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# **ON THE EFFECTIVENESS OF RESTRICTED TENDERS AS A FORM OF POLICY INTERVENTION ON AGRICULTURAL LAND MARKETS**

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# **ON THE EFFECTIVENESS OF RESTRICTED TENDERS AS A FORM OF POLICY INTERVENTION ON AGRICULTURAL LAND MARKETS**

## **Abstract**

We analyze the effect of restricted tenders in agricultural land markets on the purchase price using a dataset from Germany and Propensity Score Matching. Our results show that restricted tenders do not fulfill their purpose of allowing structurally disadvantaged groups of bidders to buy at lower prices. On the contrary, they indicate that restricted tenders actually lead to higher purchase prices.

## **Keywords**

Agricultural land markets, restricted tenders, policy intervention, propensity score matching.

## **1 Introduction**

In recent years, the prices of agricultural land in Europe have risen sharply (VAN DER PLOEG et al., 2015). One might argue that the increase in land prices has mainly negative effects, such as rising production costs (FEICHTINGER AND SALHOFER, 2016) and stronger market entry barriers for new or expanding farms (HÜTTEL et al., 2013) which both leads to a reduction in sector efficiency (KILIAN et al., 2012). The sharp rise in land prices led to a discussion on the need for political intervention and stronger market regulation on the agricultural land markets (LEHN and BAHRS, 2018). Smaller, more labor-intensive farms or young farmers have competitive disadvantages (BLAG, 2015; BVVG, 2019). Especially in countries where agricultural land has historically not been in private ownership, such as Europe's post-communist countries, tenders are being held in the course of the ongoing privatization of agricultural land (HARTVIGSEN, 2014). In this context, restricted tenders are discussed and used as one form of political intervention (STACHERZAK et al., 2019). Only certain groups of bidders may participate in such tender procedures in order to give them greater opportunities and to counteract effects such as land grabbing or structural change (BUNKUS and THEESFELD, 2018; STACHERZAK et al., 2019). However, there is yet no scientific evidence on the effect of restricted tenders on the purchase price of agricultural land.

For this reason, this article deals with two central questions: Is there a statistically significant difference between the purchase prices of agricultural land under open and restricted tenders? And onward, do restricted tenders for agricultural land thus fulfill their purpose and allow structurally disadvantaged groups of bidders to buy at lower prices?

To answer these questions we analyze a dataset of over 12,000 agricultural land transactions between 2005 and 2019, which was made available by the land privatizing agency in Eastern Germany (BVVG), using Propensity Score Matching (PSM) introduced by ROSENBAUM and RUBIN (1983) and difference-in-means-analysis. Our results are primarily of interest to policy makers in agricultural land markets as we assess the effectiveness of a widely used intervention tool in terms of purchase price levels.

## 2 Data and summary statistics

Land of the former GDR is sold through tenders (first-price sealed bid auctions) held by the BVVG<sup>1</sup>, which are mainly open. For restricted tenders, the following types of farms are eligible as tenderers: Labor-intensive farms with certain livestock units per hectare, specialized horticultural or permanent crop farms, grazing livestock farms with sheep or goats, organic farms and young farmers under 40 years of age. Only the restricted tenders are tendered with minimum bids (BVVG, 2019).

Our data set consists of 12,875 tenders between 2005 and 2019, of which 1,196 were restricted. Table 1 shows the descriptive statistics of the tenders, differentiated according to the type of tender and time period. In addition to the mean purchase price, several land characteristics which reflect the attractiveness of a land lot in terms of size, land fragmentation, possibility of use and fertility are given. The table highlights that only in the period between 2005 and 2007 is the average purchase price of restricted tenders lower than that of open tenders.

