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Factors determining the location decision: Analysis of location choice preferences of the ICI-1000 companies with the nested logit model

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ABSTRACT

The aim of this study is to analyze the location decisions of the manufacturing industry companies in the ICI Top 500 and Second Top 500 Industrial Enterprises (ICI-1000) for the year 2018. The location choice model developed accordingly is based on the assumption that companies choose the location of their production facilities with "the goal of profit maximization, and that this decision is influenced by both internal (company-specific) and external (sectoral and regional) factors". The empirical analysis is conducted utilizing the nested logit estimation method and a large data set containing information on 909 manufacturing industry companies among ICI-1000, sub-sectors and location alternatives. The results support the views of Neoclassical and Institutional location approaches. The location decisions of the companies are affected by the characteristics specific to the company, sector and location. The ICI-1000 companies in the study tend to locate in areas with high market power and market growth, qualified and abundant labor, high sectoral growth and diversity and good geographical and physical conditions. The impact of these factors on company location preferences varies depending on the technological intensity of the industry in which they operate (high/low). Companies operating in high-tech (high, medium-high, medium-low) sectors choose places with a diversified and deepened labor pool, sectoral diversity and knowledge diffusion. On the other hand, the effect of specialization that emerged with localization economies is crucial in the location decisions of companies in low-tech sectors.

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1. Introduction

Location theory is a key component of the spatial economics literature, which investigates where economic activities take place and how resources are distributed spatially. Company location, and therefore industrial location, is critical for economists to evaluate the economic conditions of that region or city. It also helps entrepreneurs to decide where to locate their companies/facilities, and policymakers to choose where resources should be distributed (Azargoon and Schröder, 2016).

The company/industry location decision is gaining more and more attention in the relevant literature in terms of both theoretical and applied studies. Company location is used to uncover locational issues specific to regional/urban business environments, as well as to determine investment climate features (Sridhar and Wan, 2010). On the other hand, it is widely acknowledged that the location decision has a direct impact on the success of the company (Azargoon and Schröder, 2016). The growing interest in industrial location determinants has been fueled by advances in econometric theory and the expansion of spatial econometric applications.

While the location policies aim to benefit from the positive externalities (agglomeration economies) that result from the spatially close location of the companies and industries, they also aim to avoid the negative externalities (congestion costs) that result from excessive agglomeration. These policies are commonly used to address issues such as regional development disparities and urban overcrowding, as well as to meet sustainability goals (Hansen, 1987). Another purpose of the policies in place is to encourage companies to locate close so that they can benefit from externalities like knowledge, learning, sharing and networking, which will help them succeed or survive.



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When the spatial patterns of industrial production indicators and its components or the share of industry in the Gross Domestic Product (GDP) in Turkey are examined, it is seen how industrial location policies are crucial for economic growth and development. Table 1 presents the regional statistics (TURKSTAT, 2021a) for industrial production and employment in Turkey by Nomenclature of Territorial Units for Statistics (NUTS1). Table 1 shows the regional shares in GDP and employment for the years of 2010, 2015 and 2020. Also, in the row of "2009–2020" of each part, there is average regional shares for 2009–2020 period. For example, according to the GDP values at current prices by kind of economic activity, Istanbul (TR1) has the highest share in industrial activities with approximately 25.4% in 2020. East Marmara (TR4) and Aegean (TR3) follow Istanbul by 17.9% and 14.2%, respectively. Contrary to high shares in the industrial production of the western parts of Turkey, the share of the eastern regions remains guite low. The regional share of Northeast Anatolia (TRA) from the GDP values at current prices in industrial activities is 0.8% in 2020, and it is followed by Middle East Anatolia (TRB) with 1.5% and East Black Sea (TR9) with 1.8%. This spatial distribution of industrial activities that is in favor of the central and western regions of Turkey is not limited to 2020 or the last few years. As it is seen in Table 1, during 2009–2020 period, the low shares in industrial activities have been common and unchanging attributes of the eastern regions of Turkev.

The regional shares in the employment part of Table 1 show that the 23.8% of industrial employment for 2020 is provided by Istanbul. Aegean and East Marmara regions follow Istanbul with the shares of 15.4% and 15.2%, respectively. As in the regional GDP shares, Northeast Anatolia is the region in which the employment share in industrial activities is the lowest (1.0%). East Black Sea (2.2%) and Central East Anatolia (2.6%) also have the low employment shares in industrial production in 2020. This heterogenous distribution of employment share by regions can be observed both for the years of 2010, 2015 and the 2009–2020 period average.

When the manufacturing industry is examined in terms of industrial activities, TURKSTAT (2022a) Regional Business Register Statistics show that Istanbul accounted for 29.72% of total manufacturing industry companies in Turkey in 2018 (442601), followed by 6.36% in Izmir, 6.18% in Ankara, 5.41% in Bursa and 3.45% in Konya. The provinces with a lower total number of enterprises in the manufacturing industry compared to the country in general are located in the Middle East and Northeast Anatolia and the East Black Sea Regions. Gaziantep, in the Southeast Anatolia Region, stands out with a share of 2.90%. In fact, Gaziantep is followed by Antalya with a share of 2.65% and Adana and Kocaeli with a share of 2.15% each. Fig. 1 shows the distribution of the share of total enterprises in the manufacturing industry in Turkey by province. The information about provinces and their license numbers are provided in Table A1 of the appendix.

It should be noted that, in terms of all three indicators discussed above, Southeast Anatolia is an exception among the eastern regions. The intense industrial activities in Gaziantep which is the most developed province of the Southeast Anatolia Region is considered as one of the reasons for this exception. According to SEGE 2017 report (Ministry of Industry and Technology, 2019b), Gaziantep is at the top of the list in Turkey by the extent of competitive and innovative capacity indicators.

A pattern similar to that seen in Table 1 or in Fig. 1 can be also expected for other policy components of industrial production, and other economic, social, cultural and environmental indicators. The dominant roles of specific provinces and occasionally their nearest neighboring provinces by means of the spillover effects stand out even within the same region, regardless of the geographical direction in Turkey. On the one hand, the spatial concentration of industrial activities in west/coastal regions and provinces of Turkey leads the economic growth and development both in these regions and thus in the country. In fact, it is accepted that the industrial clusters formed as a result of the agglomeration of industries create specialization and trade sources (Krugman, 1999). On the other hand, it is acknowledged that "the emergence of economic agglomeration is naturally associated with the emergence of inequalities across locations, regions or nations" (Fujita and Thisse, 1996). "The self-reinforcing character of spatial concentration" creates favorable economic conditions (Fujita et al., 1999) for some regions to develop, while it will cause other regions to remain relatively undeveloped (Krugman, 1991). Moreover, in terms of the regions in which the firms, industries and correspondingly population (Kilkenny and Thisse, 1999) concentrate, there are some negative externalities such as congestion costs, pollution, high land rents, disruptions in some services (health, education, urban infrastructure services etc.) (Krugman, 1999).

Consequently, the spatial concentrations of industrial activities are critical and arise as an outcome of a complex process in which interrelated factors interact (Fujita and Thisse, 2009). Therefore, the distribution of industries and industrial location policies are important in studying regional disparities in Turkey and finding solutions to them.

Based on the significance of company/industry location, this study aims at examining the location choice behavior of Turkish manufacturing industry companies and at contributing to the empirical literature by addressing the existing key points and limitations on this issue. To do so, it is estimated a location choice model using cross-sectional data of manufacturing industry companies that are among Turkey's Top 500 and Second Top 500 Industrial Enterprises of 2018 announced by Istanbul Chamber of

Table 1

	Year	TR1	TR2	TR3	TR4	TR5	TR6	TR7	TR8	TR9	TRA	TRB	TRC
GDP	2010	28.3	5.8	13.4	16.9	11.7	8.2	3.7	3.4	1.7	0.9	1.5	4.6
	2015	29.3	5.6	12.8	17.2	11	8.2	3.6	3.2	1.8	0.7	1.5	5.1
	2020	25.4	6.7	14.2	17.9	10.8	8.4	3.7	3.3	1.8	0.8	1.5	5.4
	2009-2020	28.0	5.8	13.5	17.3	11.3	8.2	3.6	3.3	1.8	0.8	1.5	4.9
	Year	TR1	TR2	TR3	TR4	TR5	TR6	TR7	TR8	TR9	TRA	TRB	TRC
Employment	2010	26.6					0.0		1.0	2.2	0.0	2.2	6.2
Employment	2010	26.6	5.7	14.6	14.5	8.9	9.6	4	4.6	2.2	0.9	2.2	0.2
Employment	2010	26.6 26.5	5.7 5.5	14.6 14	14.5 13.9	8.9 9.2	9.6 9.6	4 4.1	4.6 4.4	2.2 2.4	0.9 1.2	2.2 2.9	6.2
Employment	2010 2015 2020	26.6 26.5 23.8	5.7 5.5 5.7	14.6 14 15.4	14.5 13.9 15.2	8.9 9.2 9.5	9.6 9.6 9.3	4 4.1 4.2	4.6 4.4 4.6	2.2 2.4 2.2	0.9 1.2 1	2.2 2.9 2.6	6.2 6.2 6.4
Employment	2010 2015 2020 2009–2020	26.6 26.5 23.8 25.4	5.7 5.5 5.7 5.5	14.6 14 15.4 14.5	14.5 13.9 15.2 14.7	8.9 9.2 9.5 9.1	9.6 9.6 9.3 9.6	4 4.1 4.2 4.1	4.6 4.4 4.6 4.6	2.2 2.4 2.2 2.2	0.9 1.2 1 1.2	2.2 2.9 2.6 2.8	6.2 6.2 6.4 6.4

Notes: TR1: İstanbul, TR2: West Marmara, TR3: Aegean, TR4: East Marmara, TR5: West Anatolia, TR6: Mediterranean, TR7: Central Anatolia, TR8: West Black Sea, TR9: East Black Sea, TR4: Northeast Anatolia, TRB: Middle East Anatolia, TRC: Southeast Anatolia. Source: TURKSTAT (2021a), Regional Statistics.



Fig. 1. Number of enterprises in manufacturing Sector, 2018 (%).

Industry (ICI). The theoretical model constructed to analyze the location behavior of companies is based on the assumption that "companies choose locations based on profit maximization motivation and are influenced by company-specific, sectoral and regional factors".

In the empirical analysis, the nested logit model based on the random utility approach is employed. Within this framework, companies have a set of location alternatives for their manufacturing plants. The choice set comprises the NUTS 1 regions for Turkey: (1) Marmara (East Marmara, Istanbul and West Marmara), (2) Mediterranean and Aegean, (3) West and Central Anatolia, (4) Southeast, Middle East and Northeast Anatolia, and (5) East and West Black Sea. This enables to investigate the location choice behavior of companies by using a hierarchical decision structure that groups choice alternatives with similar characteristics.

