Access to financial services and bank restructuring: a spatial competition approach

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Abstract

This paper analyzes the distribution of closures of bank branches after a negative shock in the demand for bank services, and whether closures concentrate in less-favored regions generating or increasing financial exclusion. We present a theoretical framework to explain the increments of the distance to the nearest branch and, in particular, the conditions that determine that no branch opens in a given market. Using data of the locations of Spanish bank branches before and after the bank restructuring (2007-2014), we find that the crisis has reduced the spatial accessibility to financial services, it has been heterogeneous across regions and it has been more acute in small municipalities, increasing the risk of spatial financial exclusion. The paper provides evidence that the closures of branches during the crisis respond to two factors. On the one hand, the general decrease in the demand for banking products. On the other hand, the larger reduction of the branch network of *cajas* compared to banks, due to the closing of non-profitable branches whose existence was justified by *cajas*' social mission and to a regulation that forced the reduction of the productive capacity of bailed-out entities.

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1 Introduction

The branch network has been and still is an important asset for the provision of financial services. A thicker branch network increases the welfare of consumers because it improves the access to the financial services. Besides, physical proximity is a key variable in relationship banking to get soft information about the credit quality of the potential borrowers of a bank. The Great Recession has brought about the restructuring of banking sectors in many countries[1], and one of the consequences has been the reduction of the branch network. From the consumers' point of view, the distances to the nearest bank branch have increased, reducing their net utility from financial services. The implications are more negative in regions where the only branch that provided services disappears, because their inhabitants might become in a situation of spatial financial exclusion. Spatial financial exclusion might lead to total financial exclusion if consumers are not able to get financial services through other channels, given that some products granted by banks are based on the relationship banking built in branches.

This paper analyzes the effects on the accessibility to financial services of the reduction of the branch network in a bank system, and analyzes the ultimate consequences in terms of welfare. The paper also explores the effects on welfare of the elimination of banks with a social mission related with the provision of financial services in low-income areas. To do so, we posit a theoretical framework of spatial competition with free entry; that is, an adaptation of Salop (1979) for the banking industry. Opening and keeping a branch has a fixed cost, so banks will only enter into a market if the expected profits (including the fixed cost) are non-negative. The equilibrium with free entry determines the distance among branches and the degree of access of consumers to financial services. The higher the distance that a consumer has to cover, the higher the transportation cost and the lower the accessibility. If the distance is large enough, a client would decline to go to a branch and, thus, he would be excluded from the financial services provided by branches (i.e., financial exclusion).

In the empirical section, the paper presents three models, derived from the theoretical predictions, to analyze the determinants of (i) the average distance among branches, (ii) the population thresholds (minimum level of demand) above which it is profitable to open a branch (Cetorelli, 2002), and (iii) the probability that a municipality becomes branchless by the end of the restructuring process (i.e., spatial financial exclusion) . The models are estimated using data on the geographical location of the population of bank branches in the Spanish banking sector in the years 2007 and 2014, before and after the crisis. The use of these data is justified because the Spanish banking system has undergone through a deep bank restructuring process in which the number of branches has fallen in more than 30%, the number of competitors has decreased and *cajas*, savings banks with social mission, have disappeared. The information has been processed using a GIS software to obtain precise data of the distance between branches or the number of branches in a municipality. The empirical models include two additional variables not directly derived from the theoretical predictions, the proportion of branches of *cajas* and the proportion of branches

[1]The ECB (2015) Financial Stability Report of November 2015 acknowledges that banks are reducing the number of branches as part of their restructuring plans, and also because of the higher propensity of consumers to use digital services.

of bailed-out *cajas* . The aim is to capture two possible effects related with *cajas*' presence in a municipality. On the one hand, whether the regulatory measures [2] that obliged to reduce the branch network of the entities (basically *cajas*[3]) that received public injections of capital had an additional effect on branch closures beyond what would be explained by the fall of demand. On the other hand, whether there are more closures of cajas'branches than banks' branches beyond the effect of regulation affecting to bailed-out entities. A possible reason could be that the conversion of *cajas* into profit-maximizing banks brought about the closing of non-profitable branches that provided services in low-demand municipalities. The paper does not include any variable to address the issue of whether the use of alternative channels to access to financial services (i.e., phone, internet) has compensated the lower spatial accessibility.

This paper contributes to the previous literature in different dimensions. First, it posits a new theoretical and empirical setup to study spatial financial exclusion. Previous studies that have analyzed the location of branches, either they do not have a theoretical framework(Huysentruyt et al., 2013; Damar, 2007) or the setup aims at explaining the location and competition in markets with $N \geq 2$ (Nguyen, 2014). Our paper is the first to provide a theoretical framework that explains why a given market might be or become branchless, $N = \{0, 1\}$, and to posit empirical models to test the theoretical predictions. Second, it analyzes the actual contribution of regulatory measures that aim at affecting the size of the branch network in a banking sector. In this sense, our results could provide insights for policy makers about the actual effectiveness of these type of measures (i.e., promoting M&A among banks to reduce the number of branches). Third, it analyzes the role played by savings banks in the provision of financial services in less-favored regions (Peachy and Roe, 2006) and whether or not the provision is guaranteed by other banks once this type of institutions disappear. Fourth, it contributes to the understanding of the Spanish banking crisis and provide further insights of why the crisis has hit *cajas* much harder than banks (Martin-Oliver et al., 2015; Illueca et al., 2014; Cuñat and Garicano, 2009).

The paper can be embedded in the recent literature that analyzes branch closing in countries under bank restructuring processes (French et al., 2013; Huysentruyt et al., 2013; Damar, 2007) and papers that analyze the impact in terms of welfare of the fall of credit (Nguyen, 2014) or the destruction of relationship banking (Sapienza, 2002; Di Patti and Gobbi, 2007). The paper is also related with the literature of spatial financial exclusion. Previous papers find that geographic financial exclusion is more acute in regions with social problems and limited economic growth (Leyshon and Thrift, 1995, 1996) and districts and regions of low income[4] (Chakravarty and D'Ambrosio, 2006; Leyshon et al., 2008; Huysentruyt et al., 2013; French et al., 2013). In this sense, one of our focus is to assess whether *cajas* were really developing a social mission of finan-

[2]The application of RDL 9/2009 obliges to adjust the production capacity in banks that are to benefit from public capital injections. Among other obligations, the norm forces disinvestment between 10%-20% of the production capacity, depending on the solvency of the bank. In 2012, the European Commission established, bank per bank, the measures that were to be applied in terms of reduction of branches.

[3]There are two exceptions for two commercial banks: Banco de Valencia, which was a bank but belonged to a *caja*, and Banco Gallego

[4]Nguyen (2014) provides evidence that branch closures also can have negative effect on the supply of credit in markets with a thick branch density

cial integration in less favored regions and how the inhabitants can be affected because of the transformation of *cajas* into banks. Finally, the paper is also related with the wide literature that analyzes whether financial consolidation leads to efficiency improvements in the banking sector, due to the reduction of costs derived from synergies and scale economies (Wheelock and Wilson, 2012; Berger and Mester, 2003; Wheelock and Wilson, 2001; Berger et al., 1997).

