

## FIRM SIZE AND LOCATION CHOICE OF FOOD INDUSTRY: IZMIR/TURKEY CASE

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### **Abstract**

Purpose of the current study is to analyze the determinants of firm location in Izmir's food industry. The dataset covers 734 firms in 2018. The analyses particularly focus on the impact of experience and size of the firms, the effects of which are not yet adequately analyzed by the existing literature. In terms of methodologies, initially, explorative maps are used to illustrate the data. Then, linear regression analyses are applied to analyze the location behavior determinants. Spatial autocorrelation test is applied to as a robustness test. Our findings point to three main results. First, firm size is not statistically a significant determinant of firm location. So, big firms may locate in/around or out of cities, whereas, also small firms may locate close to or distant from city centers. Second, the influence of the experience variable is rather definite; earlier founded firms naturally locate closer to CBD. Third, with regard to results regarding sub-sectors, firms in packaged food and bakery sectors locate nearby CBDs where, in contrast, firms in animal products sector tend to locate in rural areas. Overall, the key lesson that we learn from the analysis is that concentration of large firms around urban areas should be avoided so to cope with environmental problems and to maintain fair competition between big and small firms. Moreover, younger firms should be subsidized (through tax exemptions, rental aid, export and employment subsidies) so that their capital structure remains strong even if they are not able to place close to the market.

**Keywords:** Location Choice, Food Industry, Determinants, Firm Size

**JEL classification:** D22, R3

### **1. Introduction**

In the literature on urban economics, location choice of industries is increasingly becoming a subject of substantial interest.<sup>1</sup> Although there exist a number of theories on this issue, empirical studies investigating the location preferences are rather limited (O'Sullivan, 2012; Weber, 1929; Thunen, 1966). In fact, these location choices are quite crucial for the performance, productivity and growth of the firms as they are directly related to the transportation costs, procurement and output distribution. (O'Sullivan, 2012; Sridhar and Guanghua, 2010; Balchin, Bull and Kieve, 1995; Marshall, 1920).

Proximity to big markets, agglomeration, accessibility, availability of qualified labor force nearby (human capital), closeness to raw materials, access to input supplies, social, physical, technology infrastructure and knowledge spillovers are referred to as important drivers of location choice in the literature (Tmertekin ve zgc, 2016; Cieslik, 2013; O'Sullivan, 2012; Sridhar and Guanghua, 2010; Domanski, 2004; Arauzo-Carod and Manjo-Antolin, 2004; Dumais, Ellison and Glaeser, 2002; Fujita, Krugman and Venables, 1999; Head and Ries, 1996; Fujita and Thisse, 1996; Venables, 1996; Head, Ries and Swenson 1995; Krugman, 1991; Marshall, 1920)

There are numerous empirical studies that tried to investigate the location choice of firms. Some examples of these studies are worth spending few words on.

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<sup>1</sup> This article is a product of Nilnaz Akbařođullari (2019)'s Master Thesis which Assoc.Prof.Dr. Hasan Engin Duran has supervised.

Agglomeration is one of the important driver. Head, Ries and Swenson (1995) discuss the relationship between agglomeration and the geographical location. They analyze more than 751 Japanese companies and find firms that are involved in the same industry are generally concentrated in the same region, possibly due to benefits of economies of scale and positive externalities (Fujita, Krugman and Venables, 1999; Fujita and Thisse, 1996; Venables, 1996; Krugman, 1991).

Other several factors such as human capital, population and proximity to raw materials are emphasized as important factors by the literature in location preferences. In other words, firms seek to maximize the profits and minimize the costs by locating as close as possible to markets, low cost-site areas, closer to human capital, productive labor force base and low cost inputs. (Tümertekin ve Özgüç, 2016; Cieslik, 2013; O'Sullivan, 2012; Sridhar and Guanghua, 2010; Domanski, 2004; Arauzo-Carod and Manjon-Antolin, 2004; Dumais, Ellison and Glaeser, 2002; Fujita, Krugman and Venables, 1999; Head and Ries, 1996; Fujita and Thisse, 1996; Venables, 1996; Head, Ries and Swenson 1995; Krugman, 1991; Marshall, 1920)

Despite the long standing discussions, the impact of size of the firms on the location choice has not yet been adequately analyzed in this manner (Arauzo-Carod and Manjon-Antolin, 2004; Cieslik, 2013; Meester, 2000; Callejon and Costa, 1996).

