Modeling Retail Structural Change Of İzmir Using A Dynamic Spatial Interaction Model

By

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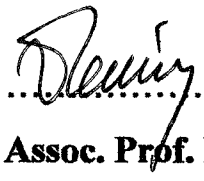

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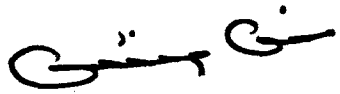

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ABSTRACT

Retailing, one of the most important sectors in all developed economies, has always been the prominent element of urban morphology, and evolves as the city evolves and expands. The last two decades have witnessed considerable changes in retailing throughout developed countries such as, the emergence of new store formats, the increased prevalence of retail chains, the development of out-of-town and edge-of-town retail parks accompanying with the changing conditions of globalized world. Since the sector has undergone major changes in scale, organization, and geography, the urban spaces have been the scene of these ongoing changes.

Under the influence of global economic transformation after 80's, there have also been dramatic changes in retail industry and retail environment in Turkey. Despite the sector in Turkey is still dominated by large number of small, independent, and single location retailers, market share and spatial prevalence of large-scale retailers' have been increasing rapidly. Especially in major cities of the country, both international and domestic retail chains have been imposing a transformation and restructuring the urban retail environment. Among all the areas of retailing, food retailing stands out as having seen the most profound changes in Turkey. With respect of this, the study explores the spatial consequences of the structural change of food retailing system in Izmir. The prevalence of large-scale food retailers such as hypermarkets and supermarkets has negative effects on the survival of many small-independent retailers. The increasing competition has led to a changing retail structure with the dominance of organized retailers where the number of small-scale retailers and their total size are decreasing. As the trends continue, this will have important and unpredictable spatial influences on urban retail environment and urban geography.

Obviously, there is a strong need for a study exploring changes in retail structure and its influences in urban spaces so that policy makers and planners could take into consideration and help restructuring of this transformation process better. For this purpose, the study explores if the ongoing restructuring process of retailing and its possible geographical consequences can be modeled using a dynamic spatial interaction model as a device to be able to predict the future transformations.

ÖZ

Tüm gelişmiş ekonomilerde önemli sektörlerin başında gelen perakende sektörü her zaman kent morfolojisinin mühim öğelerinden biri olmuş, kentler geliştikçe ve yayıldıkça perakende sektörü de gelişmiş ve değişmiştir. Küreselleşen dünyada değişen koşullar, son yirmi yılda sektörde kayda değer dönüşümler meydana getirmiştir. Yeni mağaza formatlarının ortaya çıkışı, perakende zincirlerinin yaygınlaşması, kent dışı ve çeperlerinde büyük alan kaplayan perakende alanlarının oluşması bunlar arasında sayılabilir. Sektör ölçeksel, organizasyonal ve coğrafi açıdan önemli değişimler geçirirken, kentsel mekan da bu değişimlerin sahne bulduğu alanlar olmuştur.

1980'lerden sonra yaşanan küresel ekonomik dönüşümlerin etkisi altında Türkiye'de de perakende endüstrisi ve perakende çevresi dramatik değişimlere sahne olmuştur. Türkiye'de perakende sektörü halen pek çok sayıdaki küçük, bağımsız, ve tek mekana sahip perakendecilerin egemen olduğu bir durum arz etse de, büyük ölçekli perakendecilerin pazar payları ve mekansal yaygınlıkları hızla artmaktadır. Özellikle büyük kentlerde, yerli ve yabancı perakende zincirleri perakende çevresini yeniden yapılandırmakta ve bir dönüşüm dayatmaktadır. Tüm perakendecilik kolları arasında en derin değişim gıda perakendeciliğinde yaşanmaktadır, bu bağlamda çalışma, İzmir'de gıda perakendeciliğinde yaşanan yapısal değişimin mekansal sonuçlarını araştırmaktadır. Hipermarket ve süpermarket gibi büyük ölçekli gıda perakendecilerinin yaygınlaşması pek çok küçük, bağımsız perakendecinin ayakta kalmasını olumsuz etkilemektedir. Artan rekabet ortamı, yapısal olarak organize perakendecilerin baskınlığını arttırdığı, küçük ölçekli perakendecilerin ise sayısal ve hacimsel olarak küçüldüğü bir perakende çevresi doğurmaktadır. Eğilimlerin devam etmesi durumunda ise, yaşanan bu değişimlerin, perakende çevresinde ve kentsel coğrafyada önemli ve kestirilemeyen mekansal etkileri olacağı açıktır.

Dolayısıyla, perakende çevresinde yaşanan yapısal değişimleri ve kentsel mekana etkilerini her yönüyle inceleyen çalışmalara ihtiyaç duyulmaktadır ki karar üreticiler ve plancılar, bu yeniden yapılanma sürecine daha iyi katkılar sağlayabilsinler. Bu yönde bir katkıda bulunmayı amaçlayan çalışma, kentsel perakende sisteminde süregelen yeniden yapılanma sürecinin ve bu sürecin olası mekansal sonuçlarının bir '*dinamik mekansal etkileşim modeli*' (dynamic spatial interaction model) kullanarak modellenip modellenemeyeceği sorusunun cevabını aramaktadır.

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CHAPTER 1

INTRODUCTION

Retailing the 21st century's sector will be very different from 20th century's retailing since the sector is continuously adapting itself to the changing conditions of the world. In developed nations, retail industry is creating new dimensions of 21st century's retailing, while in developing countries, as Turkey, it lives a transformation process which was experienced in developed countries two decades ago.

The last two decades have witnessed considerable changes in retailing throughout developed countries such as, the emergence of new store formats, the increased prevalence of retail chains, the development of out-of-town and edge-of-town retail parks accompanying with the changing conditions of globalized world, especially in the demographical, social, economical and physical context. Since the sector has undergone major changes in scale, organization, and geography, the urban spaces have been the scene of these ongoing changes.

Retail sector has always been the prominent element of urban morphology, and evolves as the city evolves and expands. Over the time the spatial pattern of urban retail growth has experienced a centrifugal shift from central city locations to edge of city locations (Wang and Jones, 2002). Town and city centers, by all means, have radically changed in their appearances and functions during the past thirty years. Giant buildings containing over one hundred shops have in many cases replaced the pattern of small shops, mixed with office, residential and other uses (Guy, 1994).

Under the influence of global economic transformation after 80's, there have also been dramatic changes in retail industry and retail environment in Turkey. Despite the retailing sector in Turkey is still dominated by large number of small, independent, and single location retailers, large scale retailing market share and spatial prevalence have been increasing rapidly. Especially in major cities of the country, both international and domestic retail chains have been imposing a transformation and restructuring the urban retail environment. Turkey is not also alone in these structural changes and their spatial

consequences; there are considerable similarities with some of the European Countries, such as Spain, Portugal, Greece, Hungary and Poland (Tokatlı and Boyacı, 1998)

There is a vast amount of literature about the changes in retail and urban structures. However, there are very few research and literature in developing countries as well as in Turkey concerning the development or restructuring of modern retailing, its effects on urban space and existing retail formats. Clearly, many studies in this area will be need from the perspective of policymaking file. As Tokatlı and Boyacı emphasizes (1998), the spatial expression and manifestation of the restructuring of retailing have to be thoroughly explored that we will not face unpredictable geographical consequences.

Among all the areas of retailing, food retailing stands out as having seen the most profound changes in Turkey. The 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 and entrance of large international corporations etc...

With respect of this, the study explores the spatial consequences of the structural change of food retailing system in Izmir. Heavy investment by retailers has allowed them to enjoy the economies of scale, eventually caused the rapid growth in the numbers of supermarkets and hypermarkets, supported by sophisticated distribution systems and improved efficiency resulting greater sales per outlet. The prevalence of large-scale food retailers have negative effects on the survival of many small-independent retailers. As the trends continue, there may have important and unpredictable spatial influences on urban retail environment and urban geography. Obviously, there is a strong need for a study exploring changes in retail structure and its influences in urban spaces so that policy makers and planners could take into consideration and help restructuring of this transformation process better.

At this point, there arises the research question of the study: the retail geography in Izmir has been changing rapidly especially in the field of food retailing and the arrival of the new retail formats like supermarkets and hypermarkets has been profound effects on the ability of many small-independent retailers to survive in the face of increased competition. This will have important spatial influences on urban landscapes and

change urban retail hierarchy. Can the ongoing restructuring process of retailing and its possible geographical consequences be modeled with a dynamic spatial interaction model as a device to be able to predict the future transformations?

Consequently, the body of the thesis has been formed aiming to explore restructuring process of retailing and to show if the dynamic spatial interaction model can be a useful tool to predict possible spatial consequences in the case of İzmir.

For the purpose, the thesis starts with a brief review of the historical development of modern retailing and the changing urban retail hierarchy, retail locations and formats. Than, the restructuring process of retailing in Turkey is examined and possible consequences of future expectations are discussed.

The third chapter consists of spatial interaction modeling with the review of its origins, basic concepts and major types. Moreover, range of spatial interaction models including retail applications of static and dynamic models.

The description of İzmir case is given in the fourth chapter with its general socio-economic indicators, demographic structure and spatial patterns, than the transformation process and the current structure of retailing in Metropolitan Area is discussed.

The fifth chapter includes the review of dynamic spatial interaction models and explains the methodology of empirical model while the data sources and analyzing process are discussed in the sixth chapter.

Finally, the main assumptions behind the modeling process and overall results of the empirical model are discussed in the seventh chapter and concluded taking the purposes of the thesis, the research question and future researches into consideration in eight the chapter.

CHAPTER 2

THE DEVELOPMENT PROCESS of MODERN RETAILING and THE RETAIL STRUCTURAL CHANGE IN TURKEY

2.1. Historical Development Of Modern Retailing

Retailing, one of the most important sectors in all developed economies, has always been the prominent element of urban morphology, and evolves as the city evolves and expands. The 21st century's retailing will be different from 20th century's retailing since the sector is continuously adapting itself to the changing conditions of globalized world, especially in demographical, social, economical and physical context.

There are numerous definitions of retailing, but the most comprehensive one is made by Cross (1995) as, "*the promoting and selling of merchandise directly to customers, augmented by advertising, store promotions, and personal contacts in the community where the retailer's outlet is located. Retailing is the selling of finished goods and services to the consumer for personal or family consumption. It includes store retailing, such as department stores, non-store retailing, such as direct selling and mail order, or service retailing, such as dry cleaning* (cited in Peterson and Balasubramanian, 2002, p:10)." On the other hand, the term "retail structure" that we are more interested in, fundamentally refers to the organization, functional composition, and location of retail activity in a particular city or region (Wang and Jones, 2002, p.1785).

Simple local shopping started to change in 19th century, but it has undergone radical changes during the last four decades. In other words, the roots of modern retailing development can be looked for after the second part of the twentieth century. However, it can be said that the current transformation process of retailing, defined as the 'retailing revolution', has been started with the alterations after 1970s and especially after 1980s. After this time retail sector has undergone major changes particularly in scale, organization, and geography accompanying by the shifts in the economical, political, and the social structure of the world.

The last two decades, especially in developed countries, have witnessed considerable changes in retailing such as, the emergence of new store formats, the increased prevalence of retail chains, the development of out-of-town and edge-of-town retail parks, and significant investment in new technology for stock management and improved logistics (Dobson et al., 2001, p. 247). As Guy (1994) stated, retail property, shops and shopping centers, constitute an important part of the countries' built environment, so development of new retail floor space has been one of the most important areas of capital expenditure in developed nations.

Over the time, as Wang and Jones (2002) emphasizes, the spatial pattern of urban retail growth has experienced a centrifugal shift from central city locations to edge of city locations. Although there are numerous forces associated with this shift, the most important ones are the suburbanization of population growth, increased personal mobility, higher disposable incomes, changes in transportation technologies, favorable government land-use policies and retail organizational dynamism itself. According to Guy (1994), retail development takes place broadly as the result of demand from two sectors of the service economy, first property investment industry and second retail firms themselves. In addition to this, two broad trends underlie changes in retail demand and retail provision. These are the changes in the population and its expenditure on consumer goods, and change in the retail sector, often arising from competition between retail firms.

On the other hand, if the initial period of retail growth is considered, from 1950s to 1970s, there was a prolonged period of affluence and rising demand, which laid the groundwork for the rapid suburban housing development and the construction of planned shopping centers. In addition to this, changes in consumer profile and consumption habits together with the shifts in demographic and economic structure have important contributions to beginning of retail growth in developed nations. In this respect, the effects of rapid demographical changes on consumer profile and changes occurred in shopping habits can be summarized in details as below (McGoldrick, 1984, p.27-28; Rogers, 1984,p.30-31).

- The reduced importance of the 'traditional family'
- The increase of population and number of households
- The decrease in proportion of 'married couple families' and single person households
- The increasing level of female employment or families with two or more workers
- A greater emphasis on self-fulfilment and flexible lifestyles and time budgets
- Significant changes within the major categories of consumer expenditure
- The increase of demand to electronic and technological-based products
- The increasing level of car ownership
- Enabling to travel further to shop and carry more items by car.

As a consequence of changing retailing trends and consumption conditions, retailers had to learn to serve a variety of differing market segments. An increased consumer demand for merchandise selection and choice encouraged the growth of specialty retailing, and the sales of car and durable goods started to increase by the rapid change in household formation. On the other hand, there became an important breaking point affected this plentiful growth of retailing, the economic crises in 1970s. As Rogers stated, it was most vividly demonstrated by the oil embargoes and price shock' of 1973-1979, rising inflation rates began to decrease real disposable incomes of consumers who then reacted in a number of ways. These difficult time periods in 1970s leads retailers to (Rogers, 1984, p.15),

- "respond to changing consumer preferences and needs by offering new products and services, greater convenience, and improving merchandise assortment and presentation."
- "control or reduce operational expenses and harness scale economies for competitive advantage"

and changed the development process of retailing totally in developed nations. After the difficult economic conditions of the middle and late 1970s, new types of stores and retailing techniques such as, hypermarkets, box stores and warehouses, franchising, large non-food outlets and discount stores, have developed during the 1980s and laid the foundation of today's retailing areas and shopping centers.

Apart from these, after the growth period experiments during 60s and 70s, the principal slogan of retailers became "discount". It was the reason that, a new understanding of commerce came into being and the traditional 'gross benefit/turnover' has been substituted by the 'net benefit/capital invested' meaning that the way to increase the benefit passes through in larger volumes of sales with discounted prices. This leads many small scale retailers could not afford the cost of discount and have changed retail environments providing more advantages on large scale retail outlets implanted at cheap and easily accessible peripheral locations where economies of scale could be employed (Boyacı, 1995, cited in Sert, 1996, p.13).

After the growth period of retailing, some additional trends and radical changes have occurred during the 1980s, which constitute the term described as 'the retailing revolution'. Generally, changing consumer profile and demographic conditions has continued to have effects on the growth of retail sector. Eventually, retail sector, which has adopted itself to globalized economic structure and internationalization, have witnessed competition, the economies of scale and the technology intensive development.

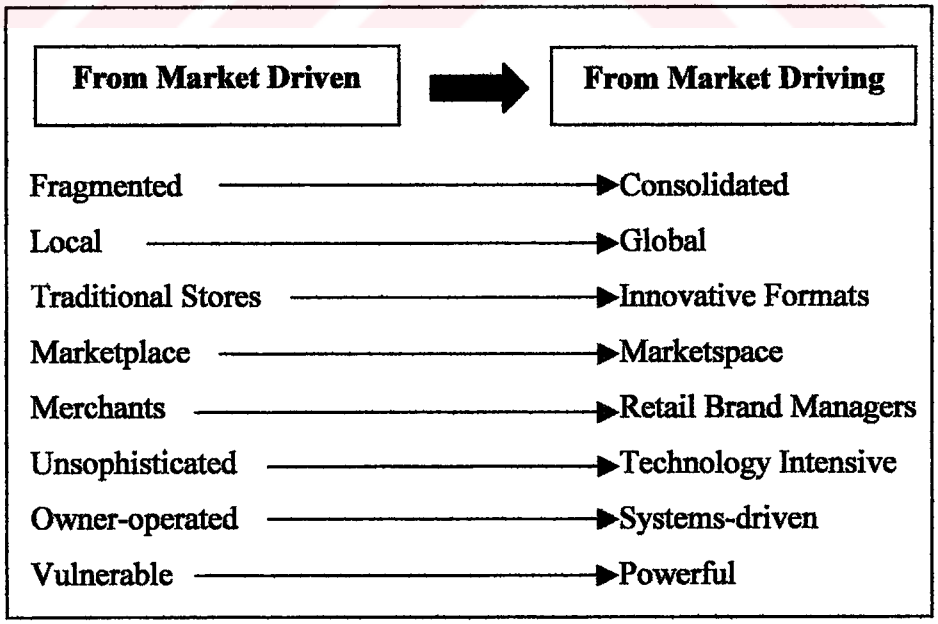
In short, increasing urban population, suburbanization, rising demand for consumption goods, increased car ownership and being widespread usage of deep freeze, together with technological advances in electronics and computer technologies can be all shown as the most important elements of the retailing revolution after 1980s. The lack of free time, increases in number of working women, and changes in packaging, warehousing, food preservation and transportation are the other factors that shift the retail systems completely (Beddignton 1990, Dawson 1980, Guy 1994).

Although there has been a significant degree of globalization until 80s in other sectors of the economy, retailing in general has been late in following this trend. Accompanied by the changes in the economic, political and social structure of the world, more emphasis is being placed on investing abroad. Falling down of trade barriers all over the world, cheaper transport, new forms of expertise in international financing and commerce make easier to do business on a global level (Boyacı, 1995, cited in Sert, 1996, p.10). Hence geographical expansion has become feasible and effective for all the major grocery retailers during the 70s and 80s.

According to Guy (1994), two trends that occurred during the 1980s were of particular importance in explaining the retailing revolution. These were an increase in the volume of consumer expenditure, and the growth of narrowly defined specialist retail markets. The former was associated with growth in real incomes, and increasing availability of means of credit, so that extra income was spent rather than saved and this extra expenditure was translated into retail sales.

Finally, it would be appropriate to state Kumar's (1997) contributions on 'the retailing revolution' debates and finalize the historical journey of retailing up to now. According to him, not so long ago retailing was, and it still is in some parts of the world, a fragmented, local, unsophisticated, traditional business run by vulnerable owner-operators. Fundamentally retailers have grown up over the past 25 years into large, global, technology-intensive, powerful, fast-growth corporations managing their own brands. The leading retailers through consolidation, global expansion, technology push and innovative formats have been 'market driving' rather than 'market driven'. They have shaped consumer behavior, transformed the market place, and redefined the rules of engagement with their competitors and suppliers.

Figure 1: The revolution in retailing: from market driven to market driving



Source: **Kumar Nirmalya,** "The Revolution in Retailing: from Market Driven to Market Driving," *Long Range Planning*, Vol. **35**, No. **6**, (1997), pp. 831

2.2. Changing Urban Retail Hierarchy Retail Locations Retail Formats

2.2.1. Changes in Urban Retail Hierarchy and Locations

The retail system is changing continuously with the partnership of the demand and supply driven factors. On the one hand, consumer preferences and shopping behaviors are changing rapidly together with the service areas of shops and shopping centers; on the other hand, retail firms are changing economic conditions and are increasing competition (Borchert, 1998).

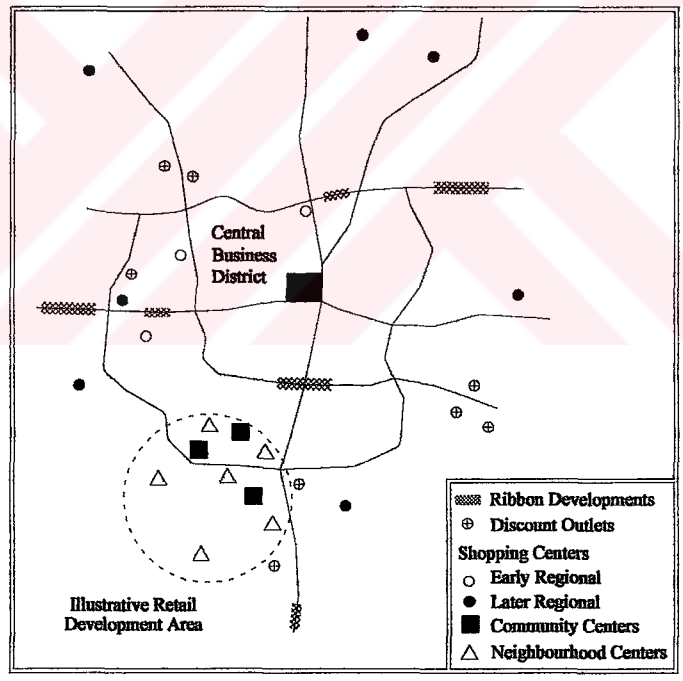
These two sets of forces have important effects on retail structures, and the urban spaces have been the scene of these ongoing changes. As Guy (1994) notes, town and city centers, by all means, have radically changed in their appearances and functions during the past four decades. Giant buildings containing over one hundred shops have in many cases replaced the pattern of small shops, mixed with office, residential and other uses. From this point of view, it would be appropriate to examine the shifts in urban retail patterns from the beginning of the change process.

Before the turn of the century, cities in North America were able to function satisfactorily as mononuclear units. The areal extent and spatial complexity of functions were limited by the modes of transportations available. The retail structure of cities tended to be relatively small in areal extent paralleling to the cities and its population distribution. The introduction and availability to large numbers of middle income residents of the automobile added a new force to retailers. Automobiles render a spatial and temporal flexibility not provided by a mass transit system and consequently offer a much greater freedom of choice to people as to where they both live and go to work or shop. Cities developing on the basis of the automobile or the automobile and mass transit in combination do not have the same requirement of a single, central, dominant core. Eventually, middle income groups moved to peripheral locations on the outskirts where cheaper lands available (Fairbairn, 1984).

Accompanied by the suburbanization, accessibility of the downtown core diminished and more appropriate opportunities became available at alternative sites. As a conclusion, a polynucleated urban structure developed with decentralized retail and commercial facilities where particularly automobile oriented activities and its usage for shopping purposes operated. Few of the older unplanned centralized retail developments persisted through in a modified form where large amounts of them could not provide car parking needs and declined in contrast (Fairbairn, 1984).

A schematic representation of the main features of the urban retail pattern after the initial experiments of retail growth can be shown as in figure 2. The hypothetical city, which especially depicted for the major North American cities, has expanded since the widespread introduction of the automobile and growing retail decentralization.

Figure 2: Retail centers and outlets in a hypothetical North American metropolitan area



Source: **Fairbairn K.,** "The Urban Pattern of Retailing: Within the UK", *in Store Location and Store Assessment Research,* edited by **R. L. Davies and D. S. Rogers,** (1984), p: 68

Dawson (1980, p.186-187) states five main headings for the reasons of retail decentralization: i) the decentralization of population and consumer demand, ii) Increased personal mobility, iii) unsuitable city centers, iv) land availability in non-central sites, v) institutional retail factors.

Similarly, Western European cities have experienced a similar process. However, in order to review the history of the retail decentralization in Western Europe, it is necessary to travel back the early 1960s. At this time, retailing was organized around the familiar principle of the hierarchy of centers and dominated by the independent retailers. As Guy (1998a) stated, two basic trends began to be important at this time and have continued since: the inexorable increase in household car ownership; and the increase in price competition between retailers.

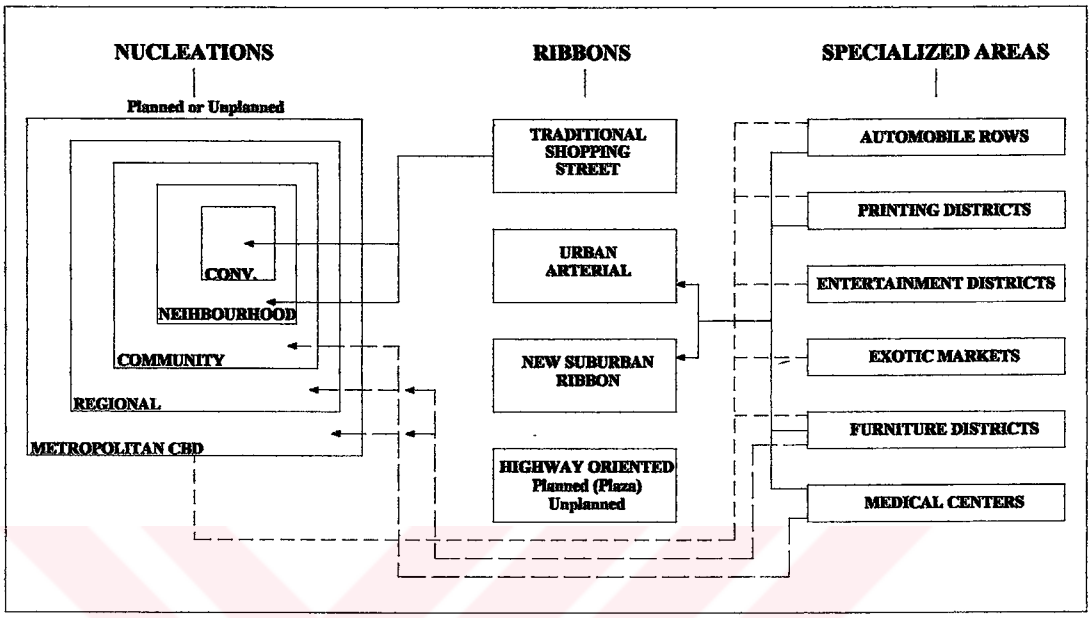
The structure of retail organization and patterns still vary greatly from one to another and this may have been both cause and effect of the contrasts in rates of decentralization. Decentralization of retailing has allowed many town center retail functions to become established in suburban or edge-of-town locations of the cities. Suburban shopping has almost totally changed in nature and it is now dominated by large stores and shopping centers. Despite all of these changes, the town centers have not entirely lost its economic and cultural role. Consumers value and protect their town centers and their small local shops (Guy, 1998a).

After the initial developments, in 1967 another classification of urban retail pattern is proposed by Berry (see in figure 3). The classification is based on the locational requirements of the various retail enterprises, which comprise the commercial structure of a relatively large urban area. Berry's classification distinguishes between three main typologies of retail configurations: nucleations, a set of nested hierarchical centers based on the principles of central place theory; commercial ribbons mainly based on traffic flows; and specialized areas based on mutual functional connections. Although Berry's typology resulted from studies in Chicago, was soon accepted as a universally applicable general typology. Within these typologies there are a number of subdivisions each of which specifies a particular type of retail activity relative to the locational emphasis of the general category (Borchert, 1998, p.327, Fairbairn, 1984, p. 60-61)

Nucleations are clusters of retail outlets and sometimes service activities placed at various transportation focuses within the urban area, and need to be accessible or central to markets of various sizes or scales. Five size orders of retail nucleations have been identified; central business district, regional shopping centers, community centers,

neighborhoods centers, convenience or isolated store clusters; and these may be either planned or unplanned.

Figure 3: Berry's Classification of Shopping Centers and Business Configurations



Source: Dawson John A., "Retail Geography", John Wiley& Sons, New York, (1980), p: 111

Ribbon commercial developments have occurred in all major cities of developed nations. The common characteristics of the ribbons are that retail outlets, which seek such locations for accessibility to the market, provided by the highway itself. They serve to traffic trade and to people who wish to make the one-stop shopping trip. Berry suggests that four subtypes of ribbons are identifiable; highway oriented ribbons, urban arterials' ribbons, traditional shopping streets' ribbons and new suburban ribbons.

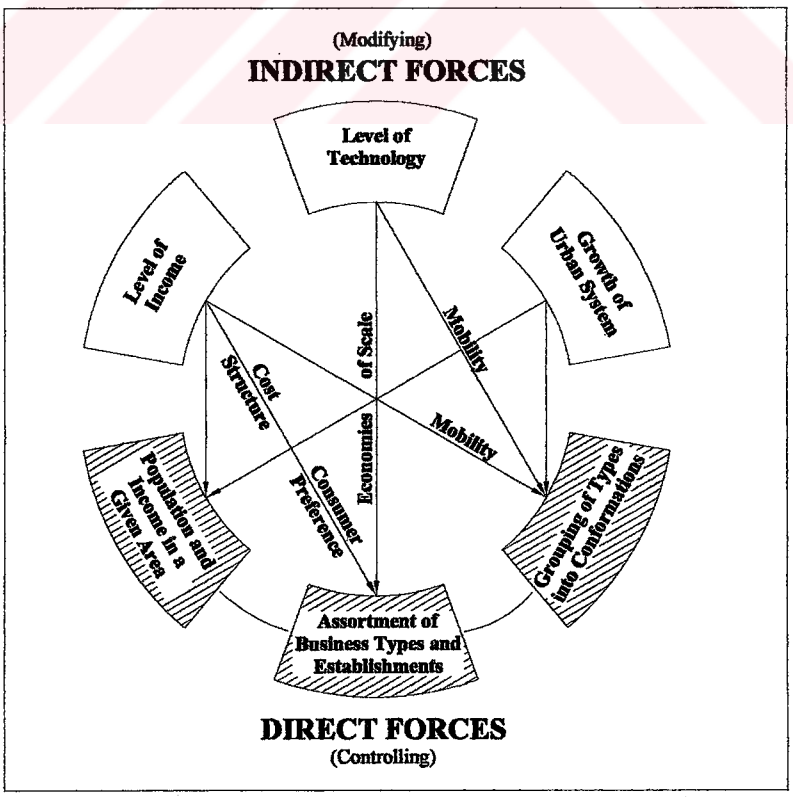
Finally six specialized districts are classified by Berry. Each is distinguished from the others by the similar nature of the business conducted. But they have common feature of a free-standing locational points within the transportation network. The automobile row of new and used vehicles and repair shops, furniture and allied stores, medical centers, entertainment districts, exotic markets, and large, independent, discount stores are in the specialized districts category.

In spite of the dynamism in modern retailing, the spatial pattern in urban areas can still adequately be described by Berry's model. On the other hand, as a consequence of increased retail decentralization and new large-store developments, it is clear that small-

scale retailers have lost their positions, whereas new retail innovations and large-store developments increased their shares of total shopping space. Taking these shifts into consideration the Berry's typology can be adjusted. The fivefold classification of hierarchical centers, nucleations, can be replaced by a threefold system as main, intermediate and local centers. The ribbon component of Berry's typology has been maintained, although highway oriented ribbons seem to be a typical American phenomenon. Finally, the specialized areas component can be extended in order to accommodate emerging types of retailing and retail nucleations such as; do-it-yourself stores, garden centers, shopping & entertainment malls (Borchert, 1998, p.333-334)

Like other hierarchical aspects of retailing, locational pattern of retailing has undergone dramatic changes in the last thirty years. Simmons stated a number of factors that interacted to produce changes in the structure and location of urban retailing. He distinguishes between controlling variables, mainly socio-economic factors and modifying variables and describes them as forces leading to changes in retail structure (Dawson, 1980).

Figure 4: Forces Leading to Changes in Retail Structure and Location



Source: Dawson John A., "Retail Geography", John Wiley& Sons, New York, (1980), p: 134

With respect of these factors, Simmons raised some important aspects of change in the retail pattern. These can be summarized as, i) increases in the scale of retail establishments have made them dependent on a wider trade area and on automobile transportation, ii) the patterns of consumption have shifted to higher-order goods in response to income and demography changes, iii) small-scattered stores in residential areas are disappearing, iv) existing unplanned centers are becoming more tightly defined and retreating at their peripheries, v) rings of centers mature and decline as the pattern of residential succession moves outwards (Dawson, 1980,p.134).

In the same way as Fotheringham and O'Kelly (1989) emphasizes that the rapid changes in retail structures have replaced the corner store by the supermarket, the clustered outlets into shopping malls and retailing strips, and the reduced downtown retailing dominance on behalf of the suburbanization of retail outlets.

In conclusion, considering several past decades' developments, such as retail decentralization, suburbanization, new retail innovations and new consumer profiles, urban retail hierarchy and locational characteristics have altered radically. Initial effects of the shifts have first influenced the town centers because of traffic congestion, lack of parking and ageing structures. On account of this, new retail establishments have taken down the town centers from the top of urban retail hierarchy. Anyway, town center has not completely lost its economic and cultural role because of the increasing efforts to create viable town centers in recent years. On the other hand, it is clear that the traditional shopping center hierarchy has collapsed that the lowest level retailers have lost their locations and a good deal of their position, whereas the highest level takes an increasing share of the total shopping space in the urban area.

2.2.2. Definitions and Classifications of New Retail Developments

2.2.2.1 The Appearance of New Retail Innovations

In the late 1960s economies of scale and new patterns of location emerged as important features of food and grocery retailing. A series of retail innovations, derived from retailers and consumers' trends, have appeared in developed nations. As Guy (1998a, p.957-958) notes, two innovative retail developments were the early results of ongoing changes.

The first innovation *hypermarket*, originated in France in the early 1960s, spread quickly into other western countries. It was a classic retail innovation combining price competition with the convenience of a varied product range, at the expense of any pretensions to quality of display and consumer service. The hypermarket sells a complete range of food and convenience items and a very range of clothing, footwear, household goods, etc. It is essentially a very large (in some countries over 2500 m^2, in others over 5000 m^2), simply designed single story building, which requires for its development cheap land and excellent road access. They have therefore been built mainly at edge-of-town locations.

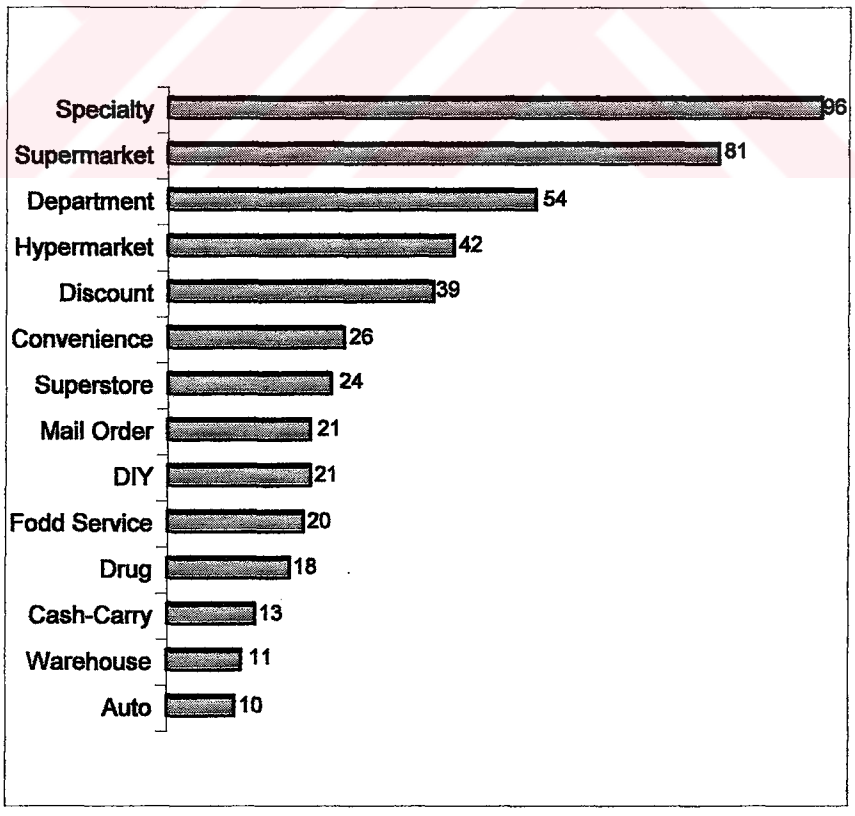
The second innovation, already familiar in North America, was the enclosed, planned, *shopping center*. The largest of these centers, the regional shopping centers, attempted to provide the full range of goods and services which would expect in a medium-sized town center, but under one roof. In North America, these centers had been built largely in newly developing suburban areas on sites provided with good access by car. In Western Europe, regional centers fitted more into the existing retail hierarchy. The out-of-town regional shopping centers emerged principally in West Germany in the 1960s and 1970s, and in the late 1980s in the UK. In 1990s, further such centers have appeared in other Western European countries.

