

MODELING THE SPATIAL CONSEQUENCES OF RETAIL STRUCTURE CHANGE OF IZMIR-TURKEY: A QUASI-EMPIRICAL APPLICATION OF SPATIAL INTERACTION MODEL¹

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Abstract: Accompanying with the changing demographic, socio-economic and physical conditions of the world the retail sector has undergone major changes in scale, organization, and geography. After 80's there have also been dramatic changes in retail sector and environment in Turkey. Especially in major cities of the country, international and domestic retail chains have imposed a transformation and started to restructure the urban retail geography introducing remarkable economic, social and spatial implications. Similarly, the retail geography in İzmir has been changing rapidly especially in the field of food retailing and the arrival of the new retail formats has been profound effects on the ability of many small-independent retailers to survive. The study explores the dimensions of this ongoing retail structure and hierarchy change in İzmir and uses a dynamic spatial interaction model as a device to be able to predict possible future transformations.

I. INTRODUCTION

The retail sector has undergone major changes in the world especially in the last two decades. The sector has radically been altered in terms scale, organization, and its geographical representation. The emergence of innovative store formats, the increased prevalence of international retail chains, the development of large-scale out-of-town retail environments and the appearance of new consumption patterns have been the foremost factors of the retail change in many countries.

There have also been profound changes in retail sector and retail environments in Turkey along with the global economic transformations after 80's. Unlike developed countries, half of the sector in Turkey is still dominated by large number of small-scale, single location retailers. However, market share and spatial prevalence of large-scale retailers have been increasing rapidly. Especially in major cities of the country, both domestic and multinational organized retailers have been imposing a transformation, and restructuring the urban retail environments with big investments. This drastic change in the retail structure has also had many economic, social and business implications as well as discernable spatial consequences on the urban geography.

Among all the areas of retailing, food retailing stands out as having seen the most profound changes in Turkey. Since food is the most important type of consumer expenditure in developing countries, supermarkets and hypermarkets have become the central retail innovation. The prevalence of large-scale food retailers has also negative effects on the survival of many small-independent retailers. For instance, the number of organized food retailers has increased from 1316 in 1996, to 5545 in 2005 while the number of groceries has decreased from 175121 to 135473 (AC Nielsen-Turkey; Migros, 2006). Furthermore, certain trends show that Turkish organized food retailing market is far from being saturated and has a substantial growth potential due to increasing population, urbanization, private car ownership, number of working women, consumption expenditures and large international investments.

Decision makers and public officials are very much concerned about the spatial consequences of this restructuring process especially in the densely built-up cities so as not to face undesired spatial and socio-economic results of enduring retail transition. In this respect, the study explores spatial dimensions of retail change in the phase of grocery to supermarket-hypermarket transition in İzmir. Similar with the other major cities of the country, the retail geography in İzmir has been changing rapidly especially in the field of food retailing. The study explores the dimensions of this ongoing retail structure and hierarchy change in İzmir Metropolitan Area and uses a dynamic spatial interaction model as a device to be able to predict possible future transformations.

¹ The major contents of this paper is initially included in unpublished master thesis entitled "Modeling Retail Structural Change of İzmir Using a Dynamic Spatial Interaction Model" prepared by Mert Kompil in July 2004.

II. REVIEW ON RETAIL STRUCTURE CHANGE

Up to the 1950's, the retail sector almost in the whole part of the world was dominated by small to medium-size store units, with a spatial configuration of Christaller's type rank-size distribution. At the lowest level, the neighborhood centers contain the retail units selling mostly food and immediate household consumption goods, and at the highest, mono or multi-nuclei city centers including the retail units selling higher level consumption goods such as durables etc. along with service, office, and entertainment units. This traditional structure of retail environments started to change after 1950s primarily in developed nations as a consequence of rising affluence and demand. However, the current transformation process of retailing, so-called 'Retail Revolution' has started with the alterations after 1970s and spread over the world.

When the rising affluence combined with a set demographic, technological, and life-style changes, the structure of the retail trade would change drastically. Demographic changes include reduced importance of traditional family, and eventual increase in numbers of households and decrease in the average household size; increase in the proportion of women participating into labor force; declining birth rates and aging population; increasing level of education and eventual sophisticated consumer tastes and preferences; expanding flexible life-styles and time-budgets. Additionally, increase in car ownership and technological development in household freezers also contributed the nature of the retail trade. The impacts of these changes on the retail market were realized in a number of ways: a deepened market segmentation for a variety of customers and products; growth of specialty retailing; increased proportion of durable consumer goods in total retail expenditures; increased proportion of food eaten a way from home and rapidly growing restaurant industry; flexible shopping times and extended working hours in retail industry; growing sensitivity to personal health and eventual increase in use of medications and cosmetics, fitness clubs, and weight loss clinics (Rogers, 1984 and McGoldrick, 1984).

Obviously, above mentioned changes and impacts came basically from the demand side. The responses from the supply side had a very basic motivation: to maximize the profit by reducing operational expenses and benefiting from economies of scale for a higher degree of competitiveness via carrying a very diversified range of products and occupying very large square-footages. All of these factors caused eventual structural change in the retail industry with organizational and spatial aspects. Typology, marketing, scale, and location of retail establishments have been changed (Bromley and Thomas, 1993). New store types and retail formats (such as specialty retailing, hypermarkets, department stores) at larger scales as multiple establishments (at expense of small scale independent retailers) have been developed with different spatial and locational formats. The rapid changes in retail structures have reduced downtown retailing dominance on behalf of the suburbanization of retail outlets, and have replaced the corner stores by the supermarkets, the clustered outlets by the shopping malls and retailing strips (Fotheringham and O'Kelly, 1989).

The change has continued in the following decades and come up to date. Increasing urban population, suburbanization, rising demand for consumption goods, increased car ownership and being widespread usage of deep freeze, together with technological advances in electronics and computer technologies can all be shown as the most important elements of retail revolution since 1980s. Additionally, the lack of free time, increases in number of working women, widespread of credit card usage, and changes in packaging, warehousing, food preservation and transportation can be set as other major factors of rapid changes in retail systems (Beddington, 1990; Dawson, 1980; Guy, 1994).

Apart from these after 80s, the retail sector has adopted itself to globalized economic structure and internationalization learning to perform in conditions of competition, economies of scale and technology intensive development. Market saturation in developed economies has forced retailers investing abroad and this leads new transformations especially in developing countries' retail environments. As Kumar (1997) states, retailing was a small, fragmented, local, unsophisticated, traditional business run by owner operators, and has grown up into large, global, technology-intensive, powerful, fast-growth corporations managing their own brands since 1980s. Separately, considering forthcoming retail innovations and recent developments in non-store retailing as e-commerce, further modifications in the retail environments with a new set of the consequences are yet to come. It should be noted that one undisputable result of the retail revolution, beyond others, is the drastic decline in the number of small-scale independent retailers from all formats, and this result seems the most relevant for the purpose of the current study.

III. THE RETAIL DEVELOPMENT IN TURKEY

The turning point of Turkish Economy in the 1980 has also had important impacts on the retail industry. Up to the 1980, the development policy of the country was based on import substitution, and a strict government protection for the national economy for almost all the industrial sectors. The structure of the economy was a semi-controlled mixed economy. Besides infrastructure and energy investments, to incubate the development, the government invested into industries with heavy capital requirement. In the same time, the private sector were also subsidized with many ways for their entrepreneurs in virtually all sectors. However, this long lasting protectionism did bring international competitiveness as opposed to the initial expectations. Instead of intermediate and capital goods, the private sector focused on production of consumer goods. Governmental establishments, on the other hand, became inefficient in time by being used as the organizations for political favors. With these policies, government ended up big budget and balance of payments deficit in the 1970's, and the situation was aggravated with the oil shocks during that time (Senses, 1991; Onis, 1991). The consequence was many social disturbances, and an eventual military coup.

The mass urbanization in the country started in the 1950's. Between 1950 and 1975, the country maintained a steady economic development of 6 % per annum on average. The percentage of industrial production of the country increased from 14 percent in 1950 to 23.2 percent in 1980; the percentage of urban population within the total population increased from 18.5 percent in 1950 to 50 percent in 1980; the per capita income of the country increased from \$166.40 in 1950 to \$1330 in 1980 (Tokatlı and Özcan, 1998, p.81). However, under these economic conditions from 1950s to 1980s, despite the stage of economic development and urbanization hardly any change in the structure of retailing had occurred. Empirical evidences (in Kumcu and Kumcu, 1987) show briefly that over the thirty-year period, neither a decline in the share of small-scale retailers nor an increase in the share of large-scale retailers had been identified. Migros (Switzerland-1955), Gima (1956), and various municipality owned stores (after 1970s) serving in the form of supermarket were the only organized retail investments in this period. As Tokatlı and Özcan (1998) states dominant type of retailing up to 1980s was still small-scale, capital-weak, independent and family-owned such as, groceries (bakkal), greengroceries (manav) butchers (kasap) and haberdashers (konfeksiyoncu) that fits well the prevailing demand pattern of the Turkish customer, the public attitudes and the macroeconomic policies.

In 1980s import-substituted industrialization strategy was replaced with the more outward-oriented development strategy, aiming to develop the export potential of the country by recognizing the global competition conditions. The economy has begun to go smoothly and experienced relatively high rates of growth (averaging %5 in 1981-1993 period), and has changed the production and consumption patterns since then (Tokatlı and Boyacı, 1998). The export-oriented development strategy has introduced a highly appropriate environment for retail growth by altering demand side factors, changing environmental conditions, and increasing attraction of the sector for large corporations. In first, high growth rates of the economy have caused improvements in income especially wins over interest, rent and other profits; second government have removed some of the initial restrictions for large-scale retailers to emerge and grow by providing necessary infrastructure and externalities; third integration with the international market and import liberalizations have had a significant effect on retailing by increasing the variety of goods available in the domestic market; finally the high cash flows in a high inflation, depreciation and nominal interest rate environment has had affirmative effects on retail growth (Tokatlı and Özcan, 1998).

The economic growth was not the only response for rapid retail development, social, political and technological shifts that country experienced are the other important factors affected the retail environments after 1980s. In details, increase in urbanization rates, consumer expenditures and private car ownership; widespread usage of credit cards and durable goods; the changing role of women and consumer profile; technological advances and internationalization of retailing have been the major factors that changed the retail structure in Turkey. Since 1980, the shifts in economic policy and its consequent socio-economic outcomes linked with demographic and physical factors have all changed the circumstances for large-scale, western type of retail developments so that a rapid change has been inevitable during the 1990s.

As a result of this, large domestic and international corporations (mostly European) successfully captured an increased market share through supermarkets, hypermarkets, department stores, and franchise-based operations starting from the 90s. Although a number of multi-purpose shopping centers and malls have been the first signs, the most crucial changes have occurred in the sector of food retailing. Migros, Tansaş, Gima,

CarrefourSA, Metro, Real, Kipa and BIM have been the major food retail chains dominate the Turkish organized retailing since 1990s (see table 1). Considering that most of the companies (except for Migros and Gima) are less than 15 years old, the momentum of retail structural change can be understood more clearly.

Store Brands	Retail Formats	Ownership	2003 Sales (EUR million)	Number of Outlets	2003 Market Share
Major Food Retailers					
Migros	Hypermarket	Turkish (Koç Holding)	1,057	436	6.2
ŞOK	Supermarket				
	Discount stores				
CarrefourSA	Hypermarket	French (Carrefour)	581	11	3.8
ChampionSA	Supermarket	&	51		
DiaSA	Discount stores	Turkish (Sabanci)	-	82	
BIM	Hard Discount Stores	Turkish, US & Saudi Arabian	975 (2001)	921	3.7
Tansas*	Hypermarket	Turkish (Dogus Holding)	400	193	2.5
Makro	Supermarket				
Gima **	Supermarket	Turkish (Fiba Group)	365	78	2.4
Endi	Discount Stores			52	
Yimpaş	Hypermarket	Turkish (Yimpas Holding)	285	50	2.0
	Supermarket				
Tesco-Kipa	Hypermarket	UK (Tesco PLc)	190	5	1.2
Metro	Cash & Carry	Germany	452	9	-
Real	Hypermarket	(Metro Group)	167	7	1.2
Kiler	Supermarket	Turkish	N/A	37	0.8
Afra	Hypermarket	Turkish	120	22	0.7
Major Non-Food Retailers					
Carsi	Department stores	Turkish	216	13	
Praktiker	DIY	German	56	8	
Koçtaş	DIY	Turkish & Switzerland	40	5	
YKM	Department stores	Turkish	N/A	42	
Marks & Spencer	Department stores	Turkish	N/A	11	
Tekzen	DIY	Turkish & German	N/A	9	
Bauhaus	DIY	German	N/A	2	

Table 1: Major Food and Non-Food Retailers in Turkey – 2004

Source: PricewaterhouseCoopers, “2004/2005 Global Retail & Consumer Study from Beijing to Budapest, report on Turkey”, p.185, <http://www.pwc.com.mu/gx/eng/about/ind/retail/growth/turkey.pdf>; * Changed ownership (Koç Holding) in 2005, ** Changed ownership (Carrefour and Sabanci Holding) in 2005

Additionally, the change in number of retail outlets and overall market shares gives a brief understanding of retail transition that the country experienced after 1990s (See table: 2&3). A great many of the large-scale retail investments have mainly concentrated in the few largest cities of the country starting from 1990s such as, İstanbul, Ankara, İzmir, Bursa and some of the well-off southern cities. The number of hypermarkets mostly located in metropolitan areas has increased more than three fold from 41 units to 129 between 1996 and 2000, whereas number of supermarkets has increased from 1275 to 2850 in the same time period. The increase in number of organized food retailers has also continued in the 2000s despite the economic crises that the country experienced in 2001, and reached a total number of 5545 in 2005. Apart from these, in the same ten-year period from 1996 to 2005, number of groceries (Bakkals, Markets) as being traditional, single location retailers has decreased 23%, from 175121 to 135473.