The results show that companies choose to locate in large and medium-sized regions. The common features of these regions are that they have a larger market size and higher market growth, more qualified and abundant labor, higher sectoral size, and more suitable geographical and physical conditions. From this point of view, it can be said that the positive externalities such as proximity to large and international markets, the knowledge spillovers, the presence of qualified labor and good infrastructure are more effective than the negative externalities (congestion costs, pollution and overcrowding etc.) in the location choice process. Most importantly, high-tech industries tend to be concentrated in regions with high sectoral size and industrial diversity, while traditional or low-tech industries tend to choose regions dominated by localization economies that emerge based on gains from specialization. The attractiveness of the western parts of Turkey (particularly the Marmara and the Aegean) prompts companies to locate in or near these "advantaged" regions in order to participate in sectoral clusters or to be adjacent to the sectors with whom they are involved in an interaction. This propensity increases the sectoral diversity in these regions, and consequently their attractiveness increases by enhancing the social and economic conditions in the aforementioned regions. This process generally causes intraregional and inter-regional disparities to have grown to unacceptable levels.

In the following section, firstly, the Turkish manufacturing industry is discussed. Then, the location choice behavior of companies is explained by taking the historical development of the literature into account, and also some studies conducted around the world and in Turkey are discussed. The fourth section contains information about the data set and the empirical methodology used in the study. Empirical results are summarized in the following section. Finally, the sixth section concludes the paper.

2. Turkish manufacturing industry

Before discussing the structure of the Turkish manufacturing industry, it is considered necessary to mention the importance of the industry sector in the main economic activities in Turkey. TURKSTAT (2022b) Annual Gross Domestic Product Statistics show that the share of agriculture has been decreased, while the shares of industry and services have been increased since 2000. Services have the greatest average share (54.1%) during the years 2000–2020. The share of industry, on the other hand, was around 25%–26% from 2000 to 2009, and it was at its lowest level (24%) in 2009 with the effect of the global financial crisis of 2007–2008.

Table 2 shows that the share of main sectors and industrial subsectors in the GDP and the Gross Value Added (GVA) for the period following the global financial crisis. The last column in the table refers to the average share during the period of 2009–2020. After 2010, the share of industry sector in the production has begun to rise and it reached its highest level (29.4%) in 2018. In the years that followed global crisis, the industry share of the GDP was 27.3 in average. However, the economic slowdown due to the Covid-19 pandemic had a negative effect on the industry share in the GDP. Although the share of industry in GDP decreased by 2 points in 2019, with the reduction of the Covid-19 precautions, it occurred by

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Table 2

The shares of economic sectors in the GDP and the GVA 2009 to 2020 (%).

Gross Domestic Product	2010	2015	2020	2009-2020
Agriculture	9.0	6.9	6.7	7.0
Industry (Total)	24.5	27.8	28.0	27.3
Mining and quarrying	1.1	0.8	1.2	1.0
Manufacturing	15.1	16.7	19.1	16.9
Electricity, gas, steam and air conditioning supply	1.5	1.3	1.8	1.4
Water supply, sewerage, waste management and remediation activities	0.8	0.9	0.7	0.9
Construction	6.1	8.1	5.2	7.1
Services	54.5	53.5	54.2	54.3
Gross Value Added	2010	2015	2020	2009-2020
Agriculture	10.2	7.8	7.5	7.9
Industry (Total)	27.8	31.6	31.5	30.8
Mining and quarrying	1.2	0.9	1.3	1.2
Manufacturing	17.1	18.9	21.5	19.1
Electricity, gas, steam and air conditioning supply	1.7	1.4	1.9	1.6
Water supply, sewerage, waste management and remediation activities	0.9	1.1	0.8	0.9
Construction	6.9	9.2	5.9	8.0
Services	62.0	60.6	61.0	61.3

Notes: The main sectors are grouped by the levels based by TURKSTAT. Source: TURKSTAT (2022b), National Accounts Statistics.

28%. In Table 2, the sectoral shares in the GVA show that the services sector has the highest share among other main sectors as in the case of the GDP shares. During the period of 2009–2020, the average share in the GVA is 30.8% for industry, while it is 61.3% for services.

As regards the sub-sectors of total industry in Table 2, manufacturing industry share in the GDP was the highest by the average share of 16.9 for the 2009-2020 period. Its share has been around 15%-16% from 2009 to 2016, and above 2009-2020 average since 2017. Despite the negative effect of the Covid-19 pandemic on industrial activities, the share of manufacturing industry in the GDP reached its highest level (19.1%) in 2020. Actually, it is seen that among the industrial activities, the effects of the pandemic have been more felt in the construction sector. Its average share in the GDP was 7.4% for a decade covering the period of 2009–2018, but its GDP share has been begun to decline after 2018. The share of the sector in the GDP was 5.4% and 5.2% in 2019 and 2020 respectively. The GVA shares of industry sub-sectors show a similar trend as the sub-sectoral GDP shares. The manufacturing industry has the highest share in the GVA among other industry sub-sectors as in the case of the GDP shares. Its share in the GVA has been above the 2009–2020 period average (19.1%) since 2017, and reached its highest level in 2020. The share of the construction sector in the GVA, on the other hand, has been decreased since 2018, while its acceleration during the 2009-2017 period.

Table 2 indicates that the share of the manufacturing industry in the GDP and the GVA is the highest within the industry sub-sectors during the years 2009–2020. However, the structure of industrial production in Turkey has changed in the last two decades and the construction sector has been gained more importance compared to the manufacturing sector. The increasing shares of the construction in the GDP and in the GVA are such as to corroborate the view that "the construction-based accumulation constitutes the main source of accumulation in Turkey" (Eşiyok, 2021). Fig. 2 is useful to see how the change in the structure of the industrial production has come true, visually providing the sectoral shares of industrial activities in the GDP (at current prices) for the 2000–2020 period.

The fact that the emphasis in the Turkish economy has been shifted from the productive sectors to the non-productive sectors, such as construction sector or the services sector, over the years can also be seen by the annual growth rate of the economic activities. During the last decade, the construction sector has grown at an annual average rate of 21.1%, while the manufacturing industry an average of 20.5%, below the total GDP growth (20.8%) (TURKSTAT, 2022b). In 2020, although manufacturing was the sector with the highest GDP share (with 19.1%), it was followed by "wholesale and retail trade; repair of motor vehicles and motorcycles (with 12.4%)" and "transport and storage (with 7.9%)" that are the services subsectors. Similarly, the sectoral growth rates by the chain linked volume show that the most growing sectors in 2020 were in services activities, not in industrial activities (TURKSTAT, 2022b). "Financial and insurance activities (with %23.4)", "arts, entertainment and recreation with (%16.7)" and "information and communication (with %14.4)" were the fastest growing sectors in 2020. In contrast, the manufacturing industry just grew by 3.2% in the same year.

An alternative indicator to see the importance that is attached to the construction sector in Turkish economy rather than a more productive sector is the GDP by expenditure approach. One of the main components of this approach is the fixed capital formation. Besides, it is important to consider the assets constituted the greatest part in the gross fixed capital formation (GFCF) that are the machine-equipment and the construction. The paths of gross fixed capital formation and fixed capital investments can be informative to evaluate the structure of the production.

Fig. 3 illustrates the GFCF share in the GDP (%) and the shares of produced non-financial assets (machinery and equipment and construction) for Turkey. The share of the GFCF in the GDP has not shown a rapid and stable growth over the years. Its percentage change compared to the same period in the previous year has fluctuated during the period of 2009-2020 and was negative for the second and third quarter of 2019. When considered the components of the GFCF, the share of the construction in the GFCF has been constantly higher than the share of the machinery and equipment during the 2009–2020 period. It has reached its highest level (60.5%) in the second guarter of 2018, and started to decline since then. This decline has continued by the effect of the precautions taken during of the Covid-19 pandemic. Meanwhile, the share of machinery and equipment in the GFCF has started to rise after the first quarter of 2019. It has exceeded the construction share in the GFCF at the first time at the end of the 2020 and occurred at its highest level (41.6%).

As can be seen from Fig. 3, it is apparent that the fixed capital formation has been focused on the construction investments over the years in Turkey. In view of these investments' non-productive



Fig. 2. GDP by kind of industrial activities (share, %), at current prices, 2000–2020.



Fig. 3. The GFCF at current prices: the share in the GDP and the percentage change (%).

characteristic, it can be said that a qualified economic growth has not been realized. Besides, the acceleration that could not be achieved in the GFCF implies that this unqualified growth is not sufficient in terms of economic development goals. Because the GFCF is regarded as one of the most basic indicators of development in countries with significant investment gaps such as Turkey. And, of course, there must be capital accumulation based on productive sectors, such as machinery and equipment investments, as well as high fixed capital investments with a high growth rate (Eşiyok, 2021). The above-mentioned industrial structure of Turkey for the period of 2009–2020 is a reflection of the neoliberal policies that has been implemented since 1980. In conjunction with these policies, an industrialization approach was adopted in developed and developing countries under an accumulation model based on the high profit shares (Türel, 2010). With a few exceptions, most developing countries have experienced a decline in the share of manufacturing industry in the employment and the real value added. Turkey has also faced with the "premature deindustrialization" by transforming into a services economy without

progressing sufficiently in industrialization (Rodrik, 2016). Over the years, the emphasis in the economy has placed on construction and services rather than the manufacturing industry, which is seen as an important driving force in the growth process.

Another indicator used for evaluating the industry sector is the index of industrial production (IIP). IIP measures the growth of the volume of industrial production (UNIDO, 2021b) and the effects of the developments in the industry and the policies implemented in the short term (TURKSTAT, 2022a). Fig. 4 shows the annual percentage change in the IIP for the period of 2015-2021. The decrease in the IIP realized in April 2020 is the lowest annual change rate of the index. The reason for this decline in the industrial production is the Covid-19 pandemic precautions first taken in March 2020 in Turkey. However, by the Summer 2020, Turkey have reached and exceeded its pre-pandemic production level and is continuing to further improve in its industrial production. Statistics show that industrial production increased by 14.4% in December 2021, compared with same month of previous year. On the other hand, among the sub-sectors of the industry, the highest annual increase in the IIP was in manufacturing by 16.2%. IIP decreased annually by 1.5 for mining and quarrying, while it increased by 6.0% for electricity, gas, steam and air conditioning supply sector (TURKSTAT, 2022a).

It is also useful to mention the Competitive Industrial Performance (CIP) of Turkey. UNIDO'S CIP Index is a composite index that provides a general overview about the competitiveness of the manufacturing production and exports of the 152 countries and economies, and ranks them to their competitive performance (United Nations Industrial Development Organization, 2020). According to CIP 2021 database (UNIDO, 2021a), Turkey was at 28 in the CIP Index ranking in 2019 (as in 2018) and was located in the top quintile of the CIP index.