In the literature, two opposite effects are discussed in the literature. On the one hand, it is expected that bigger firms might locate far away from the city centre (market) as they need large production spaces and low cost of site. On the other hand, it is argued in the literature that big firms may use the power of having extensive capital structure and locate just in the periphery of the cities. They might want to take advantage of benefits of agglomeration such as well-established infrastructure in cities, knowledge flows, human capital availability etc. (Tümertekin ve Özgüç, 2016; Cieslik, 2013; O'Sullivan, 2012; Sridhar and Guanghua, 2010; Domanski, 2004; Arauzo-Carod and Manjon-Antolin, 2004; Dumais, Ellison and Glaeser, 2002; Fujita, Krugman and Venables, 1999; Head and Ries, 1996; Callejon and Costa, 1996; Fujita and Thisse, 1996; Venables, 1996; Head, Ries and Swenson 1995; Krugman, 1991; Marshall, 1920)

Actually, there is scant empirical evidence on this issue. Callejon and Costa (1996) has for instance analyzed the firms in Barcelona and found that there is a positive relationship between firm size and population of the area. Moreover, Cieslik (2013) has analyzed the relationship between firm size and location determinants for Polish regions. They found that firms have quite distinguished location determinants depending on their size. Arauzo-Carod and Manjon-Antolin, (2004) has analyzed the relationship between location choice and firm size in 942 Spanish co-marques and municipalities. They found that large and small firms have different location choices. Labor intensive firms tend to locate close to market area (Barcelona).

Similarly, experience of firms is another explanatory factor that may influence the location choices (Tripathi and Kumar, 2017). It is argued in the literature that the more experienced firms are those which were founded earlier, and thus, they are expected to choose their location close to the market. (Tümertekin ve Özgüç, 2016; Cieslik, 2013; O'Sullivan, 2012; Tripathi and Kumar, 2017; Sridhar and Guanghua, 2010; Domanski, 2004; Arauzo-Carod and Manjon-Antolin, 2004; Dumais, Ellison and Glaeser, 2002; Fujita, Krugman and Venables, 1999; Head and Ries, 1996; Callejon and Costa, 1996; Fujita and Thisse, 1996; Venables, 1996; Head, Ries and Swenson 1995; Krugman, 1991; Marshall, 1920) .

Overall, all these variables need to be empirically verified but they are paid less attention compared to the traditional variables in the literature.

Hence, the purpose of the current study is to analyze the determinants of firm location in Izmir's food industry. The dataset covers 734 firms in 2018. The analyses particularly focus on the impact of experience and size of the firms.

The food industry is a special sector where inhabitants consume frequently and its quality must always be always high for the health and well-being of the society. Izmir is also a relevant place for study as food products have been traded massively throughout its history. Indeed, there is an extensive number of food manufacturers and traders around the port of Izmir. All these make our study more interesting.

The rest of the paper is structured in the following way: In the second part, data and methods, in the third part, empirical results are presented; in part 4, the summary, discussion and policy outcomes are included.

## 2. Data and Methods

In terms of empirical methodology, this study follows several steps. Firstly, dataset covering location, firm size, experience and firms' surrounding population is collected for 734 firms (for the year 2018) in Izmir's food industry by using the registry dataset of EBSO (Aegean Region Chamber of Industry, Turkey).<sup>2</sup>

Second, the location of firms on maps is illustrated as an explorative analysis. It is provided three different maps. First, geographical distribution of firms together with city centers, second, distribution of firms together with their employment size and, third, distribution of firms together with capital size are illustrated. The maps are produced in ArcMap 10.6 program.

Third, simple linear regression analyses are performed that help investigating the location choice determinants. To do so, the following linear regression modal is used:

$$\begin{aligned} \text{distance to Izmir CBD (or local CBD)}_i &= \alpha + \beta_1 \text{employment size (or capital size)}_i + \\ &+ \beta_2 \text{experience}_i + \beta_3 \text{population}_i + ds_i \\ &+ \varepsilon_i \quad i=\text{firms}, \quad i=1, \dots, 734 \end{aligned} \quad (1)$$

The variables to be analyzed in regression (in equation 1) are summarized in Table 1. The dependent variable is the location choice of firms, measured (in kilometers) by their travel **distance to Izmir's CBD** (Konak District) or alternatively the **distance to local CBD** (sub-provincial city center). These two dependent variables are alternatively used in the regression analyses.