Type of Retailer		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Organized Retailers		1316	1682	2135	2421	2979	3640	4005	4242	4,809	5545
Hypermarkets	>2500 m ²	41	66	91	110	129	149	151	143	152	160
Large Supermarkets	1000-2500 m ²	91	130	210	251	306	357	368	367	396	454
Supermarkets	400-1000 m ²	289	404	464	567	726	835	909	968	1082	1258
Small Supermarkets	<400 m ²	895	1082	1370	1493	1818	2299	2507	2764	3179	3673
Traditional Food Retailers		17512	17058	16761	16217	14999	14179	13589	13882	13797	13547
Larger Grocery	50-100 m ²	10755	11417	12192	13247	13232	13210	13555	14537	15197	15076
Grocery	<50 m ²	16436	15917	15542	14892	13676	12858	12234	12428	12278	12039

Table 2: Changes in Number of Organized and Unorganized Food Retailers

Source: AC Nielsen-Turkey Company data in Ak Yatırım (2003); Bocutoğlu and Atasay (2001); AC Nielsen-Turkey, (2004); Migros Türk T.A.Ş., (2006).

Similarly in increasing store numbers, the market share of the large-scale retailers have also increased radically from 17.4% to 41% whereas the share of traditional retailers decreased from 82.6% to 59% between 1996 and 2001. The increase has continued in the following years and organized retailers have captured the nearly half of the total market shares in 2003². Despite the drastic decline in numbers and shares, traditional retailers still reserves half of the total market shares across to organized retailers. However, the hard discount stores as being the most attractive investments recently and established commonly in downtowns and residential areas are expected to increase their market shares even causing more grocery failures.

Type of Retailer		1996	1997	1998	1999	2000	2001
Organized Retailers		17,4	24,4	28,1	31,3	37,1	41,0
Hypermarkets	>2500 m ²	2,9	4,0	8,8	9,1	13,4	11,8
Large Supermarkets	1000-2500 m ²	2,7	4,3	5,3	6,4	8,8	8,1
Supermarkets	400-1000 m ²	4,2	6,2	5,2	6,3	7,2	6,8
Small Supermarkets	<400 m ²	7,6	9,9	8,8	9,5	11,6	10,3
Traditional Food Retailers		82,6	75,6	71,9	68,7	62,9	59,0
Larger Grocery	50-100 m ²	15,9	15,3	16,1	16,4	13,4	14,5
Grocery	<50 m ²	66,7	60,3	55,8	52,3	45,6	48,4

Table 3: Changes in Market Shares of Organized and Unorganized Food Retailers

Source: AC Nielsen-Turkey Company data in Ak Yatırım (2003); Bocuotoğlu and Atasay (2001);

Among all the summarized changes experienced after 1990s, traditional retailers still dominate the Turkish retail system and keep surviving today. Considering small-scale, independent, single location retailers such as grocery, butcher, green grocery and other small buffets together with open-air bazaars, traditional food retailers control 64.5 percent (Hypermarkets and supermarkets control 35%, Migros Company Report, 2006) of total food retailing market. The traditional retail outlets are still preferred by the majority of Turkish customers especially in non-metropolitan and rural areas as well as low-income metropolitan neighborhoods. Open-air bazaars -with a wide variety of products, fresh fruits and vegetables-, groceries and others -with their proximity and accessibility to home- continue attracting consumers.

However, certain trends show that Turkish organized food retailing market has a high growth potential due to a large and growing population and unsaturated market conditions. Additionally, the growth of personal income along with the changes in the composition of the country's production factors, demographic characteristics, life styles and consumption patterns creates positive expectations for new organized retail developments. Considering that for per one million of the population, there are still approximately 2 hypermarkets and 15 supermarkets in Turkey, whereas there are 15 hypermarkets and 150 supermarkets in EU countries (PricewaterhouseCoopers, 2005); and contrasting with the other countries, where top three retailers have almost dominated the whole market (Sweden 95%, Norway 86%, Holland 83%, France 66%, Portugal 57%, Spain 42%, Turkey 11%) (AC Nielsen-Turkey Company data, Ak Yatırım, 2003), organized retailers in Turkey are at the initial steps of their growth.

Turkey is not alone in these structural changes and expected additional transformations in which there are considerable similarities with some of the European Countries, such as Spain, Portugal, Greece, Hungary and Poland as well as some other developing countries. In following decades, if Turkey faces up even only part of what Portugal has experienced recently³, the retail structure will continue changing rapidly as in past decade (Tokatli and Boyacı, 1998). The major players behind the transformation again will be the organized retailers increasing their market share and store numbers with their large freestanding outlets. At the same time small, single location retailers will start to disappear gradually from the urban areas leading to a decrease in overall retail activity and an increase in number of vacant stores. In conclusion, as the urban retail hierarchy and structure change continue in the forthcoming years, its social, economical and physical outcomes have to be explored. Since the most crucial retail transition might be among the groceries and super-hypermarkets as in the past, this paper intends to identify spatial dimensions of this type of transition.

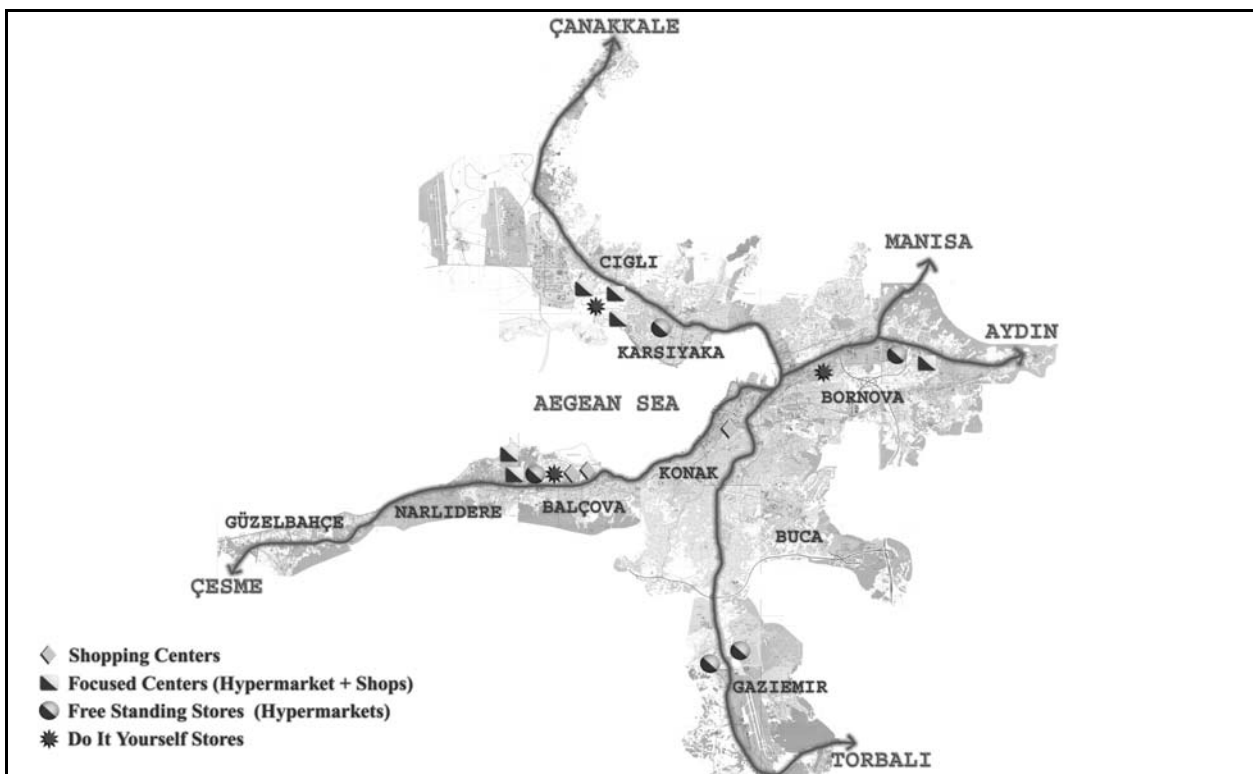
² Measurement of tobacco and tobacco products has been stayed out of the market shares account after 2001, and organized retailers market share has increased to %51.6 in 2002 and %53 in 2003 whereas unorganized retailers has decreased to %48.4 and %47 (AC Nielsen-Turkey, 2004).

³ ...in Portugal, prior to 1987 the food retail sector consisted of 45000 small family-owned shops and within the five years almost all of these have closed and today three major group dominate the retail market with a share of 57% (Eustace, 1991; cited in Tokatli and Boyacı, 1998, p.357).

IV. THE RETAIL STRUCTURE ANALYSIS OF İZMİR

İzmir, the third most populated⁴ metropole city of the country, is located on the West coast of the country along the Aegean Sea. From past to date, İzmir has always played a fundamental role in country's economy as being the commercial and economical center of the region benefiting from its international commercial seaport, productive agricultural areas in the hinterland, and economical and industrial structure that is fed from this hinterland. In the last decades the ongoing industrial growth, commercial variation, financial restructuring, and increasing number of university, tourism, housing and transportation investments have strengthened economic power of İzmir. As the country witnessed a great many of socio-economic and physical transformations, İzmir metropolitan area has been the initial scene of these transformations together with İstanbul and Ankara. In the same way, the socio-economic development level⁵ of İzmir, its dynamic demographical structure and geographical attractiveness has inevitably brought similar retail transformations with the others after 1990s.

Up to the 1990s, İzmir had a retail structure, which fairly consisted of small-scale, independent and traditional retailers as introduced before. The only western type of retail investment was Tansaş in those years serving in supermarket format as a municipality corporation. After 1990, rapid increase in population and purchase power, and being widespread of private car ownership along with decentralization of housing and some other functions has been the initial factors leading to a suitable environment for large-scale retail developments. The preliminary large-scale investments, which introduced in the second half of the 1990s, were Kipa Migros serving as independent freestanding stores in hypermarket format. Both of them established on the main exit axles of the metropolitan area landing on areas above 10.000 square meters. At the end of the 1990s similar establishments have started to develop especially in the other main road axles as well as shopping centers, focused centers (including a hypermarket and shops) and do-it-yourself stores which may sometimes exceed 20.000-25.000 m² floor spaces. The major tendency for retailers has been to locate in inexpensive and large sites accessible with the high-income groups. This also leads to a clustered large-scale retail structure on the four main road axles of the metropolitan area indicated in Map 1.



Map1: Some of the Major Large-Scale Retail Developments in İzmir After the Mid-1990s

Source: Own Study, July 2004; The base map "City Guide 2000" prepared by Greater Municipality of İzmir

⁴ The total population of İzmir province is 3.370.866 and province center is 2.273.388 (2000 Pop. Census, State Institute of Statistics).

⁵ Considering socio-economic development indicators such as urbanization rate (85%), rate of gross domestic product (7.30%), per capita GDP (\$2696), rate of agricultural workforce (28.54%), number of manufacturing workforce (94.341), literacy rate (%92), private car ownership for per 10.000 person (986) etc., İzmir is at the high level of development (3rd of 81) against the other provinces (State Planning Organization, "Research on Socio-Economic Development Levels of Provinces and Regions-Turkey, 2003)

Particularly, the focused centers and the shopping centers, with their large building sizes, have changed the nearby land uses, road patterns, traffic flows and load as well as retail hierarchy and spatial pattern of other retail outlets. The initial investments have also increased the attractiveness of the specific areas leading to an agglomeration as in the East and North of the metropolitan area. In the following years, new large-scale retail developments will inevitably be introduced as a result of rising affluence, private-car ownership and being accustomed to new consumption habits, in case suitable and accessible locations can be found.

Apart from these, considering the restructuring process of food retailing in İzmir, the most foremost actors of the retail change have been the supermarkets. The rise of supermarkets has affected the existing retail pattern and traditional retail structure more than hypermarkets. Since to find small, cheap and convenient locations inside the densely built up sites is easier, the supermarkets have increased their spatial prevalence and market shares in a very short time. Average number of supermarkets in İzmir metropolitan area has increased to 80 for per one million person whereas 15 in the whole country. In addition to the local chains Tansas and Pehlivanoglu, other national supermarket chains such as BIM, Migros and Şok have also entered into the market and increased their numbers and share during the 1990s. Much of the supermarket outlets serve in the type of discount or hard-discount stores, smaller than 400 square meters. The total number of supermarkets belong to a retail chain is 183 where 151 of these smaller. The major supermarket retailers are shown in table 4 according to their types, store brands and numbers.