The rest of the paper is organized as follows. Section 2 summarizes the impact of the bank restructuring in Spain on the branch network. Section 3 presents the theoretical model to analyze the increase of distance among branches and the mission of financial integration of savings banks. Section 4 presents the database of branches, it details the computation of distances and provides descriptive statistics of distances. Section 5 presents the empirical models and results of the determinants of the increase of the distance to the closest branch, the determinants that a municipality becomes branchless and the computation of the population thresholds needed to open one branch, before and after the crisis. Section 6 presents the conclusions and implications of the paper.

2 Bank restructuring in Spain

The number of branches in Spain have been growing continuously since the end of the 80's until the outburst of the crisis in 2008.[5]. This growth was accelerated during the years prior to the outburst of the crisis, estimulated by a continuous growth in demand for bank products, specially loans related with real estate activities (Almazan et al., 2015). The economic and financial crisis abruptly ended with the credit growth, leading to an excess of the productive capacity of the banking sector and the need of restructuring. The Spanish banking sector has undergone through a deep reestructuring process during the years following the outburst of the Great Recession, specially after 2010. The number of branches has decreased drastically and so has the number of banks operating in the Spanish banking sector. [6]

The restructuring process of the Spanish banking sector can be explained by efficiency and institutional reasons. On the one hand, the adjustment of the productive capacity through the closures of branches and the reduction of banks might respond to the fall of the demand for financial services, mainly demand for credit, during the crisis years. In this sense, adjusting the productive capacity could help to preserve the levels of efficiency and profitability during the years of low demand that characterize crisis periods. As well as demand contraction, part of the reduction of the number of branches might respond to the intervention of national and supranational authorities through regulatory

[5]Delgado et al. (2008) explore the different models of geographic expansion of the different Spanish banks during the period 1984-2007. Also, Alamá et al. (2015); Alamá and Tortosa-Ausina (2012); Bernad et al. (2008) provide estimates of different models for the determinants of the number of branches using data at municipality level during the deregulation period.

[6]The restructuring of the Spanish banking sector has brought about the reduction in the number of banks (from 361 in 2007 to 227 in 2014) and the closure of thousands of branches, from 45,597 in 2007 to 31,876 in 2014, according to the Memory of Supervision 2014 published by the Bank of Spain. In savings banks, the number of entities fell from 45 to 8 (Liberbank, BMN bank, Bankia, Caixabank, Abanca, Kutxabank, Ibercaja Banco, Unicaja Banco) and the number of branches from 24,637 to 13,984.

measures. These measures aimed at reducing the capacity of the banks that benefited from public capital injections, to enhance its efficiency, soundness, competitiveness and profitability in the long term. [7] The effectiveness of these measures would depend on whether there are closures of branches beyond those determined by the fall of demand for bank services.

On the other hand, another key factor of the Spanish bank restructuring has been the elimination of savings banks. The so-called *cajas* have been obliged by regulation to transfer the banking activities to a private bank firm and be transformed into foundations. The new foundations are allowed to hold shares of the new bank, but regulation introduces incentives that aim at reducing this participation over time. The reason that justify *cajas*' disappearance might be due to the potential inefficiency of their corporate governance, given that *cajas* were the banks that concentrated most of the losses of the banking sector during the crisis (Martin-Oliver et al., 2015). In terms of accessibility to financial services, the elimination of Spanish *cajas* could have implied the closing of branches that provided services in low-income areas. *Cajas* targeted at fighting against financial exclusion[8] as part of its social projects, and one of the targets was the fight against *spatial* financial exclusion (the so-called *financial desertification*,Thrift and Leyshon (1997)). Overall, both reasons that explain bank restructuring, efficiency and institutional, could have resulted in closures of bank branches in the Spanish banking sector. Figure 1 shows that 52.37% of the municipalities with branches in 2007 have negative growth rates in the number of branches, and in 10.18% of the cases the growth rate was smaller than 50% . In spite of these large figures, there are no studies that analyze the consequences of such restructuring process and little is known about the final welfare implications.

3 Theoretical Framework

The theoretical model posited in this paper is based on the circular market model by Salop (1979), but adapted to the banking sector. The demand for banking services is distributed uniformly along a circle of length L =1, and D is the density of the demand, that is, demand per unit of space. In the equilibrium of the model, branches maximize their capacity to attract potential consumers and they end up by being distributed equidistantly along the circle, being the distance between two branches equal to $\frac{1}{N}$, where N is the number of branches. Products offered by branches are homogeneous, but branches are heterogenous in the eyes of consumers because they face linear transportation costs equal to τ per unit of distance, so they will only buy from the closest branch. Branches compete in interest rates (p) to attract consumers, which receive a positive gross utility of v for consuming the banking product. The consumer located at the maximum distance from the closest branch (distance=$\frac{1}{2N}$) will have a net utility

[7] The introduction of measures that aim at enhancing the consolidation in the banking sector through processes of M&A and liquidation of banks is a common practice in both developed and non-developed countries. See Damar (2007) to illustrate the use of consolidation to solve banking crisis for the case of Turkey (1999-2003)

[8] Financial exclusion can be define as the inability to access to financial services properly, due to problems in the access, price, conditions, marketing or auto-exclusion because of previous negative experiences (Sinclair, 2001), and it can affect individuals (Boyce, 2000; Pollin and Riva, 2002) and groups of people living in the same region.

equal to:

$$U = v - p - \frac{\tau}{2N} \tag{1}$$

Thus, the client will buy a banking product if the total net utility U is non-negative; otherwise he will be excluded from the market of the product. The variable cost to provide one unit of the banking product for the branch is equal to c, and the fixed cost to open a branch is F. For N fixed, the price quoted by branches in the (Nash) equilibrium is determined by the expression:

$$p^* = c + \frac{\tau}{2N} \tag{2}$$

and a demand per branch equal to $\frac{D}{N}$. The profit per branch in the equilibrium would be:

$$\Pi^* = (p^* - c)\frac{D}{N} - F = \tau\frac{D}{N^2} - F \tag{3}$$

and the net utility of the consumer that is at the furthest distance to his closest branch is:

$$U^* = v - \left(c + \frac{\tau}{N}\right) - \frac{\tau}{2N} = v - c - \left(\frac{3\tau}{2N}\right) \tag{4}$$

The number of branches in the equilibrium is determined by the free-entry condition, in such a way that new branches enter in a market as long as the expected profit Π^* is non-negative. Thus, N^* is determined by the value that solves the equation $\Pi^* = \frac{\tau}{N^{*2}} - F = 0$, that is:

$$N^* = \sqrt{\frac{\tau}{F}}\sqrt{D} \tag{5}$$

In the equilibrium, we observe that the number of branches increases with the transportation cost, τ, because a higher differentiation among branches allows them to obtain a higher margin. Given that the profits are higher, so is the number of branches that enter into the market until the equilibrium is reached. The same effect applies for the density of the demand for banking services,D, whereas the size of the fixed costs per branch, F, is negatively related with N^* because it decreases the margin per branch. For the number of branches in the equilibrium, N^*, the utility of the consumer located at the maximum distance from the closest branch can be obtained substituting the value of N^* of (5) in equation (4). For the consumer that is closest to the nearest branch, there is no transportation costs (distance zero). Therefore, one can express the average utility of the consumers located between two branches as the average of the utilities of the consumers located at the maximum and the minimum distance:

$$U^* = v - c - \frac{3}{4}\left(\frac{\tau F}{D}\right)^{\frac{1}{2}} \tag{6}$$

The utility of the average consumer of banking services increases with the gross utility per unit of service, v, and with the density of the demand, D. It decreases with the fixed cost per branch, F, and with the magnitude of the transportation costs.