The distance measurements are implemented in ArcMap 10.6 Program.

In terms of independent variables, there are three types. The first one is the **firm size** measured either by employment or capital size. Both variables are expressed in categories (e.g. category 1,2,3,4). With regard to **employment size** variable, category 1 represents the smallest firms which employ 5-24 workers, whereas category 4 represents the biggest firms which employ above 200 workers. Similarly, **capital size** variable is expressed also in categories. Category 1 represents the smallest firms which have 1-24.999 Turkish Liras capital, whereas category 4 represents the biggest firms which have capital above 1.000.000 Turkish Liras. These two variables are alternatively used in the regression analyses to avoid multi-collinearity problem. The second independent variable is the **experience** of the firms. It is measured by the number of years passed since the foundation of the firm. The last independent variable is the **population** of the sub-province that the firm belongs to. It proxies the market size nearby the firm. Finally, *ds* represents the dummy variables for 5 different sub-sectors (Bakery Food, Animal Food, Packaged Food, Herbal Food sectors, Drink and Tobacco Sector).

The regressions are estimated by using a linear OLS technique for the aggregate data and also for 5 different sub-sectors (Bakery Food, Animal Food, Packaged Food, Herbal Food sectors, Drink and Tobacco Sector).

<sup>2</sup> The empirical analysis in this article is implemented in Eviews 4, R 5.53 SPDEP package

**Table 1. Definition of Variables**

Variable Definition	Definition	Measure	Spatial Units	Data Source
<b>Experience</b>	Experience of firms since foundation	years	734 firms	Aegean Region of Chamber Industry database
<b>Employment Size</b>	Firms in which 5- 24 workers employed take value (1), 25-49 workers employed take value (2), 50-199 workers employed take value (3), above 200 worker employed take value (4)	Intervals	734 firms	Aegean Region of Chamber Industry database
<b>Capital Size</b>	Firms which have capital size between 1-24.999€ take value (1), capital size between 25.000-99.999€ take value (2), capital size between 100.000-249.999€ take value (3), capital size between 250.000-999.999€ take value (4), capital size above 1.000.000€ take value (5)	Intervals	734 firms	Aegean Region of Chamber Industry database
<b>Population</b>	Population of districts in which the firm is located	number of people	734 firms	Aegean Region of Chamber Industry database
<b>Distance to Izmir CBD</b>	Linear Distance to Konak (centre of Izmir)	kilometres	734 firms	Aegean Region of Chamber Industry database
<b>Distance to local CBD</b>	Linear Distance to Sub-provincial Centre	kilometres	734 firms	Aegean Region of Chamber Industry database

As a last method, Moran  $I$ 's test of spatial dependence is applied to the independent variables to ensure inferential robustness. Classical estimates of OLS might be biased and provide misleading results in case there exists spatial dependence in data (Anselin, 1988).

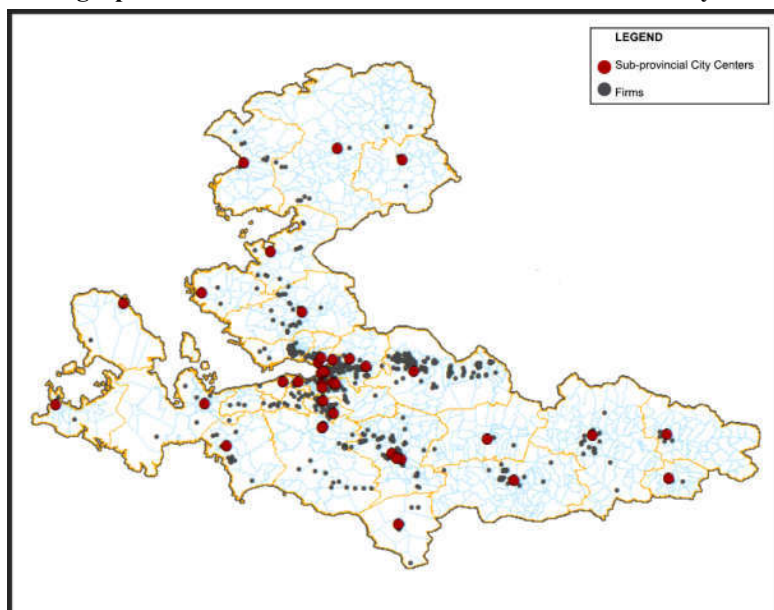
To do so, we apply a spatial dependence test to our independent variables that examines whether similar (or dissimilar) values are geographically concentrated significantly or not (Rey and Montouri, 2001; Moran, 1950).