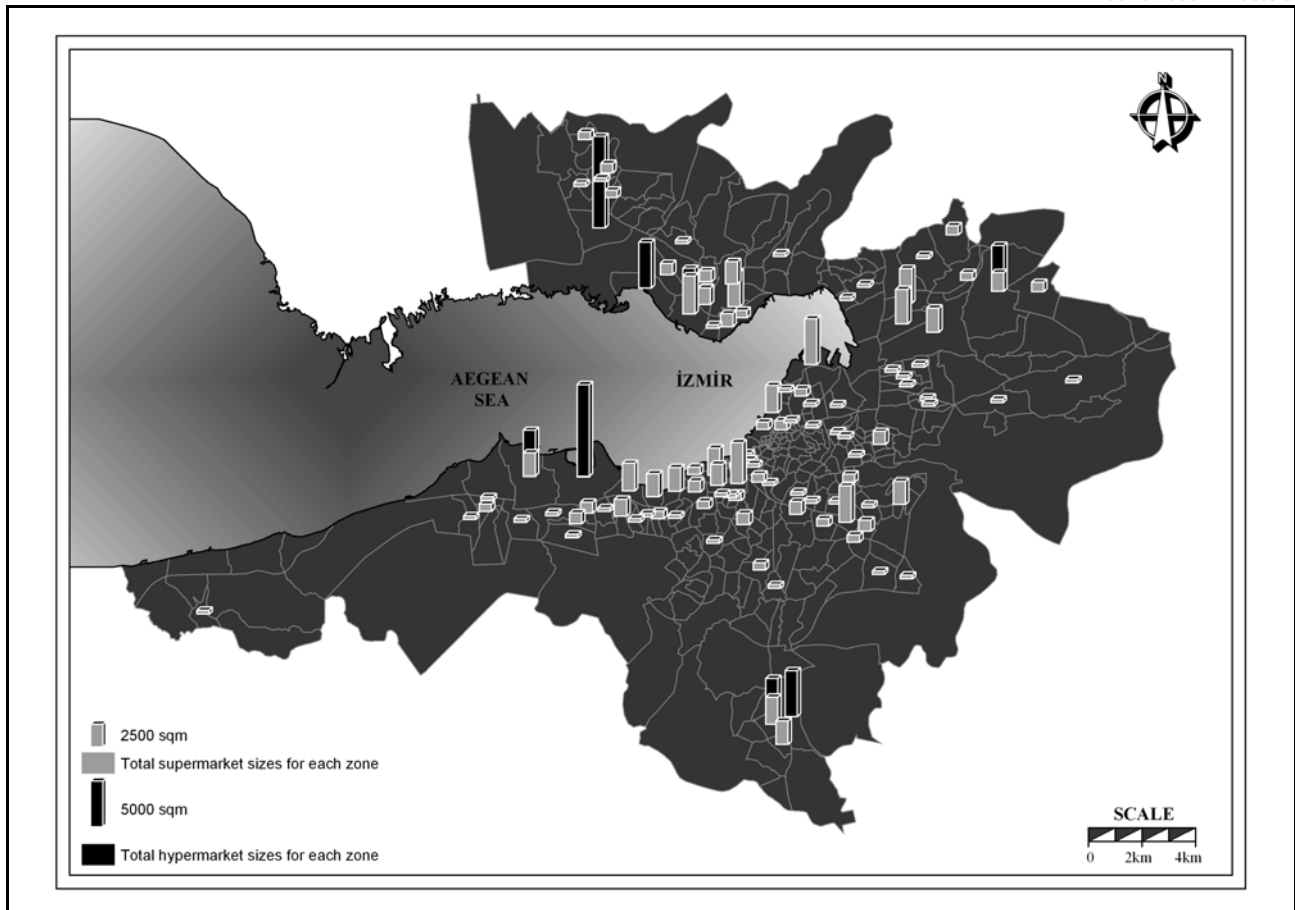
Type of Retail Outlets and Store Brands	Number of Retail Outlets	Outlet Sizes (m ²)
Groceries	<i>8231</i>	
Grocery (Bakkal)	6194	< 50 m ²
Larger Grocery (Market)	2037	50-100 m ²
Supermarkets	<i>183</i>	
<i>Small Supermarkets</i>	151	< 400 m ²
Mini Tansas	48	
Pehlivanoglu	26	
BIM	47	
Sok	30	
<i>Supermarkets</i>	17	400-1000 m ²
Midi Tansas	12	
Migros M	5	
<i>Large Supermarkets</i>	15	1000-2500 m ²
Maxi Tansas	10	
Migros MM	5	
Hypermarkets	<i>10</i>	>2500 m ²
Kipa	4	
Migros MMM	3	
Özdilek	1	
Metro	1	
Carrefoursa	1	

Table 4: Number of Retail Outlets According to Retailer Types and Store Brands-2004

Source: Ministry of Finance, list of taxpayer groceries and addresses in İzmir, 2004; Outlet address lists of each retail chain in www.tansas.com.tr, www.pehlivanoglu.com.tr, www.bim.com.tr, www.migros.com.tr, www.kipa.com.tr, July 2004.

If the spatial distribution of supermarkets is evaluated, they are mainly located in the main arterial roads, such as Mithat Paşa, İnönü, Menderes etc. streets. However, the discount or hard-discount stores may locate on the second level roads inside the residential areas. In general, the highly populated neighborhoods with high-income groups have been the destination of major supermarkets in İzmir. Much of them clustered along the sea and major arterials through the inner city centers and sub-centers as shown in Map 2. The spatial distribution of population and land values (relatively represents the income levels) also supports this type of identification in terms of supermarket locations.

The retail structure of İzmir not only consists of hypermarkets and supermarkets surely, groceries, open-air bazaars and other small buffets are constitutes the major traditional food retailers in İzmir as in other cities of the country. Since our study focuses on the transition among groceries and super-hypermarkets, once to explore the current retail structure change in the view of groceries is beneficial.



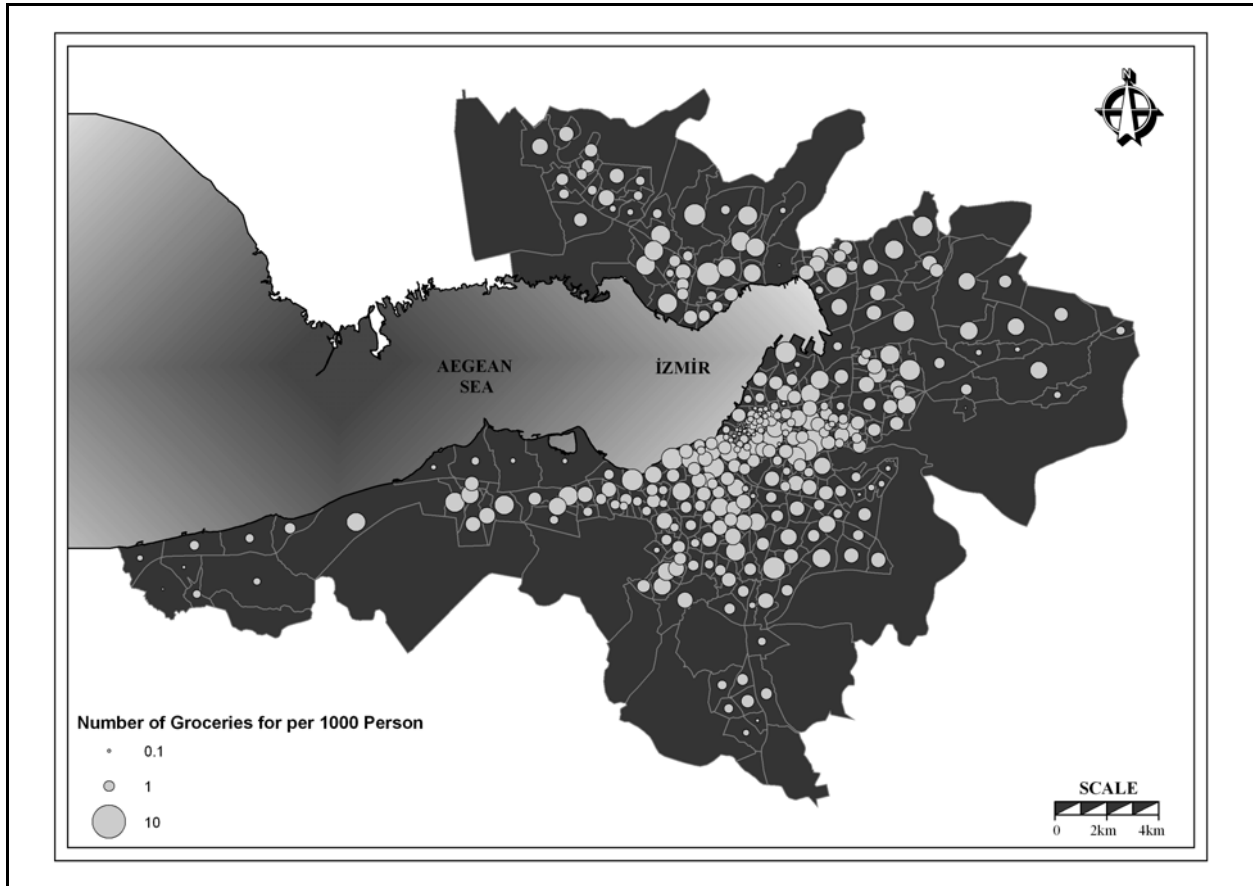
Map 2: The Spatial Distribution of Supermarkets-Hypermarkets by Total Sizes-2004

Source: Own Study, July 2004; All the outlets are shown in the center of each neighborhood. Supermarket sizes set as 400m², 1000m², 2500m², hypermarket sizes set as 5000m²

Commonly, the major advantage of neighborhood groceries is their convenience due to proximity and availability of tab purchase as well as close relationship with the residents. On this account groceries have comparatively continued the spatial prevalence in numbers and sizes up to now however much the spatial prevalence of large-scale retailers increases. Even their market shares have been decreasing and their efforts to survive have been increasing day by day, there are already 8231 “taxpayer” groceries in İzmir metropolitan area where 6194 of them small and 2037 of them are large (Ministry of Finance, taxpayer groceries’ list, 2004). Considering the İzmir Metropolitan Area the average number of groceries for per one thousand person is 3,34 (2,5 for smaller and 0,8 for larger groceries). Larger groceries known as “markets” have mainly located along the traffic arterial whereas smaller groceries located inside the residential areas. The spatial distribution of groceries (Bakkals) and larger groceries (Markets) derived from their addresses is shown in Map 3-4 based on neighborhood centers.

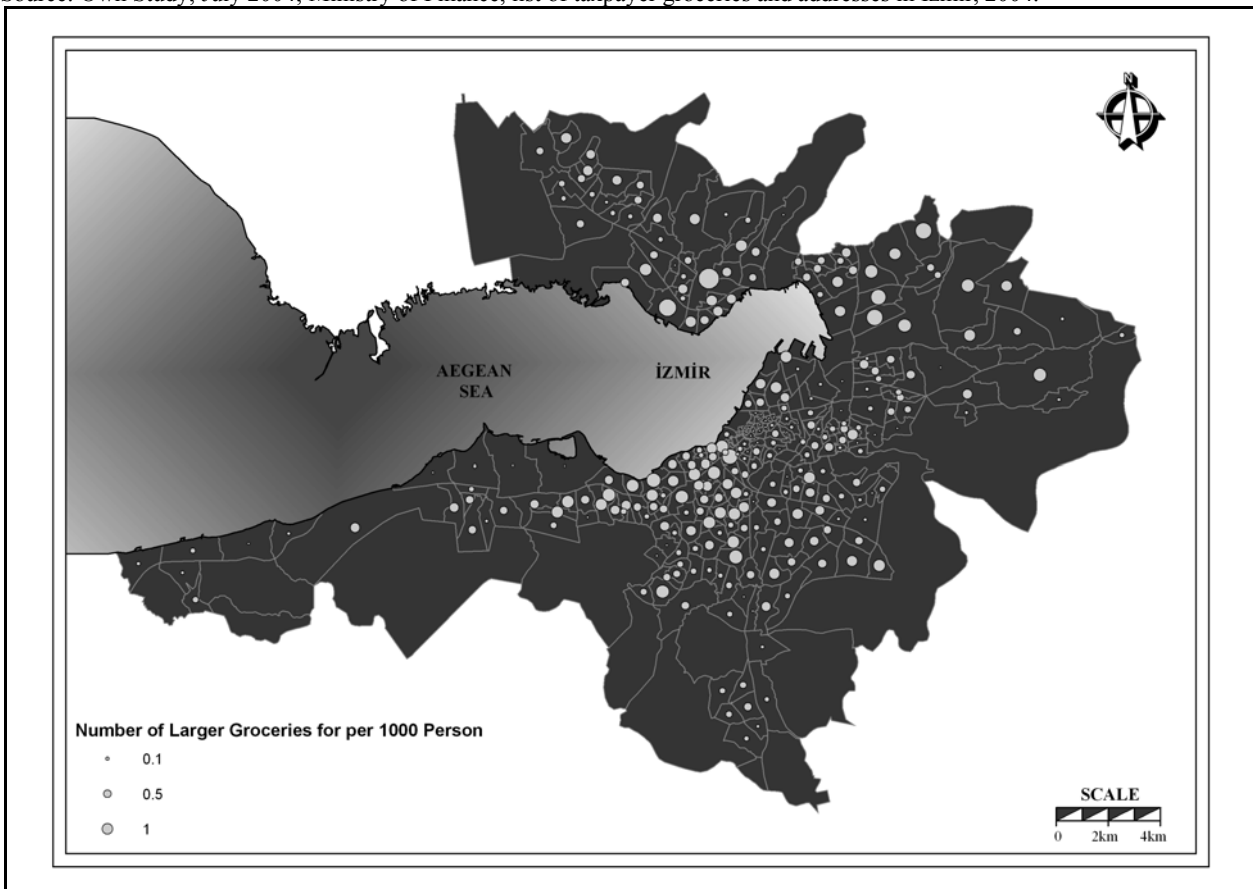
It is clear that the retail structure of İzmir has a dual structure, with the large-scale western type retail outlets and small-scale traditional retail outlets. The new emerging retail formats are mainly located along the sea-coast or near the some other highly populated, new developing zones in the outer city regions. On the other hand, the inner city areas and the urban fringes with low-income groups have been far from these type of developments and served by traditional small-scale retailers. In the past two years period approximately two thousands of grocery was closed in the whole İzmir province⁶. There are also new opened grocery outlets in this period, but it is clear that the physical presence and number of outlets have been decreasing violently. Most likely, much of the failures are seen in the zones largely dominated by the retail chains. If the trends continue by the spatial spreading of supermarkets and hypermarkets through the all zones in Metropolitan area, the retail environments for small-scale retailers will become more difficult to survive.

