THE PRICE ELASTICITY OF DEMAND FOR CREDIT OF MIDDLE & SMALL SCALED FARMERS IN TURKEY

1. Research Question

In the study, I will analyze whether the demand of credit for middle and small scaled farmers in Turkey is inelastic or not.

2. Importance of the research

Price elasticity of demand for credit has always been the key feature for financing institutions like banks, etc. to determine the interest rate that should be applied to customers. Numerous research can be found in the literature focusing on this topic. However, most of the studies are not sector-specific and, therefore, might be misleading for some sectors that behave differently from the other sectors. Thus, the different-behaving sectors need to be analyzed separately to prevent profit loss for the financial institutions. Agriculture is one leading candidate for such sectors since the cash flow for agricultural production differs from the other sectors (Continuous costs during production - instant income after harvest). Therefore, analyzing the price elasticity of demand for credit in the agricultural sector is important for financial institutions.

3. Data source and feasibility of the research

In order to establish an econometric model to determine the price elasticity of demand, we have to have different prices applied to different customers. These different prices can be found if we take the prices as a time series. However, for such a model in Turkey, endogeneity would be a challenging problem due to the economy's volatility and high inflation rates. Also, in the agricultural sector controlling the endogenous effects is another difficult task since the production process is easily affected by weather conditions, pests, etc. Therefore, a randomized experimental setup for such a problem would yield more trustful results since it allows us to prevent endogeneity issues.

This study will use data from an experiment conducted by a financial institution specializing in financing Turkey's middle and small-scale farmers in Turkey. The experiment was performed at the beginning of 2020 with many farmers from almost all cities of Turkey. A

treatment group among retailers is chosen randomly, and a different price (interest rate) is applied to the selected treatment group. Sale data (prices and sale amounts) is available for pre post and during experiment. Moreover, regional and farmer specific information is also available in case of the controlling for some features.

4. Empirical analysis

The first objective of the study is to determine whether the demand for credit for middle and small-scale farmers in Turkey is inelastic or not. In order to analyze this, the difference in differences analysis should be suitable since a randomized experimental design is available. The most demanding assumption of difference in differences analysis is parallel trends. By considering the experimental design, we should be able to observe the parallel trends between control and treatment groups.

5. Methodology:

In this project, data from an experiment conducted by a financial institution specialised in agricultural micro-credits will be used. Therefore, for the analysis, the experimental setup will be crucial to convince the reader of the project's assumptions.

5.1. Experimental Setup:

Before diving into the experimental setup, the institution's business model is as follows. The financial institution finances the farmers for the agricultural inputs, and it works with agricultural products retailers to reach the farmers. Once the farmer asks for extended payment options, the retailer makes an application via an integrated system to the financial institution. And Instant payment is made for credible farmers by the financial institution; then, the farmer pays her debt plus interest to the financial institution after her harvest. In this context, the price will be the interest rate applied to the farmer, and the demand will be the demand for credit of the farmers. The institution was using one price for all farmers and retailers as their business model.

At the beginning of 2020, the institution conducted an experiment to measure the impact of different prices. The details of the experiment are as follows:

Randomization: 25% of retailers from each city in Turkey are selected randomly as the treatment group, and the remaining retailers are left as the control group. To gather notion-wide results, the randomisation process is conducted at the city level. Thanks to the randomization process we can prevent any kind of endogeneity. For example, agricultural spending and therefore agricultural credit demand is very sensitive to region and climate. For a non-experimental setup, those factors would cause endogeneity. However, since the retailers are chosen randomly from all regions, this will not be a problem under the experimental design.

Treatment: The price of the credit (interest rate) is increased for the treatment group retailers for one week while it is kept constant for the control group retailers. Also, note that the sale strategy is continued as usual during and before the experiment except for the applied price for both treatment and control groups.

The duration of the experiment was one week, and neither treatment nor control group retailers and farmers were not informed about the experiment. Therefore, from their perspective, everything was the same as the previous week. This will prevent any spill-over effect.