Spatial dependence is tested by examining the statistical significance of Moran  $I$  test statistics (Anselin, 1988; Moran, 1950). Spatial Weight Matrix, which is an important element of the test, is calculated in a 734x734 firms form. It includes the raw standardized inverse distance across firms.

Applying these methods, the results are figured out which are explained in the next section.

### 3. Empirical Results

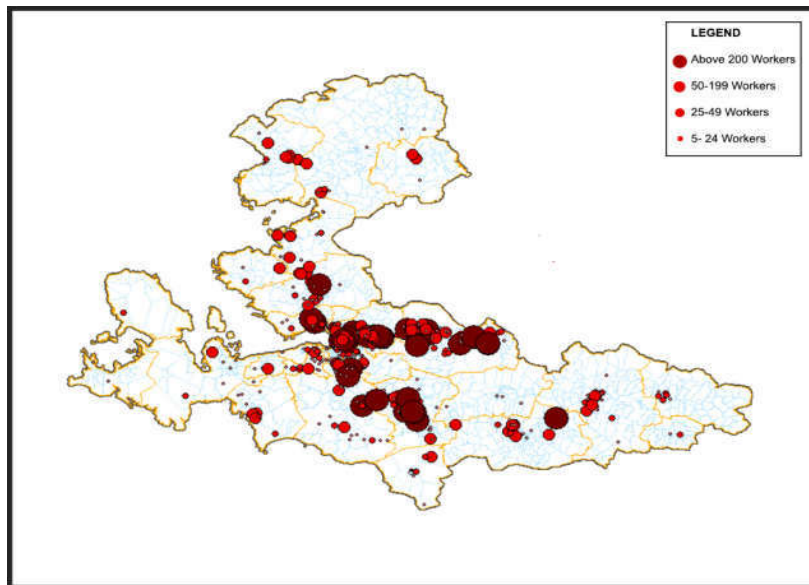
Firstly, illustrative maps are demonstrated. In Figure 1, geographical location of firms and the centers of sub-provinces are shown. It is normally observed the concentration of firms around the city centers. It seems plausible as firms naturally would like to place nearby the big markets.

**Figure 1: Geographical Distribution of Firms and Sub-Provincial City Centers, 2019**

Source: Own Map, 2019

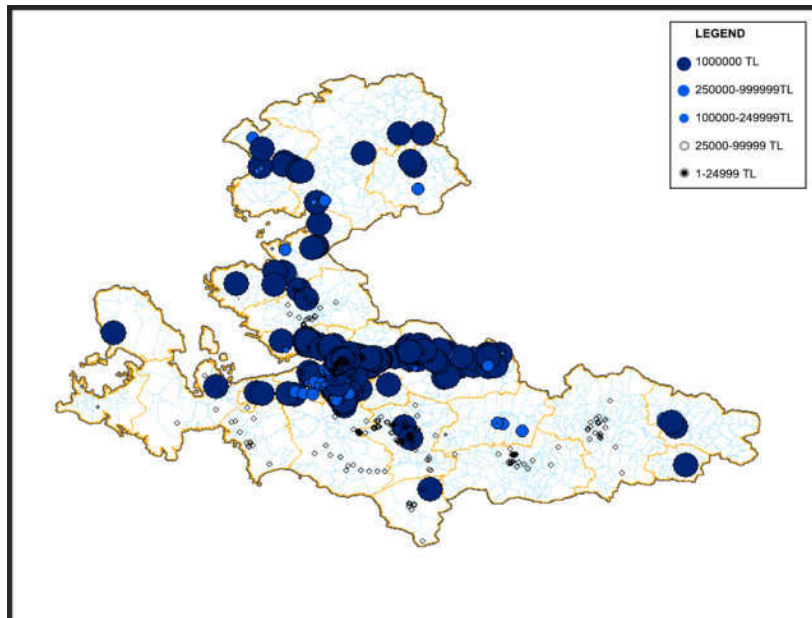
However, the picture in Figure 1 does not tell any story related to the location behavior of big/small and experienced/unexperienced firms. However, Figure 2 and 3 show the distribution of firms together with their employment and capital size respectively. At a glance, it visually seems a random distribution. Hence, big firms and small firms seem to locate randomly. There is no distinct pattern that shows the systematic closeness of big firms/small firms to the CBDs.