⁶ According to the census of place of employment, there were 10280 groceries (State Institute of Statistics, 2002) in 2002 whereas 8231 in 2004 (Ministry of Finance, taxpayer groceries’ list, 2004); According to the Chambers of Grocers, 1043 grocery have closed in a one-year period from 2003 to 2004 (Central Office of Chambers of Grocers, 2004)



Map 3: The Distribution of Number of Groceries (Bakkals) for 1000 Person-2004

Source: Own Study, July 2004; Ministry of Finance, list of taxpayer groceries and addresses in Izmir, 2004.



Map 4: The Distribution of Number of Larger Groceries (Markets) for 1000 Person-2004

Source: Own Study, July 2004; Ministry of Finance, list of taxpayer groceries and addresses in Izmir, 2004.

IV. MODELING METHODOLOGY

Dynamic Spatial Interaction Models

For more than four decades, the spatial interaction models have been in use for modeling mass human activities over space as an analogy to the planetary gravitation. Various models used in static sense to analyze the pattern and structure of the spatial interactions (Fotheringham and O'Kelly, 1989). During the 1970's, the static interaction models were criticized for not accentuating the process, not including temporal dimension and being blind for eventual changes in the evolutionary patterns of the interaction (Sayer, 1976). To address some of these critiques, Harris and Wilson (1978) proposed a groundbreaking dynamic formulation to include temporal dimension in the spatial interaction models. They put forth a framework for examining retail dynamism and started the formulation with a Lakshmanan and Hansen (1965) type production-constrained spatial interaction model:

$$S_{ij} = A_i O_i g(W_j^\alpha) \exp(-\beta c_{ij}) \quad (1)$$

where

$$A_i = 1 / \sum_k g(W_k^\alpha) \exp(-\beta c_{ik}) \quad (2)$$

to ensure

$$\sum_j S_{ij} = O_i \quad (3)$$

S_{ij} is the flow of activity being modeled from zone i to zone j ; O_{ij} is the total demand for the activity in zone i ; $g(W_j)$ is a measure of the attractiveness of zone j , W_j representing the capacity in the zone; c_{ij} is the travel cost between zones; α and β are the parameters of the models to be calibrated. From this point, it would be possible to suggest that total flow (i.e. total revenue for retail activity) to a destination zone, D_j :

$$D_j = \sum_i S_{ij} \quad (4)$$

Total profit, Π_j , considering the cost would be a function of the supply capacity at the destination is:

$$\Pi_j = D_j - C_j(W_j) \quad (5)$$

Under perfect competition, it is believed that the profit will be forced to be zero at equilibrium, and following condition must hold:

$$D_j = C_j(W_j) \quad (6)$$

Substituting equations (1), (2) and (4) into equation (6) will yield:

$$\sum_i \frac{O_i W_j^\alpha \exp(-\beta c_{ij})}{\sum_k W_k^\alpha \exp(-\beta c_{ik})} = C_j(W_j) \quad (7)$$

This expression is set of non-linear simultaneous equations in W_j s. As stated earlier, the equality implied by equation (7) indicates the equilibrium condition while the iterations leading to the equilibrium solution can well be considered. Also interpreted as the space-time evolution of the interaction if enough number of time-series data are available. In this sense, a discrete equation of motion can be expressed as:

$$\Delta W_j = \sum_i \frac{O_i W_j^\alpha \exp(-\beta c_{ij})}{\sum_k W_k^\alpha \exp(-\beta c_{ik})} - C_j(W_j) \quad (8)$$

If capacity constraint, W_j is taken as square-footage of the retail facility j , and as long as profit is positive, the facility expands ($\Delta W_j > 0$). It declines when profit is negative ($\Delta W_j < 0$), and it is at its equilibrium size when it is zero ($\Delta W_j = 0$) unless any further change is introduced to model's variables or parameters. Following this formulation, a substantial effort was spend on investigating the behavioral changes of the model depending on changes in key parameters mostly as theoretical and numerical basis in the literature (Harris and Wilson, 1978; Wilson, 1981; Clarke and Wilson, 1982 and 1983; Wilson and Oulton, 1983; Fotheringham and Knudsen, 1986 just to name few). Empirical testing of dynamic models has become a problematic due to the difficulties of assembling appropriate time series data. However, it is possible to mention about three major studies. Lombardo and Rabino (1984) showed that it was possible to pick up the process of decentralization of housing and services in Rome between 1971 and 1981. Fotheringham and Knudsen (1986) also explored the model for retail grocery data obtained in Gainesville, FL (Clarke et al., 1998). And Clarke, Langley and Cardwell (1998) showed the applied use of model in Leeds and Toronto. They reproduced the known and previous structure of retail system and explored the possible future changes of retail structure in Leeds; explored the future stability of bank branches in Toronto and future changes in education provision in Leeds.

The Empirical Model

As the study explores the possible spatial consequences and future trajectories of the transition process, the aim of the empirical dynamic model is first, to reproduce the existing retail structure of İzmir in terms of retail outlets' size and their overall grocery market shares, and second, to be able to predict the future spatial consequences of a possible equilibrium in retail sector with the help of key parameters, and eventually to be informed about the likely results of retail structural changes through the time in İzmir.

Since the spatial interaction models are formulated to quantify the interaction that occurs between origins and destinations, the study have to be hold in a zone system. The difficulties to obtain appropriate data for any zonal system except for neighborhood divisions in İzmir have forced us to establish a zone system in this way. Both the origins and destinations of the model are represented in the 326 neighborhood centers of İzmir with the help of 'ArcMap' computer software.

As in other spatial interaction models, the model allocates flows of grocery expenditure between origin and destination zones on the basis of two main hypothesis (Clarke, 1998, p. 294): i) Flows between an origin and destination will be proportional to the relative attractiveness of that destination. ii) Flows between an origin and destination will be proportional to the relative accessibility of that destination. With this respect, first, the demand side variables, monthly grocery expenditures of households (E_i), and populations of neighborhood zones (P_i), are established which give the total grocery expenditures of each zone. Second, as the supply element of the spatial interaction models represents by the attractiveness of retail destinations and the model intends to measure the changes in retail outlet sizes, the attractiveness term of the model is set as retail outlets' net floor space, (W_j). In addition to this, in order to analyze retail structure, which consist of both large and small retail outlets, it is needed to disaggregate the basic interaction model by retail outlet type (h). So, the three major food retail outlets are distinguished as groceries, supermarkets and hypermarkets. Apart from the usage of outlet sizes, a price term (p_j) added to the model in order to measure the attractiveness of retail destinations in more details considering that the supermarkets and hypermarkets can attract more consumers with their low prices.

The model works on the assumption that in general when choosing between various retail outlets which are equally accessible, consumers will show a preference for the more attractive center which is measured with the W_j s and p_j s. However, when centers are equally attractive, consumers will show a preference for the more accessible center. At this point the measure of accessibility or distance deterrence of zones have to be introduced to the model. Various forms of distance deterrence term may be used in order to measure physical separation between zones such as distance, travel time and travel cost. In this model, the straight-line distances between neighborhood centers (d_{ij}) is preferred to measure the physical separation. Since the absence of digital road maps, a hypothetical road network connecting the zone centers established between neighborhoods, and then the shortest path between each zone is measured with the help of Arcview Network Analyst computer software. Finally, the W_j s are generally best represented as power functions, however for the exact form of the separation function, two forms dominate the literature; power and exponential. In this model the parameters α and β are used as the simple power functions of the variables where the functional form of the attractiveness term become (W_j^α) and the distance deterrence term become ($d_{ij}^{-\beta}$). Additionally, no parameter has established for the price term (p_j) and included explicitly in the empirical model.

The variables specified above are used to model the retail interaction flows between origins and destinations, which than gives retailers' revenue. The revenue constitutes the left hand side of the equation and is in the form of classical production-constrained model. Further, the disaggregated retail outlet types and the price term additions produce the following model,

$$S_{ij}^h = A_i^h E_i P_i W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h} \quad \text{where} \quad (9)$$

$$A_i^h = 1 / \sum_{jh} W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h} \quad \text{to ensure that} \quad (10)$$

$$\sum_{jh} S_{ij}^h = A_i^h E_i P_i \quad (11)$$

where S_{ij}^h is the flow of grocery expenditure from residential zone i to retail destination j in the type of h ; E_i is the per capita grocery expenditure of zone i ; P_i is the population of zone i ; W_j^h is the net floor space of

retail outlets in zone j in the type of h ; p_j^h is the price factor of the h type of retail destination in zone j ; d_{ij} is the distance between zone i and j ; α and β are the model parameters which reflects the consumer preferences and physical separation of different outlet types of h ; A_i^h is the balancing factor which ensures the total amount of grocery expenditure is distributed between the different store types.

Normally, the profits in a retail market are supposed to compete to zero, and if the right hand side of the equation, which consists of retailers' costs (k) is taken as a function of the floor space, the following equilibrium condition must hold.

$$\frac{A_i^h E_i P_i W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h}}{\sum_{jh} W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h}} = k_j^h W_j^h \quad (12)$$

Than any changes in the size of retail outlets in zone j can be find with the empirical model as below:

$$\Delta W_j^h = \frac{A_i^h E_i P_i W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h}}{\sum_{jh} W_j^{\alpha h} p_i^h (d_{ij})^{-\beta h}} - k_j^h W_j^h \quad (13)$$

Data and Processing

It is difficult to find the whole required data in terms of any sub-divisions in Turkey. This has also brought some major difficulties to set the database related to neighborhood divisions and has led to make some basic assumptions when processing the required data. The main data sources used in this study can be classified into two types: the data of demand side variables, the data of the supply side variables.

The database for demand side variables include, per capita grocery expenditures and the populations of neighborhoods. Multiplication of the vector of grocery expenditures (E_i) and the vector of populations (P_i) establishes the total grocery expenditures of residential zones. In order to obtain present spatial distribution of the population, the results of the '2000 population census by neighborhoods' (State Institute of Statistics) is used, and for more accuracy it is rearranged with the help of '2004 general election' results by neighborhood divisions (İzmir District Election Commissions). The vector of grocery expenditures is hold from 'the survey of consumption expenditures of households', which is prepared according to the five different income groups of İzmir in 1994 (State Institute of Statistics). Absence of any more detailed study has leded us to rearrange 1994 rankings of grocery expenditures and matching them with spatial distribution of current income rankings. The average land values of each neighborhood (National Real Estate Administration, 2002) are calculated to represent the income levels of neighborhoods, and match with the grocery expenditure rankings (See Appendix A&B for spatial distribution of population and grocery expenditures).

The only variable of the supply side is the sizes of three different food retail outlets (W_j^h). However, the locations of all retail outlets and their overall market shares have to be known. Probably, the most difficult step of the data collecting process is to find the addresses of whole retail outlets in İzmir. The locations of groceries have drawn from 'the list of groceries' obtained from the Ministry of Finance, which includes taxpayer groceries-larger groceries and their addressees as of 2004 (See Map 3-4). The list consists of 8244 groceries serving in İzmir metropolitan area and 8233 of them are distributed to neighborhoods according to their addresses and street numbers. This procedure has carried out with the usage of a software (City Guide of İzmir 1.0) prepared by Greater Municipality of İzmir. The supermarket category of the model is represented by the major retail chains serving in İzmir: Bim, Tansas, Şok, Pehlivanoğlu and Migros. The location information of the each retail outlet has drawn from their Internet sites. There are also several local supermarkets serving in İzmir except for retail chains, these are represented in the type of larger groceries since 'the list of groceries' includes a category for larger-grocery and supermarkets. All hypermarkets represented in the model as the third retail category, and their location information has drawn in the same way of supermarket chains. Moreover, in order to hold total sizes for each retail category, the maximum size values of the categories is determined. The main categories of retailers, their numbers and sizes are introduced before in table 4 and map 2 and overall market shares of retailers are given in table 3. Finally, the latest boundaries of neighborhoods is given from the Greater Municipality of İzmir and prepared with the help of İzmir City Guide 1.0, 'Autocad' and 'Arcmap' software packages.