**Table 1: Descriptive statistics on open and restricted tenders over time (n=12,875)**

	2005 - 2007		2008 - 2010		2011 - 2013		2014 - 2016		2017 - 2019	
	<i>Open</i>	<i>Restricted</i>	<i>Open</i>	<i>Restricted</i>	<i>Open</i>	<i>Restricted</i>	<i>Open</i>	<i>Restricted</i>	<i>Open</i>	<i>Restricted</i>
Tenders	1,577	131	2,790	95	2,837	254	2,291	394	2,184	322
<i>Mean</i>										
Purchase price [€/ha]	5,681	4,506	8,303	9,556	12,264	14,053	16,689	17,820	19,765	20,761
Lot size [ha]	6.92	12.41	6.31	17.16	6.64	14.03	6.30	10.85	6.21	10.49
Number of land parcels	5.27	9.01	5.38	11.62	5.59	11.15	5.48	7.47	5.00	6.13
Share of arable land [0; 1]	0.54	0.63	0.55	0.67	0.58	0.63	0.59	0.67	0.67	0.68
Soil quality [0; 100]	41.57	40.82	43.15	43.05	45.54	50.10	44.78	43.65	44.77	42.72

## 3 Econometric model and results

The most difficult part of evaluating the effect of an intervention is measuring the counterfactual (HEINRICH et al., 2010). In this particular case, what would the purchase price have been if it had been an open tender? The aim is to calculate the so called average treatment of the treated (ATT). As can be seen from Table 1, the mean characteristics of the land put up for tender often vary between the different forms of auction. A direct comparison of the average purchase price of both groups would result in distorted estimates. ROSENBAUM and RUBIN (1983) defined the propensity score as the probability of treatment assignment conditional on observed baseline covariates. Their method matches treated and untreated individuals with comparable propensity scores and thus comparable baseline covariates (AUSTIN, 2011). In our case, restricted tenders are matched with open tenders that have comparable land lot characteristics. PSM follows four main steps: Estimating propensity

<sup>1</sup> A more detailed description of the BVVG and the privatization process of agricultural land in Eastern Germany was provided by CROONENBROECK et al. (2018).

scores, checking overlap and common support, executing a matching algorithm and finally estimating the matching quality and the ATT (CALIENDO and KOPEINIG, 2008)<sup>2</sup>.

The results of the logit model of the estimation of propensity scores and therefore the covariates that are used for matching are reported in Table 2. Literature states that in this context not only statistically significant variables should be included in the PSM model, but also those whose influence on the selection process is known (CALIENDO and KOPEINIG, 2008).

**Table 2: Logit model estimation of propensity scores (n=12,875)**

Variables	Estimates
Location in Mecklenburg-Western Pomerania [0; 1] <sup>b)</sup>	10.8986
Location in Brandenburg [0; 1] <sup>b)</sup>	10.5966
Location in Saxony-Anhalt [0; 1] <sup>b)</sup>	11.1290
Location in Saxony [0; 1] <sup>b)</sup>	11.1596
Location in Thuringia [0; 1] <sup>b)</sup>	10.5751
Lot size [ha]	0.0054***
Number of land parcels	0.0150***
Share of arable land [0; 1]	0.2163
Soil quality index [0; 100]	-0.0057**
Time period 2005 – 2007 [0; 1] <sup>a)</sup>	-0.3859***
Time period 2008 – 2010 [0; 1] <sup>a)</sup>	-1.2762***
Time period 2011 – 2013 [0; 1] <sup>a)</sup>	-0.3479***
Time period 2014 – 2016 [0; 1] <sup>a)</sup>	0.3198***

<sup>a)</sup> Reference time period 2017 – 2019; <sup>b)</sup> Dummy variables for the five Eastern German states

\*\*\*, \*\* refers to level of significance at 1 % and 5 %, respectively

The distribution of propensity scores for open and restricted tenders showed sufficient common support for matching (Figure A 1). Differences in the distribution of tender types confirm the use of the PSM method to ensure comparability. As a matching algorithm, nearest-neighbor matching is used to assign each restricted tender the open tender with the closest propensity, so that tenders with similar land lot characteristics, time period and geographical location are matched. The analysis includes only cases with matching propensity scores, leaving 969 of the 1,196 restricted tenders to which an unrestricted tender can be assigned.