Over the years, Turkey has been improved its scores in the CIP index's dimensions (*the capacity to produce and export manufactured goods; technological deepening and upgrading, and world impact* (Correa and Todorov, 2021)). On the whole, Turkey have been performed better in the capacity to produce and export manufactured goods: Its manufacturing value added per capita and manufacturing exports per capita have been increased since 2000. As can be seen from Fig. 5, Turkey has improved in the manufacturing during the period 2000–2019. On the other hand, Turkey' impact on the global market for manufactured goods have not been improved enormously. The performance of Turkey in the indicators of this dimension, which are Impact on World Manufacturing Value Added and Impact on World Manufacturing Trade, has remained stable over the years.



Fig. 5. Indicators of the capacity to produce and export manufactured goods of Turkey.

The indicators of the dimension of technological deepening and upgrading performance of Turkey reflect its effort to achieve better performance and to become more competitive in producing and exporting the medium- and high-technology products. However, when compared to the development group countries (emerging industrial economies) to which it belongs, Turkey' performance falls behind the group leaders be like itself. Fig. 6 can be useful to throw a little light on Turkey' position relative to other countries. In Fig. 6, Turkey's Industrialization Intensity Index is compared to China, Mexico, Thailand and Romania. These countries are both among the emerging industrial economies and the top economies in the CIP groups, same as Turkey. As it is seen, Turkey has been performed poorly in the industrialization intensity index compared with the others.

The Export Quality Index that is another indicator of this dimension also show that the technological complexity of Turkey's exported goods has not been sufficient to achieve a better technological deepening and upgrading performance. Compared with the abovementioned countries, Turkey have been located at the bottom since 2007 and still have not reached its highest score (0.73) that was achieved in that year. Fig. 7, which presents the manufactured export quality of Turkey in comparison to the other countries, confirms this deduction. Nevertheless, the improvements efforts in this dimension over the years can be evaluated a sign of Turkey's keep moving along to higher up on the



Fig. 4. Industrial production index annual change rates (%).

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Fig. 6. Industrialization intensity index.

technological ladder.

When examined the Annual Industry and Service Statistics (TURKSTAT, 2022a), the vast majority (99.5%) of manufacturing enterprises were SMEs (small and medium-sized enterprises; fewer than 250 persons employed) that constituted 12.3% of total enterprises in Turkey and 44.4% of manufacturing industry turnover. Although, the number of large enterprises in manufacturing (2163) were low, their share in manufacturing turnover and general turnover were high (55.6% and 47.08% respectively). Table 3 presents the basic indicators in the Turkish manufacturing industry by size class and technology level for the 2020.

As presented in Table 3, when enterprises in the manufacturing industry are classified according to their technology levels (by the EUROSTAT technology classification¹), more than a half of them (57.53%) manufactured in low-tech activities in 2020. However, the number of enterprises was quite low (0.59%) for the high-tech activities. The enterprises operating in medium-low tech and medium-high tech activities were constitute the 31.59% and 10.29% of manufacturing enterprises, respectively. Low-tech enterprises also had highest share in turnover by 38.25%. Although, the turnover share of enterprises in high-tech sectors was quite low (3.0%), they were the only technology level whose turnover share has increased.

Regarding the contribution to employment, Small and Medium Sized Enterprises Statistics show that the ratio of industry employment was 28.9% and within the industrial activities, the ratio of manufacturing industry employment was 27.01% in 2020 (TURKSTAT, 2022a). In the same year, the manufacturing employment was predominantly provided by SMEs (with 65.1%). In terms of technology levels of manufacturing enterprises, the ratio of employment in low-tech activities (52.6%) were the highest and it was followed by medium-low tech activities (26.9%). High-tech and medium-high tech activities together constituted the 20.4% of total manufacturing employment.

Table 3 also gives the information about trade statistics by technology level of manufacturing industry enterprises. In 2020, the total manufacturing industry exports mainly comprised medium-high-tech products (39.47%). It is followed by low- and



medium-low tech exports 29.24% and 28.10% respectively. In the same year, the total manufacturing industry import was mediumlow tech-dominated by the rate of 38.25%. The shares of the high-tech exports (3.19%) and import (6.95%) were quite low compared to the other technological levels in 2020. The high-tech exports and imports were mostly carried by the large manufacturing enterprises out. SMEs exports and imports, on the other hand, were comprised of low-tech products. The prominent manufacturing commodity groups (CPA 2008, Statistical Classification of Products by Activity in the European Economic Community) in the SMEs exports were the "wearing apparel (13.9%)" and the "textiles (10.1%)" and the "machinery and equipment n.e.c. (10%)". The manufacturing products having most share in SMEs 2020 import were the "basic metals (33.6%)", the "chemicals and chemical products (12.4%)" and the "machinery and equipment n.e.c. (12%)".

Finally, TURKSTAT' Research and Development Activities Survey (TURKSTAT, 2021b) shows that the gross domestic expenditure on research and development (GERD) in manufacturing industry was 20 billion 333 million TL. 44.7% of this expenditure made by the enterprises in the high-tech sectors. The rise in this rate, which was 35.3% in 2015, over the years is seen as an important development in terms of the manufacturing industry R&D activities. In 2020, 40.4% of the total R&D expenditure in the manufacturing industry was made by the medium-high-tech sectors, while 9.2% and 5.7% by the medium-low-tech and low-tech sectors respectively.

3. Literature review

A large literature, rooted in classical industrial location theory to more current research based on industrial zones, clusters, agglomeration and new economic geography, lies at the heart of location choice decisions (Balbontin and Hensher, 2019). In broad terms, this literature can be divided into two sets of theories. The first group of theories that can be characterized as traditional is called the Neoclassical economic theory of location. These theories are based on the original Weberian Model (Weber, 1929), which emphasizes that the primary reason for companies to choose a location is cost reduction (Hansen, 1987; Maggioni, 1999; Mai, 1984). Later on, the original model was elaborated and expanded (Yeh et al., 1996). Isard (1956), Moses (1958) and many other researchers considered the choice of location in an economic context, while Lösch (1959), Greenhut (1963) and other researchers focused on markets, interdependence between companies (especially



¹ EUROSTAT groups manufacturing activities to "high-technology", "medium high-technology", "medium low-technology" and "low-technology" according to the level of their technological intensity (R&D expenditure/value added) by following sectoral approach (EUROSTAT, 2021).

Table 3
Basic indicators in manufacturing industry by size class and technology level, 2020

Size Class	Technology Level	Number of Enterprises	Number of Persons Employed (Thousand)	Turnover (Billion, TL)	Export rate (%)	Import rate (%)
Turkey	High	2535	108.41	103.30	3.19	6.95
	Medium-high	45170	797.14	812.38	39.47	33.87
	Medium-low	129840	1167.95	980.59	28.10	38.25
	Low	231931	2234.81	1155.30	29.24	20.93
SMEs	High	2442	29.89	15.78	10.47	7.25
	Medium-high	44483	406.82	217.31	15.19	9.57
	Medium-low	128960	771.58	323.84	21.08	7.89
	Low	230424	1456.68	489.38	36.63	20.20
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Large	High	93	78.52	87.52	89.53	92.75
	Medium-high	687	390.32	595.07	84.81	90.43
	Medium-low	880	396.37	656.75	78.92	92.11
	Low	1507	778.13	665.92	63.37	79.80

Source: TURKSTAT (2022a), Small and Medium Sized Enterprises.

oligopoly) and other demand-side factors (Hansen, 1987). In its current form, the traditional approach reduces the (industrial) location of companies aiming to maximize their profits to two phenomena: uniform resource distribution across a flat space and optimum transportation costs (Jovanovic, 2003). In this context, in the location choice, production costs and sales revenues are specified as surfaces in space and the choice that maximizes the optimal profit is attempted to be determined (Hansen, 1987).

Another group of theories that can be classified as modern are behavioral and institutional approaches. Despite the fact that these approaches are based on the Weberian model, they arose in response to the unrealistic assumptions of that model. Doubts concerning the assumptions of classical location models have grown, particularly after the 1950s, when high technology began to dominate production processes (Blair and Premus, 1987). On the one hand, these concerns have stemmed from the need for a viewpoint that considers both the characteristics of technology and the relationships of companies with one another, customers, suppliers, trade associations, regional systems, government and universities (Malecki, 1985). This perspective, which introduced the "institutional approach" to location theory (Blair and Premus, 1987; Chapman and Walker, 1987; Dahl and Sorenson, 2007; Galbraith, 1985; Kilvits, 2012; Massey, 1984; Scott and Storper, 1981; Smith, 1971; Taylor and Thrift, 1984 and many other important researcher), focused on popular issues of the day such as regulations and trade unions to protect the environment, especially the quality of life of labor (Chapman, 1980; Malecki, 1984; Vlachou and Iakovidou, 2013).

The growing doubts about the applicability of the idea of homoeconomicus is another factor that feeds doubts about the validity of traditional location choice models. In the arguments made on this axis, it is noted that the entrepreneur, who is accepted to act with the aim of profit maximization in traditional models, should also consider his/her "own inner world" when making decisions (Simon, 1955). When the satisfaction level of the entrepreneur is taken into account, it is agreed that the assumptions of profit maximization, full information and immediate response to changes in factor prices of traditional models cause divergence in research (Simon, 1959). According to these perspectives, which introduce the "behavioral approach" to the location theory (Arauzo-Carod and Antolín, 2004; Carr, 1983; Claus and Claus, 1971; Greenhut, 1956; Pred, 1969; Smith, 1966; Townroe, 1969, 1972; Walker, 1975; Webber, 1972 and many other important researcher), entrepreneur-specific qualities such as the spiritual income, abilities, knowledge level, experience, connections and luck of the entrepreneurs should not be overlooked.

When the literature developed according to neoclassical,

behavioral and institutional settlement approaches is examined, it has focused on the analysis of location selection decisions of manufacturing industry enterprises. In the studies, the aim of "determining the factors shaping the location preferences of companies in high-tech sectors" comes to the forefront, which is due to the increasing importance of technology in the manufacturing processes. The samples employed in the studies may consist of small or large regional units or regions/states that are in a leading position in terms of various characteristics in a country. When evaluated the studies in terms of the factor or factor groups that affect the location decisions, it is clear that the aim is to determine the impact of externalities that arise with agglomeration economies, labor market conditions and especially human capital on the choice behavior.