5.2. Data Set and Variable Specification:

Consequently, we have cross-sectional data from the prior week and experiment week. To see the impact of price change, we will use and compare data from both experiment week and the previous week. The required variables will be the following:

Prices:

Since we will be measuring the impact of the price change on demand, we will need the applied prices for control and treatment groups for the experiment week and the prior week.

Application amount:

This project aims to analyse the causal effect of prices (interest rates) on credit demand in the agricultural sector (price elasticity of credit demand). Therefore, we need to measure the credit demand with available data. There are two candidate variables in the data set for this purpose. One is the total sale of the company to the treatment and control

retailer groups and the second option is the total application amount from those retailers. The difference between those two is application amount shows every application even if it doesn't turn to sale. On the other hand, the sale amount is the number that stands for only accepted farmers. In other words, an application turns to a sale if the farmer is found credible and her application is accepted. Then, choosing between these two variables is a question equivalent to "is the demand of non-credible farmers important to us?" The answer is supposed to be yes; because we are dealing with the demand side of the equation, and accepting or rejecting a farmer is on the supply side of the equation. Therefore, we can use the total application from each retailer on the treatment and control group for the experiment week and the prior week to measure the demand for credit.

Control Variables:

To make more accurate analysis, we need to include some control variables too. All control variables should be on retailer scale since our analysis will be done on retailer scale (the reason will be provided in the next section) Firstly, the consumer profile of the retailer should matter for the credit demand from the retailer. The credit demand of high-scored farmers ought to be different from low scored ones. Because, for low credit scored farmers there are not many available alternatives for financing their production this should make them inelastic for credit demand. Therefore, the ***mean credit score of farmers of the retailer*** will be included as a control variable.

In some studies, it is observed that ***gender***, ***age*** and ***region*** of the farmers matter for their credit demand. It should be valid also for agricultural credits. Therefore***, mean age*** and ***share of male farmers and the region of the retailer*** will be included to the analysis.

Moreover, the price (interest rate) of rivals is one of the most crucial factors determining the demand for the retailer. However, this might cause multicollinearity if it is included to the model with applied price of the retailer. Therefore, **the price ratio of rivals to retailer** will be included as another time specific control variable.

5.3. Econometric Model Selection:

In this project, difference in differences method can be used to measure the impact of price change on credit demand. The most binding assumption of Diff in Diff estimation is parallel trends across treatment and control groups. As stated in the experimental setup section of this report. The randomization process allows us to have exogeneity. Therefore, the treatment and control group retailers should have parallel trends for credit demand.

Also note that we are aiming to find an aggregate variable (The elasticity of farmers in Turkey), however the total credit demand of a farmer is not available to us since we have data only from one institution while the farmer may have used credit from other institutions. Therefore, if the analysis is made farmer specific then we would have measurement error. So, we are going to analyze using aggregate data of the retailers and retailer specific customer profile.

The variable specification is following:

R_i: Treatment dummy

T_t: Time dummy which is 1 in treatment week 0 for previous week

$\gamma_{i,t}$: Log of total application to retailer i at time t (Dependent var.)

$P_{i,t}$: Applied price at time t

X_i^1: Vector for retailer specific control variables (customer profile - region) of retailer i

X_t^2: Vector for time specific control variables (price ratio etc.) of time t

The Diff and Diff estimation equation is following:

$$\gamma_{i,t} = \beta_0 + \beta_1 R_i + \beta_2 T_i + \beta_{DID}(R_i * T_i) + \beta_3 X_i^1 + \beta_3 X_t^2 + u_{i,t}$$

Our main interest is β_{DID} which shows the change of credit demand because of higher price for treatment retailers and treatment time.

6. Expected Results:

It is a common sense that increasing price should decrease the demand of a good. It is also the case for credit demand and interest rates. Therefore, I would expect β_{DID} to be negative in this study. One concern may be the demand behaviour change of risky customers at different prices. However, since we have included the credit score to our control variables it will eliminate the impact of risk on our main interest variable. Also,

note that, as a business plan the institution was applying the same interest rate to all farmers regardless of their risks in contrast the usual business plan of banks. Therefore, it prevented any choosing bias that may cause our parameter of interest to be biased.