3.1 Dynamics in N and distance across branches

The previous setup allows us to analyze the dynamics in the number of branches. The increment in N^* comparing two different periods can be obtained taking differences in equation (5)

$$\Delta \ln N^* = \frac{1}{2}\Delta \ln \left(\frac{\tau}{F}\right) + \frac{1}{2}\Delta \ln D \tag{7}$$

From this equation, we observe that the increment of N in a market is determined by the evolution of the demand, of the transportation costs and of the fixed costs of opening a branch. If one assumes that the ratio $\frac{\tau}{F}$ has not changed during the period considered, then (7) becomes:

$$\Delta \ln N^* = \frac{1}{2}\Delta \ln D \tag{8}$$

According to (8), the increment in the number of branches only responds to changes in the density of the demand. Notice that the value of the elasticity of N to the density of demand is smaller than one [9], which can be explained because new openings are not only affecting the demand per branch, but they also decrease the margins per unit of demand as the number of competitors, N, increases.

The closure of branches implies an increase in the transportation costs of consumers because they will have to cover a larger distance to get to the nearest branch. Given that in Salop (1979) branches are distributed equidistantly along the circle (and with the same market share), one can obtain the distance between two branches as the inverse of the optimal number of branches N in (5). Thus, the increment in the distance between two branches can be written as:

$$\Delta \ln DIST^* = -\frac{1}{2}\Delta \ln D \tag{9}$$

According to (9), an increase in the demand for banking products implies a reduction (less than proportional) in the minimum distance between two branches, given the opening of new branches attracted by the increase of the expected profits. Again, the magnitude of the coefficient is lower than 1 in absolute terms because the margin needed to keep a branch open changes as a consequence of the entry/exit of branches into/from the market.

Policy implications Under this theoretical framework, regulatory measures aiming at reducing the number of branches (i.e., imposing size reduction, enhancing M&A, etc) would not be effective because opening and closing decisions are governed only by demand factors. As long as the free entry condition holds, if a branch with non-negative profits closes as a result of exogenous determinants, the model predicts the entry of a new branch. The reason is that the exit of the branch generates expectations of positive profits and, either banks already in that market or banks that were not operating in that market, will open a branch and restore the equilibrium where an additional entry implies negative expected profits.

[9] The concrete value of $\frac{1}{2}$ responds to linear transportation costs

3.2 Markets without bank branches

The equilibrium determined by equations (5) and (6) is valid when there is actual competition among branches, that is, the optimal number of branches must be at least equal to $N^* = 2$. From these equations, the minimum demand to grant the existence of $N^* = 2$ is $D_{min}(N = 2) \geq \frac{4F}{\tau}$. Notice that the function $D_{min}(N)$ that determines the thresholds of demand to open an additional branch (from $N - 1$ to N) are increasing for $N \geq 2$, since the first and second derivatives of the demand of banking products with respect to the number of branches (equation(5)) are positive. In the markets where the density of demand is smaller than the threshold $D_{min}(N = 2)$, there is only room for one branch. In this case, the first bank that enters the market enjoys monopoly power, knowing that a second branch would generate negative profits and competitors would renounce to enter. Now, the interest lies in whether one branch is profitable enough to be opened in the market, and if the potential monopolist gains are sufficient to cover F. The maximum profit that the monopolist can obtain is given by the situation in which he is able to discriminate prices, that is, he can extract all the consumer surplus to every consumer. Assuming that all the consumers obtain a non-negative utility to purchase the bank product (that is, the consumer located at the further distance is interested in buying), the average price per unit of service set by the monopolist would be $p_M = v - \frac{\tau}{4}$, and his profit for N^* would be given by:

$$\Pi_M = \left(v - c - \frac{\tau}{4}\right) D - F \tag{10}$$

If this maximum profit is negative, there would be no room for one single branch and the market would be excluded from the provision of financial services. The minimum demand that guarantees the provision of financial services is given by the threshold:

$$D_{min} = \frac{F}{v - \left(c + \frac{\tau}{4}\right)} \tag{11}$$

The expectation of negative profits in markets with $D < D_{min}$ would deter the entry of profit-maximizing banks. So, if a bank decides to open a branch, it is against the criterion of profit maximization. This framework could explain why *cajas* provided bank services in municipalities where banks were not interested. *Cajas* would be opening branches in municipalities with $D < D_{min}$ as part of their social labor of fighting against financial exclusion, subsidizing these branches with positive profits obtained in other segments of their activity.

4 Database

4.1 Data sources

The database used in the analysis combines information from different sources. First, the geographical location of bank branches comes from the *Guía de la Banca*, published by Maestre Ediban, which provides the complete census of the active bank branches during the period 2007-2014. The database identifies branches that have been closed or integrated into another existing branch, and provides a complete picture of the openings and closures of branches over time. It also allows to identify changes in the ownership of branches that result from the processes of M&A and liquidation that take place during the bank restructuring, or from the sale of branches to another bank.

Changes in the demand of the municipalities will be studied with data from the Spanish Institute of Statistics (INE). The database contains information for 2007 and 2014 of the number of people and its distribution into groups attending to age (percentage of people under the age of 16 old, 16-64 and over 64) and education (percentage of illiterates, Primary School, High School, graduates and higher). From the Spanish Employment Institute (Servicio Publico de Empleo Estatal, *SEPE*) we draw data on the number of people registered as unemployed and the percentage of unemployed workers in each economic sector.

Census data are also used because they provide a more precise measure of employment, though the information refers to years 2001 and 2011 because data are only available for Census years, every ten years. From Census, we construct the ocupation rate (*%OCUPATION*) and the percentage of occupied people working in each of the economic sectors. The INE also provides information of the cartographic limits of administrative division (municipalities, provinces, regions) and its areas that are used to compute distances to the nearest branch for each municipality and the extension of the geographic area. We combine the previous data with indicators of per-capita income in 2007 for each of the municipalities with more than 5,000 inhabitants, data provided by FEDEA and constructed from microdata of individual tax reports provided by the Spanish Tax authority (AEAT).