After the 1970s, location decisions have been attempted to be explained in terms of where organizations might find opportunities to innovate, build their knowledge stocks, create networks, improve the quality of life of their employees, or attract potential future employees. Malecki (1985), Hart et al. (1989), Maggioni (1999), Chen and Yu (2008) and Jo and Lee (2014) investigated the accuracy of this proposition in terms of technological level and proficiency. Malecki (1985) discovered that high-tech industries are concentrated in the Northeastern and Western areas of the United States (mostly in California, Massachusetts, Texas and Colorado). Similarly, Hart et al. (1989) observed no differences between the location choice decisions of the firms in Oakland County (Michigan) in terms of most spatial criteria, although there were substantial variances in terms of sector and technological level. Proximity to markets/customers, infrastructure facilities, business environment and proximity to the residence of the owner or employees are all important spatial factors in location decisions (Hart et al., 1989).

In his study published in 1999, Maggioni conducted an analysis by accepting as given that the location behavior of high-tech sectors differs, and concluded that locations that stand out in terms of innovation, dynamism and international competition in the four industrialized countries (USA, the United Kingdom, France and Italy) are considered the greatest locations for high-tech firms. Another study that tested the hypothesis that firms operating in different industries, and thus at different technological levels, will choose different locations is provided by Arauzo-Carod (2013). The author examined 4282 manufacturing industry firms operating in the 12-36 code range in Catalonia. It has been determined that companies consider the human capital stock in their location decisions. Jo and Lee (2014), on the other hand, took the account to the effect of the differences of the firms' technological capability rather than the differences of technological levels. They suggested that a firm's technological capability would influence its choice among

regions with various types of agglomeration. According to the results, competitive specialization or knowledge externalities of competitors in the chosen location are important factors for firms with low technological capability. For companies with high technological competence, knowledge externalities or complementary specialization of firms in related or complementary industries are more essential (Jo and Lee, 2014).

The importance of urbanization effects and other agglomeration economies for manufacturing firms is also confirmed by Barrios et al. (2006), Jofre-Monseny et al. (2011), Mejia-Dorantes et al. (2012) and Sanchez-Reaza (2018). According to Sanchez-Reaza (2018), localization economies, competitive markets and market access are important variables that determine the spatial distribution of firms in Tanzania. Barrios et al. (2006) state that government incentives in Ireland are the most important element after urbanization economies for firms in Ireland. Jofre-Monseny et al. (2011) indicate that the labor market pooling and the input sharing are the most important agglomeration mechanisms, while the knowledge spillovers mechanism seems to be much less important. But the effects these three mechanisms differ by the geographical scale (Jofre-Monseny et al., 2011).

A current study investigating the locational attractiveness by considering the spatial concentration of high-tech firms is provided by Gómez-Antonio and Sweeney (2021) for Madrid (Spain). They employed spatial point processes to estimate the location model, in which it is assumed that the differences in intra-metropolitan location affect firms' profits only through variation in their costs between locations. This cost function is represented by depending on the prices of goods and intermediate inputs, the technological level of the firm, workers' efficiency, nominal wage, and any of the urbanization and localization variables that enter the empirical specification of productivity. The results show that the benefits of the knowledge spillovers stem from the proximity to other firms in the same industry. This implies that the agglomeration economies creating by close cooperation and networking between close located firms are main location choice factor (Gómez-Antonio and Sweeney, 2021).

Campi et al. (2004) conducted a different study from the other empirical location studies. The authors suggest that location choice differs according to industry life cycles and agglomeration economies. According to the results, industry life cycles are important in the location decisions of new firms established between 1980 and 1994 in Spain. Furthermore, urbanization effects lose their attractiveness in favor of localization effects. Firms prefer small cities with high specialization rather than big cities with a dense population and a wide range of products. Firms in R&D-intensive industries choose large cities and areas with lower production costs to capture these technological externalities (Campi et al., 2004).

Artz et al. (2016), Devereux et al. (2007), Brülhart et al. (2007) and Kohlhase and Ju (2007) also considered the interaction between agglomeration economies and public policy variables while investigating the location choice process of companies. Artz et al. (2016) determined that agglomeration economies are more important than local opportunities and fiscal policies in the location decisions of firms in Iowa and North Carolina. While, Devereux et al. (2007) found that agglomeration economies limit the impact of discretionary governmental grants in a study that covered the regions of Great Britain and Scotland from 1986 to 1992. The last two of these studies, on the other hand, examined the location choice of firms or enterprises operating in the industry other than the manufacturing industry, such as brokerage and wealth management, software development and consulting, financeinsurance-real estate (FIRE), oil and gas, services etc. Brülhart et al. (2007) found that for Swiss firms operating in sectors at NACE-2-, NACE-3- and NACE-4-digit levels (41 sectors in the twodigit level, 133 sectors at the three-digit level, and 242 sectors at the four-digit level), agglomeration economies neutralize tax effects. In contrast, Kohlhase and Ju (2007) found that the effect of agglomeration economies is weaker than the tax effects for firms in the manufacturing, oil and gas, services and finance-insurance-real estate (FIRE) sectors in Houston.

Ferreira et al. (2016) investigated whether location decisions differed both between industries and between urban and rural areas, and found that the location decisions of companies in Portugal vary depending on the sector, geography (urban/rural area) and entrepreneur characteristics. Their sub-sample contains firms from different sectors: agriculture, services, the manufacturing and extractive industries, the construction sector and KIBS (Knowledge Intensive Business Services. Companies that provide information-intensive services prefer to be located in urban areas. These companies prefer rural locations when it comes to institutional aspects such as access to universities, research institutions and technology parks, closeness to administrative hubs, technological fairs and R&D incentives. Similarly, Lafuente et al. (2010) found that entrepreneurial characteristics are not effective in choosing a rural location for firms providing knowledgeintensive services. According to the authors (Lafuente et al., 2010), local infrastructure, local economic conditions, institutional framework and individual and spatial motivations are among the factors driving the choice of location.

The study of Bottazzi and Gragnolati (2015) is another one examining the location choice of companies operating in a sector other than the manufacturing industry. They focused on the question that whether the spatial distribution of manufacturing and service activities in Italy relies on the urbanization economies or the sector-specific localization economies. Based on the findings, they indicate that the spatial distribution of economic activities depends on the technological dynamics and urbanization effects. van den Heuvel et al. (2012) investigated the spatial concentration and location dynamics for logistics establishments in North Brabant (The Netherland). The general conclusions of the study show that the logistics concentration areas (Absolute and Relative Employment Concentration (AREC) areas) are attractive for logistics establishments. Accordingly, the location dynamics of the logistics establishments in North Brabant case can be explained by the agglomeration economies (van den Heuvel et al., 2012).

When the literature is examined in Turkey, it is seen that the majority of the studies are focused on the location choice of foreign direct investments (FDI). In these studies, many factors such as information infrastructure, political constraints, R&D intensity and partnership size (Demirbag et al., 2010); bureaucracy, ease of market entry, access to suppliers, labor costs and availability of skilled labor and country similarities (Kayam et al., 2011), have been found to be effective on the location preferences of multinational companies. Demirbag et al. (2010) identified two country groups (developed and emerging countries) and two regions (the European Union and the Former Soviet Union), and Kayam et al. (2011) determined 4 country groups as the European Union, Middle East and North Africa, Transition Economies and other countries as alternative locations for companies. According to the results, Turkish companies value the political climate, the degree of commercial restrictions/facilitation, the human and legal framework of the labor market as much as the technological competence of the host country that contributes to their technological experience (Kayam et al., 2011).

The subject of studies investigating the factors that guide multinational companies' location choices in Turkey is mostly approached in terms of production and distribution costs (such as cost-reducing public policies, geographical facilities, regulations), demand conditions, agglomeration economies and the impact of human capital. The effects of the political climate and labor market regulations have not been examined. According to Tatoglu and Glaister (1998), the most crucial location choice factors are market size, Turkey's growth rate and official FDI policy. Berkoz and Turk (2009) found that agglomeration economies, infrastructure, information costs and labor costs were the most important factors in their provincial analysis. These results are similar to the findings of Deichmann et al. (2003). However, Deichmann et al. (2003) found that, in addition to agglomeration, depth of local financial markets and human capital, the coastal access is also a significant variable. Yavan (2010)'s findings also confirm that agglomeration economies, human capital and geographic opportunities all have an impact on a firm's decision to relocate between provinces. According to the findings, other location factors that attract investors include the fast-growing market, educated labor force, dense road network, public investment, mild climate, wide open space and great quality of life (Yavan, 2010).

Karahasan (2015) modeled the number of new firms (new firm formation) in the manufacturing industry, service sector and trade activities at the provincial level as a function of local demand, human capital, financial development, public policy and industrial externalities. Similar to the findings obtained in previous studies, local demand and human and financial capital are the most important factors determining the distribution of firms between provinces in Turkey.

The most recent study examining firm location for Turkey was conducted by Akbaşoğulları and Duran (2020). In the study, the location of the firm was examined in terms of distance (km) and, and it was primarily investigated how firm size (employment and capital size) and age (experience) influenced the location distribution of the firms in İzmir. Firm size is not a significant variable in terms of firm location preferences for 734 firms working in the bakery goods, food products, packaged food, herbal products, beverage, and tobacco products sectors within the province borders of İzmir. However, experience has a positive impact on the spatial distribution of firms. Firms with more experience are located closer to the city center, while those with less experience are located further away (Akbaşoğulları and Duran, 2020).

In this study, a solution to the company location problem is sought within the context of companies' profit maximization expectation and industrial location policy practices in Turkey. The location choice model developed in this direction is based on Neoclassical and Institutional location approaches. In this way, on the one hand, it has become possible to alleviate the restrictive and unsuitable assumptions of traditional location models. On the other hand, the effect of the objectives of the companies to cooperate with various economic players/facilitate cooperation and the industrial location policies implemented in light of these objectives have been examined. The way the industrial location policy practices contained in the location model assumptions are handled is another aspect that distinguishes the applied empirical specification in this study from the others in the relevant literature. In this study, the split of the organized industrial zones (OIZ), which are the topic of the company's location choice, into two groups as "traditional" and "new generation" OIZs makes the location model unique and compatible with today's OIZ concept. One further distinctive feature of the study is that the empirical analysis of the location choice is performed for the production facilities. Furthermore, by means of considering the effect of the technological density of the sectors in the location choice, it has been seen that sectoral technological differences should be taken into account when examining the distribution of companies in Turkey.

4. Data and empirical methodology

The main data sources are Turkey's 1000 Largest Industrial Enterprises research data for 2018 (ICI, 2020) released by ICI and, TURKSTAT Regional Statistics database (TURKSTAT, 2021a). The ICI-1000 (Turkey's Top 500 and Second Top 500) data are the product of a survey-based study that covers all enterprises operating in the industrial sector in Turkey. The survey data includes information about companies' production-based sales, net sales, exports, annual average number of employees, gross value added, equity, total assets, profit/loss for the reference period, earnings before interest, tax, depreciation and amortization (EBITDA), capital structure and economic activity code (NACE Rev. 2, ISIC Rev.2). The productionbased sales of companies are used as a basic indicator of the ranking, but also the companies are ranked by other indicators collected within the scope of the survey (ICI, 2021). The research is recognized as an essential and reliable source by the components of the industry and academia in terms of seeing and directing the development of the Turkish industry.