In the 1970s, the principle of developing large single story buildings selling a wide range of goods at low prices continued in food retailing. The food *superstore*, known as *supermarkets*, smaller than the hypermarket and with a smaller range of non-food goods became established particularly in the UK. Furthermore, *specialty stores*, self-service

stores specializing in particular types of non-food retailing, and *retail warehouses* in the same way became established. In the 1980s, off-center retail development became more organized and the retail *warehouse park* or *retail park*, three or more retail warehouses, became enormously popular with developers in 1990s. At the same time, the pace of development of out of town *regional shopping centers* and large food stores increased while, especially in Germany, there was substantial development of limited line discount food stores (Guy, 1998a, p. 958-959).

Today development pressures still exist for all of these types of retail innovations. Figure 5 shows that, new retail innovations especially extended all over the world after 80s and 90s such as specialty stores, supermarkets, hypermarkets and hard-discount stores have dominated todays retailing. In addition to this most of the top 200 retailers' chain has been operating more than several countries and continuing being widespread in all over the world. In account of this the retail innovations of developed countries have rapidly become introduced in developing countries.

Figure 5: Sectoral Composition of Top 200 Retailers



Source: **Deloitte Touche Tohmatsu,** 2003 Global Powers of Retailing, annually published online report in www.stores.org, January2003.

2.2.2.2. Classifications of Retail Outlets and Shopping Centers

Considering the types of retail developments, an initial distinction should be made between unplanned and planned retailing. An unplanned retail area is one that has evolved in a gradual or piecemeal manner, often through conversion of buildings originally designed for some other purpose. Most of the central shopping areas of towns and city centers comprise mainly unplanned retailing but can include both unplanned and planned retail areas. Planned retailing areas, on the other hand, are deliberately developed in a coordinated manner of retail use. Planned development creates either, a single building with one or more retail stores contained within it, or an organized group of physically separated retail stores with common arrangements for vehicle access and car parking (Guy 1994, p.11-12).

Table 1: Retail Outlets Classified by Trip Purpose and Size

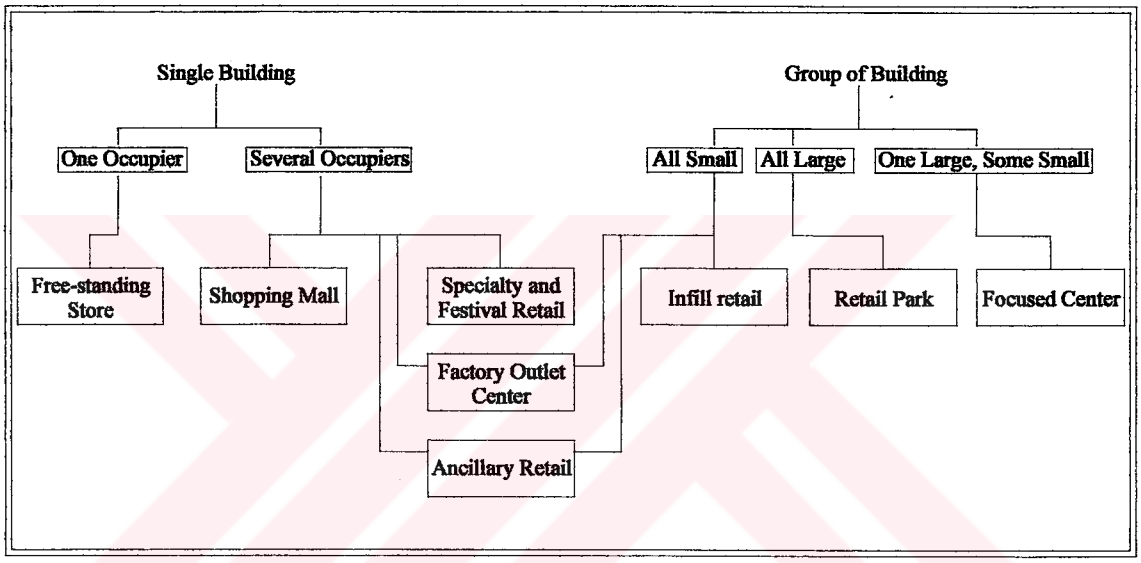
Sales Area	*Convenience Shopping*	*Household Shopping*	*Personal/fashion Shopping*
Under 250	Convenience store Butcher Pharmacy		Fashion boutique Shoe shop
250-1000	Small supermarket	Hardware store Video hire	Bookshop Sports goods shop
1000-2500	Large supermarket	Retail warehouse Fachmarket	
Over 2500	Hypermarket	Retail warehouse	Department store

Source:Guy Clifford M., "Classifications of Retail Stores and Shopping Centers: Some Methodogical Issues", ***Geojournal***, Vol. **45**, (1998b), p.258

A retail outlet can be defined as a building from which retailing is carried out. For the retail outlets, classifications simply based upon types of goods sold, shopping trip purposes, size, and types of store ownership (see a comprehensive review in Guy 1998b). In table 1, classification by size and type of stores related to trip purposes is shown that we are more interested in. Classification by size also implies the use of arbitrary boundaries. For instance, hypermarkets are generally recognized in Europe as having a lower limit of 2500 m^2 sales area, but in Germany lower limit of 1500 m^2 is sometimes used, whereas in the UK the term hypermarket refers to superstores.

Classifying shopping centers is much more complex and uncertain. In one view, the term shopping center should be applied to any group of shops, whether old, new, planned, unplanned, purpose-built or converted. The opposite view is that the term should be confined to planned, purpose-built developments.. If unplanned clusters of retail outlets evaluated as other retail areas, the classification of planned shopping centers can be established by size and function, physical form, retail offer and purpose, center ownership and tenancy ownership (Guy, 1998b).

Figure 6: Retail Development: Classification based on Physical Characteristics



Source: Guy Clifford M., "Classifications of Retail Stores and Shopping Centers: Some Methodogical Issues", ***Geojournal***, Vol. 45, (1998b), p.261

The classification in figure 6 extends from simple to complex form of planned retail development, and is based upon physical characteristics and composition of the center in terms of the number of the buildings or occupiers. Conventional classification of free-standing stores here is also referred to hypermarket as a food store and retail warehouse as a non-food store. Additionally, the category of focused center consists of one or more stores similar to free-standing stores, plus some smaller stores. (The detailing definitions and the characteristics of other retail formats are included in Appendix A).

Finally, since the locational context for retail developments (especially the out-of-town and off-center developments) has particular significance for land use planning, it would be appropriate to mention about the classification of retail locations.

Table 2: Classifications of Retail Locations

Type of Center	Town Center	Edge of Center	Other Retail Area	Other Urban Area	New Residential Area	Edge of town
Free Standing Store		+		+	+	+
Focused Center			+		+	+
Retail Park				+		+
Shopping Mall	+			+		+
Regional Center				+		+
Specialty Center	+	+		+		
Factory Outlet Center				+		+

Town Center: the historic central retail core of a town, possibly including modern shopping malls.

Edge of town center: an area characterized by non-retail land uses but within easy walking distance of retail core

Other retail Area (unplanned): this refers to traditional suburban retail areas and ribbon developments.

Other urban: any urban area with some form of existing commercial development like industrial areas or waterfronts

New residential area: usually edge of town or on land not clearly within the current urban boundary

Edge-of-town: a site originally rural in nature or bounded by rural land.

Source: Guy Clifford M., "Classifications of Retail Stores and Shopping Centers: Some Methodogical Issues", *Geojournal*, Vol. 45, (1998b), p.262

The location of a specific retail development implies a unique relationship with the local residential population and the competition among retailers. There is no generally agreed typology or classification of retail locations. The commonly used classifications discussed by Dawson (1983), Davies (1984), Thorpe (1991). These classifications are mainly derived from central place theory and commonly distinguished as: town or city centers, inner urban or inner suburban, new district center and edge of town. However, Guy (1998b) emphasizes that new retailing developments may locate in other land uses of urban area and may serve an adjoining residential area. In this respect, various possibilities for location within typical urban areas can be proposed and simple analysis of relationships between these locational types and certain types of modern retail developments become as in table above (Guy 1994 -1998b).

2.3. The Restructuring Process Of Retailing In Turkey

During the several past decades, Turkey has been exposed to various political and economic shifts in terms of its national and international institutions. The transformations accompanying with the globalization have occurred especially after 80s, and affected the economic structure and physical landscapes of the cities.

Under the influence of global economic transformations, there have also been dramatic changes in retail industry and retail environment in Turkey. Despite the fact that the retailing sector in Turkey is still dominated by large number of small, independent, and single location retailers, large scale retailing market share and spatial prevalence have been increasing rapidly. Especially in major cities of the country, international and domestic retail chains have been changing the urban retail hierarchy, restructuring the urban retail environment and imposing a transformation process.

More liberal policies in the Turkish economy especially resulted in the rapid development of food retailing in Turkey. Since food is the most important type of consumer expenditure in developing countries supermarkets and hypermarkets have become the most important retail innovation that has changed the retail environment. On the account of this restructuring retailing process of Turkey is examined below, mainly related to food retailing developments as two initial development periods.

2.3.1. Pre-1980 Period

Until 1980s, Turkey was carrying out a development strategy based on import-substituted industrialization. This economic development model was especially dominated with privately-owned agricultural sector, and both publicly and privately-owned but state dependent industrial sector. Import-substituted industrialization model under semi-controlled mixed economy showed little responsiveness to changes in international circumstances. The business environment was protected and directed to the internal market and primary focus was given on manufacturing and industrial investments (Tokatlı and Boyacı, 1998). Consequently, it is difficult to mention about the existence of an appropriate environment for western type of retailing developments due to the economic conditions and the given priorities in this period.

Under these economic conditions from 1950s to 1980s, any change in the structure of retailing had hardly occurred. Empirical evidences (in Kumcu and Kumcu, 1987) shows that over the thirty-year period, neither a decline in the share of small retailers nor an increase in the share of large retailers had been identified clearly.

However, it is possible to mention some noteworthy developments after 1950s. For instance, in order to deal with high inflation environment, the state encouraged the formation of consumer cooperatives, which included supermarket formats with municipal ownership and other types of retail (Tokatlı and Özcan, 1998). In 1955, a Switzerland company, Migros was invited to Turkey by the government to establish Migros-Turk aiming to sell basic foodstuffs in İstanbul. Later, İstanbul Municipality, Ziraat Bank, TMO and EBK provided financial support to the company. The principle aim of the company was to lower the distribution costs and establish competitiveness in the retail market. In 1956, another retail company Gima has been established in Ankara again as another government initiative to distribute basic foodstuffs and basic consumption goods at lower prices. In 1970s various municipality owned regularity stores were quite popular but they were only able to serve a small portion of the society (Sert, 1996).

In the pre-1980 period, although state-supported large retailers and cooperatives caused a decline in the rate of small and independent retailers in their immediate neighborhoods, small retailers remained the main source of retail business. Further, private sector aiming to establish modern and large retail institutions in Turkey could not prosper because of both supply side and demand side obstacles such as consumer resistance, the lack of infrastructure and technology, externalities, and other enabling conditions. As a consequence, retail industry had remained nearly the same from 1950 to 1980 despite the stage of economic development. Dominant type of retailing was still small and independent such as, grocery stores (bakkal), greengroceries (manav) butchers (kasap) and haberdashers (konfeksiyoncu). This small-scale retail structure fits well the prevailing demand pattern of the Turkish customer, the public attitudes and the policies supporting small-scale retailing (Tokatlı and Özcan, 1998).

2.3.2. Post-1980 Period

Import-substituted industrialization model achieved quite successful results in the early phase of creating an industrial base in consumption goods while the strategy would not be as successful in the phase of producing intermediate and capital goods. This was caused by the dependency of domestic performance on the availability of imports. Additionally, deep economic crisis emerged in the late 1970s together with the oil shocks and resultant high inflation rates up to day. On this account, a more outward-oriented development strategy, aiming to develop the export potential of the country by recognizing the global competition conditions, was replaced the import-substituted industrialization strategy (Tokatlı and Boyacı, 1998).

After having put into practice of the new strategy, the economy has begun to go smoothly and experienced relatively high rates of growth, and changed the production and consumption patterns. As Tokatli and Özcan (1998) notes, since then state intervention in the economy has shifted from manufacturing to infrastructural activities along with a considerable reduction of government involvement in price determination. The shift in policy and its consequent outcomes changed the circumstances so that new efforts towards large-scale retailing, during the 1990s, began to prove successful.

The new development strategy has affected the retail sector in a number of direct and indirect ways by altering demand side factors, changing environmental conditions, and increasing attraction of the sector for large corporations. As Tokatli and Özcan, (1998, p.98-1001) expounds, these fundamental factors and changes after 80s are as follow.

- The high growth rates of the economy have caused improvements in income especially wins over interest, rent and other profits rather than agricultural incomes, wages and salaries. In much more quantities the increasing urban population has been benefited from this improvement, and disproportionate share of the increases in income lead to the transfer of resources from rural areas to large cities such as Istanbul, Ankara and Izmir. For instance, low level of per capita income $ 1152 in 1982 increased to $ 2685 in 1995. Further, the total number of motor vehicles in the country, for example, increased from 63 511 in 1967 to 2 997 632 in 1993. These circumstances have created an environment

including a segment of relatively well off, western oriented upper class and an expanding middle-income group.

- The post 1980 policies of the government have removed some of the immediate obstacles for large-scale retailers to emerge and grow by providing some of necessary infrastructure, externalities, as well as other conditions. Additionally, penetration of technology has been striking and computer technology and bar code system have been started to adopt in retailing activities after 1985.

- As a consequence of integration with the international market, import liberalizations have had a significant effect on retailing by increasing the variety of goods available in the domestic market.

- The appeal of retailing has increased with the high cash flows in a high inflation, depreciation and nominal interest rate environment. Further, being the least affecting sector of food retailing from economic downturns has increased the appealing of the sector.

Of course, the growing economy after 1980s was not the only response of the development of retailing in Turkey. Social, political and technological shifts that country experienced are the other important factors affected the retail environment and caused an increase in the large-scale retailing market share. In summary, increase in urbanization rates and private car ownership, widespread usage of credit cards and durable goods, utilization of installment payments, the changing role of women and consumer profile, technological advances and internationalization of retailing have changed the retail environment in Turkey (Tokatli and Boyaci, 1997).

The overall result has been a growing consumer market promising a large, steady and consistent demand for products especially in the large major cities. This has also made Turkish retailing more prone to the pressure of large domestic and international corporations (Tokatli and Ozcan, 1998). As a result, large domestic and international corporations successfully captured an increased marked share through supermarkets, hypermarkets, department stores, and franchise-based operations during the 1990s.

Especially the last decade has witnessed the emergence of large-scale retailing, and introduced a trend towards ownership of multiple retail outlets having common managerial control. As Tokatli and Boyacı (1998) states Turkish retail structure before the 1990s was highly fragmented and was neither horizontally nor vertically integrated. Small-scale, capital-weak, independent, and family-owned retailers dominated the trade. The activities of large retailers were quite negligible, except for a few semi public retailers such as Tansaş of İzmir Municipality, and multinational retail firms were unheard of, except for Migros-Türk in Istanbul.

During this period, foreign retailers were encouraged to move into Turkey retail market and at the same time, Turkish firms were motivated to form partnerships with Europeans by a variety of pressures. There were domestic corporations, international retailers, and to a lesser extent, some exceptionally successful small domestic traders behind the transformations. In accordance with the foreign retail companies invited to Turkish retailing in the late 1990s the transformation in the sector started to appear. Certain factors played key roles in making retail internationalization possible. These are enhanced data communication technologies, new forms of international financing, cheap transportation and finally the progressive lowering of barriers to international development (.Tokatli and Boyaci, 1997;1998; Tokatli and Özcan, 1998)

The import of western type of retailing by France, UK and USA companies together with the strong domestic retailers have altered the structure of retailing in major cities like İstanbul, Ankara, İzmir and Bursa as well as in well-off southern cities. The spread of large-scale retailing has resulted in increased competition, the introduction of new marketing techniques and the appearance of supporting activities (Sert, 1996). Until 1990, when Metro, a German retailer, opened its first store, there were no hypermarkets in the country. Since then there has been a remarkable increase in the number of hypermarkets: 41 in 1996, 66 in 1997, 91 in 1998, 110 in 1999, and 149 in 2001. In the same period, large supermarkets have also increased, both in number (from 91 in 1996, to 251 in 1999, and 357 in 2001) and in terms of share in total turnover. Meanwhile, the number of small establishments selling foodstuff, groceries, has declined, from 159171 in 1997, to 128 580 in 2001 (Tokatlı and Eldener, 2002; AC Nielsen ZET data, 2001)

2.3.3. Current Process and Future Trends

Currently, the spatial structure of Turkish retailing follows the hierarchical pattern where; small, independent and single location retailers such as grocery, butcher and green-grocery, which are primarily located in the residential areas as clustered at the bottom. On the top, as in other countries, sits the central business district, which traditionally specializes in clothing, shoe, household needs and luxury goods. Another component of the retail system is open bazaars, which are either permanent or held periodically in certain places in almost all neighborhoods of the country (Toaktlı and Boyacı, 1998).

The transformations since especially the late 1990s have brought the enormous organizations establishing giant buildings and stores, which are highly different from small-scale single location retailers (Table 3). The most crucial changes have occurred in the sector of food retailing, although a number of multi-purpose shopping centers have among the first signs.

Table 3: Major Food and Non-Food Retailers-Formats-Store Numbers

Parent Company	Store Brands	Retail Formats	Number of Stores	2002 Sales (EUR mn)
Major Food Retailers				
Begendik Family	Beğendik	Hypermarkats	13	n/a
BIM & international partners	Bim	Hard Discount	655	n/a
Carrefour and Sabancı	Carrefoursa Championsa Diasa	Hypermarkats Supermarkets Hard Discount	10 3 132	497
Doğuş	Tansaş Macro	Supermarkets Supermarkets	195 11	348
Fiba Holding	Gima Endi	Supermarkets Supermarkets	74 54	351
Koç	Migros Şok	Hypermarkats Supermarkets Hard Discount	240 217	805
Metro	Metro Real	Cash & Carry Hypermarkats	9 6	515
Tesco	Kipa	Hypermarkats	5	181
Yimpaş	Yimpaş	Supermarkets	55	367
Major Non-food Retailers				
Fiba Holding	Marks&Spencer	Department Stores	11	181
Boyner Group	Carşı	Department Stores	13	367
Tekfen Holding and Götzen	Tekzen	DIY	9	n/a
Koç Holding and BQ (JV)	Koçtaş	DIY	5	n/a
Metro	Praktiker	DIY	7	45
Bauhaus	Bauhaus	DIY	2	n/a

Source: PricewaterhouseCoopers, 2003/2004 Russia and Central & Eastern European Retail & Consumer Study, report on Turkey, www.pwcglobal.com

The major food retail chains dominate the Turkish retailing after 90s are Migros, Tansaş, Gima, Yimpaş, Carrefoursa, Metro, Real, Beğendik and Kipa. Among the existing chains Migros, Yimpaş, Tansaş, Gima and Beğendik belong to domestic groups whereas others partly or completely owned by foreign retailers. Most of the companies except for Migros and Gima are less than 15 years old. Also there are more than 50 local and regional small chains, which operate less than ten stores.

A great many of these large retailers have mainly concentrated in the few largest cities of the country and opened stores one after another such as hypermarkets (with floor areas between 2500and 15000sqm) and supermarkets. As a consequence, the number of stores serving in these formats has rapidly increased from 1316 in 1996, to 4407 in 2003 whereas, the number of traditional single location retailers (up to 100 sqm) has decreased dramatically from 175 121 to127 700 as indicated in table 4.

Table 4: Changes in Number of Organized and Unorganized Food Retailers

Type of Retailer	1996	1997	1998	1999	2000	2001	2003*
Organized Retailers	**1316**	**1682**	**2135**	**2421**	**2979**	**3640**	**4407**
Hypermarkets >2500 sqm	41	66	91	110	129	149	170
Large Supermarkets 1000-2500sqm	91	130	210	251	306	357	417
Supermarkets 400-1000sqm	289	404	464	567	726	835	970
Small Supermarkets <400 sqm	895	1082	1370	1493	1818	2299	2850
Traditional Food Retailers	**175121**	**170588**	**167612**	**162172**	**149995**	**141790**	**127700**
Larger Grocery 50-100sqm	10755	11417	12192	13247	13232	13210	12700
Grocery <50sqm	164366	159171	155420	148925	136763	128580	115000
Grocery (Urban)	92174	87185	83742	78930	71213	66243	58650
Grocery (Rural)	72192	71986	71678	69995	65550	62337	56350

Source: Rearranged based on AC Nielsen data in Tansaş Report (2003) and in Bocutoglu and Atasay (2001)
*AC Nielsen Estimate

With increasing store numbers, market shares of the organized large- scale retailers have started to dominate the traditional retailers. In today numbers, traditional food retailers, including only small-scale groceries, have a market share of 53% across the organized retailers with a share of 47%, which are hypermarkets and supermarkets. Table 5 shows the rapid changes in market shares among organized and unorganized retailers in years as below.

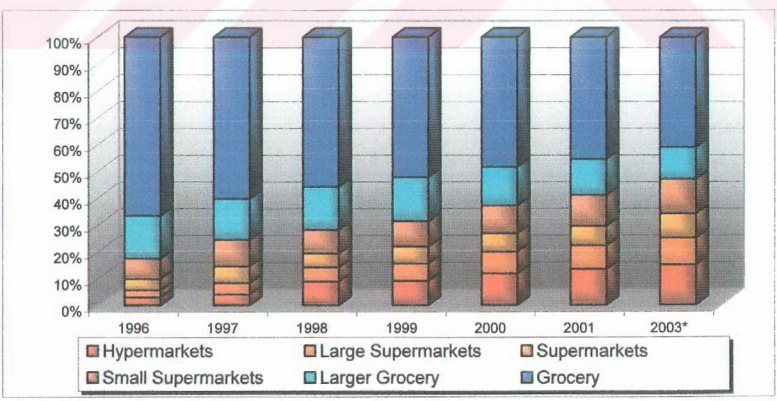
Table 5: Changes in Market Shares of Organized and Unorganized Food Retailers

Type of Retailer	1996	1997	1998	1999	2000	2001	2003*
Organized Retailers	**17,4**	**24,4**	**28,1**	**31,3**	**37,1**	**41,0**	**47**
Hypermarkets >2500 sqm	2,9	4,0	8,8	9,1	11,8	13,4	15
Large Supermarkets 1000-2500sqm	2,7	4,3	5,3	6,4	8,1	8,8	10
Supermarkets 400-1000sqm	4,2	6,2	5,2	6,3	6,8	7,2	9
Small Supermarkets <400 sqm	7,6	9,9	8,8	9,5	10,3	11,6	13
Traditional Food Retailers	**82,6**	**75,6**	**71,9**	**68,7**	**62,9**	**59,0**	**53**
Larger Grocery 50-100sqm	15,9	15,3	16,1	16,4	14,5	13,4	12
Grocery <50sqm	66,7	60,3	55,8	52,3	48,4	45,6	41

Source: Rearranged based on AC Nielsen data in Tansaş Report (2003)
*AC Nielsen Estimate

During the past decade the market share of groceries have been exposed more drastic decreases in their store numbers where 82.6% in 1996 to 53% in 2003 (Figure 7). Hypermarkets are the most leaping format although there are only two for per one million inhabitants opposed to an average of 15 in Western Europe. However, the actual retail segment, which has been stealing a significant market share from neighborhood groceries, is discount stores other than hypermarkets. Discount stores, also called small supermarkets and established commonly in downtowns or residential areas, are expected to increase their market shares even caused groceries failure.

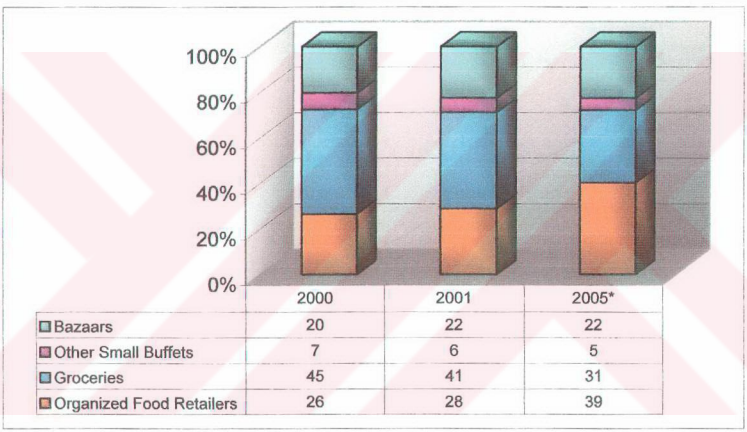
Figure 7:Changes in Market Shares of Organized and Unorganized Food Retailers



Source: Rearranged based on AC Nielsen data in Tansaş Report (2003)
*AC Nielsen Estimate

Although market shares of organized food retailers seem to be affirmative among the groceries, the situation reverses if open bazaars and other small buffets are taken into consideration. Unlike in developed countries, share of unorganized food retailers consisting of open bazaars, neighborhood groceries and other small buffets is much more higher than organized food retailers. In 2001, open bazaars (22%), groceries (41) and other small buffets (7%) shared 72% of total food retail market whereas organized food retailers shared only 28% (Figure 8).

Figure 8: Market Shares of Organized and Unorganized Food Retailers: Including Bazaars and Other Small Buffets

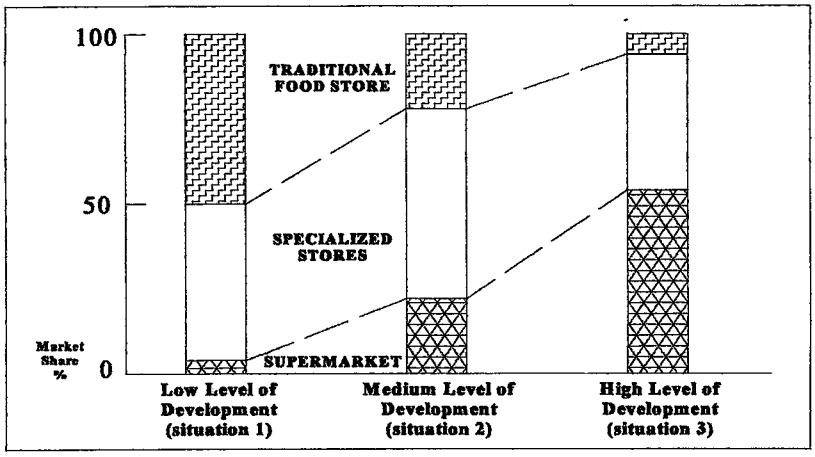


	2000	2001	2005*
Bazaars	20	22	22
Other Small Buffets	7	6	5
Groceries	45	41	31
Organized Food Retailers	26	28	39

Source: Rearranged based on AC Nielsen data in Tansaş Report (2003)
*AC Nielsen Estimate

As Mittendorf (1978) states there are three different situations in food retailing, which reflect varying degrees of economic development. Situation 1 is characterized by the predominance of many small traditional food retailers and hawkers, and is typical of the least developed countries of Africa and Asia. Situation II relates to the existence of well-established specialized grocery stores and limited-line or organized retailers as in Latin American and Mediterranean countries. Finally situation III applies to those with higher consumer incomes as in Western European where integrated and associated food chains have already been developed. These changes in food retailing over the course of economic development are illustrated in figure 9 (cited in Kaynak and Cavusgil, 1982; p: 257)

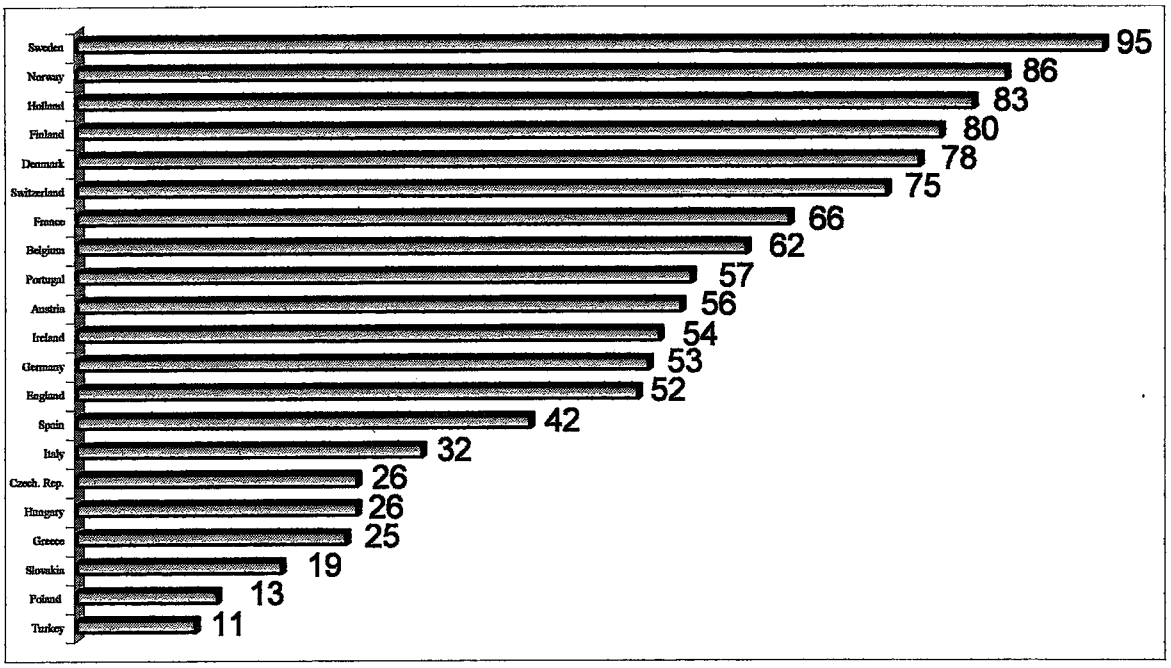
Figure 9: Food Retailing Over the Course of Economic Development



Source: Hans – Joachim Mittendorf, "The Challenge of Organizing City Food Marketing Systems in Developing Countries, Zeitschrift fur nuslandische Landwirtschaft,Vol.17,1998, .333 (cited in Kaynak and Cavusgil, 1982;,p.258)

Since the retail industry in Turkey has a dual structure, which consists of both traditional small-scale retailers and modern large-scale retailers, the current level of retail development process can be explained by situation 2. Clearly, accompanying with the economic development, the current situation will start to turn out against to unorganized retailers as in situation 3. Because contrasting with the other countries, organized retailers in Turkey are at the initial steps of their growth, whereas top three retailers in some developed countries have almost dominated the whole market (fig. 10).

Figure 10: Market Share of Top 3 Retailers in National Markets



Source: AC Nielsen, cited in Tansaş Report (2003)

The retail systems in both developed and developing countries of the world, share certain common characteristics, but they also differ from each other in many important ways. As Tokatlı and Boyacı (1998) states, Turkey is not alone in these structural changes and their spatial consequences, 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. On the other hand, the Turkish retail system has always been similar to that of Portugal and Greece, where the majority of food retailers were small and independent.

In following decades, if Turkey encounters even only part of what Portugal has experienced recently - 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 Tokatlı and Boyacı, 1998) - , the retail structure will continue changing as in 1990s (Tokatli and Boyacı, 1998). The major players behind the transformation again will be the large retailers increasing their market share and store numbers. At the same time small, single location retailers will start to disappear gradually from the urban areas.

It is clear that, the spatial consequence of a retail environment increasingly dominated by organized corporations, scattered through the urban systems with their large freestanding stores, will also differ from the traditional urban retail hierarchy and structure including mainly small-scale retailers. The Turkish cities have also experiencing transformations, especially after 1990s, with the restructuring of its basic components such as industrial, commercial and residential activities. Transformations in retail structure perhaps are the most visible in accordance with the new innovations. As Tokatlı and Boyacı (1998) emphasizes, "market demands determines the locational dynamics of retailers in urban area, largely controlled by accessibility, the interaction of threshold and range effects associated with the products they sell, cluster dynamics and consumer attitudes". However, past trends show that the restructuring process of retailing will go on increasing its spatial consequences in all cities of the country. Therefore, restructuring of retailing has to be explored thoroughly taking the economies of scale, agglomeration, competition and retail organizations into consideration to decrease negative consequences of rapid changes and developments.

2.4. Conclusion and The Research Question

A brief review of modern retailing developments has shown us, retail industry is creating new dimensions of 21st century's retailing in developed nations, while in developing countries, as Turkey, it lives a transformation process experienced in developed countries two decades ago. The last two decades have witnessed considerable changes in retailing throughout developed countries such as, the emergence of new store formats, the increased prevalence of retail chains, the development of out-of-town and edge-of-town retail parks accompanying with the changing conditions of globalized world, especially in the demographical, social, economical and physical context. Since retail sector has undergone major changes in scale, organization, and geography, the urban spaces have been the scene of these ongoing changes.

Under the influence of global economic transformation after 80's, there also have been dramatic changes in retail industry and retail environment in Turkey. Turkish retail structure exhibits a dual structure with small-scale traditional types and modern large-scale retail stores. Despite the sector is still partly dominated by large number of small, independent, and single location retailers, large scale retailing market share and spatial prevalence has been increasing rapidly. Especially in major cities of the country, both international and domestic retail chains have been imposing a transformation and restructuring the urban retail environment.

There is a vast amount of literature about the changes in retail and urban structures. However, there are very few research and literature in developing countries as well as in Turkey concerning the development or restructuring of modern retailing and its effects on urban space and existing retail formats.. As Tokatlı and Boyacı emphasizes (1998, p: 359), the spatial expression and manifestation of the restructuring of retailing have to be thoroughly explored so that we will not face unpredictable geographical consequences.

Among all the areas of retailing, food retailing stands out as having seen the most profound changes in Turkey. The certain trends show that Turkish organized food retailing market is far from being saturated and has a substantial growth potential due to:

- Increasing population (annual 1.83%)
- Urbanization (60% in 1990, 65 in 2000)
- Increasing use of credit cards (hardly any before 90s, over 30million in 2001)
- Increasing number of working women (950 000 in 1990, 1 900 000 in 2000)
- Increasing private car ownership
- Changing shopping habits from street shopping to mall shopping
- Entrance preparation of largest international corporations (Tesco, Wall-Mart)

With respect of this, the study explores the spatial consequences of the structural change of food retailing system in Izmir. Heavy investment by retailers has allowed them to enjoy the economies of scale, eventually caused the rapid growth in the numbers of supermarkets and hypermarkets, supported by sophisticated distribution systems and improved efficiency resulting greater sales per outlet. The prevalence of large-scale food retailers has negative effects on the survival of many small-independent retailers. As the trends continue, there may have important and unpredictable spatial influences on urban retail environment and urban geography. Obviously, there is a strong need for a study exploring changes in retail structure and its influences in urban spaces so that policy makers and planners could take into consideration and help restructuring of this transformation process better.

At this point, there arises the research question of the study: the retail geography in Izmir has been changing rapidly especially in the field of food retailing and the arrival of the new retail formats like supermarkets and hypermarkets has been profound effects on the ability of many small-independent retailers to survive in the face of increased competition. This will have important spatial influences on urban landscapes and change urban retail hierarchy. *Can the ongoing restructuring process of retailing and its possible geographical consequences be modeled with a dynamic spatial interaction model as a device to be able to predict the future transformations?*

CHAPTER 3

SPATIAL INTERACTION MODELING

3.1. An Overview

The explanation and prediction of social and economic interaction over geographic space have always been one of the main research areas for geographers, planners, and regional scientists. The need to plan spatial and locational behavior of individuals, households and firms has increased the efforts to explain driving forces of spatial behaviors. In this respect, recent decades have witnessed a number of developments in the category of spatial models.