Table 1 presents descriptive statistics of the main variables that will be used as regressors in the empirical models. We observe that, on average, the population of municipalities have decreased in 3% and the per-capita income in 13.3%, figures that suggest a fall in the demand for bank products. The proportion of illiterates, with lower capacity to generate income, has increased in 7.8%, whereas the proportion of the elderly has increased in 4.1%.

4.2 Computation of Distances

From the postal directions of the population of branches, we have obtained the exact coordinates of the location[10] the the population of bank branches in 2007 and 2014. We exclude the branches of banks located in foreign countries and end up with 44,818 branches in 2007 and 31,647 in 2014. This information is processed with a GIS software (Geographic Information System) and we generate the Euclidean distance [11] between two branches and, with the boundaries of each municipality, the average distance of the branches located in the municipality to the nearest competitor. For municipalities without branches, we approximate the distance to the nearest branch as the average value of the radius of the Thiessen poligons that intersect the municipality [12]. We also assume

[10] In 90.16% of the cases we are able to obtain the exact coordinates of the branch. For 7.2% of the branches we can locate the street, but not the exact location of the branch. For the rest of the cases, we have the coordinates of the locality of the branch. In this latter case, we drop the information for municipalities with more than 3 branches, to mitigate possible measurement errors in the computation of distances.

[11] We assume that the Euclidean distance is a good proxy for the actual distance (through paths, roads or alleys) to the nearest branch.

[12] See Appendix A for the computation of Thiessen Poligons and the distance imputed to municipalities without branches

that, *ceteris paribus*, the indifferent consumer is located at the middle point of the Eucledian distance that separates two branches.

4.3 Population of the municipality and distance to the nearest branch

Table 2 presents descriptive statistics of the average distance to the nearest branch for consumers living in municipalities of different population size. Table 2 shows that the reduction of the branch network in Spain has brought about an increase in the distance to the nearest branch and, thus, of the transportation costs faced by consumers, and the increase is a common feature for all the municipalities, independently of their population size.

From Table 2, we also observe that the smaller the population size of the municipality, the larger are both the distance to the closest branch in 2007 and the growth of the distance in 2014. This result is in line with the theoretical predictions (5) and (9) that the number of branches (distance) decreases with the fall of the demand for banking products. That is, consumers from low-populated municipalities (lower demand) face higher initial transportation costs, and they are also the ones that suffer from a higher increase in the relative distance to the nearest branch as a consequence of the bank restructuring. For example, the average distance increases in 972 meters (from 7.454 kilometers to 8.426 kilometers) for an individual living in a municipality with a population lower than 1,000 inhabitants, and in 683 meters (from 1.680 kilometers to 2.363 kilometers) if the population ranges between 1,000 and 2,000 inhabitants. This figures are large if compared with the increments in distance for highly-populated municipalities, whose consumers face relatively low increases in transportation costs: for municipalities with more than 10,000 inhabitants, the average minimum distance remains below 200 meters, and it is reduced to 100 meters for municipalities with more than 50,000 inhabitants.

Therefore, Table 2 presents evidence that the reduction in the number of branches has been relatively higher in municipalities with lower population. Now, we address the question of whether the reduction in the number of branches responds only to the fall of the demand for banking products or whether there are other explanatory factors related with the bank restructuring. We will also analyze whether branch closings can be explained, as well as by demand factors, by the removal of *cajas* and their financial integration target from the Spanish banking system.

5 Empirical Model and Results

5.1 Dynamics of the distance

5.1.1 Empirical model

This Section explores the determinants of the growth rate of the distance to the nearest branch. From (9), the empirical model to estimate has the functional form:

$$GR\_DIST_i^{14-07} = \kappa_1 GR\_D_i^{14-07} + \kappa_2 \%CAJAS_i^{07} + \\ + \kappa_3 \%CAJAS\_PROBLEM_i^{07} + \sum_{m=1}^{52} \kappa_m^R PROV_m + \zeta_i \tag{12}$$

where variable $GR\_DIST_i^{14-07}$ is the growth of the distance to the nearest branch in municipality i during the period 2007-2014, and $GR\_D_i^{14-07}$ the growth of the demand in municipality i that is proxied with different socioeconomic variables (Okeahalam (2009)) that aim to capture the change in the total population and the change in the per-capita income. Depending on the model specification, demand growth GR_D^{14-07} is proxied with the growth of population ($GR\_POPULATION$), the growth of the unemployment rate ($GR\_UNEMPLOY$), the growth of the percentage of illiterates ($GR\_ILLITERATES$), the growth of people over the age of 64 ($GR > 64YEARS$) or the growth of a proxy of the per capita income constructed from data of tax reports, GR_PC_INCOME .[13].

We expect a negative sign in $GR\_POPULATION$ and GR_PC_INCOME and smaller than 1 in absolute value, in line with the model prediction that a variation in distance would be less than proportional than a variation in the demand because of the change in the competitive conditions of the market as a result of branch entries/closures. The coefficient of $GR\_UNEMPLOY$ is expected to be negative because unemployment is inversely related with the per-capita income. Assuming that the demand for bank branches is higher in municipalities with lower proportion of illiterates (higher income), we expect a positive sign of $GR\_ILLITERATES$. Finally, the coefficient of $GR > 64YEARS$ should be negative because elderly in Spain has been a core consumer of the bank branch, because of their high transportation and switching costs. Nonetheless, the literature of financial exclusion (Pollin and Riva, 2002) predict a positive sign of the coefficient, given that they are a collective traditionally excluded from the provision of financial services.

Besides the variables of demand, the empirical model includes the proportion of branches located at municipality i in year 2007 that belonged to savings banks, $\%CAJAS$, and the percentage of savings banks that were injected with public funds during the crisis, $\%CAJAS\_PROBLEM$. These variables aim at capturing whether differences in the relative weight of *cajas* in 2007 are related with changes in the average distance to the closest branch. Two effects could explain this result. On the one hand, regulation obliged to reduce the productive capacity of the the bailed-out entities, which in practical terms only affected to $cajas$ because only two small commercial banks were injected with public funds. A positive coefficient of $\%CAJAS\_PROBLEM$ would support this hypothesis. The non-significance of the coefficient could explained because either the regulatory measure has not implied more closures beyond what could

[13]To obtain a measure of the per capita income for all the municipalities in 2007 and 2014, we estimate a model that relates the per capita income with the log of the population, the area of the municipality, the unemployment rate and province dummies using the available data of the 1,109 municipalities in 2007. With the estimated coefficients, we predict the income of 2007 for the rest of municipalities. By the same token, the value of the per capita income of 2014 for all the municipalities is predicted with the estimated coefficients using the values of the explanatory variables for 2014.

be explained by the fall of demand, and/or that regulation did force closures of branches with positive profits, but they were replaced by new branches of commercial banks (not subject to such regulation) as our theoretical model predicts. On the other hand, a higher increase in the distance could be due to the closure of branches that are no profitable after the transformation of *cajas* into banks, whose existence was justified by the social mission of savings banks. Once they disappear from the banking sector, there would be no commercial banks interested in replacing the closed branches. This effect would be captured by the proportion of branches of cajas $\%CAJAS$, once we have controlled by $\%CAJAS\_PROBLEM$. A positive coefficient would imply that the distance has increased more in municipalities where *cajas* were relatively more important. We expect this effect to be stronger in low-populated municipalities.