According to the NACE Rev.2 Classification (2021), 16 of the Top 500 and Second Top 500 Industrial Enterprises (ICI-1000) in Turkey in 2018 are in the "Mining and Quarrying" sector, 964 are in the "Manufacturing" sector, and 20 are in the "Electricity, Gas, Steam and Air Conditioning Supply" sector. The Manufacture of Food Products (183), Manufacture of Textile Products (124) and Manufacture of Basic Metals (121) have the most companies, according to the distribution of companies among the manufacturing subsectors. The sectoral distribution of ICI-1000 companies according to NACE classification is graphically shown in Fig. 8.

According to the high-tech classification guideline (EUROSTAT, 2021) prepared by the European Statistical Office (EUROSTAT) for the manufacturing industry, 242 of the ICI-1000 companies operate in high-technology-intensive sectors (with NACE Rev.2 2-digit "20, 21, 26, 27, 28, 29, 30" codes²) in 2018. In 2018, there are 176 companies with foreign capital shares and 104 companies that were publicly held among the ICI-1000 companies. There are 172 foreign-owned manufacturing companies and 102 publicly traded manufacturing companies.

In this study, the location choice of the ICI-1000 companies is examined by a choice model that is based on Neoclassical and Institutional location approaches. The primary assumption adopted in this model is that "the companies behave with the goal of maximizing profit (Varian, 1992)". Following the empirical location studies in the abovementioned relevant literature in Section 3, it is assumed in the model that the expected profit of a company is primarily affected by the region-, sector- and company-specific factors. Accordingly, this company chooses its optimum location by evaluating the demand and cost factors that affect its maximum expected profit.

The expected profit $(\pi_{j,i,k})$ model, which forms the basis of the location choice model in this study, can be expressed by equation (1):

$$\pi_{j,i,k} = \overline{\pi}_{j,i,k} + \left(\varepsilon_{j,i,k} + \eta_{i,k}\right) \tag{1}$$

where j (j = 1, 2, ..., N) stands for the company, i represents the sector in which the company operates and k is the companies'

² NACE Rev. 2 2-digit level: 20-Manufacture of chemicals and chemical products; 21-Manufacture of basic pharmaceutical products and pharmaceutical preparations; 26-Manufacture of computer, electronic and optical products; 27-Manufacture of electrical equipment; 28-Manufacture of machinery and equipment n.e.c.; 29-Manufacture of motor vehicles, trailers and semi-trailers; 30-Manufacture of other transport equipment.



Fig. 8. Sectoral distribution of ICI-1000 companies (NACE), 2018.

optimum location from a set of location alternatives (k = 1, 2, ..., K). The term $\overline{\pi}_{j,i,k}$ in equation (1) is a random variable that contains characteristics specific to the region (R), sector (S) and company (C). The expected profit function also contains two error terms. $\eta_{i,k}$, reflects the unobservable characteristics that equally affect the location of the companies in a given sector i, and $\varepsilon_{j,i,k}$, reflects the unique factors of the company j located in k.

$$\pi_{j,i,k} = f[R_k, S_i, C_j] + \left(\varepsilon_{j,i,k} + \eta_{i,k}\right) \tag{2}$$

As it can be seen, f is a function of internal and external factors representing demand and cost conditions. If the model is expressed in clearer notation:

$$\pi_{j,i,k} = \alpha + \beta_1 R_k + \beta_2 S_i + \beta_3 C_j + \left(\varepsilon_{j,i,k} + \eta_{i,k}\right) \tag{3}$$

Internal and external factors affecting the company's expected profit (equation (3)) reflect the factors that the entrepreneur and the company have as decision makers, and regional and sectoral conditions and characteristics. The main internal factors that belong to the company and the entrepreneur (C_i) are entrepreneurial characteristics (such as age, education, motivation and environment), company characteristics (establishment, ownership, size, number of employees, and so on), and competencies (performance, efficiency, and so on). Agglomeration economies, public policy and privileges, economic outlook and financial development, infrastructure, accessibility and physical circumstances, and labor market conditions are all examples of regional factors (R_k) , one of the external factors. Demand structure, competition and relationships with business partners, business environment (costs, industrial tradition, public policies), technology, and knowledge generation abilities are all examples of sector-specific characteristics (S_i) .

Observing $\pi_{j,i,k}$ is practically impossible because there are many factors affecting expected profit, and company behavior is uncertain. To overcome this constraint, an assumption is used that "the company will choose a location in which it achieves the greatest expected profit compare with the other alternative locations". Accordingly, the choice behavior of the company is reflected by the qualitative outcomes or responses. And correspondingly, the dependent variable in the choice model is determined as an indicator of a discrete choice, such as a "yes or no" decision (Greene, 2008).

Let $y_{i,i,k}$, be a variable indicating that company *j* in sector *i* chose

to be located in region k at time t. Assuming that companies are risk neutral, the location choice of a company $i(y_{j,i,k})$ can be defined as (Devereux et al., 2007):

$$y_{j,i,k} = \begin{cases} 1 \; ; \; \pi_{j,i,k} > \pi_{j,i,n} \; , \quad \forall n \neq k \\ 0 \; ; \; otherwise \end{cases}$$
(4)

where the dependent variable takes the value of 1 (otherwise, it takes the value of 0) if the company *i* chooses the region *k*. Equation (4) can be estimated using discrete choice models (DCM) as in Hansen (1987), Barrios et al. (2006), Devereux et al. (2007), Kohlhase and Ju (2007), Lafuente et al. (2010), Alcacer ve Delgado (2012), Jo and Lee (2014), Jofre-Monseny et al. (2011), Bottazzi and Gragnolati (2015), Artz et al. (2016).

Discrete choice models are used to model the choice behavior of individuals or firms. The general framework of these models includes a decision maker, a set of alternatives, attributes and a decision rule. In these models, the decision-maker is assumed to be an individual that chooses a single option by evaluating a finite set of choice alternatives for maximizing its utility within the scope of a decision rule. Characteristics that are specific to decision-makers and attributes of choice set affect this utility (Ben-Akiva and Bierlaire, 1999; Baltas, 2007; Greene, 2008). Therefore, the utility is modeled as a random variable being developed to reflect uncertainties in order to take the complexity of human behavior into consideration (Ben-Akiva and Bierlaire, 1999):

$$U_{jk} = V_{jk} + \varepsilon_{jk} \tag{5}$$

where the utility (*U*) of alternative *k* for individual/company *j* has a deterministic (*V*) and a stochastic (ε) component (Baltas, 2007). This approach is used in the DCMs as an alternative explanation of the individual choices and known as the *random utility maximization*. The approach has also been used to analyze discrete micro-economic data in location models, under the leadership of Carlton (1979, 1983), who found that the McFadden (1974) model can be easily applied to company location decisions (Guimarães et al., 2004).

McFadden (1974)'s Multinomial (Conditional) Logit Model (MNL) is the most favored model in empirical studies investigating the choice behavior. However, the main restriction of the model is the independence of irrelevant alternatives (IIA) axiom (McFadden, 1974). The IIA implies that "the probabilities of choosing any two alternatives are independent of the attributes of any other

alternative" (Hausman and McFadden, 1984). Therefore, MNL should be used when interdependence or correlation is not expected among utility functions of choice alternatives. To test the IIA, Hausman and McFadden (1984) suggest an application of the Hansen (1987) specification test (Wooldridge, 2001). According to the test result, MNL or an alternative model to MNL is used.

Several alternative models to MNL have been developed to relax the IIA (Wooldridge, 2001). One of these is to the Nested Logit (NL) Model, which was first introduced to the literature by Ben-Akiva (1973, 1974) with the development of the McFadden (1974) model. NL model groups the similar alternatives into subgroups (nests). This creates a hierarchical structure of the alternatives that allow the variance to differ across the groups while maintaining the IIA assumption within the groups (Greene, 2008) (Silberhorn et al., 2008). Fig. 9 illustrates the model's hierarchical structure applied in this study.

In Fig. 9, the choice set (C_k) with 12 alternatives is divided into 5 nests (B_n) . The location alternatives are the NUTS1 regions for Turkey: C_k = (East Marmara, Istanbul, West Marmara, Aegean, Mediterranean, West Anatolia, Central Anatolia, Southeast Anatolia, Central East Anatolia, Northeast Anatolia, East Black Sea, West Black Sea). And the location groups (nests) are as follows: B_b = (Marmara, Aegean- Medit, Anatolia1, Anatolia2, BlackSea). The choice process can be thought of as choosing from the 5 choice sets, and making the specific choice within the chosen set (e.g., choosing East Marmara ($c_{EastMarmara} | Marmara$) from Marmara ($B_{Marmara}$); in numerical expression choosing $c_{k|b}$ from B_b). It should be noted that there is no ordering among the levels of this hierarchical structure, such as that the decision-maker firstly choose in one level and then another level.

For company *j*, the unconditional probability P_{kb} of an alternative *k* within nest *b* is defined as (Greene, 2008):

$$P\left[c_{jk}, B_b\right] = P_{jkb} = \frac{\exp\left(x'_{jk|b}\beta + z'_{jb}\gamma\right)}{\sum_{b=1}^{B}\sum_{k=1}^{K_b}\exp\left(x'_{jk|b}\beta + z'_{jb}\gamma\right)}$$
(6)

where, $x_{jk|b}$ and z_{jb} are the attributes of the choices and of the choice sets, respectively. IV_{jb} to represent the scalar that is defined as for the *l* th branch:

$$IV_{jb} = \ln\left(\sum_{k=1}^{K_b} \exp\left(x'_{jk|b}\beta\right)\right)$$
(7)

The IV_{jb} is the inclusive value that is calculated as a weighted average of the attributes of alternatives in a nest (Hausman and McFadden, 1984). The inclusive value transfers the impact of choices in lower-levels to upper levels (Baltas, 2007) and measures the degree of correlation of random shocks across the alternatives (StataCorp, 2015). Substituting this in the probability and (Greene,

2008) and deriving P_{jkb} from the product of the marginal choice probability P_b for nest b (Level 2) and the conditional choice probability $P_{jk|b}$ for alternative k within nest b (Level 1) (Silberhorn et al., 2008):

$$P_{jkb} = P_{jk|b}P_{b} \\ = \left(\frac{exp\left(x'_{jk|b}\beta\right)}{\sum_{k=1}^{K_{b}} exp\left(x'_{jk|b}\beta\right)}\right) \left(\frac{exp\left[\tau_{b}\left(z'_{jb}\gamma + IV_{jb}\right)\right]}{\sum_{b=1}^{B} exp\left[\tau_{b}\left(z'_{jb}\gamma + IV_{jb}\right)\right]}\right)$$
(8)

where, τ is a scalar parameter of the model and a measure of the degree of the independence between the stochastic parts (namely error terms) of the utility for each of the alternatives in a nest. It is commonly known as the "log-sum coefficient" or the "dissimilarity parameter" (Train, 2003). For $\tau_b \neq 1$, the NL model arises, otherwise (under the restriction $\tau_b = 1$) the McFadden (1974) model. In the NL model, the inclusive value coefficients (τ) are unrestricted and this allows the model to incorporate some degree of heteroscedasticity. Thus, the IIA assumption continues to hold within each branch (Greene, 2008). The relaxation of the $\tau_b = 1$ restriction is also crucial because of its economic interpretation: " $\tau_b IV_{jb}$ " is the expected utility that the company obtain from the choice among the location alternatives in a nest (Train, 2003).