**Figure 2: Geographical Distribution of Employment Size, 2019**



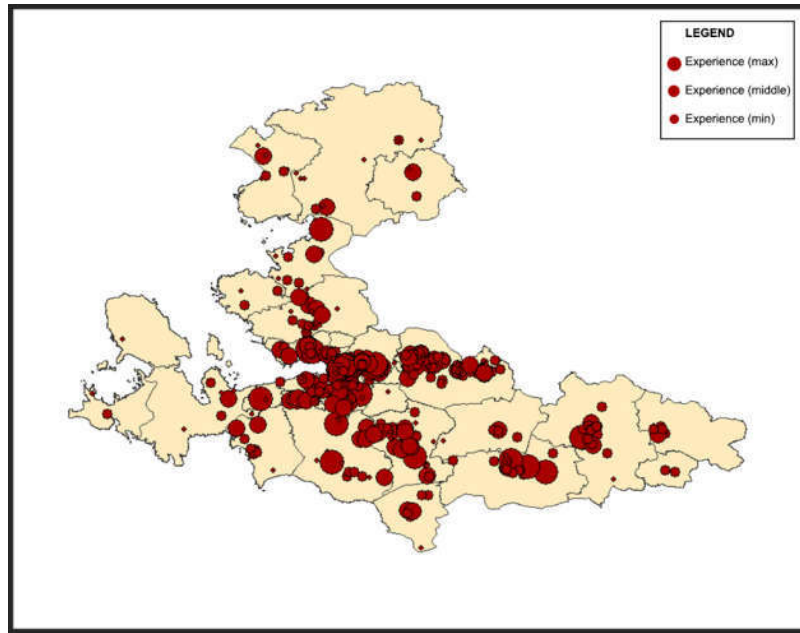
Source: Own Map, 2019

**Figure 3: Geographical Distribution of Firms by Capital Size, 2019**



Source: Own Map, 2019

On the contrary, the location of firms seems to be well associated with their experience in Figure 4. Such that the more experienced firms seem to have located closer to CBDs. This is reasonable as the earlier founded establishments tend to place nearby big markets.

**Figure 4: Geographical Distribution of Firms by Experience, 2019**

Source: Own Map, 2019

However, none of the above mentioned descriptive facts provide statistical evidence on the location choice and its determinants. To pursue such an analysis, we present the results of the regression in equation (1) for the aggregate data in Table 2 and Table 3 in which distance to Izmir's main CBD and distance to local sub-provincial CBDs is taken as two different dependent variables respectively.

At a glance, the both tables tell somewhat similar story. With regard to the impact of firm size, it is found in most of the cases as an insignificant variable. Such that firm size is not statistically a significant determinant of firm location. Big firms may locate around or out of cities, whereas, small firms may also locate close to or distant from CBDs. Only in Table 3, capital size variable's coefficient is found positive and significant. It, thus, indicates that the firms which are bigger in capital size are likely to locate closer to local (sub-provincial) CBDs.

The interpretation of the ambiguous impact of firm size on the location choice is twofold. On the one hand, big firms need large production space and urban areas are too costly in that manner (Hence, they might locate in distant areas. On the other hand, big firms have strong capital structure which are capable of locating nearby markets. They possibly prefer to take the advantage/benefits of agglomeration economies' benefits. (Tümertekin ve Özgüç, 2016; Cieslik, 2013; O'Sullivan, 2012; Sridhar and Guanghua, 2010; Domanski, 2004; Arauzo-Carod and Manjon-Antolin, 2004; Dumais, Ellison and Glaeser, 2002; Fujita, Krugman and Venables, 1999; Head and Ries, 1996; Callejon and Costa, 1996; Fujita and Thisse, 1996; Venables, 1996; Head, Ries and Swenson 1995; Krugman, 1991; Marshall, 1920). The two forces might have neutralized each other and insignificant effect of firm size arise.

The influence of the experience is rather definite. In tables, 2 and 3, it has consistently negative and significant coefficient. It, thus, means that earlier founded firms naturally locate closer to CBD. This seems plausible as they take advantage of having long standing experience and early establishing the companies.

With regard to the sub-sectoral dummies, some interesting patterns of location appear. For instance, firms in packaged food and bakery products sector locate nearby CBDs, regardless of Izmir's main or local (sub-provincial) CBDs. In contrast, firms in animal products sector tends to locate in rural areas which are away from CBDs. These patterns are statistically significant in all regressions. Finally, firms in Herbal, Drink and Tobacco goods production sector tend to locate away from local (sub-provincial) CBDs.