V.RESULTS

The initial goal of the empirical model is to reproduce the existing retail structure of İzmir depending on the retail outlet sizes and current market shares of various retail formats. In order to be able to produce existing retail structure it is needed to have the initial parameter values which reproduce the existing psychical retail structure of İzmir. In normal processes, the distance decay and attractiveness parameters are drawn from the observed flow patterns between origin and destination zones or set from the previous studies explaining the flow patterns. However, in our study it is difficult to obtain observed flow patterns data or to find a reference study exploring the flows between origins and destinations. This also constitutes a problem in the calibration of model related to initial parameter values, and requires some logical assumptions.

In many studies held in developed countries, the observed flow patterns can be given from the large international retail firms such as Tesco, Asda, Wall-Mart. Then the key parameter values can be easily obtained from these observed interaction matrices in an calibration process. Since the difficulties in creating or obtaining an observed interaction matrix which explains the flow pattern of whole İzmir, a different method is accepted other than the classical parameter calibration process. It would be proper here to mention about the calibration process of the empirical model before explaining the results. The calibration process of the model is hold using the 'Matlab' computer software, which works in the sense of matrices. The required mathematical codes have written in Matlab Editor in order to produce desired model with its parameters and functional form.

In the first step of the calibration process, the optimum values of the attractiveness parameter α and distance deterrence parameter β have obtained by grid search. Since the absence of observed flow matrix, the model have run several times in the dynamic mode (for only groceries) which produces the existing retail sizes. The procedure was the line search calibrating, searching minimum error terms between real sizes and model produced sizes (error = $W_j - W_j^*$). Equations have solved simultaneously in terms of parameters α , β and the cost term k . The optimal parameter values of α and β have searched in this way between the values 0 and 3. Although some values hold which minimizes the error terms, the optimization process has failed. Because the optimum parameter values do not explain the existing retail flows in a realistic manner. When the attractiveness parameter value is closed to 1 and distance parameter value is closed to 0.1 the optimum results hold. There is no problem in terms of attractiveness parameter, but considering the distance parameter closed to zero; it might be possible for a grocery to serve to the zones, which are 40 kilometers far away from the grocery. Therefore with this distance parameter values it is impossible to produce realistic retail interaction flows. One of the main assumptions arises here to obtain appropriate distance parameter value. The assumption is that, 'the groceries in any neighborhood zone serves in large proportions to inhabitants live in the same zone'. With this assumption the sensitivity of residents to distant destinations is increased so that the unrealistic flow patterns could be eliminated.

In order to analyze the distribution of expenditures in each grocery destination the static form of the model (left hand side of the model) is used. The static model also produces a matrix (S_{ij}) with the dimensions of 326x326, which shows the expenditure interactions. The diagonals of this matrix (S_{ij} s where $i=j$) gives that how much of the expenditures of a zone spending in the same zone. Finally, to know the expenditures spends in own zones gives an opinion with the distance sensitivity of residents. For the purpose, in order to produce desired interaction flows, various combinations of parameters tried to hold the appropriate distance parameter β . Initial experiments and studies showed that there is no objection to set the attractiveness parameter (α) as 1. As we need the parameters that provide the distance sensitivity where groceries serve to their zones in large amounts, it is seen that the distance parameter can be determined between 3.5 and 4. After the examinations in details, the value of 3.5 is determined for parameter β . With this value the groceries earn their incomes from own zones with a mean of 75 % and with a standard deviation of 16.

The assumption has concluded with a hypothetical retail flow pattern for grocery destinations with the more realistic parameters of $\alpha_1=1$ and $\beta_1=3.5$. However, the distance sensitivity of residents to large-scale retail destinations is also different from groceries. It is expected to be smaller than 3.5 for supermarkets and hypermarkets in the account of the car-owners can travel more distant zones or the people do not care the distance comparing with the low prices. Moreover, it is also expected that the price parameter (p) is differs between each type of retail outlets. Finally, since the attractiveness parameter is set according to the sizes from 50 m² to 5000 m² and the differences between sizes explains differing attractiveness terms, there is no need to change the parameter for each retail type at the initial steps. As we have the initial parameter values

for the grocery flows, it would be possible to find how much these parameters change for supermarkets and hypermarkets using market shares of each retail type. If we hold the total sales (ΣS_{*j}) in each destinations and calculate the overall totals of different retail types, than we can obtain the overall market shares of groceries, supermarkets and hypermarkets. Since we already know the real market shares, we can draw the appropriate parameter values, which produce the existing market shares.

However it is needed to make some analysis on market shares of retailers. The change in the overall market shares is introduced in the previous section (see table 3) including the values from 1996 to 2001, these numbers have established for the İzmir case in our study. However, since the retail outlets refer the current structure of İzmir, today's market shares have to be known. Moreover, in the next step we will need the future values of market shares in order to be able to model the future changes in the retail structure. On the account of these, a trend analysis of hypermarkets and supermarkets' market shares is build using five different projection techniques (see Appendix C). However much all the projection techniques fit the past trends well, considering the future expectations (market shares of western type of retailers will increase in decreasing rates) the results of power model is selected. If the projection results distinguished between supermarkets and hypermarkets according to their shares in 2001, the market shares estimate of 2004 become 52% for groceries, 32.5% for supermarkets and 15.5% for hypermarkets. Further, we will use five years later forecasts of the model to see changes in retail structure where the rate of groceries will decline to 41%, supermarkets and hypermarkets will increase to 40% and 19% respectively (see table 5).

Years	Groceries	Supermarkets	Hypermarkets
Current Market Shares	52%	32.5%	15.5%
5 Years Later Market Shares	41%	40%	19%

Table 5: Projected Market Shares of Different Retail Formats (See Appendix C fro details)

Now, the initial parameter values and overall market shares of retail outlets are known. If the all parameters set same as in grocery flows (see table 6, condition 1: $\alpha=1$, $\beta=3.5$ and $p=1$) a retail environment dominated largely by groceries appears. With these parameters the 79.5% of the total expenditures spend in grocery destinations whereas 17% in supermarkets and 3.5% in hypermarkets. The market shares of large scale retailers has not been at the desired levels yet, because the ease of distance and price terms have not constitute any advantage for supermarkets and hypermarkets. With the experiments holding different combinations of parameter values, it is tried to find the real market shares of different retail outlets (table 6). The most effective changes appear when a small change is hold in parameters α and β , the price parameter p has the smallest effects comparing with them due to its entrance to the model directly. As mentioned earlier, the attractiveness term can be represented with the sizes in the model. However, there is a need to change the distance parameter to create more realistic flows. With this respect the solution results for real market shares can be hold by the parameters of: $\alpha_1=1$, $\beta_1=3.5$, $p_1=1$ for grocery destinations, $\alpha_2=1$, $\beta_2=3.3$, $p_2=1.30$ for supermarket destinations, $\alpha_3=1$, $\beta_3=2.95$, $p_3=1.35$ for hypermarket destinations, providing the market shares of 52%, 32,3% and 15,7%. See the different conditions and the solution parameters in table 6.

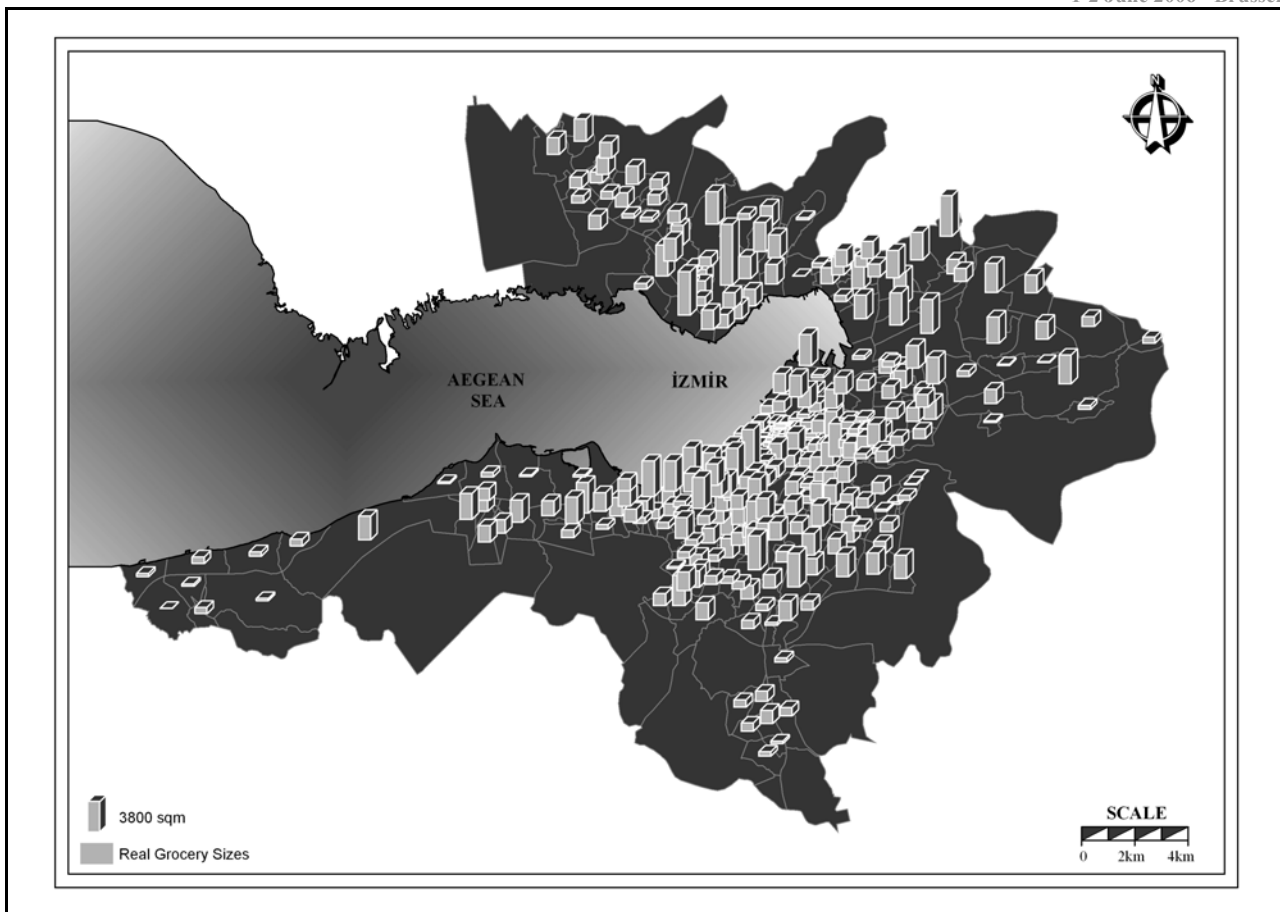
As the appropriate model parameters have drawn, there is no objection to produce the existing retail structure with the dynamic model. The model with the aggregate costs and aggregate solution parameters (see condition 7), we can hold an equilibrium model which produces the new sizes of retail outlets. Although the aggregate model is important for identifying the stable and optimal locations for retail developments in İzmir, it is clearly unable to replicate the real-world retail outlets, which may lie in non-optimal locations or city centers. Aggregate model produces unrealistic results especially for some of the grocery and supermarket destinations, which are located in the central business districts, sub-centers or located near the hypermarkets. Consumers may shop at particular centers for other reasons than purely physical sizes. This situation also make useless to run the model in an iterative manner where in all steps, attractive centers grow up. So, to produce a more realistic retail environment, spatially disaggregated attractiveness terms have to be introduced: for the grocery destinations near the hypermarkets ($\alpha_{11}=1.125$), for the grocery destinations in the central business districts or district centers ($\alpha_{11}=1.250$), and for the grocery destinations holds both situations, and for the supermarket destinations in the central business districts or district centers ($\alpha_{11}=1.125$). These additions also decrease the market share of hypermarkets a little, so the distance parameter of hypermarkets have rearranged and established $\beta_3=2.92$ (see condition 8).