The quality of matching is analyzed in two different ways – a visual inspection (Figure A 2) and through calculating the mean absolute standardized difference. This is the most widely used measure of matching quality and should be below 0.25 according to literature (ROSENBAUM and RUBIN, 1985; RUBIN, 2001; STUART, 2010). Both the visual inspection and the calculation (0.064) indicate a good covariate balance. Since the Shapiro-Wilk-test showed that the purchase prices of the matched sample are not normally distributed, the difference-in-means-analysis is performed using a Mann-Whitney-U-test to calculate the ATT.

**Table 3: Estimation of ATT: Effect of restricted tenders on purchase price (n=1,938)**

Tenders	Average purchase price [€/ha]
Open	16,934
Restricted	17,564
ATT [€]	630
p-value	0.04207**

\*\* refers to level of significance at 5 %

<sup>2</sup> For a detailed description of the methodology and different matching methods see ROSENBAUM and RUBIN (1983) and AUSTIN (2011).

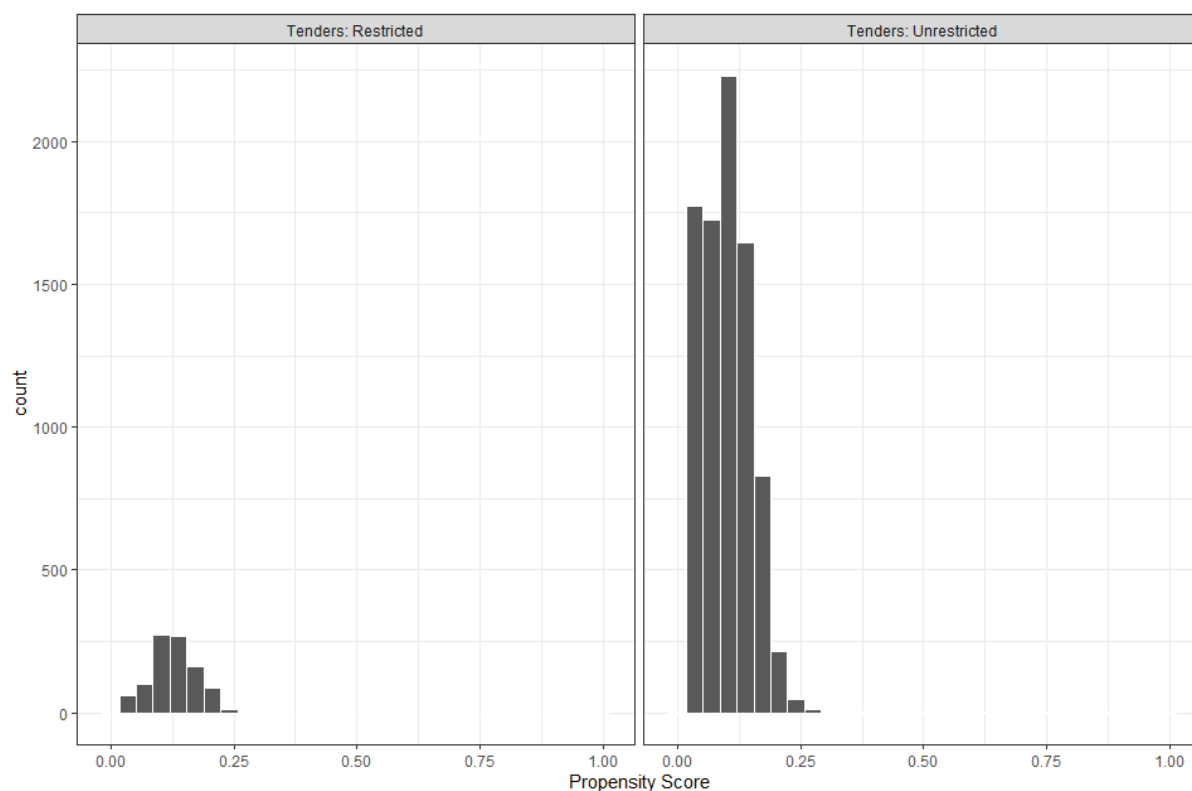
The results presented in Table 3 reveal a statistically significant difference in average purchase prices of open and restricted tenders. The ATT shows that restricted tenders lead on average to a higher purchase price of agricultural land by 630 €/ha.

