CONSTANTINE PORPHYROGENETUS
INTERNATIONAL ASSOCIATION
Institute of Interdisciplinary Studies in
Environmental Management,
Locational Decisions and Regional Planning

UNIVERSITY OF THE AEGEAN
Department of Shipping, Trade and Transport
Laboratory of Geographic Information Systems,
Geo-economy and Geopolitics

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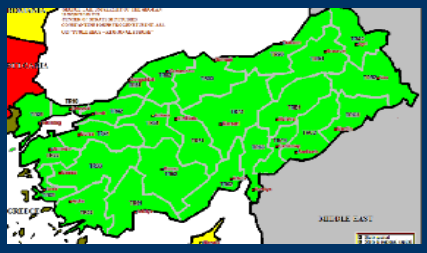

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SPECIAL REPORT

GEOGRAPHIC INFORMATION SYSTEM "PTOLEMEOS – REGIONAL TURKEY" Theoretical background, users guide and applications

Author: John Karkazis

CONTENTS

GEOGRAPHIC INFORMATION SYSTEM "PTOLEMEOS - REGIONAL TURKEY" Theoretical background, users guide and applications

A. THEORETICAL BACKGROUND

A1. THE NOTION OF POSITION EFFICIENCY

A thumb rule approach to express the regional efficiency (attractiveness) of geographical areas or administrative units is **the position efficiency**.

Let Ei1, Ei2, … , Ein, Mi1, Mi2,..., Mim be the values of criteria (statistics) according to which the socio-economic image of an area Ai will be assessed (i=1,2,…,k). Let also assume that for the first n criteria maximization is required to attain efficiency whereas for the last m of them minimization is required. An area Ai is characterized by position efficiency at level k, in the context of a set (A1, A2,…, Ak) of k areas under assessment, if for any criterion j under assessment **Eij is among the k largest values of the set (E1j, E2j,…,Enj)** and at the same time **Mij is among the k smallest values of the set (M1j, M2j,…,Mkj).**

Example. Six regions R1, R2,..,R6 are assessed on the basis of 2 criteria, an economic criterion, the GDP, for which maximization is required, and a social criterion, the persons per physician (PHY) for which minimization is required. The values of these criteria for the 6 regions are given in the following table:

	Reg1	**Reg2**	**Reg3**	**Reg4**	**Reg5**	**Reg6**
GDP:	100	120	112	130	90	104
PHY:	60	90	50	55	70	83

Region 3 is characterized by position efficiency at level 2 because its GDP is the largest among the 6 regions considered and the value it achieves on the social criterion is the second smallest among them.

We distinguish two cases for the position efficiency evaluation:

Case 1: Maximization Problem

(up to) three criteria of maximization type: Max C1(i), C2(i), C3(i)
and one criterion of minimization type: Min C0(i)
can be employed by the system i=1,..81 (the codes of provinces)

The above three criteria are reduced to the following three ones:

Max R1(i), R2(i), R3(i)
where R1(i) = C1(i)/C0(i), R2(i) = C2(i)/C0(i), R3(i) = C3(i)/C0(i)

The provincial values of the three ratio criteria are then sorted in an increasing order of magnitude. Let s1(i), s2(i) and s3(i) be the rankings of province i according to each one of the above three ratio criteria. A province i is characterized as **efficient** at the level k if :

s1(i) <= k, s2(i) <= k and s3(i) <= k

and as **inefficient** at level k if:

s1(i) >= 82-k, s2(i) >= 82-k and s3(i) .>= 82-k

Note. In the context of a maximization problem if a criterion Cj should be minimized then the system maximizes the expression 1/Cj(i) (i=1,2, 3)

Case 2: Minimization Problem

(up to) three criteria of minimization type: Min C1(i), C2(i), C3(i)
and one criterion of maximization type: Max C0(i)
can be employed by the system i=1,..81 (the codes of provinces)

The above three criteria are reduced to the following three ones:

Min R1(i), R2(i), R3(i)
where R1(i) = C1(i)/C0(i), R2(i) = C2(i)/C0(i), R3(i) = C3(i)/C0(i)

The remaining three criteria (provincial) values are sorted in a decreasing order of magnitude. Let s1(i), s2(i) and s3(i) be the ranking of province i according to each one of the three criteria. A province i is characterized as **efficient** at the level k if :

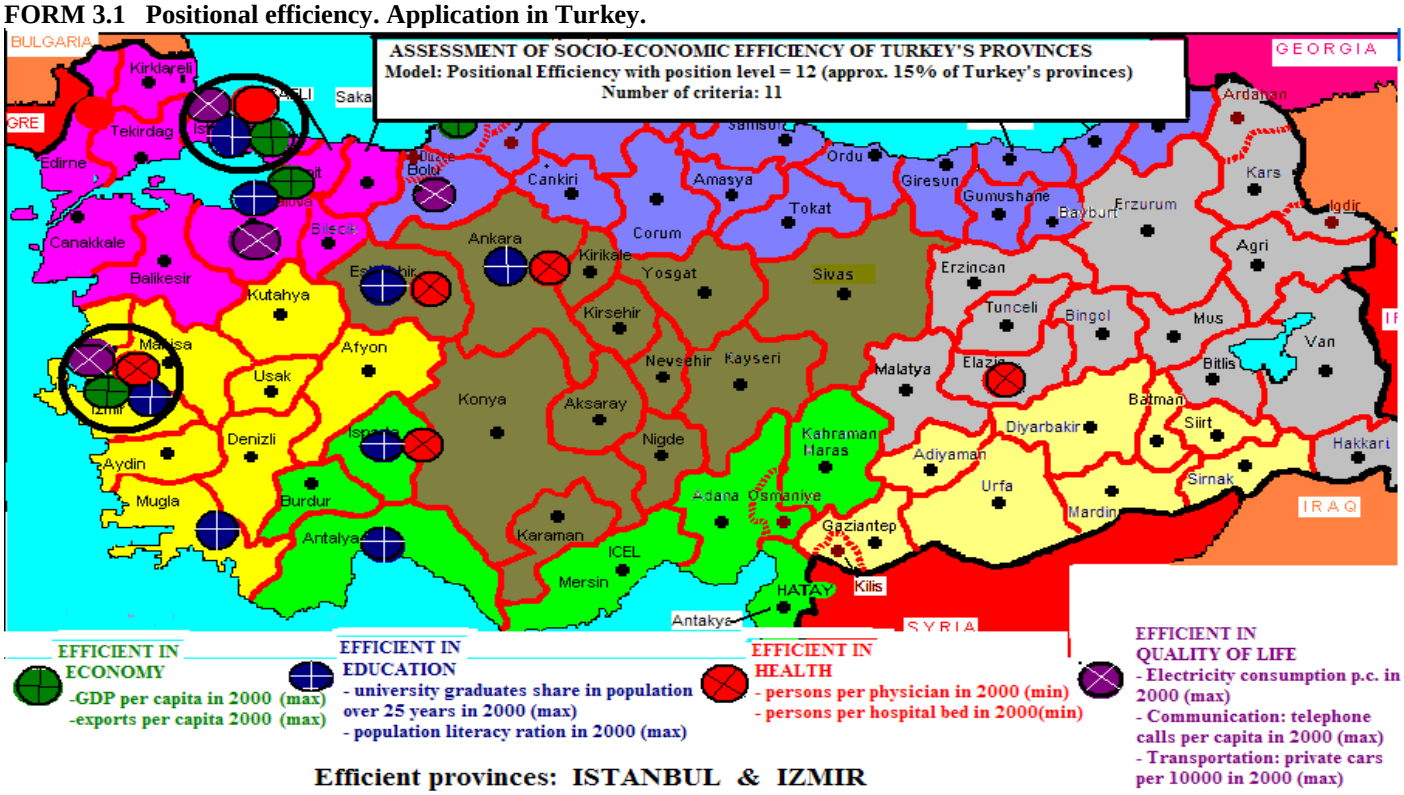
s1(i) <= k, s2(i) <= k and s3(i) <= k

and as **inefficient** at level k if:

s1(i) >= 82-k, s2(i) >= 82-k and s3(i) .>= 82-k

Form 3.1 presents an application of positional efficiency in the case of Turkey.

FORM 3.1 Positional efficiency. Application in Turkey.



A2. THE NOTION OF A GRAVITY SYSTEM

The Geo-economic Gravity Model

The n-Facilities Location Problem
The n-Facilities Location Problem regards the location of n non-competing supply facilities in a geographical area which will fully cover the demand for services (public sector or social type facilities) or commodities (private sector or economic type facilities) of a system of area-type demand poles at a minimum, fixed and transport, cost.

The Concept of "Area-Type Demand Poles"
Area-type demand poles represent large spatial conglomerations of demand points such as an urban area or even an administrative unit (province, region or a state). In the context of the modeling process, area-type demand poles are spatially represented by a "central" point inside them, usually the location of the corresponding administrative center. Note also that, in the context of regional development approaches, the demand of large geographical areas (cities or administrative units) can be represented by summary measures such as their population, their GDP, their MVA or their imports.

Versions of the Problem
The n-Facilities Location Model has two methodological versions:

- The n-Facilities Location Model on the plane (the planar case)
- The n-Facilities Location Model on a transport network (the network case)

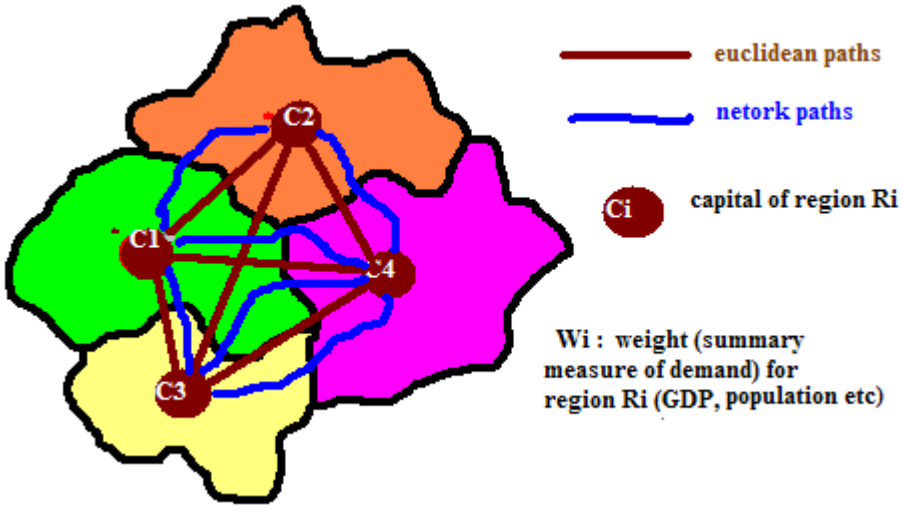
Weber (1909) introduced the one center Facility Location model on the plane using Euclidean distances and a linear cost function. Weiszfeld (1936) introduced a rapidly converging algorithm for its solution. Karkazis and Boffey (1981) and Boffey and Karkazis (1984) introduced efficient optimal algorithms for the n-Facilities Location Problem on a transport network.

The Geo-Economic Gravity Model

In the case of area-type demand poles coinciding with administrative units (provinces, regions, states etc.) corresponding n-Facilities Location Model will be called thereon "Geo-Economic Gravity Model" since the role of the network nodes attracting supply facilities is played by administrative units which exercise geo-economic type gravitating forces on their environment.

The general geo-economic gravity model was introduced by Karkazis (1999a) and it was applied to the Balkans (Karkazis, 1999b), Turkey (Karkazis, 2005), Greece (Karkazis and Doumi , 2007a) and Europe (Karkazis, 2007b).

FIGURE 4.1 The Geo-economic Gravity Model



The objective in the geo-economic gravity model is the minimization with respect to ***P*** of the following **supply cost** function:

$$C(\boldsymbol{P}) = O(\boldsymbol{P}) + T(\boldsymbol{P},C1) + T(\boldsymbol{P},C2) + T(\boldsymbol{P},C3) + ... + T(\boldsymbol{P},Cm)$$

where $\boldsymbol{P} = (P1,P2,\ldots,Pn)$ is a vector consisting of the locations on the plane (candidate locations) of the n supply centers, $O(\boldsymbol{P})$ represents the cost of **operating** the n supply centers and $T(\boldsymbol{P},Ci)$ represents the **transportation** cost for transporting, for every region i, Wi units (the demand of region i) to its capital Ci from its nearest supply center. Function T is defined as follows:

$$T(\boldsymbol{P},Ci) = \min_j \; Wi\, T(Dij)$$

where Wi represents the summary measure of demand for region i, Dij represents the distance (euclidean or true network distance) between capital Ci and supply center j and T(Dij) the cost of transporting one unit of demand for a distance Dij **.**

In the planar case (euclidean distances) the corresponding geo-economic gravity model is called **Planar Gravity Model** whereas in the network case (true network distances) this is called **Network Gravity Model**.

The concept of Social, Economic, Industrial and Trade Gravity Systems

The solution of the general geo-economic gravity model, that is the system of the n supply center locations minimizing corresponding cost function, will be called thereon "Geo-Economic Gravity System".

If the demand summary measure is *regional population* then the corresponding Geo-Economic Gravity System will be called *Social Gravity System.* This system of supply centers is associated with public sector facilities offering social services. On the other hand, if the demand summary measure is *regional GDP*, *regional MVA* or *regional imports* then the corresponding Geo-Economic Gravity System will be called *Economic, Industrial or Trade Gravity System* respectively.

In order to distinguish between the various values n is taking in the applications performed in this paper, the Geo-Economic Gravity Systems corresponding to the values n=**1**, **2** and **3** will be thereon called **simple**, **dual** and **triple** Geo-Economic Gravity Systems respectively.

A final distinction regards the type of distance employed. If **euclidean distances** are employed then the corresponding Gravity Systems are termed **Planar Gravity Systems** whereas if **true network distances** are employed then the corresponding Gravity Systems are termed **Network Gravity Systems.**

The notion of Normalized Supply Cost in the simple network gravity model

Consider the simple (n=1) network gravity model. The Normalized Supply Cost for establishing a supply unit at the capital Ci of a region i is defined as follows:

$N(Ci) = C(Ci) / \min_j C(Cj)$

where $\min_j C(Cj)$ represents the supply cost for a supply unit established at the network gravity center. It is apparent that $N(Ci) >= 1$ for every i and $N(GC) = 1$ for the gravity center GC of the network.

A3. REFERENCES

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"The network-based geo-economic gravity centers of Greece", J. Karkazis and M. Doumi, *Middle East Forum*, Issue 6, 2007a, pp.37-58

"The impact of transport cost on the European geo-economic dynamics", J. Karkazis, *Journal of Transport and Shipping*, Issue 4, 2007b, pp. 53-70

B. USERS GUIDE

The geographic information system "Ptolemeos III", which is developed in a Visual Basic Environment, offers advanced algorithmic tools for an in-depth strategic analysis of Turkey's regional (provincial) geo-economic profile. Corresponding data base consists of 130 provincial statistics grouped into the following categories:

- People
- Urbanization
- Education
- Health
- Quality of life in general
- Quality of life in villages
- Gross Domestic Product (GDP)
- Employment
- Manufacturing industry
- Mining and quarrying industry
- Agriculture
- Budget and investment
- GDP origins
- Sectoral profile of manufacturing industry

The source of data is Turkey's National Institute of Statistics.

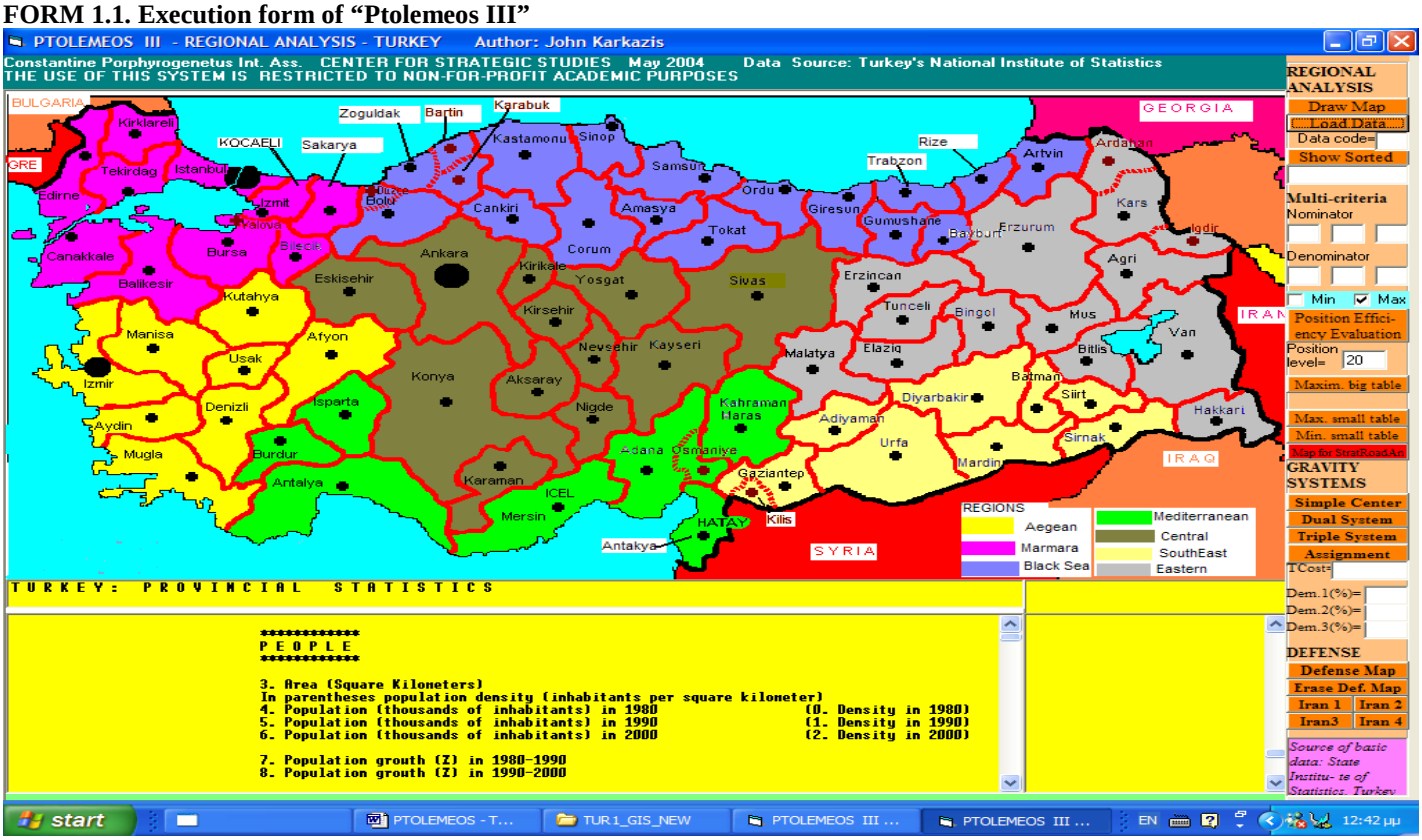
B.1 SYSTEM'S ROUTINES (COMMAND BUTTONS)

System's routines are grouped into the following sections:

- Regional analysis
- Gravity systems analysis
- Defense analysis

To activate the system, open folder "PTOLEMEOS III – REGIONAL ANALYSIS – TURKEY" in the attached diskette and double click on the file "Ptolemeos III Execution". The execution form of the system is presented in the form 1.1.

FORM 1.1. Execution form of "Ptolemeos III"



B.2 REGIONAL ANALYSIS ROUTINES

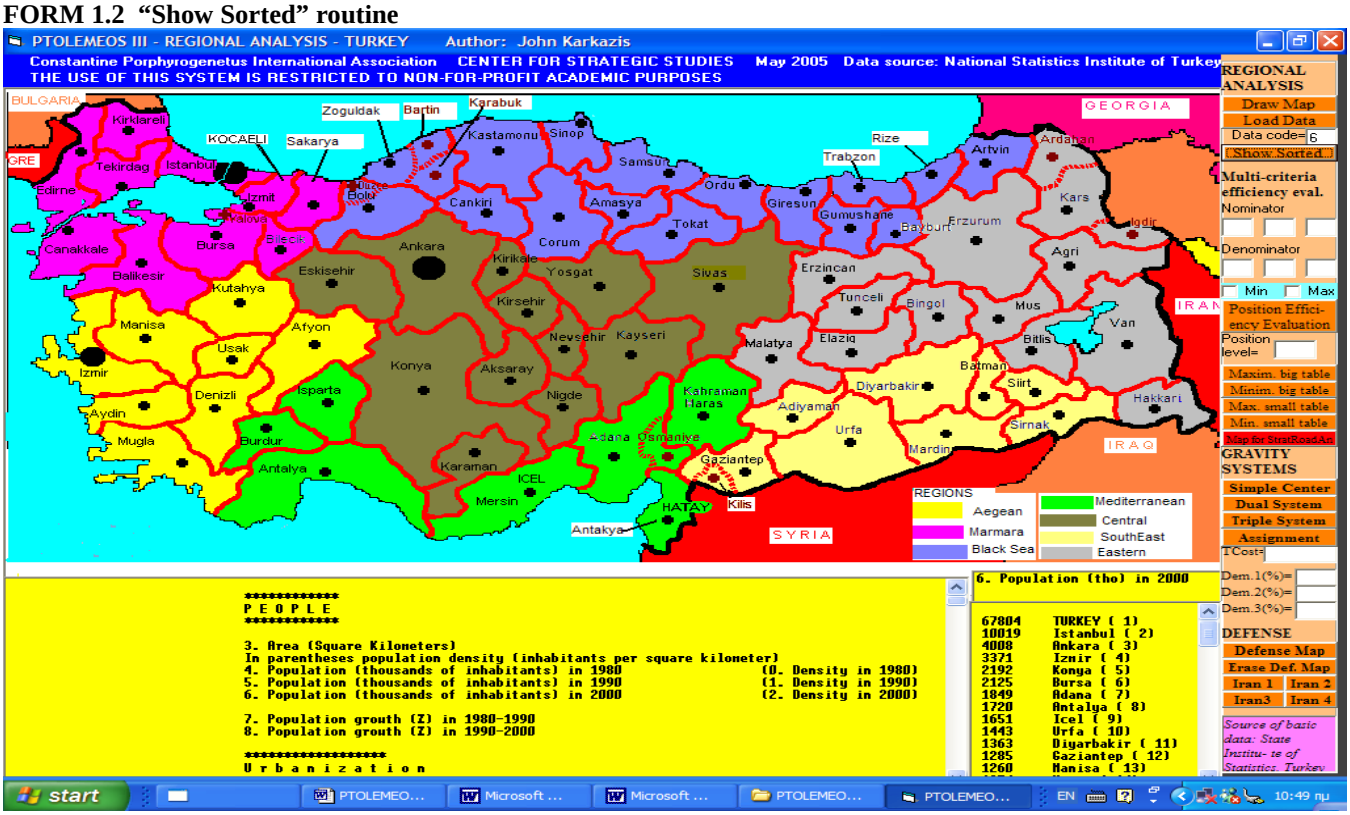
"Draw Map" routine (upper right part of the form)
The activation of the routine "Draw Map" loads a map of Turkey into the large white picture box of the form.

"Load Data" routine (upper right part of the form)
The activation of the routine "Load Data" loads the data and prints the data titles with their corresponding data codes in the large yellow text box located in the lower part of the form (form 1.1).