	α	β	p	Market Shares (%)		α	β	p	Market Shares (%)
Real Condition (Market Shares-Current)					<i>Condition 6</i>				
Groceries	1	3,5	1	52,0	Groceries	1	3,5	1	56,4
Supermarkets	1	3,5	1	32,5	Supermarkets	1	3,3	1	29,1
Hypermarkets	1	3,5	1	15,5	Hypermarkets	1	2,95	1	14,5
<i>Condition 1</i>					<i>Condition 7</i>				
Groceries	1	3,5	1	79,5	Groceries	1	3,5	1	52,0
Supermarkets	1	3,5	1	17,0	Supermarkets	1	3,3	1,3	32,3
Hypermarkets	1	3,5	1	3,5	Hypermarkets	1	2,95	1,35	15,7
<i>Condition 2</i>					Projected Condition (Market Shares-5 Years Later)				
Groceries	1	3,5	1	69,7	Groceries				41,0
Supermarkets	1,1	3,5	1	25,8	Supermarkets				40,0
Hypermarkets	1,1	3,5	1	4,5	Hypermarkets				19,0
<i>Condition 3</i>					Condition 8 (Produces Current Retail Structure)				
Groceries	1	3,5	1	71,4	Groceries	1	3,5	1	52,25
Supermarkets	1	3,4	1	24,4	Supermarkets	1	3,3	1,3	32,25
Hypermarkets	1	3,4	1	4,2	Hypermarkets	1	2,92	1,35	15,50
<i>Condition 4</i>					<i>Condition 9</i>				
Groceries	1	3,5	1	78,3	Groceries	1	3,5	1	40,5
Supermarkets	1	3	1,1	18,1	Supermarkets	1,1	3,3	1,3	39,5
Hypermarkets	1	3	1,1	3,6	Hypermarkets	1,1	2,92	1,35	20,0
<i>Condition 5</i>					Condition 10 (Produces Projected Years' Retail Structure)				
Groceries	1	3,5	1	57,6	Groceries	1	3,5	1	41,4
Supermarkets	1	3,3	1	29,8	Supermarkets	1,05	3,25	1,3	40,0
Hypermarkets	1	3	1	12,6	Hypermarkets	1,06	2,9	1,35	18,6

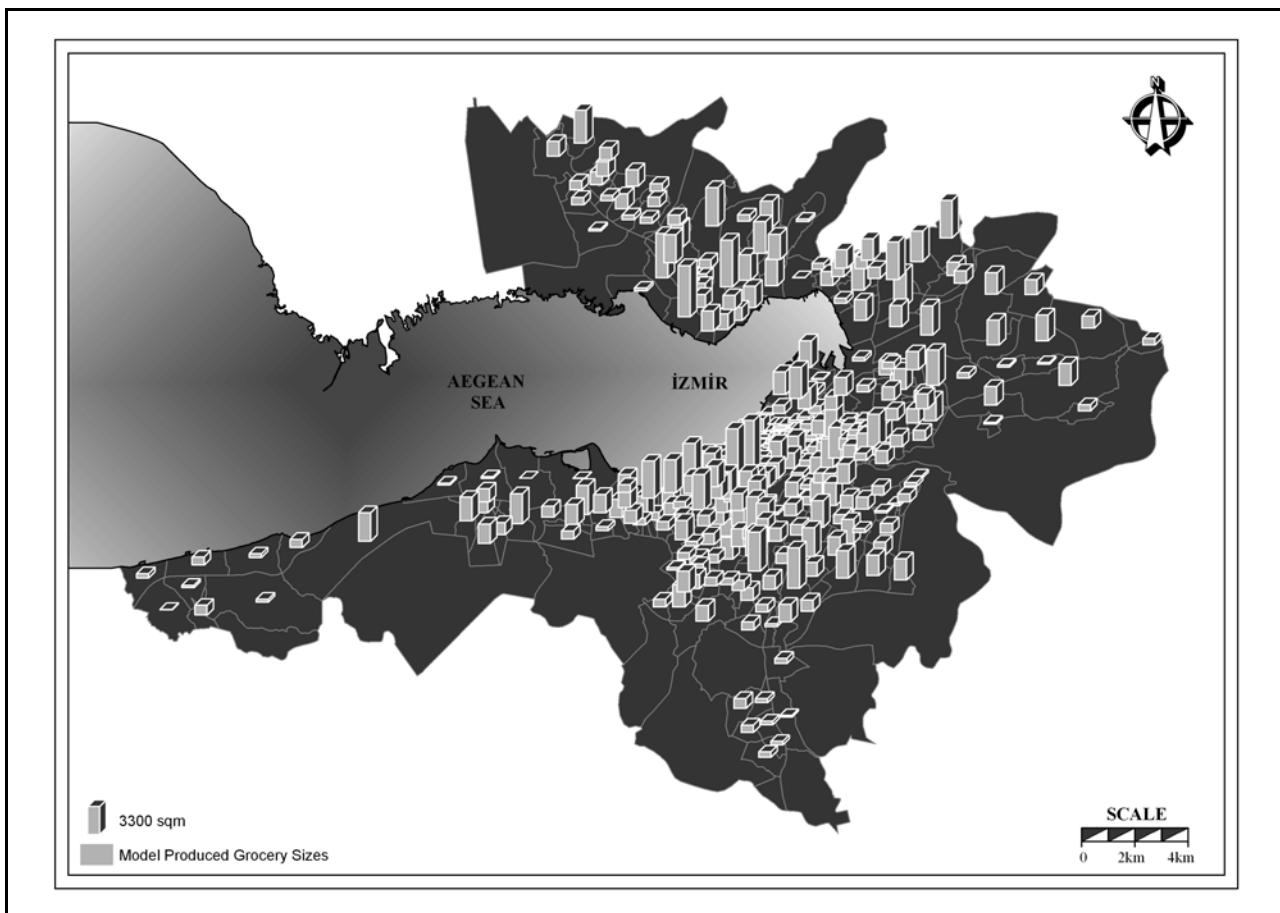
Table 6: The Changes in Market Shares with the Different Combinations of Model Parameters

The disaggregate model in terms of attractiveness, produces more realistic results where the sum of squared errors started to decrease. However, in order to hold more closed results to real sizes we have to introduce the spatially disaggregate costs (k_s) in the assumption of 'retailers hold normal profits, and costs may decrease or increase related to location and competition'. With this respect the zones are grouped according to their sales and sizes, and four different cost values determined for groceries, supermarkets and hypermarkets, which also provides total sizes of each retail format. As the consequence of the spatially disaggregated attractiveness terms and costs, it is now possible to hold the closest results to real retail outlet sizes. With the disaggregated solution, the initial goal of the empirical model is completed and considering the model produced distribution, to produce existing retail structure of İzmir in terms of retail outlet sizes and market shares have succeeded. The comparisons of real sizes and model-produced sizes of groceries and supermarkets&hypermarkets are illustrated in maps 5-6-7-8.

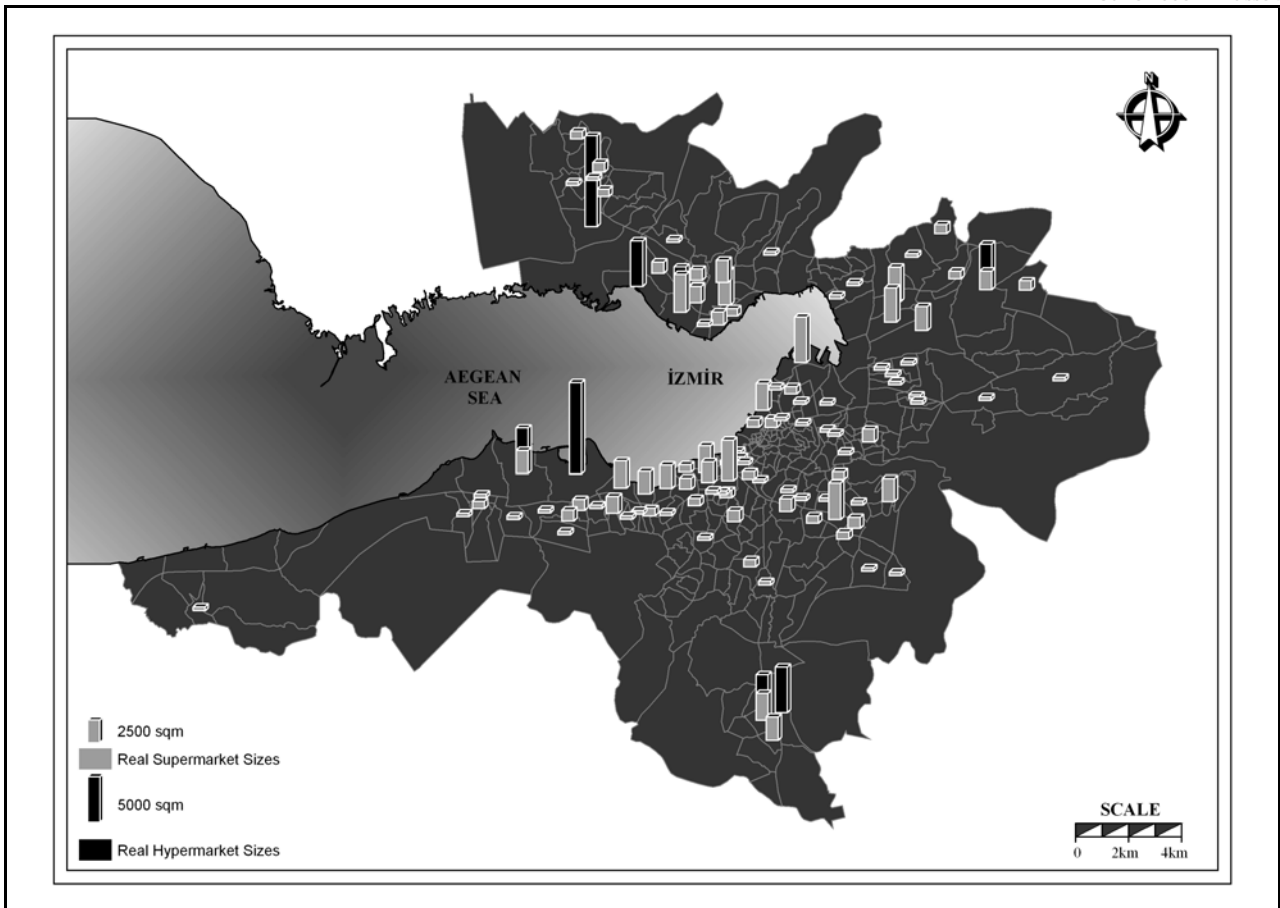
As the study states, the increasing dominance of large scale retailers have been profound effects on the ability of many small-scale food retailers to survive, the empirical model intends to predict the possible spatial dimension of future transition. It is largely discussed about the future expectations of large-scale retail developments in the phase of urban spaces and market shares. The trend analysis of the past developments shows that in a five years period the market shares of the large-scale retailers will increase to 59% from 48% (Appendix C) and this will also concluded with the decline in the total grocery outlet sizes. The main question is how will this expected changes affect the current spatial pattern of retailing in İzmir and which parts of the city decline or which type of retail outlet rises in a specific location. In short, all the questions can be answered using the empirical model with the help of key parameter changes. Table 6 shows the combinations of different parameters and determined parameters (in condition 10) with projected years' shares. There may also be a great many of alternatives in parameters to reach such a solution considering various 'what if' scenarios. However, it is seen that the changing both distance deterrence and attractiveness parameters in the assumption of "the distance sensitivity will decrease in account of increasing private car ownership and retail firms increase their effectiveness and profits for per square meter" is the most logical choose for the İzmir case.



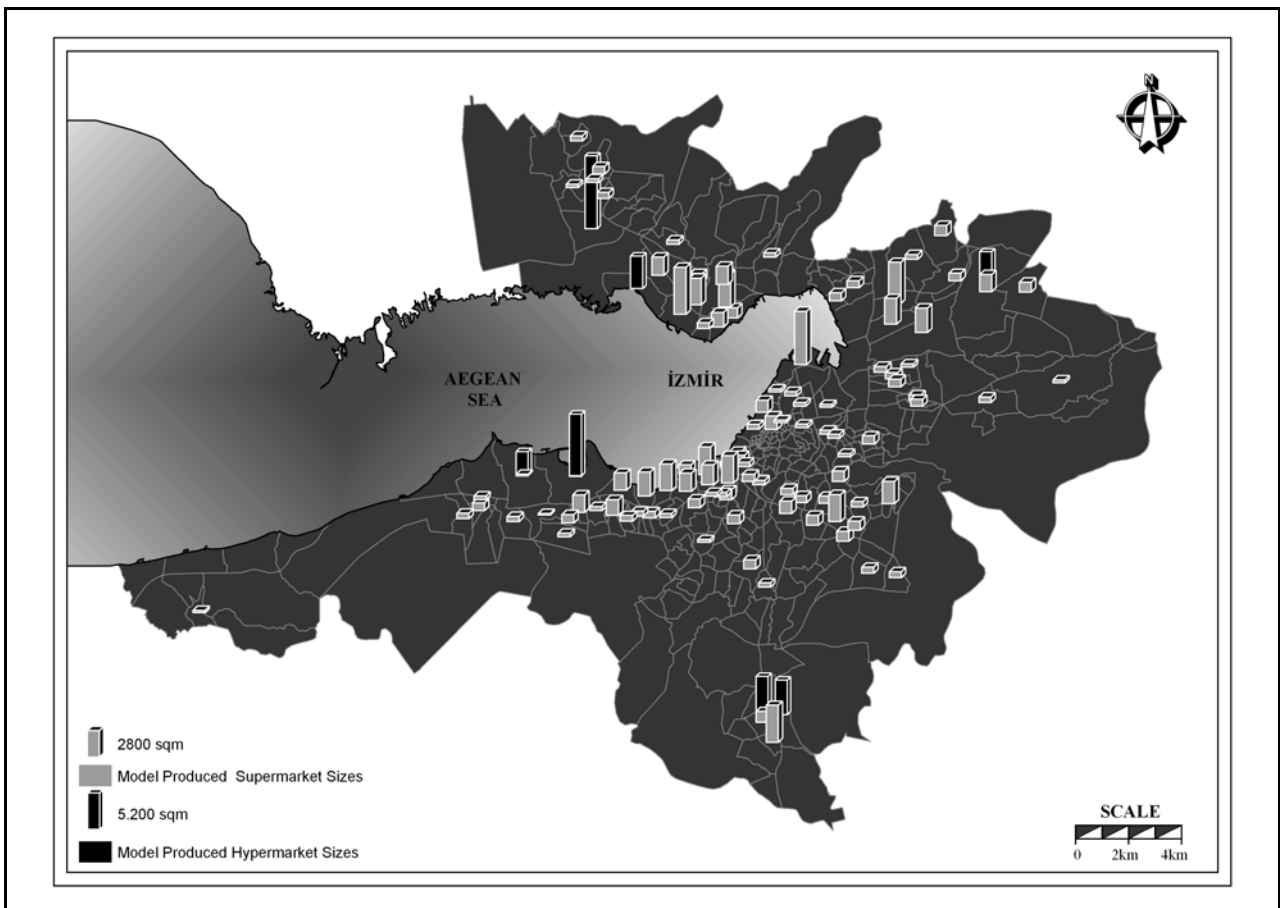
Map 5: The Spatial Distribution of Real Grocery Sizes-Existing Structure