To investigate the effect of the firm size and experience for the sub-sectors, we run the regression in equation 1 for 5 subsectors, excluding sub-sectoral dummies. The results are presented in table 4. The results are quite consistent with the previous findings. Such that

firms size variable (regardless of employment or capital size) does not have significant coefficient in the major part of the regressions. There are some significant cases in packaged and drink and tobacco sectors but the signs of the coefficients are inconsistent. Hence, there is no robust evidence in that manner.

Similar to what is observed in tables 2 and 3, experience variable has consistently negative and significant coefficient in almost all sub-sectors and specifications, with the only exception of Bakery goods production sector.

The last analysis concerns a robustness check. The empirical analyses on urban/regional studies are commonly subject to spatial dependence. Hence, ignorance of spatial autocorrelation might induce serious bias and misleading results. Therefore, we apply a Moran's I spatial dependence test on the independent variables. The results are presented in Table 5. In none of the variables, spatial dependence is found evident, that is a result confirming the reliability of OLS estimates.

**Table 2. Regression Results, OLS, Dependent Variable: Distance to Izmir CBD, Data Source: Own Estimation**

Dependent Variable: Distance to Izmir CBD										
Independent Variables:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Constant	2,92E+01* **	2,88E+01***	28,34***	2,72E+01***	23,92***	23,23771***	27,98***	26,84***	29,28***	28,93***
Employment Size	6,68E-01		0,47		0,62		0,36		0,10	
Capital Size		4,54E-01		5,81E-01		0,46		0,52		0,23
Experience	-2,27E-01***	-2,27E-01***	-0,17***	-1,79E-01***	-0,13**	-0,13**	-0,18***	-0,19***	-0,19***	-0,20***
Population	-7,16E-04***	-7,14E-04***	-0,00***	-7,37E-04***	-0,00071***	-0,0007***	-0,00***	-0,00***	-0,00***	-0,00***
Dummy Packaged Food	-1,09E+01* **	-1,10E+01***								
Dummy Herbal Food			-1,11239	-1,19E+00						
Dummy Animal Food					11,09***	11,23***				
Dummy Drink and Tobacco							3,62	3,53		
Dummy Bakery Food									-9,09***	-9,57***
R-Square	0,1									
N=734	734	734	734	734	734	734	734	734	734	734

Notes. \*\*\* denotes 1 % statistical significance, \*\* at 5 %, \* at 10.

**Table 3. Regression Results , OLS, Dependent Variable: Distance to local CBD, Data Source: Own Estimation**

Dependent Variable: Distance to local CBD										
Independent Variables:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Constant	7,85E+03***	8,13E+03***	7,22E+03***	73,57***	8,08E+03***	8,15E+03***	7,74E+03***	7,42E+03***	7,79E+03***	8,07E+03***
Employment Size	5,25E+02*		4,59E+02*		4,41E+02		-3,16E-01*		3,75E+02	
Capital Size		1,27E+02*		0,13*		1,67E+02*		8,38E+01		7,64E+01*
Experience	9,50E+01***	8,09E+01***	-8,69E+01**	-0,07**	-8,94E+01**	-7,80E+01**	1,12E+02***	1,11E+02***	-8,52E+01**	-7,43E+01**
Population	-1,43E-01**	-1,45E-01**	-1,37E-01**	-0,00**	-1,49E-01**	-1,50E-01**	-1,26E-01**	-1,21E-01**	-1,10E-01*	-1,08E-01*
Dummy Packaged Food	-3,29E+03**	-3,26E+03**								
Dummy Herbal Food			6,18E+02*	0,70*						
Dummy Animal Food					-1,74E+03*	-1,86E+03*				
Dummy Drink and Tobacco							1,68E+04***	1,67E+04***		
Dummy Bakery Food									-2,26E+03*	-2,43E+03*
R Square	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,0
n=732	732	732	732	732	732	732	732	732	732	732

Notes.\*\*\* denotes 1 % statistical significance, \*\* at 5 %, \* at 10 %.