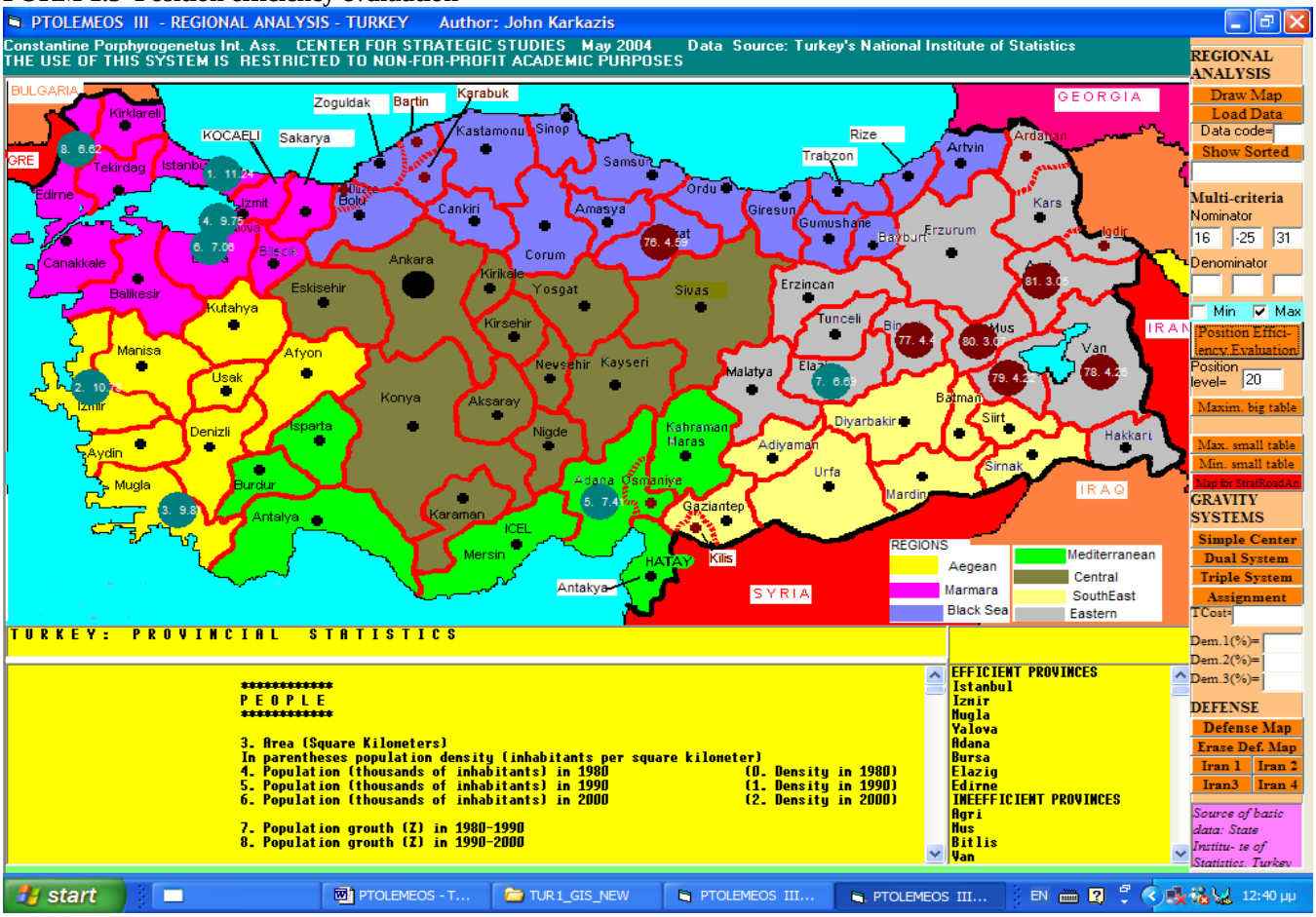
"Show Sorted" routine (upper right part of the form)
The activation of the routine "Show Sorted" prints selected data in a sorted form in the small yellow text box in the lower right part of the form. To select the data, the user finds the data code, corresponding to the data title under consideration, by scanning the large yellow text box and inserts it in the white text box with the label "Data Code" in the upper right part of the form (form 1.2).

"Position Efficiency Evaluation" routine (central right part of the form)
The activation of the routine "Position Efficiency Evaluation" evaluates the positional efficiency of Turkey's provinces at a given position level according to a given set of criteria (statistics), prints the sets of the efficient and inefficient provinces in the yellow text box in the lower right part of the form and also indicates in the map the

FORM 1.2 "Show Sorted" routine



FORM 1.3 Position efficiency evaluation



efficient and inefficient provinces with blue and red circles respectively. Note that the notion of "position efficiency" is presented in chapter 3.

For example, consider the problem of evaluation of regional efficiency at level 20 according to the following criteria:

- *C1: University graduates share in 25 years old and over population in 2000 (for efficiency this criterion should be maximized)*
- *C2: Persons per physician in 2000 (for efficiency this criterion should be minimized)*
- *C3: Electricity consumption per capita in 2000 (for efficiency this criterion should be maximized)*

From the large yellow text box the user finds the codes of the above statistics which are 16, 25 and 31 respectively. The user next checks (selects) the 'Max' option just above the "Position Efficiency Evaluation" command button and inserts the value 20 in the white text box labelled "Position level". Next, the user inserts the codes 16 and 31 in the white text boxes of the nominator line. Since criterion C2 is of different (Min) type than the rest ones the user should insert the minus code value in the third text box that is the value –25. The minus sign indicates an optimisation type different (minimisation) than the one selected (checked). Finally the user clicks on the command button "Position Efficiency Evaluation" to activate the evaluation process. The set of efficient and inefficient units are printed in the small yellow text box. In the same time the efficient and inefficient provinces are indicated with blue and red circles, respectively, in the map (form 1.3).

The above routine can be appropriately employed so as to evaluate extreme values of a given statistic and depict the provinces exhibiting these extreme values. Assume, for example, that it is required to find the four provinces of Turkey with the highest and lowest GDP per capita in 2000. From the large yellow text box the user finds the code of the above statistic which is 49. The user, next, checks (selects) the 'Max' option just above the "Position Efficiency Evaluation" command button and inserts the value 4 in the white text box labelled "Position level". Finally, the user clicks on the command button "Position Efficiency Evaluation" to activate the evaluation process. The sets of the 4 provinces with the highest (termed "efficient") and with the lowest (termed "inefficient") GDP per capita in 2000 are printed in the small yellow text box in the lower right part of the form whereas corresponding provinces are depicted in the map with blue and red circles respectively which contain corresponding extreme values (form 1.4).

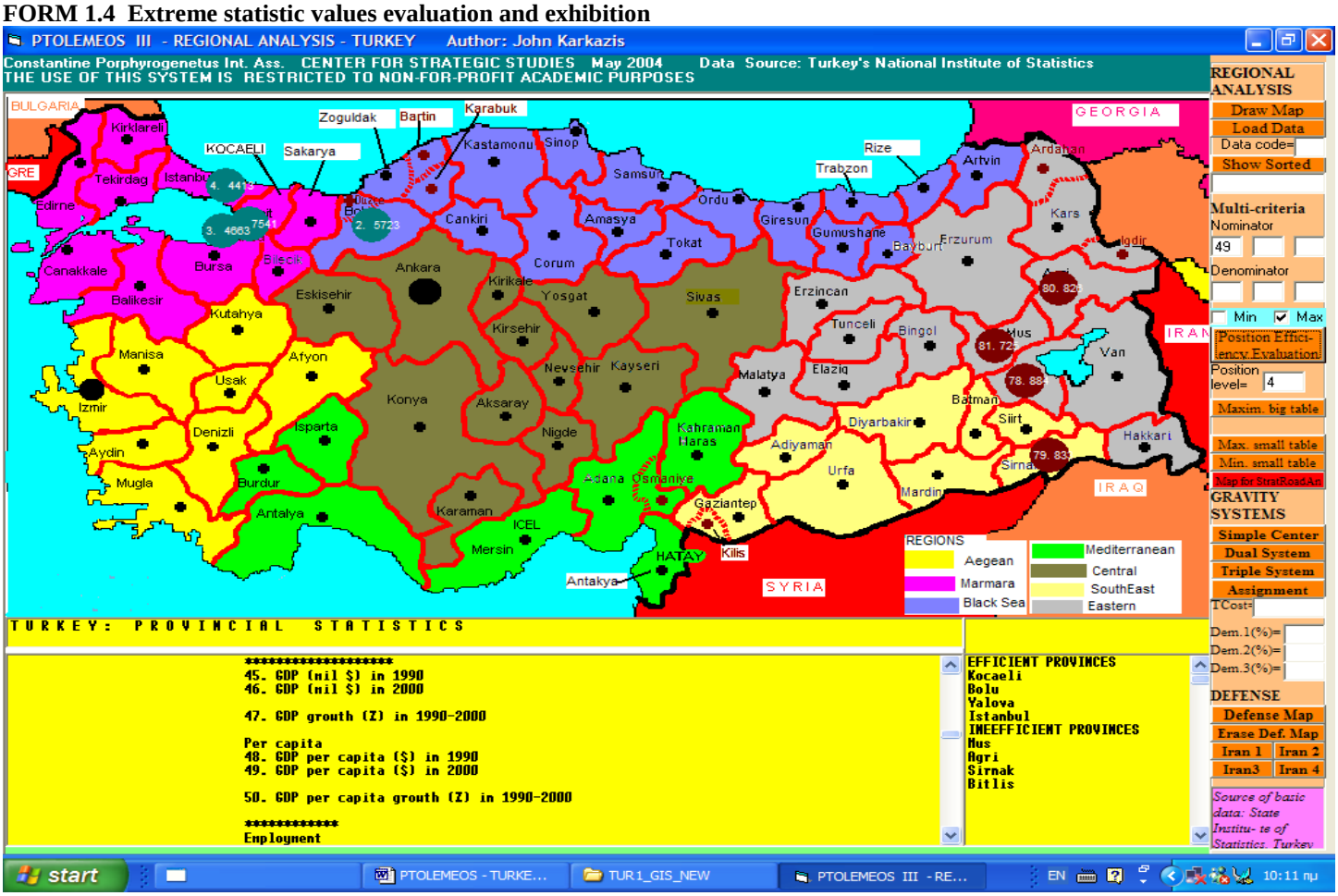
B.3 GRAVITY SYSTEMS ANALYSIS ROUTINES

Note that the notion of geo-economic gravity systems is analyzed in chapter 4.

The present system evaluates **planar** gravity systems characterized by zero operating cost and **linear** transportation cost.

In the beginning the user inserts the appropriate data code (for population, GDP etc) in the white text box in the upper right part of the form.

FORM 1.4 Extreme statistic values evaluation and exhibition



"Simple Center" routine (center right part of the form)

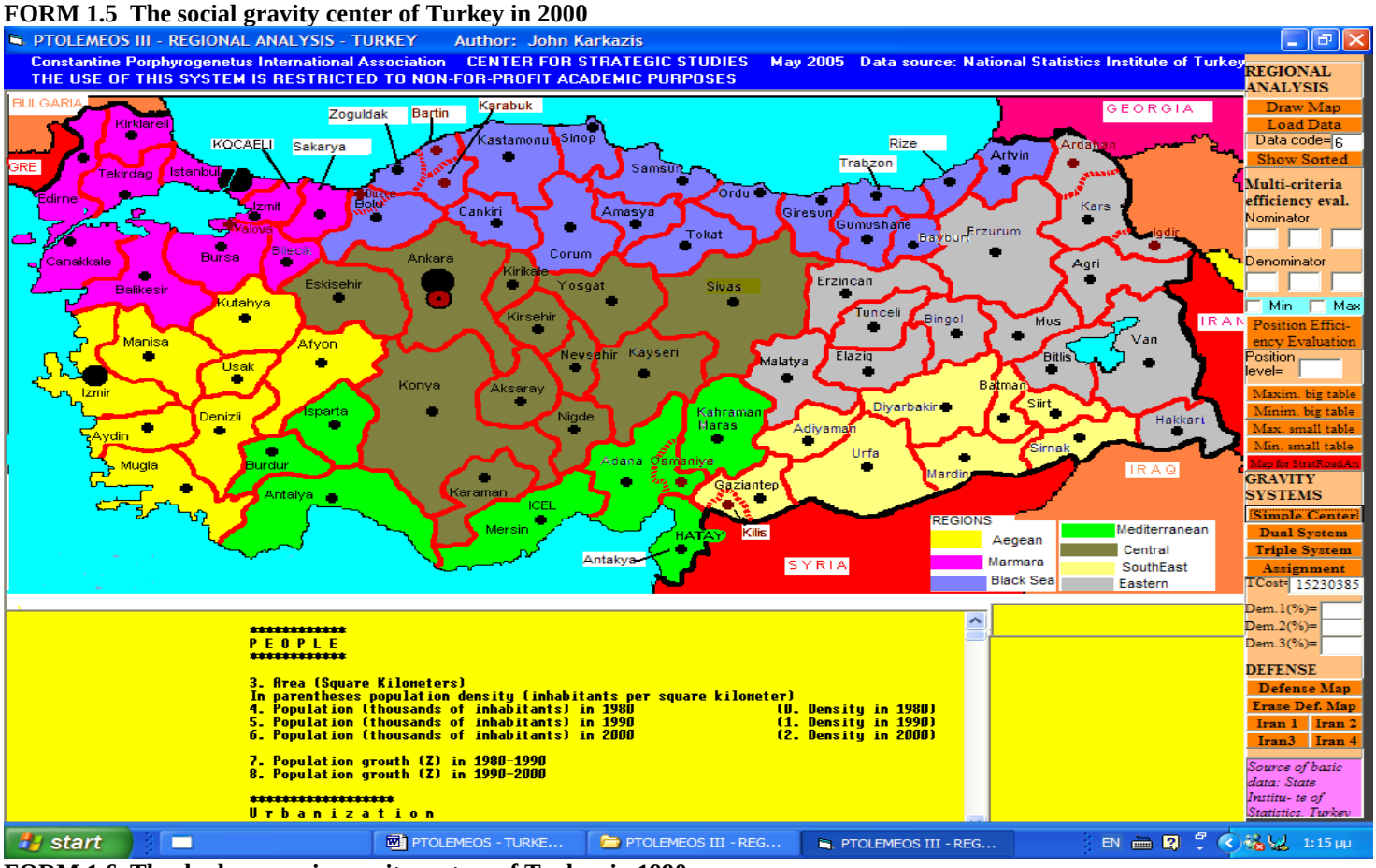
The activation of the routine "Simple Center" evaluates the simple geo-economic center of Turkey which is indicated by a red circle in the map. The corresponding total transport cost is printed in the white text box labeled "TCost" in the lower right part of the form. For example, if the user wants to evaluate and depict in the map the social gravity center of Turkey for 2000, he/she gets the data code of statistic "population in 2000" from the large yellow text box (which is 6) and inserts it in the white text box labeled "Data code" in the upper right part of the form. Then the user activates the routine "Simple Center" (form 1.5).

"Dual System" routine (center right part of the form)

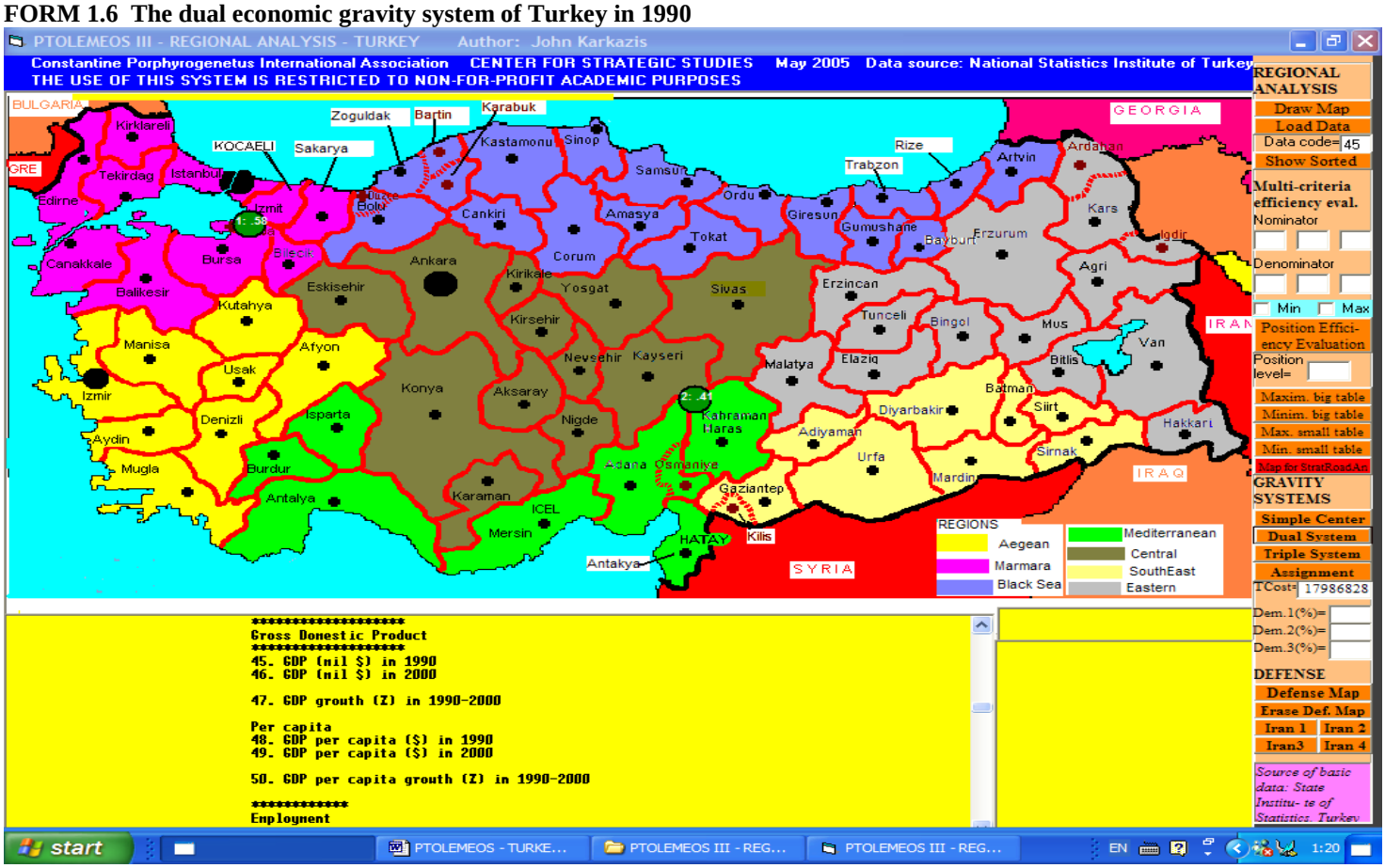
The activation of the routine "Dual System" evaluates the two geo-economic centers of the dual system which are indicated in the map with green circles. The values inside the circles indicate the corresponding transport cost shares. As in the previous

case, systems total transport cost is printed in the white text box labelled "TCost" in the lower part of the form. For example, if the user wants to evaluate and depict in the map the two centers of the economic gravity system of Turkey for 1990, he/she gets the data code of statistic "GDP in 1990" from the large yellow text box (which is 45) and inserts it in the white text box labeled "Data code" in the upper right part of the form. Then the user activates the routine "Dual System" (form 1.6).

FORM 1.5 The social gravity center of Turkey in 2000



FORM 1.6 The dual economic gravity system of Turkey in 1990

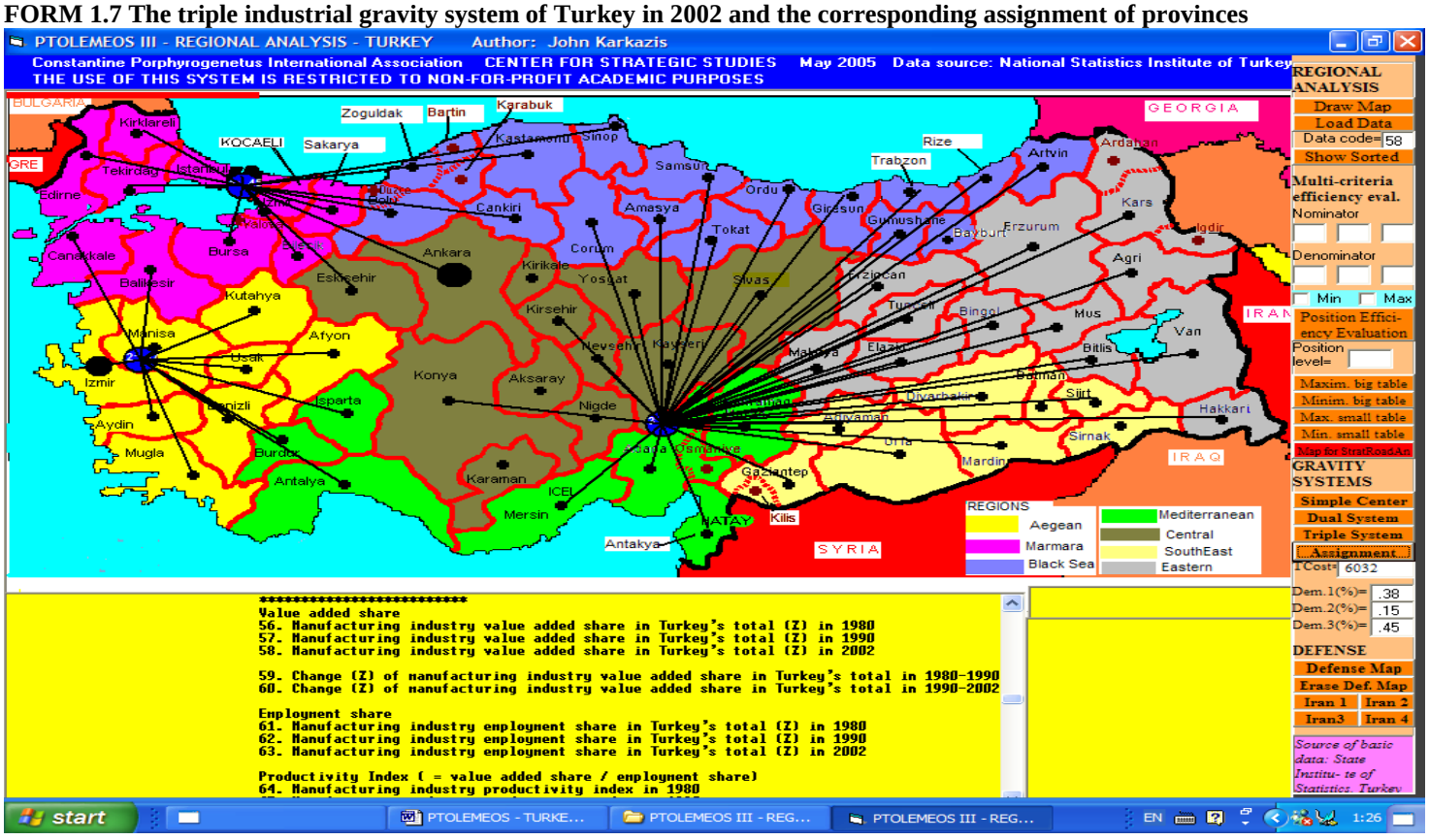


"Triple System" routine (center right part of the form)
The activation of the the routine "Triple System" evaluates the three geo-economic centers of the triple gravity system which are indicated in the map with blue circles. The values inside the circles indicate, as in the previous case, the corresponding transport cost shares. As in the previous cases, systems total transport cost is printed in the white text box labeled "TCost"' in the lower part of the form.

"Assignment" routine (lower right part of the form)
The activation of the routine "Assignment" evaluates the demand shares for each one of the centers of the dual or triple geo-economic system of Turkey and prints them in the white text boxes labeled "Dem.1", "Dem.2" and "Dem.3" in the lower right part of the form. The activation of this routine depicts also in the map the provinces assignments to the above centers (form 1.7).

For example, if the user wants to evaluate and depict in the map the three centers of the industrial gravity system of Turkey in 2002 and the assignment of Turkey's provinces to them, he/she gets the data code of statistic "Manufacturing Value Added in 2002" from the large yellow text box (which is 58) and inserts it in the white text box labeled "Data code" in the upper right part of the form. Then the user activates routine "Dual System" and also routine "Assignment" (form 1.7).

FORM 1.7 The triple industrial gravity system of Turkey in 2002 and the corresponding assignment of provinces



B.4 DEFENSE ANALYSIS ROUTINES

"Defense Map" routine (lower right part of the form)
The activation of the routine "Defense Map" draws the air, sea and land defense systems of Turkey (form 1.8).

The command buttons “Iran 1” to “Iran 4” are associated with the Iranian threat factor.

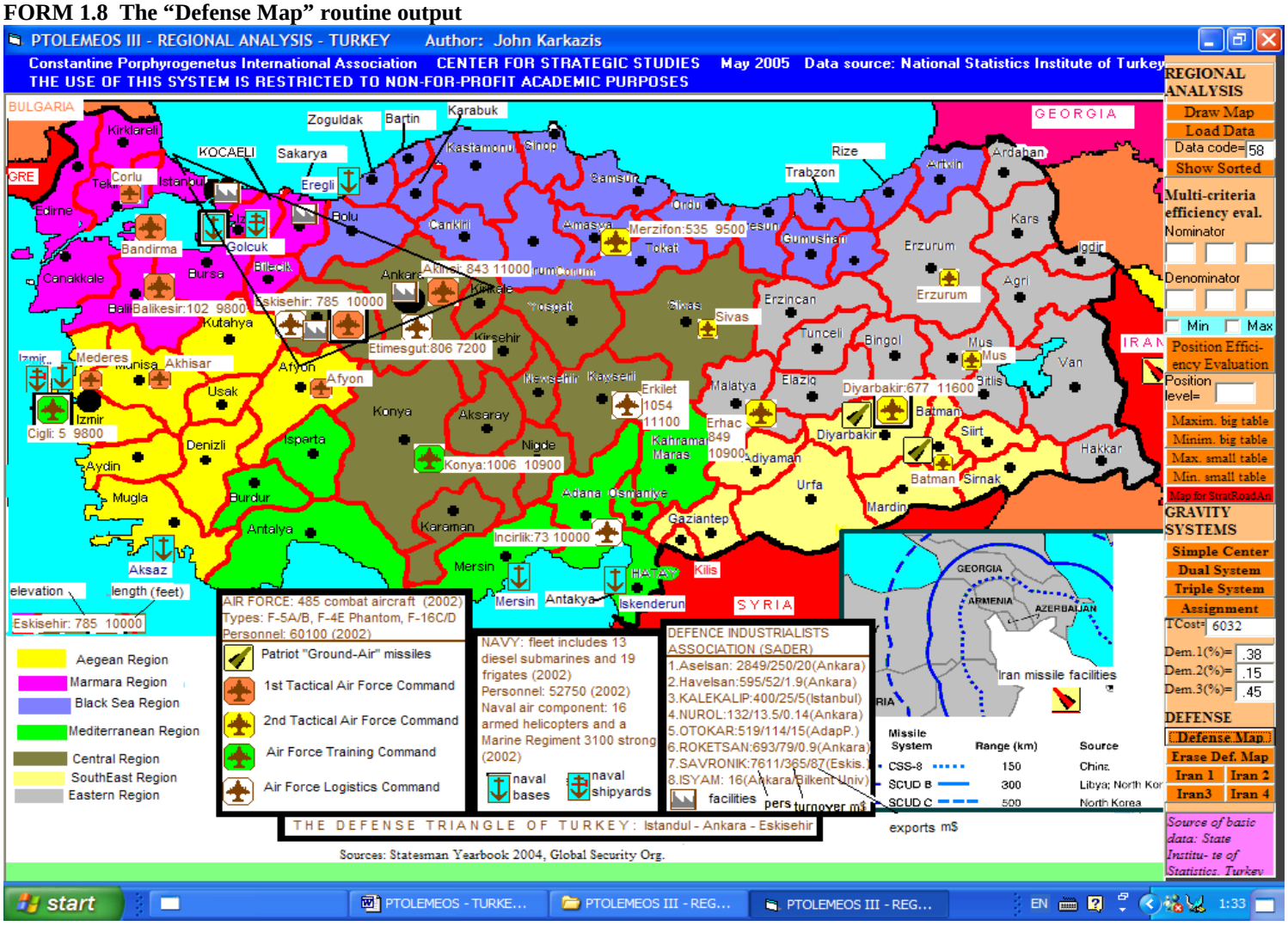
“Iran 1” routine (lower right part of the form)
The activation of this routine loads a global map with ranges of Iran’s ballistic missiles.