5.1.2 Results

Results are presented in Table 3. We first analyze the coefficients of the variables tied to changes in the demand of bank products. The different specifications differ in the variable that is used as a proxy of the increment in the demand for bank products (9) between 2007 and 2014. The first specification uses the population growth, the second uses the growth of the percentage of illiterates and of the people over the age of 64 and the third uses the growth of the estimated income per capital.

The last three specifications, (3), (4) and (5) are estimated with instrumental variables to cope with the measurement error of the variable GR_PC_INCOME, which has been estimated as explained in footnote 13. The instruments used are the proportion of each economic sector in the economy of the municipality in 2001 and 2011 and the explanatory variables included in the specification of Column 2. The difference across specifications is that Column (3) includes the whole sample of observations, whereas (4) and (5) split the sample to analyze the different effect of $\%CAJAS$ depending on the size of the population: Column (4) only includes observations of municipalities with population lower than 1,000 inhabitants, with low demand and where *cajas*' might have opened branches because of their social mission, and Column (5) is estimated with municipalities larger than 5,000 inhabitants, less likely to be under risk of financial exclusion.

We observe that the sign of the coefficients of the proxies for the increment in the demand are in line with the model predictions. First, Column (1) shows that the growth of the population is negative and statistically significant. This means that the distance to the nearest branch has increased in regions where the number of inhabitants has decreased. Besides, and as predicted by the theoretical model, the null hypothesis of the coefficient being smaller than 1 in absolute terms cannot be rejected. Thus, we find evidence that a fall in the demand for bank products is not translated into a proportional decrease (increase) of the number of branches (of the distance). As stated above, the reason is that the closing of branches increases the market power of the competitors that stay in the municipality, and they can get higher margin with lower demand in such a way that they can cover the cost F. More concretely, we estimate that if the population decreased in 10%, the average distance to the closest branch would increase in 2.21%, after controlling for the heterogeneity across provinces.

Column 2 of Table 3 shows that a higher weight of illiterates implies an increase of the minimum distance to a bank branch, which is a reasonable result if the literacy level is a good indicator of the economic progress of a region. We also observe that an increase in the group of people over the age of 64 years reduces the average distance to the closest branch. This might be due to the intensive use of bank branches of elderly to manage their savings, given the low substitution with respect to other bank channels such as phone banking or internet banking. In Column 3, the proxies for the growth of demand are GR_PC_INCOME and $GR\_POPULATION$. Both coefficients are negative and statistical significant with an absolute value smaller than zero, results that confirm the predictions from the theory that a decrease in demand increases the distance to the nearest branch.

As for the coefficients of $\%CAJAS$ and $\%CAJAS\_PROBLEM$, they are both positive and statistically significant and their magnitude does not change much across the three specifications. The significance of $\%CAJAS\_PROBLEM$ suggests that regulation measures forced closures of bailed-out *cajas* beyond what would be expected by a fall in the demand. Besides, the statistical significance of $\%CAJAS$ also suggests that even savings banks that could cope with the crisis without public aids did close more branches than commercial banks. Results in Columns (4) and (5) show that these effects are only observed in small municipalities with population lower than 1,000 inhabitants, but not in municipalities larger than 5,000 inhabitants, once the fall in the demand has been controlled for. The significance of $\%CAJAS$ in small villages is consistent with the hypothesis that *cajas* opened branches in less-favored regions to fight against financial exclusion; this would explain why it is not significant in larger municipalities. The significance of $\%CAJAS\_PROBLEM$ in Column (4) and not in Column (5) could be possibly explained because bailed-out *cajas* choose to concentrate the overall reduction of their branch network in smaller municipalities.

5.2 The mission of financial integration of savings banks

This section presents two empirical models to explore the idea of whether savings banks opened branches in regions where it was not profitable in economic terms to do so. The first model aims at estimating the population thresholds from which it is profitable to open an additional branch in a given municipality. The results will allow to assess whether savings banks opened branches in municipalities applying a lower threshold than that required by banks. The second model is a probabilistic model to analyze whether municipalities where the provision of financial services was carried out exclusively by savings banks have a higher probability of becoming branchless.

5.2.1 Thresholds of population

Empirical model The first model is based on the methodology posited in Cetorelli (2002) to estimate the population thresholds that determine the minimum demand from which it is profitable that a new firm enters a market. It uses an ordered Probit and the main equation derived in the theoretical model comes from the profit function of the N^{th} bank that considers whether or not to enter the market. This equation depends on the socioeconomic characteristics of the region (i.e., unemployment rate, wages, income, etc).

The empirical model assumes that, when the expected profits of the potential entrant N^{th} become higher than a certain threshold, then that firm decides to enter the market, and this fact decreases the unit profits of the incumbent competitors. The model estimated is an Ordered Probit in which the dependent variable takes the values from 1 to 5 if there are 1,2,3,4 or 5 firms and 6 if there are 6 or more firms. From the estimates derived from the model, Cetorelli (2002) estimates the population thresholds that determine the entry of a firm in a market.

This section presents an adaptation of the methodology in Cetorelli (2002) for the banking sector, being our main equation to be estimated:

$$\begin{aligned} y_i^T &= \delta_1 \ln POPULATION_i^T + \\ &+ \delta_2 \%CAJAS_i^{07} + \sum_{m=1}^{52} \delta_m^R PROV_m + \epsilon_i \end{aligned} \tag{13}$$

where y_i^T is the dependent variable that takes values from 0 to 6 if there are 0,1,2,3,4,5 or 6 and more branches in municipality i in year $T = 2007/2014$. $\ln POPULATION_i^T$ captures the effect of a larger potential market on the expected profit of the N^{th} bank. Once we have estimated the Ordered Probit, this variable will allow us to compute each of the thresholds of population that make it profitable to open an additional branch in the municipality.

In order to capture the differences in the population thresholds attending to whether the financial services are provided mainly by savings banks, we add the proportion of branches owned by savings banks in 2007, $\%CAJAS$. We expect a positive coefficient if savings banks subsidized non-profitable branches in municipalities with low demand for bank products, for the sake of their mission to fight against financial exclusion. Notice that here we do not include $\%CAJAS\_PROBLEM$ because the main target is to compare whether the population thresholds were smaller for *cajas* than for *banks* in 2007, which is not related with the regulatory measures introduced after the outburst of the crisis. Lastly, the empirical model also has dummy variables that identify the province of the municipality, to capture the most significant differences in terms of income and unemployment across provinces. The populations thresholds are computed for the average values of the coefficients of these dummy variables.