Map 6: The Spatial Distribution of Model Produced Grocery Sizes-Modeled Existing Structure



Map 7: The Spatial Distribution of Real Supermarket&Hypermarket Sizes-Existing Structure



Map 8: The Spatial Distr. of Model Produced Supermarket&Hypermarket Sizes-Modeled Existing Structure

The empirical model with the newly determined parameters for projected year have produced the spatial impacts of future changes, which had already been expected for İzmir. With the model, it is shown that if the trends continue, the total grocery stocks will decline 23% from 513400 m² to 395577 m², and in the five years period, approximately 1900 grocery will closed in an average of 7 for 262 declining neighborhoods. If the spatial distribution of grocery declines considered, it can easily be seen that the most dramatic changes will appear in the zones near or next to the zones which include a hypermarket or several supermarkets. Further it can be seen that since the absence of any western type of retailer, some of the neighborhoods will carry on dominating by traditional retailers unless any developments occur. The spatial distribution of grocery decline and supermarket&hypermarket rise is given in map 9-10 illustrating the likely results of future transition in the five years period.

Finally, it would be more appropriate to conclude the model calibration process exploring the future pattern of the ongoing retail change. If the empirical model is run in an iterative manner, taking new retail sizes as an input for the following, the equilibrium solution can easily be hold without any additional parameter changes. The number of iterations and the overall results give useful insights of the possible future pattern of retail change through the time. As shown in table 7, the equilibrium solution in terms of retail outlet sizes is hold after the seventh iteration. However much the model iterations could not be replaced with the actual time periods, the results of the iterations show the noteworthy decline in groceries and rise in especially supermarkets and hypermarkets briefly. In the equilibrium conditions, market shares of groceries become 18,2%, supermarkets become 58,2% and hypermarkets become %23,2. If the overall results taken into consideration, in the following years, İzmir and probably other major cities of the country will inevitably be experiencing a retail transition similar with the developed countries experienced 25-30 years before.

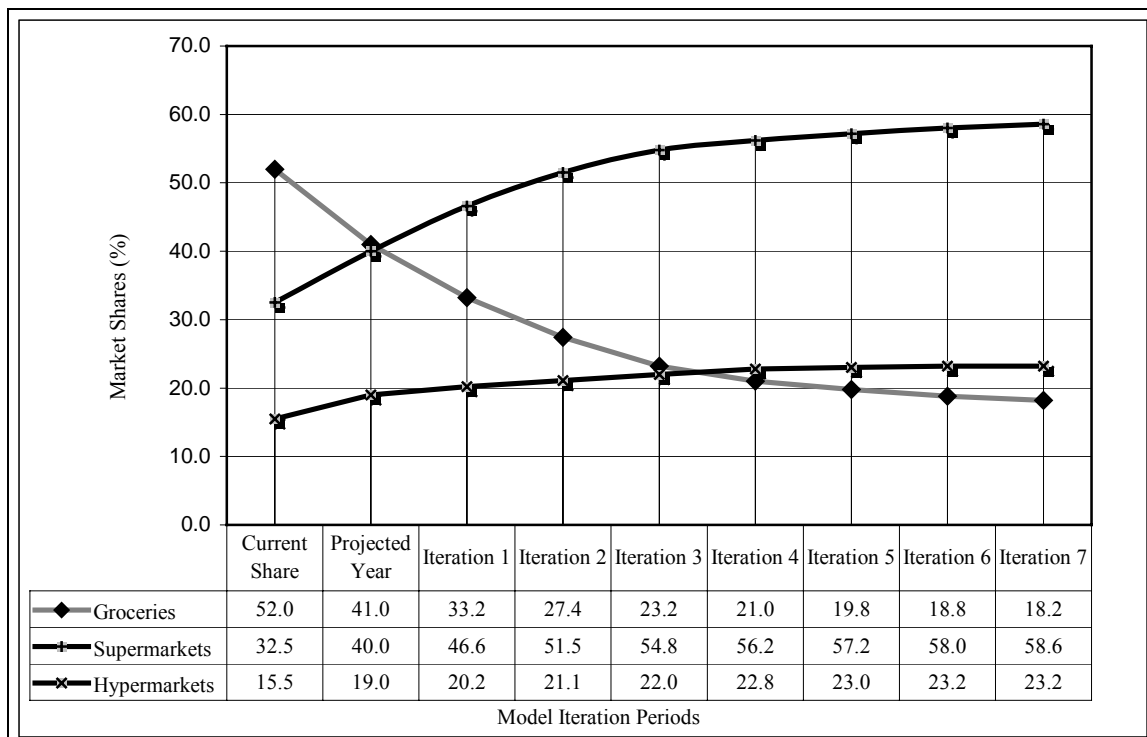
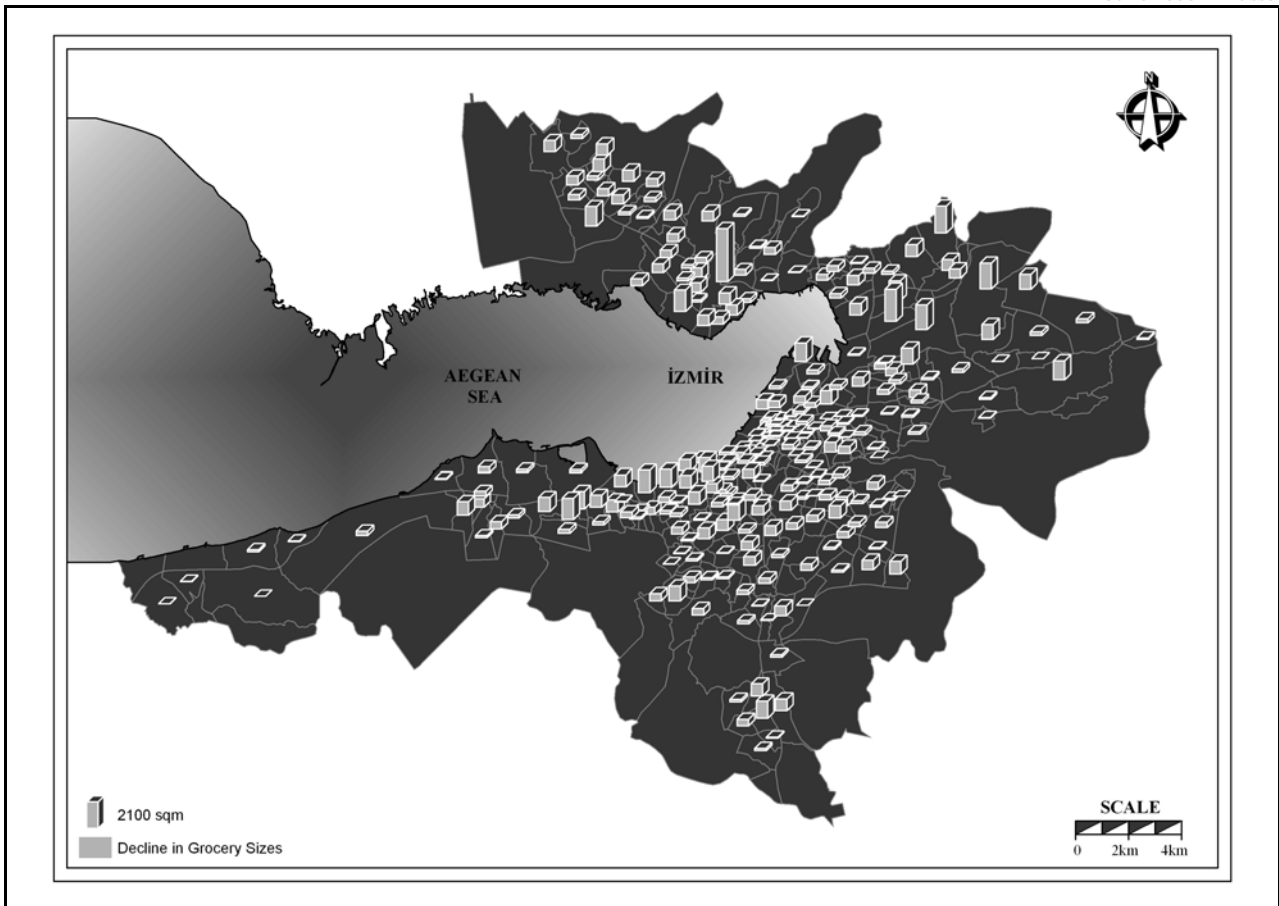


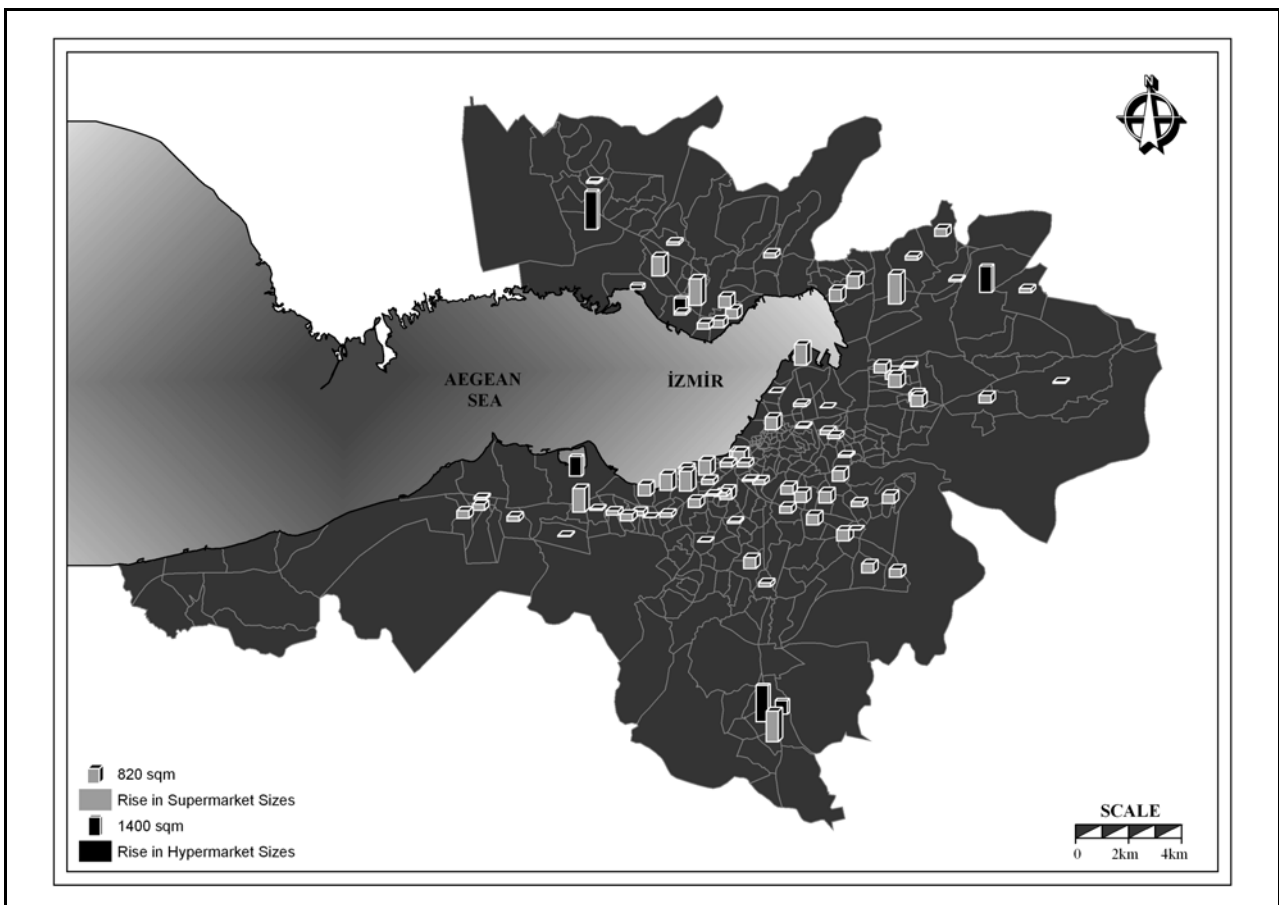
Table 7: The Future Pattern of Retail Transition Among Groceries and Supermarkets&Hypermarkets

VI.CONCLUSION

As in most of the other developing countries, Turkey has been experiencing radical changes in the field of its retail geography. After brief reviews on general process of the restructuring of Turkish retailing, the paper initially put forth its expectation for consideration that the most crucial retail transition will be among the groceries and supermarkets&hypermarkets as in the past, and intended to identify the spatial dimensions of this type of retail transition in İzmir Metropolitan Area. For the purpose, an empirical dynamic spatial interaction model has been built. Despite the dynamic spatial interaction models have been firstly developed in the late 70s giving permission to model the rapid structural changes in retail systems, the attempts to apply the model to real world data have remained limited. So, the study additionally intends to make contributions to the dynamic model literature with a quasi-empirical work using real world data.