“Iran 2” routine (lower right part of the form)
The activation of this routine prints, in the large yellow text box in the lower part of the form, a March 2004 Report for U.S. Congress on “Ballistic and cruise missiles of foreign countries”

“Iran 3” routine (lower right part of the form)
The activation of this routine prints, in the large yellow text box in the lower part of the form, the February 2006 Annual Threat Assessment (“Weapons of Mass Destruction and States of key concerns”) of the Director of National Intelligence of U.S. Government.

“Iran 4” routine (lower right part of the form)
The activation of this routine prints, in the large yellow text box in the lower part of the form, the February 2005 Report for U.S. Congress on “Iran: U.S. concerns and policy responses”.

FORM 1.8 The “Defense Map” routine output



C. APPLICATIONS

A comparative analysis of the geo-economic gravity systems of Europe and Turkey

Author: John Karkazis

Part of this book has been published in the journal "Middle East Forum", Issue 10, December 2007, under the title "The impact of Southeastern Anatolia Project on the geo-economic gravity systems of Turkey"

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A COMPARATIVE ANALYSIS OF THE GEO-ECONOMIC GRAVITY SYSTEMS OF EUROPE AND TURKEY

John Karkazis

Google Earth

Abstract. In this paper the notion of the "Geo-Economic Gravity System" will be introduced as a conceptual tool in the analysis of the key issue of "regional efficiency" and as a modeling tool in the effort to tackle the above problems. Subsequent analysis is divided into the following 8 chapters. In chapter 2, selected regional efficiency models are presented and applications related to Turkey are discussed. In chapter 3, the notion of the "Economic Gravity System" is introduced and analyzed. In chapter 4, the general socio-economic profile of Turkey in the context of Europe is concisely presented. In chapter 5, the regional socio-economic profile of Turkey is concisely presented and discussed. In chapter 6, the impact of Turkey on the Geo-Economic Gravity Systems of Europe is analyzed and discussed whereas in chapter 7, the Geo-Economic Gravity Systems of Turkey and its internal geo-economic dynamics are also analyzed and discussed. In chapter 8, the impact of Southeastern Anatolia Project on the Geo-Economic Gravity Systems of Turkey is analyzed. Finally, chapter 9 gives the concluding remarks of the preceding analysis

December 2008

To my mother Rodi Karkazis who is the inspiring force of Constantine Porphyrogenetus International Association and to my colleagues in the other side of the Aegean Archipelago

I would like to express my gratitude to Dr. Heinz Fischer, Federal President of the Republic of Austria, Mrs Angela Merkel, Chancellor of the Federal Republic of Germany, Monsieur Dominique de VILLEPIN, Prime Minister of France, Mr Stefan Meller, Minister of Foreign Affairs of the Republic of Poland and Mrs Benita Ferrero-Waldner, E.U. Commissioner for their very positive remarks regarding this work.

CONTENTS

PREFACE

Since its establishment in 1992 as a non-for-profit international scientific association, Constantine Porphyrogenetus (C.P.) made visionary efforts to enhance academic "ethos", to promote the principles of inter-disciplinarity and inter-regionality in the academic research and to develop educational and scientific exchanges and cooperation among Europe, America and the Middle East. In particular, C.P. was pioneer in its efforts to promote the friendship, the understanding and the cooperation between the academic communities of Greece and Turkey, of Israel and Palestine. In this context, C.P. organized numerous conferences and edited scientific journals in which our colleagues from the Middle East, Europe and America worked together in a climate of friendship, vision and understanding. The symbolic epitome of the above initiatives was an international conference on The Role of the Academic Community on the Peace Process in the Middle East, which was organized in 1996 by the Institute of Middle East Studies "Al Mamun" in Kavala, Greece. During this conference, on the recommendation of Professor Kriton Curi from Turkey and as a symbolic gesture of high political significance towards Peace, the diplomatic representatives of Israel and Palestine together with the academic representatives of Greece, Turkey, Israel, Palestine, Kuwait and Croatia planted the "Olive Tree of Peace" in the courtyards of the Prefecture of Kavala.

The author of this book had the honor and the pleasure to visit most of the countries of the Region and the opportunity to enjoy their sincere and warm hospitality and also to ascertain the respect of the people for their neighbors, their vision and readiness to work hard in a climate of understanding, cooperation and good will in order to overcome the numerous socio-economic and ideological obstacles and make again the Region the cradle of the civilization. In order to achieve this vision, it is necessary for the Region to undergo a peaceful ideological

transformation integrating, in a sustainable manner, the best of its traditions with the principle of democracy in the political sphere, the principles of humanism and free expression in the educational and cultural spheres and the principle of entrepreneurialism in the economic sphere.

These principles, being the legacy of the Hellenistic era to the mankind, formed the backbone of the Old Order which lasted for almost seven centuries until the radical ideological transformation of the Roman Empire, in the 4th and 5th century, which was imposed by the emergence of Christianity. During this period the above principles were passing from one historical cycle to the next one with surprising persistence. The Roman Empire of the Christians, which emerged from this painful transformation, adopted these principles adjusting them to the new ideological framework which was characterized by intense mysticism and the pursuit of esoteric expression. The traumatic events of this period resulted in the transformation of the Old Order to the Divine Order. During this transformation the principles of humanism and free expression in the educational sphere were reduced to the pursuit of a sterile and ideologically entrenched circle of disciplines, the principle of entrepreneurialism was reduced to a strict system of professional conduct which gradually weakened the social esteem enjoyed by the class of traders and businessmen in the Old Order. During the late Roman and Ottoman Periods, this class ranked third after the military and the clergy, which were the Guardians of the Divine Order.

The above ideological framework worked effectively for almost one millennium carrying with it the remnants of the powerful legacy of the early Roman Period which offered the sense of security to its citizens and a legalizing power to its rulers. It was passing from one historical cycle to the next one (from Roman to Arab, from Arab to Seljuq and from Seljuq to Ottoman) almost intact carrying with it its ideological symbols. A characteristic example of the striking similarities of the ideological profile of the late Roman and Ottoman Dynasties was the basic principle of their foreign policies according to which the emperor or sultan traded the enormous geo-economic wealth of his dominions in order either to gain time or to achieve short term political advantages.

With the beginning of Western European Renaissance, the Eastern (Divine) Order, under the influence of its worn out principles which nurtured the seeds of its destruction, entered a period of steady decline until the dawn of the 20th century, when it finally collapsed. To the great astonishment of the Big Powers the decaying Order in the very last moment of its life created the seeds of a revival process. The principles imposed by Kemal Ataturk in the heartland of the collapsing Empire was the first decisive attempt to change the powerful ideological dogma of the Divine Order and to create the appropriate environment for the development of a new one. On the other side of the Aegean, the young Greek Democracy succeeded in less than a century to revive, after an absence of two thousand years, and “constitutionalize” the basic principles of the Hellenistic era.

These are very positive signs for the future of the Region. Still, the difficulties and the dangers in front of the governments and the citizens of the Region are great but not insurpassable. By resolving the governments of the Region these problems by themselves (and not with external assistance that creates in the long term bigger problems) and in a peaceful manner and by putting the natural and human resources of their countries under a new ideological Order promoting understanding and the principles of democracy, humanism and entrepreneurialism could unleash tremendous socio-economic powers, being in a state of hypnosis during a very long decadence period, which will transform again the Region into the cradle of civilization.

This work aims at adding a very small stone in the edifice of understanding and cooperation.

C1. INTRODUCTION

Turkey occupies a geographical area of 780 thousand square kilometers. This area was the heartland of two great empires, the late Roman (Byzantine) Empire and the Ottoman Empire, which ruled over the euro-asiatic peninsula for more than 1500 years until the dawn of 20th century. The western and central part of the country, covering an area of 500 thousand square kilometers approximately, is also known as Asia Minor which is its historic geographical name. During the last 30 centuries Asia Minor accommodated also a plethora of kingdoms (some times subordinate to the above empires) the most important of which were the Pontic kingdom and the kingdom of Cappadocia (in the northern and eastern part of it respectively) which flourished during the ancient times and the kingdom of Armenia and the Seljuq kingdom (in the eastern and central part of it respectively) which flourished during the medieval times.

The geo-strategic significance of Asia Minor contributed highly to the vitality of these two empires and through a feed-back mechanism these empires further enhanced its geo-strategic value through a system of administrative, military, socio-economic and ideological interventions which produced powerful and long-living traces. Furthermore, Turkey is situated at the center of an ideologically explosive triangle. At the one side is Western Europe, full of hidden socio-economic and ideological instabilities, an area which is technologically and socio-economically advanced, but it is still undergoing a turbulent transition period after the collapse of the monarchical orders (in WW I) and the emergence of numerous democratic orders competing with each other. At the other side is Eastern Europe characterized by the vitality of its human (predominantly Slav) resources, which is economically less advanced and which is undergoing an even more turbulent transition period characterized by the sense of insecurity mainly due to the external ideological, military and economic encircling pressures. Finally, at the third side is the Middle East, a socio-economically backward area characterized by a highly destabilizing ideological process in the context of which religious fanaticism merges with awakening nationalism in the presence of a strong feeling of national and religious humiliation due to the external military interventions and the negative stereotypes and attitudes extensively developed in its environment. As a consequence, Turkey's unique geo-strategic significance is undisputed whereas its geo-economic importance is rapidly emerging. The paper will focus on a comparative analysis of the regional geo-economic profiles and trends of Turkey and Europe.

The recent inauguration of European Union – Turkey negotiations process, which is expected to last for many years, offers significant opportunities for both partners mainly in the economic sphere. The maximization of the positive impact of these opportunities requires the introduction of appropriate policies, incentives and infrastructure investments. In this context, the comparative analysis of the geo-economic profiles of Europe and Turkey could offer valuable insight into the mechanism controlling the regional socio-economic attractiveness (regional efficiency). Consequently, such an analysis can greatly assist the exploration of the spatial dimension of emerging opportunities and it can also enhance negotiating partners ability to intervene in making these profiles more cooperative.

In this paper the notion of the "Geo-Economic Gravity System" will be introduced as a conceptual tool in the analysis of the key issue of "regional efficiency" and as a modeling tool in the effort to tackle the above problems. Subsequent analysis is divided into the following 8 chapters. In chapter 2, selected regional efficiency models are presented and applications related to Turkey are discussed. In chapter 3, the notion of the "Economic Gravity System" is introduced and analyzed. In chapter 4, the general socio-economic profile of Turkey in the context of Europe is concisely presented. In chapter 5, the regional socio-economic profile of Turkey is concisely presented and discussed. In chapter 6, the impact of Turkey on the Geo-Economic Gravity Systems of Europe is analyzed and discussed whereas in chapter 7, the Geo-Economic Gravity Systems of Turkey and its internal geo-economic dynamics are also analyzed and discussed. In chapter 8, the impact of Southeastern Anatolia Project on the Geo-

Economic Gravity Systems of Turkey is analyzed. Finally, chapter 9 gives the concluding remarks of the preceding analysis.

C2. REGIONAL EFFICIENCY MODELS

The introduction of policies enhancing the ability of administrative units (provinces, regions or states) to better exploit the capabilities of their infrastructure as well as of their human and natural resources so as to attain sustainable growth both in the social and the economic sphere is of paramount importance in regional planning.

In this context, the location of administrative units or areas possessing (hidden or partially exploited) comparative geo-economic advantages and the development of new or the expansion of existing infrastructure which could unleash the growth generation power of them, is critical. Such regions will be thereon called "efficient regions". Modeling the above problem is a very difficult process and relevant attempts were not always fully convincing.

There are two basic approaches in the literature as far as modeling of regional efficiency is concerned.

(a) The systemic approach and
(b) The cost approach

2.1 The systemic approach

The systemic approach encompasses models that can be further distinguished into two categories:

(a1) Frontier analysis models and
(a2) Regional image attractiveness models

Frontier analysis models

Frontier analysis models express regional efficiency through an input-output systemic structure (figure 2.1).

Figure 2.1 Frontier analysis models

In general, a region is considered efficient if it can best exploit existing inputs (resources, investments and infrastructure) so as to produce high levels of socio-economic growth.

Karkazis and Thanassoulis (1998) applied this approach to assess the effectiveness of regional development policies in Northern Greece using Data Envelopment Analysis (DEA), a

specialized linear programming based method. They employed the following systemic structure (figure 2.2):

Figure 2.2 Karkazis and Thanassoulis approach

The interested reader can find suitable introductions to DEA in Dyson et al (1990) and Charnes et al (1994).

In the above context, Athanassopoulos and Karkazis (1997) introduced the concept of "Systemic Duality" as a modeling tool to analyze regional growth sustainability and they applied it to assess the effectiveness of the prefectures of Greece to perform the following dual transformation process:

(a) to transform improvements in five key indices of their regional social image (education, health care, culture, telecommunications and transportation) into GDP growth and
(b) to transform GDP growth into further improvements of the above social image indices.

Anemodouras et al (2001) applied a similar model on the provinces of Turkey. The input criteria for each unit (province) were its population and the public investment directed to it in 1995 and the output criterion was its GDP in the same year. Note that, according to this model a province is assessed as efficient if its human administrative force in combination with the existing socio-economic development mechanisms exploit efficiently public investment flows so as to produce high increments in GDP. The application of the DEA methodology produced a categorization of Turkey's provinces in the following 4 groups:

(a) Model provinces (the provinces achieving the maximum assessment mark):
Kocaeli and Zoguldak

(b) Highly efficient provinces:
Istanbul, Kirklareli, Sakarya, Canakkale, Izmir, Manisa, Mugla and Aydin

(c) Moderately efficient provinces:
Balikesir, Kutahya, Usak, Denizli, Burdur, Karaman, Icel, Adana, Osmaniye, Kahraman-Maras, Bolu, Ankara, Nevsehir and Artvin

(d) Highly inefficient provinces:
Most of the provinces of the Eastern Region and five provinces of the Black Sea Region

Most of the highly efficient provinces coincide either with the provinces accommodating the two largest urban areas of the country, Istanbul and Ankara, or they form a zone around them. Also, the moderately efficient provinces include most of the provinces of the Mediterranean Region whereas five of them form a second zone around Izmir, from Balikesir to Burdur.

It is interesting to underline the striking similarity of the above results with the findings of Karkazis and Thanassoulis (1998). In both cases, the most efficient administrative units were located in the neighborhood of the largest urban areas of the two countries. A possible explanation for the above phenomenon (the vicinity of Kocaeli with Istanbul and of Boiotia with Athens) is that these administrative units employ part of the workforce of the nearby huge

urban areas (mainly in the industrial sector) which contribute to the GDP of them without requiring from these administrative units the analogous public investment support.

Regional image attractiveness models

Regional image attractiveness models focus on the structure of the socio-economic profile of an area and in particular on its capability to attract capital and labor. According to this approach the socio-economic image (profile) of an area is expressed through a set of social, environmental and economic elements (indices) capable of being easily and commonly identified both by employees and investors candidate to move in this area. Then an "area attractiveness" function, employing relevant indices as independent variables, is developed. This function employees catastrophe theory concepts to express the relative attractiveness of an area as perceived by employees and investors candidate to move in it.

Stellakou and Karkazis (1992) applied this approach to evaluate the effects of infrastructure on the long-term viability of investments in the North Aegean Region whereas Angelis and Dimaki (1998) examined the trends of selected areas' images and applied a survival analysis approach to study their variations.

The interested reader can find suitable introductions to this subject in Hunter and Reid (1968), Isnard and Zeeman (1976) and Townroe (1979).

2.2 The cost approach

In the cost approach the key concept of regional efficiency is expressed as the geo-economic ability of an area to act as a distribution (supply) center under cost criteria. The notion of the "supply center" is expressed by a system of facilities, with the necessary infrastructure, supplying surrounding areas with services or products at low cost. The notion of cost covers both the cost of establishing and operating the facilities as well as the associated transport cost. Note at this point that, when the cost of establishing and operating the facilities does not exhibit significant spatial variations then relevant models employ only the transport cost. This is the case of the Weber model that will be presented in the following chapter. The demand of the surrounding areas on services or products, in general, is usually expressed by regional summary measures such as population, GDP, Manufacturing Value Added (MVA), imports etc.

The geo-economic ability of an area to act as a distribution center lies mainly on two factors:

(a) on its spatial position on transport networks connecting wider geographical areas (position centrality) and
(b) on its infrastructure and on its human and exploitable natural resources that offer economies-of-scale (profile attractiveness)

It is interesting to note at this point that, although certain areas possess a favorable spatial position on transport networks they lack the appropriate profile attractiveness (as an example absence of relevant infrastructure) necessary to exploit the former advantage. It lies in the ability of regional planners and above all in the intuition of decision makers to unearth these hidden geo-economic advantages and thus allow relevant areas to develop rapidly. Such areas, capable of attracting supply center facilities, will be thereon termed "Geo-Economic Gravity Areas" and the supply centers attracted by them "Geo-Economic Gravity Centers". Geo-Economic Gravity Centers will be characterized as Social, Economic, Industrial and Trade if demand summary measure is the population, the GDP, the MVA and the imports respectively.

Karkazis (1999a) introduced the simple Geo-Economic Gravity Model and applied it to E.U. regions. According to his findings, the Social Gravity Center of E.U. during the period 1985-

1994 was located in northeastern France moving at a rather low for the size of E.U. velocity of 5 km per annum towards Belgium. In 1985 it was located 100 km east of Paris whereas in 1994 it was located near the borders of France with Belgium. During the above period, the Economic Gravity Center of E.U. exhibited a significant relocation moving at a velocity of 20 km per annum from the northwestern part to the southeastern part of Belgium. In 1985 it was located between the city of Brussels and the city of Lille in France whereas in 1994 it was located near the city of Namur in Belgium.

Karkazis (1999b) applied the simple Geo-Economic Gravity Model to the Balkan countries. The author noted that, in 1993 the population of Turkey was approximately 90% of the total population of the rest of the Balkan countries whereas the Manufacturing Value Added (MVA) of Turkey was approximately equal to the total MVA of the rest of the Balkan countries. On the other hand, in 1993 the GDP of Turkey was significantly higher than the total GDP of the rest of the Balkan countries. The above, favourable for Turkey, distribution of the socio-economic indices under consideration forced all three Geo-Economic Gravity Centers (Social, Economic and Industrial) to be located inside Turkey. In particular, the Social Gravity Center of the Balkans exhibited, during the period 1980-1993, a significant movement, at a velocity of 15 km per annum, from Plovdiv, Bulgaria to Istanbul, Turkey. This movement was due to the following two reasons:

(a) the rapid increase of Turkey's population at a rate higher than 2% per annum and
(b) the sudden collapse of the living standards of the ex-communist Balkan countries which resulted in negative rates of population increase.

The Economic Gravity Center of the Balkans exhibited an even stronger relocation, at a velocity of 40 km per annum, from Edirne to Ankara, Turkey. This fact is due to similar trends which tended to be stronger in the economic sphere than in the social one: much higher GDP increment rates for Turkey and much higher GDP decrement rates for Romania, Bulgaria and Yugoslavia. During the above period, the Industrial Gravity Center of the Balkans exhibited the strongest dislocation among the three ones examined. The relocation of this center took place at a velocity of 45 km per annum, moving it from Danube (southwest of Bukurest, Romania) to Ankara, Turkey.

In the following chapter the general Geo-Economic Gravity Model and the concept of the "Geo-Economic Gravity System" will be analytically presented and discussed.

C3. THE GENERAL GEO-ECONOMIC GRAVITY MODEL

The n-Facilities Location Problem regards the location of n non-competing supply facilities in a geographical area which will fully cover the demand for services (public sector or social type facilities) or commodities (private sector or economic type facilities) of a system of demand poles at a minimum, fixed and transport, cost. The term "fixed cost" refers to the facility establishment and operations cost. The notion of the "demand pole" plays a crucial role in the modeling process varying widely as its spatial size is concerned. It can represent a small size "point-type demand pole" which may coincide, for example, with an industrial plant or warehouse or a market complex (mall or supermarket) or even with an industrial zone demanding raw materials, intermediate products or services for its activities. On the other hand, it can represent an "area-type demand pole", which is a larger spatial conglomeration of demand points such as an urban area or even an administrative unit (province, region or a state). The notion of the "supply facilities", which is mainly determined by the characteristics of the relevant demand poles, can vary widely from "point-type supply facilities" coinciding with industrial plants, warehouses, industrial zones etc (which act this time as supply sources for a

system of demand poles) to "area-type supply facilities" which represent a system of social or/and economic activities covering an urban area or even an administrative unit. For example, a point-type supply facility may represent a plant or warehouse that a firm plans to establish in an area so as to cover the demand of a system of demand poles in it at a minimum, fixed and transport, cost (the case of private sector supply centers) or it may represent a public facility, health or athletic center or school, that a local authority plans to establish in an administrative area that will cover the associated demand of it with the minimum social cost (the case of a public sector supply facility). Note that, in the context of the modeling process, area-type demand poles are spatially represented by a "central" point inside them, usually the location of the corresponding administrative center (as an example the capital of the province, region or state, figure 3.1). Note also that, in the context of regional development approaches, the demand of large geographical areas (cities or administrative units) can be represented by summary measures such as their population, their GDP, their MVA or their imports.

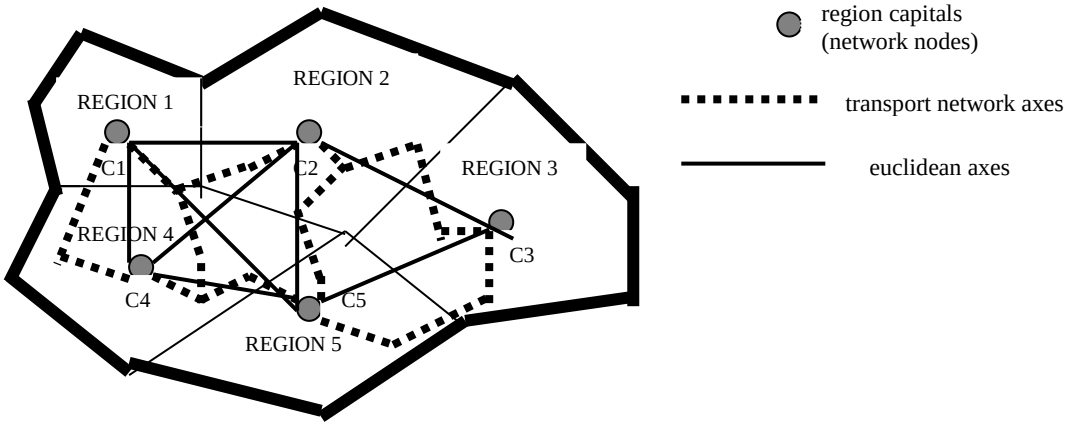


Figure 3.1 The n-Facilities Location Problem

The mathematical formulation of the above problem is given below:

THE N-FACILITIES LOCATION MODEL

$\text{Min}_{P1,P2,..,Pn \in \boldsymbol{P}}$ $C(P_1, P_2,.. ,P_n) = F(P_1, P_2,.. ,P_n) + T(P_1, P_2,.. ,P_n)$
where $F(P_1, P_2,.. ,P_n) = \sum^{n}_{i=1} f(P_i)$ and
$T(P_1, P_2,.. ,P_n) = \sum^{m}_{j=1} t(b_j, d(A_j, \boldsymbol{P}))$
and $d(A_j, \boldsymbol{P}) = \text{Min}_i\, d(A_j, P_i)$

The above formulation regards the selection of n points from the set ***P*** (the set of permissible positions for establishing the facilities) that will minimize cost function C which is the sum of the fixed cost F and the transport cost T. f(Pi) represents the cost for establishing and operating a facility at point P_i. The sum $\sum^{m}_{j=1} t(b_j, d(A_j,\boldsymbol{P}))$ represents the total transport cost for supplying the m demand points A_j j=1,2,…,m. In this context b_j represents the demand of A_j and $d(A_j,\boldsymbol{P})$ the distance (either on the network or on the plane) between point A_j and the closest to it point (facility) of the set ***P***.