Results Table 4 presents the results of the estimation of the population thresholds to open the first and successive branches in a municipality, obtained from the estimation[14] of the Ordered Probit (13). Such cut points have been computed for the average values of the explanatory variables. Table 4 displays the thresholds estimated for 2007 and 2014 in three different scenarios: i) a municipality with a proportion of savings banks, $\%CAJAS$, equal to the average across municipalities in 2007, which is equal to 31.6%; ii) a municipality without branches of savings banks; and (iii) a municipality whose all branches belong to savings banks in 2007.

From Table 4 we observe that the population thresholds to open the first and successive branch in a municipality have increased in 2014, compared with 2007. For a municipality with an average proportion of savings banks (Column 1), the

[14]Value and statistical significance of coefficients: For 2007, δ_1=1.490 and δ_2=1.142, both significant at 1%. For 2014, δ_1=1.429 and δ_2=0.684, both significant at 1%.

minimum population needed to have at least one branch has increased from an average of 484 inhabitants to 539. Notice that the increase in population that is required to open an additional branch is increasing in both years 2007 and 2014 (for instance, in 2007 the increase in population needed to open the second branch is equal to 632 inhabitants, 1,078 for the third, 1,158 for the fourth, 1,207 for the fifth and 1,531 for the sixth and beyond), in line with the theoretical prediction that increases in demand (population) are translated less than proportionally into increases in the number of branches (i.e., coefficient $\kappa_1$of (12) smaller than 1 in absolute value).

Next, we compare whether there are differences in the thresholds to open 1 branch for banks and for savings banks. The thresholds have been computed replacing the value of $\%CAJAS$ by 1 (Column 3) and 0 (Column 2) for *cajas* and banks, respectively. We observe that the minimum number of people for a *caja* to open a branch in 2007 is less than half of the threshold of banks (288 and 618 inhabitants, respectively). Then, if the threshold for banks is close or equal to the minimum demand D_{min} that guarantees positive economic profits, the lower threshold of *cajas* would be in line with the hypothesis that they opened branches with negative profits in less-favored municipalities. It can also explain why *cajas* are the entities that provide financial services in more than two thirds (68.2%) of the municipalities with only one branch (843 out of 1.236 municipalities), whereas banks only provided financial services in 77 of these municipalities (6.2%). The rest corresponds to municipalities where the branch belong to a credit cooperative.

Comparing the threshold to open the first branch in 2007 and 2014, we observe that it remains practically unchanged in municipalities without savings banks. However, in municipalities with savings banks, the minimum threshold increases from 288 to 402 inhabitants. The results suggest that, in the case of banks, the closing of branches would respond to the fall in the population below the minimum threshold, but not due to changes in that threshold. However, in the case of savings banks, the closing of branches could be due to both a fall in the demand and/or an increase in the population threshold. In other words, the increase in the threshold could result in closures of branches, even when the demand for bank products has increased but not enough to compensate the higher threshold. The evidence shows that savings banks are adjusting their minimum thresholds and they are converging to banks'. This evidence is, then, consistent with the hypothesis that the transformation of *cajas* into banks brings about the reduction of investment in social projects, in this case the fight against spatial financial exclusion. But it could also be consistent with the hypothesis that bailed-out *cajas* concentrate the adjustment of their productive capacity in smaller municipalities. Which of the two hypothesis can better explain the closures in small municipalities is the target of the next empirical model.

5.2.2 Probability of becoming branchless

Empirical model The target of this Subsection is to analyze which factors determine the closing of *all* the branches by 2014 in a municipality with branches in 2007. We test whether the two complementary hypotheses stated above can explain why an municipality becomes branchless. First, it might be due to the fall in the demand of the municipality between 2007 and 2014 below the population threshold that guarantees non-negative economic profits, D_{min}. Second, it might be due to the increase of the minimum threshold , D_{min}, and that the new demand does not guarantee enough income to keep the branch open. In the previous Section we found that former *cajas* are the ones that have increased the minimum threshold, so evidence in favor of the second hypothesis would suggest that the closures of *cajas*' branches explain why small municipalities become branchless. If this is the case, we will try to discern whether the reason is (i) the disappearance of savings banks that subsidized the branches' losses under the umbrella of their financial integration mission and/or (ii) the concentration in smaller municipalities of the adjustment in productive capacity forced by regulation . To test these hypotheses, we posit the following Logit model to be estimated:

$$Pr(p_i = 1) = f\left(\%CAJAS, \%CAJAS\_PROBLEM, X_i, PROV_m\right) + \nu_i \quad (14)$$

The dependent variable p_i takes the value of 1 if the municipality had branches in 2007 but losses them all by 2014. Vector X_i includes the following socioeconomic characteristics of the municipality: area in Km^2, population in municipality i, proportion of illiterates, proportion of population over the age of 64, unemployment rate and the growth rate of the last four variables. X_i also includes the weight of the different economic sectors of the economy and the occupation rate of the population of the municipality as in 2001, with the aim of capturing differences in the starting points of these economies. Lastly, we control for heterogeneity across the 50 Spanish provinces with the inclusion of a set of dummies that identifies the province where the municipality belongs to. We restrict the sample to municipalities with 1, 2 and 3 branches in 2007 because they represent a significant percentage of the municipalities that become branchless by 2014. Thus, municipalities with a higher number of branches are excluded because the probability to become branches tends to zero as we increase the threshold.

Our two hypotheses are non-exclusive, and the test is based on the sign and statistical significance of the coefficients estimated. If the closing of all the branches in small municipalities responds to the first hypothesis (demand falls below D_{min}), then we can expect that the coefficients of the growth rates of the socioeconomic variables in X_i would be statistically significant and with the same expected signs as in (12). On the other hand, if the main determinant of becoming branchless is the increase of the minimum thresholds, D_{min}, then we would expect the levels of the socioeconomic variables in 2007 to be statistically significant. This second hypothesis would be also consistent with a positive and statistically significant coefficient of $\%CAJAS$, if they were closing branches with negative profits in less favored municipalities. It would also be compatible with a positive coefficient of $\%CAJAS\_PROBLEM$, if bailed-out *cajas* closed more branches in small municipalities to fulfill the regulatory imposition of reducing their productive capacity.

Results Table 5 displays the results of the estimation of equation (14). The results show evidence in support of the second hypothesis, that is, the closures obeys to the increase in the minimum thresholds. But it does not seem to support the first hypothesis of the decrease in the demand. More concretely, the results show that lower population, higher percentage of illiterates and lower proportion of people over the age of 64 in 2007 increase the probability that a municipality becomes branchless by 2014. However, the probability does not depend on the growth rates of these variables in the period 2007-2014 (with the exception of the growth of illiterates, significant at 10%).

As for the coefficient of the *cajas* variables, $\%CAJAS$ is positive and statistically significant, whereas $\%CAJAS\_PROBLEM$ is not statistically significant. This result suggests that, besides the increase in the thresholds, small municipalities become branchless because *cajas*stop subsidizing branches whose existence was justified by their social mission of fighting against financial exclusion. We do not find evidence that bailed-out *cajas* concentrated closures in smaller municipalities or, if they did, those the closures must have been replaced by branches of new banks, provided that they had positive expected profits.