Map 9: The Spatial Distribution of the Decline in Grocery Sizes-Projected Year



Map 10: The Spatial Distribution of the Rise in Supermarket & Hypermarket Sizes-Projected Year

It is clear that, there are a few researches and literature in Turkey related to the development of modern retailing and its effects on urban space and existing retail formats. So, any study hold in this way makes useful contributions to understand spatial expression of restructuring of retailing. Considering that the current retail structure of İzmir has been thoroughly explored and analyzed for the first time with this study, one more goal of the study has carried out.

Further, the usefulness of dynamic spatial interaction model is tested with the quasi-empirical model in terms of analyzing retail structural changes. The first task has been to reproduce the existing retail structure of İzmir according to retail outlets' size and their overall grocery market shares. There is also a need for more and better data as well as time series data, but when the first task has been achieved than it has been possible to be able to predict the future spatial consequences of a possible equilibrium in retail system with the help of key parameters' change and additional iterations. This is shown clearly with the empirical work provided more accurate information about the likely results of retail structural change in İzmir through the time.

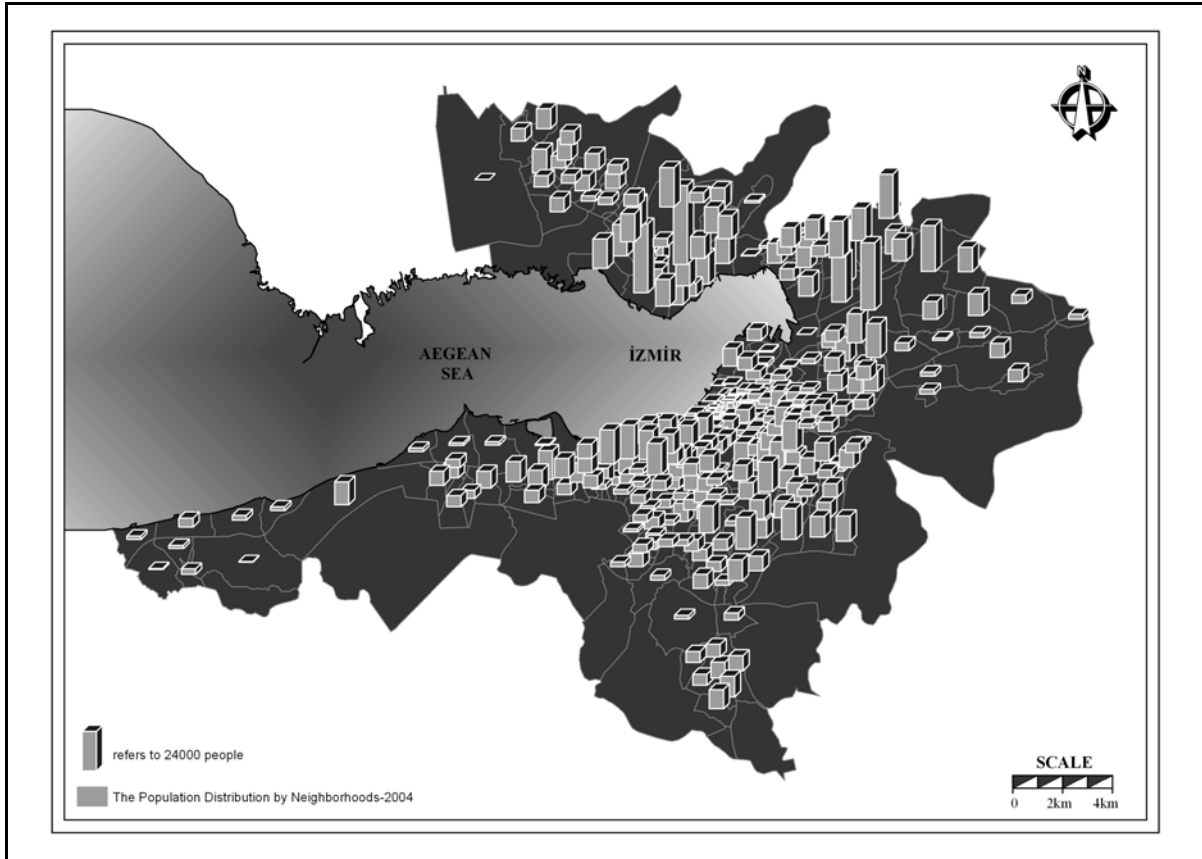
Finally as the study states, the arrival of supermarkets and hypermarkets has been profound effects on the ability of many small-independent retailers to survive; the overall results of the empirical model have brought up the possible spatial dimensions and consequences of this statement. The results in numbers are highly dramatic that if the trends continue, the total grocery stocks will decline 23% from 513400 m² to 395577 m², and in the five years period approximately 1900 grocery will be closed. Moreover, in the following decades market shares of groceries radically decrease to 18,2%, whereas supermarkets increase 58,2% and hypermarkets increase %23,2. With these numerical results the study have proved the initial propositions empirically and carried out the major aim.

In conclusion, the ongoing retail structural change is creating new challenges and opportunities for planners and decision makers. The study has explored only the one dimension of this restructuring process and showed the declines in the numbers and sizes of the groceries in spatially disaggregated zones. Since, the empirical model gives permission to analyze spatially distributed consequences of any specific changes in the system, planners and decision makers should take into consideration such an analyze made in this study. This would help to produce more accurate locational decisions and to reduce the negative effects of the restructuring process of retailing to the urban retail environments.

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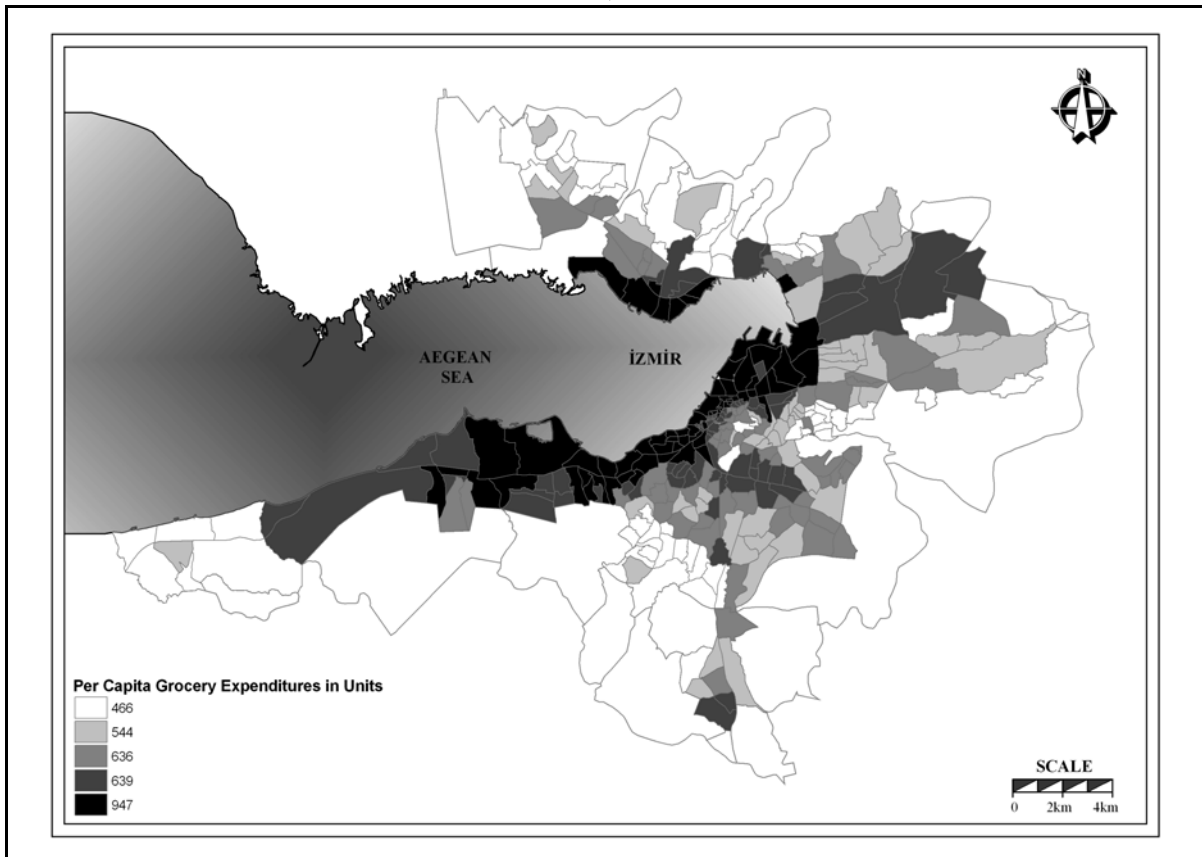
APPENDIX A



The Distribution of the Population by Neighborhood Divisions-2004

Source: 2000 population census by neighborhoods (State Institute of Statistics); 2004 general election' results by neighborhood divisions (İzmir District Election Commissions).

APPENDIX B



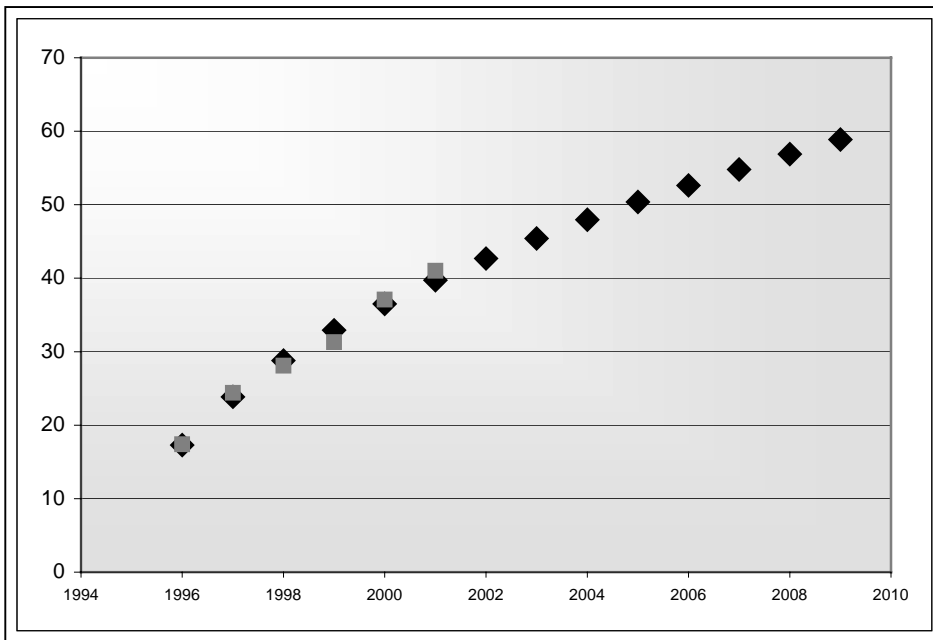
The Spatial Distribution of Per Capita Grocery Expenditures by Neighborhood Divisions

Source: Prepared based on the survey of consumption expenditures of households; İzmir, 1994 (SIS); Overall Results, 2004 (SIS)

APPENDIX C

Years	Time index (t)	Market Shares of Supermarkets and Hypermarkets (Y)	PRORECTIONS				
			Linear Model $Y=B_0+B_1*t$	Logarithmic Model $Y= B_0+B_1*\ln(t)$	Power Model $Y= \ln(B_0)+B_1*\ln(t)$	Invers Model $Y= B_0+(B_1/t)$	Logistic Model (upper limit 75) $\ln(1/Y-1/u)=\ln(B_0)+(\ln B_1)*t$
1996	1	17,40	18,50	16,03	17,30	15,22	18,83
1997	2	24,40	23,06	24,79	23,86	27,61	22,78
1998	3	28,10	27,61	29,91	28,81	31,74	27,16
1999	4	31,30	32,16	33,54	32,92	33,81	31,87
2000	5	37,10	36,71	36,36	36,51	35,05	36,77
2001	6	41,00	41,26	38,67	39,74	35,87	41,69
2002	7		45,81	40,61	42,68	36,46	46,47
2003	8		50,36	42,30	45,41	36,91	50,96
2004	9		54,92	43,79	47,96	37,25	55,05
2005	1		59,47	45,12	50,37	37,53	58,67
2006	11		64,02	46,32	52,65	37,75	61,78
2007	12		68,57	47,42	54,81	37,94	64,41
2008	13		73,12	48,43	56,89	38,10	66,59
2009	14		77,67	49,37	58,88	38,23	68,37
			R square	R square	R square	R square	R square
			0,988	0,955	0,990	0,990	0,979

The Trend Analysis on Market Shares of Supermarkets and Hypermarkets



The Curve Fitting Presentation of Power Model Projection