The n-Facilities Location Model has two methodological versions:

(a) The n-Facilities Location Model on a transport network (the network case)
(b) The n-Facilities Location Model on the plane (the planar case)

In the network case, ***P*** represents the nodes (demand poles) of the transport network (urban centers or administrative unit capitals) and the distance between two demand poles represents the length of the shortest path on the network connecting these demand poles. In the planar case, ***P*** represents an area in which supply facilities can be established (the area enclosed by the bold line in figure 3.1). In this case f(Pi) is considered as independent of the position Pi (it is everywhere the same) and hence cost function reduces to its transport part only. Also in this case the distance between two points, A_j and P_i, is taken to be their "euclidean distance" given by the following formula:

$$d(A_j, P_i) = \sqrt{(x_j-x_i)^2 + (y_j-y_i)^2}$$

where (x_i, y_i) and (x_j, y_j) are the planar coordinates of the points Pi and Aj respectively. Consequently, euclidean distances are employed as approximations of the real ones (the shortest path lengths on networks). The accuracy of this approximation varies with the morphology of the ground and the quality and density of the transport system. In the case in which the analysis is focusing on the location of whole areas (instead of specific points inside them) to establish a center then numerical experience has shown that the solution of a planar model employing euclidean distances represents an acceptable approximation of the solution of the corresponding network model even in cases of mountainous ground morphology (Karkazis (2006)).

In the applications presented in chapters 6, 7 and 8 the N-Facilities Location Model on the plane was employed. The model was solved in the context of the Geographical Information System "Ptolemeos II" (see Appendix A) by a specialized complete enumeration type routine (algorithm).

Karkazis and Boffey (1981) and Boffey and Karkazis (1984) introduced efficient optimal algorithms for the n-Facilities Location Problem on a transport network. It is interesting to note that, Weber (1909) introduced the 1-Facility Location Problem on the plane with a linear cost function whereas Weiszfeld (1936) introduced a rapidly converging algorithm for its solution.

In the case of area-type demand poles coinciding with administrative units (provinces, regions, states etc.) corresponding n-Facilities Location Model will be called thereon "General Geo-Economic Gravity Model" since the role of the network nodes attracting supply facilities is played by administrative units which exercise geo-economic type gravitating forces on their environment. The solution of this model, that is the system of the n supply center locations minimizing corresponding cost function C, will be called thereon "General Geo-Economic Gravity System".

If the demand summary measure is *regional population* then the corresponding Geo-Economic Gravity System will be called *Social Gravity System.* This system of supply centers is associated with public sector facilities offering social services. On the other hand, if the demand summary measure is *regional GDP*, *regional MVA* or *regional imports* then the corresponding Geo-Economic Gravity System will be called *Economic, Industrial or Trade Gravity System* respectively. The last three systems are associated with private sector facilities.

In order to distinguish between the various values n is taking in the applications performed in this paper, the Geo-Economic Gravity Systems corresponding to the values n=1, 2 and 3 will be thereon called simple, dual and triple Geo-Economic Gravity Systems respectively.

C4. THE GENERAL SOCIO-ECONOMIC PROFILE OF TURKEY IN THE CONTEXT OF EUROPE

Turkey occupies an area of 780 thousand square kilometers whereas its population in 2004 was estimated to be 68.9 millions. Note that the source of statistical information presented in this chapter is *www.cia. gov/cia/publications / factbook*/.

In terms of area, Turkey is the second largest country of Europe after Russia and the largest in E.U. enlarged, whereas in terms of population Turkey ranks third in Europe, after Russia and Germany, and second in E.U. enlarged. Note that the term "E.U. enlarged" refers to the set of countries composed by the 25 member E.U. states and Turkey.

17075.2	RUSSIA(1)	83.9	AUSTRIA(20)
780.6	TURKEY(2)	78.9	CZECHIA(21)
603.7	UKRAINE(3)	70.3	IRELAND(22)
547	FRANCE(4)	65.2	LITHUANIA(23)
504.8	SPAIN(5)	64.6	LATVIA(24)
450	SWEDEN(6)	56.5	CROATIA(25)
357	GERMANY(7)	51.1	BOSNIA(26)
338.1	FINLAND(8)	48.8	SLOVAKIA(27)
324.2	NORWAY(9)	45.2	ESTONIA(28)
312.7	POLAND(10)	43.1	DENMARK(29)
301.2	ITALY(11)	41.5	NETHERLANDS(30)
244.8	UNITED KINGDOM(12)	41.3	SWITZERLAND(31)
237.5	ROMANIA(13)	33.8	MOLDOVA(32)
207.6	BELARUS(14)	30.5	BELGIUM(33)
131.9	GREECE(15)	28.7	ALBANIA(34)
110.9	BULGARIA(16)	25.3	FYROM(35)
102.4	SERBIA(17)	20.8	ISRAEL(36)
93	HUNGARY(18)	20.3	SLOVENIA(37)
92.4	PORTUGAL(19)	*9.3*	*CYPRUS* .
2.6	*LUXEMBOURG* .	*0.3*	*MALTA*

Table 4.1 Europe's countries: Area (000 of square kilometres)

On the other hand, Turkey's population annual growth rate, 1.13% (2004 estimate), is the third largest in Europe after Ireland. Note at this point that, ten years ago Turkey's population annual growth rate was twice as much, but the rapid adoption of the Euro-american life style model in combination with the fast increasing purchasing power of a large proportion of its population led to the rapid reduction of its population growth rate.

143.8	RUSSIA(1)	8.2	AUSTRIA(20) .
82.4	GERMANY(2)	7.5	SWITZERLAND(21)
68.9	TURKEY(3)	7.5	BULGARIA(22)
60.4	FRANCE(4)	6.2	ISRAEL(23)
60.3	UNITED KINGDOM(5)	5.4	SLOVAKIA(24)
58.1	ITALY(6)	5.4	DENMARK(25)
47.7	UKRAINE(7)	5.2	FINLAND(26)
40.3	SPAIN(8)	4.6	NORWAY(27)
38.6	POLAND(9)	4.5	CROATIA(28)
22.4	ROMANIA(10)	4.4	MOLDOVA(29)
16.3	NETHERLANDS(11)	4	IRELAND(30)

10.8	SERBIA(12)	4	BOSNIA(31)
10.6	GREECE(13)	3.6	LITHUANIA(32)
10.5	PORTUGAL(14)	3.5	ALBANIA(33)
10.3	BELGIUM(15)	2.3	LATVIA(34)
10.3	BELARUS(16)	2.1	FYROM(35)
10.2	CZECHIA(17)	2	SLOVENIA(36)
10	HUNGARY(18)	1.34	ESTONIA(37)
9	SWEDEN(19)	*0.78*	*CYPRUS 2005 est.*
0.47	*LUXEMBOURG 2005 est.*	*0.40*	*MALTA 2005 est.*

Table 4.2 Europe's countries: Population, 2004 estimate (millions of inhabitants)

Turkey has a population density (2004 estimate) equal to 88.3 inhabitants per square kilometer which is near the European median.

The GDP of Turkey (2004 estimate) is 458.2 billions of Purchasing Power Parity US $ (PPP $) which is the 8th highest in Europe and the 7th highest in E.U. enlarged.

1.29	ISRAEL(1)	.14	AUSTRIA(20)
1.16	IRELAND(2)	.14	SLOVAKIA(21)
1.13	TURKEY(3)	.09	ITALY(22)
.57	NETHERLANDS(4)	.03	SERBIA(23)
.54	SWITZERLAND(5)	.02	GERMANY(24)
.5	ALBANIA(6)	.02	POLAND(25)
.45	BOSNIA(7)	0	SLOVENIA(26)
.41	PORTUGAL(8)	0	CZECHIA(27)
.41	NORWAY(9)	0	CROATIA(28)
.39	FYROM(10)	-.1	ROMANIA(29)
.39	FRANCE(11)	-.1	BELARUS(30)
.35	DENMARK(12)	-.2	HUNGARY(31)
.29	UNITED KINGDOM(13)	-.3	LITHUANIA(32)
.2	GREECE(14)	-.4	RUSSIA(33)
.18	SWEDEN(15)	-.7	UKRAINE(34)
.18	MOLDOVA(16)	-.7	LATVIA(35)
.18	FINLAND(17)	-.7	ESTONIA(36)
.16	BELGIUM(18)	-.9	BULGARIA(37)
.16	SPAIN(19)	0.54	CYPRUS 2005 est.
0.13	*LUXEMBOURG 2005 est.*	*0.42*	*MALTA 2005 est.*

Table 4.3 Europe's countries: Population annual growth rate, 2004 estimate (%)

393	NETHERLANDS(1)	94	ROMANIA(20)
338	BELGIUM(2)	88	TURKEY(21)
298	ISRAEL(3)	83	FYROM(22)
246	UNITED KINGDOM(4)	80	GREECE(23)
231	GERMANY(5)	80	SPAIN(24)
193	ITALY(6)	80	CROATIA(25)
182	SWITZERLAND(7)	79	UKRAINE(26)
130	MOLDOVA(8)	78	BOSNIA(27)
129	CZECHIA(9)	68	BULGARIA(28)
125	DENMARK(10)	57	IRELAND(29)
123	POLAND(11)	55	LITHUANIA(30)
122	ALBANIA(12)	50	BELARUS(31)

114	PORTUGAL(13)	36	LATVIA(32)
111	SLOVAKIA(14)	30	ESTONIA(33)
110	FRANCE(15)	20	SWEDEN(34)
108	HUNGARY(16)	15	FINLAND(35)
105	SERBIA(17)	14	NORWAY(36)
99	SLOVENIA(18)	8	RUSSIA(37)
98	AUSTRIA(19)	*84*	*CYPRUS 2005 est.*
181	*LUXEMBOURG 2005 est.*	*1261*	*MALTA 2005 est.*

Table 4.4 Europe's countries: Population densities, 2004 estimate (inhabitants per sq. km.)

Turkey's GDP growth rate estimate for 2004 was 5.8% according to which Turkey ranks 8th in Europe and 1st in E.U. enlarged. In view of the fact that the Netherlands GDP growth rate for 2004 was estimated to be negative, Turkey is expected to surpass in 2005 the Netherlands' GDP which will place this country among the 6 biggest economic powers of E.U. enlarged.

On the other hand, Turkey's GDP per capita estimate for 2004 was 6650 PPP$, which was one of the lowest in Europe and the lowest in E.U. enlarged with the second lowest being that of Latvia (10391 PPP $).

2271	GERMANY(1)	155	ROMANIA(20)
1666	UNITED KINGDOM(2)	142.2	FINLAND(21)
1661	FRANCE(3)	139.8	HUNGARY(22)
1550	ITALY(4)	120.9	ISRAEL(23)
1282	RUSSIA(5)	116.2	IRELAND(24)
885.5	SPAIN(6)	72.3	SLOVAKIA(25)
461.4	NETHERLANDS(7)	62.6	BELARUS(26)
458.2	TURKEY(8)	57.1	BULGARIA(27)
427.1	POLAND(9)	47.1	CROATIA(28)
299.1	BELGIUM(10)	40.9	LITHUANIA(29)
260.4	UKRAINE(11)	36.8	SLOVENIA(30)
245.3	AUSTRIA(12)	24.3	BOSNIA(31)
239.3	SWITZERLAND(13)	23.9	SERBIA(32)
238.3	SWEDEN(14)	23.9	LATVIA(33)
213.6	GREECE(15)	17.4	ESTONIA(34)
181.8	PORTUGAL(16)	16.1	ALBANIA(35)
171.7	NORWAY(17)	13.8	FYROM(36)
167.2	DENMARK(18)	7.8	MOLDOVA(37)
161.1	CZECHIA(19)	*16.8*	*CYPRUS 2005 est.*
29.4	*LUXEMBOURG 2005 est.*	*7.5*	*MALTA 2005 est.*

Table 4.5 Europe's countries: GDP, 2004 estimate (bil. of Purchasing Power Parity US $)

Turkey's GDP composition (agricultural sector accounting in 2001 for 11.7% of GDP, industrial sector for 29.8% and the services sector for 58.5% of GDP) deviated significantly from E.U. average levels. In particular, the agricultural sector of Turkey (as % of GDP) is the 6th highest in Europe and the highest in E.U. enlarged with Greece having the second highest agriculture share (6.7%). The services sector share of Turkey is the second lowest, after Ireland, in E.U. enlarged. Finally, Turkey's industrial sector share is near the E.U. average levels.

9.4	UKRAINE(1)	2.4	SPAIN(20)
9	LITHUANIA(2)	2.3	SLOVENIA(21)
7.4	LATVIA(3)	2.2	UNITED KINGDOM(22)
7.3	RUSSIA(4)	1.9	FINLAND(23)
7	ALBANIA(5)	1.7	SWEDEN(24)

6.8	BELARUS(6)	1.5	SERBIA(25)
6.3	MOLDOVA(7)	1.4	IRELAND(26)
5.8	TURKEY(8)	1.3	ISRAEL(27)
4.9	ROMANIA(9)	1.1	BELGIUM(28)
4.7	GREECE(10)	.7	AUSTRIA(29)
4.7	ESTONIA(11)	.6	NORWAY(30)
4.3	BULGARIA(12)	.5	FRANCE(31)
4.3	CROATIA(13)	.4	ITALY(32)
3.9	SLOVAKIA(14)	0	DENMARK(33)
3.7	POLAND(15)	-.1	GERMANY(34)
3.5	BOSNIA(16)	-.5	SWITZERLAND(35)
2.9	HUNGARY(17)	-.8	NETHERLANDS(36)
2.9	CZECHIA(18)	-1.3	PORTUGAL(37)
2.8	FYROM(19)	*3.8*	*CYPRUS 2005 est.*
3.5	*LUXEMBOURG 2005 est.*	*1.4*	*MALTA 2005 est.*

Table 4.6 Europe's countries: GDP annual growth rate, 2004 estimate (%)

37326	NORWAY(1)	13980	HUNGARY(20)
31907	SWITZERLAND(2)	13389	SLOVAKIA(21)
30963	DENMARK(3)	12985	ESTONIA(22)
29915	AUSTRIA(4)	11361	LITHUANIA(23)
29050	IRELAND(5)	11065	POLAND(24)
29039	BELGIUM(6)	10467	CROATIA(25)
28307	NETHERLANDS(7)	10391	LATVIA(26)
27629	UNITED KINGDOM(8)	8915	RUSSIA(27)
27561	GERMANY(9)	7613	BULGARIA(28)
27500	FRANCE(10)	6920	ROMANIA(29)
27346	FINLAND(11)	6650	TURKEY(30)
26678	ITALY(12)	6571	FYROM(31)
26478	SWEDEN(13)	6078	BELARUS(32)
21973	SPAIN(14)	6075	BOSNIA(33)
20151	GREECE(15)	5459	UKRAINE(34)
19500	ISRAEL(16)	4600	ALBANIA(35)
18400	SLOVENIA(17)	2213	SERBIA(36)
17314	PORTUGAL(18)	1773	MOLDOVA(37)
15794	CZECHIA(19)	*21600*	*CYPRUS 2005 est.*
62700	*LUXEMBOURG 2005 est.*	*18800*	*MALTA 2005 est.*

Table 4.7 Europe's countries:GDP per capita,2004 estimate(Purchasing Power Parity US $)

Turkey's industrial production growth rate estimate for 2004 was 8.5%, one of the highest in E.U. enlarged, actually the 3d highest after Lithuania and Poland. This makes industry the locomotive of Turkey's economy.

17 (2004)	MOLDOVA(1)	1.9 (2004)	AUSTRIA(20)
16.1 (2004)	LITHUANIA(2)	1.9 (2004)	SWEDEN(21)
15.8 (2004)	UKRAINE(3)	1.7 (2004)	SERBIA(22)
8.6 (2004)	POLAND(4)	1.6 (2004)	SPAIN(23)
8.5 (2004)	TURKEY(5)	1.4 (2002)	SLOVENIA(24)
8 (2004)	LATVIA(6)	.8 (2004)	FINLAND(25)
7.2 (2004)	SLOVAKIA(7)	.7 (2004)	GREECE(26)
7 (2004)	RUSSIA(8)	.4 (2004)	SWITZERLAND(27)

6.7 (2004)	IRELAND(9)	.4 (2004)	PORTUGAL(28)
6.4 (2004)	HUNGARY(10)	.3 (2004)	DENMARK(29)
6.3 (2004)	BULGARIA(11)	.2 (2004)	GERMANY(30)
5.5 (2003)	BOSNIA(12)	-.3 (2003)	NORWAY(31)
5 (2003)	BELARUS(13)	-.3 (2004)	FRANCE(32)
5 (2000)	ESTONIA(14)	-.5 (2004)	ITALY(33)
4.5 (2004)	FYROM(15)	-.6 (2004)	ISRAEL(34)
3.9 (2004)	CROATIA(16)	-.7 (2004)	UNITED KINGDOM(35)
3.3 (2004)	CZECHIA(17)	-1.5 (2004)	BELGIUM(36)
2.7 (2003)	ALBANIA(18)	-2.1 (2004)	NETHERLANDS(37)
2.3 (2004)	ROMANIA(19)	*3.7 (2005)*	*CYPRUS*
4.4	*LUXEMBOURG 2005 est.*	-	*MALTA 2005 est.*

Table 4.8 Europe's countries: Industrial production growth rate, 2004 estimate (%)

696.9	GERMANY(1)	31.3	PORTUGAL(20)
346.5	FRANCE(2)	29.3	ISRAEL(21)
304.5	UNITED KINGDOM(3)	23.6	UKRAINE(22)
278.1	ITALY(4)	21.3	SLOVAKIA(23)
253.2	NETHERLANDS(5)	17.6	ROMANIA(24)
182.9	BELGIUM(6)	12	SLOVENIA(25)
159.4	SPAIN(7)	9.4	BELARUS(26)
134.4	RUSSIA(8)	7.9	LITHUANIA(27)
110	SWITZERLAND(9)	7.3	BULGARIA(28)
102.8	SWEDEN(10)	6.4	CROATIA(29)
98.3	IRELAND(11)	5.9	GREECE(30)
83.5	AUSTRIA(12)	4.1	ESTONIA(31)
67.3	NORWAY(13)	3	LATVIA(32)
64.2	DENMARK(14)	2.7	SERBIA(33)
57.6	POLAND(15)	1.4	FYROM(34)
54.3	FINLAND(16)	1.3	BOSNIA(35)
49.1	TURKEY(17)	.8	MOLDOVA(36)
46.8	CZECHIA(18)	.42	ALBANIA(37)
42	HUNGARY(19)	*1.24*	*CYPRUS 2005 est.*
13.4	*LUXEMBOURG 2005 est.*	*2.74*	*MALTA 2005 est.*

Table 4.9 Europe's countries: Exports, 2004 estimate (bil. $)

Turkey's value of exports (49.1 billion $) and of imports (62.4 billion $) in 2004 place this country in a median position in Europe. The exports per capita of Turkey was 713 $ in 2003, the second lowest in E.U. enlarged with Greece being at the bottom of the list with 557 $.

585	GERMANY(1)	37.4	FINLAND(20)
363.6	UNITED KINGDOM(2)	33.3	GREECE(21)
339.9	FRANCE(3)	32.3	ISRAEL(22)
271.1	ITALY(4)	23.6	UKRAINE(23)
217.7	NETHERLANDS(5)	22.2	ROMANIA(24)
197.1	SPAIN(6)	21.9	SLOVAKIA(25)
173	BELGIUM(7)	12.9	CROATIA(26)
102.2	SWITZERLAND(8)	12.6	SLOVENIA(27)
83.3	SWEDEN(9)	11.1	BELARUS(28)
81.6	AUSTRIA(10)	9.7	BULGARIA(29)
74.8	RUSSIA(11)	9.2	LITHUANIA(30)
63.7	POLAND(12)	7.1	SERBIA(31)

62.4	TURKEY(13)	5.5	ESTONIA(32)
57.5	IRELAND(14)	4.9	LATVIA(33)
54.5	DENMARK(15)	4.7	BOSNIA(34)
50.4	CZECHIA(16)	2.2	FYROM(35)
46.2	HUNGARY(17)	1.76	ALBANIA(36)
43.7	PORTUGAL(18)	1.3	MOLDOVA(37)
40.2	NORWAY(19)	5.55	CYPRUS 2005 est.
18.7	*LUXEMBOURG 2005 est.*	*3.86*	*MALTA 2005 est.*

Table 4.10 Europe's countries: Imports, 2003 estimate (bil. $)

Turkey, with 906 $ imports per capita, ranks last in E.U. enlarged. In 2003 Germany received 15.8 % of Turkey's exports value, USA 8.0% , U.K. 7.8% and Italy 6.8%. On the other hand, in the same year Turkey imported 13.6 % of total value from Germany, 7.9 % from Italy, 7.8% from Russia and 6.0 % from France.

C5. THE REGIONAL SOCIO-ECONOMIC PROFILE OF TURKEY

Turkey is divided into 81 administrative units called provinces whereas in Turkish are called "iller" (see map 7.1). The source of the statistical information presented in this chapter is *Turkey's State Institute of Statistics*.

774820	TURKEY (1)	12313	Malatya (22)	7610	Adiyaman (43)	5400	Hatay (64)
38157	Konya (2)	11973	Izmir (23)	7440	Artvin (44)	5341	Usak (65)
28488	Sivas (3)	11900	Erzincan (24)	7390	Cankiri (45)	5220	Istanbul (66)
25710	Ankara (4)	11875	Kutahya (25)	7312	Nigde (46)	4817	Sakarya (67)
25070	Erzurum (5)	11870	Denizli (26)	7172	Sirnak (47)	4694	Batman (68)
20590	Antalya (6)	11380	Agri (27)	7120	Hakkari (48)	4685	Trabzon (69)
19069	Van (7)	10960	Bursa (28)	6930	Giresun (49)	4365	Kirikkale (70)
18584	Urfa (8)	10040	Bolu (29)	6890	Burdur (50)	4310	Bilecik (71)
16917	Kaiseri (9)	9958	Tokat (30)	6710	Bitlis (51)	4074	Karabuk (72)
15853	Icel (10)	9740	Canakkale (31)	6580	Gumushane (52)	3920	Rize (73)
15360	Diyarbakir (11)	9579	Samsun (32)	6570	Kirsehir (53)	3652	Bayburt (74)
14327	K.Maras (12)	9442	Kars (33)	6550	Kirklareli (54)	3626	Kocaeli (75)
14290	Balikesir (13)	9163	Karaman (34)	6280	Edirne (55)	3539	Igdir (76)
14230	Afyon (14)	9150	Elazig (35)	6218	Tekirdag (56)	3481	Zonguldak (77)
14123	Yozgat (15)	8930	Isparta (36)	6210	Gaziantep (57)	3320	Osmaniye (78)
13810	Manisa (16)	8891	Mardin (37)	6001	Ordu (58)	2140	Bartin (79)
13650	Eskisehir (17)	8196	Mus (38)	5862	Sinop (59)	1338	Kilis (80)
13338	Mugla (18)	8130	Bingol (39)	5576	Ardahan (60)	1014	Duzce (81)
13108	Kastamonu (19)	8000	Aydin (40)	5520	Amasya (61)	674	Yalova (82)
12820	Corum (20)	7774	Tunceli (41)	5467	Nevsehir (62)		
12790	Adana (21)	7626	Aksaray (42)	5406	Siirt (63)		

Table 5.1 Turkey's provinces: Area, 2000 (square kilometers)

In terms of area, the biggest provinces of Turkey are: Konya with 38200 square kilometers (approximately the size of the Netherlands), Sivas with 28500, Ankara with 25700, and Erzurum with 25100 square kilometers whereas

67804	TURKEY (1)	951	Aydin (21)	529	Agri (41)	314	Duzce (61)
10019	Istanbul (2)	937	Erzurum (22)	524	Giresun (42)	310	Nevsehir (62)

4008	Ankara (3)	888	Ordu (23)	514	Isparta (43)	271	Bolu (63)
3371	Izmir (4)	878	Van (24)	465	Canakkale (44)	270	Cankiri (64)
2192	Konya (5)	854	Malatya (25)	459	Osmaniye (45)	264	Siirt (65)
2125	Bursa (6)	850	Denizli (26)	457	Batman (46)	257	Burdur (66)
1849	Adana (7)	828	Tokat (27)	454	Mus (47)	254	Bingol (67)
1720	Antalya (8)	812	Afyon (28)	403	Edirne (48)	253	Kirsehir (68)
1651	Icel (9)	756	Sakarya (29)	396	Aksaray (49)	243	Karaman (69)
1443	Urfa (10)	755	Sivas (30)	389	Bitlis (50)	237	Hakkari (70)
1363	Diyarbakir (11)	715	Mugla (31)	384	Kirikkale (51)	226	Sinop (71)
1285	Gaziantep (12)	706	Eskisehir (32)	375	Kastamonu (52)	225	Karabuk (72)
1260	Manisa (13)	705	Mardin (33)	366	Rize (53)	194	Bilecik (73)
1254	Hatay (14)	683	Yozgat (34)	365	Amasya (54)	192	Artvin (74)
1209	Samsun (15)	657	Kutahya (35)	353	Sirnak (55)	187	Gumushane (75)
1206	Kocaeli (16)	624	Adiyaman (36)	348	Nigde (56)	184	Bartin (76)
1076	Balikesir (17)	624	Tekirdag (37)	328	Kirklareli (57)	169	Yalova (77)
1060	Kaiseri (18)	616	Zonguldak (38)	325	Kars (58)	169	Igdir (78)
1002	K.Maras (19)	597	Corum (39)	322	Usak (59)	134	Ardahan (79)
975	Trabzon (20)	570	Elazig (40)	317	Erzincan (60)	115	Kilis (80)
						97	Bayburt (81)
						94	Tunceli (82)

Table 5.2 Turkey's provinces: Population, 2000 (000 of inhabitants)

the smallest provinces are: Yalova with 670, Duzce with 1010, Kilis with 1340, Bartin with 2140, Osmaniye with 3320, Zonguldak with 3480 and Igdir with 3530 square kilometers. Note that the three biggest provinces of Turkey belong to the Central Region of it.