One of the important fields of spatial models is the spatial interaction modeling, which are used to explain or estimate todays and future patterns of human and economic interaction over geographic space. As Olsson (1970) states, *"the concept of spatial interaction is central for everyone concerned with theoretical geography and regional science... Under the umbrella of spatial interaction and distance decay, it has been possible to accommodate most model work in transportation, migration, commuting, and diffusion, as well as significant aspects of location theory"* (cited in Fotheringham and O'Kelly, 1989, p.1).

In general, spatial interaction can be defined as the movement of people, commodities, capital and information over geographic space that results from a decision process. The interaction term comprises various behaviors such as migration, shopping, travel-to-work, recreation, commodity flows, capital flows, communication flows, the movement of goods, the choice of health-care services, the choice of a university by students, airline passenger traffic, and even attendance at events such as conferences, cultural and sport events (Fotheringham and O'Kelly, 1989,p.1).

Spatial interaction is linked with economic development through the process of specialization. Since we are surrounded with the roads, bridges, railways, canals, airports, telephones, mailboxes, and computer networks, movement over space plays an

important role in human activities and decisions. All of these in our environment are the evidence of specialization, and also economic development takes place by increased specialization. As a consequence, since specialization is possible through spatial interaction, modeling this specialization become the subject of intensive investigation in human geography and regional science.

3.2. Origins and Development Of Spatial Interaction Models

The original foundations for modeling interactions over space were based on the analogues world of interacting particles and gravitational force. Since first usage to examine potential effects and notions of market area for retail trade, the gravity models have been extensively employed by city planners, geographers, transportation analysts, retail location firms, investors and so on. The past 30 years have brought fundamental contributions to the initial model related to appropriate weights, functional forms, definitions of economic and transportation costs, disaggregations by route choice, trip type, transport mode, and so forth (Batten and Boyce, 1986).

There are many factors, which led to the rapid growth of this area of research. De La Barra (1989) explains these factors as twofold. The first, spatial interaction models are easy to apply to real cases, producing useful and realistic results. The second, spatial interaction approach is particularly relevant to transportation analysis. During the 1960s and early 1970s, as a result of rapid urban growth and increase in car availability, many transport-related projects were implemented, thus spatial interaction models were in great demand.

As mentioned earlier, spatial interaction models were mainly based on a gravitational analogy. Rather than the individual molecules of an urban area, spatial interaction was more interested in the behavior of whole masses, and the relationship among them . The interaction (flow) between two regions is proportional to the product of the sizes of these regions, and inversely related to the distance between them. This has a close analogy with the Theory of Universal Gravitation introduced by Newton (1687). The earliest formulation of the concept is usually attributed to Carey (1958), studies of Ravenstein (1885) on migration and the work of Lill (1891) on railway traffic (De La Barra, 1989,Vries et al., 2001).

One of the first steps in this direction was the law of Reilly's (1929) retail gravitation. However, most authors agree on placing the origins of modern spatial interaction models in 1959 with the work of Hansen who elaborated on the location of residents as a function of accessibility to employment. Then Huff (1962-1963) made an important contribution by interpreting the basic gravity model in economic terms and probabilities. Lowry (1964) achieved a landmark in the history of spatial interaction models, by using economic base principles and introducing a multiplier to provide a comprehensive explanation of the urban structure. Rogers (1968) and Garin (1966) improved Lowry's work on Matrix methods (De La Barra, 1989).

Spatial interaction drifted further away from its original gravity formulation with the important work of Wilson (1967, 1970, 1974) on entropy maximization. Maximum Entropy method created the basis for the development and implementation of numerous operational models such as those by Echnique (1968) and Batty (1976). Finally, a general and flexible spatial interaction model, "Alonso's General Theory of Movement', was proposed by Alonso (1973,1978), and the same model was independently developed Bikker (1987,1992) and Bikker and De Vos (1992). As well as these, applying spatial interaction models to real cases has been further improved by the development of calibration techniques to estimate the various parameters involved (De La Barra, 1989, Vries et al., 2001).

All of these studies can be seen as the initial studies of spatial interaction models. There is a considerable amount of literature on spatial interaction, and it is possible to find excellent reviews in Fotheringham and O'Kelly (1989), review of Batten and Boyce (1986), De La Barra, (1989), and as De La Barra proposes in Lee (1973), Batty (1975,1976) and Baxter (1976). The following section includes basic concepts and formulations of major static spatial interaction models. Additionally, the notations of formulas, and definitions in following section are primarily based on work of De La Barra, (1989), Fotheringham & O'Kelly (1989) and Wilson (1974).

3.3. Basic Concepts and Major Types Of Spatial Interaction Models

3.3.1. Gravity Models

In spatial interaction models, the land used by activities is defined as aggregate units of space or zones, containing a certain number of activities within them. Each interacting zone is described in terms of number of attributes. The zones are linked to each other by all means of infrastructures or networks, depending on the nature of the flows. The gravity form of a spatial interaction model states that interaction between any two zones is proportional to the number of activities in each zone (masses), and inversely proportional to the friction imposed by the particular infrastructure that connects them (De La Barra, 1989). The simplest formulation is:

$$F_{ij} = gM_iM_jf(C_{ij}) \tag{3.1}$$

where, F_{ij} is the magnitude of the flow between zones i and j, M_i and M_j are some measure of magnitudes in zone i and j, $f(C_{ij})$ is a function of the friction imposed by the infrastructure connecting i to j and it is measured as physical distance, time or cost, g is a constant that transforms the activity units into the flow units

If the system is composed of more than two zones, flows between any particular pair of zones must be restricted by the combined effect of all other zones in the system. The denominator represents the effect of all zones in the system, including i and j.

$$F_{ij} = g\frac{M_iM_jf(C_{ij})}{\sum_j M_jf(C_{ij})} \tag{3.2}$$

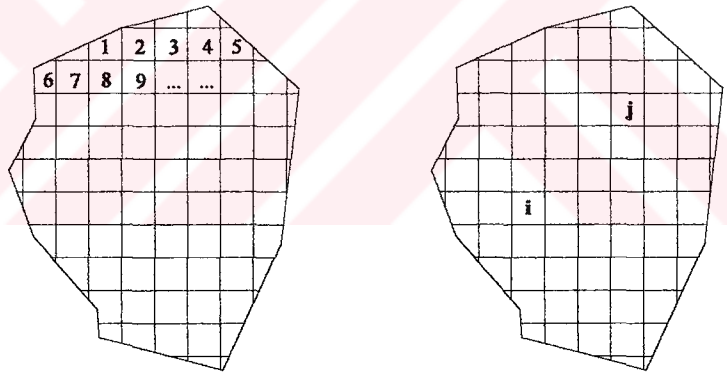
As De La Barra (1989) states, this basic gravity model can be used in several ways. If the main interests are the flows themselves, as in a transport demand model, F_{ij} represent trips, M would represent attraction and production variables, and g is a trip generation factor. If, however, the model was intended for the simulation of the location of activities, F_{ij} would represent the flow that are generated in i and ending in j.

Finally, this basic formula has generally been modified and expanded when it has been applied to human and economic interactions. Many discussions have hold about the nature of these masses, the choice and definition of distance, the numeric value of its exponent, and the evolutions of constants.

3.3.2.The elements of Spatial Interaction Models and A General Formulation

Considering a zone system in any city or a region (figure 11), the starting point of spatial interaction analysis is to build an origin-destination matrix related to this zone system. There is a set of flows T, between m origins and n destinations (figure12), and compatible m x n matrix C whose elements show the spatial separation between origins and destinations, an m x p matrix of origin propulsiveness measures V, and an n x q matrix of destination attractiveness variables, W. The symbols p and q respectively, indicate the number of propulsiveness and attractiveness variables.

Figure 11: A Zone System and Letters Standing for 'any' Zone



Source: **Wilson A.G.**, "Urban & Regional Models in Geography & Planning," John Wiley & Sons, (1974), 36p

In the observed interaction matrix T, by summing the all elements of each rows, we obtain the observed outflow from each origin, O_i, and by summing the each elements of columns, we obtain the observed inflow into each destination, D_j, where $\sum O_i = \sum D_j$ are named as trip conservation constraint. Then, the total interaction in the system which is represented by T become,

Figure 12: The basic Elements of Spatial Interaction Modeling

$$T = \begin{bmatrix} T_{11} & T_{12} & \dots & T_{1n} \\ T_{21} & T_{22} & \dots & T_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ T_{m1} & T_{m2} & \dots & T_{mn} \\ D_1 & D_2 & \dots & D_n \end{bmatrix} \begin{matrix} O_1 \\ O_2 \\ \dots \\ \dots \\ O_m \end{matrix} \qquad C = \begin{bmatrix} C_{11} & C_{12} & \dots & C_{1n} \\ C_{21} & C_{22} & \dots & C_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ C_{m1} & C_{m2} & \dots & C_{mn} \end{bmatrix}$$

$$V = \begin{bmatrix} V_1^1 & V_1^2 & \dots & V_1^p \\ V_2^1 & V_2^2 & \dots & V_2^p \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ V_m^1 & V_m^2 & \dots & Vm^p \end{bmatrix} \qquad W = \begin{bmatrix} W_1^1 & W_1^2 & \dots & W_1^q \\ W_2^1 & W_2^2 & \dots & W_2^q \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ W_m^1 & W_m^2 & \dots & W_m^q \end{bmatrix}$$

Source: **Fotheringham A.S. and O'Kelly M.E.**, "Spatial Interaction Models: Formulations and Applications," Kluwer Academic Publishers, (1989), p.5

$$T = \sum_j D_j = \sum_j \sum_i T_{ij} \tag{3.3}$$

or equivalently,

$$T = \sum_i O_i = \sum_i \sum_j T_{ij} \tag{3.4}$$

The matrix V contains variables that determine the propulsiveness of an origin, in other words, variables influencing the volume of flows from each origin. Of course, these variables might change according to the context of interaction. In the same way, the matrix W contains variables that determine the attractiveness of a destination, and again which variables are appropriate depends on the particular interaction system being investigated.

Finally, matrix C contains the variable, measuring the spatial separation between zones. The definition of what constitutes a relevant measure of spatial separation in the matrix C is also problematic. As Fotheringham and O'Kelly (1989) notes, generally three types of measures dominate the literature. These are physical distance, travel cost and travel time. Of the three measures described above, distance is the most commonly used variable in spatial interaction modeling. In addition to this, it is generally assumed that for intra-urban interactions, spatial interaction is measured by travel cost while for interurban interactions spatial separation is measured by distance.

Eventually, a general spatial interaction model can be formulated as follow, where T_{ij} represents a flow between i and j zones, V_i represents a variable measuring the propulsiveness of i, W_j represents a variable measuring the attractiveness of j, and C_{ij} represents the spatial separation between i and j.

$$T_{ij} = f\left(\mu_1 V_i^1 . \mu_1 V_i^1 . \mu_2 V_i^2 \ldots \mu_p V_i^p ; \alpha_1 V_i^1 . \alpha_1 V_i^1 . \alpha_2 V_i^2 \ldots \alpha_q V_i^q ; \beta C_{ij}\right) \qquad (3.5)$$

The parameters μ, α, and β stands for to show the relationship between each of these variables and T_{ij}. The model can be represented in more basic form by assuming that there is only one relevant variable for measurement of propulsiveness and one for attractiveness. In the meantime, the historical development of spatial interaction models was dominated by this type of simple model (a form of gravity model), and a three variable model can yield surprisingly high levels of goodness-of-fit.

$$T_{ij} = f\left(\mu V_i ; \alpha W_j ; \beta C_{ij}\right) \qquad (3.6)$$

The exact functional form of each type of variable in the model is subject to varying degrees of conjecture. However, many studies show that the site-specific variables V_is and the W_js are generally best represented as power functions. However for the exact form of the separation function two forms dominate the literature. These are the power and exponential function. In addition to this, the parameter β is often written as a negative value for the reason that increases in separation value causes decrease in the interaction. In conclusion, if functions of the variables are reformed as,

$$f(\mu_1, V_i) = V_i^{\mu} \qquad (3.7)$$

$$f(\alpha_1, W_j) = W_j^{\alpha} \qquad (3.8)$$

$$f(\beta, C_{ij}) = C_{ij}^{\beta} \qquad (3.9)$$

or, $$f(\beta, C_{ij}) = \exp(\beta, C_{ij}) \qquad (3.10)$$

than, the general model formulation become:

$$T_{ij} = \left(V_i^{\mu} W_j^{\alpha} C_{ij}^{\beta}\right) \qquad (3.11)$$

or, $$T_{ij} = \left(V_i^{\mu} W_j^{\alpha} \exp(\beta C_{ij})\right) \qquad (3.12)$$

3.3.3. Family of Spatial Interaction Models

Wilson (1970,1974) introduced Family of Spatial Interaction Models distinguishing several cases. The flows can be unconstrained as in the basic type of the gravity model, or they can be constrained at either the origins or destinations, or at both of them.

The main assumption of Wilson's Models is that the interaction is proportional to the total of interaction flows leaving zone i, the total interaction flows terminating at zone j, and proportional to some decreasing function of travel cost (Wilson, 1974).

$$T_{ij} \propto O_i \, , T_{ij} \propto D_j \, , T_{ij} \propto f(C_{ij}) \tag{3.13}$$

At this point of view, Wilson introduces a constant (K), which substitutes for the proportionality of interactions. Then, if total outflow from i, and total inflow to j is known, it can be possible to derive the proportionality constant K.

$$\mathbf{T_{ij} = KO_iD_jf(C_{ij})} \tag{3.14}$$

$$\mathbf{\sum_j T_{ij} = O_i} \tag{3.15}$$

$$\mathbf{\sum_j T_{ij} = D_j} \tag{3.16}$$

$$\text{if } O_i \text{ is known} \Longrightarrow \sum_j KO_i D_j f(C_{ij}) = KO_i \sum_j D_j f(C_{ij}) = O_i \Longrightarrow \mathbf{K = 1 / \sum_i O_i f(C_{ij})} \tag{3.17}$$

$$\text{if } D_j \text{ is known} \Longrightarrow \sum_i KO_i D_j f(C_{ij}) = KD_j \sum_i O_i f(C_{ij}) = D_j \Longrightarrow \mathbf{K = 1 / \sum_j D_j f(C_{ij})} \tag{3.18}$$

Considering these derivations, four cases can be distinguished:

1. Neither the set of row totals O_i nor the set of column totals D_j is known.
2. The set of row totals O_i is known
3. The set of column totals D_j is known
4. Both sets of totals, O_i and D_j are known

As mentioned earlier, the quantity O_i is considered to be the total production of interaction flows out of zone i, while the quantity D_j is associated with the attraction of interaction flows into zone j.

Wilson (1974) named these four cases as,

1. Unconstrained case
2. Production Constrained case
3. Attraction-Constrained case
4. Production-Attraction case (Doubly Constrained)

Additionally, it is essential to emphasize that if either O_i or D_j is not known, the corresponding term is replaced by propulsiveness or attractiveness term, either V_i^{μ} or W_j^{α} is appropriate.

Unconstrained Models

Unconstrained model corresponds to the situation of minimum information where neither origins nor destinations known. Therefore, in this case, O_i should be replaced by V_i^{μ} and D_j replaced by W_j^{α}, a constant and distance function in additionally constitutes the model form. The expression of the unconstrained model, which nearly has the same form of the traditional "unconstrained" gravity model is,

$$T_{ij} = KV_i^{\mu}W_j^{\alpha}f(-\beta d_{ij}) \tag{3.19}$$

As it can be seen in the formulation, the model is unconstrained in terms of the production of trips from origins and the attraction of trips to destinations.

Production-Constrained Models

In this case, O_i, numbers of flows originating in each zone i, is known, while D_j is not, and so D_j is replaced by W_j^{α}. Furthermore, if the proportionality constant K in equation 2.19 replaced by A_i, and D_j replaced by W_j^{α}, the expression of production-constrained model become,

$$T_{ij} = A_i W_j^{\alpha} O_i f(-\beta d_{ij}) \tag{3.20}$$

where

$$A_i = 1/\sum_j W_j^{\alpha} f(-\beta d_{ij}) \tag{3.21}$$

A_i is called the partition function and the value of A_i serves to ensure that the model reproduces the volume of flow originating at zone i. It is often referred to as a balancing factor in the spatial interaction literature. The major application of production-constrained models have been the allocation of retail flows from residential zones to retail establishments.

Attraction-Constrained Models

This case is the mirror image of the production-constrained model where D_j is known but O_i is not. Here, O_i is replaced by V_i^{μ} and proportionality factor replaced by B_j. The major application area of Attraction-Constraint Models has been the location of residential land use, and the form of the model is,

$$T_{ij} = B_j V_i^{\mu} D_j f(-\beta d_{ij}) \tag{3.22}$$

where

$$B_j = 1/\sum_i V_i^{\mu} f(-\beta d_{ij}) \tag{3.23}$$

Production-Attraction Models (Doubly Constrained)

Doubly constrained model corresponds to the case of maximum information, because both the origins O_i and destinations D_j are known. This case is more complicated in relation to the proportionality factor. Here, both equations 3.25 and 3.26 are hold as a proportionality factor. Since terms A_i and B_j are mutually dependent, they have to be solved iteratively. The expression of the doubly-constrained models is

$$T_{ij} = A_i B_j O_i D_j f(-\beta d_{ij}) \tag{3.24}$$

and the balancing factors are,

$$A_i = 1/\sum_j W_j^{\alpha} B_j D_j f(-\beta d_{ij}) \tag{3.25}$$

$$B_j = 1/\sum_i V_i^{\mu} A_i O_i f(-\beta d_{ij}) \tag{3.26}$$

In transportation studies, it is usually known that certain numbers of trips originate and end in each zone. For the reason, doubly constrained model has found a wide applicability in trip distribution problems and transportation planning process.

3.4. The Purposes And The Range Of Spatial Interaction Models

After having introduced the basic concepts of the spatial interaction models, it would be appropriate to discuss the purposes of the models, and express their various applications. All mathematical models can have two major aims: explanation and prediction. According to Fotheringham and O'Kelly (1989), explanation in terms of spatial interaction models involves determining attributes of locations that promote flows of people, goods or ideas between them. Unconstrained models provide information on the attributes of both the origins and the destinations of the interactions; production-constrained models provide information on destination characteristics; and attraction-constrained models provide information on origin characteristics. The doubly constrained or production attraction-constrained models' purpose is predictive rather than explanatory. In contrast to others, it provides no information on what characteristics make a destination or origin attractive or unattractive, instead it generally provides high levels of predictive conclusions (Fotheringham and O'Kelly 1989).

There arises a question "since the unconstrained model provides the most information, why not use it to answer all of the questions regarding spatial interaction" by Fotheringham and O'Kelly. As shown in table 6, a model providing large amounts of high-quality information is needed, that is to say, a model in the top left-hand corner of the diagram. While, unconstrained model provides large quantity of information, its quality is generally not considered in acceptable levels, whereas doubly constrained model provides high quality information but in generally unacceptably low quantities.

Table 6: Trade of Between the Quantity and Quality of Information Provided by Spatial Interaction Models

		Quantity	
		Large	**Small**
Quality	**High**	Production-constrained/ Attraction-constrained	Production-attraction constrained
	Low	Unconstrained	

Source: **Fotheringham A.S.** and **O'Kelly M.E.**, "Spatial Interaction Models: Formulations and Applications," Kluwer Academic Publishers, (1989), p.4

In all cases except unconstrained, we know some or all the parts of the interaction matrixes. Although we already have known the interaction matrixes, there is a need to undertake or calibrate an interaction model. Fotheringham and O'Kelly (1989, p.43) explain what further information can be hold with spatial interaction modeling in threefold. With the usage of spatial interaction models,

- We can predict interactions at some future time or in different spatial systems.
- We can forecast the probable effects of planned spatial changes on interaction patterns. For example, it would be possible to forecast the changes in traffic patterns that would result if a major industrial development took place in some part of the city.
- We can estimate parameters of different time periods, which provide information on systems under investigation, and it is possible to draw conclusions about interaction behavior from a comparison of these parameter estimates. For example, it might be possible to conclude, from a comparison of the two distance-decay parameters, that migrants are becoming less or more constrained by distance over time.

For these reason, the spatial interaction models can be applied in a variety of ways. The most mentioned studies and researches in the literature are included in the titles of, migration analysis, retailing, transportation analysis, flows of goods and services, locational analysis, and network design.

For instance, if we are interested in migration analysis, it can be possible to explain either, the characteristics of destinations that make them attractive or unattractive for migrants, or the patterns of flows between any origin and destination. In retailing applications, it might be possible to find the optimal location of a new store, or forecast future turnover of an existing store, and analyze retail structural change. In transportation analyses it can be measured that if a new investment of rail service or road system is effective or not over the expected demand, or the sensitivity of various types of movements to changes in travel costs. Additionally, if we are interested in locational analysis like residential location, it is possible to predict the increase in housing demand due to the development of a new industrial center. Finally, in network design applications it can be answered that where should facilities such as terminals,

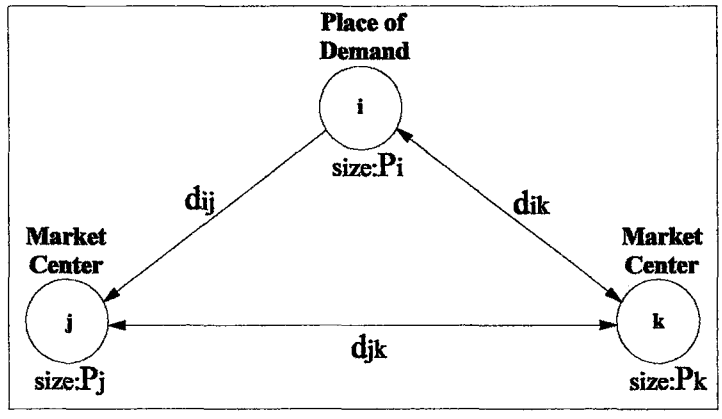
airports be located so as to connect the cities in a network, or how should be the organization of phone-networks (Fotheringham and O'Kelly, 1989). In conclusion, applications of spatial interaction models are numerous and few examples are mentioned here.

3.5. Retail Applications Of Static Spatial Interaction Models

The spatial interaction models, generally in the form of the gravity type, are widely used to forecast optimal location or turnover of new outlets and the impact of changes in the retail environment on an outlet performance, or to clarify any retail system characteristics.

In general, retail interaction models are based on empirical analysis of spatial pattern of consumer shopping habits. With these models, the spatial pattern of consumer shopping trips and the pattern of expenditures at different outlets can also be predicted in more detail and with more accuracy than in other forecasting models. Owing to their mathematical flexibility, spatial interaction can be used to analyze numerous characteristics of trade areas and forecast sales of many different types of retail and service institutions (Ghosh and McLafferty, 1988).

Figure 13: Market Centers & Places of Consumer Demand - Retail Gravitation



Batten F. David and Boyce E. David, " Spatial Interaction, Transportation, and Interregional Commodity Flow Models," *in Handbook of Regional and Urban Economic: Volume I Regional Economics,* Edited by **P. Nijkamp,**Elsevier Science Publishers, (1986), p. 357-406

Traditional gravity models are the origins of today's more specialized spatial interaction models used in retailing studies. The pioneering applications of gravity models to retailing start with the Reilly's Law of Retail Gravitation to measure the attractiveness of a shopping center or a store and to find the optimal distance between the consumer's home and the location of the center (figure 13). Reilly presented his law (3.27) for the first time in 1929 assuming that there were N places of consumer demand, denoted by subscript i, and M market centers, denoted by subscript j, the equation is,

$$\frac{P_{ij}}{P_{ik}} = \left(\frac{P_j}{P_k}\right)^{\alpha}\left(\frac{d_{ik}}{d_{ij}}\right)^{\beta} \tag{3.27}$$

where P_{ij} and P_{ik} are the proportions of all the demand or trade attracted from some space of consumer demand i to centers j and k, P_j and P_k are the populations of j and k, d_{ij} and d_{ik} are the distances from i to the centers j and k, and α and β are empirical constants. In order to define the market hinterlands around j and k an equilibrium condition "breakpoint" proposed that gives the spatial boundaries where the proportions of sales of j and k are equal (3.28). The boundary condition between market areas (3.29) and explicit breakpoint equation (3.30) can be derived as below

$$P_{ij} = P_{ik} \tag{3.28}$$

$$\frac{d_{ik}}{d_{ij}} = \left(\frac{P_k}{P_j}\right)^{\alpha/\beta} \tag{3.29}$$

$$d_{ij} = d_{jk} \Big/ \left[1 + \left(\frac{P_k}{P_j}\right)^{\alpha/\beta}\right] \tag{3.30}$$

One of the first refinements and modifications of this basic concept was provided by Converse (1949), and since then gravity models has been widely developed as a marketing and planning tool. According to Dawson (1980) the deterministic 'break point' models of Reilly and Converse took a major step forward under the probabilistic

formulation of Huff. As Ghosh and McLafferty (1988) state, Huff (1962,1964) was the first who proposed a spatial interaction model for estimating retail trade areas.

$$U_{ij} = W_i^{\alpha} d_{ij} \tag{3.31}$$

$$P_{ij} = U_{ij} \Big/ \sum_{k \to N} U_{ik} \tag{3.32}$$

Huff (1962) suggested that the utility (U) of a store depends on its size and distance to consumers (3.31), where W_j is the size of outlet j and d_{ij} is distance from zone i to zone j. Additionally, according to him the probability of a consumer visiting a particular store is equal to the ratio of the utility of that store to the sum of all the stores considered by consumers (3.32) where P_{ij} is the probability of a consumer at i visiting store j, and N is the set of competing stores in the region. Finally substituting equation 3.31 and 3.32, the Huff model, shown in equation 3.33, can be obtained.

$$P_{ij} = W_j d_{ij} \Big/ \sum_{k \to N} W_k^{\alpha} d_{ik}^{\beta} \tag{3.33}$$

Huff's model has reached a high degree of maturity for the model presented by Lakshmanan and Hansen (1965). During the late 1960s and early 1970s, there were a number of academic attempts to theoretically determine the optimum parameters and variables for attraction and distance functions. Wilson (1970,1974) made contributions including entropy maximization techniques and the non-linear minimization of the sums of squares of the differences between actual and predicted flows (Dawson 1980, Ghosh and McLafferty 1988).

The production-constrained shopping-trip model, originally developed by Huff, Lakshmanan and Hansen, has been in use for more than 30 years. As Dawson (1980) expresses, the model states that a shopping center located in a given zone will attract consumer expenditure from another zone proportionally to total consumer expenditure, in direct proportion to the size of the center measured in floor space, inversely proportional to the distance to the consumers expressed in travel time, and if included, inversely proportional to competing facilities. The general form of the formula can be presented as

$$S_{ij} = A_i e_i p_i W_j^{\alpha} \exp(C_{ij}) \tag{3.34}$$

where

$$A_i = 1 / \sum_j W_j^{\alpha} \exp(C_{ij}) \tag{3.35}$$

which ensures that

$$\sum S_{ij} = e_i p_i \tag{3.36}$$

S_{ij} is the flow of expenditure from residential zone i to shops or shopping centers; e_i is the per capita expenditure of residents of i; P_i, the population of zone i; W_j, the size of the shopping center in zone j (which is taken as a measure of attractiveness); C_{ij} is a measure of travel distance or cost between zone i and j; α and β are the model parameters. As mentioned earlier, this model is typically used to estimate turnover in a shopping center where e_i, P_i, W_j and C_{ij} are usually considered to be given exogenously, and α and β are obtained by calibrating the model against survey data (Wilson, 1974).

In conclusion, there are numerous applications of this basic formula extended with more specialized variables and parameters aiming to model retail system characteristics more accurately (see in Fotheringham and O'Kelly, 1989). Beside forecasting optimal location and turnover of a store, spatial interaction models are most commonly used to examine the market characteristics for an existing or proposed store, determine the optimal size of new store in given location, examine the effects of increasing store size on market share, analyze the factors leading closure, derive potential revenue surfaces and trading areas around stores.

3.6. Retail Applications Of Dynamic Spatial Interaction Models

As mentioned earlier, locational pattern of retailing has undergone dramatic changes in last thirty years. Being widespread of large-scale retailers implies a rapid and dramatic structural dynamism and reshapes the form of urban retailing. Rapid changes in retail structures have led the replacement of the corner store by the supermarket, the clustering of outlets into shopping malls and retailing strips, and the reduction of downtown retailing dominance.

These changes have taken place continuously and cannot be modeled by static interaction models, since they model discrete events. In geographical theory there are two modes of representation for time: static and dynamic. In spatial interaction models the major applications have been set within a static or comparative static framework, in other words, models are built to represent structures at one point in time and then key variables are changed to analyze the future structure (Clarke et al.1998).

In 1970s there were a number of criticisms about static flow models and this led to an important contribution to spatial interaction models by Harris and Wilson (1978). They introduced a dynamic mechanism to the model structure and explored explanations for discontinuities in retail size dynamics (Clarke et al.1998).

The Harris-Wilson model examines the behavior of an equilibrium point between supply and demand. If we define the profit, Π, associated with a retail outlet of type m (supermarket, hypermarket etc.) at location j by equation 3.37,

$$\Pi_j^m = D_j^m - C_j^m \tag{3.37}$$

$$D_j^m = \sum_i S_{ij}^m \tag{3.38}$$

$$C_j^m = kW_j \tag{3.39}$$

D_j^m is the revenue generated by a type m outlet at location j and C_j^m is the operating costs incurred by a type m outlet locating at j. In addition to this the demand side is modeled by summing the potential revenue generated by an outlet of a particular size at a particular location over all origins (3.38). And in order to model the supply side, retailers' cost (3.39) C_j, can be taken as a function of as floorspace, Wj (Fotheringham and O'Kelly 1989, Clarke et al.1998, Munroe, 2001).

Considering all, if normal profits are included in retailers costs, then the market will ensure that the Π_js are competed to zero and so the following equilibrium condition must hold:

$$D_j^m = C_j^m \tag{3.40}$$

Finally, if potential revenue is estimated by a production-constrained shopping model, introduced earlier, from above equations a basic dynamic spatial interaction model can be written as:

$$\sum_i S_{ij}^m = kW_j \tag{3.41}$$

which is equal to

$$\sum_i \frac{e_i p_i W_j^{\alpha^m} e^{-\beta^m c_{ij}}}{\sum_k W_k^{\alpha^m} e^{-\beta^m c_{ij}}} = kW_j \tag{3.42}$$

which are a set of nonlinear simultaneous equations in the W_js.

Therefore, if revenue exceeds costs ($S_j > C_j$) a particular retail center is likely to grow on the contrary, if cost exceeds revenue ($C_j > S_j$) the location of the facility is unstable and the center will decline. This process continues in an iterative manner until the solutions reach stability and no further growth/decline takes place unless further change is introduced to any of the model's variables or parameters.

With the application of dynamic spatial interaction models, it can be possible to reproduce known structures or previous structures of retail systems, and to analyze rapid changes in retail structure. These are shown by the empirical study of Clarke, Langley and Cardwell in Leeds (1998). However, the empirical testing of these models has been problematic because of the difficulties of obtaining time series data so that, except for Fotheringham and Knudsen (1986b), there is hardly any retail application of dynamic spatial interaction model.

In conclusion, it is clear that if there is a need to explore critical changes in retail structure, dynamic spatial interaction model can be a useful tool to analyze future characteristics of urban retail systems.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA: THE CASE İZMİR

4.1. The Description Of Izmir

İzmir, the third most populated metropole city of the Turkey 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 country. The core city surrounding the İzmir Bay has also become an attraction center due to the international commercial seaport, productive agricultural areas in the hinterlands, and economical and industrial structure that is fed from this hinterland.

It would be more appropriate to start with the overall socio-economic analysis of the İzmir Province than the city of İzmir. According to the report of socio-economic development levels (DPT),İzmir is on the third row among the other 81provinces. Table 7 shows the fundamental socio-economic indicators comparing with İzmir and Turkey.

Table 7:Demographic and Socio-Economic Indicators of Turkey and İzmir

	Years	Turkey	İzmir	Rate (%)	Bench of İzmir (within 81 Provinces)
Demographic Indicators					
Total Population	2000	67 803 927	3 370 866	4,97 %	3
Population Density (km^2)	2000	88	280	———	3
Annual Population Growth Rate	1990-2000	1,83	2,38	———	15
Mean Household Size	2000	4,50	3,58	———	78
Urbanization Rate	2000	65	85	———	3
Health and Educational Indicators					
Literacy Rate	2000	87,30	91,86	———	10
Rate of Persons Have a University	2000	8,42	11,47	———	4
Number of Doctors for per 10 000 person	2000	13	23	———	2
Economical Indicators					
GDP (at current prices – Billions TL)	2001	178 412 438	13 382 809	7,5 %	3
Per Capita GDP (at current prices -$)	2001	2 146	3 215	———	6
Increase Rate of GDP	1975-2001	3,3	5,4	———	-
Total Exports (Million $)	2002	35 753	7 156	20 %	2
Total Imports (Million $)	2002	51 203	6 096	12 %	6
Other Socio-Economic Indicators					
Per Capita Bank Accounts (Million-TL)	2000	939	1117	———	3
Private Car Ownership (per 10000 person)	2000	652	986	———	4
Number of Motor Vehicles (per 10000 pers.)	2000	1056	1527	———	8
Per Capita Electricity Consumption - Mws	2000	1	3	———	7

Source: Compiled from the "Socio-Economic Development Levels Report- İzmir 2003 prepared by DPT " and SIS

İzmir has had always a dynamic demographical structure proceeding over the country. According to 2000 census, the population of İzmir province is 3 370 866 with a growth rate of 2,38 whereas the province center is 2 273 388 with a growth rate of 2,46. The urbanization rate of İzmir is 81% where the country's is 65%. High levels of growth and urbanization rates are due to the socio-economic advantages and geographical attractiveness of the İzmir. This has also been the reason for the huge migration flows started after 1960s like other major cities of the Turkey. The high rates of inner migration rates such as 8.5% in 1960s and 6,5% in 1970s has decreased to 3.5% in 1980s and 2,2% in 1990s (State Institute of Statistics).

In recent years, especially with the ongoing industrial growth, the financial restructuring, industrial and tourism developments within its wider region İzmir strengthened its economic power. Additionally, advances in major transportation developments, government supports to manufacturing and trade (organized industrial districts, free trade zone, small industrial sites), increasing number of universities, growth in exports-imports and services, and new investments in tourism and housing have increased the economic power of İzmir at the national level (Kılınçkaya, 2003).

Table 8: The Comparison of GDP by Economic Sectors 2000: Turkey and İzmir

	IZMIR			TURKEY	
Kind of Activity	Value(Mil.TL)	Share	L.Q.	Value(Mil.TL)	Share
Agriculture	606484	7,2	0,54	15369000	13,9
Industry	2613904	31,1	1,12	31814000	28,8
Construction	368006	4,4	0,87	5739000	5,2
Trade	1898778	22,6	1,09	23756000	21,5
Trans. and Communication	1119448	13,3	1,03	14834000	13,4
Financial Institution	225930	2,7	1,05	2931000	2,6
Ownership of Dwelling	428764	5,1	1,03	5651000	5,1
Bussines and Personal Serv.	224893	2,7	1,21	2533000	2,3
Input. Bank S. Char.	135844	1,6	0,78	2376000	2,1
Government S.	273509	3,3	0,78	4868000	4,4
Private Non-profit Ins.	1726	0	0,06	407000	0,4
Import Duties	767956	9,1	2,08	5120000	4,6

Source: SIS, 2000 (1999 by 1987 prices)

On the other hand, Izmir's economy is mainly based on the sectors of industry, trade and services where location quotients are over one comparing with the Turkey (Table7). These sectors also constitute the great part of the gross domestic product. The share of İzmir's gross domestic product within the country is 7,5% and per capita GDP is $ 3 215 whereas the country's is $ 2 146. Apart from these, all other socio-economic indicators show that İzmir is at the high level of development against the other cities.

Much of the discussions above is also mainly constituted by the metropolitan area of İzmir. It is a fact that over the 65% of total population lives in the core city and much of the economic activities have located in the metropolitan area.