## 4 Conclusion

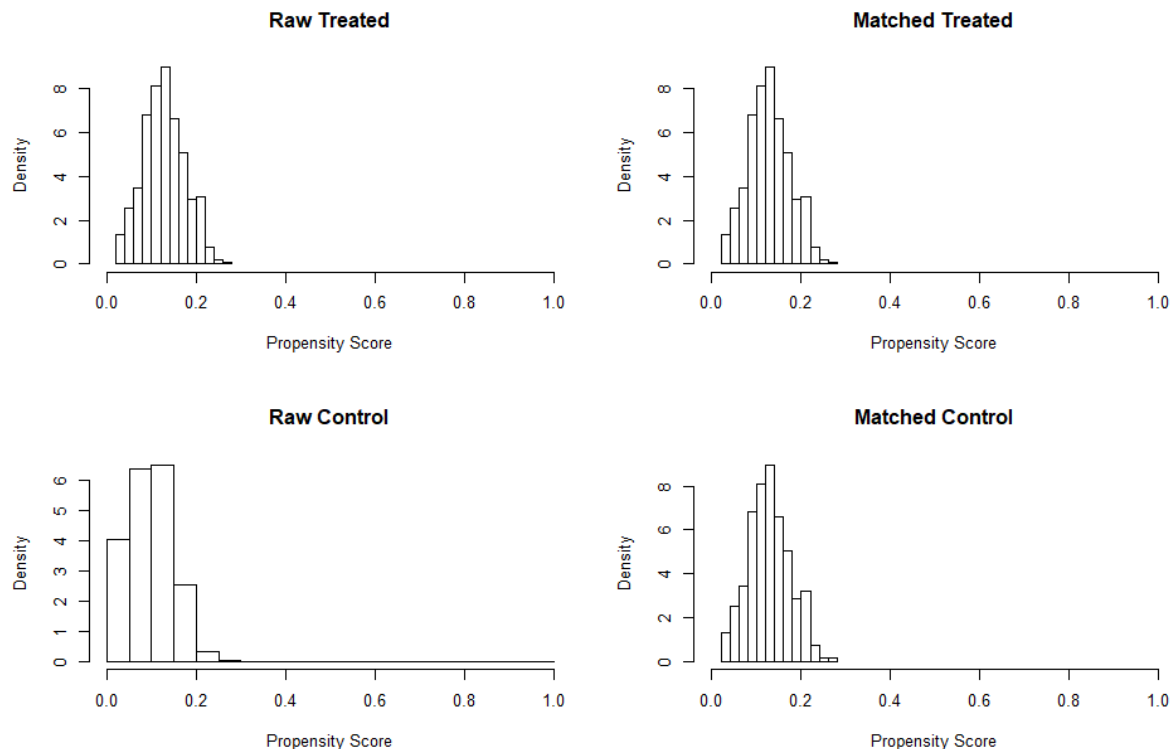
An important contribution of this paper is to show that restricted tenders on agricultural land markets do not fulfill their purpose of allowing structurally disadvantaged groups of bidders to buy at lower prices. On the contrary, the findings indicate that restricted tenders actually lead to higher purchase prices. A possible explanation for this paradox could be that participants in restricted tendering procedures have an incentive to offer more than usual, since they see a chance of success they do not see in open tenders. Furthermore, speculation on resale to previously excluded bidders could be a price driver. Finally, the assignment of minimum bids could also play a role due to anchor effects. Further scientific evidence is needed, in particular with regard to possible motivations for bidding behavior in restricted tenders on agricultural land markets. Based on our results, policy makers are recommended to question the effectiveness of restricted tenders as an intervention tool on agricultural land markets in their existing form.

## Appendix

**Figure A 1: Propensity score distribution and common support**



**Figure A 2: Histograms of propensity scores before and after matching**



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