In 2000, the provinces of Turkey with the largest population were: Istanbul with 10.1 millions of inhabitants, Ankara with 4.0, Izmir with 3.37 and Konya with 2.19 millions of inhabitants whereas the smallest ones were: Tunceli with 94 thousands of inhabitants, Bayburt with 97, Kilis with 115, Ardahan with134 and Igdir with 169 thousands of inhabitants. The five least populous provinces of Turkey belong to the eastern part of the country whereas the four most populous provinces belong to the western part of it.

In 2000, the provinces of Turkey with the highest population density were: Istanbul with 1885 inhabitants per square kilometer, Kocaeli with 333, Izmir with 281, Hatay with 215 and Trabzon with 209, whereas the provinces with the

1885	Istanbul (1)	93	Rize (22)	58	Isparta (43)	39	Sinop (64)
333	Kocaeli (2)	90	Diyarbakir (23)	57	Nevsehir (44)	39	Kirsehir (65)
281	Izmir (3)	89	Bartin (24)	56	Mus (45)	38	Van (66)
215	Hatay (4)	88	TURKEY (25)	55	Karabuk (46)	37	Erzurum (67)
209	Trabzon (5)	84	Kirikkale (26)	55	Afyon (47)	36	Cankiri (68)
198	Yalova (6)	83	Antalya (27)	55	Bitlis (48)	36	Burdur (69)
195	Bursa (7)	82	Tokat (28)	55	Mugla (49)	33	Hakkari (70)
188	Gaziantep (8)	82	Adiyaman (29)	55	Kutahya (50)	33	Bolu (71)
186	Zonguldak (9)	80	Kilis (30)	54	Konya (51)	32	Kars (72)
158	Ankara (10)	80	Mardin (31)	52	Kirklareli (52)	31	Bingol (73)
155	Sakarya (11)	77	Giresun (32)	51	Eskisehir (53)	29	Kastamonu (74)
149	Ordu (12)	75	Urfa (33)	50	Aksaray (54)	29	Gumushane (75)
144	Osmaniye (13)	74	Balikesir (34)	49	Sirnak (55)	27	Ardahan (76)
132	Adana (14)	72	Denizli (35)	49	Yozgat (56)	27	Karaman (77)
129	Samsun (15)	71	Malatya (36)	48	Siirt (57)	27	Erzincan (78)

121	Duzce (16)	69	K.Maras (37)	47	Igdir (58)	26	Bayburt (79)
120	Aydin (17)	66	Edirne (38)	47	Corum (59)	26	Sivas (80)
106	Icel (18)	64	Amasya (39)	47	Nigde (60)	26	Artvin (81)
98	Batman (19)	62	Kaiseri (40)	47	Canakkale (61)	12	Tunceli (82)
98	Tekirdag (20)	61	Elazig (41)	46	Agri (62)		
95	Manisa (21)	60	Usak (42)	45	Bilecik (63)		

Table 5.3 Turkey's provinces: Population density, 2000 (inhabitants per square kilometer)

lowest population density were: Tunceli with 12 inhabitants per square kilometer, Artvin with 26, Sivas with 26, Bayburt with 26 and Erzincan with 27 inhabitants per square kilometer The four least densely populated provinces belong to an arc (lying in the northeastern part of the country) that starts from Sivas and ends up to Artvin.

The provinces with the largest population growth rate during the period 1990-2000 were: Antalya with 51.9% increase, Urfa with 44.1%, Van with 37.8%, Hakkari with 37.7%, Istanbul with 37% and Sirnak with 34.7% (corresponding national figure is 20%). Note that, the four out of the six provinces with the highest population growth rate belong to the southeastern part of the country. Among the seventeen Turkey's provinces with the highest population growth rate five belong to the Marmara Region, two to the Aegean Region, one to the Central Region, three to the Mediterranean Region and one to the Southeast Region.

51.9	Antalya (1)	21	Agri (22)	10.4	Erzurum (43)	-2.2	Corum (64)
44.1	Urfa (2)	20.4	Mus (23)	10.2	Bilecik (44)	-3.3	Cankiri (65)
37.8	Van (3)	20	TURKEY (24)	10.1	Eskisehir (45)	-4.5	Adana (66)
37.7	Hakkari (4)	18.1	Isparta (25)	10	Kirikkale (46)	-9.4	Bayburt (67)
37	Istanbul (5)	17.9	Yozgat (26)	9.8	Afyon (47)	-9.9	Artvin (68)
34.7	Sirnak (6)	17.8	Bitlis (27)	9.1	Manisa (48)	-11.6	Kastamonu (69)
33	Tekirdag (7)	15.2	Aydin (28)	8.6	Siirt (49)	-14.8	Sinop (70)
32.5	Bursa (8)	15.1	Tokat (29)	7.6	Canakkale (50)	-29.4	Tunceli (71)
32.4	Batman (9)	14.4	Elazig (30)	6.9	Ordu (51)	-42.7	Zonguldak (72)
30.3	Icel (10)	13.7	Nigde (31)	6.8	Nevsehir (52)	-49.6	Bolu (73)
28.8	Kocaeli (11)	13.6	Kutahya (32)	6	Erzincan (53)	-51	Kars (74)
26.9	Mugla (12)	13.1	Denizli (33)	5.8	Kirklareli (54)	-	Duzce (75)
26.3	Mardin (13)	12.9	Hatay (34)	5	Giresun (55)	-	Osmaniye (76)
25.2	Konya (14)	12.6	Gaziantep (35)	4.8	Rize (56)	-	Kilis (77)
25	Izmir (15)	12.4	Kaiseri (36)	4.4	Samsun (57)	-	Karabuk (78)
24.4	Diyarbakir (16)	12.2	K.Maras (37)	2.2	Amasya (58)	-	Yalova (79)
23.8	Ankara (17)	11.4	Karaman (38)	1.1	Bingol (59)	-	Igdir (80)
22.4	Trabzon (18)	11	Usak (39)	.7	Burdur (60)	-	Ardahan (81)
21.6	Adiyaman (19)	10.6	Gumushane (40)	-.5	Edirne (61)	-	Bartin (82)
21.6	Malatya (20)	10.6	Sakarya (41)	-1.6	Sivas (62)		
21.4	Aksaray (21)	10.5	Balikesir (42)	-1.6	Kirsehir (63)		

Table 5.4 Turkey's provinces: Population growth rate, 1990-2000 (%)

The touristic development of the Aegean and the Mediterranean Regions on the one hand, and the industrial development of the Marmara Region on the other hand seem to be the main population attraction sources. The regions contributing most to corresponding internal population movements are: Eastern Region with an outmigation reaching 16% during the period 1985-90 and Black Sea and Central Regions with an outmigration around 10% each during the same period. The six provinces with the lowest population growth rate (actually the highest population decline rate) during the period 1990-2000 were: Tunceli with 29.4% decline,

Sinop with 14.8% decline, Kastamonu with 11.6% decline, Artvin with 9.9% decline and Bayburt with 9.4% population decline rate. It is interesting to note that four out of the above five provinces belong to the Black Sea Region. Note at this point that the high population decline rate of the provinces of Bolu, Zonguldak and Kars is mainly due to the reduction of their size in the context of provincial spatial rearrangements that took place during the period 1990-2000.

200000	TURKEY (1)	2310	Diyarbakir (23)	1087	Isparta (43)	509	Karabuk (63)
44214	Istanbul (2)	2214	Sakarya (24)	989	Giresun (44)	493	Kirsehir (64)
16650	Ankara (3)	2137	Tekirdag (25)	979	Van (45)	486	Erzincan (65)
14594	Izmir (4)	1955	K.Maras (26)	918	Kastamonu (46)	437	Agri (66)
9094	Kocaeli (5)	1891	Trabzon (27)	907	Nevsehir (47)	435	Cankiri (67)
7354	Bursa (6)	1865	Urfa (28)	899	Rize (48)	430	Sinop (68)
6108	Adana (7)	1620	Canakkale (29)	875	Nigde (49)	376	Kars (69)
5496	Icel (8)	1594	Malatya (30)	812	Mardin (50)	372	Siirt (70)
5002	Antalya (9)	1551	Bolu (31)	788	Yalova (51)	344	Bitlis (71)
4975	Konya (10)	1486	Kutahya (32)	780	Adiyaman (52)	329	Mus (72)
4172	Manisa (11)	1472	Tokat (33)	754	Amasya (53)	294	Sirnak (73)
3053	Mugla (12)	1467	Edirne (34)	724	Osmaniye (54)	281	Gumushane (74)
3050	Balikesir (13)	1445	Kirklareli (35)	706	Burdur (55)	275	Bingol (75)
3037	Hatay (14)	1409	Afyon (36)	697	Batman (56)	269	Kilis (76)
2819	Samsun (15)	1376	Erzurum (37)	687	Bilecik (57)	263	Hakkari (77)
2804	Aydin (16)	1373	Corum (38)	684	Karaman (58)	257	Bartin (78)
2721	Gaziantep (17)	1331	Sivas (39)	663	Usak (59)	197	Igdir (79)
2644	Yozgat (18)	1318	Kirikkale (40)	573	Aksaray (60)	191	Tunceli (80)
2454	Kaiseri (19)	1295	Elazig (41)	547	Artvin (61)	144	Ardahan (81)
2390	Eskisehir (20)	1228	Ordu (42)	517	Duzce (62)	130	Bayburt (82)
2377	Denizli (21)						
2352	Zonguldak (22)						

Table 5.5 Turkey's provinces: GDP, 2000 (mil. $)

In 2000, the eight provinces with the highest GDP were: Istanbul with 44.2 bil. $, Ankara with 16.7, Izmir with 14.6, Kocaeli with 9.1, Bursa with 7.4, Adana with 6.1, Icel with 5.5 and Antalya with 5.0 bil. $. From the above provinces three belong to the Marmara Region, one to the Central Region, one to the Aegean Region and three to the Mediterranean Region. In the same year, the eight provinces with the lowest GDP were: Bayburt with 130 mil. $, Ardahan with 144, Tunceli with 191, Igdir with 197, Bartin with 257, Hakkari with 263, Kilis with 269 and Bingol with 275 mil. $. With the exception of Bayburt, all the above provinces belong to Southeast and Eastern Regions.

In 2000, the provinces with the highest per capita GDP were: Kocaeli with 7541 $, Bolu with 5723 $, Yalova with 4663 $, Istanbul with 4413 $, Kirklareli with 4405 $, Izmir with 4329 $, Mugla with 4270 $ and Ankara with 4154 $. It is interesting to note that, all the above provinces are lying in western part of the country, being located in the neighborhood of the three largest urban centers of it or accommodating them. In the same year, the eight provinces of Turkey with the lowest GDP per capita were: Mus with 725 $, Agri with 826 $, Sirnak with 833 $, Bitlis with 884 $, Ardahan with 1075 $, Bingol with 1083 $, Hakkari with 1110 $ and Van with 1115 $. All the above provinces belong to the eastern part of the country.

7541	Kocaeli (1)	2948	Aydin (22)	2118	Gaziantep (43)	1469	Erzurum (64)
5723	Bolu (2)	2929	Sakarya (23)	2115	Isparta (44)	1447	Aksaray (65)
4663	Yalova (3)	2926	Nevsehir (24)	2066	Amasya (45)	1409	Siirt (66)

4413	Istanbul (4)	2908	Antalya (25)	2059	Usak (46)	1397	Bartin (67)
4405	Kirklareli (5)	2849	Artvin (26)	2032	Tunceli (47)	1383	Ordu (68)
4329	Izmir (6)	2835	Balikesir (27)	1951	K.Maras (48)	1340	Bayburt (69)
4270	Mugla (7)	2815	Karaman (28)	1949	Kirsehir (49)	1292	Urfa (70)
4154	Ankara (8)	2796	Denizli (29)	1939	Trabzon (50)	1250	Adiyaman (71)
3871	Yozgat (9)	2747	Burdur (30)	1903	Sinop (51)	1166	Igdir (72)
3818	Zonguldak (10)	2514	Nigde (31)	1887	Giresun (52)	1157	Kars (73)
3640	Edirne (11)	2456	Rize (32)	1867	Malatya (53)	1152	Mardin (74)
3541	Bilecik (12)	2448	Kastamonu (33)	1778	Tokat (54)	1115	Van (75)
3484	Canakkale (13)	2422	Hatay (34)	1763	Sivas (55)	1110	Hakkari (76)
3461	Bursa (14)	2339	Kilis (35)	1735	Afyon (56)	1083	Bingol (77)
3432	Kirikkale (15)	2332	Samsun (36)	1695	Diyarbakir (57)	1075	Ardahan (78)
3425	Tekirdag (16)	2315	Kaiseri (37)	1646	Duzce (58)	884	Bitlis (79)
3385	Eskisehir (17)	2300	Corum (38)	1611	Cankiri (59)	833	Sirnak (80)
3329	Icel (18)	2272	Elazig (39)	1577	Osmaniye (60)	826	Agri (81)
3311	Manisa (19)	2270	Konya (40)	1533	Erzincan (61)	725	Mus (82)
3303	Adana (20)	2262	Karabuk (41)	1525	Batman (62)		
2950	TURKEY (21)	2262	Kutahya (42)	1503	Gumushane (63)		

Table 5.6 Turkey's provinces: GDP per capita, 2000 ($)

In 2000, the variation (ratio) between the highest and the lowest provincial per capita GDP reached 10, a value underlying the extreme regional discrimination problems Turkey is facing. Note at this point that, among the 34 provinces with the highest per capita GDP in Turkey, there is no one belonging to the Southeast and Eastern regions.

Turkey's GDP growth rate during 1990-2000 was 33.3% . The provinces with the highest GDP growth rate during the above period were: Yozgat (268%) in the Central Region, Urfa (84%) in the Southeast Region, Hakkari (133%) and Agri (67%) in the Eastern Region, Karaman (94%) in the Mediterranean Region, Mugla (62%) in the Aegean Region and Bayburt (71%) and Giresun (59%) in the Black Sea Region. The provinces with the lowest GDP growth rate during the same period were: Adiyaman (34% decline) in the Southeast Region, Kars (29% decline) and Erzincan (8.2%) in the Eastern Region, Zonguldak (0.4%) and Sinop (3.1%) in the Black Sea Region and Kirklareli (3.8%), Bilecik (4.7%) and Canakkale (9.8%) in the Marmara Region.

267.7	Yozgat (1)	39.5	Kaiseri (22)	24.8	Tunceli (43)	10.5	Diyarbakir (64)
132.7	Hakkari (2)	38.9	Kocaeli (23)	24.3	Usak (44)	9.8	Canakkale (65)
93.7	Karaman (3)	36.9	Tokat (24)	22.8	Edirne (45)	8.2	Erzincan (66)
84.4	Urfa (4)	35.3	Ordu (25)	22.7	Samsun (46)	4.7	Bilecik (67)
71	Bayburt (5)	35.3	Rize (26)	22.5	Nigde (47)	3.8	Kirklareli (68)
67.4	Agri (6)	34.9	Bitlis (27)	22.3	Hatay (48)	3.1	Sinop (69)
62	Mugla (7)	34.5	Konya (28)	19.4	Artvin (49)	.4	Zonguldak (70)
59.2	Giresun (8)	34.2	Siirt (29)	19.1	Tekirdag (50)	-29.4	Kars (71)
58.1	Van (9)	33.8	Denizli (30)	18.6	Aydin (51)	-31.4	Adiyaman (72)
55.2	Aksaray (10)	33.3	TURKEY (31)	18.6	Bursa (52)	-	Duzce (73)
51	Bingol (11)	30.3	Izmir (32)	17.1	Gaziantep (53)	-	Osmaniye (74)
50.3	Antalya (12)	30.2	Malatya (33)	16.9	Manisa (54)	-	Kilis (75)
44.8	Gumushane (13)	30.2	Burdur (34)	16.8	Adana (55)	-	Karabuk (76)
44.1	Sakarya (14)	30.1	Eskisehir (35)	15.8	Afyon (56)	-	Yalova (77)
43	Isparta (15)	29.7	Trabzon (36)	15.5	Corum (57)	-	Igdir (78)
42.4	Mardin (16)	29.4	Icel (37)	15.1	Kirsehir (58)	-	Ardahan (79)
41.4	Ankara (17)	29.4	Kastamonu (38)	11.8	Cankiri (59)	-	Bartin (80)

40.8	Erzurum (18)	28.1	Sivas (39)	11.5	Balikesir (60)	-	Sirnak (81)
40.5	Istanbul (19)	25.5	Mus (40)	11.2	Bolu (61)	-	Batman (82)
40.2	Kirikkale (20)	25.1	Kutahya (41)	11	Amasya (62)		
39.6	K.Maras (21)	25	Elazig (42)	10.8	Nevsehir (63)		

Table 5.7 Turkey's provinces: GDP growth rate, 1990-2000 (%)

High population densities together with high population growth rates characterize, in many cases, areas exhibiting economic vitality which is not near saturation levels. Istanbul (with an annual population growth rate in 2001 equal to 2.2% and a population density in the same year equal to 1962) and Tekirdag (with 2.2% and 103 respectively) in Marmara Region, Izmir (with 1.9% and 287 respectively) in the Aegean Region, Icel (with 2.7% and 107 respectively) in the Mediterranean Region, Ankara (with 1.3% and 158 respectively) in the Central Region, Trabzon (with 1.7% and 212 respectively) in the Black Sea Region, and finally Gaziantep (with 2,2% and 212 respectively) and Batman (with 6.1% and 103 respectively) in the Southeast Region are the provinces of Turkey exhibiting sustainable population attraction mechanisms. On the other hand, low population densities (well below the level of 88 inhabitants per square kilometer, which was the population density of Turkey in 2001) and at the same time low annual population growth rate (well below Turkey's 2001 annual population growth rate which was 1.1%) characterized the following provinces (the numbers in parentheses represent population growth rates and densities in 2001): Edirne (-0.5%, 64) in the Marmara Region, Denizli (-0.3%, 71) in the Aegean Region, Burdur (-0.4%, 37) in the Mediterranean Region, Sivas (-0.7%, 26) in the Central Region, Sinop (-1.8%, 38), Kastamonu (-0.8%, 28), Corum (-0.6%, 46) and Artvin (-0.6%, 26) in the Black Sea Region and Tunceli (-3.2%, 12), Bingol (-0.4%, 31) and Kars (-1.0%, 34) in the Eastern Region. It is interesting to note that the Black Sea and the Eastern Regions exhibit strong population desertification trends.

High per capita GDP levels in combination with high GDP growth rates characterize, in many cases, areas exhibiting sustainable economic development. Note that the numbers in parentheses after the provinces names represent their GDP annual growth rate (expressed in TL) in the period 2000-2001 and their per capita GDP in 2001 expressed in TL. Note also that the corresponding national indices during the above years were 43% and 2030 TL respectively. Kirklareli (59%, 4350) and Kocaeli (61%, 7465) in the Marmara Region, Mugla (53%, 4008) in the Aegean Region, Antalya (50%, 2657) and Icel (47%, 2970) in the Mediterranean Region, Zoguldak (49%, 3596) in the Black Sea Region and Kirikale (54%, 3301) in the Central Region are the provinces of Turkey exhibiting high economic development with strong sustainability characteristics. On the other hand, Agri (35%, 688) in the Eastern Region, Gumushane (39%, 1303) and Cankiri (37%, 1373) in the Black sea Region and Aksaray (32%, 1170) in the Central Region exhibit a repulsive economic image.

Conclusively, Kocaeli in the Marmara Region and Icel in the Mediterranean Region are the provinces of Turkey exhibiting the most positive profile with respect to the following 4 key indices: population density, population growth rate, per capita GDP and GDP growth rate. On the other hand, the Black Sea Region accommodates some of the most repulsive, with respect to the above indices, provinces of Turkey.

From the above analysis one may conclude that in Turkey exist two regional development feed-back mechanisms, working in parallel but in different directions, that sustain or even deteriorate regional discrimination trends. In highly efficient provinces such as Kocaeli, which has also attained sustainable development, the quality of its socio-economic profile improves the quality of investment flows exploitation mechanism which, through a feed-back process, further improves its socio-economic profile. On the other hand, the repulsive socio-economic profile of the Eastern Region and part of the Black Sea Region, in combination with possible administrative inefficiencies influence negatively the quality of investment flows exploitation

mechanism which, through a feed-back process, further downgrades their socio-economic profile. To further highlight the causes of the above regional discrimination process one may consider also a long term strategic index, the number of people with masters or doctoral education per million of inhabitants. In 1995, in the Marmara Region (the region accommodating Kocaeli) approximately 1500 people in every million of inhabitants were holding a masters or doctoral degree whereas in the Eastern Region the corresponding number was approximately 440.

Finally, Turkey exhibits two development poles which are mainly propelled by the industry. A development pole around Kocaeli and Istanbul in the northwestern part of the country and another pole around Icel in the southeastern part of it. To further highlight the power of these two poles one may consider a strategic index regarding industry, the productivity of their manufacturing value added process expressed as the value added per hour of employment. In 1993 (the latest year for which relevant data were available to the author), Kocaeli and Icel exhibited the highest, after the province of Batman, manufacturing productivity in Turkey with 0.79 millions TL per hour.

C6. THE IMPACT OF TURKEY ON THE GEO-ECONOMIC GRAVITY SYSTEMS OF EUROPE

In this section we will analyze the impact on the position of the Geo-Economic Gravity Centers of Europe from a 50% increase in the considered demand measures for Turkey. Three types of Gravity Center Systems will be examined:

(a) The Social Gravity System which is based on population data for 2004 (population statistics in table 4.2). According to this scenario the population of Turkey is taken to be 102 millions, 50% up with respect to its 2004 population which was 68 million inhabitants. Such a relative population increase could take place within the following 25-30 years if the corresponding birth and death rates of the country will not be altered significantly.

(b) The Economic Gravity System which is based on GDP data (billions $ in purchasing power parity) for 2004 (GDP statistics in table 4.5). According to this scenario the GDP of Turkey is taken to be 687 billions $, 50% up from 2004 levels (458 bil. $). Such a scenario could take place within the following 15-20 years if Turkey retains a GDP annual growth rate exceeding European average by 2 percentage units.

(c) The Trade Gravity System which is based on imports data (billions $ f.o.b.) for 2003 (imports statistics in table 4.10). According to this scenario Turkey's imports value is taken to be 94 billions $, 50% up from 2003 levels (62.4 mil. $).

The above scenarios will be summarily called "Dynamic Development Scenarios for Turkey".

6.1 Turkey's impact on the Social Gravity Systems of Europe

In 2004, the simple Social Gravity Center of Europe was situated in Wroclaw, Poland near the borders with Czechia. The corresponding Dynamic Development Scenario for Turkey forces this center to move southeast almost 100 km away, from position C to position C* in map 6.1.