The land use pattern of İzmir metropolitan area is shown in map 1 and distribution of these usages shown in table 9. The dominant share of land use distribution belongs to residential areas and services with the rate of 27,2% whereas the public institutions including military areas come after it with the rate of 11,92. Urban activities sub-total comprises approximately half of the metropolitan area and growing through the urban fringes limited to physical thresholds.

Table 9: Land Use Distribution of İzmir Metropolitan Area 1997

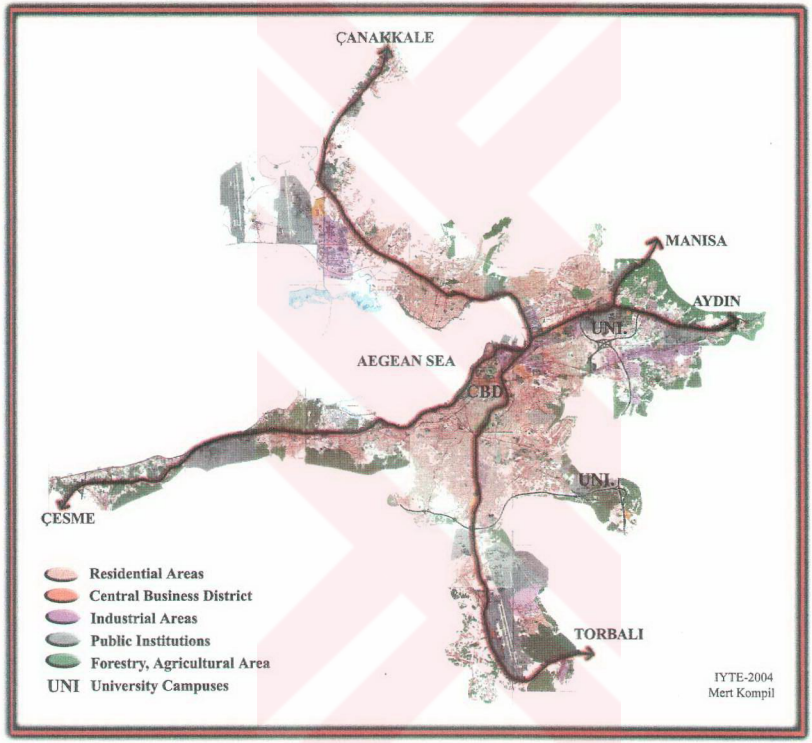
Land Use	Area (ha)	%
Residential Areas and Services	11565	27,2
CBD and Central Areas	304	0,72
Employment Areas	2791	6,57
Public Institutions	5065	11,92
Tourism Facility Areas	26	0,06
Recreation, Sports, and Green Areas	759	1,79
Transportation and Infrastructure	1768	4,16
Urban Activities Sub-total	22278	52,41
Agricultural Areas, Forestry, Unsettlable Area	20222	47,59
Total	42500	100

Source: Rearranged using the data of Greater Municipality of İzmir in Kılınçkaya (2003)

Urban growth of İzmir represents a linear pattern along the main four arterials which of two are parallel to the cost. However, especially in other two axises lying down to interiors of the city, partly a raveling out growth has been seen in recent years. There has been an increasing decentralization of main activities from the city center such as major industrial, commercial and residential activities. This also implies a decrease in the historical CBD and inner city regions leading to a polycentric development within the each metropolitan districts as the sub-centers.

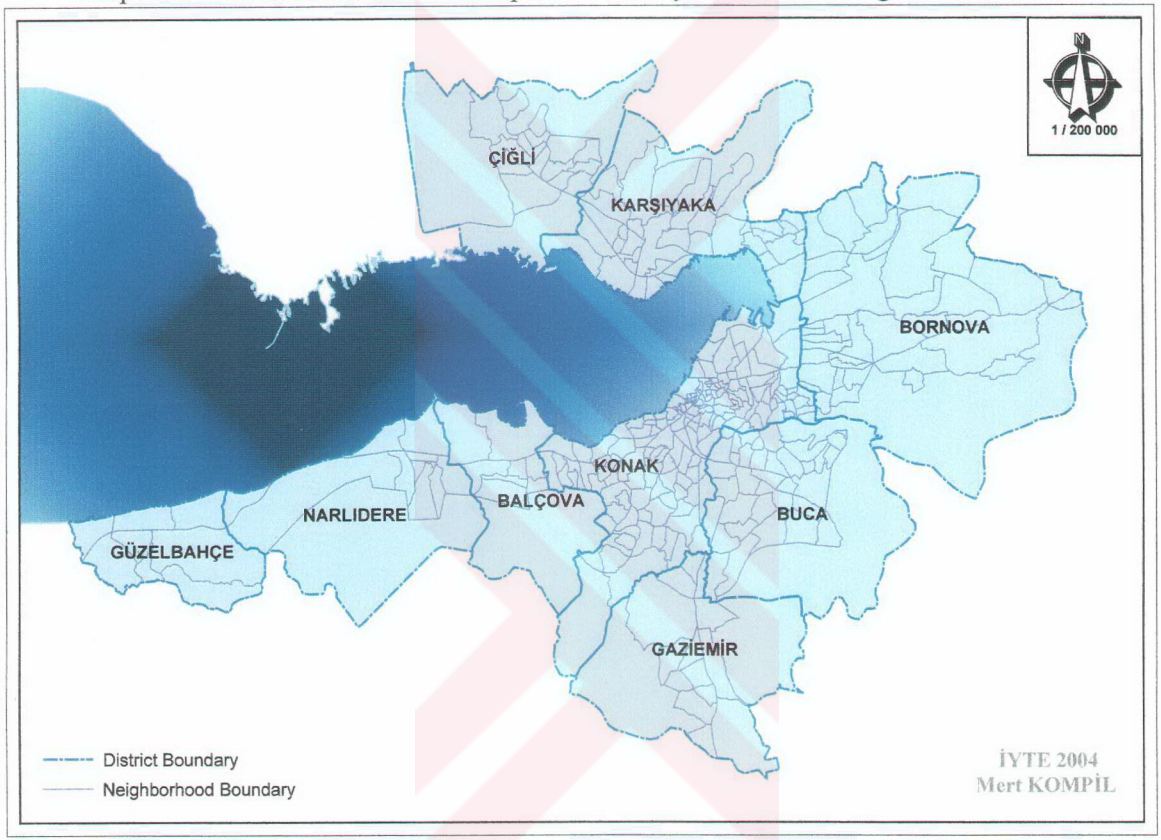
İzmir Metropolitan Area is divided into nine district municipalities, which are under the authority of the Greater Municipality: Balçova, Bornova, Buca, Çiğli, Gaziemir, Güzelbahçe, Karşıyaka, Konak and Narlıdere. These districts are altogether divided into 329 neighborhood units and shown in Map 2 s the sub-divisions of Metropolitan Area.

Map 1: The Land Use Pattern of Izmir and Main Arterial Road Axises



Source: Created based on the "City Guide 2000" prepared by Greater Municipality of İzmir

Map 2 : Sub-divisions of İzmir Metropolitan Area by District and Neighborhood Zones



In 1990, there were only four district centers including others: Konak, Buca, Bornova and Karşıyaka. During the ten-year period from 1990, the population of metropolitan area has increased approximately half a million from 1.757.414 to 2.232.265 as a consequence of the factors such as young demographic structure, migration patterns and increasing student numbers.

Accompanying with the decentralization of residential areas and some other activities, new district centers have been the scene of highest population growths (table 10). Although the population densities have not been enough to compare with older district centers yet, map 4 and 5 clearly shows this expressive growth in the outer zones of the İzmir.

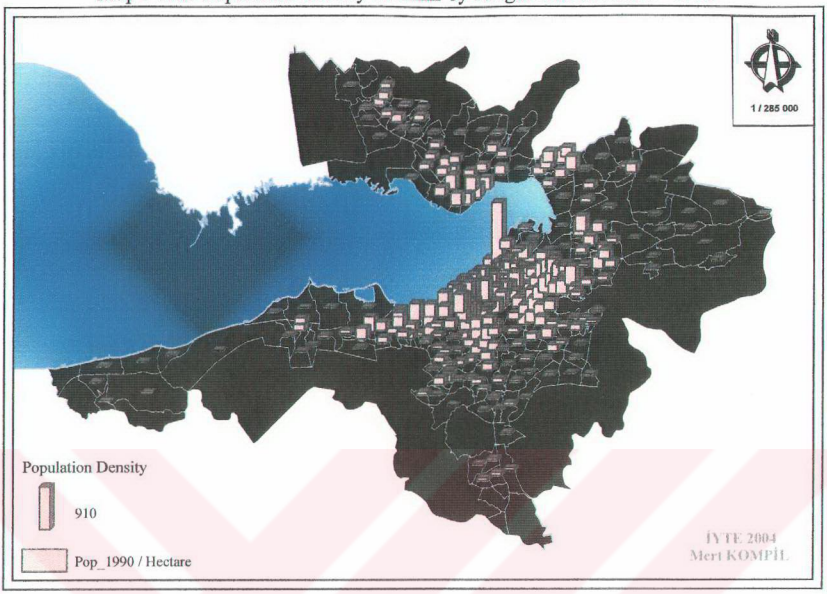
Table 10: The population distribution of İzmir by Districts

Districts	Population 2000			Annual Growth Rate (%)	Urban Population 2004*	District Area** (hectare)	Population Density* P/km^2
	Total	Urban	Rural				
Balcova	66877	66877	0	1,114	69907	2762	3185
Bornova	396770	391128	5642	3,55	449696	9090	1771
Buca	315136	308661	6475	4,382	366424	4808	2352
Çiğli	113543	106740	6803	3,749	123670	4678	1171
Gaziemir	87692	70035	17657	5,623	87166	4509	1392
Güzelbahce	18190	14924	3266	2,498	16472	2107	155
Karşıyaka	438764	438430	334	2,385	481776	4493	6648
Konak	782309	781363	946	0,811	807020	5490	11338
Narlıdere	54107	54107	0	4,4	64277	4476	859
Total	2273388	2232265	41123	2,46	2466410	42413	2662

Source: Census of Population 2000 SIS, *Calculated based on annual growth rates, ** Calculated based on own data

Finally, if the spatial distribution of population is taken into consideration (Map 4) it can be easily seen that the most concentrated zones lies along the seacoast in Konak and Karşıyaka. There is hardly any emptiness along with the coast, except for the central business districts in Konak , seaport and military areas whereas a scattered structure is seen in outer urban areas. This also explains having the highest land values of coastal zones with the earnings of dense residential and commercial activities in İzmir (Map 6).

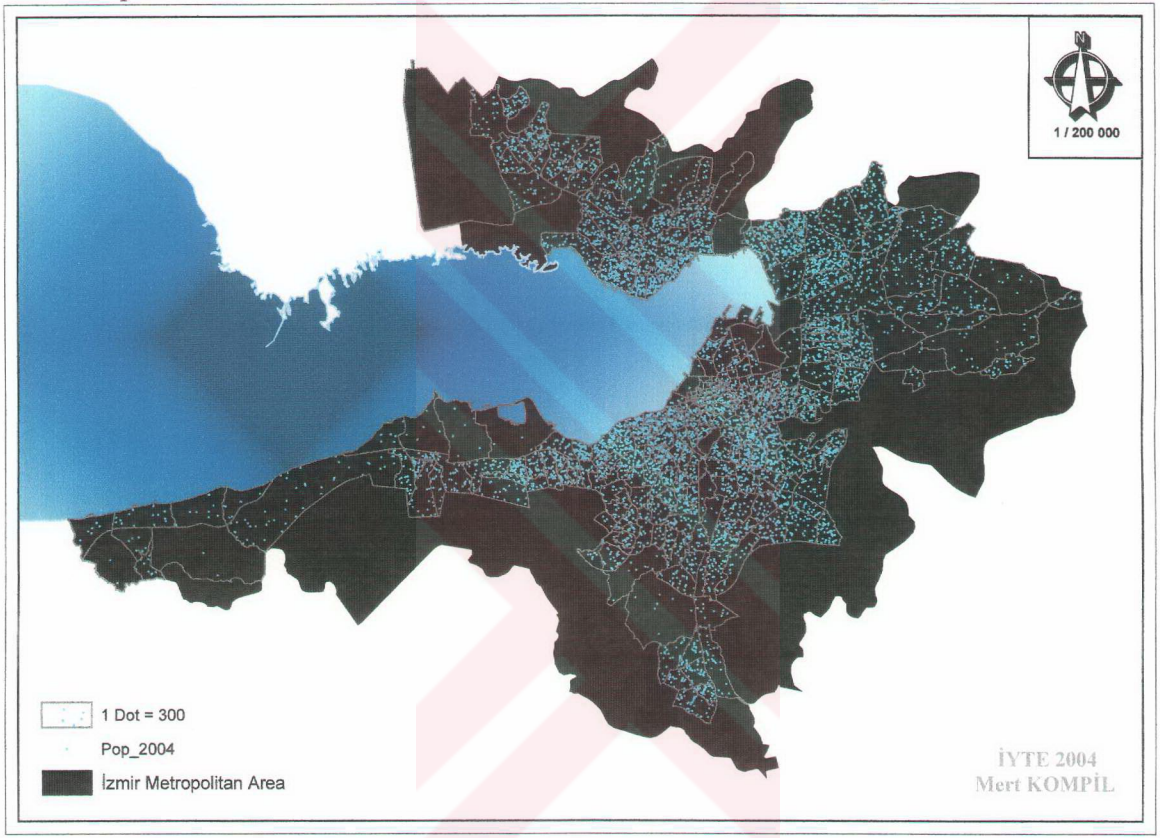
Map 3 :The Population Density of İzmir by Neighborhood Zones - 1990



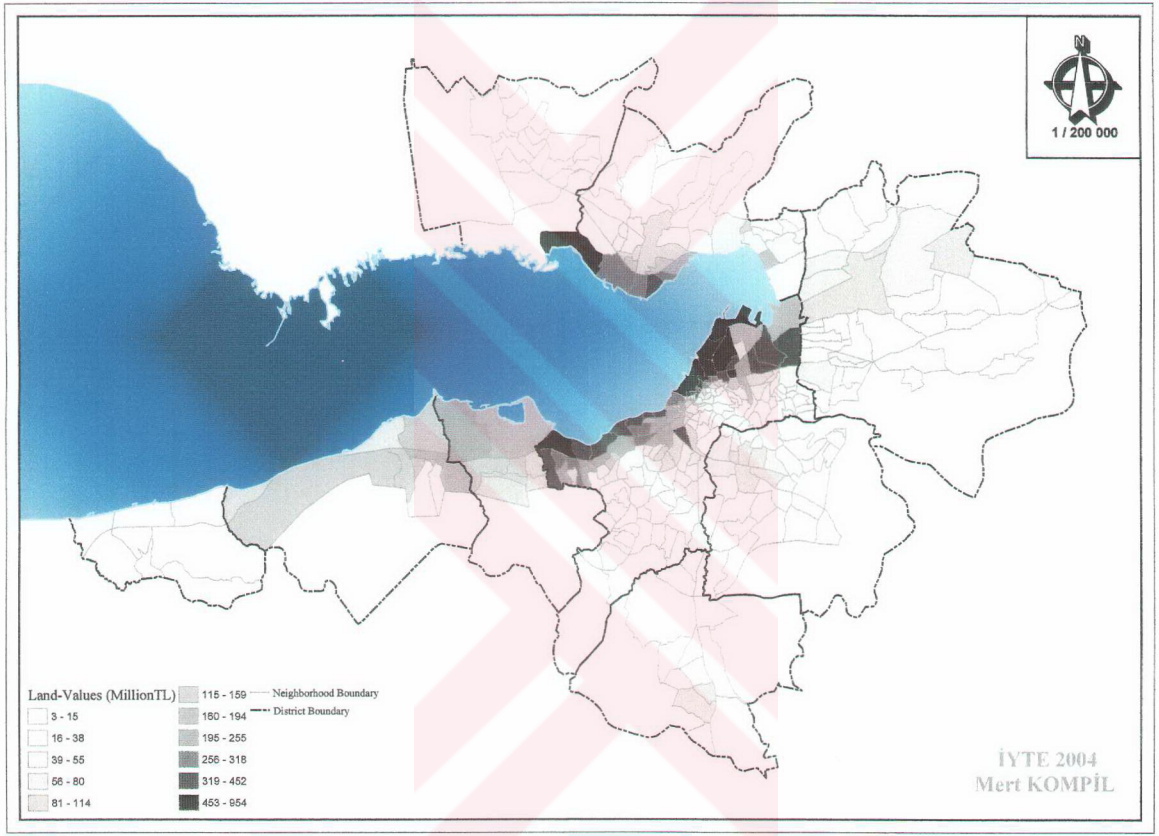
Map 4: The Population Density of İzmir by Neighborhood Zones - 2004

Note: Bar sizes are adjusted depending on their highest values to be able to be comparable visually

Map 5 : Sub-divisions of İzmir Metropolitan Area by District and Neighborhood Zones



Map 6 : Land Values of İzmir by Neighborhoods



4.2. The Retail Structure Analysis Of İzmir

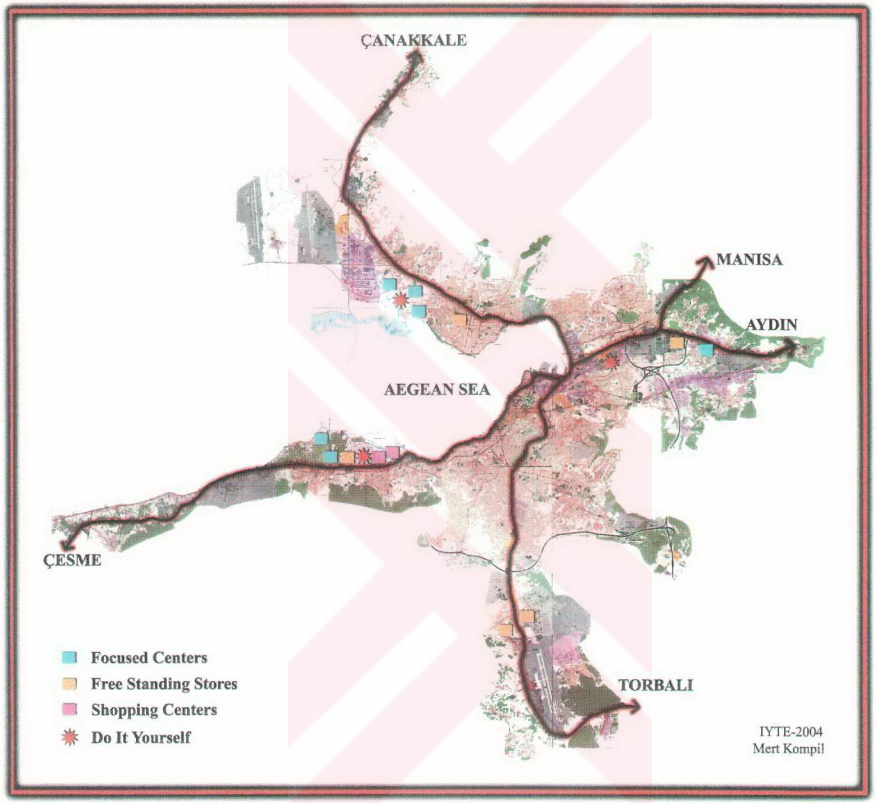
Much of the previous discussions about the retail structural changes in Turkey refers to developments in largest cities of Turkey such as, İstanbul, Ankara, İzmir, Adana etc... As being one of the major cities of Turkey, İzmir has also experienced considerable developments in the field of its retail structure.

Up to mid 1990s the retail structure of İzmir mainly consisted of the traditional small-scale retailers. The only western type retailer was Tansaş which was a semi public corporation of İzmir Municipality and serving in the form of supermarket. The mid 1990s have introduced some new large-scale retail developments due to changes in demand side factors such as increasing population, incomes and consumer profile; changes in environmental and spatial conditions such as decentralization of residential areas and other activities; and changes in supply side factors such as increasing attraction of the sector for large corporations.

The initial large-scale developments have mainly taken place on the exits of the city in the field of food retailing. Kipa in the south and Migros in the West have been the first large-scale developments in the mid 1990s. Since than, similar establishments have started to develop especially in the other main road axles of the city. The late 1990s have also introduced new retail formats such as focused centers, shopping centers, do it yourself stores.

The initial large-scale developments were the hypermarkets, which were free-standing stores, and relatively smaller (5000-10000sqm) comparing with the recent developments. The focused centers including a large hypermarket and many small shops, and regional shopping malls have become popular and established on over 20 000-25 000 sqm floorspaces than. The major tendency for location 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 7.

Map 7: Some of the Major Large-Scale Retail Developments After the Mid-1990s



Considering the restructuring process of food retailing in İzmir, most effective retail format has been the supermarkets. Starting with the local chains Tansaş and Pehlivanoglu especially in 1990s, other national chains such as BIM, Migros and Şok have entered into the market and increased as their numbers and share.

Much of the supermarket outlets serve in the type of hard-discount stores, smaller than 400 square meters. There are also several brands serving in each of the retail type. The major retail chains and their outlet numbers and types are given in table 11.

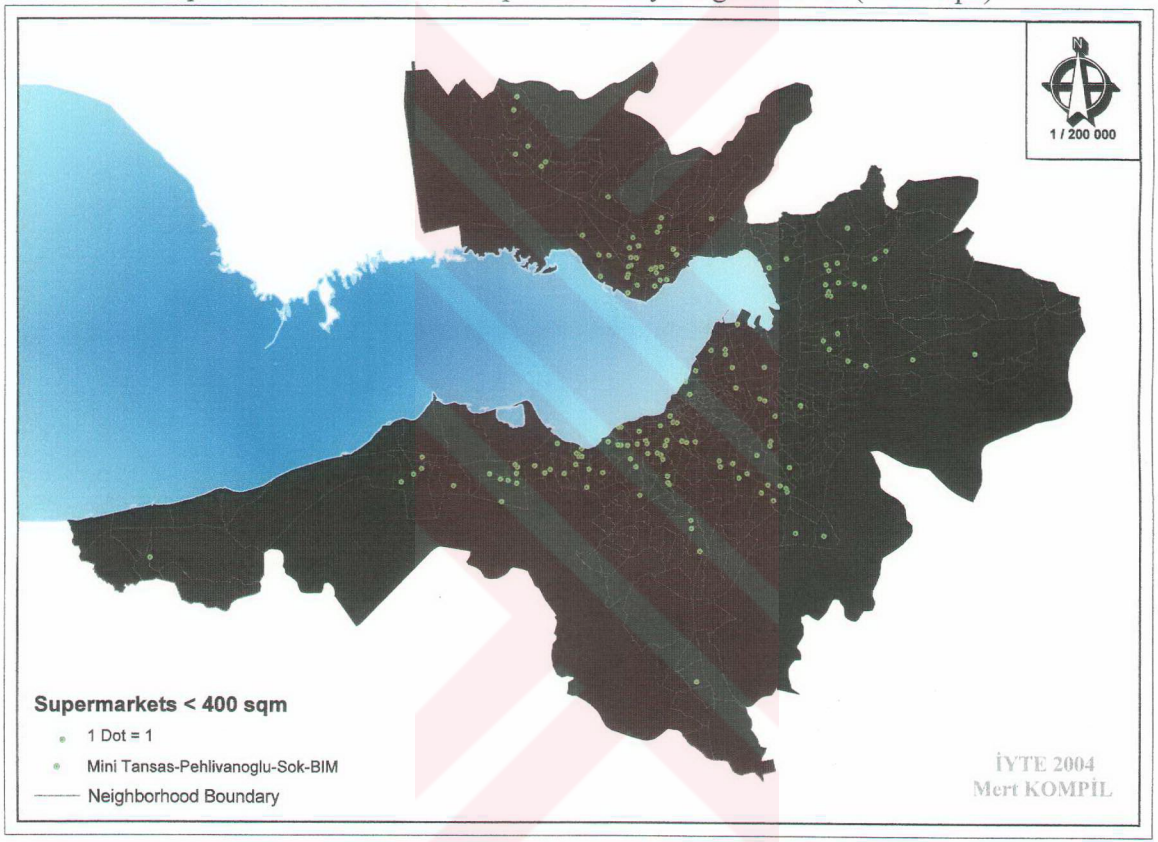
Table 11: Numbers of Retail Outlets and Sizes of Differing Retail Chains in İzmir

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

Source: Grocery list from Government of Finance and address lists of each retail changes from their web pages

If the spatial distribution of supermarkets is evaluated, they are mainly located in the main arterials, such as Mithat Paşa, İnönü, Menderes etc. streets. Moreover, 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. Considering the land value distribution (Map 6) it is seen that the supermarkets are densely located in the high valued lands. (see Map 6 and Map 8-9).

Map 8: The Distribution of Supermarkets by Neighborhoods (<400 sqm)



Map 9: The Distribution of Supermarkets by Neighborhoods (<400-2500 sqm)

The retail structure of İzmir not only consists of hypermarkets and supermarkets, but dominated by groceries and corner shops. The major advantage of neighborhood groceries is their convenience due to proximity and availability of tab purchase. However much the spatial prevalence of large-scale retailers increases, small-scale retailers have been continuing the dominance in numbers and sizes. Even their market shares have been decreasing, there are already 8231 "taxpayer" groceries;6194 of them small and 2037 of them are large.

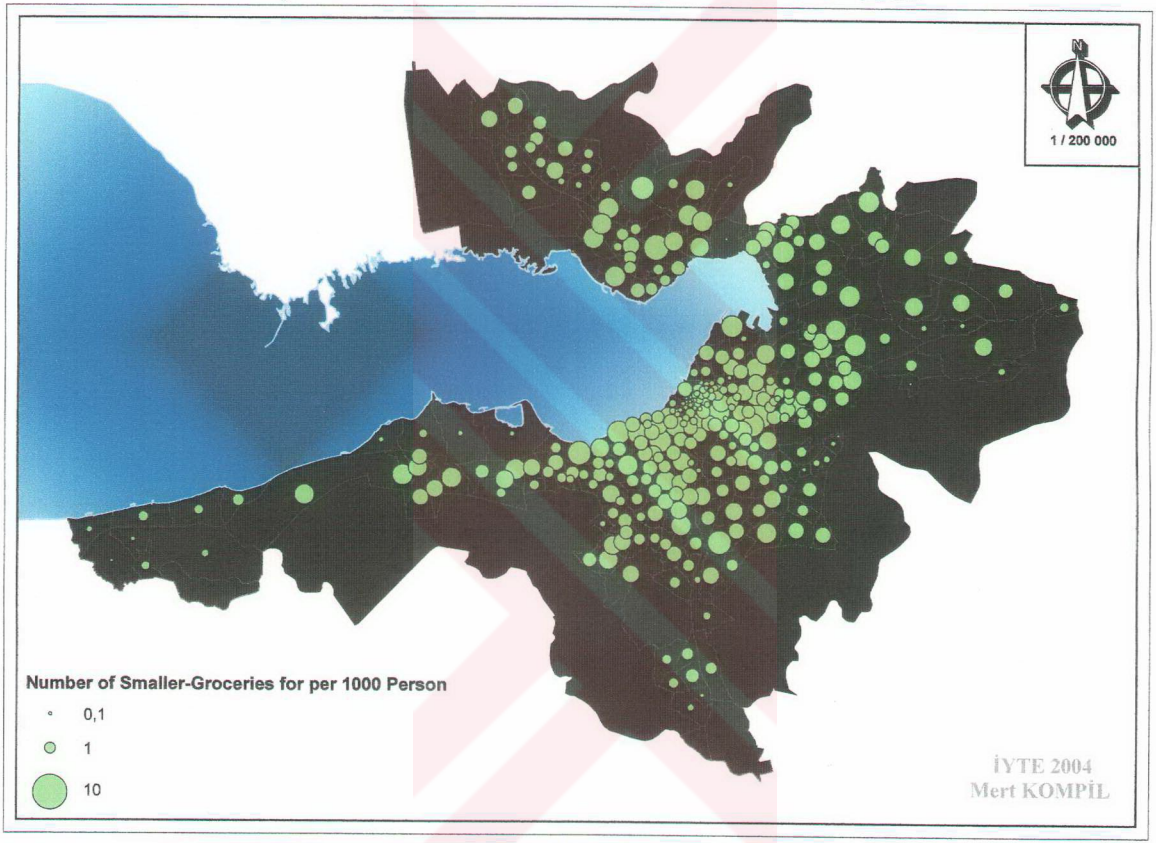
Considering the İzmir Metropolitan Area the average number of groceries per one thousand person is 3,34 (2,5 for smaller and 0,8 for larger groceries). Larger groceries known as "markets" have mainly located along traffic arterial whereas smaller groceries located inside of the residential areas. The spatial distribution of groceries have been determined from their addresses and shown in Map 10-11 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 mainly located along the sea cost and in some other highly-populated zones. On the other hand, the inner city areas and the urban fringes with low income groups have been far from these developments and served by traditional small retailers. This structure is also shown in Map 12-13 where retail outlets distributed by totals sizes.

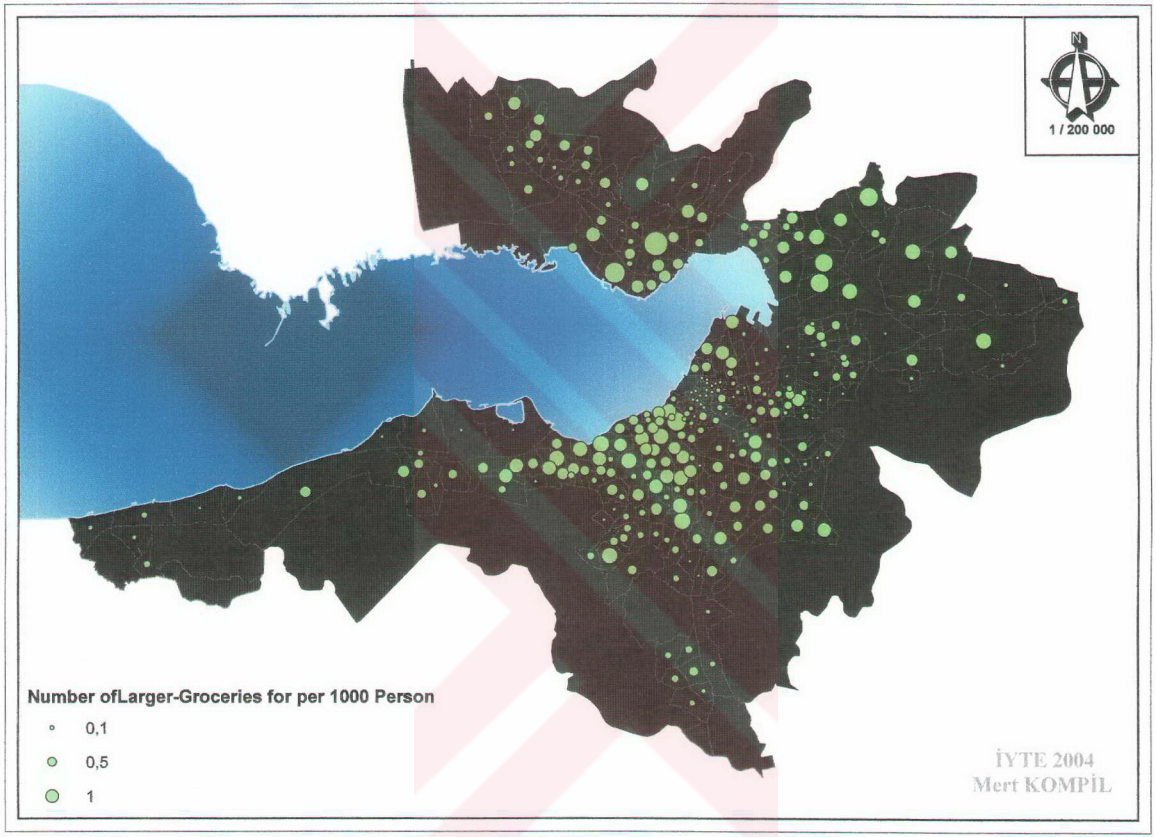
As the market shares and spatial prevalence of retail chains increase, the number of groceries has decreased. In the past two or three years period approximately two thousands of grocery was closed in whole İzmir province (according to "*the census of place of employment* (SIS, 2002)" there were 10280 groceries in 2002, and according to the Chambers of Grocers, 1043 grocery have closed in 2003 in the İzmir Province). 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.

Undoubtly, 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 environment for small-scale retailer will become difficult to survive.

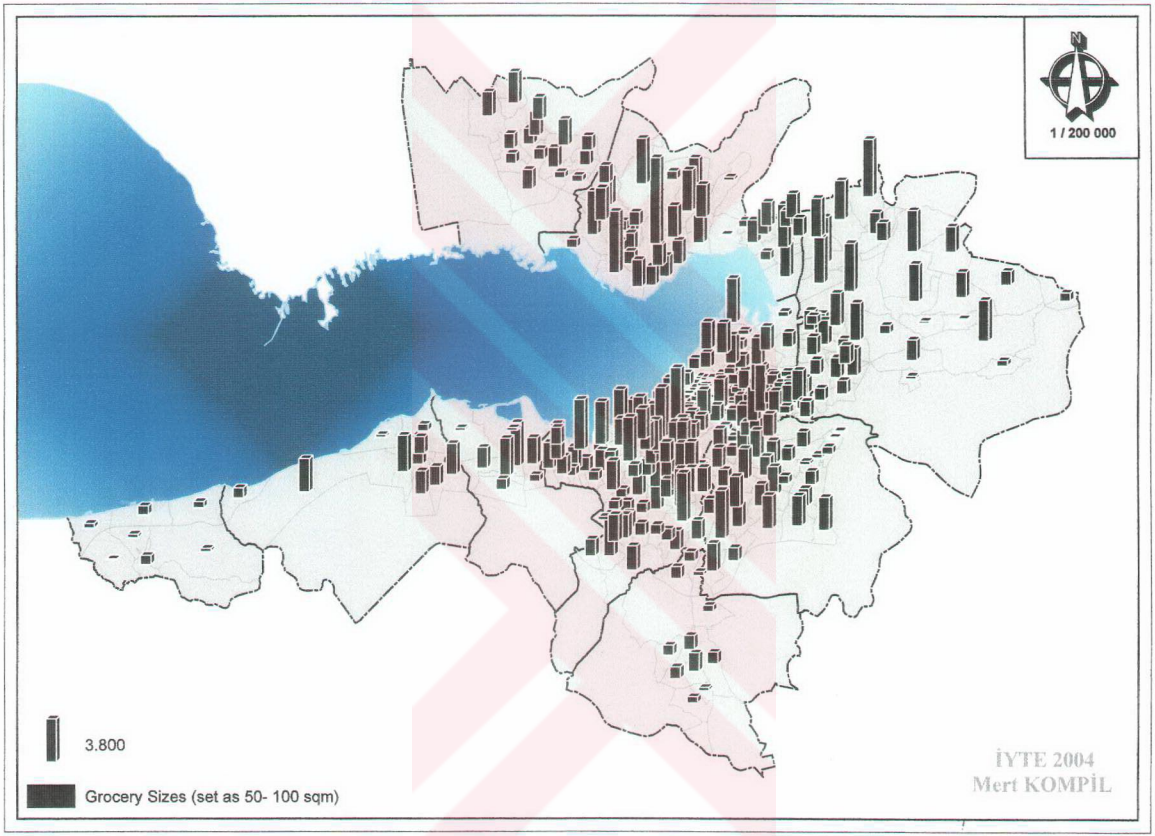
Map 10: Number of Smaller Groceries for Per 1000 Person



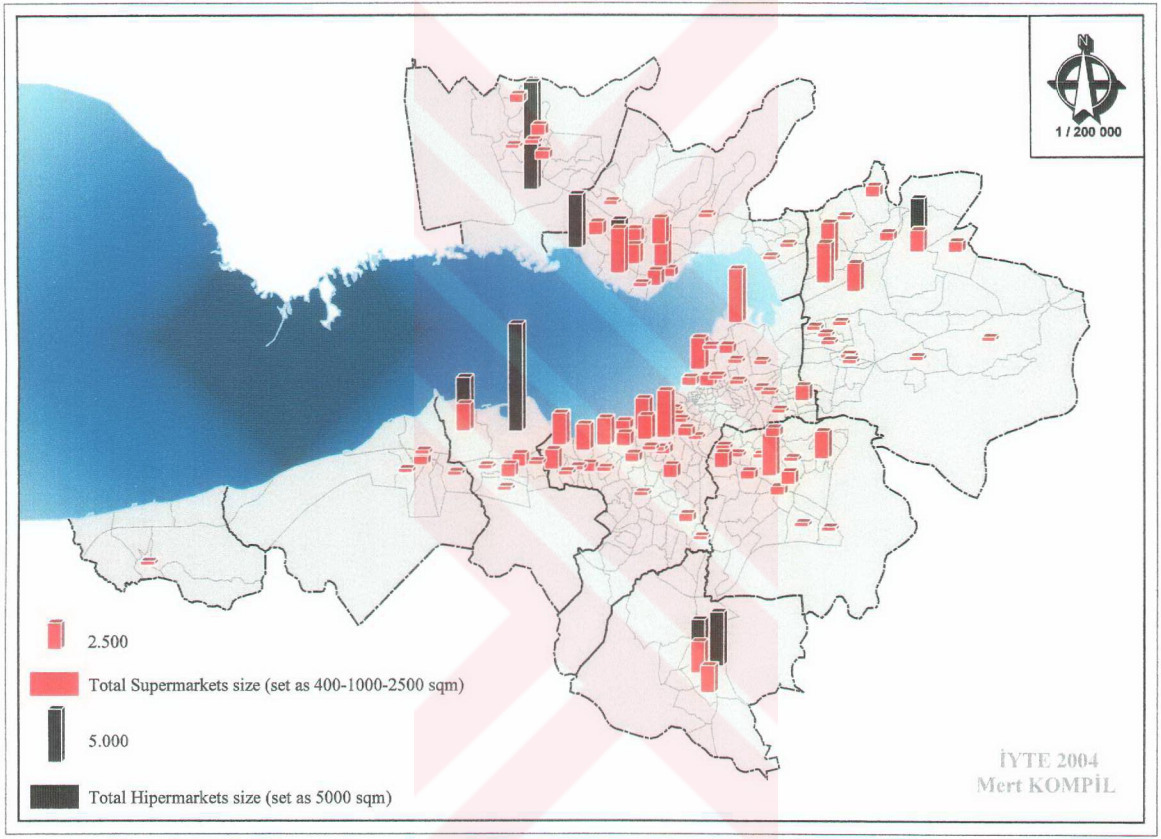
Map 11: Number of Larger-Groceries for Per 1000 Person



Map 12 : The Spatial Distribution of Groceries by Total Sizes



Map 13 : The Spatial Distribution of Supermarkets-Hipermarkets by Total Sizes



CHAPTER 5

MODELING METHODOLOGY

5.1. Dynamic Spatial Interaction Model and Some Theoretical Issues

Most of the existing urban models do not pay the enough attention to the temporal scales of urban change. In general, models are built to represent structures at one point in time, then the future impacts of an event can be seen by changing model parameters. These types of models are called static models. If a model has an explicit time dimension, its inputs and outputs vary over time and its states depend on its earlier states, these models are called dynamic models (Wegener et al., 1986). The most prominent static urban models are the spatial interaction models. It doesn't matter if it is used as a transport or a location model, it predicts the flows at a particular point in a time.