Finally, it is necessary to briefly mention the decision rule of the nested model applied in the study. Within the scope of decision rule, it is assumed that the choice alternatives evaluated by the companies were determined according to the region of the province, where their manufacturing facilities were located. However, when the open addresses of the companies in the sample are examined, it is seen that some of them have production facilities in more than one province. The location choice of these companies is determined by the answer to the following question: "Does the company have a production facility in the province where it is registered to the chamber of industry?" If the answer is yes, the company's location choice is accepted as the province where it is registered to the chamber of industry. If the answer is no, the main factor that determines the location choice is whether the company operates in at least one of the OIZs compatible with the "new generation OIZ concept" in any province. Otherwise, the choice is based on whether they have a production facility in OIZs defined as "traditional OIZs" or in other industrial zones with special advantages (small industrial site/zone, free zone, shipyards zone). In the study, when discriminating between the new generation and traditional OIZs, the "innovation need in the current age of technology and digitalization" has been taken into account. For this reason, in addition to the infrastructure services that they provide to their participants, a new generation OIZs are expected to provide superstructure services such as keeping up with the technological and digital transformation, meeting the professional and social needs of their employees, establishing cooperation with the society



Fig. 9. Tree structure for companies' locational behavior (Two-Level Nested Logit).

and the city, and being sensitive to the environment.

Following the theoretical and empirical studies in the literature, the main empirical specification of this study can be represented as:

$$\pi_{j,i,k} = \alpha + \beta_1 lrgdppc_{j,k} + \beta_2 pop_{-}g_{j,k} + \beta_3 lfa_{j,k} + \beta_4 l_{-}es_{-}lf_{j,k} + \beta_5 spec_{j,i,k} + \beta_6 size_{j,i,k} + \beta_7 cs_{-}fr_{j,i,k} + \beta_8 lpbsales_{j,i,k} + \beta_9 hmhltec_{j,i,k} + \epsilon_{j,i,k}$$
(9)

Equation (9) implies that the location decision of an ICI-1000 company is associated with the expected profit function, which is thought to be determined by internal and external factors according to the company. In the study, local demand and labor market conditions in the province where the company is located are considered as external factors, while industry- and company-specific factors as the internal factors.

lrgdppc and *pog_g* included in the model to reflect the effect of local demand conditions (such as the volume of demand in the region and the purchasing power of the people who live there) (as in the Maggioni (1999); Yavan (2006); Devereux et al. (2007); Chin (2013)). *pog_g* is the population growth and represents the market growth. *lrgdppc* stands for the size of the market and is the log-transformed series of the GDP per capita that is deflated using the GDP deflator from the World Bank World Development Indicator Database (World Bank, 2020). In line with the widespread consensus in the literature, it is expected that demand conditions will have a positive effect on a company's location choice.

Another factor that plays a significant role in the location choices of companies is the labor market conditions. Companies are expected to choose places with labor factor suitable for production activities. In the literature, the effect of labor market conditions is examined in terms of labor supply (labor force indicators), skill and qualification level (education and R&D indicators), labor cost (wages) and labor market regulations and organizational strength. In this study, the labor supply is represented by the labor force participation rate of population aged 15 and over (*lfa*).

Human capital, which can be defined as the progress that emerges as a result of education and knowledge accumulation in labor (Krugman and Wells, 2012), is an important industrial policy indicator both in terms of showing the existence and quality of skilled labor in the labor market and in terms of the locational distribution of firms/industries. Especially in high-tech sectors such as pharmaceuticals, electrical-electronics, automotive and chemistry, knowledge-based and technology-based development is necessary, and the primary source of this development is the qualified labor force. Since the production technologies and processes change rapidly in such industries, the availability of skilled labor is critical to the long-term sustainability of production and gives a relative advantage. This is why the effect of the skill and the qualification level of labor is controlled in the study. The education is considered as an important factor to evaluate the skill and qualification level of the labor force, because of its contribution to development of the knowledge accumulation and professional experience and skills, and hence the human capital. For this purpose, *l_es_lf* is used as a log-transformed series of the economically active population (labor force) by educational status. The raw data, provided by TURKSTAT within the scope of Household Labour Force Statistics (TURKSTAT, 2021a), includes the labor force aged 15 and over by the educational level ("less than high school", "high and vocational high school" or "higher education"). It is expected that the coefficient estimates of each labor market condition variable to be positive, implying that companies choose locations that have favorable labor market conditions.

The size of the industry (*size*) in which a company operates refers to how much of the industry (%) is in the province where this company is located. Specialization (*spec*) depicts the differentiation rate of the share of a sector in a province from the general picture across the country (GBS, 2021). The size and specialization parameters are provided by the Ministry of Industry and Technology. The measurement of the variables is formulated as follows:

$$size = 100*\frac{d_{\rm S}}{D_{\rm S}} \tag{10}$$

$$spec = \frac{d_{S/d}}{D_{S/D}}$$
(11)

where d_S and D_S denote the value of the "S" sector in the region and in Turkey, respectively. d and D represent the total value in the region and in Turkey, respectively. Additionally, both parameters are calculated using the net sales values (GBS, 2021).

In the study, the size and specialization parameters are used to control the effects of agglomeration economies.³ In the literature, it is argued that regional agglomerations tend to intensify in a selfreinforcing manner, attracting companies until they produce negative externalities (Jo and Lee, 2014). Companies can profit from pure external economies such as lowering labor and transportation expenses by locating in clusters of similar companies (Artz et al., 2016), innovating through knowledge exchange and enhancing business productivity (Marshall, 1890; Porter, 1990; Krugman, 1999). From this perspective, it can be said that the positive externalities that develop with agglomeration economies attract companies to a location. However, it is expected that the concentration of production activity in a location will be accompanied by the concentration of the population over time (Kilkenny and Thisse, 1999). Noise and environmental pollution, urban congestion, service disruptions, increases in housing prices, and corporate espionage (exporting corporate knowledge) may all be costs (negative externalities) associated with a dense population (Capello, 2013; Karahasan, 2019; Öztürk et al., 2019). Therefore, the direction of the effects of specialization and size ratios on the choice of location is uncertain.

It is accepted that the company-specific variables play a crucial role in the location choice process, as they affect both the decisions of the company who is the decision-maker and other companies related with it. The company-specific variables that is frequently used in the location studies can be grouped under four headings: the entrepreneurial-specific characteristics (such as age, gender, educational attainment, risk sensitivity, financial means and motivation), the company-specific characteristics (such as age, ownership structure and size), the company' capabilities (such as economic performance, innovation capabilities, technological capabilities) and the business environment in which company is operated (such as competitive pressure, risks, business connections (with customers, suppliers or competitors), restrictions and opportunities). In the study, the effects of company-specific variables on location choice are reflected by two company-specific characteristics. These are the capital structure and the net-production sales of ICI-1000 companies.

The capital structure of a company is proxied with its foreign

³ The term "agglomeration economies" was introduced to the literature by Marshall (1890). According to Marshall, companies that are strategically positioned together will have higher production as the geographic concentration of the companies will attract a larger pool (mass) of specialized labor and suppliers, and will also facilitate the circulation of knowledge from one company to the next (Alcacer and Delgado, 2012; Capello, 2013).

capital share (cs fr). In the literature, there is an opinion suggesting that foreign or primarily foreign-owned companies prefer to locate close to one another (Barrios et al., 2006). It is also argued that foreign companies may tend to prefer locations with certain privileges and conveniences. Therefore, it is expected that the foreign capital share of the companies in the location decisions will have a positive effect in the geographically and economically advantageous locations. Another variable that reflects company-specific characteristics in the model is the value of net production-based sales (excluding sale of goods manufactured by the enterprises, and sale of commercial goods) (lpbsales). It is included in the location choice model to control the effect of the company size. Because the rank of the ICI-1000 companies is based on the criterion of production-based sales, this variable is important for ICI-1000 companies and was regarded as a suitable indicator to control the effect of firm size in location choice model. Although the information about the other variables that describe the company' size such as number of employees, total assets or total sales of companies are also available in the ICI-1000 data, some values of these indicators are not publicly disclosed for some companies. Since the inclusion of one of these variables into model reduces the sample size, they are not included in the model. The expectation is that the company size positively affects the probability of chosen of a location.

The technological environment or regime of a company is accepted as a vital factor in location choice, because it allows for the technological spillovers and knowledge externalities (Jo and Lee, 2014). In the study, it is proxied by the technological intensity variable (*hmhltec*) that takes the value of 1 if the industry is high (high and medium-high) technology-intensive and zero otherwise. Within this scope, industries with NACE Rev.2 2-digit "20, 21, 26, 27, 28, 29, 30" codes are defined as high-tech, while the others are defined as low-tech industries. These definitions are based on EUROSTAT' high-tech classification of the manufacturing industries in accordance with the technological intensity and the NACE Rev.2. The expectation is that a company with high technological intensity will chose locations that have more clustering high-tech firms and more innovative output (hence more metropolitan regions in Turkey' case) (Maggioni, 1999; Barrios et al., 2006; Jo and Lee, 2014).

Due to data constraints, the effects of some important indicators on location choice of companies could not be investigated. It is thought that mentioning briefly these constraints would be beneficial for future research. First, in this study, the effect of local demand conditions is examined only within the scope of the size and the growth of the market. However, indicators of the potential and strength of the market are also included in empirical location studies. Thus, in the absence of data limitations, to better assess the effects of local demand conditions, other indicators such as the strength and growth of the market or the elasticity of demand for the company's product should be included in the location choice model.

Second, the location choice model does not involve any of the labor cost indicators. However, labor costs are accepted as a major location factor that increases the production costs of the companies. For this reason, low wages are considered as a factor giving an advantage to employers and policymakers in countries like Turkey, where the level of organization of labor unions is low. It should be noted that there are also studies in the literature that have found that low wages are a negligible factor compared to labor quality (Ramón-solans Prat and Marcén, 2006; Rossi, 2019) or that companies are more likely to be located in high-cost regions (Yavan, 2006; Devereux et al., 2007). Hence, it is expected that the value attached to labor costs by companies will vary based on the technological intensity of the sectors in which they operate, and labor

force qualifications they need.