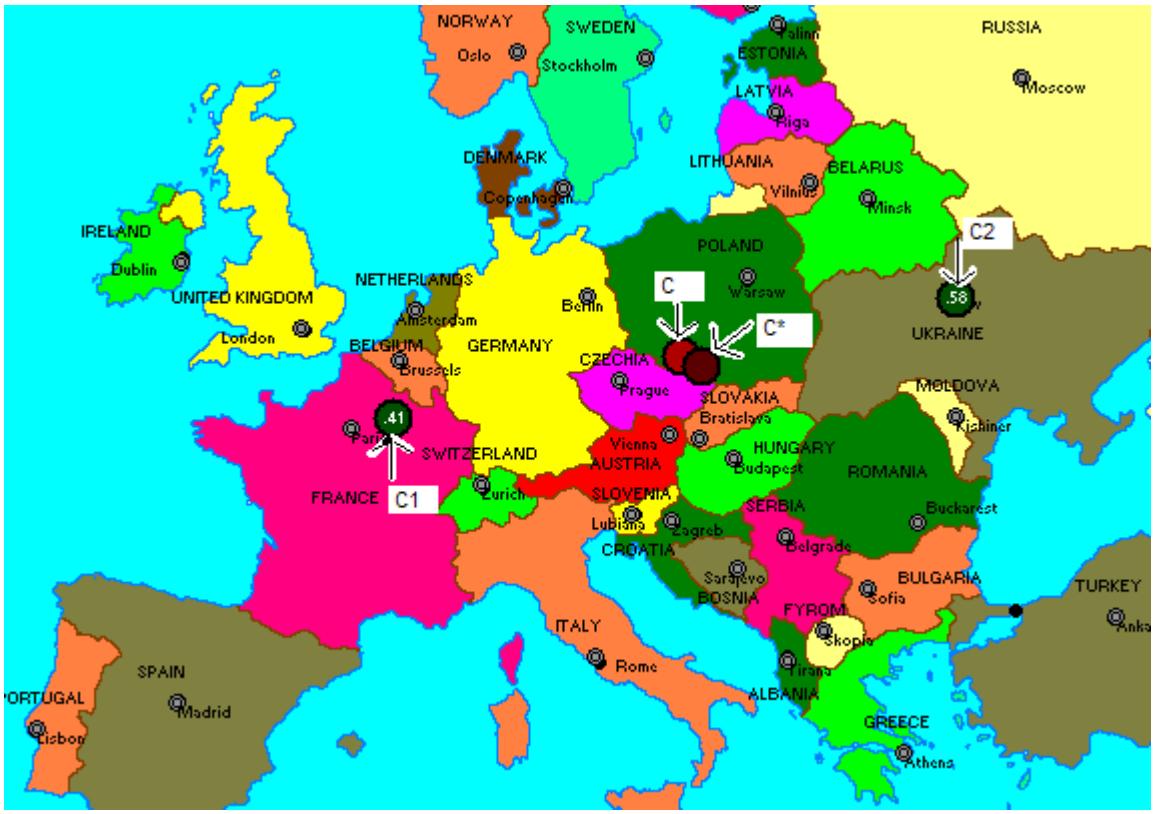
The impact on the dual Social Gravity System

In 2004, the dual Social Gravity System of Europe consisted of a center in northeastern France near Reims (point C1 in map 6.1) and of a second center in Ukraine near Kiev (point C2 in map 6.1).

The introduction of the Dynamic Development Scenarios for Turkey has no effect on the position of these centers.

The impact on the triple Social Gravity System

In 2004, the triple Social Gravity System consisted of a center in northern France near the borders with Belgium (point C1 in map 6.2), of a second center in the Germany-Poland-Czechia borders (point C2 in map 6.2) and of a third one in central Ukraine (point C3 in map 6.2). The eastern center was the largest one accounting for 50% of system's total transport cost.



Map 6.1. Turkey's impact on the simple and dual Social Gravity Systems of Europe

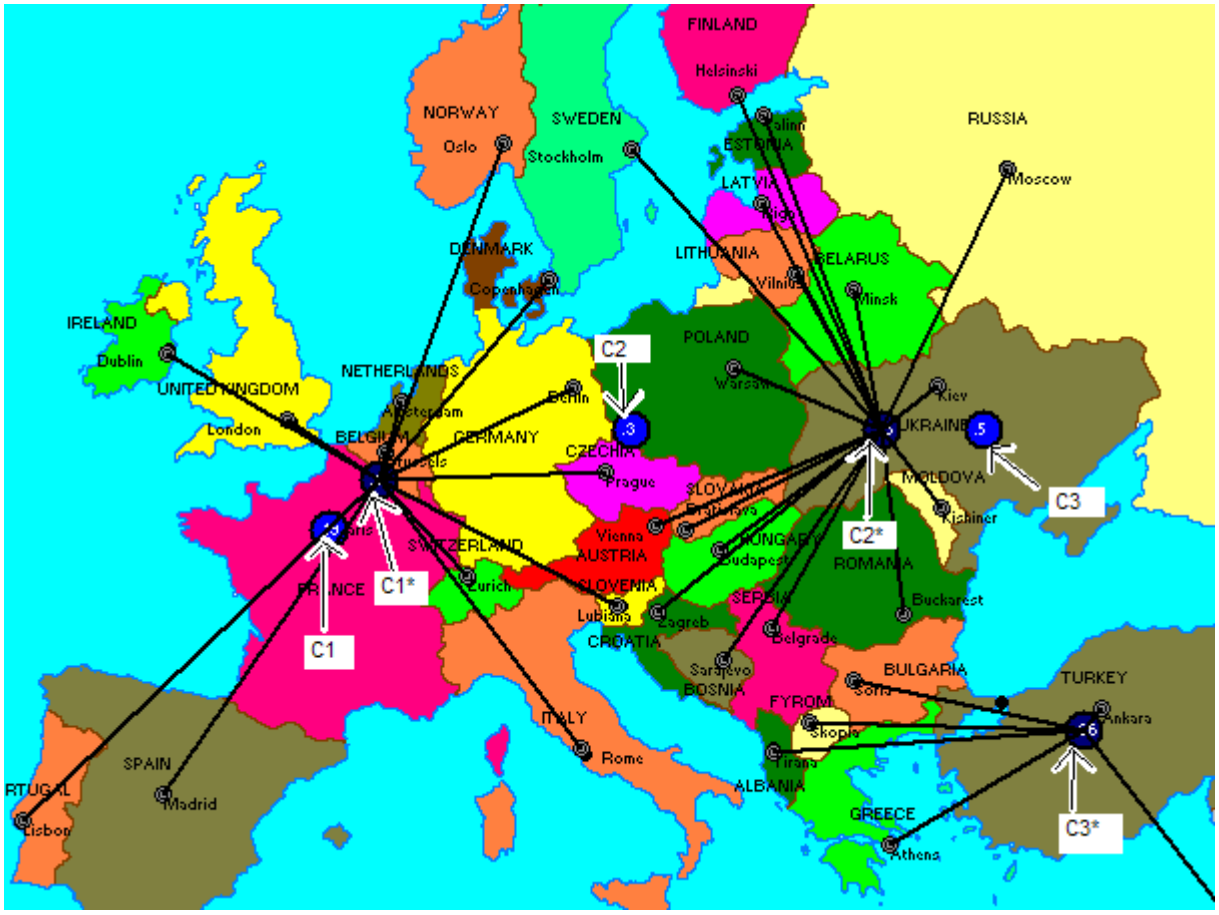
The allocation of European demand poles to the gravity centers of the triple Social Gravity System is as follows:

(a) Switzerland, Spain, Portugal, Belgium, the Netherlands, U.K. and Ireland are assigned to the center in France which accounts for 20% of system's total transport cost
(b) Russia, Belarus and the eastern Balkan countries (Turkey, Greece, Bulgaria,Romania and FYROM) are assigned to the Ukraine center which is the largest among the three accounting for 50% of system's total transport and

(c) the rest countries (central Europe, Nordic and Baltic as well as western Balkan countries) are assigned to the German-Poland-Czechia center.

Unlike the previous case, the introduction of the Development Scenarios for Turkey causes dramatic changes in the position of the central and eastern centers, making thus the triple system quite unstable. The main impact regards the Germany-Poland-Czechia center which ceases to exist under the pressure of the increased gravitating forces of the eastern Europe and the subsequent rearrangement of the spheres of influence which turns to be in favor of the center in France. Actually, the western center moves northeast to France-Belgium borders (to point C1* in map 6.2). The central one moves from Germany-Poland-Czechia borders to western Ukraine (point C2* in map 6.2) whereas the third one is located in the province of Ankara, Turkey (point C3* in map 6.2).

After the introduction of the Dynamic Development Scenarios for Turkey, the allocation of Europe demand poles to the above centers becomes quite interesting. Norway, Czechia, Slovenia and all the countries of western Europe except Austria belong to the domain of France-Belgium center, southern Balkan countries belong to the domain of the center in Turkey whereas the rest eastern European countries, together with Austria, Sweden and Finland, belong to the domain of the Ukraine center.



Map 6.2. Turkey's impact on the triple Social Gravity System of Europe

6.2 Turkey's impact on the Economic Gravity Systems of Europe

In 2004, the simple Economic Gravity Center of Europe was situated in Thuringen, Germany. The corresponding Dynamic Development Scenario for Turkey forces this center to move slightly (a few kilometers) to the east (point C in map 6.3).

The impact on the dual Economic Gravity System

In 2004, the dual Economic Gravity System of Europe consisted of a center in Paris, France (point C1 in map 6.3) and of a second center in Poznan, Poland (point C2 in map 6.3).

The introduction of the Dynamic Development Scenarios for Turkey has no effect on the position of the western center in France whereas it exerts a rather strong effect on the eastern center in Poland forcing it to move eastwards 120 km away from Poznan.

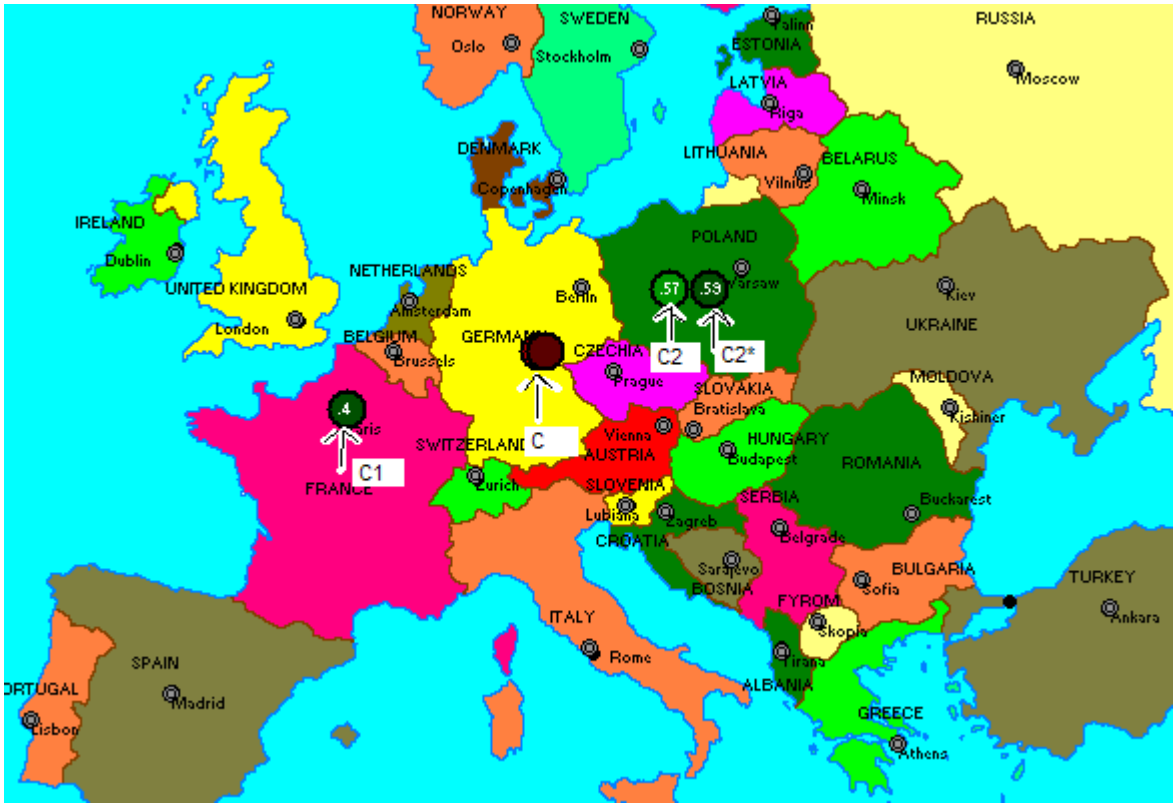
The impact on the triple Economic Gravity System

In 2004, the triple Economic Gravity System consisted of a center in Calais, France (point C1 in map 6.4), of a second center north of Rome, Italy (point C2 in map 6.4) and of a third one in Wroclaw, Poland (point C3 in map 6.4). The center in Poland was the largest one accounting for 50% of system's total transport cost.

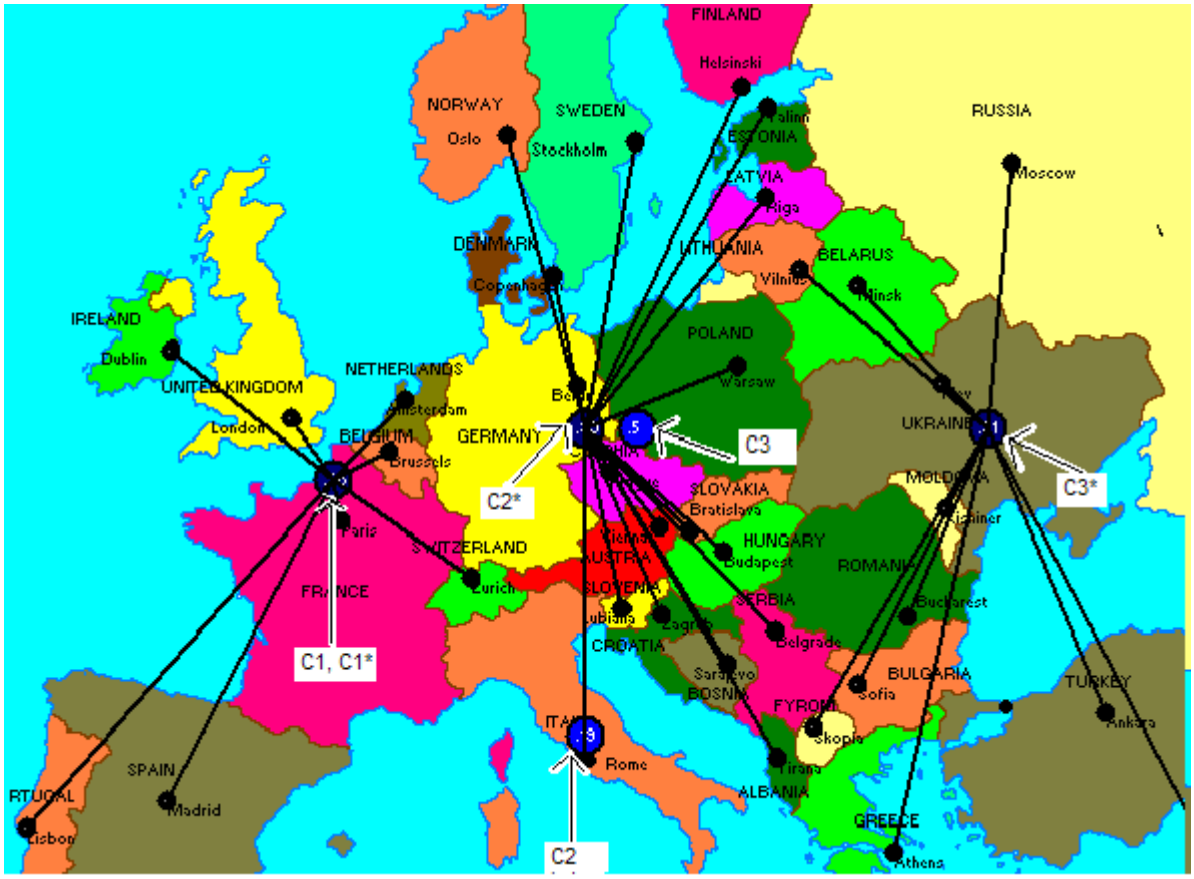
The allocation of European demand poles to the gravity centers of the triple Economic Gravity System is as follows:

(a) Switzerland, Spain, Portugal, Belgium, the Netherlands, U.K. and Ireland are assigned to the center in France which accounts for 29% of system's total transport.
(b) all Balkan countries except Romania are assigned to the center in Italy and
(c) Nordic and all central and eastern European countries are assigned to the center in Poland which is the largest among the three accounting for 51% of system's total transport cost.

As with the triple Social Gravity System, the introduction of the Dynamic Development Scenarios for Turkey causes dramatic changes in the position of two out of three centers, making again the triple system quite unstable. Actually, the position of the western center in France remains unaffected, whereas the central one moves 200 km west of Wroclaw to Dresden, Germany. The most interesting effect regards the center in Italy which ceases to exist giving its place to a center in central Ukraine (point C3* in map 6.4). As with the triple Social Gravity System, the Development Scenarios for Turkey causes a drastic relocation of Europe's gravity centers by greatly increasing the geo-economic gravitating forces of Germany and also those of eastern Europe, making Ukraine and Turkey the leading competitors for the eastern center.



Map 6.3. Turkey's impact on Europe's simple and dual Economic Gravity Systems



Map 6.4. Turkey's impact on Europe's triple Economic Gravity System

6.3 Turkey's impact on the Trade Gravity Systems of Europe

In 2003, the simple Trade Gravity Center of Europe was located in Frankfurt, Germany. The corresponding Dynamic Development Scenario for Turkey forces this center to move slightly (a few kilometers) to the east (point C map 6.5).

The impact on the dual Trade Gravity System

In 2003, the dual Trade Gravity System of Europe consisted of a center in Paris, France (point C1 in map 6.5) and of a second center in Berlin, Germany (point C2 in map 6.5).

The introduction of the Dynamic Development Scenarios for Turkey has no effect on the position of the above centers.

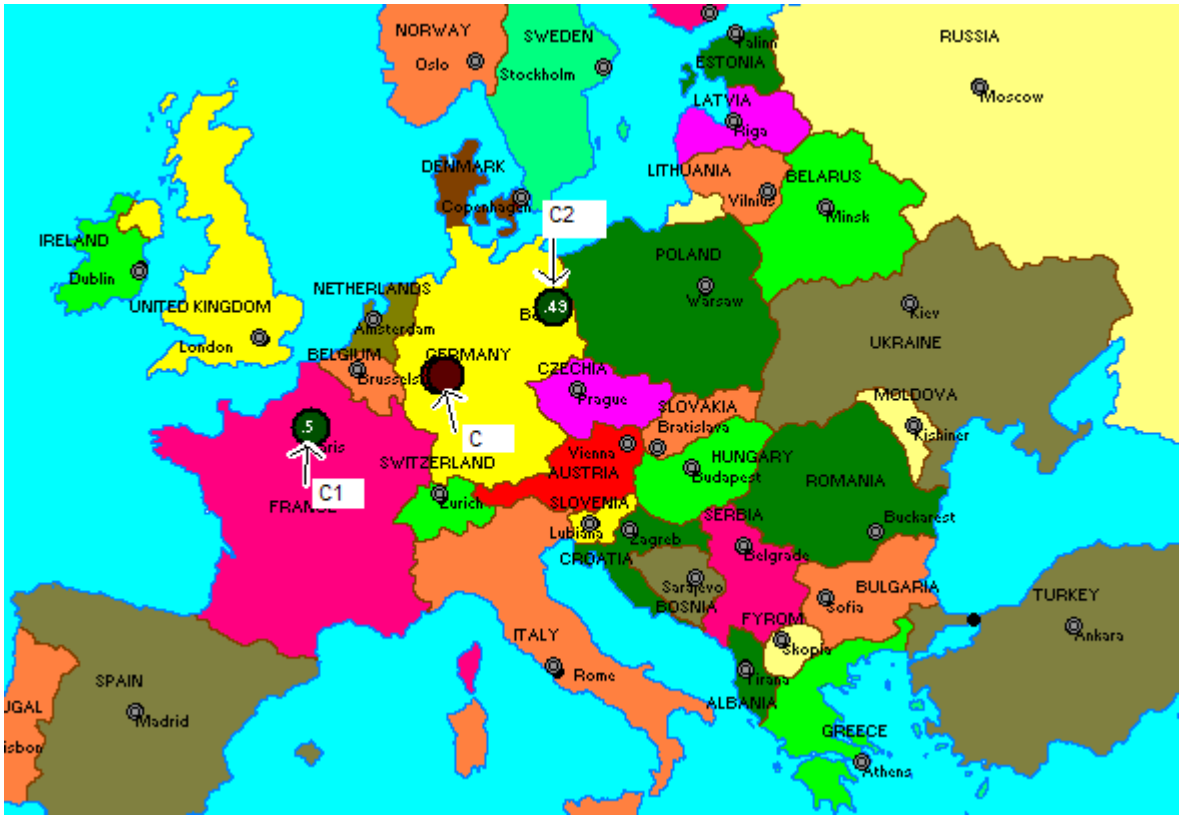
The impact on the triple Trade Gravity System

In the same year, the triple Trade Gravity System consisted of a center in Calais, France (point C1 in map 6.6), of a second center north of Rome, Italy (point C2 in map 6.6) and of a third one in Dresden, Germany (point C3 in map 6.6).

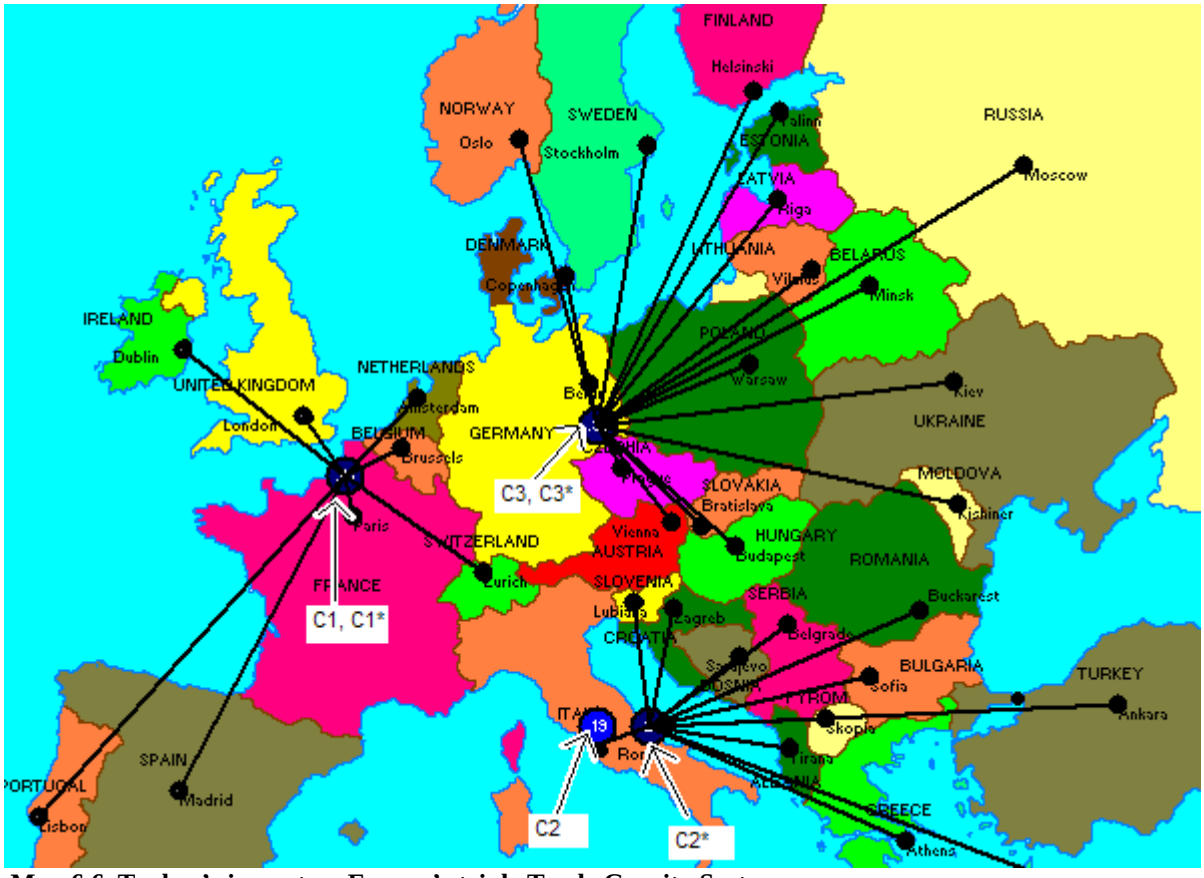
The allocation of European demand poles to the gravity centers of the triple Trade Gravity System is as follows:

(a) Switzerland, Spain, Portugal, Belgium, the Netherlands, U.K. and Ireland are assigned to the center in France,
(b) all Balkan countries are assigned to the center in Italy and
(c) Nordic and all central and eastern European countries are assigned to the center in Germany which is the largest among the three ones.

The introduction of the Dynamic Development Scenarios for Turkey does not cause significant changes in the position of the triple Trade Gravity System as in the previous two scenarios. Actually, the position of the centers in Calais and Dresden are not affected. On the other hand, the center in Italy is relocated in an eastward direction to Pescara, 200km away from Rome. The above relative stability of the Trade Gravity System is due to the domination on European trade of the geographically compact area consisted of Germany, Netherlands and Belgium. It is interesting to note, that the above compact area accounted for almost one third of total European imports value in 2003. This fact enforces the trade gravitating forces of central Europe to such a degree that out-weight the impact of the Dynamic Development Scenarios for Turkey.