**Table 4. Regression Results, Location Choice in Subsectors, Data Source: Own Estimation**

Dependent Variable; Distance to	Packaged Food				Herbal Food			
	Izmir CBD	Izmir CBD	Local CBD	Local CBD	Izmir CBD	Izmir CBD	Local CBD	Local CBD
Independent Variables:	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	7,18E-11	1,10E-10	7,76E-12	8,70E-12	-2,29E-11	5,12E-11	-1,20E-12	1,95E-11
Employment Size	2,94E+03***		8,22E+01		-3,93E+02		1,59E+03	
Capital Size		-6,02E+02**		9,85E+01		4,15E+01		2,09E+02
Experience	-5,04E+02***	-3,54E+02***	-3,90E+01	-2,78E+01	-1,77E+02**	-2,08E+02***	-1,06E+02**	-7,32E+01
Population	-1,88E-01***	-1,94E-01***	8,63E-02***	8,36E-02***	-3,39E-01**	-3,33E-01**	-1,11E-01	-9,69E-02
N=732	73	73	73	73	310	310	310	310
Dependent Variable; Distance to	Drink and Tobacco				Bakery Food			
	Izmir CBD	Izmir CBD	Local CBD	Local CBD	Izmir CBD	Izmir CBD	Local CBD	Local CBD
Independent Variables:	Model 5	Model 6	Model 7	Model 8	Model 1	Model 2	Model 3	Model 4
Constant	9,41E-12	-1,12E-12	2,72E-11	9,15E-12	5,13E-11	2,35E-11	1,66E-11	-1,28E-11
Employment Size	-1,80E+03***		1,17E+04***		1,10E+03		3,07E+01	
Capital Size		2,02E+03***		-5,13E+03***		-1,94E+02		1,60E+02
Experience	-2,96E+02***	-3,69E+02***	4,29E+02***	-7,18E+02***	-4,92E+01	9,88E+00	2,77E+01	2,91E+01
Population	-1,14E+00***	-9,40E-01***	1,64E+00***	-1,13E+00***	-3,96E-01***	-4,02E-01***	-5,70E-02***	-4,99E-02***
N=732	35	35	35	35	113	113	113	113
Dependent Variable; Distance to	Animal Food							
	Izmir CBD	Izmir CBD	Local CBD	Local CBD				
Independent Variables:	Model 1	Model 2	Model 3	Model 4				
Constant	-6,80E-12	4,97E-11	-5,61E-12	4,60E-12				
Employment Size	8,12E+01		4,31E+02					
Capital Size		3,08E+02		1,89E+02				
Experience	-1,97E+02**	-1,93E+02**	8,20E+01***	-7,90E+01***				
Population	-1,18E+00***	-1,16E+00***	-2,62E-02	-1,80E-02				
N=732	198	198	198	198				

Notes.\*\*\* denotes 1 % statistical significance, \*\* at 5 %, \* at 10 %.



**Table 5. Spatial Dependence Test, Data Source: Own Estimation**

Variable Analyzed	Test Statistics	Variance	P Value
Experience	-1,74E+03	2,44E+01	0,5302
Employee	-2,65E+03	0,6021	2,45E+01
Capital	-1,11E+03	2,45E+01	0,4792
Population	2,24E+03	2,44E+01	0,2325

Notes: \*\*\* denotes 1 % statistical significance, \*\* at 5 %, \* at 10 %.

#### 4. Discussion

All the results explained previously provide important insights about the future urban/rural planning, policies and applications on food industry in Izmir.

The finding that **firm size** does not matter for firm location implies the following: big firms are able to locate close to urban areas. This might bring negative environmental externalities, air pollution, water pollution, traffic congestion, hazardous waste, etc. Therefore, policy appliers should be aware of this fact and they should either not allow anymore the foundation of large scale industries nearby urban areas or should set up efficient monitoring and regulating mechanisms. Moreover, one other problem with the placement of large industries close to the CBD is that it reduces their distribution cost. Therefore, small firms can hardly compete with the big ones. Therefore, it deteriorates the competitive structure of food industry.

Regarding the impact of experience variable, it follows that earlier founded firms are able to locate close to CBDs. Put it differently, newly founded “unexperienced” firms can only place in more distant areas. In case these firms are market oriented, the distribution costs of products become high and this distorts their capital structure (O’Sullivan, 2012).

Overall, the key lesson that we learn from the analysis is that concentration of large firms around urban areas should be avoided so to cope with environmental problems and to maintain fair competition between big and small firms. Moreover, younger firms should be subsidized (through tax exemptions, rental aid, export and employment subsidies, etc.) so that their capital structure remain strong even if they are not able to place close to market.

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