In the mid 1970s, there were a number of criticisms about static models. The efforts to attain fully dynamic models considering time scale of urban change have provided affirmative results than. Mainly, the theoretical arguments used in the development of dynamic spatial interaction model were drawn from experiments undertaken on the retail interaction model (see formulas 3.33 and 3.34 in chapter 3) by Harris and Wilson (1978). Harris and Wilson introduced a dynamic mechanism to the model structure. Utilizing a retail interaction model, they demonstrate the potential for size discontinuities or catastrophes within a retail system.

The basic idea of the model is simple: it starts from the production-constrained shopping trip model of the Lakshmanan-Hansan (1965) type and interprets its column sum. Depending on their sign as unsatisfied demand or excess supply model derives the growth or decline of retail facilities (Beaumont, Clarke and Wilson, 1981; cited in Wegener et al., 1986).

Let assume that the profit, Π, earned by retail outlet j is given by:

$$\Pi_j = D_j - C_j \tag{5.1}$$

where D_j is the revenue earned at location j and C_j the costs incurred by the outlet. The revenue is modeled using the production-constrained model of the Huff (1964) and Lakshmanan and Hansan (1965). This is given by

$$S_{ij} = \frac{e_i p_i W_j^{\alpha} f(-\beta c_{ij})}{\sum_j W_j^{\alpha} f(-\beta c_{ij})} \tag{5.2}$$

where S_{ij} is the flow of expenditures from residential zone i to outlet j; e_i is the per capita expenditure of residents of i; p_i is the population of zone i; W_j is the size of retail outlet j, c_{ij} is a measure of physical separation usually measured by travel distance or travel cost between i and j; and α and β are parameters representing consumer preferences towards larger and nearer stores. Total revenue of the outlet j is than found by summing across all origins, and cost is taken by a linear function of outlet size where k is costs of retail services,

$$D_j = \sum_i S_{ij} \tag{5.3}$$

$$C_j = kW_j \tag{5.4}$$

If normal profits are included in retailers costs, the market will ensure that the $\prod_j$s are competed to zero, than equation 5.8 is hold,

so: $$D_j - C_j = 0 \implies D_j = C_j \tag{5.5}$$

$$\sum_i S_{ij} = kW_j \tag{5.6}$$

$$\sum_i \frac{e_i p_i W_j^{\alpha} f(-\beta c_{ij})}{\sum_j W_j^{\alpha} f(-\beta c_{ij})} = kW_j \tag{5.7}$$

and the final model which gives the changes in retail size become,

$$\Delta W_j = \frac{e_i p_i W_j^{\alpha} f(-\beta c_{ij})}{\sum_j W_j^{\alpha} f(-\beta c_{ij})} - kW_j \tag{5.8}$$

If profits are positive, $\Delta W_j>0$, an outlet expands and when negative, $\Delta Wj<0$, it declines. Such an equilibrium outlet size can be reached when profits are zero, $\Delta W_j=0$. This procedure also continues iteratively until the solutions reach stability and no further growth or decline takes place unless further change is introduced to model's variables or parameters. The number of iterations to reach such a solution also provides knowledge about the time period between existing structure and the model produced structure.

Empirical testing of these types of models is also problematic because of the difficulties of assembling appropriate time series data. The absence of time series data brings difficulties to have certain knowledge about real the time periods passes through each iterations. So, as Clarke and Wilson (1983, cited in Clarke et al., 1998, p.159) identify, "much of the theoretical work can only be carried out adequately in the context of more effective empirical work".

The most obvious example of applied use was the presentation of future trajectories of various urban structures given key changes in model parameters. These numerical experiments took the theoretical work forward with demonstrating the possibility of rapid structural change from one kind of equilibrium solution to another at critical parameter values of variables. This is known as the bifurcation or catastrophe theory with works of Clarke&Wilson, 1986; Fotheringham&Knudsen, 1986; Wilson, 1981; Wilson & Clarke, 1979. The work than extended to use in other subsystems of urban structure such as industrial location (Birkin&Wilson, 1986), agricultural location (Wilson&Birkin, 1987) and housing (Clarke&Wilson, 1983). Finally in a series of papers, Fotheringham (1985); Fotheringham and Knudsen (1984, 1985, 1986) extended the framework through the Fotheringham's (1983,1984) competing destinations (Clarke et al., 1998,p.159-160; Munroe, 2001, p.359).

The attempts to apply the model to real data are also limited. However, it is possible to mention about three major studies. Lombardo and Rabino showed that it was possible to pick up the process of decentralization of housing and services in Rome between 1971 and 1981. Fortheringham and Knudsen (1986) also explored the model for retail grocery data obtained in Gainsville, FL (Clarke et al., 1998). And Clarke, Langley and Cardwell (1998) showed that it could be possible to reproduce known structures or previous structures of retail systems, and to analyze changes in retail structure in Leeds.

5.2. The Empirical Model

5.2.1. The Purpose of the model

The arrival of the new retail formats such as supermarkets and hypermarkets has been profound effects on the ability of many small-scale food retailers to survive. The increasing competition has led to a changing retail structure with the dominance of large- scale retailers where the number of small-scale retailers and their total size are decreasing.

As the study explores the possible spatial consequences and future trajectories of this transition process, the aim of the 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 in Izmir.*

5.2.2. Geographical Representation - Model Variables and Parameters

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, required a zone system established in this way.

For the purpose, both the origins and destinations of the model are represented in the 326 neighborhood centers of İzmir. There are also 329 neighborhoods in İzmir introduced in the previous chapter, however there are no inhabitants or retail outlets in three of them. So both the origins and destinations data is constituted in the base of 326 neighborhood divisions.

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):

- Flows between an origin and destination will be proportional to the relative attractiveness of that destination
- Flows between an origin and destination will be proportional to the relative accessibility of that destination

With this respect, the demand side variables, monthly grocery expenditures of households $\mathbf{E_i}$, and populations of neighborhood zones $\mathbf{P_i}$, are determined which give the total grocery expenditures of each zone.

The supply element of the spatial interaction models represents by the attractiveness of retail destinations. Since the model intends to measure the changes in retail outlet sizes, the attractiveness term of the model is retail outlets' net floor space, $\mathbf{W_j}$. 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 (see the size details in data chapter).

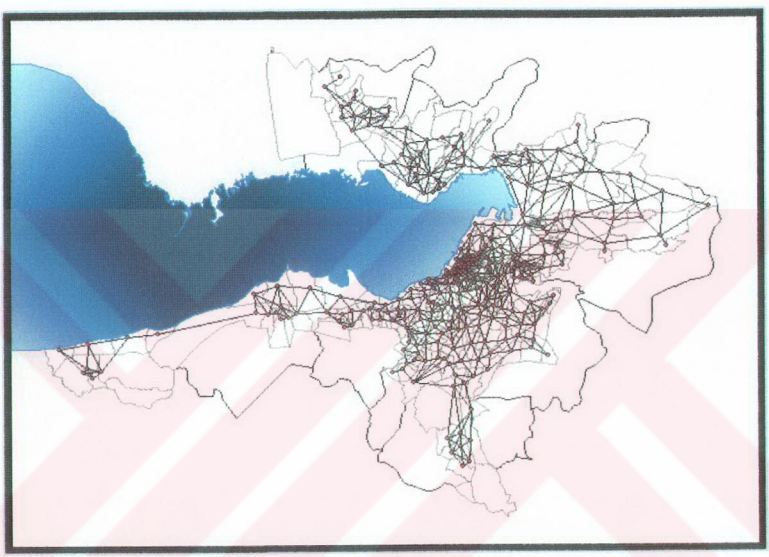
Apart from the usage of outlet sizes to measure the attractiveness of retail destinations, a price term $\mathbf{p_j}$ added to the model. It is the reason that small-scale retailers have a disadvantage position in terms of high prices, comparing with the large-scale retailers. Considering the economies of scale in both buying and selling, supermarkets and hypermarkets 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_js and p_js. 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 $\mathbf{d_{ij}}$ is used to measure the physical separation.

Since the absence of digital road maps, a hypothetical road network connecting zone centroids (figure14) established between neighborhood zones, then the shortest path between each zone is measured using the Arview Network Analyst software.

Figure 14 : The Hypothetical Road Network Between Neighborhood Centers



All the variables in the model have introduced without their parameters and the functional forms. It is mentioned in chapter 3, the W_js are generally best represented as power functions, however for the exact form of the separation function two forms dominate the literature. These are the power and exponential function.

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 determined for the price variable p_j, and included in the model explicitly.

5.2.3. The Functional Form of The 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,

$$S_{ij}^{h} = A_i^{h} E_i P_i W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h} \tag{5.9}$$

where

$$A_i^{h} = 1 / \sum_{jh} W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h} \tag{5.10}$$

to ensure that

$$\sum_{jh} S_{ij}^{h} = E_i P_i \tag{5.11}$$

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

$$\frac{A_i^{h} E_i P_i W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h}}{\sum_{jh} W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h}} = k_j^{h} W_j \tag{5.12}$$

Than any changes in the size of retail outlet j can be find as,

$$\Delta W_j^{h} = \frac{A_i^{h} E_i P_i W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h}}{\sum_{jh} W_j^{\alpha h} p_i^{h} (d_{ij})^{-\beta h}} - k_j^{h} W_j \tag{5.13}$$

CHAPTER 6

DATA SOURCES and PROCESSING

In Turkey, to obtain any required data related to spatial references is also problematic as in other developing countries. It is not possible to find the whole required data in terms of any sub-divisions. 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. Following sections describe these main data sources and the main assumption under the evaluation procedure.

6.1. Demand Side Variables

The database for demand side variables includes, 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 the vector of expenditures, *the survey of consumption expenditures of households* is used. The survey includes the results of İzmir province center in 1994 and prepared by the State Institute of Statistics. Due to the surveys after 1994 are not reported in the base of province centers, recent information on household expenditures could not be used.

Since the results of survey based on five different income groups in İzmir, to draw the grocery expenditures of each neighborhood is a problem. In order to solve this problem an assumption, "income levels can be represented with the levels of land values", is preferred. For this, *land values of İzmir*, which has prepared by the National Real Estate Administration in 2002 is used.

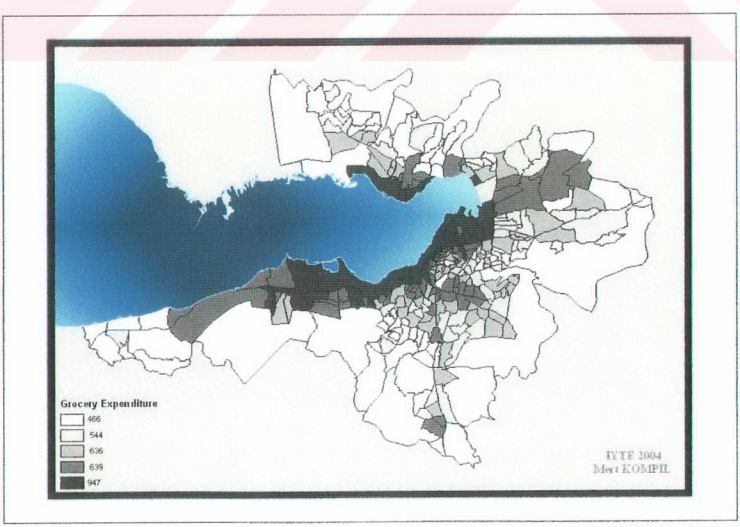
First of all, the average land values of each neighborhood are calculated, than the 1990 populations and the land values of neighborhoods are matched with the five income levels' population of 1994. So, five levels of income groups are spatially distributed. Since the per capita expenditures of income levels are known, the 1994 values are calculated for 2004 neighborhood populations. The five levels value of per capita expenditures is shown in table 12 , and its spatial distribution by neighborhood divisions is shown in figure 15.

Table 12 : Number of Households and Consumption Expenditures of İzmir by Quintiles Ordered by Consumption Expenditures

Quintiles Ordered by Consumption Expenditures	Number of Households	Number of Households Members	Total Consumption Expenditures	Grocery Expenditures	Total Consumption Expenditures*	Grocery Expenditures*
First %20	99278	325438	416936000	188331000	1032	466
Second %20	99278	372511	641893000	268909000	1298	544
Third %20	99278	376116	859085000	320407000	1706	636
Fourth %20	99278	412248	1168514000	376349000	1985	639
Fifth %20	99278	416477	2641819000	448491000	5578	947

Source: "the survey of consumption expenditures of households 1994", SIS (with 1994 prices in thsounds)
*Own calculations based on the above data and 2004 populations

Figure 15: Per Capita Grocery Expenditure by Neighborhood Divisions



To obtain the present distribution of the population is also a problematic. The nearest population data by neighborhood divisions belongs to year 1990, and the results of 2000 population census are yet to come.

It is not reasonable to use the 1990 population data due to the many new developments in urban area after 1990s. Therefore, the *number of electors by neighborhoods* (March 2004) is collected from the each Districts Election Commissions to provide closest knowledge for the spatial distribution of the today's population. Further, for more accuracy the 2000 populations of districts have projected to date according to their annual growth rates (see in table 13), and distributed neighborhood divisions according to number of electors.

Table 13 : The Population Distributions and Growth Rates

Districts	Urban Populations 2000	Annual Growth Rate (%)	Urban Population 2004
Balcova	66877	1,114	69907
Bornova	391128	3,55	449696
Buca	308661	4,382	366424
Çiğli	106740	3,749	123670
Gaziemir	70035	5,623	87166
Güzelbahce	14924	2,498	16472
Karşıyaka	438430	2,385	481776
Konak	781363	0,811	807020
Narlıdere	54107	4,4	64277
Total	2232265	2,46	2466410

Source: Census of Population 2000 SIS, *Calculated based on annual growth rates,

6.2. Supply Side Variables

The only variable of 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 November 2003. 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 prepared by Greater Municipality of İzmir: *City Guide of İzmir 1.0*

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 (see addresses in references). There are also several local supermarkets serving in İzmir, but it is very difficult to obtain information about their numbers and locations. However, the list of groceries includes a category of larger-grocery and supermarkets, so there is no objection to represent local supermarkets in the category of larger groceries. Moreover, all hypermarkets represented in the model as the third retail category, and their location information has drawn in the same way of supermarket chains.

Having known the number of retail outlets in each zone, the next term is to produce the total retail floorspaces of the zones differing according to the retail type. In order to hold total sizes for each category, the maximum size values of the category is determined. The main categories of retailers, their numbers, sizes and overall market shares represented in the model is shown in the table 14 .

Table 14 : Numbers, Sizes, and Market Shares of Differing Retail Types

Type of Retail Outlets and Store Brands	Number of Retail Outlets	Determined Net Outlet Sizes (sqm)	Overall Market Shares (%)*
Groceries	**8231**		**52.5**
Small- Groceries	*6194*	**50**	
Larger-Groceries	*2037*	**100**	
Supermarkets	**183**		**32.5**
Small Supermarkets	**151**	**400**	
Mini Tansas	48		
Pehlivanoğlu	26		
BIM	47		
Sok	30		
Medium Supermarkets	**17**	**1000**	
Midi Tansas	12		
Migros M	5		
Large Supermarkets	**15**	**2500**	
Maxi Tansas	10		
Migros MM	5		
Hypermarkets	**10**	**5000**	**15.5**
Kipa	4		
Migros MMM	3		
Özdilek	1		
Metro	1		
Carrefoursa	1		

*Projected according to AC Nielsen data, see details in Results chapter

The overall market shares of different retail formats are used for to produce existing retail patterns in İzmir. The values shown above belong to 2004 year and projected from data of the Company of AC Nilsen according to retail trends during 1996-2001.

It would be proper to state the data sources of spatial references besides the data of demand side and supply side variables. The latest boundaries of neighborhoods and districts is given from the Greater Municipality of İzmir . All the locations of retail outlets have set from the İzmir City Guide 1.0, which prepared by the Greater Municipality, according to street numbers and addresses. Moreover, all the zones have created using the software Autocad and transferred to ArcMap to create the final maps with classified data.

Finally after having described the data both for the demand side variables and the supply side variables briefly, the final vectors of the variables are shown in table 15 as the model inputs.

Table 15 : Vectors of the Demand Side and Supply Side Variables

No	District Name	Neighborhood Name	Per Capta Grocery Expend. (E_i)	Population 2004 (P_i)	Total Groceries sqm (W_j^1)	Total Supermarkets sqm (W_j^2)	Total Hipermarkets sqm (W_j^3)
1	Balcova	Bahcelerarasi	947	825	165		10000
2	Balcova	Cetin Emec	639	6650	375		
3	Balcova	Egitim	639	11618	1545	400	
4	Balcova	Fevzi Cakmak	639	11708	2250	1200	
5	Balcova	Inciralti	947	2077	165	2500	5000
6	Balcova	Koruturk	947	12101	1245	400	
7	Balcova	Onur	639	17493	2565	1200	
8	Balcova	Teleferik	639	7435	645	400	
9	Bornova	Ataturk	544	19590	2295	400	
10	Bornova	Barbaros	544	10326	1335	400	
11	Bornova	Birlik	636	7987	1050	400	
12	Bornova	Camkule	466	5770	675		
13	Bornova	Cinar	544	6775	480		
14	Bornova	Doganlar	636	13044	1440		
15	Bornova	Egemenlik-Isikkent	636	2551	1245	400	
16	Bornova	Ergene	639	13111	1035	800	
17	Bornova	Erzene	639	27488	2490	2000	5000
18	Bornova	Evka 3	639	14635	1545	1000	
19	Bornova	Gaziosmanpasa	544	14440	1350	400	
20	Bornova	Gurpinar	466	7321	330		
21	Bornova	Inonu	544	26599	3480	1000	
22	Bornova	Isiklar	466	2879	180		
23	Bornova	Karacaoglan	636	4776	465		
24	Bornova	Kazim Dirik	639	40402	2835	2600	
25	Bornova	Kemalpasa	544	8533	2445	400	
26	Bornova	Kizilay	544	14491	1200		
27	Bornova	Kosukavak	636	7790	1080	400	
28	Bornova	Manavkuyu	639	37176	2820	3700	
29	Bornova	Mansuroglu	639	28089	2850	3700	
30	Bornova	Meric	636	9291	825		
31	Bornova	Merkez-Altindag	466	5733	735		
32	Bornova	Mevlana	466	10904	2205		
33	Bornova	Naldoken	466	5156	780		
34	Bornova	Osmangazi	636	21876	2340		
35	Bornova	Rafetpasa	544	17360	1815	400	
36	Bornova	Serintepe	544	9190	1140		
37	Bornova	Tuna	544	8276	990		
38	Bornova	Umit	544	2991	90		
39	Bornova	Yesilcam	466	3104	495		
40	Bornova	Yesilova	544	20346	2115		
41	Bornova	Yildirim Beyazit	544	8125	1200	400	
42	Bornova	Yunus Emre	544	1554	120		
43	Bornova	Zafer	544	12016	1515		
44	Buca	Adatepe	544	8146	750		
45	Buca	Akincilar	636	9738	960		
46	Buca	Ataturk	636	9101	1020		
47	Buca	Aydogdu	636	1698	30		
48	Buca	Baris	639	17665	1605	400	
49	Buca	Cagdas	636	10534	450		

50	Buca	Caldiran	636	5526	300		
51	Buca	Camlik	636	10081	765		
52	Buca	Camlikule	544	18735	1875		
53	Buca	Dicle	636	5527	1530		
54	Buca	Dumlupinar	636	4260	450	1200	
55	Buca	Efeler	639	17822	1785	800	
56	Buca	Firat	544	11569	1785		
57	Buca	Gaziler	636	4867	210		
58	Buca	Goksu	544	19253	2730		
59	Buca	Guven	639	6041	585	400	
60	Buca	Hurriyet	639	12022	1110	400	
61	Buca	Inkilap	639	9381	1170	1400	
62	Buca	Inonu	636	12711	1620		
63	Buca	Karanfil	636	5757	225	2500	
64	Buca	Kozagac	636	14518	1590	800	
65	Buca	Kurucesme	636	15130	1980	400	
66	Buca	Laleli	639	6669	315		
67	Buca	Menderes	639	14520	1290		
68	Buca	Murathan	636	5698	90		
69	Buca	Mustafa Kemal	544	8975	750		
70	Buca	Seyhan	544	2782	825		
71	Buca	Sirinkapi	636	10867	930		
72	Buca	Ufuk	544	17771	1215	800	
73	Buca	Vali Rahmi Bey	639	10639	1140	3900	
74	Buca	Yaylacik-Bahcekapi	544	9842	750	400	
75	Buca	Yenigun	636	10178	1290		
76	Buca	Yesilbaglar	544	10770	1350		
77	Buca	Yigitler	639	15313	1320		
78	Buca	Yildiz	636	12320	1785	400	
79	Cigli	Ahmet T. Kislali	466	9936	855		
80	Cigli	Aydinlikevler	636	4314	375		
81	Cigli	Balatcik	466	7497	1350		
82	Cigli	Cagdas	544	7515	945	400	
83	Cigli	Egekent	466	11894	1470	1000	
84	Cigli	Evka 2	466	5753	900		
85	Cigli	Evka 5	544	11892	1860	800	
86	Cigli	Guzeltepe	466	9536	1530		
87	Cigli	Istasyonalti	636	8587	1155		10000
88	Cigli	Izkent	466	8157	1320		
89	Cigli	Koyici	544	5180	630	800	
90	Cigli	Kucukcigli	466	14166	885	400	
91	Cigli	Maltepe	636	3202	375		
92	Cigli	Sirintepe	466	9312	1080		
93	Cigli	Yeni	544	6730	585		
94	Gaziemir	Aktepe	466	8445	690		
95	Gaziemir	Atif Bey	636	9590	1095	2900	5000
96	Gaziemir	Beyazevler	636	4283	360		
97	Gaziemir	Binbasi Resat Bey	466	2993	225		
98	Gaziemir	Dokuz Eylul	544	8991	675		5000
99	Gaziemir	Emrez	466	5977	525		
100	Gaziemir	Gazi	544	7523	825		
101	Gaziemir	Gazikent	639	12312	210	2500	
102	Gaziemir	Irmak	466	6646	600		
103	Gaziemir	Sevgi	639	11427	375		
104	Gaziemir	Yesil	544	6734	705		
105	Guzelbahce	Ataturk	466	3296	540	400	
106	Guzelbahce	Celebi	544	1878	210		
107	Guzelbahce	Kahramandere	466	743	30		
108	Guzelbahce	Maltepe	466	2844	345		
109	Guzelbahce	Siteler-Camlicay	466	1956	270		
110	Guzelbahce	Yaka	466	463	180		

111	Guzelbahce	Yali	466	5291	525		
112	Karsiyaka	75. Yil	639	1436	450		
113	Karsiyaka	Adalet	544	12015	1980		
114	Karsiyaka	Aksoy	947	16091	1635	400	
115	Karsiyaka	Alaybey	947	7869	1290	800	
116	Karsiyaka	Alparslan	544	8483	1470		
117	Karsiyaka	Bahariye	639	15945	1335	3700	
118	Karsiyaka	Bayrakli	947	6651	510	400	
119	Karsiyaka	Bostanli	947	41342	3765	4100	5000
120	Karsiyaka	Cay	544	6533	1095		
121	Karsiyaka	Cengizhan	466	11577	1350		
122	Karsiyaka	Cicek	636	23965	2475	400	
123	Karsiyaka	Cumhuriyet	544	16089	1515	400	
124	Karsiyaka	Dedebasi	636	12080	1095	1200	
125	Karsiyaka	Demirkopru	636	4085	240		
126	Karsiyaka	Dogancay	466	1545	195		
127	Karsiyaka	Donanmaci	947	13888	1155	1400	
128	Karsiyaka	Emek	466	12927	1830		
129	Karsiyaka	Fikri Altay	636	4731	525		
130	Karsiyaka	Fuat Edip Baksi	636	11911	1305		
131	Karsiyaka	Goncalar	639	7787	1260	800	
132	Karsiyaka	Gumuspala	466	15212	1560		
133	Karsiyaka	Imbatli	466	5225	810		
134	Karsiyaka	M. Erener	466	6481	915		
135	Karsiyaka	Mavisehir	947	17647	555		5000
136	Karsiyaka	Nergis	947	9044	705	1800	
137	Karsiyaka	Onur	466	12316	1530		
138	Karsiyaka	Org. Nafiz Gurman	466	13963	1875	400	
139	Karsiyaka	Ornekkoy	466	23554	2640		
140	Karsiyaka	Postacilar	544	6060	480		
141	Karsiyaka	R. Sevket Ince	466	11861	1455		
142	Karsiyaka	Semikler	636	16828	1830		
143	Karsiyaka	Sogukkuyu	639	47346	5220	2400	
144	Karsiyaka	Tersane	947	17756	1410		
145	Karsiyaka	Turan	639	309	30		
146	Karsiyaka	Yali	636	18754	2565	1200	
147	Karsiyaka	Yamac	466	6934	1080		
148	Karsiyaka	Yamanlar	466	15539	2415		
149	Konak	1. Kadriye	636	6648	1530		
150	Konak	19 Mayis	636	3557	900		
151	Konak	2. Kadriye	636	6301	900		
152	Konak	26 Agustos	544	3253	660		
153	Konak	A. Fuat Cebesoy	636	4976	1320	400	
154	Konak	A. Fuat Erden	466	1853	195		
155	Konak	Abdi Ipekci	466	3705	555		
156	Konak	Adnan Suvari	947	3089	495		
157	Konak	Akarcali	639	4228	360		
158	Konak	Akdeniz	947	182	660	2900	
159	Konak	Akin Simav	947	5666	720		
160	Konak	Akinci	947	846	90	400	
161	Konak	Alireis	636	3040	315		
162	Konak	Alsancak	947	6792	2535	4900	
163	Konak	Altay	636	1581	120		
164	Konak	Altinordu	639	955	195		
165	Konak	Altintas	947	7105	900	400	
166	Konak	Anadolu	466	2675	960		
167	Konak	Arap Hasan	947	11654	1875	2200	
168	Konak	Asik Veysel	636	2507	1350		
169	Konak	Atamer	466	4002	435		
170	Konak	Atilla	947	11420	3285	400	
171	Konak	Aydin	639	6563	1110	400	

172	Konak	Aziziye	636	3830	615		
173	Konak	Bahar	639	9262	1605		
174	Konak	Bahcelievler	947	15596	2925	4300	
175	Konak	Bahriye Ucok	466	2575	495		
176	Konak	BalliKuyu	544	4619	525		
177	Konak	Barbaros	947	8227	2055	400	
178	Konak	Baris	544	6311	1005		
179	Konak	Basin Sitesi	947	17459	1620	1200	
180	Konak	Bogazici	544	4774	510		
181	Konak	Bozkurt	639	414	60		
182	Konak	Bozyaka	636	9613	2370	1200	
183	Konak	Cakabey	947	713	30		
184	Konak	Calikusu	636	9644	2145		
185	Konak	Cankaya	947	13517	2235	800	
186	Konak	Cengiz Topel	636	2762	285		
187	Konak	Cennetcesme	466	3010	975		
188	Konak	Cennetoglu	636	4079	1755		
189	Konak	Cimentepe	636	3101	720		
190	Konak	Cinarli	947	264	270		
191	Konak	Cinartepe	466	5610	855		
192	Konak	Dayiemir	544	912	60		
193	Konak	Devrim	466	4471	720		
194	Konak	Doganay	639	8714	360	800	
195	Konak	Dolaplikuyu	639	1103	135		
196	Konak	Duatepe	636	2549	255		
197	Konak	Ege	639	2047	480		
198	Konak	Emirsultan	639	2063	210		
199	Konak	Esenlik	639	7834	1590	400	
200	Konak	Esentepe	947	7364	1125	400	
201	Konak	Esenyali	947	10432	1650		
202	Konak	Etiler	947	2230	210		
203	Konak	Fahrettin Altay	947	11524	1620	1800	
204	Konak	Faikpasa	639	1697	285		
205	Konak	Fatih	947	704	60		
206	Konak	Ferahli	544	11316	2565		
207	Konak	Fevzipasa	947	74	30		
208	Konak	Gazi	466	4172	915		
209	Konak	Gen. Asim Gunduz	639	1998	375		
210	Konak	Gen. Kazım Ozalp	639	2838	510		
211	Konak	Goztepe	947	20264	2595	2500	
212	Konak	Gulyaka	639	7338	1185		
213	Konak	Gunaltay	636	11093	1635		
214	Konak	Gunes	639	43	120		
215	Konak	Gunesli	947	5929	1050	800	
216	Konak	Guney	639	4824	1110		
217	Konak	Gungor	639	1428	90		
218	Konak	Guzelyali	947	20431	2940	2400	
219	Konak	Guzelyurt	947	49	300		
220	Konak	Halkapinar	947	714	1290		
221	Konak	Hasan Ozdemir	544	3273	720		
222	Konak	Hilal	947	2411	660		
223	Konak	Hursidiye	947	87	165		
224	Konak	Huzur	544	2957	360		
225	Konak	Ihsan Alyanak	466	7183	645		
226	Konak	Imariye	466	8186	1605		
227	Konak	Ismet Kaptan	947	407	930		
228	Konak	Ismetpasa	544	6641	1860		
229	Konak	Kadifekale	636	6900	1380		
230	Konak	Kahraman Mescit	639	174	30		
231	Konak	Kahramanlar	947	5395	1665	400	
232	Konak	Karabaglar	639	6561	1380		

233	Konak	Kazim Karabekir	639	8534	1395		
234	Konak	Kemal Reis	947	3999	465		
235	Konak	Kestelli	947	46	225		
236	Konak	Kibar	466	3092	570		
237	Konak	Kilic Reis	947	8675	1425	400	
238	Konak	Kocakapi	639	3674	540	400	
239	Konak	Kocatepe	639	1842	300		
240	Konak	Konak	947	208	660	800	
241	Konak	Kosova	466	3303	150		
242	Konak	Kubilay	636	3132	510		
243	Konak	Kucukada	544	3960	735		
244	Konak	Kultur	947	10742	1620	400	
245	Konak	Kurtulus	947	426	135		
246	Konak	Lale	544	5510	660		
247	Konak	Levent	544	5640	780	400	
248	Konak	Limontepe	466	4309	465		
249	Konak	M. Ali Akman	947	8825	1035	2900	
250	Konak	Maliyeciler	639	3252	765		
251	Konak	Mecidiye	639	700	120		
252	Konak	Mehmet Akif	466	2655	420		
253	Konak	Mehtap	544	5070	1140		
254	Konak	Mersinli	947	3177	795		
255	Konak	Metin Oktay	639	6179	1230	400	
256	Konak	Millet	466	6440	1785	1400	
257	Konak	Mimar Sinan	947	7465	1860	800	
258	Konak	Mirali	636	1083	210		
259	Konak	Mithatpasa	947	9863	1260		
260	Konak	Muammer Akar	947	8905	1365	400	
261	Konak	Murat	466	5988	885		
262	Konak	Murat Reis	947	14970	1860	2900	
263	Konak	Namazgah	947	63	150	1000	
264	Konak	Namik Kemal	639	762	60		
265	Konak	Odunkapi	639	317	60		
266	Konak	Oguzlar	947	387	360		
267	Konak	Osman Aksuner	639	1156	165		
268	Konak	Ozgur	466	4677	1320		
269	Konak	Pazaryeri	639	1487	165		
270	Konak	Peker	466	6854	1095		
271	Konak	Piri Reis	947	5973	1440		
272	Konak	Poligon	947	4684	825	800	
273	Konak	Refet Bele	636	5558	1020		
274	Konak	Reis	639	8801	1800	400	
275	Konak	S. Nedim Tugaltay	947	297	135		
276	Konak	Sakarya	639	934	150		
277	Konak	Salih Omurtak	544	5020	1710		
278	Konak	Sariyer	544	7897	2130		
279	Konak	Saygi	636	5656	1200		
280	Konak	Sehitler	636	2697	525		
281	Konak	Selcuk	639	3671	420		
282	Konak	Selvili	636	6750	2250		
283	Konak	Sevgi	544	4386	1845		
284	Konak	Sumer	639	257	60		
285	Konak	Suvari	639	2301	465		
286	Konak	Tahsin Yazici	636	5955	705		
287	Konak	Tan	947	220	60		
288	Konak	Tinaztepe	639	2149	375		
289	Konak	Trakya	466	2769	555		
290	Konak	Turgut Reis	947	3909	1380		
291	Konak	Turkyilmaz	639	471	30		
292	Konak	Tuzcu	639	2420	285		
293	Konak	Uckuyular	947	11978	2175		

294	Konak	Ugur	947	46	105		
295	Konak	Ugur Mumcu	544	6461	900		
296	Konak	Ulku	639	1474	255		
297	Konak	Ulubatli	466	8478	1305	400	
298	Konak	Umurbey	947	865	270		
299	Konak	Umut	466	7134	900		
300	Konak	Uzundere	466	2970	1395		
301	Konak	Vatan	636	19117	2625	800	
302	Konak	Veziraga	636	666	135		
303	Konak	Yavuz Selim	544	2093	240		
304	Konak	Yeni	636	1427	225		
305	Konak	Yenidogan	947	3508	975		
306	Konak	Yenigun	947	48	135		
307	Konak	Yenisehir	947	3527	1440	400	
308	Konak	Yesildere	636	3130	720		
309	Konak	Yesiltepe	947	1523	405		
310	Konak	Yildiz	639	137	30		
311	Konak	Yunus Emre	636	16219	2880	800	
312	Konak	Yurtoglu	544	7728	2535		
313	Konak	Yzb. Serafettin	466	5123	1500		
314	Konak	Zafertepe	639	7350	930	400	
315	Konak	Zeybek	544	2473	420		
316	Konak	Zeytinlik	639	9095	1905	400	
317	Narlidere	2. İnönü	636	6758	1335		
318	Narlidere	Altievler	639	2271	165		
319	Narlidere	Ataturk	636	4947	1050		
320	Narlidere	Camtepe	639	8845	1680	800	
321	Narlidere	Huzur	639	13719	1920		
322	Narlidere	Ilica	947	10081	1755	400	
323	Narlidere	Limanreis	639	2447	570		
324	Narlidere	Narli	947	8359	2115	400	
325	Narlidere	Sahilevleri	639	1829	390		
326	Narlidere	Yenikale	947	5020	945	400	

CHAPTER 7

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 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 Turkey it is very 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. Than the key parameter values can be 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 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 between the values 0 and 3. Although some values hold which minimizes the error terms, the optimization process have 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 assumption arises here to obtain appropriate distance parameter value. The assumption is that, *the groceries (corner shops) 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 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. Model results with different combinations of parameters and descriptive statistics shown in Appendix A in details.