Third, professional skills and qualifications of the labor force is handled only from the aspect of the contributions of education on human capital. For a more comprehensive review, indicators of the dynamic efficiency of companies should also be included in the location choice model. It is thought significant to explore the influence of companies' technological capabilities (innovative skills and competencies, absorptive capacities) on location choice. Because, the competencies that are directly linked to the innovation performance of the company are the product of both the knowledge externalities used in the chosen location and the knowledgeintensive strategies followed by the company and the competence accumulation fed by the growing stock of knowledge.

Fourth, the impact of urbanized economies that reflect the gains from industrial diversification should also be considered in order to make a clearer inference about agglomeration economics. One of the reasons behind this is that the nature of externalities varies from one region to the other. For instance, in large regions, the industrial structure is diversified and therefore knowledge diffusion between companies in different industrial sectors (urbanization economies) becomes prominent. This is why ICI-1000 companies are concentrated in the Mediterranean, Aegean, and particularly in the Marmara Region, similar to the overall distribution in Turkey. By locating in these regions, companies derive substantial cost benefits from knowledge diffusion between different sectors, and logistical and geographical opportunities. This contributes to the development of various sectors, from agriculture, livestock, and manufacturing to trade and tourism. By means of sectoral diversity, the attractiveness of these regions further increases. In medium and small regions, on the other hand, the industrial structure is less diversified and externalities between economic agents in the same sector (localization economies) are more important. Consequently, including the industrial diversification to the location choice model is vital for controlling the effects of industrial mix and of the cross-industry spillovers between firms on industrial location. This can be achieved by an index of diversity defined as a function of regional employment in the industries, as has been done in various empirical studies (e.g., Kort, 1981; Lall and Chakravorty, 2004; Campi et al., 2004; Barrios et al., 2006; Devereux et al., 2007). Or, as in others, the employment level in the region or sector in which firms operating can be used (e.g., Sanchez-Reaza, 2018; Arauzo-Carod, 2013; Kohlhase and Ju, 2007).

Finally, to better control the effect of foreign capital share on the location choice, further studies may use agglomeration economies specific to foreign companies, similar to the Barrios et al. (2006), or consider the interaction of these agglomerations with other variables. Moreover, observing the effects of the abovementioned company-specific variables other than foreign capital share or company size is highly recommended.

5. Empirical results

This study employs the NL model to analyze the location choices of manufacturing industry companies included in the ICI-1000 list for 2018. The cross-sectional data employed in the analysis includes both company-specific, region (location)-specific and sectorspecific variables. The estimation sample covers the year 2018 and includes 909 companies with 10908 company (decision maker)-alternative (location) observations. The decrease in the number of ICI-1000 companies to 909 is due to the fact that 10 of these companies are public, and the data of 45 of them are confidential.

Table 4 contains information about the location choice for the production facility of ICI-1000 manufacturing industry companies and Table 5 shows the estimation results of the location choice

Table 4

Tree structure specified for the Nested Logit Model and companies' location choice.

Level	Alternative	k
Marmara	East Marmara	228
	İstanbul	146
	West Marmara	90
Aegean-Medit	Aegean	147
	Mediterranean	95
Anatolia1	West Anatolia	65
	Central Anatolia	35
Anatolia2	Southeast Anatolia	53
	Central East Anatolia	4
	Northeast Anatolia	1
BlackSea	East Black Sea	16
	West Black Sea	29
	N	10908

k: Number of times alternative is chosen.

N: Number of observation (company) at each level.

model.

In Table 5, the "Lower Nest" section contains the results related to the choice of an alternative within a nest. In the "Upper Nest" section, on the other hand, there is results related the choice of a nest. The Anatolia2 location group (level) was determined as the base group as

Table 5

Two-Level Nested Logit Results

a requirement of the estimation method in the upper nest. Accordingly, the upper nest equation results will be interpreted in accordance with the Anatolia2 group. The third section of Table 5 presents the dissimilarity parameters. In the last section of Table 5, the Likelihood Ratio LR ($\tau = 1$) test values (χ) are given, where the consistence of the NL model structure is tested with the hypothesis that "all the dissimilarity parameters are equal to 1". As it is mentioned before, if $\tau = 1$ for all nests, NL model reduces to McFadden (1974) model, and hence it is said that there is complete independence (no correlation) among all the alternatives in all nests (Train, 2003). The log-likelihood value, the number of observations and the number of companies for the estimation are also given in Table 5.

The LR test value in Table 5 shows that the NL model structure is supported for the sample. The dissimilarity (τ) parameters are in the range of (0,1) for some region groups and greater than 1 for others. The fact that the $0 < \tau_b < 1$ indicates that the model's explanatory variables are consistent with utility maximization for the nest B_b . For $\tau_b > 1$, the consistency is showed for certain explanatory variables in the nest B_b (Train, 2003). From the results, it is seen that all the explanatory variables are consistent with the utility maximization for Marmara, Anatolia1 and Anatolia regions. The model is also consistent with the utility maximization for Aegean-Medit and BlackSea nests, but this consistency doesn't hold for all the explanatory variables in the model.

According to the upper nest estimation results, where the effects of company-specific variables can be seen, the sectoral specialization and size parameters have statistically significant effects on the probability of choosing for some regions. In addition, their effects

Lower Nest					
	GDP per capita		2.2778***		
			(0.6189)		
	Population growth		0.0934***		
	1 5		(0.0202)		
	Labour force participatio	n rate	-0.0459		
			(0.0542)		
	Educational status of lab	our force	0.7393**		
			(0.3570)		
Upper Nest					
Levels					
	Marmara	Aegean-Medit	Anatolia1	BlackSea	
Specialization	-0.3952***	-0.0574	-0.0327	0.3037***	
-	[-0.2964]	[-0.0478]	[-0.0272]	[0.2531]	
	(0.0588)	(0.0496)	(0.0551)	(0.0746)	
Size	4.0874***	-6.4995***	-7.4761***	-63.3599***	
	[3.0655]	[-5.4163]	[-6.2300]	[-52.7999]	
	(1.3682)	(1.7342)	(2.1901)	(10.8387)	
Foreign capital share	0.0248*	0.0242*	0.0202	0.0151	
	[0.0186]	[0.0202]	[0.0168]	[0.0126]	
	(0.0136)	(0.0137)	(0.0141)	(0.0160)	
Production-based sales	0.2334	0.3119	0.2793	0.2479	
	[0.1750]	[0.2599]	[0.2327]	[0.2066]	
	(0.1945)	(0.1970)	(0.2163)	(0.2817)	
High / Medium-high-tech	2.8108***	2.7112***	2.9459***	1.5658	
	[2.1081]	[2.2594]	[2.4549]	[1.3048]	
	(1.0223)	(1.0283)	(1.0423)	(1.2214)	
Dissimilarity Parameters					
	Marmara	0.9981			
	Aegean-Medit	2.0834			
	Anatolia1	0.7952			
	Anatolia2	0.3996			
	BlackSea	1.3149			
LR ($\tau = 1$); $\chi = 27.17*$ Log-likelihood = -1725.3986					

N = 10908, k = 909

Notes: 1. * p < 0.10, ** p < 0.05, *** p < 0.01. The estimated average probabilities of choosing a location in square brackets and the standard errors in parenthesis. 2. Anatolia2 is the base group.

differ between locations/regions. Since these variables also represent the effects of agglomeration economies, the varying effects of them on location choice are consistent with expectations. The results support the evidence that positive and negative externalities stemming from the agglomeration economies affect location choices with mutual interaction. Similar findings have also been obtained in previous empirical studies (Berkoz and Turk (2009), Deichmann et al. (2003) and Yavan (2010) for Turkey, Sanchez-Reaza (2018) for Tanzania, Barrios et al. (2006) for Ireland, Artz et al. (2016) for North Carolina, Jo and Lee (2014) for South Korea.

Compared to the Anatolia location, as the specialization rate in the sector in which the company operates increases, the probability of choosing the Marmara decreases, while that of the Black Sea location increases. According to the estimated average probability of being chosen for the Marmara location $[0.395 \times (1 - 3/12) = 0.296]$, as sectoral specialization improves in Marmara, the probability of companies establishing a facility in this region reduces by an average of 0.296 compared with the Anatolia2 location.⁴ On the other hand, as sectoral specialization in the Black Sea increases, the probability of companies choosing this region for their manufacturing facilities increases by 0.253 on average.

In comparison with the Anatolia2 location, the improvements in the size of the sector in which the companies operate reduces the probability of being chosen for Aegean-Medit, Anatolia1, and the Black Sea, while giving Marmara an edge. The probability of the ICI-1000 companies choosing Marmara as the location for their manufacturing facilities rises by an average of 3.066 as the sectoral size value increases in Marmara. The rise in the sectoral size value reduces the location choice probability of the companies by an average of 5.416, 6.23 and 52.8 in the Aegean-Medit, Anatolia1 and Black Sea locations, respectively. In comparison with the base group, the effect of sectoral size on the probability of a company having a manufacturing facility in a location is remarkably higher for the Black Sea than other regions.

The foreign capital share of the companies gives them an advantage over the base group in terms of the choice of Marmara and Aegean-Medit locations. As the foreign capital share of the companies increases, the probability of choosing the Marmara and Aegean-Medit locations increases by an average of 0.019 and 0.020, respectively. This finding coincides with studies that have analyzed the location determinants of multinational companies in Turkey (Tatoglu and Glaister (1998); Berkoz and Turk (2009); Deichmann et al. (2003); Yavan (2010)). Companies that have high foreign capital share consider whether a location has good market access and various local opportunities. The findings from previous studies that have examined other countries (Sanchez-Reaza (2018) for Tanzania, Hart et al. (1989) for Oakland County (Michigan/USA) and Mejia-Dorantes et al. (2012) for Spain) also support this result.

The upper nest estimation results show that the net productionbased sales variable has no statistically significant effect on the location choice of ICI-1000 companies. This coincides with the results of Akbaşoğulları and Duran (2020) indicating that the firm size (measured by capital size and employment size) does not play a significant role in firm location (in İzmir/Turkey). However, it is clear from numerous studies that firm size plays a vital role in the location choice process. It is expected that large firms (measured by various indicators such as sales, capital size or employment) tend to locate in large regions or cities. For instance, Arauzo-Carod and Antolín (2004) found that firm size, proxied by the total investment and also the number of employees, is an important location criterion for Spanish firms. Similarly, the findings of previous studies using the number of employees by different forms (such as level, average or log-transformed) to represent firm size (Kohlhase and Ju (2007); Sridhar and Wan (2010); van den Heuvel et al. (2012); Sanchez-Reaza (2018)) show that the size of the firm has a positive effect on location choice.