Map 6.5. Turkey's impact on Europe's simple and dual Trade Gravity System



Map 6.6. Turkey's impact on Europe's triple Trade Gravity System

7. THE GEO-ECONOMIC GRAVITY SYSTEMS OF TURKEY

7.1 The Social Gravity Systems of Turkey

During the period 1990-2001 the simple Social Gravity Center of Turkey was located in the province of Ankara. During the above period this center exhibited a very slow westward movement (see map 7.1 and table 7.1).

The dual Social Gravity System

In 2001, the dual Social Gravity System consisted of a center in the western edge of the country located in the province of Bursa and of a second center in the eastern part of it located in the province of Malatya (map 7.2).

The Bursa center was serving 28 provinces which covered approximately 60% of total demand (population) at a cost reaching 50% of system's total transport cost. The provinces allocated to this center were: all Aegean and Marmara Region provinces, the western provinces of the Central Region (Ankara, Kirikale, Eskisehir and Konya) and the western provinces of the Black Sea Region (Bolu, Zonguldak, Kastamonu and Cankiri).

The Malatya center was serving the rest 45 provinces of central and eastern Turkey which covered approximately 40% of total demand at the same with Bursa cost.

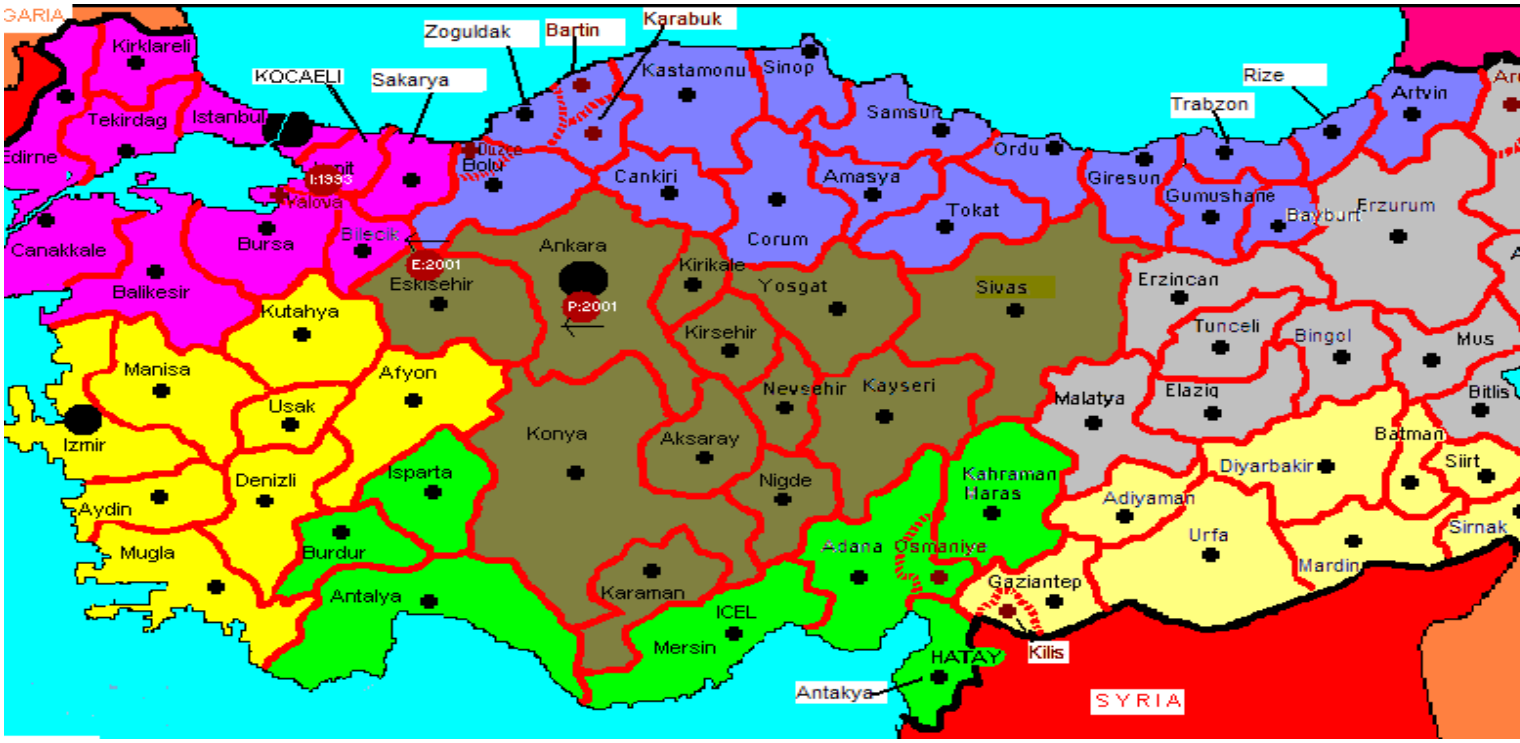
The triple Social Gravity System

In the same year the triple Social Gravity System consisted of a center in the western part of the country located in the province of Istanbul, of a center in the central part of it located in the province of Konya and of a center in the eastern part of it located in the province of Elazig (map 7.3).

The Istanbul center was serving 15 provinces which covered approximately 33% of total demand at a cost reaching 24% of system's total transport cost. The provinces allocated to this center were: all provinces of Marmara Region, the northern provinces of the Aegean Region (Izmir, Manisa and Kutahya) and the western provinces of the Black Sea Region (Bolu, Zonguldak and Kastamonu).

The Konya center was serving 25 provinces which covered the same amount of demand with the Istanbul center accounting for 36% of system's total transport cost. The provinces allocated to this center were: the southern provinces of the Aegean Region, all the provinces of the Mediterranean Region except K. Maras and Hatay, all the provinces of the Central Region except Sivas and the central provinces of the Black Sea Region (Cankiri, Sinop, Corum and Amasya).

The Elazig center was serving 33 provinces in the eastern part of the country which covered 33% of total demand at a cost reaching 40% of system's total transport cost.



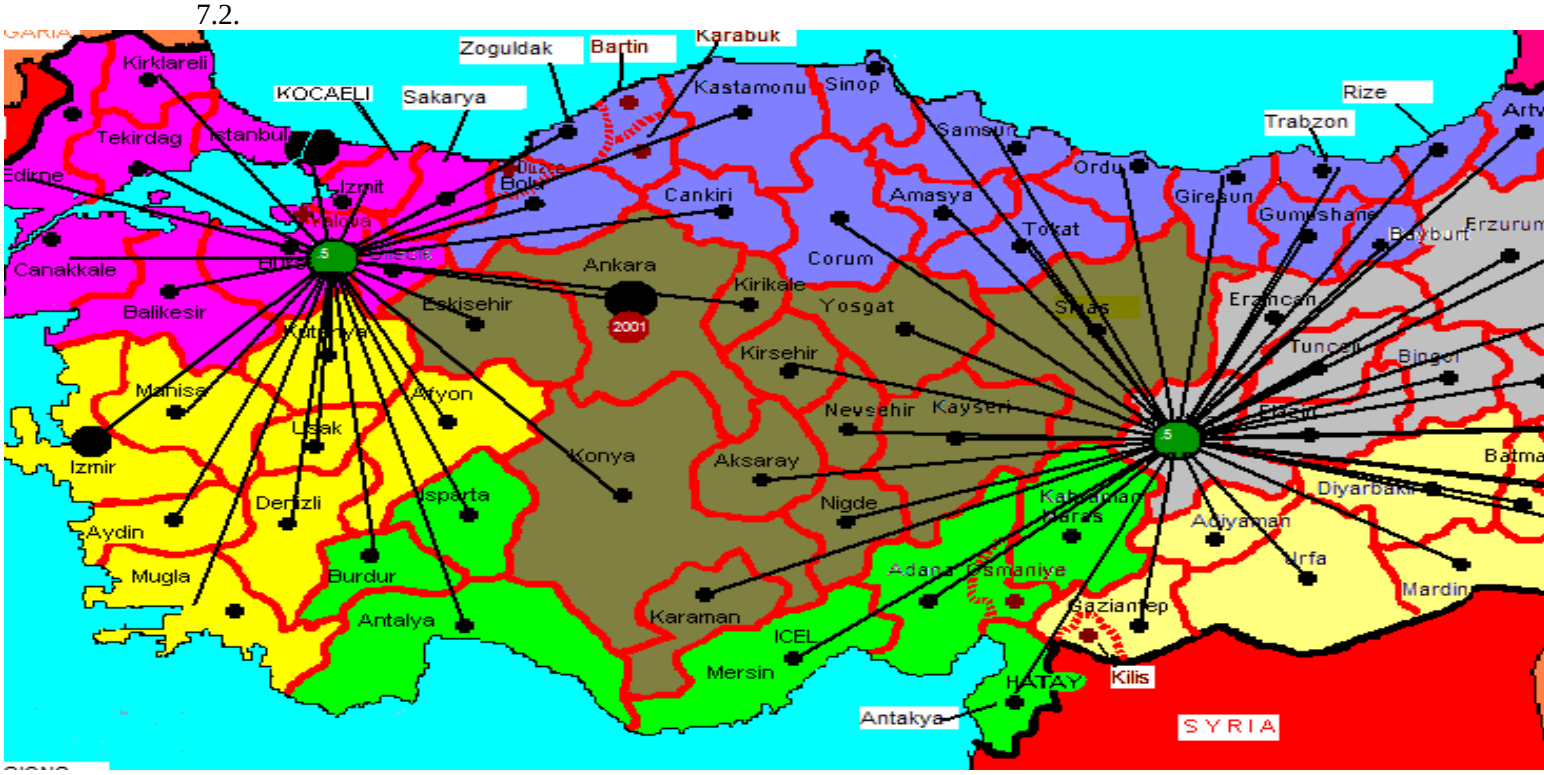
Map 7.1 The simple Social and Economic Gravity Centers of Turkey in 2001 and the simple Industrial Gravity Center of Turkey in 1993

1. ISTANBUL: 10243
2. ANKARA: 4060
3. IZMIR: 3436
4. KONYA: 2250
5. BURSA: 2144
6. ADANA: 1875
7. ANTALYA: 1771
8. ICEL: 1697
9. URFA: 1468
10. DIYARBAKIR: 1383
11. GAZIANTEP: 1314
12. MANISA: 1264
13. HATAY: 1240
14. KOCAELI: 1226
15. SAMSUN: 1203
16. BALIKESIR: 1082
17. KAYSERI: 1067
18. K.MARAS: 1008
19. TRABZON: 991
20. AYDIN: 958
21. ERZURUM: 948
22. VAN: 894
23. ORDU: 889
24. MALATYA: 864
25. DENIZLI: 847
26. TOKAT: 834
27. AFYON: 815
28. SIVAS: 750
29. SAKARYA: 749
30. MUGLA: 727
31. MARDIN: 714
32. ESKISEHIR: 708
33. YOZGAT: 689
34. KUTAHYA: 662
35. TEKIRDAG: 638
36. ADIYAMAN: 632
37. ZONGULDAK: 611
38. CORUM: 593
39. ELAZIG: 574
40. AGRI: 535
41. GIRESUN: 524
42. ISPARTA: 518
43. BATMAN: 485
44. CANAKKALE: 465
45. MUS: 458
46. AKSARAY: 405
47. EDIRNE: 400
48. BITLIS: 391
49. KIRIKKALE: 384
50. KASTAMONU: 372
51. RIZE: 365
52. AMASYA: 365
53. SIRNAK: 361
54. NIGDE: 351
55. KIRKLARELI: 328
56. USAK: 324
57. KARS: 321
58. ERZINCAN: 317
59. NEVSEHIR: 310
60. CANKIRI: 270
61. BOLU: 270
62. SIIRT: 264
63. BURDUR: 256
64. BINGOL: 252
65. KIRSEHIR: 252
66. KARAMAN: 245
67. HAKKARI: 240
68. SINOP: 222
69. BILECIK: 194
70. ARTVIN: 189
71. GUMUSHANE: 187
72. BAYBURT: 96
73. TUNCELI: 90

Table 7.1. The population of the provinces of Turkey in 2001 (thousands of inhabitants)

7.2 The Economic Gravity Systems of Turkey

During the period 1990-2001 the simple Economic Gravity Center of Turkey was located in the northern part of Eskisehir province. During the above period this center exhibited a very slow westward movement (map 7.1). The GDP of the provinces of Turkey in 2001 is given in tables 7.2.



Map 7.2. The dual Social Gravity System of Turkey

Map 7.3. The triple Social Gravity System of Turkey

The dual Economic Gravity System

In 2001, the dual Economic Gravity System of Turkey consisted of a center in the western edge of the country located in the province of Kocaeli and of a second center in the eastern part of it located in the borders of Kayseri and K.Maras provinces, with Malatya being located in a relatively small distance from it (see map 7.4).

The Kocaeli center was serving 24 provinces which covered approximately two thirds of total demand (GDP) at a cost accounting for 57% of system's total transport cost. The provinces allocated to this center coincided with those served by the Bursa center in the dual Social Gravity System except of Konya which was served by the eastern center. The eastern center, in Kayseri and K.Maras borders was serving the rest 49 provinces.

The triple Economic Gravity System

In the same year the triple Economic Gravity System consisted of a center in the northwestern part of the country located in the province of Istanbul, of a center in the southwestern part of it located in the borders of Izmir and Denizli provinces and of a third center in the eastern part of Turkey located in the borders of Kayseri and K.Maras provinces, again in no great distance from Malatya (see map 7.5).

The Istanbul center was serving 15 provinces which covered approximately 50% of total demand at a cost reaching 31% of system's total transport cost. The provinces allocated to this center were: all provinces of Marmara Region, the western provinces of the Central Region (Ankara and Eskisehir) and the western provinces of the Black Sea Region (Bolu, Zonguldak and Kastamonu).

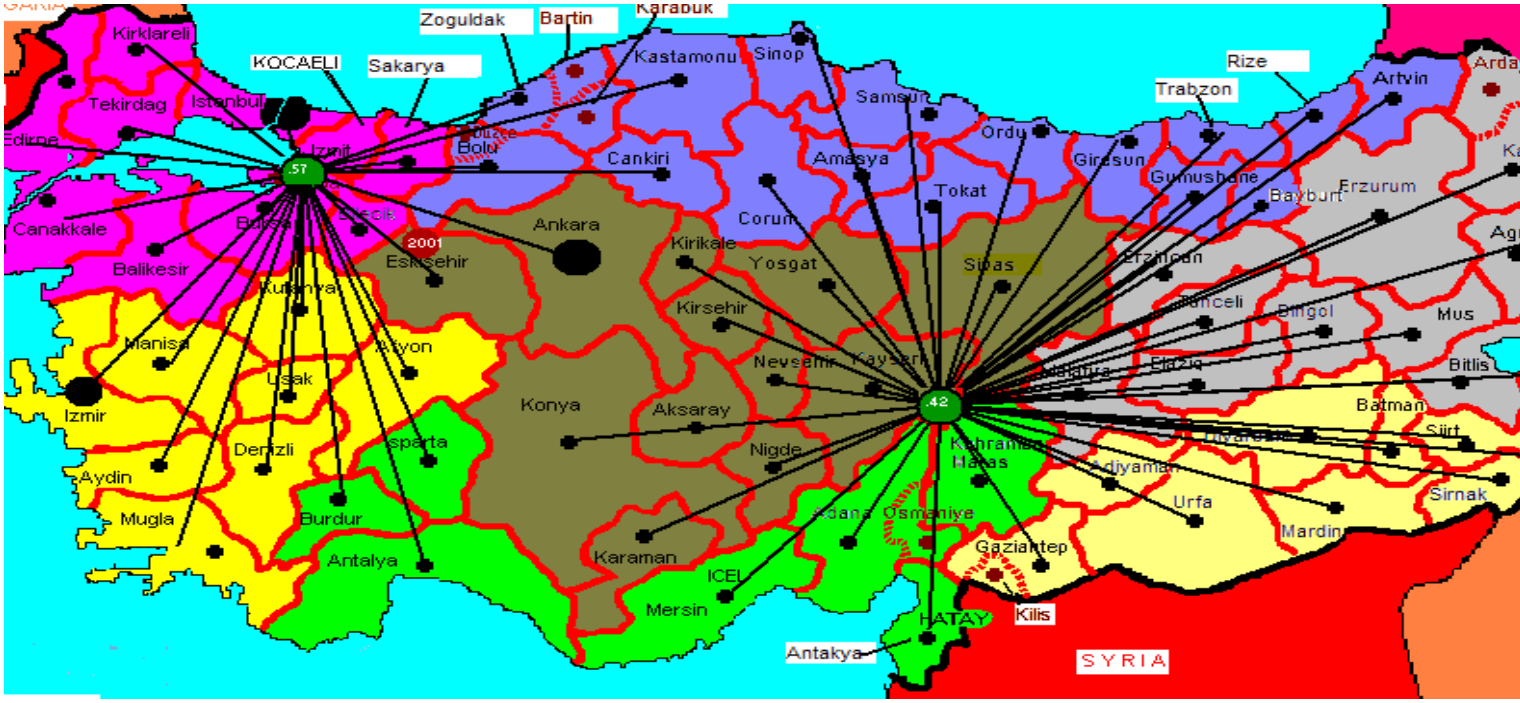
The Izmir-Denizli center was serving only 12 provinces which covered approximately 20% of total demand at a cost accounting for 20% of system's total transport cost. The provinces allocated to this center were: all provinces of the Aegean Region and the western provinces of the Mediterranean Region (Antalya, Burdur and Isparta).

The Kayseri-K.Maras center was serving a huge area consisted of 46 provinces (all provinces of Turkey located east of Ankara) which covered 30% of total demand at a cost accounting for 49% of system's total transport cost.

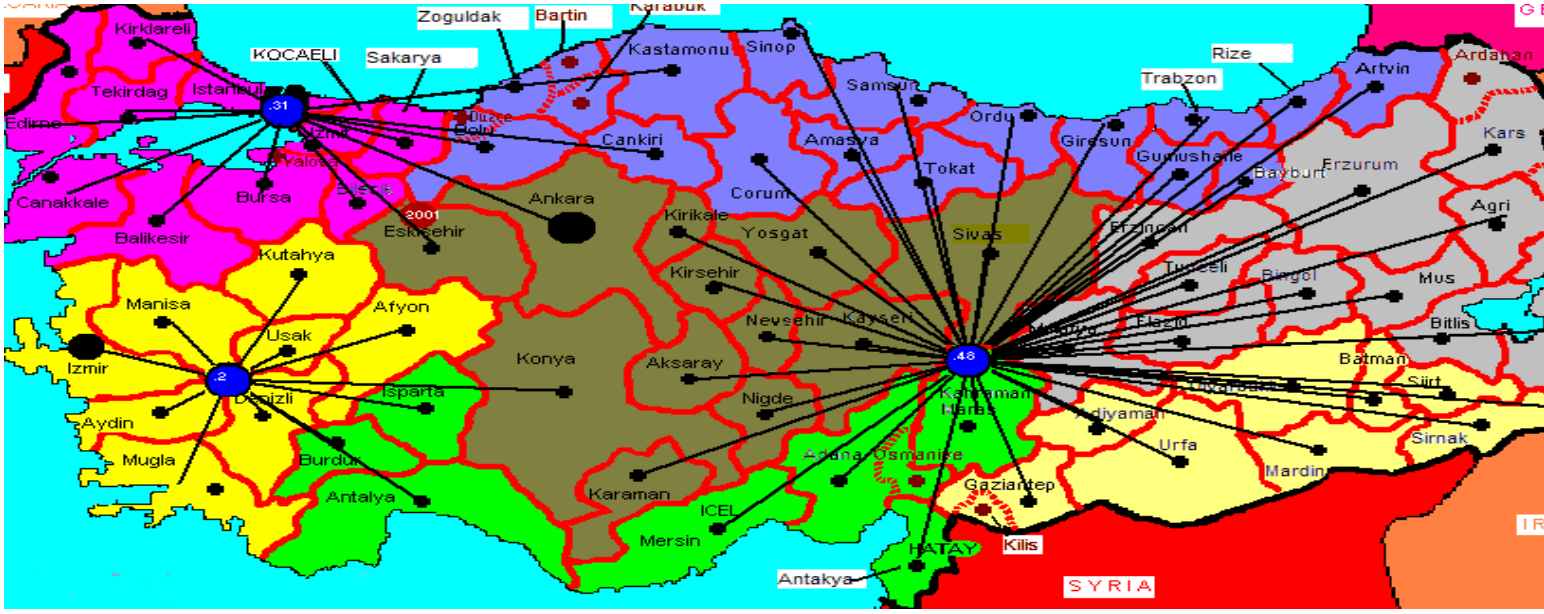
1. ISTANBUL: 38010000
2. ANKARA: 13536000
3. IZMIR: 13382000
4. KOCAELI: 9160000
5. BURSA: 6510000
6. ADANA: 5312000
7. ICEL: 5040000
8. ANTALYA: 4705000
9. KONYA: 4237000
10. MANISA: 3769000
11. MUGLA: 2918000
12. HATAY: 2638000
13. BALIKESIR: 2628000
14. GAZIANTEP: 2535000
15. SAMSUN: 2449000
16. KAYSERI: 2355000
26. TRABZON: 1809000
27. URFA: 1794000
28. MALATYA: 1482000
29. KUTAHYA: 1446000
30. KIRKLARELI: 1431000
31. TOKAT: 1386000
32. BOLU: 1381000
33. CANAKKALE: 1319000
34. KIRIKKALE: 1271000
35. SIVAS: 1270000
36. AFYON: 1248000
37. ERZURUM: 1218000
38. CORUM: 1191000
39. ELAZIG: 1185000
40. EDIRNE: 1168000
41. ORDU: 1148000
51. BATMAN: 685000
52. AMASYA: 636000
53. BILECIK: 611000
54. BURDUR: 606000
55. KARAMAN: 597000
56. USAK: 564000
57. ARTVIN: 491000
58. AKSARAY: 474000
59. KIRSEHIR: 455000
60. ERZINCAN: 445000
61. SINOP: 392000
62. CANKIRI: 372000
63. AGRI: 368000
64. SIIRT: 356000
65. KARS: 345000
66. MUS: 321000

17. AYDIN: 2343000	42. ISPARTA: 949000	67. BITLIS: 307000
18. DIYARBAKIR: 2200000	43. VAN: 932000	68. SIRNAK: 279000
19. ZONGULDAK: 2197000	44. GIRESUN: 917000	69. GUMUSHANE: 245000
20. YOZGAT: 2197000	45. MARDIN: 852000	70. HAKKARI: 244000
21. DENIZLI: 2192000	46. RIZE: 842000	71. BINGOL: 244000
22. ESKISEHIR: 2159000	47. KASTAMONU: 802000	72. TUNCELI: 175000
23. K.MARAS: 1935000	48. NEVSEHIR: 797000	73. BAYBURT: 119000
24. TEKIRDAG: 1931000	49. NIGDE: 757000	
25. SAKARYA: 1913000	50. ADIYAMAN: 702000	

Table 7.2. The GDP of the provinces of Turkey in 2001 (billions of Turkish Lira)



Map 7.4. The dual Economic Gravity System of Turkey



Map 7.5. The triple Economic Gravity System of Turkey

7.3 The Industrial Gravity Systems of Turkey

In 1993 the simple Industrial Gravity Center of Turkey was located in the province of Kocaeli, country's industrial locomotive (see map 7.1).

The dual Industrial Gravity System

In the above year, the dual Industrial Gravity System consisted of a center in the western edge of the country located in the province of Istanbul and of a second center in the eastern part of it located in the province of Adana (see map 7.6).

The Istanbul center was serving 24 provinces which covered approximately 80% of total demand (Manufacturing Value Added) at a cost reaching 70% of system's total transport cost. The provinces allocated to this center were: all Aegean and Marmara Region provinces and Burdur from the Mediterranean Region, the western provinces of the Central Region (Ankara and Eskisehir) and the western provinces of the Black Sea Region (Sinop, Kastamonu, Cankiri, Zonguldak and Bolu).

The Adana center was serving the rest 49 provinces of central and eastern Turkey which covered only 20% of total demand at a cost accounting for 30% of system's total transport cost.

