farms (EC, 2005).

The aim of our paper is to identify the effects of the Austrian farm-investment support programme on structural change in agriculture. Due to the fact that almost all investing Austrian farmers participate in this programme and due to data gaps, we cannot exclusively measure the effects of the government support itself; instead, we analyse the effects of government-supported farm-investment activities on structural change. Since farm investments are not only important for the farmers themselves but also for

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society in general, we do not limit our analysis to such structural effects as farm growth, but we also consider the consequential effects of societal relevance, such as changing production intensity or increasing participation in the organic-farming programme. Furthermore, we analyse the durability of the programme effects by conducting our analysis over a longer time period. This focusing on the dynamics of the programme effects and the additional inclusion of consequential effects of societal relevance allow us a comprehensive assessment which goes – to the best of our knowledge – beyond the current state of literature.

Since we have a rich Integrated Administration and Control System (IACS) dataset, we apply an econometric approach. We combine a *matching* approach with a *difference-in-difference* (DiD) *estimator* (Heckman and Smith, 1999; Smith and Todd, 2005). This DiD approach allows us to tackle self-selection and endogeneity problems which occur in particular in observational evaluation studies like this. As mentioned previously, we use Austria as our study region, since Austria offers its farmers a broad and well-accepted farm-investment support programme: In the period of 2007–2012, about €542 million – 8% of total Austrian RDP – were spent and about 28,000 farms (or 18% of all Austrian farms) participated in the programme (BMLFUW, 2013). Animal husbandry, for which investment decisions are fundamental, is highly present in Austria. Furthermore, environmental soundness and social acceptance of agricultural production methods are of major importance and society clearly expects that even government-supported farm-investments contribute to this goal (Schneider, 2003).

Our paper is structured as follows: in Section 2 (below), we give an overview of the literature and elaborate the main criteria which have to be considered for an assessment of farm-investment support programmes. In Section 3, we describe our conditional DiD model. In Section 4, we present the dataset and select output and *matching* variables. The results of our analysis are outlined in Section 5 and discussed in Section 6. Finally, in Section 7, we draw our conclusions for policy-makers and for further research.

2. Evaluation of the European farm-investment support programme

The evaluation of European agriculture policy measures and the analysis of the corresponding effects caused by subsequent agricultural production decisions have a long tradition. Essentially, researchers try to identify those agricultural production decisions which are caused by policy measures, try to estimate structural effects of the decisions and try to verify whether these effects correspond to the envisaged targets. Practical studies cover a broad range of subject areas and methods: for instance, Pufahl and Weiss (2009) apply a *conditional DiD* approach in order to analyse the effects of the German agri-environmental scheme and find a significant increase in area under cultivation and a decrease in cattle livestock densities; Schader et al. (2013) extend the sector-representative positive mathematical programming model FARMIS to calculate the cost-effectiveness of organic farming support in achieving environmental policy targets in Switzerland and show that policy cost for organic farming support are slightly higher in comparison to a combination of three single agri-environmental measures; Schroeder et al. (2014) combine the Common Agricultural Policy Regionalised Impact (CAPRI) modelling system with a regional Computational General Equilibrium (CGE) model; they show that the RDP causes an increase of farm income and area under cultivation. Alongside these quantitative approaches, Midmore et al. (2008) analyse effects caused by the RDP by using qualitative semi-structured in-depth interviews and documentary evidence; they conclude that the reform of the RDP has only minor impacts on a broad variety of economic aspects, such as the development of competitive premium agricultural products, the professionalization of the agricultural service sector and the development of the food supply chain.

Even the evaluation of farm-investment support programmes has a long history. To the best of our knowledge, it goes back at least to the early 1970s, when researchers began to analyse the effectiveness of these programmes (Beck and Dogot, 2006; Cueto, 2006; Dirksmeyer et al., 2006; Forstner et al., 2009; Hoffmann et al., 1997; Koester, 1974; Lüthge, 1978; Papadopoulou et al., 2012; Peters, 1978; Pfefferli, 2006; Stockhausen, 1971; Striewe et al., 1996). Studies have applied a broad scope of methods ranging from purely qualitative to purely quantitative applications: Stockhausen (1971) and Koester (1974) started in the early 1970s with qualitative works. The first quantitative studies which applied cost-benefit analyses and descriptive statistics appeared with Lüthge (1978) and Peters (1978). In the late 1990s, the applications of before–after analysis increased (Hoffmann et al., 1997; Striewe et al., 1996) and after the year 2000 researchers began to combine quantitative methods with qualitative interviews and descriptive analysis (Beck and Dogot, 2006; Forstner et al., 2009; Pfefferli, 2006). Other current studies exclusively focus on qualitative interviews (Dirksmeyer et al., 2006; Papadopoulou et al., 2012) or descriptive analysis (Cueto, 2006).

With regard to the results of previous studies, it becomes clear that the effect of investment support on the economic success of farms tends to be small. In his theoretical work, Peters (1978) argues that farm-investment support is expected to foster production, but Lüthge (1978) concludes that the effects on profits and equity are small. Moreover, Striewe et al. (1996) describe small effects on equity and Hoffmann et al. (1997) come to a similar conclusion with regard to farm income. Even more current studies do not identify a noteworthy increase in farm income (Beck and Dogot, 2006; Cueto, 2006; Forstner et al., 2009; Pfefferli, 2006). However, these studies detect an improvement in working conditions and working productivity.

The literature review further reveals that a major concern of evaluation studies is assuring the causality between programme measures and estimated effects (Bergschmidt, 2009; Blandford et al., 2010; Margarian et al., 2010). The elaboration of an unambiguously causal connection between policy measures and subsequent effects has challenged social scientists for a long time (Brady, 2008; Heckman et al., 1998; Holland, 1986; Imbens and Wooldridge, 2009; Rosenbaum and Rubin, 1983; Rubin, 1974, 1977). The evaluation of the European RDP is a particular challenge, since programme participation is mostly voluntary and participants are very heterogeneous, working under very heterogeneous conditions. As a consequence, participation decisions might not be solely caused by programme measures but are dependent on other observable and unobservable variables. This problem is referred to in literature as “the self-selection and endogeneity problem”. For instance, the probability of taking an investment decision might not be only driven by the political programme but might also depend on farm size; this correlation might bias estimated programme effects.

In order to avoid a biased estimation of effects, econometric and statistical methods, such as *regression analysis*, *matching approaches* and other *propensity score methods* can be applied (Caliendo and Hujer, 2005; Imbens and Wooldridge, 2009; Morgan and Winship, 2010). However, since these methods control solely for observable variables, literature recommends combining these methods with others which allow controlling for unobservable variables (Caliendo and Kopeinig, 2008; Heckman and Smith, 1999; Imbens and Wooldridge, 2009; Smith and Todd, 2005). Such methods can be *sensitivity analyses* (Rosenbaum, 2005; Rosenbaum and Rubin, 1985), *bounds analyses* (Lechner, 1999; Manski, 1990), *instrumental variables* (Angrist et al., 1996; Imbens and Angrist, 1994), *regression discontinuity design* (Hahn et al., 2001; Van Der Klaauw, 2002) or

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