6 Conclusion

The branch network is a key factor in the provision of financial services of banks. On the one hand, banks get soft information from potential borrowers in branches and certain loans could not be granted without this relationship banking. A higher number of branches also benefits consumers because they have to face lower transportation costs to the nearest branch.

On the other hand, the opening of an additional branch implies a fixed cost that banks have to cover with the activity and margin of the branch. If the branch opens in a region with a low density of demand, the branch will need to attract potential consumers from further distances to get non-negative profits, compared with a branch located in the center of a populated city. Spain has a large and thick network of branches, but the spatial accessibility or average distance of the consumers of banking products is not homogeneous across regions. Indeed, we could find small municipalities where demand is not high enough to guarantee non-negative economic profits even for a single branch, and their inhabitants have to move to other bigger, more populated municipalities to get bank services from a branch. Besides, the lower the density of demand, the higher is the margin in the equilibrium for a given distance among branches. This implies that clients of branches in municipalities with low demand will pay more for their credits and will be paid less by their deposits that clients of branches in big cities.

Banking and finance professionals claim that the banking sector in Spain is translating from a traditional model, based on proximity of branches, to a new model based on new technologies in which branches will not be so important. From 2008 until present, the number of branches in Spain has decreased at unprecedented rates since the liberalization of the banking sector at the end of the 80's. One of the potential reasons is the change from the branch-based model towards a model where internet and digital connections substitute branches. If this is the case, the closure of branches should not be a concern, because they are substituted by phone/internet banking and other channels with transportation costs close to zero. Nonetheless, it should be taken into account whether relationship banking is affected by the decrease in physical proximity or, on the contrary, it can be substituted efficiently by transactional banking through the digital support.

In all events, bank branches are an access point to bank services and deepening in the reasons and implications of the closures of bank branches is relevant, to understand the future of the banking system and to extract lessons that can be useful for policy makers. This paper aims at assessing the adjustment of the number of branches in Spain during the years previous to the crisis, under the null hypothesis that it is due to the fall of the demand for bank services during the crisis years. To test this hypothesis, we posit a model of spatial competition focusing on the bank branch as the decision unit, and we test the predictions derived from the theoretical framework using an empirical model. The results suggests that not only the fall of demand for bank products determines branch closings, but the proportion of closures is higher in municipalities with higher number of branches belonging to savings banks.

A potential explanation of this result is that savings banks have been closing branches with negative profits whose existence was justified by the *cajas*' mission of financial integration. Once savings banks are transformed into profit-maximizing commercial banks as an outcome of the bank restructuring, the new banks no longer support non- profitable activities and close these branches. Another potential explanation is that the number of branch closures is higher in savings banks than in commercial banks because the growth of the former during the expansion years was excessive. As well as readjusting, savings banks were forced by regulation to reduce their productive capacity as a condition to perceive financial aids to enhance their capital ratio.

There is evidence supporting both explanations. On the one hand, the provision of financial services only by savings banks in a municipality in 2007 increases the probability that the municipality becomes branchless by 2014, possibly because they are branches with negative profits that fulfill the mission of financial integration (it seems less reasonable to think that this branches in small municipalities were opened as an expansion strategy of cajas). On the other hand, the deep restructuring in the number of branches cannot only be explained by the closures of branches in small municipalities. Whatever the reason, further research is needed to explore the evolution of banks' branches in Spain, in the present and in the future, and study the transition from the *proximity* banking to a *digital* banking.

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Table 1: Descriptive Statistics of Main Variables at Municipality Level

VARIABLE	Definition	Mean	Std.Dev	p10	p50	p90
$\%CAJAS$	% of branches belonging to *cajas*	.368	.367	0	.375	1
$\%CAJAS\_PROBLEM$	% of *cajas*' branches belonging to bailed-out *cajas*	.377	.428	0	0	1
$POPULATION_{2007}$	Population in 2007, in thousands	5.574	44.90	0.084	5.780	8.476
$\ln PC\_INCOME_{2007}$	Estimation of the Taxable Income of a municipality divided by number of inhabitants in 2007, in th€	6.289	2.814	3.397	5.770	9.637
$\%ILLITERATES_{2007}$	% of illiterates in 2007	.146	.088	.053	.123	.275
$\% \geq 64YEARS_{2007}$	% of people over the age of 64 in 2007	.271	.107	.147	.255	.421
$UNEMPLOY_{2007}$	Unemployment rate using the number of people registered as *unemployed* at SEPE	.056	.033	.020	.051	.099
$GR\_POPULATION$	Growth rate of the population between 2007 and 2014	-.030	.134	-.187	-.033	.126
GR_PC_INCOME	Growth rate of the estimation of the per-capita income between 2007 and 2014	-.133	.177	-.356	-.127	.073
$GR\_ILLITERATES$	Growth rate of illiterates between 2007 and 2014	.078	.081	-.000	.071	.180
$GR\_ \geq 64YEARS$	Growth rate of elderly between 2007 and 2014	.041	.135	-.117	.034	.201
$GR\_UNEMPLOY$	Growth rate of unemployment rate between 2007 and 2014	1.486	1.455	.297	1.180	2.762

Table 2: Descriptive Statistics

Distance to the Nearest Branch, by Size of Municipality (Km)

2007	**Mean**	**Std.Dev**	**p10**	**p50**	**p90**
<1,000 inhab	7.454	4.603	0.161	7.736	13.387
1,000-2,000 inhab	1.680	2.846	0.020	0.104	5.823
2,000-5,000 inhab	0.622	1.775	0.018	0.057	1.790
5,000-10,000 inhab	0.181	0.512	0.018	0.050	0.357
10,000-50,000 inhab	0.111	0.139	0.027	0.061	0.250
50,000-500,000 inhab	0.069	0.039	0.037	0.057	0.109
>500,000 inhab	0.043	0.006	0.035	0.044	0.049
2014	**Mean**	**Std.Dev**	**p10**	**p50**	**p90**
<1,000 inhab	8.426	4.671	1.894	8.538	14.340
1,000-2,000 inhab	2.363	3.524	0.023	0.336	7.278
2,000-5,000 inhab	0.816	2.173	0.019	0.061	2.815
5,000-10,000 inhab	0.197	0.540	0.019	0.051	0.434
10,000-50,000 inhab	0.132	0.170	0.028	0.071	0.301
50,000-500,000 inhab	0.093	0.051	0.049	0.075	0.162
>500,000 inhab	0.056	0.008	0.045	0.057	0.065