The assumption has concluded with a hypothetical retail flow pattern for grocery destinations with the more realistic parameters of α_1=1 and β_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 car-owners can travel more distant zones or people do not care the distance comparing with the low prices. Moreover, it is also expected 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 sqm to 5000 sqm the differences between sizes also explains differing attractiveness terms and there is no need to change for each retail type.

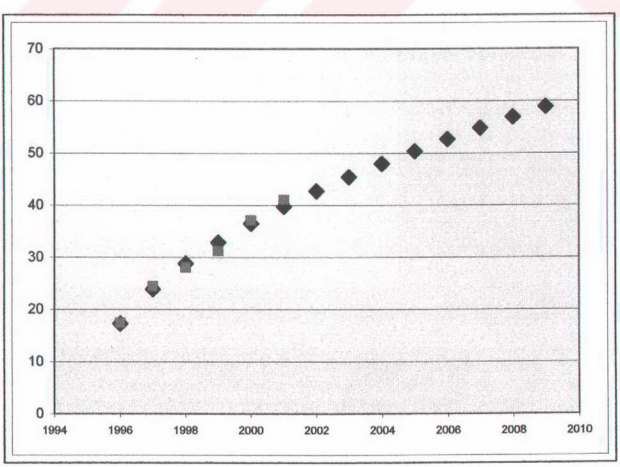
Now the term is to determine differing parameter values for supermarkets and hypermarkets to reproduce the existing retail structure in İzmir. As we have the initial parameter values for grocery flows, it would be possible to find how much these parameters change for supermarkets and hypermarkets using market shares of each 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 changes in the shares is given previous chapters (page 27-28) including the values from 1996 to 2001. Since the retail outlets refers the current structure in İzmir, today's market shares are 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 structure. On the account of these, a trend analysis of hypermarkets and supermarkets' market shares is build using five different projection techniques (Table 16). 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. The R square of the projection model is so closed to 1 and parameters are significant in 95% confidence interval.

Table 16: Trend Analysis: Market Shares of Supermarkets and Hypermarkets

Years	Time index (t)	Market Shares of Supermarkets and Hypermarkets (Y)	PRORECTIONS				
			Linear Model Y=Bo+B1*t	Logarithmic Model Y= Bo+B1*ln(t)	Power Model Y= ln(Bo)+B1*ln(t)	Invers Model Y= Bo+(B1/t)	Logistic Model (upper limit 75) Ln(1/Y-1/u)=ln(Bo)+(lnB1)*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

Figure 16: The Curve Fitting of Power Model and Projections



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.

Table 17: Projected Market Shares of Different Retail Formats

Years	Groceries	Supermarkets	Hypermarkets
2004	52%	32.5%	15.5%
2009	41%	40%	19%

Now, the initial parameter values and overall market shares of retail outlets are known. If the all parameters set same as in grocery flows (condition 1: α=1, β=3.5 and p=1) a retail environment dominated largely by groceries appear. 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 17). The most effective changes appear when a small change is hold in parameters α and β, the price parameter p has the small effects comparing with them due to its entrance to 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 and to create realistic flows. With this respect the solution results for real market shares can be hold by the parameters of : α_1=1, β_1=3.5, p_1=1 for grocery destinations, α_2=1, β_2=3.3, p_2=1.30 for supermarket destinations, α_3=1, β_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 18.

Table 18: The Different Combinations of Model Parameters and Results

	α	β	p	Rate of Market Shares
Real Condition				
Groceries	1	3,5	1	52
Supermarkets	1	3,5	1	32,5
Hypermarkets	1	3,5	1	15,5
Condition 1				
Groceries	1	3,5	1	79,5
Supermarkets	1	3,5	1	17,0
Hypermarkets	1	3,5	1	3,5
Condition 2				
Groceries	1	3,5	1	69,7
Supermarkets	1,1	3,5	1	25,8
Hypermarkets	1,1	3,5	1	4,5
Condition 3				
Groceries	1	3,5	1	71,4
Supermarkets	1	3,4	1	24,4
Hypermarkets	1	3,4	1	4,2
Condition 4				
Groceries	1	3,5	1	78,3
Supermarkets	1	3	1,1	18,1
Hypermarkets	1	3	1,1	3,6
Condition 5				
Groceries	1	3,5	1	57,6
Supermarkets	1	3,3	1	29,8
Hypermarkets	1	3,0	1	12,6
Condition 6				
Groceries	1	3,5	1	56,4
Supermarkets	1	3,3	1	29,1
Hypermarkets	1	2,95	1	14,5
Condition 7				
Groceries	1	3.5	1	52.0
Supermarkets	1	3,3	1,30	32,3
Hypermarkets	1	2,95	1,35	15,7

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 (condition 7), we can hold an equilibrium model which produces the new sizes of retail outlets (Model 1 see in Appendix B). 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.

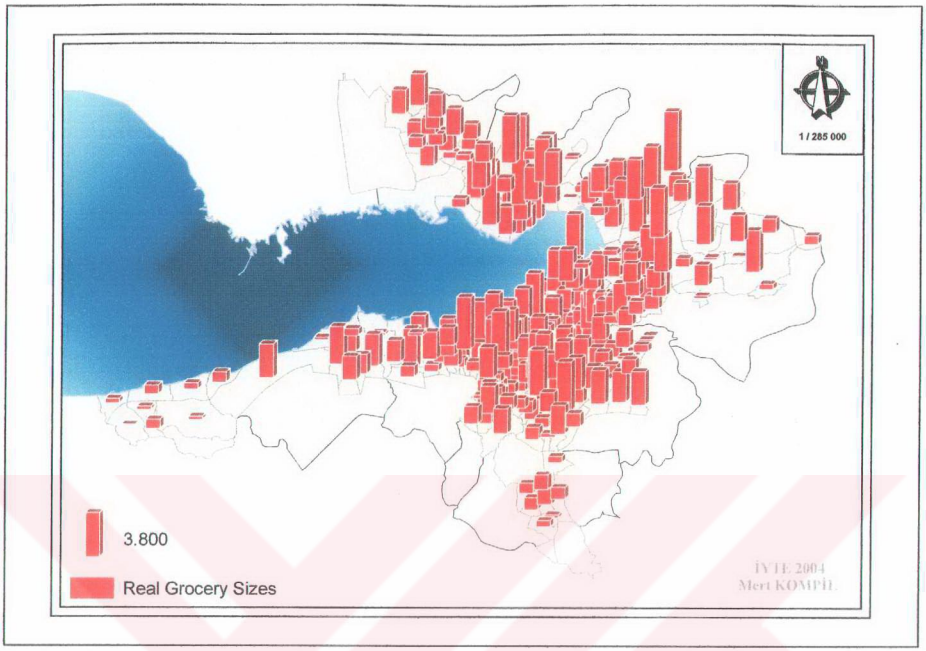
Aggregate model produces unrealistic results especially for some of the grocery and supermarket destinations which are located in the central business districts, sub-centers or located near the hypermarkets. Consumers may shop at particular centers for other reasons than purely physical sizes. This situation also make useless to run the model in an iterative manner where in all steps, attractive centers grow up.

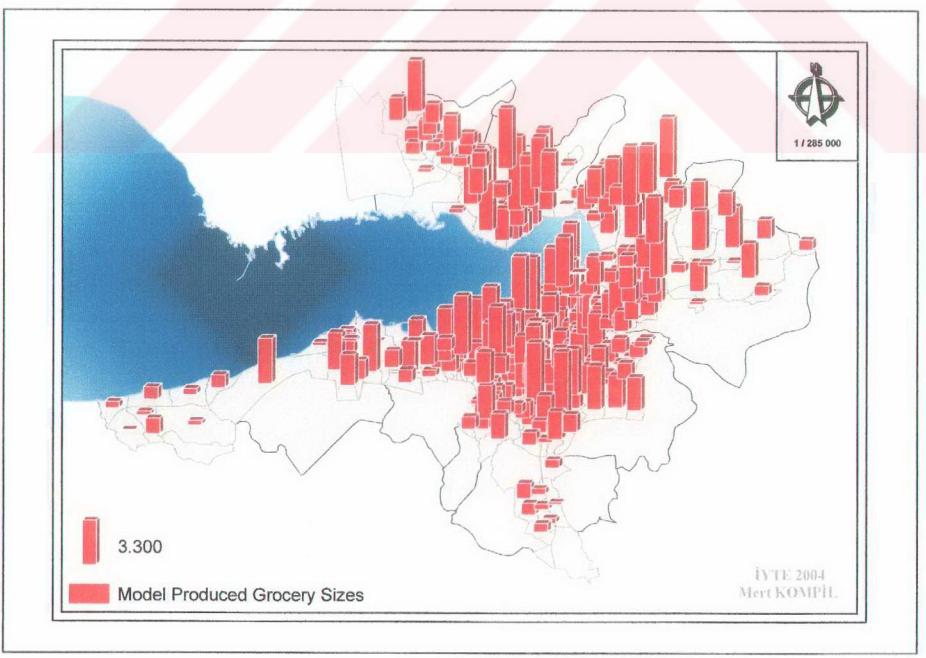
So, to produce a more realistic retail environment, spatially disaggregated attractiveness terms have to be introduced (Model 2 see in appendix B): for the grocery destinations near the hypermarkets (α_{11}=1.125), for the grocery destinations in the central business districts or district centers (α_{11}=1.250), and for the grocery destinations holds both situations, and for the supermarket destinations in the central business districts or district centers (α_{11}=1.125). These additions also decrease the market share of hypermarkets a little, so the distance parameter of hypermarkets have rearranged and become β_3=2.92

The disaggregate model in terms of attractiveness, produces more realistic results where the sum of squared errors started to decrease (See in Appendix B). However, in order to hold more closed results to real sizes we have to introduce the spatially disaggregate costs (k_js) 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. The disaggregated costs of each zone with the results of model are shown in Appendix B as the name of model 3.

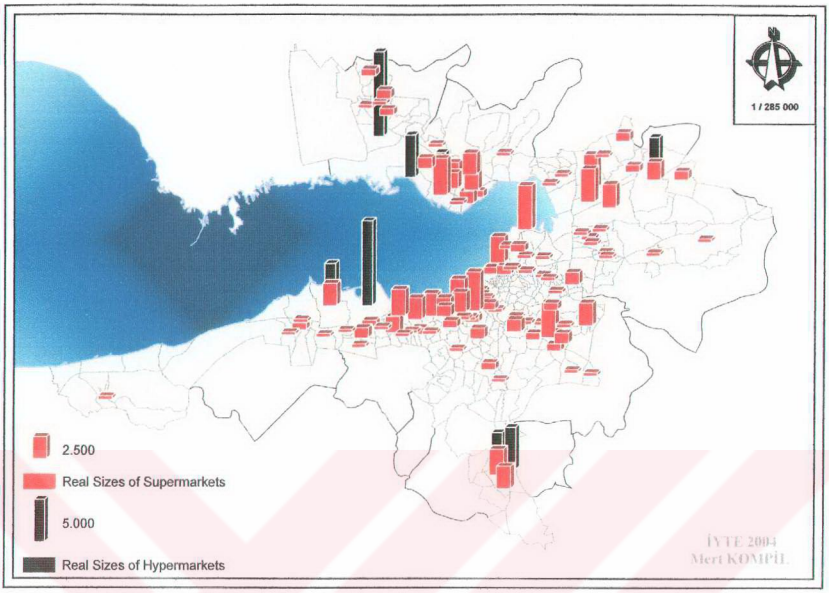
As consequence of the spatially disaggregated attractiveness terms and costs, it is now possible to hold the closest results to real retail outlet sizes. With the equilibrium solution, the initial goal of the empirical model is completed. The comparisons of real sizes and model produced sizes are illustrated in Map 14 and 15. Considering the model produced distribution, to produce existing retail structure of İzmir in terms of retail outlet sizes and market shares have succeeded.

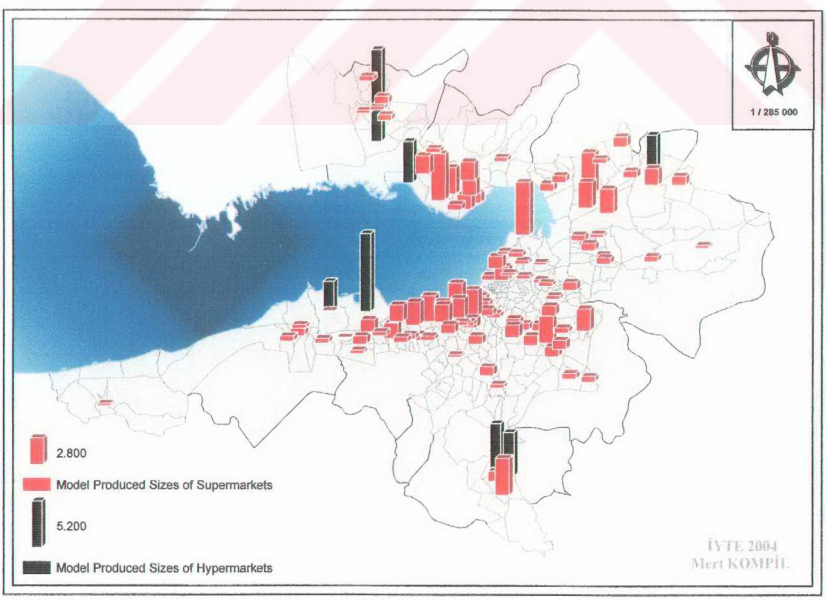
Map 14 :The Spatial Distribution of Real Grocery Sizes and Model Produced Sizes





Map 15 : The Spatial Distribution of Real Sizes and Model Produced Sizes of Supermarkets and Hypermarkets





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 consequences of future structural changes.

In the previous chapters of the thesis, 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% (see the projections in table 16) 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 equilibrium model with the help of key parameter changes. Table 19 shows the combinations of different parameters and determined parameters in condition 10 with desired shares.

Table 19: Changes in market Shares with Different Parameter Combinations

	α	β	p	Market Shares
Projected Market Shares				
Groceries				**41**
Supermarkets				**40**
Hypermarkets				**19**
Empirical Model (Model 3)				
Groceries	**1**	**3,50**	**1**	**52,25**
Supermarkets	**1**	**3,30**	**1,30**	**32,25**
Hypermarkets	**1**	**2,92**	**1,35**	**15,50**
Condition 8				
Groceries	**1**	**3,50**	**1**	**41,00**
Supermarkets	**1**	**3,20**	**1,30**	**39,80**
Hypermarkets	**1**	**2,82**	**1,35**	**19,20**
Condition 9				
Groceries	**1**	**3,50**	**1**	**40,50**
Supermarkets	**1,1**	**3,30**	**1,30**	**39,50**
Hypermarkets	**1,1**	**2,92**	**1,35**	**20,00**
Condition 10				
Groceries	**1**	**3,50**	**1**	**41,40**
Supermarkets	**1,05**	**3,25**	**1,30**	**40,00**
Hypermarkets	**1,06**	**2,90**	**1,35**	**18,60**

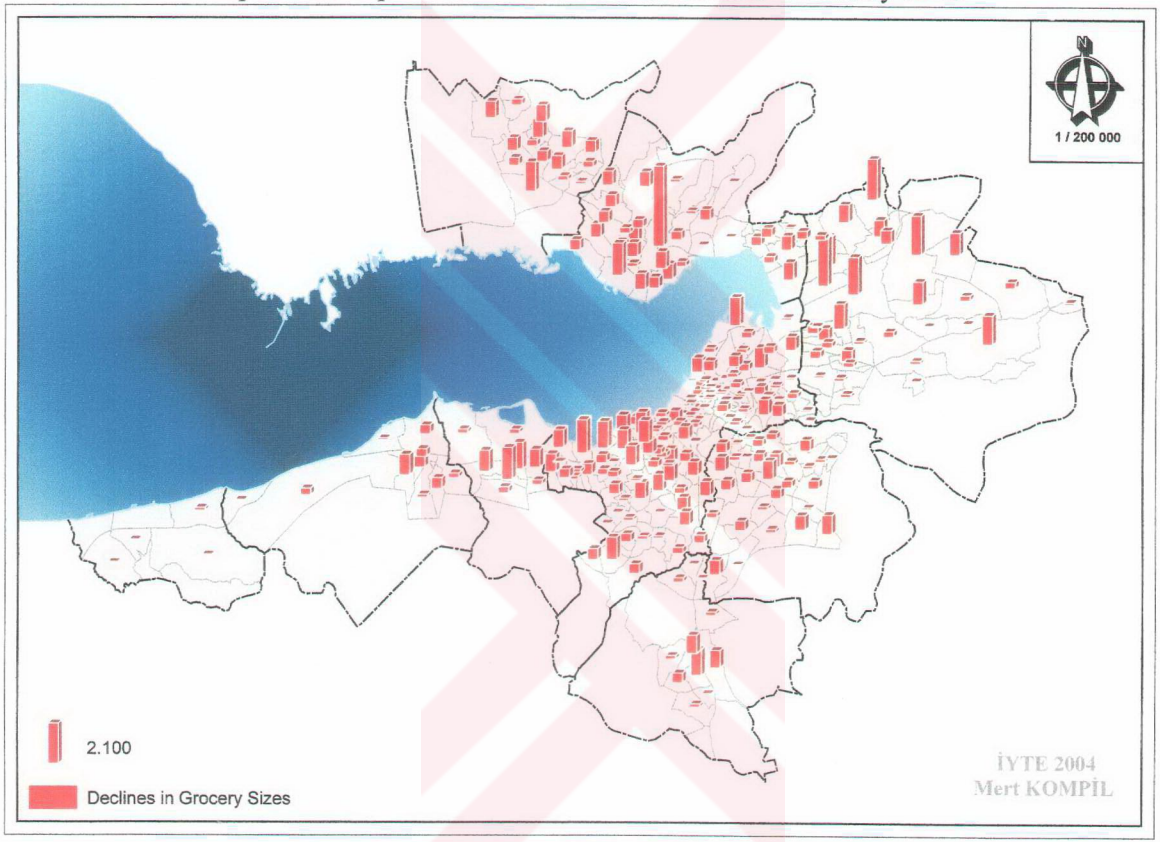
There may be also a great many of alternatives in parameters to reach such a solution. However, it is seen that the changing both distance deterrence and attractiveness parameters in the assumption of "the distance sensitivity will decrease in account of increasing private car ownership and retail firms increase their effectiveness and profits for per square meter" is the most logical choose.

The projected model with the new determined parameters, have produced the spatial impacts of future changes which had already been expected for İzmir. (See Projected model in Appendix B). With the model, it is shown that if the trends continue, the total grocery stocks will decline 23% from 513400 sqm to 395577 sqm, and in the five years period, approximately 1900 grocery will closed in an average of 7 for 262 declining neighborhoods.

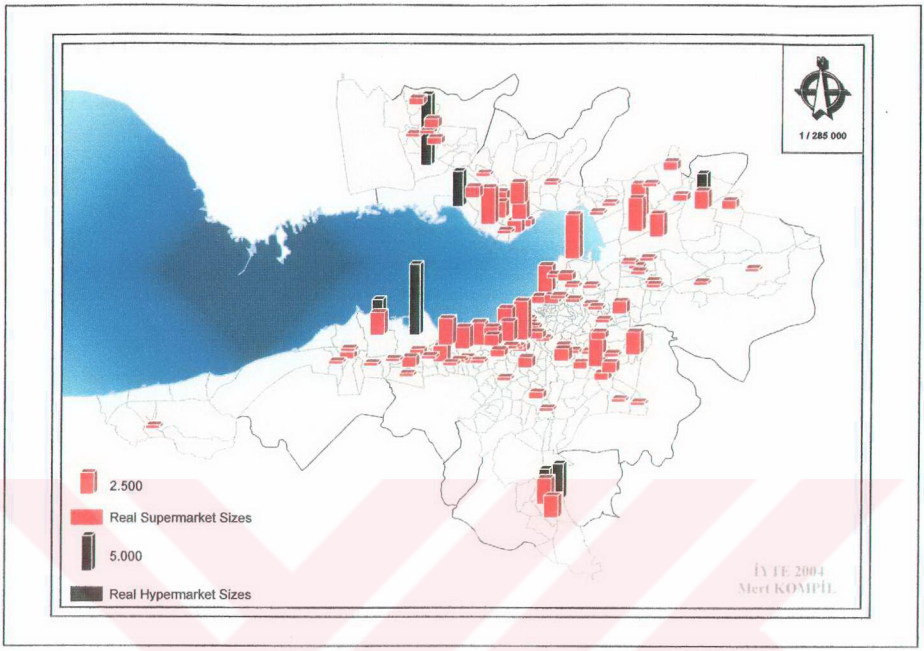
If the spatial distribution of grocery declines considered, it can easily be seen that the most dramatic changes will appear in the zones near or next to the zones which include a hypermarket or several supermarkets. Further it can be seen that since the absence of any western type of retailer, some of the neighborhoods will carry on be dominated by traditional retailers unless any developments occur. The spatial distribution of grocery declines and future pattern of hypermarkets and supermarkets are given in Map 16-17.

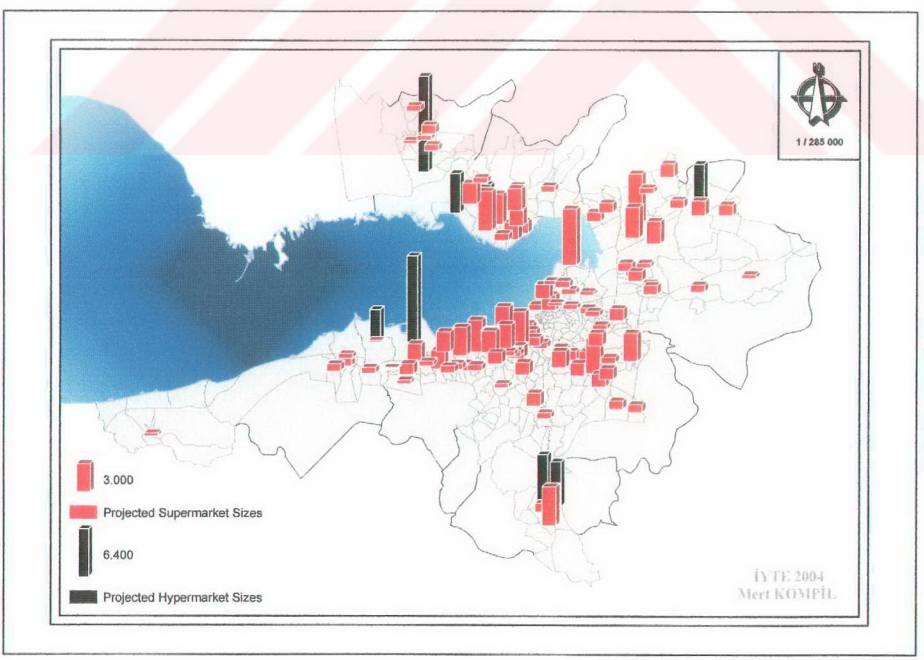
In conclusion it is shown that: the existing retail structure of İzmir can be reproduced which makes possible to hold more accurate locational decisions, and the spatial consequences of possible future changes can be predict with the empirical dynamic model.

Map 16 : The Spatial Distribution of the Declines in Grocery Sizes



Map 17 : The Current and The Future Pattern of Supermarkets and Hypermarkets





CHAPTER 8

CONCLUSION

During the last two decades, transformations accompanying with the globalization have affected the economic structure and physical landscapes of the Turkish cities. Under the influence of these transformations, there have also been dramatic changes in retail industry and retail environments. Most of the changes have experienced towards the larger-scale retailing with the entrance of new formats.

Turkish retailing is still dominated by large number of small-scale, independent, and single location retailers, however large-scale retailing market share and spatial prevalence have been increasing rapidly especially in major cities of the country. The increasing dominance of large-scale retailing has been altering the urban retail hierarchy and restructuring the urban retail environments.

Among all the areas of retailing, food retailing stands out as having seen the most profound changes in Turkey. The arrival of the new retail formats such as supermarkets and hypermarkets has been profound effects on the ability of many small-scale food retailers to survive. The increasing competition has led to a changing retail structure with the dominance of large-scale retailers where the number of small-scale retailers and their total size are decreasing. With this respect, the study intends to analyze the structural change of retailing at this point of view and for this reason one of the major cities of the Turkey, İzmir, has been selected as the case study.

In order to make such an analyze about the corner shops to supermarket-hypermarket transition and to show some possible spatial consequences of the restructuring process of food retailing, 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 also intends to make contributions to the dynamic model literature with an empirical work using real world data.

It is clear that, there are very few research 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 of the initial goals of the thesis have carried out.

Further, the usefulness of dynamic spatial interaction model is tested with the 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, 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. This is shown clearly with the empirical work provided more accurate information about the likely results of retail structural change in Izmir.

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 sqm to 395577 sqm, and in the five years period approximately 1900 grocery will be closed. With these results the study have proved the hypothesis empirically and carried out the major aim of the thesis.

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

RESULTS FOR STATIC MODEL

No	Neigh borhood Name	Grocery_Exp (EiPi)	Sales in Own Zone (S_{ij} i=j) (α_1 β_2)	Rate (%)	Sales in Own Zone (S_{ij} i=j) (α_1 β_2. 5)	Rate (%)	Sales in Own Zone (S_{ij} i=j) (α_1 β_3)	Rate (%)	Sales in Own Zone (S_{ij} i=j) (α_1 β_3. 5)	Rate (%)	Sales in Own Zone (S_{ij} i=j) (α_1 β_4)	Rate (%)
1	Bahcelerarasi	781	20	3	37	5	60	8	88	11	120	15
2	Cetin Emec	4249	974	23	1695	40	2407	57	2997	71	3432	81
3	Egitim	7424	2991	40	4195	57	5119	69	5796	78	6284	85
4	Fevzi Cakmak	7481	4616	62	5519	74	6072	81	6449	86	6721	90
5	Inciralti	1967	98	5	212	11	395	20	640	33	919	47
6	Koruturk	11460	2431	21	3624	32	4700	41	5638	49	6462	56
7	Onur	11178	5932	53	7220	65	8042	72	8628	77	9079	81
8	Teleferik	4751	1545	33	2326	49	2956	62	3440	72	3805	80
9	Ataturk	10657	4956	47	7101	67	8582	81	9474	89	9986	94
10	Barbaros	5617	2392	43	3157	56	3673	65	4049	72	4345	77
11	Birlik	5080	2805	55	3702	73	4235	83	4553	90	4748	93
12	Camkule	2689	696	26	1152	43	1554	58	1860	69	2082	77
13	Cinar	3686	1553	42	2175	59	2575	70	2851	77	3054	83
14	Doganlar	8296	2439	29	3804	46	4945	60	5794	70	6416	77
15	Egemenlik-Isikkent	1622	1020	63	1368	84	1504	93	1553	96	1574	97
16	Ergene	8378	4102	49	5865	70	6964	83	7583	91	7926	95
17	Erzene	17565	6003	34	8760	50	10944	62	12523	71	13652	78
18	Evka 3	9352	3855	41	5925	63	7368	79	8215	88	8692	93
19	Gaziosmanpasa	7855	3249	41	4398	56	5164	66	5690	72	6078	77
20	Gurpinar	3412	1470	43	2125	62	2563	75	2863	84	3066	90
21	Inonu	14470	5726	40	8229	57	10126	70	11418	79	12282	85
22	Isiklar	1342	278	21	483	36	644	48	772	58	883	66
23	Karacaoglan	3038	331	11	603	20	929	31	1263	42	1579	52
24	Kazim Dirik	25817	6502	25	9630	37	12510	48	14909	58	16823	65
25	Kemalpasa	4642	3581	77	4194	90	4402	95	4483	97	4524	97
26	Kizilay	7883	2446	31	3707	47	4729	60	5485	70	6033	77
27	Kosukavak	4954	1982	40	2755	56	3274	66	3624	73	3874	78
28	Manavkuyu	23755	12044	51	16328	69	19157	81	20903	88	21974	93
29	Mansuroglu	17949	7285	41	10448	58	12797	71	14384	80	15443	86
30	Meric	5909	1091	18	1825	31	2575	44	3245	55	3803	64
31	Merkez-Altindag	2672	567	21	956	36	1323	50	1624	61	1860	70
32	Mevlana	5081	2520	50	3624	71	4298	85	4651	92	4834	95
33	Naldoken	2403	443	18	793	33	1157	48	1467	61	1709	71
34	Osmangazi	13913	4538	33	6460	46	8049	58	9295	67	10257	74
35	Rafetpasa	9444	1761	19	2596	27	3352	35	3997	42	4553	48
36	Serintepe	4999	2523	50	3442	69	4019	80	4377	88	4603	92
37	Tuna	4502	859	19	1356	30	1819	40	2206	49	2522	56
38	Umit	1627	246	15	566	35	928	57	1214	75	1397	86
39	Yesilcam	1446	659	46	1110	77	1332	92	1408	97	1433	99
40	Yesilova	11068	3206	29	4682	42	5908	53	6859	62	7599	69
41	Yildirim Beyazit	4420	2677	61	3353	76	3712	84	3925	89	4065	92
42	Yunus Emre	845	76	9	164	19	279	33	400	47	510	60
43	Zafer	6537	3225	49	4325	66	5008	77	5443	83	5739	88
44	Adatepe	4431	913	21	1600	36	2293	52	2873	65	3315	75
45	Akincilar	6193	1151	19	2016	33	2955	48	3793	61	4456	72
46	Ataturk	5788	3009	52	4137	71	4792	83	5169	89	5395	93
47	Aydogdu	1080	516	48	933	86	1049	97	1072	99	1077	100
48	Baris	11288	3945	35	5925	52	7504	66	8636	77	9426	84

49	Cagdas	6700	2358	35	4241	63	5451	81	6022	90	6291	94
50	Caldiran	3515	551	16	1137	32	1837	52	2443	69	2864	81
51	Camlik	6412	1466	23	2381	37	3238	50	3952	62	4521	71
52	Camlikule	10192	3610	35	5443	53	6876	67	7863	77	8525	84
53	Dicle	3515	1551	44	2286	65	2787	79	3083	88	3255	93
54	Dumlupinar	2709	484	18	893	33	1331	49	1714	63	2014	74
55	Efeler	11388	3420	30	5412	48	7183	63	8514	75	9440	83
56	Firat	6294	1736	28	2745	44	3661	58	4371	69	4886	78
57	Gaziler	3095	504	16	1022	33	1568	51	2023	65	2364	76
58	Goksu	10474	4983	48	6968	67	8311	79	9131	87	9625	92
59	Guven	3860	813	21	1397	36	1965	51	2438	63	2810	73
60	Hurriyet	7682	2342	30	3921	51	5274	69	6185	81	6739	88
61	Inkilap	5994	1169	19	1972	33	2805	47	3535	59	4120	69
62	Inonu	8084	2233	28	3533	44	4692	58	5583	69	6233	77
63	Karanfil	3661	1255	34	2320	63	3015	82	3350	92	3506	96
64	Kozagac	9233	3294	36	5015	54	6373	69	7312	79	7936	86
65	Kurucesme	9623	5316	55	7350	76	8439	88	8973	93	9248	96
66	Laleli	4261	486	11	952	22	1541	36	2152	51	2699	63
67	Menderes	9278	3341	36	5153	56	6525	70	7430	80	8012	86
68	Murathan	3624	453	12	1066	29	1710	47	2186	60	2522	70
69	Mustafa Kemal	4882	984	20	1681	34	2378	49	2980	61	3465	71
70	Seyhan	1513	395	26	698	46	988	65	1200	79	1333	88
71	Sirinkapi	6911	2184	32	3746	54	4991	72	5755	83	6190	90
72	Ufuk	9667	2231	23	3656	38	5092	53	6325	65	7284	75
73	Vali Rahmi Bey	6798	2546	37	3968	58	5013	74	5670	83	6072	89
74	Yaylacik-Bahcekapi	5354	1207	23	2090	39	2933	55	3603	67	4097	77
75	Yenigun	6473	1864	29	3004	46	4003	62	4750	73	5275	81
76	Yesilbaglar	5859	2212	38	3373	58	4256	73	4841	83	5213	89
77	Yigitler	9785	3941	40	5895	60	7310	75	8213	84	8774	90
78	Yildiz	7836	4234	54	5631	72	6422	82	6871	88	7147	91
79	Ahmet T. Kislali	4630	3143	68	3927	85	4285	93	4452	96	4534	98
80	Aydinlikevler	2744	673	25	1176	43	1647	60	2008	73	2257	82
81	Balatcik	3494	1743	50	2352	67	2745	79	2997	86	3160	90
82	Cagdas	4088	2668	65	3234	79	3571	87	3773	92	3896	95
83	Egekent	5543	3723	67	4369	79	4758	86	5010	90	5178	93
84	Evka 2	2681	1148	43	1598	60	1891	71	2082	78	2214	83
85	Evka 5	6469	4204	65	5214	81	5706	88	5968	92	6127	95
86	Guzeltepe	4444	3034	68	3704	83	4051	91	4232	95	4327	97
87	Istasyonalti	5461	1953	36	2843	52	3548	65	4072	75	4454	82
88	Izkent	3801	2174	57	2645	70	2937	77	3138	83	3287	86
89	Koyici	2818	1188	42	1684	60	2062	73	2326	83	2502	89
90	Kucukcigli	6601	2839	43	3792	57	4489	68	5003	76	5385	82
91	Maltepe	2036	692	34	1098	54	1423	70	1648	81	1795	88
92	Sirintepe	4339	2361	54	3055	70	3500	81	3786	87	3971	92
93	Yeni	3661	1663	45	2382	65	2875	79	3185	87	3373	92
94	Aktepe	3935	1717	44	2717	69	3307	84	3594	91	3737	95
95	Atif Bey	6099	2768	45	3665	60	4230	69	4634	76	4949	81
96	Beyazevler	2724	468	17	1021	37	1660	61	2144	79	2425	89
97	Binbasi Resat Bey	1395	309	22	600	43	871	62	1069	77	1198	86
98	Dokuz Eylul	4891	1970	40	2859	58	3439	70	3832	78	4116	84
99	Emrez	2785	716	26	1249	45	1721	62	2069	74	2306	83
00	Gazi	4093	1584	39	2324	57	2822	69	3161	77	3408	83
01	Gazikent	7867	2570	33	4204	53	5307	67	6030	77	6527	83
02	Irmak	3097	1922	62	2558	83	2842	92	2972	96	3034	98
03	Sevgi	7302	3783	52	5413	74	6208	85	6611	91	6839	94
04	Yesil	3663	2510	69	3108	85	3376	92	3509	96	3578	98
05	Ataturk	1536	1134	74	1313	85	1388	90	1433	93	1463	95
06	Celebi	1022	648	63	814	80	899	88	948	93	977	96
07	Kahramandere	346	50	14	79	23	107	31	136	39	165	48