According to results, the sectoral technological regime works in favor of being chosen by ICI-1000 companies for Marmara, Aegean-Medit, and Anatolia. If an ICI-1000 company operates in a sector with high or medium-high technology, the probabilities of being chosen for Marmara, Aegean-Medit and Anatolia1 location groups increase by an average of 2.108, 2.259 and 2.455, respectively. This finding confirms the findings of previous empirical location studies (Malecki (1985); Hart et al. (1989); Maggioni (1999); Campi et al. (2004); Chen and Yu (2008); Jo and Lee (2014); Arauzo-Carod (2013); Ferreira et al. (2016)) and coincides with the general expectation that there are considerable differences between firms' location choice in terms of sector and technological regime.

As for the lower nest estimation results, local demand and labor market conditions are important factors that determine the locational distribution of ICI-1000 companies. Real GDP per capita, population growth rate, and the educational status of the labor force have increasing effect on the probability of location choice. Similar results have also obtained in many previous studies. Concerning local demand conditions, for example, Tatoglu and Glaister (1998), Yavan (2006) and Karahasan (2010, 2015) for Turkey; Ramón-solans Prat and Marcén (2006) for Spain; Devereux et al. (2007) for Great Britain and Brülhart et al. (2007) for Switzerland have demonstrated that companies tend to be located close to areas where demand conditions are suitable. Moreover, Deichmann et al. (2003), Yavan (2010) and Karahasan (2015) for Turkey; Lall and Chakravorty (2004) for India; Ramón-solans Prat and Marcén (2006), Chen and Yu (2008) for Taiwan, Jofre-Monseny et al. (2011) and Arauzo-Carod (2013) for Spain; Lafuente et al. (2010) and Chin (2013) for USA have revealed that qualified labor is a crucial location factor. As a consequence, it can be deduced that ICI-1000 companies are attracted by regions/locations having favorable demand conditions and a more diversified and deepened labor pool. Lastly, there is no evidence that the labor force participation rate representing labor market conditions, has a statistically significant effect on the location choice of ICI-1000 companies.

6. Conclusions

This study analyzes the location choice of the manufacturing industry companies in the ICI Top 500 and Second Top 500 Industrial Enterprises (ICI-1000) for 2018. The location choice model is based on the assumption that companies choose the location of their manufacturing facilities with the aim of profit maximization, and their decisions are affected by internal (company-specific) and external (sectoral and regional) factors.

In conclusion, the study provides useful insights into the choice behavior of the ICI-1000 manufacturing companies. First, local demand and labor market conditions have a considerable and positive effect on the location decisions of ICI-1000 companies for their production facilities. As the size of the market, i.e., the purchasing power of residents, grows in a given location, ICI-1000 companies operating in Turkey are more likely to turn to that location. Another demand condition indicator, market growth, has also a positive impact on location behavior. The newly established or relocating companies are expected to concentrate on regions/ places with higher market size and market growth in order to achieve a competitive advantage.

Second, no evidence has been found to support the view that labor force participation has a significant influence in shaping

⁴ This calculation was done by using the estimated coefficient of the variable under discussion for a location and the probability of choosing this location among the alternative locations, as calculated in the study of Barrios et al. (2006).

location choice behavior. However, the skill and gualification level (quality) of the labor, represented by the educational status of the labor force, has a positive effect on the location choice of companies. This result is in line with the expectation that companies operating in high-tech (high and medium-high) industries will concentrate their operations in locations having a more diverse and deepened labor pool. The distribution of high- and medium-hightech sectors in the sample is similar to Turkey's overall pattern: companies operating in these sectors are mostly concentrated in the Marmara (especially East Marmara) and Aegean regions. Nevertheless, it should not be forgotten that each industry has its own set of labor requirements that change over time (Malecki, 1985). While choosing a location, it is critical for companies to determine whether the locations under consideration provide suitable labor conditions for the industry in which they operate and the manufacturing technologies they employ. In particular, companies in sectors that require a high degree of specialized labor should be tending to locate regions where either there is skilled and experienced labor and/or the opportunity cost of training and skill development is low. However, it is clear that this situation probably has an adverse influence on regional disparities in Turkey. Because, given Turkey's long-standing labor migration from east to west, it would not be unrealistic to expect that companies seeking "suitable labor conditions" will choose to locate their production facilities in western regions. Therefore, it can be concluded that policies regarding labor market conditions and education in Turkey should be transformed by taking this inequality into account.

Third, the impact of agglomeration economies on location choices varies from region to region. While specialization, which is a criterion for decentralization economies (expressing positive externalities that are external to the firm but internal to the industry and region), is to the disadvantage of Marmara; it gives an advantage to the Black Sea. Thus, the findings support the hypothesis that small cities/regions with high specialization are more attractive in terms of location choice than large cities/regions with a larger population density and product diversification (Campi et al., 2004). The sectoral size, on the other hand, plays a role in favor of the Marmara, while affecting the other regions negatively.

Fourth, the foreign capital share of the ICI-1000 companies increases their tendency to head towards the Marmara, Aegean, and Mediterranean regions. The economic and social opportunities, and suitable geographical and physical possibilities in these regions can be shown as the factors affecting this situation. It can be said that the Marmara, Aegean and Mediterranean regions respond to the needs of companies with high foreign capital shares in terms of easy access to production factors and intermediate/final goods, knowledge, and international and more diverse markets. The easier a region accesses and connects to large markets, the more likely it would be chosen by companies.

Finally, the sectoral technological intensity of a company affects location choice behavior to Marmara, Aegean, Mediterranean and West and Central Anatolia regions' benefit. This means that the ICI-1000 firms operating in sectors with high- and medium-hightechnological intensity tend to locate in regions where have many research universities and institutions, educated and qualified human capital, and knowledge externalities. Besides the many spatial criteria, the sectoral technological regime has also significant influences on the locational distribution of ICI-1000 companies in Turkey.

On the basis of these findings, it can be useful to touch on a few issues and make some recommendations. Policy interventions to attract companies to disadvantaged regions should be taken by following the global trends in the sectors, taking into account the criteria and targets set by significant international platforms for the sector, and the raw material needs/dependence of sectors and companies. Industrial restructuring in the region should be supported in the case of disadvantaged industries in locations that have favorable particular characteristics. If the case is for disadvantaged regions, steps should be taken to improve the regional economic environment (such as infrastructure and commercial services) and social possibilities, while taking local dynamics into account. When promoting specific sectors or companies to head to a region or to cluster in that region, cross-sectoral interactions should be considered.

It is also critical to implement a policy based on knowledge and technology while also considering the raw material requirements of the various sectors. For example, despite the basic raw materials of the textile sector, which is a low-tech sector, are products based on agriculture and animal husbandry, the sector also interacts with high-tech sectors such as electricity-electronics, automotive, chemistry and machinery and can be affected by developments in these industries. Similarly, the automobile, chemistry, pharmaceutical, mechanical, and electrical-electronics industries all interact with a variety of low- and high-tech industries and require tacit knowledge. Therefore, while directing a sector to a region, the suitability of the target region to the structure of the relevant sector and the sectors with which it interacts should be assessed. It is worth noting that the target region should promote development and satisfy the needs in order to increase competitiveness at the sector and company levels.

It is predicted that Turkey is one of the countries that will benefit the most from the upcoming transformation in global supply structures (TIM, 2021). For this reason, it is critical for Turkey to monitor global trends and develop the essential plans and strategies. The EU, for example, establishes priorities for transitioning to a new economy, industry, and social order in collaboration with its neighbors and stakeholders in its 2019-2024 policies. These priorities include the realization of green, digital and circular transformation with "The European Green Deal (2019)", "A Europe fit for the Digital Age (2020)" and "A New Industrial Strategy for Europe (2020)". Turkey has also prepared the Green Deal Action Plan 2021 to adapt to the changes envisaged in the transformation process of Europe, which is the most important trade and investment partner, and to support the transition to a sustainable, resource-efficient and green economy (Resmi Gazete, 2021). The rapid and determined implementation of the plan is important for companies and sectors to adapt to the transformation as soon as possible and for Turkey to avoid falling behind.

Overcoming disorganization in industrial areas and achieving a more organized structure is one of the goals outlined in the Ministry of Industry and Technology's 2023 Industry and Technology Strategy, which was released in 2019. In this context, it has been stated that deficiencies in all types of infrastructure, services and legal processes in regard to industrial areas will be rectified (Ministry of Industry and Technology, 2019a). These Ministry-set targets are recognized to be crucial in terms of decreasing the bureaucratic barriers faced by companies and minimizing application discrepancies in the services they receive. In order to avoid falling behind global trends and breakthroughs and to maintain steady progress, it is essential that moves be made not only at the sector and product level but also within the framework of industrial areas. Necessary steps should be taken so that industrial areas (zones) can keep up with the "green, digital and circular transformation". It is hoped that the new generation OIZ concept will bring these steps closer to end point more quickly. OIZs (and other industrial areas/zones) should evolve into a new generation model by providing services that assist their participants in keeping up with the green, circular and digital transformations, meeting their social and professional demands, and cooperating with society and the city.

Appendix

Table	A1
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Provinces and license numbers in Turkey

Code	Province	Code	Province	Code	Province	Code	Province	Code	Province
01	Adana	18	Çankırı	34	İstanbul	50	Nevşehir	66	Yozgat
02	Adıyaman	19	Çorum	35	İzmir	51	Niğde	67	Zonguldak
03	Afyonkarahisar	20	Denizli	36	Kars	52	Ordu	68	Aksaray
04	Ağrı	21	Diyarbakır	37	Kastamonu	53	Rize	69	Bayburt
05	Amasya	22	Edirne	38	Kayseri	54	Sakarya	70	Karaman
06	Ankara	23	Elâzığ	39	Kırklareli	55	Samsun	71	Kırıkkale
07	Antalya	24	Erzincan	40	Kırşehir	56	Siirt	72	Batman
08	Artvin	25	Erzurum	41	Kocaeli	57	Sinop	73	Şırnak
09	Aydın	26	Eskişehir	42	Konya	58	Sivas	74	Bartın
10	Balıkesir	27	Gaziantep	43	Kütahya	59	Tekirdağ	75	Ardahan
11	Bilecik	28	Giresun	44	Malatya	60	Tokat	76	Iğdır
12	Bingöl	29	Gümüşhane	45	Manisa	61	Trabzon	77	Yalova
13	Bitlis	30	Hakkâri	46	Kahramanmaraş	62	Tunceli	78	Karabük
14	Bolu	31	Hatay	47	Mardin	63	Şanlıurfa	79	Kilis
15	Burdur	32	Isparta	48	Muğla	64	Uşak	80	Osmaniye
16	Bursa	33	Mersin	49	Muş	65	Van	81	Düzce
17	Çanakkale								

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