Table 3: Determinants of the Growth Rate of the Distance to the Nearest Branch

Dependent:Growth Rate of Distance to the Nearest Branch					
	(1)	(2)	(3)	(4)	(5)
$\%CAJAS$	0.328***	0.309***	0.307***	0.214***	0.202
	(6.32)	(5.73)	(5.68)	(3.47)	(1.39)
$\%CAJAS\_PROBLEM$	0.300***	0.309***	0.301***	0.488***	-0.058
	(5.46)	(5.52)	(5.40)	(7.25)	(-0.05)
$GR\_POPULATION$	-0.221***	-0.318***	-0.241**	0.0165	-0.101
	(-3.26)	(-3.25)	(-2.29)	(0.14)	(-0.48)
$GR\_ILLITERATES$		0.500***			
		(3.47)			
$GR > 64YEARS$		-0.156*			
		(-1.93)			
$GR\_UNEMPLOY$		0.0147*			
		(1.94)			
GR_PC_INCOME			-0.203**	-0.210**	-0.411*
			(-2.13)	(-2.14)	(1.75)
N.Observations	7997	6713	6880	3724	1248
Province Dummies	Yes	Yes	Yes	Yes	Yes

Notes: t statistics in parentheses

* p<0.1, ** p<0.05, *** p<0.01

The table reports the estimated coefficients and robust standard errors (in parentheses) clustered at the province level. Coefficients in Columns (1) and (2) are estimated using least squares and (3), (4) and (5) are estimated using instrumental variables for the growth rate of the per-capita income. Estimation (4) contains the observations of municipalities with population lower than 1,000 inhabitants; Estimation (5) is estimated with municipalities larger than 5,000 inhabitants. The variable definitions and summary statistics of selected variables are in Table 1

Table 4: Population Thresholds to Open One Branch and Successive Openings

2014	**Average**	**No Cajas**	**All Cajas**
1^{st} Branch	539	629	402
2^{nd} Branch	1,225	1,430	887
3^{rd} Branch	2,462	2,868	1,777
4^{th} Branch	3,790	4,418	2,738
5^{th} Branch	5,341	6,227	3,859
6^{th} Branch	7,333	8,534	5,289
2007	**Average**	**No Cajas**	**All Cajas**
1^{st} Branch	484	618	288
2^{nd} Branch	1,116	1,424	662
3^{rd} Branch	2,194	2,799	1,302
4^{th} Branch	3,352	4,278	1,989
5^{th} Branch	4,559	5,820	2,706
6^{th} Branch	6,090	7,769	3,613

Note: The table reports the estimated thresholds of population to open a branch in a municipality. They have been computed using the coefficients estimated from the Order Probit in (13). The variable definitions and summary statistics of selected variables are in Table 1

Table 5: Probability of becoming branchless by 2014

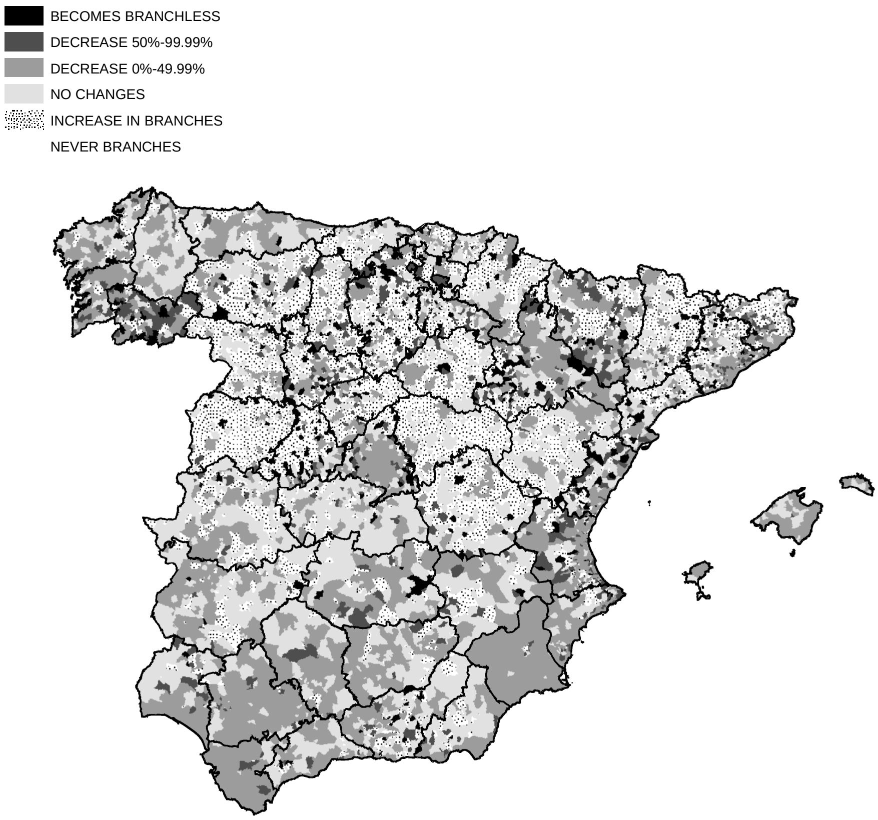
Dependent: $\mathbb{1}$(Municipality becomes branchless)	
	Marginal Effects
$\%CAJAS$	0.605***
	(2.89)
$\%CAJAS\_PROBLEM$	-0.087
	(-0.34)
$\ln POPULATION_{2007}$	-1.611***
	(-12.46)
$GR\_POPULATION$	-0.017
	(-0.02)
$\ln AREA$	-0.228***
	(-2.86)
$\ln ILLITERATES_{2007}$	2.656*
	(1.93)
$GR\_ILLITERATES$	-0.415
	(-0.40)
$\% > 64YEARS$	-3.148**
	(-2.47)
$GR\_64YEARS$	1.716
	(1.62)
$\%UNEMPLOY$	-0.472
	(-0.16)
$GR\_UNEMPLOY$	0.067
	(1.52)
$\%SECTOR\_II_{2001}$	0.765
	(1.09)
$\%SECTOR\_III_{2001}$	0.277
	(0.40)
$\%SECTOR\_REALESTATE_{2001}$	1.485
	(1.32)
$\%OCUPATION_{2001}$	-1.884*
	(-1.65)
N.Observations	2,666
Province Dummies	Yes

Notes: t statistics in parentheses

* p<0.1, ** p<0.05, *** p<0.01

The table reports the estimated marginal effects of the Probit model in (14) and the robust standard errors (in parentheses) clustered at the province level. The variable definitions and summary statistics of selected variables are in Table 1

Figure 1: Growth Rates of the Number of Branches, 2007-2014



7 Appendix

Figure 2: Thiessen Poligons

The Thiessen polygons are the areas that would determine the influence region of a branch, assuming that transportation costs are homogeneous along the space and that individuals only take into account the Euclidean distance to the nearest branch. They are built from the intersection of the perpendicular bisectors of the pair of branches that are closer together. The limit between two polygons A and B determines the consumer that is indiferent between going to the branch centered in polygon A or going to the branch centered in B. To impute distances to the closest branch in municipalities without branches, we have computed the radius of the Thiessen polygons assuming that its area is determined by the equation that determines the area of a circumference. The imputed distance would be the average value of the radius of the polygons that intersect with the area of a municipality.