08	Maltepe	1325	594	45	967	73	1157	87	1240	94	1280	97
09	Siteler-Camlicay	911	364	40	609	67	745	82	815	89	854	94
10	Yaka	216	112	52	151	70	173	80	187	87	197	91
11	Yali	2466	1376	56	1939	79	2191	89	2311	94	2375	96
12	75. Yil	918	415	45	651	71	790	86	857	93	889	97
13	Adalet	6536	3386	52	4786	73	5632	86	6077	93	6301	96
14	Aksoy	15238	9004	59	11602	76	13145	86	14016	92	14506	95
15	Alaybey	7452	4103	55	5294	71	6076	82	6579	88	6900	93
16	Alparslan	4615	2849	62	3552	77	3955	86	4197	91	4348	94
17	Bahariye	10189	3607	35	4935	48	6091	60	7063	69	7851	77
18	Bayrakli	6298	2198	35	3766	60	4929	78	5597	89	5945	94
19	Bostanli	39151	22234	57	27663	71	31237	80	33574	86	35122	90
20	Cay	3554	1695	48	2393	67	2866	81	3156	89	3328	94
21	Cengizhan	5395	2675	50	3504	65	4031	75	4382	81	4629	86
22	Cicek	15242	6213	41	8463	56	10145	67	11386	75	12312	81
23	Cumhuriyet	8752	4108	47	5591	64	6639	76	7337	84	7795	89
24	Dedebasi	7683	2924	38	4213	55	5286	69	6083	79	6634	86
25	Demirkopru	2598	427	16	767	30	1173	45	1575	61	1911	74
26	Dogancay	720	174	24	398	55	587	82	674	94	705	98
27	Donanmaci	13152	4972	38	6802	52	8243	63	9365	71	10240	78
28	Emek	6024	2765	46	3889	65	4708	78	5241	87	5566	92
29	Fikri Altay	3009	1109	37	1724	57	2217	74	2547	85	2745	91
30	Fuat Edip Baksi	7575	3199	42	4456	59	5303	70	5872	78	6276	83
31	Goncalar	4976	3681	74	4390	88	4712	95	4853	98	4917	99
32	Gumuspala	7089	2538	36	3649	51	4511	64	5141	73	5600	79
33	Imbatli	2435	869	36	1337	55	1726	71	1997	82	2170	89
34	M. Erener	3020	967	32	1384	46	1733	57	2019	67	2251	75
35	Mavisehir	16712	3797	23	6210	37	8484	51	10404	62	11946	71
36	Nergis	8565	3127	37	4501	53	5635	66	6492	76	7107	83
37	Onur	5739	2590	45	3646	64	4371	76	4839	84	5141	90
38	Org. Nafiz Gurman	6507	2448	38	3291	51	3925	60	4413	68	4804	74
39	Ornekkoy	10976	5587	51	7573	69	8915	81	9735	89	10219	93
40	Postacilar	3297	733	22	1263	38	1800	55	2262	69	2613	79
41	R. Sevket Ince	5527	3107	56	4068	74	4614	83	4927	89	5118	93
42	Semikler	10703	5246	49	6849	64	7998	75	8809	82	9379	88
43	Sogukkuyu	30254	17356	57	21091	70	23664	78	25449	84	26699	88
44	Tersane	16815	9118	54	11766	70	13470	80	14569	87	15291	91
45	Turan	197	1	1	3	1	5	2	8	4	11	6
46	Yali	11928	8327	70	9969	84	10827	91	11286	95	11542	97
47	Yamac	3231	1415	44	2122	66	2606	81	2887	89	3040	94
48	Yamanlar	7241	5203	72	6211	86	6704	93	6951	96	7081	98
49	1. Kadriye	4228	1636	39	2328	55	2829	67	3168	75	3401	80
50	19 Mayis	2262	1004	44	1436	63	1701	75	1858	82	1958	87
51	2. Kadriye	4007	958	24	1605	40	2230	56	2735	68	3110	78
52	26 Agustos	1770	523	30	836	47	1109	63	1317	74	1465	83
53	A. Fuat Cebesoy	3165	779	25	1296	41	1814	57	2240	71	2551	81
54	A. Fuat Erden	863	85	10	176	20	298	34	427	49	544	63
55	Abdi Ipekci	1727	491	28	850	49	1149	67	1348	78	1471	85
56	Adnan Suvari	2925	590	20	1023	35	1460	50	1837	63	2135	73
57	Akarcali	2702	310	11	511	19	707	26	880	33	1033	38
58	Akdeniz	172	46	27	81	47	112	65	133	78	147	85
59	Akin Simav	5366	2247	42	3379	63	4140	77	4592	86	4859	91
60	Akinci	801	110	14	230	29	359	45	468	58	553	69
61	Alireis	1933	753	39	1203	62	1512	78	1695	88	1798	93
62	Alsancak	6432	2473	38	3597	56	4427	69	4981	77	5355	83
63	Altay	1006	77	8	142	14	220	22	306	30	394	39
64	Altinordu	610	153	25	270	44	364	60	431	71	477	78
65	Altintas	6728	2365	35	3355	50	4175	62	4832	72	5347	79
66	Anadolu	1247	551	44	773	62	919	74	1012	81	1074	86

57	Arap Hasan	11036	4815	44	6696	61	8043	73	8947	81	9554	87
58	Asik Veysel	1594	514	32	809	51	1053	66	1223	77	1336	84
59	Atamer	1865	409	22	642	34	856	46	1045	56	1211	65
70	Atilla	10815	5735	53	7318	68	8318	77	8938	83	9338	86
71	Aydin	4194	1103	26	1811	43	2477	59	3007	72	3392	81
72	Aziziye	2436	443	18	763	31	1108	45	1426	59	1690	69
73	Bahar	5918	1750	30	2678	45	3505	59	4154	70	4634	78
74	Bahcelievler	14769	5499	37	7789	53	9718	66	11192	76	12260	83
75	Bahriye Ucok	1200	218	18	387	32	559	47	707	59	825	69
76	BalliKuyu	2513	983	39	1580	63	1990	79	2220	88	2345	93
77	Barbaros	7791	4076	52	5347	69	6151	79	6652	85	6974	90
78	Baris	3433	807	23	1299	38	1780	52	2193	64	2521	73
79	Basin Sitesi	16534	4766	29	7277	44	9554	58	11393	69	12795	77
80	Bogazici	2597	854	33	1404	54	1829	70	2105	81	2274	88
81	Bozkurt	265	22	8	45	17	74	28	105	40	135	51
82	Bozyaka	6114	2612	43	3734	61	4574	75	5132	84	5488	90
83	Cakabey	27	3	12	8	28	13	47	17	62	20	74
84	Calikusu	6134	3020	49	4204	69	4970	81	5417	88	5678	93
85	Cankaya	12801	5104	40	7371	58	9101	71	10276	80	11049	86
86	Cengiz Topel	1757	334	19	635	36	938	53	1181	67	1356	77
87	Cennetcesme	1403	604	43	870	62	1046	75	1161	83	1237	88
88	Cennetoglu	2594	894	34	1332	51	1688	65	1947	75	2130	82
89	Cimentepe	1972	799	41	1245	63	1556	79	1736	88	1835	93
90	Cinarli	250	19	8	39	16	65	26	93	37	118	47
91	Cinartepe	2614	967	37	1500	57	1878	72	2112	81	2258	86
92	Dayiemir	496	24	5	42	8	62	13	85	17	110	22
93	Devrim	2083	447	21	770	37	1090	52	1357	65	1561	75
94	Doganay	5568	920	17	1542	28	2168	39	2738	49	3237	58
95	Dolaplikuyu	705	220	31	393	56	528	75	611	87	657	93
96	Duatepe	1621	246	15	446	28	667	41	879	54	1063	66
97	Ege	1308	340	26	595	45	829	63	1004	77	1121	86
98	Emirsultan	1318	277	21	530	40	769	58	948	72	1068	81
99	Esenlik	5006	2246	45	3120	62	3724	74	4121	82	4386	88
00	Esentepe	6974	3796	54	5222	75	6030	86	6453	93	6676	96
01	Esenyali	9879	4738	48	6570	67	7799	79	8565	87	9040	92
02	Etiler	2112	320	15	626	30	973	46	1285	61	1528	72
03	Fahrettin Altay	10913	5321	49	6980	64	8097	74	8862	81	9403	86
04	Faikpasa	1084	354	33	584	54	754	70	864	80	934	86
05	Fatih	667	81	12	170	25	276	41	377	57	462	69
06	Ferahli	6156	2151	35	2980	48	3647	59	4160	68	4556	74
07	Fevzipasa	70	12	17	29	41	45	64	55	79	61	87
08	Gazi	1944	838	43	1221	63	1479	76	1642	84	1745	90
09	Gen. Asim Gunduz	1277	208	16	383	30	571	45	741	58	881	69
10	Gen. Kazım Ozalp	1813	457	25	749	41	1009	56	1215	67	1373	76
11	Goztepe	19190	7943	41	11225	58	13741	72	15495	81	16678	87
12	Gulyaka	4689	1193	25	1915	41	2607	56	3179	68	3614	77
13	Gunaltay	7055	2483	35	3865	55	4991	71	5755	82	6232	88
14	Gunes	675	86	13	169	25	265	39	356	53	433	64
15	Gunesli	5615	1346	24	2171	39	2984	53	3680	66	4225	75
16	Guney	3083	1094	35	1673	54	2133	69	2456	80	2672	87
17	Gungor	912	118	13	247	27	406	44	559	61	681	75
18	Guzelyali	19348	10185	53	13328	69	15374	79	16669	86	17505	90
19	Guzelyurt	46	23	49	34	74	40	87	43	93	44	96
20	Halkapinar	676	170	25	287	43	402	59	490	73	552	82
21	Hasan Ozdemir	1781	1018	57	1353	76	1537	86	1638	92	1696	95
22	Hilal	2283	433	19	706	31	977	43	1218	53	1425	62
23	Hursidiye	82	24	29	42	51	55	67	63	77	68	83
24	Huzur	1609	422	26	705	44	950	59	1136	71	1270	79
25	Ihsan Alyanak	3347	911	27	1493	45	1986	59	2353	70	2617	78

26	Imariye	3815	3304	87	3643	95	3749	98	3787	99	3802	100
27	Ismet Kaptan	385	123	32	202	53	268	70	312	81	339	88
28	Ismetpasa	3613	1767	49	2438	67	2886	80	3163	88	3332	92
29	Kadifekale	4388	2116	48	2991	68	3545	81	3863	88	4048	92
30	Kahraman Mescit	111	13	12	31	28	50	45	66	60	79	71
31	Kahramanlar	5109	2242	44	3210	63	3875	76	4292	84	4554	89
32	Karabaglar	4192	1300	31	1989	47	2584	62	3040	73	3373	80
33	Kazim Karabekir	5453	1887	35	2918	54	3775	69	4379	80	4773	88
34	Kemal Reis	3787	1337	35	2126	56	2739	72	3146	83	3399	90
35	Kestelli	44	4	9	8	19	14	31	19	44	24	55
36	Kibar	1441	381	26	680	47	952	66	1144	79	1264	88
37	Kilic Reis	8215	2306	28	3291	40	4140	50	4840	59	5412	66
38	Kocakapi	2348	565	24	992	42	1400	60	1713	73	1928	82
39	Kocatepe	1177	208	18	369	31	537	46	687	58	810	69
40	Konak	197	47	24	76	38	102	52	124	63	141	71
41	Kosova	1539	223	15	459	30	725	47	958	62	1136	74
42	Kubilay	1992	513	26	813	41	1069	54	1273	64	1434	72
43	Kucukada	2154	449	21	715	33	978	45	1217	56	1422	66
44	Kultur	10173	4254	42	6328	62	7801	77	8720	86	9278	91
45	Kurtulus	403	79	20	144	36	200	50	243	60	274	68
46	Lale	2997	560	19	968	32	1390	46	1757	59	2048	68
47	Levent	3068	1197	39	1800	59	2252	73	2553	83	2745	89
48	Limontepe	2008	288	14	518	26	771	38	1005	50	1202	60
49	M. Ali Akman	8357	3758	45	5325	64	6409	77	7111	85	7559	90
50	Maliyeciler	2078	450	22	723	35	978	47	1192	57	1367	66
51	Mecidiye	447	117	26	211	47	295	66	356	80	395	88
52	Mehmet Akif	1237	357	29	598	48	803	65	952	77	1053	85
53	Mehtap	2758	1370	50	1956	71	2314	84	2510	91	2617	95
54	Mersinli	3009	212	7	340	11	479	16	607	20	715	24
55	Metin Oktay	3948	1379	35	2007	51	2494	63	2850	72	3115	79
56	Millet	3001	1568	52	2067	69	2374	79	2567	86	2694	90
57	Mimar Sinan	7069	2468	35	3643	52	4587	65	5286	75	5791	82
58	Mirali	689	264	38	443	64	558	81	619	90	650	94
59	Mithatpasa	9340	3332	36	5039	54	6381	68	7315	78	7944	85
60	Muammer Akar	8433	3061	36	4411	52	5515	65	6362	75	6987	83
61	Murat	2790	1076	39	1593	57	1974	71	2235	80	2413	86
62	Murat Reis	14177	5774	41	7984	56	9625	68	10786	76	11614	82
63	Namazgah	60	12	21	22	37	31	52	38	64	44	73
64	Namik Kemal	487	245	50	391	80	452	93	473	97	481	99
65	Odunkapi	203	53	26	106	52	146	72	169	83	183	90
66	Oguzlar	366	69	19	125	34	182	50	231	63	270	74
67	Osman Aksuner	739	71	10	154	21	266	36	383	52	485	66
68	Ozgur	2179	900	41	1259	58	1513	69	1689	78	1816	83
69	Pazaryeri	950	163	17	298	31	432	45	547	58	640	67
70	Peker	3194	1350	42	2027	63	2479	78	2743	86	2898	91
71	Piri Reis	5656	2834	50	3942	70	4664	82	5088	90	5330	94
72	Poligon	4436	1015	23	1592	36	2153	49	2656	60	3082	69
73	Refet Bele	3535	694	20	1125	32	1566	44	1966	56	2303	65
74	Reis	5624	3004	53	4014	71	4628	82	4984	89	5198	92
75	S. Nedim Tugaltay	281	97	35	160	57	202	72	229	81	246	87
76	Sakarya	597	133	22	246	41	350	59	429	72	484	81
77	Salih Omurtak	2731	1284	47	1849	68	2213	81	2418	89	2533	93
78	Sariyer	4296	2031	47	2832	66	3382	79	3726	87	3938	92
79	Saygi	3597	1494	42	2121	59	2582	72	2904	81	3126	87
80	Sehitler	1715	572	33	948	55	1245	73	1438	84	1553	91
81	Selcuk	2346	988	42	1565	67	1936	83	2131	91	2229	95
82	Selvili	4293	1549	36	2251	52	2819	66	3237	75	3536	82
83	Sevgi	2386	862	36	1285	54	1627	68	1871	78	2037	85
84	Sumer	164	35	21	75	46	112	68	135	82	147	90

85	Suvari	1470	523	36	829	56	1055	72	1199	82	1290	88
86	Tahsin Yazici	3787	556	15	964	25	1427	38	1879	50	2278	60
87	Tan	208	37	18	80	38	123	59	153	74	173	83
88	Tinaztepe	1373	415	30	705	51	943	69	1104	80	1203	88
89	Trakya	1290	581	45	836	65	994	77	1090	85	1152	89
90	Turgut Reis	3702	2040	55	2729	74	3137	85	3368	91	3500	95
91	Turkyilmaz	301	54	18	114	38	170	57	213	71	242	81
92	Tuzcu	1546	908	59	1243	80	1395	90	1462	95	1496	97
93	Uckuyular	11343	7533	66	9135	81	10016	88	10523	93	10828	95
94	Ugur	44	9	20	19	43	28	64	34	78	38	86
95	Ugur Mumcu	3515	788	22	1274	36	1760	50	2191	62	2543	72
96	Ulku	942	103	11	162	17	219	23	272	29	321	34
97	Ulubatli	3951	1367	35	2080	53	2652	67	3054	77	3325	84
98	Umurbey	819	38	5	73	9	121	15	180	22	247	30
99	Umut	3324	1015	31	1619	49	2117	64	2471	74	2714	82
00	Uzundere	1384	490	35	783	57	1012	73	1159	84	1247	90
01	Vatan	12158	4117	34	6150	51	7942	65	9304	77	10254	84
02	Veziraga	424	50	12	111	26	192	45	269	64	328	77
03	Yavuz Selim	1139	395	35	655	58	843	74	958	84	1027	90
04	Yeni	908	204	22	355	39	492	54	601	66	684	75
05	Yenidogan	3322	1434	43	2115	64	2583	78	2869	86	3040	91
06	Yenigun	45	8	18	16	36	25	55	31	70	36	80
07	Yenischir	3340	1313	39	1965	59	2450	73	2765	83	2964	89
08	Yesildere	1991	646	32	1053	53	1382	69	1602	80	1739	87
09	Yesiltepe	1442	362	25	634	44	876	61	1052	73	1170	81
10	Yildiz	88	18	20	41	47	62	70	74	84	80	91
11	Yunus Emre	10315	4556	44	6362	62	7656	74	8501	82	9050	88
12	Yurtoglu	4204	2024	48	2516	60	2802	67	2986	71	3121	74
13	Yzb. Serafettin	2387	1313	55	1675	70	1902	80	2052	86	2156	90
14	Zafertepe	4697	1544	33	2515	54	3306	70	3831	82	4156	88
15	Zeybek	1345	496	37	784	58	989	74	1117	83	1196	89
16	Zeytinlik	5812	2779	48	3778	65	4449	77	4880	84	5161	89
17	2. İnönü	4298	2089	49	2625	61	3022	70	3327	77	3564	83
18	Altievler	1451	115	8	215	15	338	23	479	33	630	43
19	Ataturk	3146	1120	36	1460	46	1740	55	1982	63	2191	70
20	Camtepe	5652	3155	56	3816	68	4303	76	4673	83	4951	88
21	Huzur	8766	4093	47	5157	59	5868	67	6394	73	6807	78
22	Ilica	9547	6173	65	7537	79	8275	87	8703	91	8968	94
23	Limanreis	1564	928	59	1337	86	1487	95	1534	98	1550	99
24	Narli	7916	5369	68	6247	79	6788	86	7142	90	7381	93
25	Sahilevleri	1169	156	13	285	24	434	37	584	50	721	62
26	Yenikale	4754	2346	49	3078	65	3600	76	3966	83	4218	89
		total grocery exp.	total	mean	total	mean	total	mean	total	mean	total	mean
		1602075	647374	35	910580	52	1107254	65	**1245286**	75	1341404	82
			overall mean	40	overall mean	57	overall mean	69	overall mean	78	overall mean	84
			std.dev	16	std.dev	18	std.dev	18	std.dev	16	std.dev	14
			intervals	19 - 51	intervals	34 - 70	intervals	47 - 83	intervals	59 - 90	intervals	68 - 96
			a_1 b_2		**a_1 b_2.5**		**a_1 b_3**		**a_1 b_3.5**		**a_1 b_4**	

APPENDIX B

The Overall Results of Emprical Dynamic Model

Numbers	Zone Numbers	Neighborhood Name	Total Grocery Expenditure in Zones (E_iP_i)	Type of Retail Outlets	Real Outlet Sizes (Wjs)	Model 1 Retail Outlet sizes - Before Disagregate- (Wj*s)	Model 1 Changes in Retail Sizes - errors (ΔWjs)	Model 1 Sum of Squared Errors (ΔWjs^2)	The zones Disaggregated in terms of Attractiveness	Model 2 Retail Outlet Sizes -Disaggregated in terms of Attractiveness- (Wj*s)	Model 2 Changes in Retail Sizes - errors (ΔWjs)	Model 2 Sum of Squared Errors (ΔWjs^2)	Model 3 Retail Outlet Sizes -Disaggregated in terms of Costs (Wj*s)	Disaggregated Costs (k)	Model 3 Changes in Retail Sizes - errors (ΔWjs)	Model 3 Sum of Squared Errors (ΔWjs^2)	Projected Model Retail Outlet Sizes (Wjs)	Projected Model Changes in Retail Sizes (ΔWjs)
1	1	Bahcelerarasi	781	1	250	5	-245	60167	α11	8	-242	58796	22	0,55	-228	51815	13	-237
2	2	Cetin Emec	4249	1	600	813	213	45538		694	94	8901	510	2,22	-90	8105	322	-278
3	3	Egitim	7424	1	2350	984	-1366	1864641	α11	1833	-517	267212	2199	1,36	-151	22890	1389	-961
4	4	Fevzi Cakmak	7481	1	3350	2424	-926	857971		2056	-1294	1675702	2466	1,36	-884	782323	1648	-1702
5	5	Inciralti	1967	1	250	3	-247	60837	α11	6	-244	59688	17	0,55	-233	54327	10	-240
6	6	Koruturk	11460	1	1850	217	-1633	2667091	α11	437	-1413	1996656	1300	0,55	-550	302921	721	-1129
7	7	Onur	11178	1	3850	2507	-1343	1802835	α11	4726	876	767325	3471	2,22	-379	143590	2433	-1417
8	8	Teleferik	4751	1	950	863	-87	7525		803	-147	21576	963	1,36	13	177	616	-334
9	9	Ataturk	10657	1	3450	3401	-49	2371		3020	-430	185222	3622	1,36	172	29560	2479	-971
10	10	Barbaros	5617	1	2050	2698	648	420447		2619	569	324133	1924	2,22	-126	15924	1424	-626
11	11	Birlik	5080	1	1600	2435	835	696832		2402	802	643171	1764	2,22	164	26953	1356	-244
12	12	Camkule	2689	1	1100	1175	75	5567		1155	55	3063	1386	1,36	286	81677	1185	85
13	13	Cinar	3686	1	750	1784	1034	1068541		1748	998	995465	799	3,57	49	2366	680	-70
14	14	Doganlar	8296	1	2250	1407	-843	711345		1042	-1208	1458128	3100	0,55	850	723306	1960	-290
15	15	Egemenlik-Isikkent	1622	1	1800	777	-1023	1047090		752	-1048	1098220	2237	0,55	437	190697	1635	-165
16	16	Ergene	8378	1	1600	1523	-77	5862		1206	-394	155198	1447	1,36	-153	23529	882	-718
17	17	Erzene	17565	1	3650	386	-3264	10651507	α13	2151	-1499	2245982	2580	1,36	-1070	1143931	1557	-2094
18	18	Evka 3	9352	1	2250	788	-1462	2136711	α11	1468	-782	611478	1761	1,36	-489	239270	1055	-1195
19	19	Gaziosmanpasa	7855	1	2150	3431	1281	1640689		3344	1194	1424664	2456	2,22	306	93487	1838	-312
20	20	Gurpinar	3412	1	500	1655	1155	1333925		1632	1132	1281090	746	3,57	246	60365	679	179
21	21	Inonu	14470	1	5100	1980	-3120	9731740	α11	3738	-1362	1855863	4483	1,36	-617	380402	2922	-2178
22	22	Isiklar	1342	1	250	340	90	8150		331	81	6584	243	2,22	-7	46	188	-63
23	23	Karacaoglan	3038	1	750	637	-113	12795		530	-220	48361	636	1,36	-114	13037	451	-299
24	24	Kazim Dirik	25817	1	4250	1654	-2596	6740327	α12	2904	-1346	1813055	3483	1,36	-767	588834	2248	-2002

25	25	Kemalpasa	4642	1	3600	2227	-1373	1886120		2173	-1427	2037603	2606	1,36	-994	988239	2063	-1537
26	26	Kizilay	7883	1	1850	730	-1120	1255067		543	-1307	1708023	1615	0,55	-235	55119	961	-889
27	27	Kosukavak	4954	1	1700	2066	366	133753		2010	310	95883	1476	2,22	-224	50167	1101	-599
28	28	Manavkuyu	23755	1	4050	3742	-308	95128		3508	-542	294132	4207	1,36	157	24746	2448	-1603
29	29	Mansuroglu	17949	1	4050	2270	-1780	3170060		2131	-1919	3680737	2557	1,36	-1493	2230166	1456	-2594
30	30	Meric	5909	1	1300	1916	616	379636		1863	563	317101	1368	2,22	68	4678	1175	-125
31	31	Merkez-Altindag	2672	1	1200	986	-214	45866		957	-243	59167	1148	1,36	-52	2746	1007	-193
32	32	Mevlana	5081	1	3300	1540	-1760	3098193	α11	2487	-813	660741	2983	1,36	-317	100341	2078	-1222
33	33	Naldoken	2403	1	1250	294	-956	913239	α11	485	-765	585074	1443	0,55	193	37157	906	-344
34	34	Osmangazi	13913	1	3400	3955	555	308364		3721	321	102780	4463	1,36	1063	1129363	3135	-266
35	35	Rafetpasa	9444	1	2850	2007	-843	710564		1811	-1039	1078623	2173	1,36	-677	458673	1542	-1308
36	36	Serintepe	4999	1	1750	3768	2018	4071127		3718	1968	3873580	1699	3,57	-51	2596	1581	-169
37	37	Tuna	4502	1	1600	1339	-261	68229		1292	-308	94710	1550	1,36	-50	2499	1205	-395
38	38	Umit	1627	1	150	517	367	134868		448	298	88793	205	3,57	55	2993	147	-3
39	39	Yesilcam	1446	1	750	707	-43	1879		652	-98	9512	783	1,36	33	1064	634	-116
40	40	Yesilova	11068	1	3300	3742	442	195258		3480	180	32337	4174	1,36	874	763741	3136	-164
41	41	Yildirim Beyazit	4420	1	1750	2411	661	436970		2346	596	355146	1723	2,22	-27	728	1327	-423
42	42	Yunus Emre	845	1	200	128	-72	5131		85	-115	13121	254	0,55	54	2933	173	-27
43	43	Zafer	6537	1	2400	3796	1396	1949997		3747	1347	1813469	2752	2,22	352	123756	2552	152
44	44	Adatepe	4431	1	1200	995	-205	42168		980	-220	48592	1175	1,36	-25	627	766	-434
45	45	Akincilar	6193	1	1450	1743	293	85756		1713	263	69119	1258	2,22	-192	36836	920	-530
46	46	Ataturk	5788	1	1500	3401	1901	3614517		3375	1875	3516714	1542	3,57	42	1796	1388	-112
47	47	Aydogdu	1080	1	50	705	655	429414		700	650	422802	320	3,57	270	72889	311	261
48	48	Baris	11288	1	2400	3723	1323	1749896		3691	1291	1665998	2711	2,22	311	96548	1965	-435
49	49	Cagdas	6700	1	650	2175	1525	2324288		2148	1498	2243724	982	3,57	332	109898	647	-3
50	50	Caldiran	3515	1	500	1496	996	991673		1460	960	920654	667	3,57	167	27868	603	103
51	51	Camlik	6412	1	1200	2641	1441	2077487		2611	1411	1990369	1193	3,57	-7	49	1102	-99
52	52	Camlikule	10192	1	2900	4538	1638	2683714		4448	1548	2395504	3267	2,22	367	134482	2706	-194
53	53	Dicle	3515	1	2150	2783	633	400424		2756	606	367445	2024	2,22	-126	15796	1790	-360
54	54	Dumlupinar	2709	1	700	415	-285	81334		410	-290	83824	492	1,36	-208	43118	307	-393
55	55	Efeler	11388	1	2650	2681	31	948		2652	2	2	3180	1,36	530	281318	2113	-537
56	56	Firat	6294	1	2700	2927	227	51643		2859	159	25434	3430	1,36	730	532670	2964	264
57	57	Gaziler	3095	1	300	552	252	63354		546	246	60687	250	3,57	-50	2534	154	-146
58	58	Goksu	10474	1	4200	6731	2531	6404133		6580	2380	5663882	4833	2,22	633	400322	4378	178
59	59	Guven	3860	1	900	1312	412	169782		1299	399	159148	954	2,22	54	2919	694	-206
60	60	Hurriyet	7682	1	1750	2392	642	412551		2365	615	378236	1737	2,22	-13	168	1238	-513
61	61	Inkilap	5994	1	1700	1205	-495	245091		1190	-510	259928	1428	1,36	-272	74222	945	-755
62	62	Inonu	8084	1	2450	3047	597	356923		2863	413	170904	2103	2,22	-347	120357	1657	-793

63	63	Karanfil	3661	1	350	253	-97	9362		251	-99	9849	301	1,36	-49	2423	185	-165
64	64	Kozagac	9233	1	2450	2413	-37	1396		2385	-65	4186	2861	1,36	411	168989	1937	-513
65	65	Kurucesme	9623	1	2900	3456	556	309042		3416	516	266700	2509	2,22	-391	152683	1878	-1022
66	66	Laleli	4261	1	500	1123	623	388085		1105	605	366405	505	3,57	5	26	398	-102
67	67	Menderes	9278	1	1950	2599	649	420653		2577	627	392772	1893	2,22	-57	3305	1235	-715
68	68	Murathan	3624	1	150	972	822	675636		952	802	643754	435	3,57	285	81330	318	168
69	69	Mustafa Kemal	4882	1	1150	1908	758	574207		1831	681	464249	1345	2,22	195	38053	1142	-8
70	70	Seyhan	1513	1	1300	1015	-285	81056		996	-304	92567	1194	1,36	-106	11158	1055	-246
71	71	Sirinkapi	6911	1	1350	2394	1044	1088963		2362	1012	1024153	1079	3,57	-271	73255	759	-591
72	72	Ufuk	9667	1	1950	1980	30	870		1956	6	39	2346	1,36	396	157171	1618	-332
73	73	Vali Rahmi Bey	6798	1	1650	909	-741	549104		901	-749	560595	1081	1,36	-569	323714	667	-983
74	74	Yaylacik-Bahcekapi	5354	1	1150	1207	57	3203		1193	43	1859	1431	1,36	281	79013	926	-224
75	75	Yenigun	6473	1	1900	2977	1077	1159503		2928	1028	1056083	2150	2,22	250	62634	1710	-190
76	76	Yesilbaglar	5859	1	2050	3691	1641	2691581		3627	1577	2488001	1658	3,57	-392	154016	1529	-521
77	77	Yigitler	9785	1	2050	5307	3257	10609526		5261	3211	10312691	2404	3,57	354	125475	2026	-24
78	78	Yildiz	7836	1	2650	3326	676	456559		3297	647	418922	2422	2,22	-228	52115	1887	-763
79	79	Ahmet T. Kislali	4630	1	1250	2558	1308	1710768		2434	1184	1401091	1112	3,57	-138	19018	924	-326
80	80	Aydinlikevler	2744	1	550	291	-259	67049		243	-307	94185	723	0,55	173	29940	407	-143
81	81	Balatcik	3494	1	2100	912	-1188	1410455	a11	1459	-641	411017	1750	1,36	-350	122577	1213	-887
82	82	Cagdas	4088	1	1400	1341	-59	3472		1297	-103	10627	1556	1,36	156	24210	1059	-341
83	83	Egekent	5543	1	2150	1470	-680	462981		1433	-717	514763	1718	1,36	-432	186393	1132	-1018
84	84	Evka 2	2681	1	1300	855	-445	197919		772	-528	279273	925	1,36	-375	140303	643	-657
85	85	Evka 5	6469	1	2750	1456	-1294	1675356		1302	-1448	2097239	3872	0,55	1122	1258455	2431	-319
86	86	Guzeltepe	4444	1	2300	1793	-507	257228		1642	-658	433328	1969	1,36	-331	109437	1396	-904
87	87	Istasyonalti	5461	1	1750	46	-1704	2905126	a11	98	-1652	2728437	292	0,55	-1458	2125566	167	-1583
88	88	Izkent	3801	1	1950	1279	-671	450886		1220	-730	533309	1463	1,36	-487	237160	1050	-900
89	89	Koyici	2818	1	950	246	-704	494987		217	-733	537472	645	0,55	-305	93012	361	-589
90	90	Kucukcigli	6601	1	1350	977	-373	138881		886	-464	215633	1062	1,36	-288	82778	637	-713
91	91	Maltepe	2036	1	550	225	-325	105329		189	-361	130522	561	0,55	11	127	309	-241
92	92	Sirintepe	4339	1	1750	695	-1055	1113536		596	-1154	1331990	1772	0,55	22	495	1015	-735
93	93	Yeni	3661	1	900	346	-554	307362		291	-609	370888	865	0,55	-35	1193	472	-428
94	94	Aktepe	3935	1	1050	2143	1093	1193990		2050	1000	1000844	937	3,57	-113	12777	807	-243
95	95	Atif Bey	6099	1	1650	73	-1577	2487412	a11	148	-1502	2254940	441	0,55	-1209	1461127	252	-1398
96	96	Beyazevler	2724	1	550	124	-426	181597	a11	207	-343	117798	615	0,55	65	4226	354	-196
97	97	Binbasi Resat Bey	1395	1	350	773	423	178849		734	384	147561	335	3,57	-15	211	280	-70
98	98	Dokuz Eylul	4891	1	1050	32	-1018	1036438	a11	63	-987	975095	186	0,55	-864	746535	106	-944
99	99	Emrez	2785	1	850	1317	467	218528		1260	410	168202	926	2,22	76	5703	776	-74
100	100	Gazi	4093	1	1250	82	-1168	1364298	a12	157	-1093	1194866	467	0,55	-783	613640	266	-984

101	101	Gazikent	7867	1	300	151	-149	22166		138	-162	26334	410	0,55	110	12014	218	-82
102	102	Irmak	3097	1	900	483	-417	173774		392	-508	258104	1166	0,55	266	70626	693	-207
103	103	Sevgi	7302	1	550	629	79	6192		545	-5	23	654	1,36	104	10799	361	-189
104	104	Yesil	3663	1	1050	376	-674	453686		300	-750	561773	894	0,55	-156	24433	516	-534
105	105	Ataturk	1536	1	800	397	-403	162764		393	-407	165487	1169	0,55	369	136485	816	16
106	106	Celebi	1022	1	300	624	324	104900		619	319	101680	283	3,57	-17	296	254	-46
107	107	Kahramandere	346	1	50	71	21	451		71	21	424	52	2,22	2	3	41	-9
108	108	Maltepe	1325	1	550	656	106	11326		622	72	5184	457	2,22	-93	8679	375	-175
109	109	Siteler-Camlicay	911	1	400	436	36	1278		416	16	245	499	1,36	99	9714	411	11
110	110	Yaka	216	1	300	120	-180	32551		118	-182	33055	352	0,55	52	2654	290	-10
111	111	Yali	2466	1	800	1306	506	256230		1267	467	217794	930	2,22	130	16988	815	15
112	112	75. Yil	918	1	600	611	11	111		602	2	3	722	1,36	122	14851	692	92
113	113	Adalet	6536	1	2950	3449	499	249445		3349	399	158849	2459	2,22	-491	240684	2005	-945
114	114	Aksoy	15238	1	2400	3666	1266	1602478		3246	846	715484	2384	2,22	-16	257	1551	-849
115	115	Alaybey	7452	1	1850	2199	349	121692		2156	306	93636	1584	2,22	-266	71017	1025	-826
116	116	Alparslan	4615	1	2250	4082	1832	3357192		4036	1786	3189715	1844	3,57	-406	164606	1768	-482
117	117	Bahariye	10189	1	1900	1426	-474	224559		1382	-518	268059	1658	1,36	-242	58581	1003	-898
118	118	Bayrakli	6298	1	750	1337	587	344721		1320	570	324649	603	3,57	-147	21583	409	-341
119	119	Bostanli	39151	1	5450	825	-4625	21390217	α13	5090	-360	129531	6105	1,36	655	429527	3719	-1731
120	120	Cay	3554	1	1600	2997	1397	1950279		2924	1324	1754061	1336	3,57	-264	69516	1176	-424
121	121	Cengizhan	5395	1	2100	3043	943	888423		3004	904	817644	2207	2,22	107	11345	2130	30
122	122	Cicek	15242	1	3800	5390	1590	2528872		5267	1467	2153285	3869	2,22	69	4725	3036	-764
123	123	Cumhuriyet	8752	1	2450	2449	-1	1		2253	-197	38981	2702	1,36	252	63437	1802	-648
124	124	Dedebasi	7683	1	1750	1189	-561	315031		1095	-655	429168	1313	1,36	-437	190723	802	-948
125	125	Demirkopru	2598	1	400	259	-141	19768		209	-191	36347	251	1,36	-149	22168	152	-248
126	126	Dogancay	720	1	300	285	-15	239		257	-43	1852	308	1,36	8	68	223	-77
127	127	Donanmaci	13152	1	1700	1626	-74	5423		1544	-156	24415	1852	1,36	152	23004	1111	-589
128	128	Emek	6024	1	2800	2688	-112	12447		2536	-264	69499	3042	1,36	242	58702	2346	-454
129	129	Fikri Altay	3009	1	850	1170	320	102393		1060	210	44179	779	2,22	-71	5087	557	-293
130	130	Fuat Edip Baksi	7575	1	2000	3683	1683	2832153		3618	1618	2617990	1653	3,57	-347	120205	1531	-469
131	131	Goncalar	4976	1	1850	1489	-361	130553		1405	-445	198460	1685	1,36	-165	27337	1101	-749
132	132	Gumuspala	7089	1	2450	2722	272	73829		2583	133	17583	3098	1,36	648	419561	2407	-44
133	133	Imbatli	2435	1	1200	965	-235	55367		877	-323	104018	1053	1,36	-147	21754	741	-459
134	134	M. Erener	3020	1	1400	1995	595	353990		1959	559	312352	1439	2,22	39	1500	1299	-101
135	135	Mavisehir	16712	1	750	61	-689	474806	α11	118	-632	399541	351	0,55	-399	159461	197	-553
136	136	Nergis	8565	1	1100	606	-494	243758		521	-579	334891	1550	0,55	450	202894	907	-193
137	137	Onur	5739	1	2450	2694	244	59347		2573	123	15018	3086	1,36	636	404082	2604	154
138	138	Org. Nafiz Gurman	6507	1	2900	2602	-298	88713		2507	-393	154108	3008	1,36	108	11572	2325	-575

139	139	Ornekkoy	10976	1	4050	4193	143	20365		3787	-263	69237	4542	1,36	492	242273	3261	-790
140	140	Postacilar	3297	1	750	1129	379	143785		1039	289	83755	763	2,22	13	180	580	-170
141	141	R. Sevket Ince	5527	1	2150	3553	1403	1967498		3497	1347	1814224	2568	2,22	418	175041	2440	290
142	142	Semikler	10703	1	2850	3142	292	85463		2803	-47	2231	3362	1,36	512	261958	2233	-617
143	143	Sogukkuyu	30254	1	7600	5021	-2579	6651477		4647	-2953	8720920	5574	1,36	-2026	4105645	3324	-4276
144	144	Tersane	16815	1	2100	5717	3617	13084518		5616	3516	12362840	2566	3,57	466	217463	1818	-283
145	145	Turan	197	1	50	6	-44	1928		6	-44	1969	17	0,55	-33	1106	13	-37
146	146	Yali	11928	1	3850	1992	-1858	3451430		1766	-2084	4343053	5252	0,55	1402	1966643	3140	-710
147	147	Yamac	3231	1	1550	1089	-461	212856		970	-580	336826	1163	1,36	-387	149739	784	-766
148	148	Yamanlar	7241	1	3650	5238	1588	2522382		5135	1485	2205336	3772	2,22	122	14766	3481	-169
149	149	1. Kadriye	4228	1	2400	2358	-42	1797		2252	-148	21900	2701	1,36	301	90725	2569	169
150	150	19 Mayis	2262	1	1400	1531	131	17279		1507	107	11454	1808	1,36	408	166153	1753	353
151	151	2. Kadriye	4007	1	1400	1599	199	39502		1541	141	19774	1848	1,36	448	200631	1582	182
152	152	26 Agustos	1770	1	1000	1099	99	9750		1088	88	7727	1305	1,36	305	92963	1169	169
153	153	A. Fuat Cebesoy	3165	1	1900	1123	-777	604455		1105	-795	631331	1326	1,36	-574	329556	1020	-880
154	154	A. Fuat Erden	863	1	300	274	-26	676		264	-36	1273	317	1,36	17	290	268	-32
155	155	Abdi Ipekci	1727	1	850	1067	217	47011		1050	200	39956	771	2,22	-79	6224	716	-134
156	156	Adnan Suvari	2925	1	750	1125	375	140531		1108	358	128128	814	2,22	64	4064	664	-86
157	157	Akarcali	2702	1	550	652	102	10376		635	85	7245	466	2,22	-84	6977	415	-135
158	158	Akdeniz	172	1	950	58	-892	795442	a12	79	-871	758141	236	0,55	-714	510063	192	-758
159	159	Akin Simav	5366	1	1100	2988	1888	3563453		2964	1864	3473872	1354	3,57	254	64697	1278	178
160	160	Akinci	801	1	150	70	-80	6369	a12	79	-71	5092	94	1,36	-56	3099	80	-70
161	161	Alireis	1933	1	500	1230	730	533284		1158	658	432534	529	3,57	29	842	510	10
162	162	Alsancak	6432	1	3850	817	-3033	9197025	a12	1048	-2802	7853676	3116	0,55	-734	539330	2363	-1487
163	163	Altay	1006	1	200	243	43	1844		223	23	539	268	1,36	68	4589	251	51
164	164	Altinordu	610	1	300	355	55	3011		283	-17	274	340	1,36	40	1599	304	4
165	165	Altintas	6728	1	1400	2462	1062	1126938		2438	1038	1076615	1114	3,57	-286	81860	854	-546
166	166	Anadolu	1247	1	1400	987	-413	170409		977	-423	178575	1172	1,36	-228	51812	1122	-278
167	167	Arap Hasan	11036	1	2700	2090	-610	371718		2075	-625	390002	2489	1,36	-211	44317	1522	-1178
168	168	Asik Veysel	1594	1	2150	1318	-832	691876		1301	-849	720666	1561	1,36	-589	347396	1383	-767
169	169	Atamer	1865	1	700	643	-57	3222		637	-63	3936	764	1,36	64	4144	601	-99
170	170	Atilla	10815	1	4800	4919	119	14092		4849	49	2355	5816	1,36	1016	1031514	4562	-238
171	171	Aydin	4194	1	1650	1376	-274	74965		1349	-301	90586	1618	1,36	-32	1017	1215	-435
172	172	Aziziye	2436	1	1000	1010	10	105		958	-42	1791	1149	1,36	149	22111	1075	75
173	173	Bahar	5918	1	2350	2543	193	37387		2517	167	27929	3019	1,36	669	447821	2470	120
174	174	Bahcelievler	14769	1	4400	2269	-2131	4542301		2248	-2152	4630723	6686	0,55	2286	5226610	4143	-258
175	175	Bahriye Ucok	1200	1	750	581	-169	28555		569	-181	32731	683	1,36	-67	4544	596	-154
176	176	BalliKuyu	2513	1	850	1839	989	979066		1809	959	919054	826	3,57	-24	553	794	-56

177	177	Barbaros	7791	1	3000	3314	314	98662		3274	274	74944	3927	1,36	927	858873	3147	147
178	178	Baris	3433	1	1600	1789	189	35629		1766	166	27617	2118	1,36	518	268815	1935	335
179	179	Basin Sitesi	16534	1	2350	2959	609	371246		2927	577	333336	2150	2,22	-200	39983	1343	-1007
180	180	Bogazici	2597	1	850	1608	758	574836		1585	735	540601	724	3,57	-126	15775	694	-156
181	181	Bozkurt	265	1	100	66	-34	1175		49	-51	2628	145	0,55	45	2021	129	29
182	182	Bozyaka	6114	1	3550	2142	-1408	1983447		2123	-1427	2035938	2547	1,36	-1003	1006762	1857	-1693
183	183	Cakabey	27	1	50	21	-29	854		18	-32	1034	53	0,55	3	9	49	-1
184	184	Calikusu	6134	1	3200	4052	852	725805		4017	817	667241	2950	2,22	-250	62380	2755	-445
185	185	Cankaya	12801	1	3500	3362	-138	18927		3324	-176	31072	3987	1,36	487	236866	2581	-920
186	186	Cengiz Topel	1757	1	450	805	355	126254		788	338	113933	360	3,57	-90	8123	341	-109
187	187	Cennetcesme	1403	1	1500	794	-706	498635		783	-717	514174	939	1,36	-561	314599	901	-599
188	188	Cennetoglu	2594	1	2600	1703	-897	804890		1685	-915	837545	2021	1,36	-579	335374	1874	-726
189	189	Cimentepe	1972	1	1150	1398	248	61392		1331	181	32628	977	2,22	-173	29824	908	-242
190	190	Cinarli	250	1	450	181	-269	72443		154	-296	87521	458	0,55	8	72	324	-126
191	191	Cinartepe	2614	1	1350	1283	-67	4495		1269	-81	6549	1522	1,36	172	29656	1349	-1
192	192	Dayiemir	496	1	100	78	-22	481		69	-31	957	83	1,36	-17	295	77	-23
193	193	Devrim	2083	1	1100	865	-235	55118		844	-256	65533	1012	1,36	-88	7682	910	-190
194	194	Doganay	5568	1	600	689	89	8003		684	84	7136	503	2,22	-97	9463	342	-258
195	195	Dolaplikuyu	705	1	200	408	208	43464		363	163	26574	166	3,57	-34	1164	158	-42
196	196	Duatepe	1621	1	400	583	183	33524		486	86	7358	357	2,22	-43	1867	323	-77
197	197	Ege	1308	1	800	665	-135	18211		585	-215	46252	702	1,36	-98	9680	584	-216
198	198	Emirsultan	1318	1	350	714	364	132755		700	350	122405	320	3,57	-30	911	306	-44
199	199	Esenlik	5006	1	2350	1860	-490	240099		1847	-503	253140	2215	1,36	-135	18157	1630	-720
200	200	Esentepe	6974	1	1600	2181	581	337742		2143	543	294784	1574	2,22	-26	680	1125	-475
201	201	Esenyali	9879	1	2350	5135	2785	7755029		5080	2730	7454131	2321	3,57	-29	814	1913	-437
202	202	Etiler	2112	1	350	719	369	136509		636	286	81924	291	3,57	-59	3513	254	-96
203	203	Fahrettin Altay	10913	1	2300	1857	-443	196157		1788	-512	261693	2145	1,36	-155	23973	1347	-953
204	204	Faikpasa	1084	1	450	767	317	100560		712	262	68582	523	2,22	73	5308	492	42
205	205	Fatih	667	1	100	277	177	31202		265	165	27334	121	3,57	21	451	113	13
206	206	Ferahli	6156	1	4100	3079	-1021	1042723		3037	-1063	1130019	3643	1,36	-457	209085	3297	-803
207	207	Fevzipasa	70	1	50	45	-5	24		42	-8	68	50	1,36	0	0	48	-2
208	208	Gazi	1944	1	1400	1509	109	11818		1491	91	8263	1788	1,36	388	150760	1716	316
209	209	Gen. Asim Gunduz	1277	1	550	588	38	1447		581	31	966	697	1,36	147	21607	643	93
210	210	Gen. Kazım Ozalp	1813	1	750	662	-88	7695		645	-105	11014	774	1,36	24	562	572	-178
211	211	Goztepe	19190	1	3800	3305	-495	245469		3266	-534	284792	3918	1,36	118	13890	2382	-1418
212	212	Gulyaka	4689	1	1750	1739	-11	121		1722	-28	802	2065	1,36	315	99277	1601	-149
213	213	Gunaltay	7055	1	2450	3625	1175	1379825		3572	1122	1258005	2623	2,22	173	30008	2385	-65
214	214	Gunes	675	1	200	243	43	1866		205	5	20	245	1,36	45	2054	223	23

215	215	Gunesli	5615	1	1600	1152	-448	200655		1139	-461	212941	1366	1,36	-234	54924	926	-674
216	216	Guney	3083	1	1750	1643	-107	11370		1607	-143	20320	1928	1,36	178	31712	1729	-21
217	217	Gungor	912	1	150	350	200	39918		336	186	34777	154	3,57	4	14	137	-13
218	218	Guzelyali	19348	1	4450	3729	-721	519131		3677	-773	597053	4411	1,36	-39	1537	2673	-1777
219	219	Guzelyurt	46	1	500	58	-442	195784		43	-457	208735	128	0,55	-372	138192	112	-388
220	220	Halkapinar	676	1	2100	423	-1677	2812311	a12	712	-1388	1925852	2118	0,55	18	337	1726	-374
221	221	Hasan Ozdemir	1781	1	1200	1708	508	257709		1678	478	228444	1232	2,22	32	1050	1205	5
222	222	Hilal	2283	1	1100	787	-313	98189		739	-361	130335	886	1,36	-214	45633	722	-378
223	223	Hursidiye	82	1	250	81	-169	28609	a12	95	-155	23983	283	0,55	33	1086	244	-6
224	224	Huzur	1609	1	600	900	300	89844		889	289	83739	653	2,22	53	2832	633	33
225	225	Ihsan Alyanak	3347	1	1000	1675	675	455524		1649	649	421783	1211	2,22	211	44717	1105	105
226	226	Imariye	3815	1	2600	3159	559	312254		3076	476	226139	2259	2,22	-341	116361	2222	-378
227	227	Ismet Kaptan	385	1	1350	249	-1101	1212340	a12	332	-1018	1036526	987	0,55	-363	131677	815	-535
228	228	Ismetpasa	3613	1	3000	2914	-86	7396		2884	-116	13469	3459	1,36	459	210851	3252	252
229	229	Kadifekale	4388	1	2150	2938	788	621682		2842	692	479554	2088	2,22	-62	3879	2019	-131
230	230	Kahraman Mescit	111	1	50	67	17	295		62	12	155	46	2,22	-4	17	44	-6
231	231	Kahramanlar	5109	1	2500	2217	-283	80249		2067	-433	187457	2479	1,36	-21	427	1930	-570
232	232	Karabaglar	4192	1	2150	2285	135	18176		2260	110	12164	2711	1,36	561	314871	2533	383
233	233	Kazim Karabekir	5453	1	2100	2816	716	513287		2788	688	474009	2048	2,22	-52	2699	1730	-370
234	234	Kemal Reis	3787	1	700	2230	1530	2339479		2214	1514	2290896	1012	3,57	312	97042	945	245
235	235	Kestelli	44	1	350	19	-331	109459	a12	29	-321	102782	87	0,55	-263	68932	75	-275
236	236	Kibar	1441	1	850	852	2	5		840	-10	98	1008	1,36	158	24853	908	58
237	237	Kilic Reis	8215	1	2200	2252	52	2662		2231	31	949	2676	1,36	476	226349	2007	-193
238	238	Kocakapi	2348	1	850	668	-182	33255		643	-207	42710	772	1,36	-78	6138	582	-268
239	239	Kocatepe	1177	1	450	515	65	4239		475	25	638	570	1,36	120	14411	508	58
240	240	Konak	197	1	1100	258	-842	709582	a12	512	-588	345468	1523	0,55	423	179325	1357	257
241	241	Kosova	1539	1	250	657	407	165682		644	394	155486	294	3,57	44	1974	284	34
242	242	Kubilay	1992	1	800	1035	235	55176		972	172	29466	714	2,22	-86	7457	680	-120
243	243	Kucukada	2154	1	1150	1216	66	4368		1200	50	2467	1439	1,36	289	83499	1360	210
244	244	Kultur	10173	1	2400	2819	419	175482	a12	3658	1258	1582861	2687	2,22	287	82234	2175	-225
245	245	Kurtulus	403	1	200	114	-86	7408		72	-128	16366	214	0,55	14	206	183	-17
246	246	Lale	2997	1	1100	1367	267	71465		1334	234	54729	980	2,22	-120	14463	910	-190
247	247	Levent	3068	1	1250	1167	-83	6813		1156	-94	8821	1387	1,36	137	18680	1071	-179
248	248	Limontepe	2008	1	750	698	-52	2657		678	-72	5214	813	1,36	63	3967	696	-54
249	249	M. Ali Akman	8357	1	1500	789	-711	506061		778	-722	520790	934	1,36	-566	320817	550	-950
250	250	Maliyeciler	2078	1	1100	838	-262	68393		826	-274	75187	991	1,36	-109	11987	802	-298
251	251	Mecidiye	447	1	200	362	162	26275		355	155	24123	162	3,57	-38	1416	147	-53
252	252	Mehmet Akif	1237	1	650	700	50	2457		693	43	1886	832	1,36	182	33029	755	105

253	253	Mehtap	2758	1	1900	2658	758	574921		2628	728	530121	1930	2,22	30	915	1848	-53
254	254	Mersinli	3009	1	1300	316	-984	968347		270	-1030	1060670	803	0,55	-497	246656	577	-723
255	255	Metin Oktay	3948	1	1850	1702	-148	21910		1682	-168	28387	2017	1,36	167	27860	1555	-295
256	256	Millet	3001	1	2650	1317	-1333	1776294		1303	-1347	1813306	3877	0,55	1227	1504425	2879	229
257	257	Mimar Sinan	7069	1	2700	1763	-937	877748		1252	-1448	2097680	3723	0,55	1023	1045808	2710	10
258	258	Mirali	689	1	350	509	159	25433		493	143	20308	362	2,22	12	138	342	-8
259	259	Mithatpasa	9340	1	1900	2887	987	974426		2860	960	922253	2101	2,22	201	40330	1488	-412
260	260	Muammer Akar	8433	1	2000	2256	256	65586		2213	213	45246	2654	1,36	654	427803	1798	-202
261	261	Murat	2790	1	1400	1510	110	12006		1492	92	8464	1790	1,36	390	151789	1490	90
262	262	Murat Reis	14177	1	2900	2432	-468	219148		2414	-486	236319	2895	1,36	-5	22	1788	-1112
263	263	Namazgah	60	1	250	58	-192	36884		41	-209	43609	122	0,55	-128	16268	106	-144
264	264	Namik Kemal	487	1	100	318	218	47626		310	210	44098	142	3,57	42	1735	140	40
265	265	Odunkapi	203	1	100	137	37	1349		131	31	943	96	2,22	-4	16	94	-6
266	266	Oguzlar	366	1	500	321	-179	32071		299	-201	40591	358	1,36	-142	20143	294	-206
267	267	Osman Aksuner	739	1	250	258	8	68		255	5	20	305	1,36	55	3054	267	17
268	268	Ozgur	2179	1	2050	1408	-642	412079		1391	-659	434736	1668	1,36	-382	145894	1602	-448
269	269	Pazaryeri	950	1	250	360	110	12083		285	35	1190	209	2,22	-41	1685	186	-64
270	270	Peker	3194	1	1700	2074	374	140046		2038	338	114269	1497	2,22	-203	41262	1357	-343
271	271	Piri Reis	5656	1	2150	3279	1129	1275142		3256	1106	1222377	2391	2,22	241	58148	1989	-161
272	272	Poligon	4436	1	1200	806	-394	155090		795	-405	164208	953	1,36	-247	60860	615	-585
273	273	Refet Bele	3535	1	1500	1541	41	1661		1520	20	416	1824	1,36	324	104750	1505	5
274	274	Reis	5624	1	2700	2710	10	99		2691	-9	72	3228	1,36	528	279146	2391	-310
275	275	S. Nedim Tugaltay	281	1	200	209	9	80		195	-5	26	234	1,36	34	1144	226	26
276	276	Sakarya	597	1	250	280	30	921		209	-41	1709	250	1,36	0	0	220	-30
277	277	Salih Omurtak	2731	1	2600	1937	-663	439518		1908	-692	478275	2289	1,36	-311	96667	2062	-538
278	278	Sariyer	4296	1	3100	3042	-58	3313		3017	-83	6881	3619	1,36	519	269196	3376	276
279	279	Saygi	3597	1	1850	1923	73	5390		1907	57	3223	2287	1,36	437	191057	2023	173
280	280	Sehitler	1715	1	800	852	52	2676		840	40	1587	1007	1,36	207	42996	819	19
281	281	Selcuk	2346	1	650	1468	818	669177		1376	726	526633	629	3,57	-21	456	597	-53
282	282	Selvili	4293	1	3300	2550	-750	562573		2520	-780	608587	3023	1,36	-277	77004	2617	-683
283	283	Sevgi	2386	1	2650	1729	-921	848174		1710	-940	883786	2051	1,36	-599	358845	1763	-887
284	284	Sumer	164	1	100	99	-1	1		92	-8	68	110	1,36	10	101	105	5
285	285	Suvari	1470	1	750	1023	273	74698		923	173	30090	678	2,22	-72	5147	639	-111
286	286	Tahsin Yazici	3787	1	1100	1083	-17	292		1064	-36	1310	1276	1,36	176	30975	977	-123
287	287	Tan	208	1	100	104	4	18		96	-4	14	115	1,36	15	239	110	10
288	288	Tinaztepe	1373	1	550	778	228	52190		648	98	9519	476	2,22	-74	5533	431	-119
289	289	Trakya	1290	1	850	889	39	1542		881	31	948	1056	1,36	206	42634	1031	181
290	290	Turgut Reis	3702	1	2000	2732	732	536286		2711	711	505153	1991	2,22	-9	82	1778	-223

291	291	Turkyilmaz	301	1	50	157	107	11373		151	101	10291	69	3,57	19	369	68	18
292	292	Tuzcu	1546	1	450	1049	599	358294		1020	570	324515	466	3,57	16	254	460	10
293	293	Uckuyular	11343	1	3150	5482	2332	5436547		5390	2240	5016909	3959	2,22	809	653934	3090	-60
294	294	Ugur	44	1	150	40	-110	12202		36	-114	12988	107	0,55	-43	1834	100	-50
295	295	Ugur Mumcu	3515	1	1400	1669	269	72233		1651	251	63115	1213	2,22	-187	35055	1104	-297
296	296	Ulku	942	1	400	290	-110	12043		273	-127	16079	328	1,36	-72	5229	312	-88
297	297	Ulubatli	3951	1	1950	1459	-491	240684		1445	-505	255297	1733	1,36	-217	47132	1343	-608
298	298	Umurbey	819	1	400	65	-335	112236		38	-362	130936	113	0,55	-287	82105	85	-315
299	299	Umut	3324	1	1400	1833	433	187175		1803	403	162435	1324	2,22	-76	5735	1222	-178
300	300	Uzundere	1384	1	2150	666	-1484	2203607		638	-1512	2287622	1896	0,55	-254	64485	1612	-538
301	301	Vatan	12158	1	3900	3557	-343	117952		3509	-391	152538	4209	1,36	309	95755	2896	-1004
302	302	Veziraga	424	1	200	268	68	4587		260	60	3587	191	2,22	-9	83	180	-20
303	303	Yavuz Selim	1139	1	400	754	354	125130		748	348	121057	342	3,57	-58	3390	332	-68
304	304	Yeni	908	1	350	346	-4	17		249	-101	10135	299	1,36	-51	2595	262	-88
305	305	Yenidogan	3322	1	1600	2331	731	534601		2295	695	483098	1686	2,22	86	7334	1565	-35
306	306	Yenigun	45	1	200	25	-175	30783	α12	28	-172	29559	83	0,55	-117	13574	71	-129
307	307	Yenisehir	3340	1	2350	1425	-925	855028		1349	-1001	1001338	1618	1,36	-732	535131	1279	-1071
308	308	Yesildere	1991	1	1200	1463	263	69190		1440	240	57664	1058	2,22	-142	20241	1019	-181
309	309	Yesiltepe	1442	1	600	663	63	3995		637	37	1339	764	1,36	164	26755	697	97
310	310	Yildiz	88	1	50	57	7	52		53	3	11	64	1,36	14	193	62	12
311	311	Yunus Emre	10315	1	4250	3930	-320	102337		3885	-365	133338	4660	1,36	410	167878	3541	-709
312	312	Yurtoglu	4204	1	3750	2228	-1522	2316312		2200	-1550	2401675	2639	1,36	-1111	1234014	2546	-1204
313	313	Yzb. Serafettin	2387	1	2350	2108	-242	58802		2086	-264	69446	2503	1,36	153	23301	2441	91
314	314	Zafertepe	4697	1	1400	1515	115	13337		1491	91	8307	1789	1,36	389	150988	1313	-87
315	315	Zeybek	1345	1	600	944	344	118287		936	336	112960	688	2,22	88	7662	670	70
316	316	Zeytinlik	5812	1	3000	2688	-312	97073		2656	-344	118216	3186	1,36	186	34590	2596	-404
317	317	2. İnönü	4298	1	2050	1988	-62	3843		1936	-114	12937	2322	1,36	272	74242	1878	-172
318	318	Altievler	1451	1	250	94	-156	24410		80	-170	28957	237	0,55	-13	158	142	-108
319	319	Ataturk	3146	1	1700	1263	-437	190656		1207	-493	243384	1447	1,36	-253	63834	1097	-603
320	320	Camtepe	5652	1	2600	2231	-369	135923		2196	-404	163534	2634	1,36	34	1126	1906	-694
321	321	Huzur	8766	1	2950	2975	25	610		2830	-120	14446	3394	1,36	444	197357	2587	-363
322	322	Ilica	9547	1	2750	3105	355	125670		2952	202	40779	3541	1,36	791	625272	2496	-254
323	323	Limanreis	1564	1	900	847	-53	2857		808	-92	8416	969	1,36	69	4828	822	-78
324	324	Narli	7916	1	3250	3887	637	405244		3812	562	315440	2800	2,22	-450	202930	2152	-1098
325	325	Sahilevleri	1169	1	600	40	-560	313850	α11	72	-528	278444	215	0,55	-385	148149	123	-477
326	326	Yenikale	4754	1	1500	1321	-179	32069		1294	-206	42449	1552	1,36	52	2711	1088	-412
Sub -Total					513400	513371		265491549		513403		212899848	513410			57168083	395577	
1	3	Egitim	7424	2	400	258	-142	20068		185	-215	46223	429	1,9	29	820	497	97

2	4	Fevzi Cakmak	7481	2	1200	1281	81	6530		1088	-112	12524	899	5,4	-301	90459	1141	-59
3	5	Inciralti	1967	2	2500	70	-2430	5906362		60	-2440	5952969	139	1,9	-2361	5572839	187	-2313
4	6	Koruturk	11460	2	400	82	-318	101365		65	-335	112312	150	1,9	-250	62352	159	-241
5	7	Onur	11178	2	1200	1177	-23	507		803	-397	157491	1861	1,9	661	436676	2487	1287
6	8	Teleferik	4751	2	400	530	130	17019		495	95	9118	409	5,4	9	90	470	70
7	9	Ataturk	10657	2	400	660	260	67365		587	187	34993	485	5,4	85	7254	616	216
8	10	Barbaros	5617	2	400	809	409	167565		787	387	149585	650	5,4	250	62605	874	474
9	11	Birlik	5080	2	400	883	483	233625		875	475	225609	723	5,4	323	104406	1006	606
10	15	Egemenlik-Isikkent	1622	2	400	273	-127	16133		265	-135	18310	613	1,9	213	45475	824	424
11	16	Ergene	8378	2	800	1199	399	159568		942	142	20156	778	5,4	-22	463	902	102
12	17	Erzene	17565	2	2000	423	-1577	2485646	a21	789	-1211	1466717	1828	1,9	-172	29637	1610	-390
13	18	Evka 3	9352	2	1000	623	-377	142487		445	-555	307660	1032	1,9	32	1010	1227	227
14	19	Gaziosmanpasa	7855	2	400	985	585	342178		963	563	316673	796	5,4	396	156532	1084	684
15	21	Inonu	14470	2	1000	720	-280	78296		473	-527	277930	1095	1,9	95	9111	1428	428
16	24	Kazim Dirik	25817	2	2600	1879	-721	519640	a21	3162	562	316083	2613	5,4	13	179	2399	-201
17	25	Kemalpasa	4642	2	400	401	1	1		393	-7	56	324	5,4	-76	5716	473	73
18	27	Kosukavak	4954	2	400	765	365	133095		746	346	119999	617	5,4	217	47028	846	446
19	28	Manavkuyu	23755	2	3700	5651	1951	3804851		5295	1595	2544131	4376	5,4	676	456990	5328	1628
20	29	Mansuroglu	17949	2	3700	3541	-159	25386		3327	-373	139159	2750	5,4	-950	903408	3307	-393
21	35	Rafetpasa	9444	2	400	506	106	11297		459	59	3521	380	5,4	-20	416	510	110
22	41	Yildirim Beyazit	4420	2	400	787	387	149697		766	366	133596	633	5,4	233	54123	867	467
23	48	Baris	11288	2	400	938	538	288936		936	536	286857	773	5,4	373	139283	1018	618
24	54	Dumlupinar	2709	2	1200	1187	-13	182		1182	-18	340	976	5,4	-224	49961	1215	15
25	55	Efeler	11388	2	800	1291	491	240750		1285	485	235145	1062	5,4	262	68593	1354	554
26	59	Guven	3860	2	400	884	484	234377		881	481	231326	728	5,4	328	107624	966	566
27	60	Hurriyet	7682	2	400	820	420	176662		816	416	173259	675	5,4	275	75391	874	474
28	61	Inkilap	5994	2	1400	1634	234	54864		1625	225	50413	1343	5,4	-57	3298	1776	376
29	63	Karanfil	3661	2	2500	2887	387	150117		2877	377	141933	2377	5,4	-123	15020	3006	506
30	64	Kozagac	9233	2	800	1284	484	234152		1278	478	228083	1056	5,4	256	65454	1381	581
31	65	Kurucesme	9623	2	400	758	358	128361		755	355	125829	624	5,4	224	50056	856	456
32	72	Ufuk	9667	2	800	1267	467	217739		1260	460	211492	1041	5,4	241	58184	1368	568
33	73	Vali Rahmi Bey	6798	2	3900	3483	-417	174105		3474	-426	181165	2871	5,4	-1029	1058134	3757	-143
34	74	Yaylacik-Bahcekapi	5354	2	400	672	272	73899		669	269	72226	553	5,4	153	23311	661	261
35	78	Yildiz	7836	2	400	771	371	137372		769	369	136209	636	5,4	236	55500	901	501
36	82	Cagdas	4088	2	400	521	121	14695		506	106	11138	418	5,4	18	317	499	99
37	83	Egekent	5543	2	1000	972	-28	772		952	-48	2345	786	5,4	-214	45617	971	-29
38	85	Evka 5	6469	2	800	710	-90	8017		638	-162	26309	527	5,4	-273	74473	639	-162

39	89	Koyici	2818	2	800	313	-487	237294		277	-523	273527	642	1,9	-158	25032	683	-117
40	90	Kucukcigli	6601	2	400	433	33	1114		395	-5	29	326	5,4	-74	5460	354	-46
41	95	Atif Bey	6099	2	2900	224	-2676	7159551	α21	497	-2403	5773348	1152	1,9	-1748	3055464	941	-1959
42	101	Gazikent	7867	2	2500	1849	-651	423746		1694	-806	650379	3924	1,9	1424	2027099	4138	1638
43	105	Ataturk	1536	2	400	312	-88	7817		311	-89	7961	257	5,4	-143	20496	334	-66
44	114	Aksoy	15238	2	400	869	469	220345		776	376	141227	641	5,4	241	58154	743	343
45	115	Alaybey	7452	2	800	1353	553	305698		1333	533	284595	1102	5,4	302	91223	1319	519
46	117	Bahariye	10189	2	3700	4299	599	358391		4185	485	235377	3459	5,4	-241	58193	4303	603
47	118	Bayrakli	6298	2	400	1031	631	397846		1023	623	388420	846	5,4	446	198593	1036	636
48	119	Bostanli	39151	2	4100	1038	-3062	9378785	α21	2158	-1942	3771150	5000	1,9	900	810000	4254	154
49	122	Cicek	15242	2	400	914	514	264105		898	498	248442	743	5,4	343	117309	1072	672
50	123	Cumhuriyet	8752	2	400	617	217	46944		571	171	29116	472	5,4	72	5126	573	173
51	124	Dedebasi	7683	2	1200	1233	33	1058		1141	-59	3428	943	5,4	-257	65878	1110	-90
52	127	Donanmaci	13152	2	1400	1982	582	338201		1892	492	242012	1564	5,4	164	26757	1807	407
53	131	Goncalar	4976	2	800	857	57	3204		809	9	78	668	5,4	-132	17304	790	-10
54	136	Nergis	8565	2	1800	1419	-381	145196		1229	-571	325482	2849	1,9	1049	1099576	3252	1452
55	138	Org. Nafiz Gurman	6507	2	400	583	183	33519		565	165	27287	467	5,4	67	4501	667	267
56	143	Sogukkuyu	30254	2	2400	2539	139	19253		2366	-34	1183	1955	5,4	-445	198007	2358	-42
57	146	Yali	11928	2	1200	936	-264	69745		835	-365	132943	1936	1,9	736	540971	2235	1035
58	153	A. Fuat Cebesoy	3165	2	400	379	-21	426		376	-24	574	311	5,4	-89	7960	444	44
59	158	Akdeniz	172	2	2900	331	-2569	6597223	α21	550	-2350	5521027	1275	1,9	-1625	2640554	1496	-1404
60	160	Akinci	801	2	400	252	-148	21763	α21	336	-64	4123	278	5,4	-122	15005	312	-88
61	162	Alsancak	6432	2	4900	1775	-3125	9766061	α21	2436	-2464	6069807	5645	1,9	745	554535	6006	1106
62	165	Altintas	6728	2	400	916	516	266666		913	513	263262	755	5,4	355	125750	1014	614
63	167	Arap Hasan	11036	2	2200	2483	283	79862		2481	281	78706	2050	5,4	-150	22496	2488	288
64	170	Atilla	10815	2	400	577	177	31455		573	173	29795	473	5,4	73	5362	660	260
65	171	Aydin	4194	2	400	538	138	19106		531	131	17084	439	5,4	39	1489	613	213
66	174	Bahcelievler	14769	2	4300	3426	-874	763241		3416	-884	781253	2823	5,4	-1477	2180929	3677	-623
67	177	Barbaros	7791	2	400	598	198	39010		594	194	37559	491	5,4	91	8234	694	294
68	179	Basin Sitesi	16534	2	1200	2299	1099	1208375		2290	1090	1187634	1892	5,4	692	479367	2275	1075
69	182	Bozyaka	6114	2	1200	1118	-82	6644		1116	-84	7080	922	5,4	-278	77181	1316	116
70	185	Cankaya	12801	2	800	1179	379	143352		1173	373	139059	969	5,4	169	28674	1182	382
71	194	Doganay	5568	2	800	1286	486	236370		1285	485	235360	1062	5,4	262	68689	1352	552
72	199	Esenlik	5006	2	400	445	45	2057		445	45	2029	368	5,4	-32	1037	483	83
73	200	Esentepe	6974	2	400	742	342	117119		734	334	111454	606	5,4	206	42633	765	365
74	203	Fahrettin Altay	10913	2	1800	2073	273	74588		2004	204	41735	1656	5,4	-144	20615	2017	217
75	211	Goztepe	19190	2	2500	3360	860	739596		3343	843	711344	2763	5,4	263	69232	3379	879