The triple Industrial Gravity System of Turkey

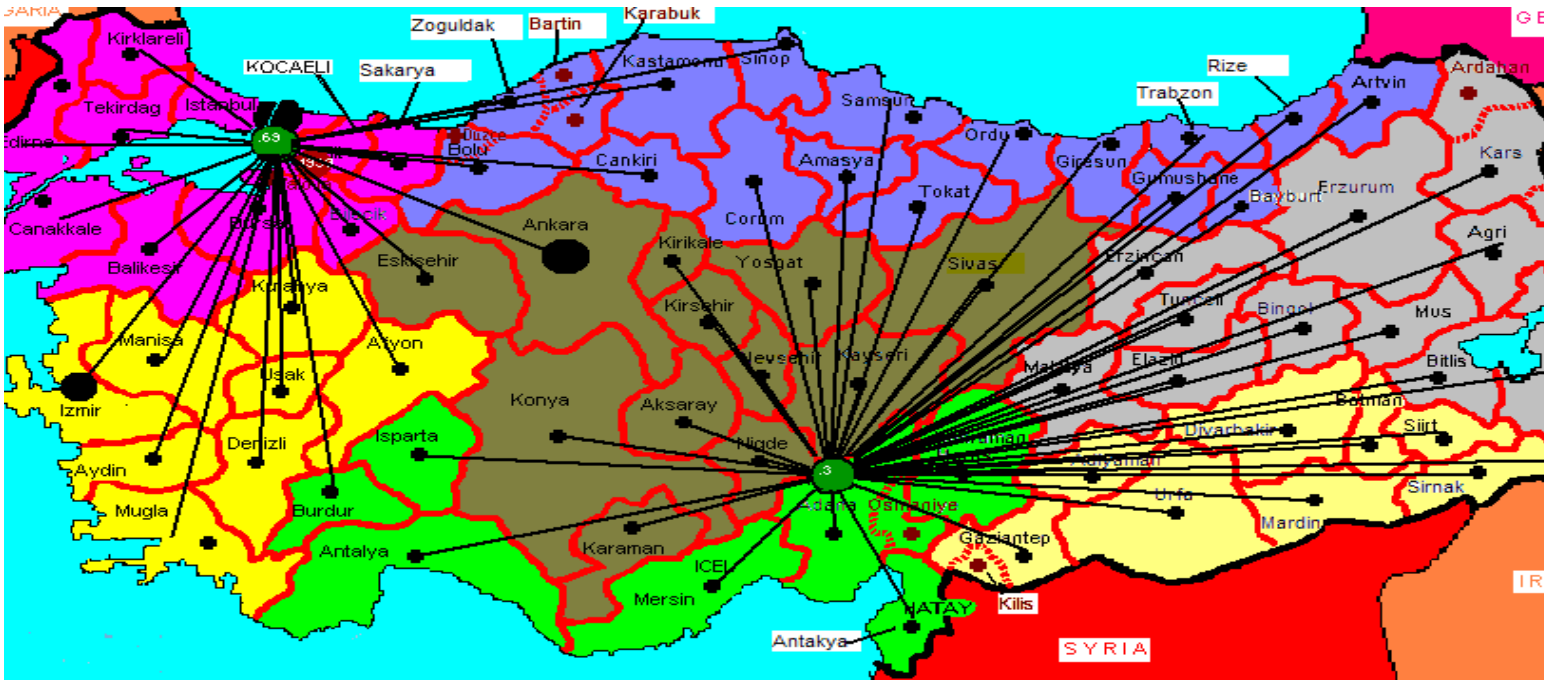
In 1993, the triple Industrial Gravity System consisted of a center in the northwestern part of the country located again in the province of Istanbul, of a center in the southwestern part of it in the borders of Manisa and Usak provinces and of a third one in the eastern part of Turkey located in the province of Adana (see map 7.7).

The Istanbul center was serving 14 provinces which covered roughly 60% of total demand at a cost reaching 41% of system's total transport cost. The provinces allocated to this center were: all provinces of the Marmara Region except Balikesir, the western provinces of the Central Region (Ankara and Eskisehir) and the western provinces of the Black Sea Region.
The Manisa-Usak center was serving 12 provinces which covered 20% of total demand at a cost accounting for 41% of system's total transport cost. The provinces allocated to this center

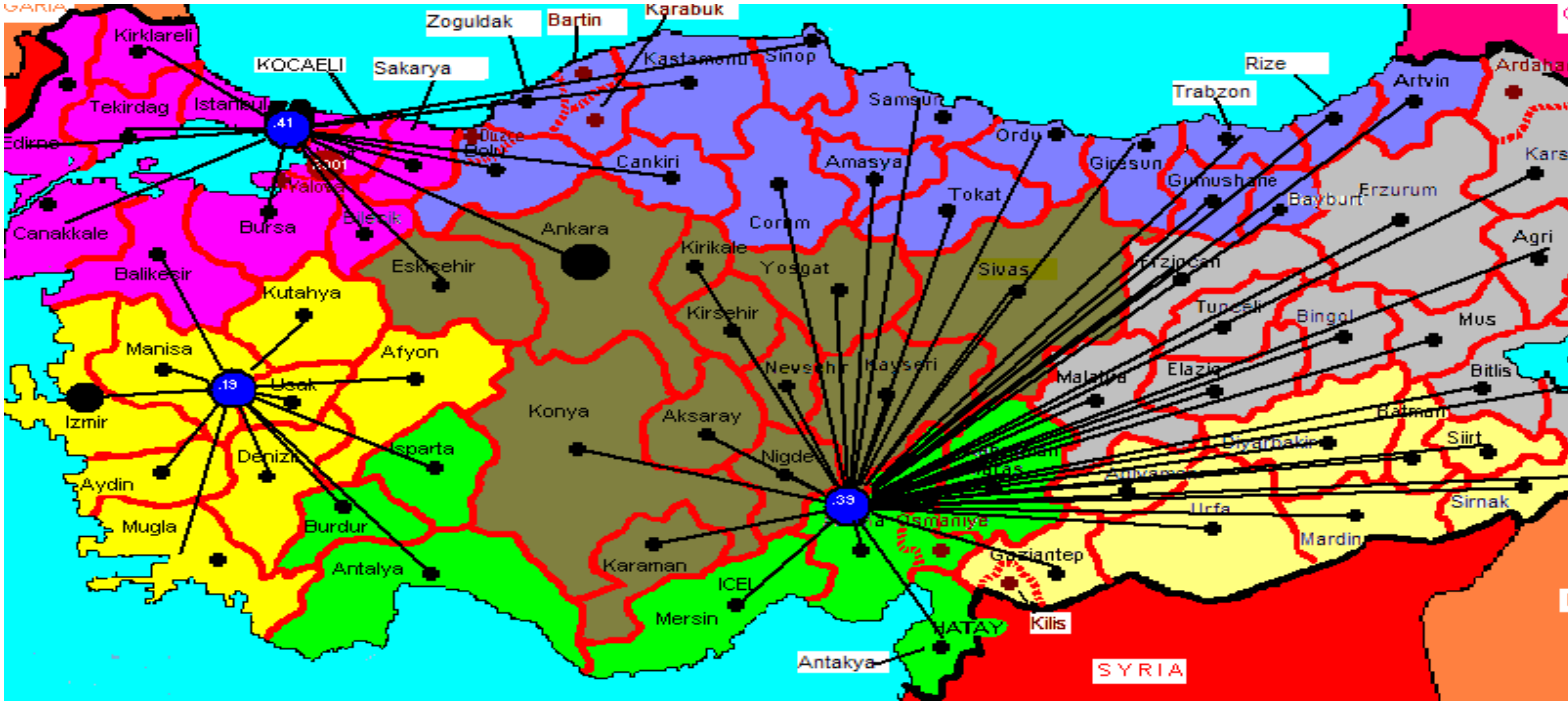
were: all Aegean Region provinces, Balikesir from the Marmara Region and the western provinces of the Mediterranean Region.
Finally, the Adana industrial center was serving two thirds of all provinces of Turkey which covered almost 20% of total demand at a cost reaching 40% of system's total transport cost.

1. ISTANBUL: 126989
2. KOCAELI: 60520
3. IZMIR: 58119
4. BURSA: 35400
5. ADANA: 15859
6. ANKARA: 15609
7. ICEL: 15380
8. TEKIRDAG: 9989
9. MANISA: 8159
10. KIRIKKALE: 6980
11. ZONGULDAK: 6869
12. BILECIK: 6820
13. GIRESUN: 6760
14. ESKISEHIR: 6760
15. KONYA: 5969
16. HATAY: 5119
17. BALIKESIR: 4320
18. KAYSERI: 4219
19. KIRKLARELI: 4099
20. BOLU: 3980
21. SAKARYA: 3769
22. DENIZLI: 3559
23. CANAKKALE: 2950
24. MALATYA: 2769
25. GAZIANTEP: 2619
26. TOKAT: 2609
27. SAMSUN: 2589
28. AFYON: 2380
29. AYDIN: 1470
30. KUTAHYA: 1460
31. TRABZON: 1450
32. K.MARAS: 1299
33. CORUM: 1200
34. NIGDE: 1190
35. ELAZIG: 1179
36. BURDUR: 1169
37. EDIRNE: 1100
38. SIVAS: 1000
39. RIZE: 939
40. ANTALYA: 939
41. ORDU: 870
42. ISPARTA: 870
43. AMASYA: 829
44. NEVSEHIR: 819
45. BATMAN: 800
46. YOZGAT: 740
47. AGRI: 740
48. USAK: 689
49. KASTAMONU: 689
50. ADIYAMAN: 670
51. ERZURUM: 540
52. KARAMAN: 500
53. ERZINCAN: 449
54. SIRNAK: 439
55. DIYARBAKIR: 400
56. VAN: 349
57. ARTVIN: 349
58. KIRSEHIR: 310
59. URFA: 270
60. SINOP: 270
61. MUGLA: 200
62. CANKIRI: 189
63. KARS: 180
64. AKSARAY: 100
65. SIIRT: 87
66. MUS: 65
67. MARDIN: 45
68. GUMUSHANE: 19
69. BITLIS: 19
70. HAKKARI: 9
71. BAYBURT: 1
72. TUNCELI: <1
73. BINGOL: <1

Table 7.3. The Manufacturing Value Added of the provinces of Turkey in 1993 (billions Turkish Lira)



Map 7.6. The dual Industrial Gravity System of Turkey



Map 7.7. The triple Industrial Gravity System of Turkey

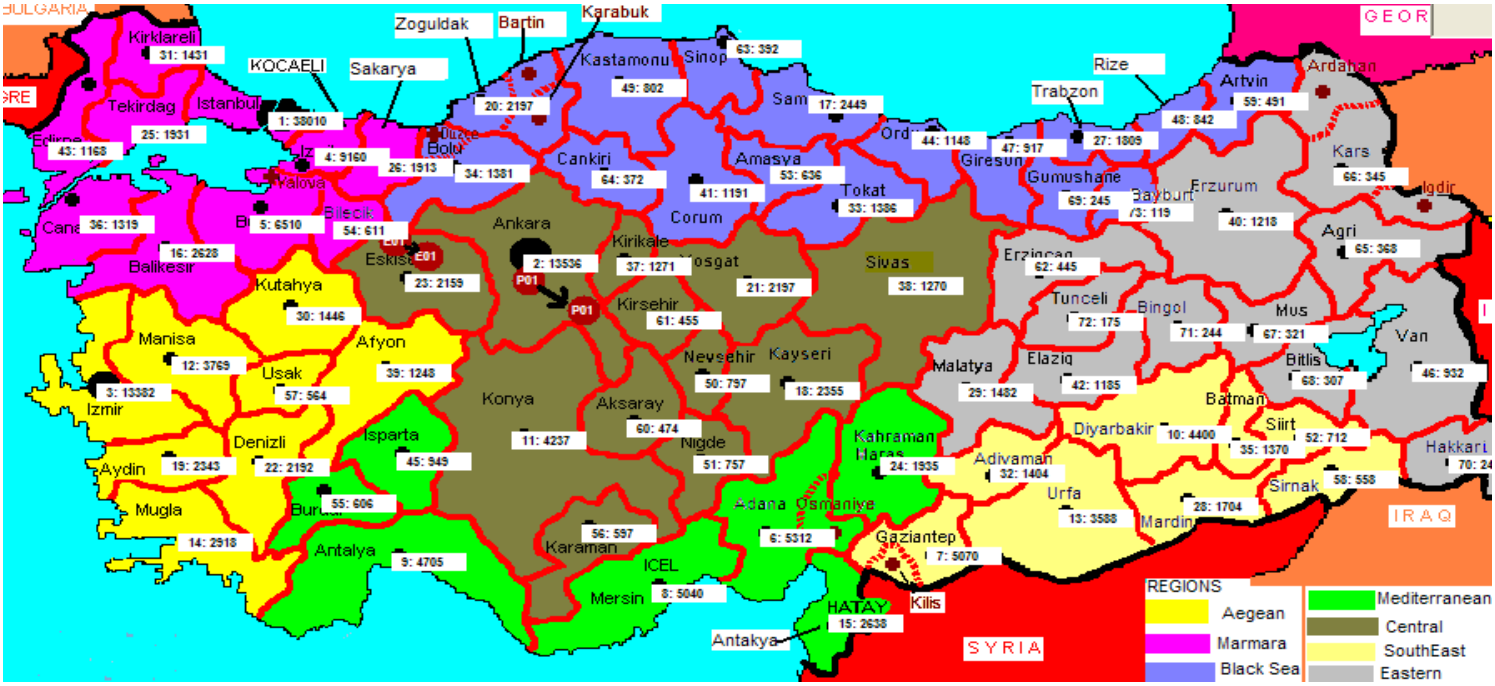
C8. THE IMPACT OF SOUTHEASTERN ANATOLIA PROJECT ON THE GRAVITY SYSTEMS OF TURKEY

The Southeastern Anatolia Project (GAP in its Turkish acronym) is a multi-sectoral project aiming at the sustainable development of the Southeast Region which is the least developed region of the country. The project started in 1984. The sustainable development of the region will be based on the hydroelectric exploitation of the Euphrates and Tigris river waters, mainly for irrigation purposes, so as to develop an efficient agro-industrial base. GAP covers the following provinces: Adiyaman, Batman, Gaziantep, Kilis, Mardin, Siirt, Urfa and Sirnak. The area of the region covered by the project is approximately 75000 square kilometers, almost 10% of Turkey's total area, whereas its population in 2001 was approximately 6.6 millions or 9.5% of Turkey's total population. In 2001 this region produced only 5.3% of the national income and was predominantly agricultural. The share of agriculture in the economy of the region is almost 40%, more than twice as large as the national level.

Given the great geo-economic and geo-political significance of the project the analysis of this chapter will focus on the impact of GAP on the Gravity Systems of Turkey. In this context, the following two scenarios (expressing the best case outcome in a long term basis exceeding 30 years) will be examined:

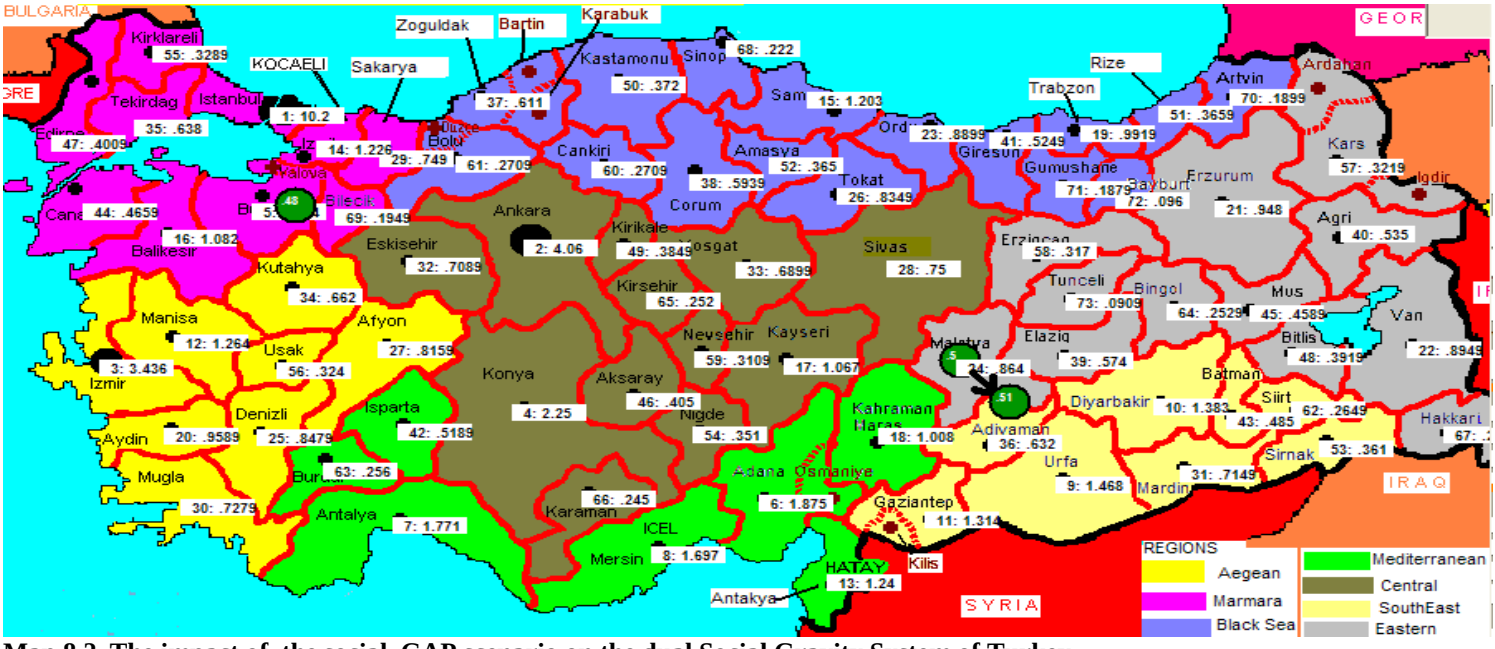
(a) The social scenario according to which GAP region's population will double its share in the national total reaching 19% of Turkey's total population.
(b) The economic scenario according to which GAP region's GDP will double its share in the national total reaching 10.6% of Turkey's total GDP.

The impact of the social GAP scenario on the simple Social Gravity Center of Turkey in 2001 is rather significant. It forces this center to move roughly 60 km away of the capital Ankara towards the southeastern direction (towards Nevsehir). The impact of the economic GAP scenario on the simple Economic Gravity Center of the country is insignificant (see map 8.1).



Map 8.1 The impact of GAP scenarios on the simple Social and Economic Gravity Centers of Turkey

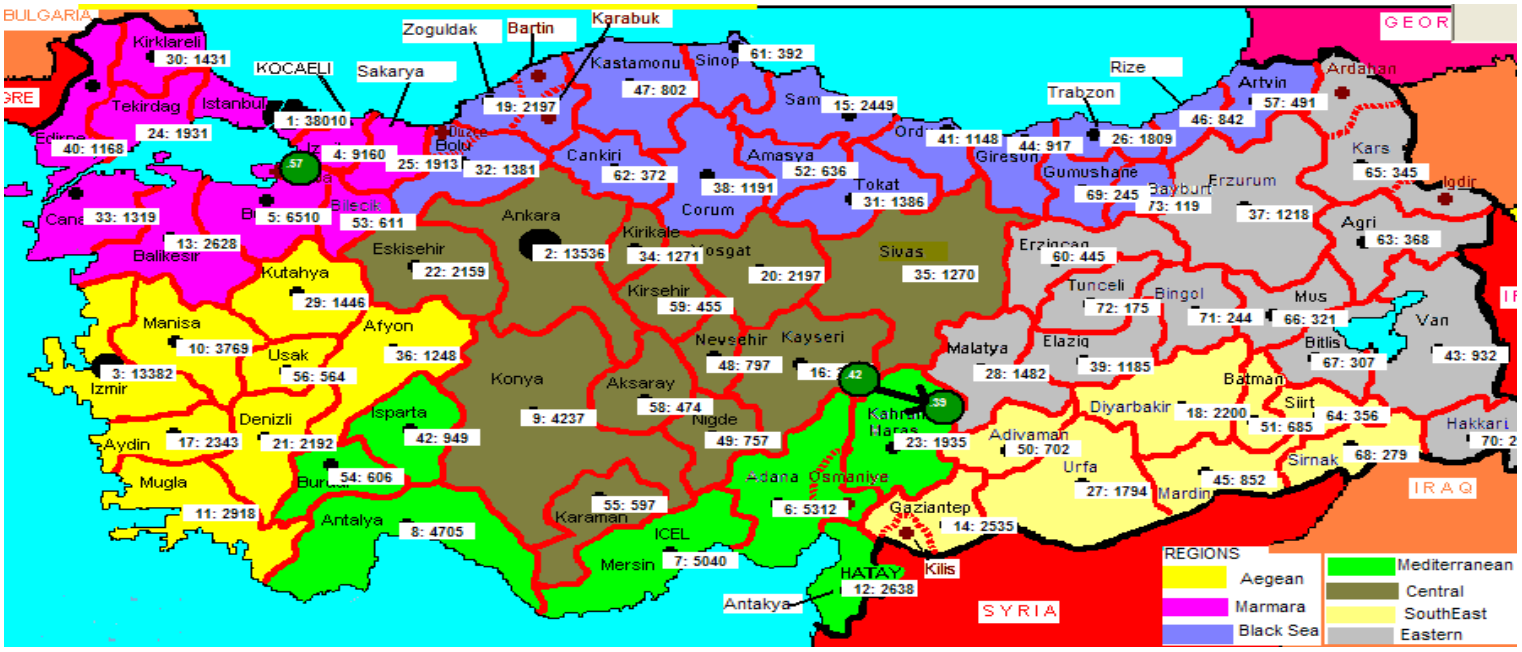
The introduction of the social GAP scenario has no effect on the western center of the dual Social Gravity System. On the contrary, it forces the eastern center (which is located in Malatya) to move almost 100 km away from Malatya city towards Urfa city. The new location of this center is near the borders of Malatya with Adiyaman (see map 8.2).



Map 8.2 The impact of the social GAP scenario on the dual Social Gravity System of Turkey

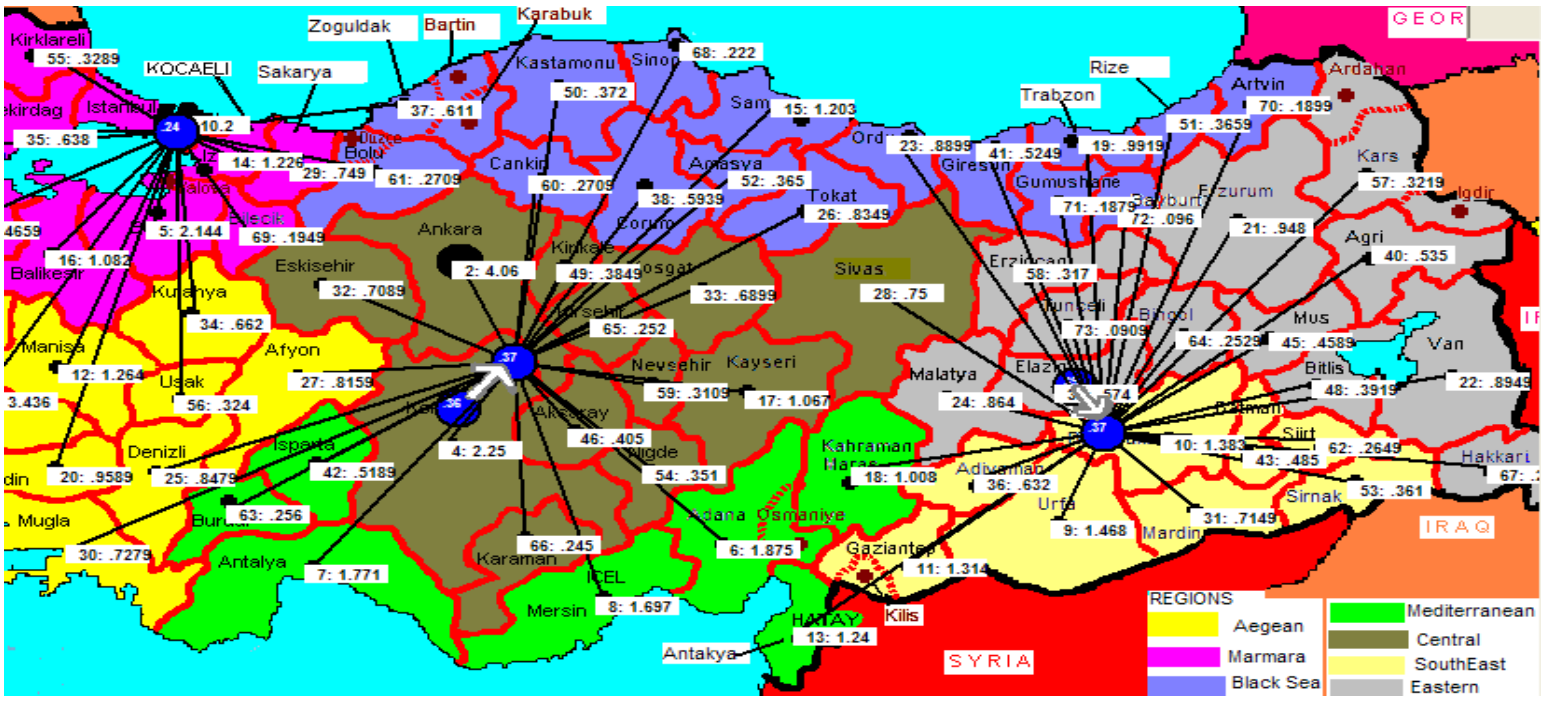
The introduction of the economic GAP scenario has no effect on the western center of the dual Economic Gravity System. On the other hand it exerts a very significant effect on the eastern center, located in the borders of Kayseri with K.Maras, by forcing it to move almost 150 km away in the southeastern direction. The new location of this center is near the borders of K.Maras with Malatya (see map 8.3). The above relocation is accompanied by a strengthening

of the western center which now accounts for 61% of system's total transport cost (previous value was 58%).



Map 8.3 The impact of the economic GAP scenario on the dual Economic Gravity System of Turkey

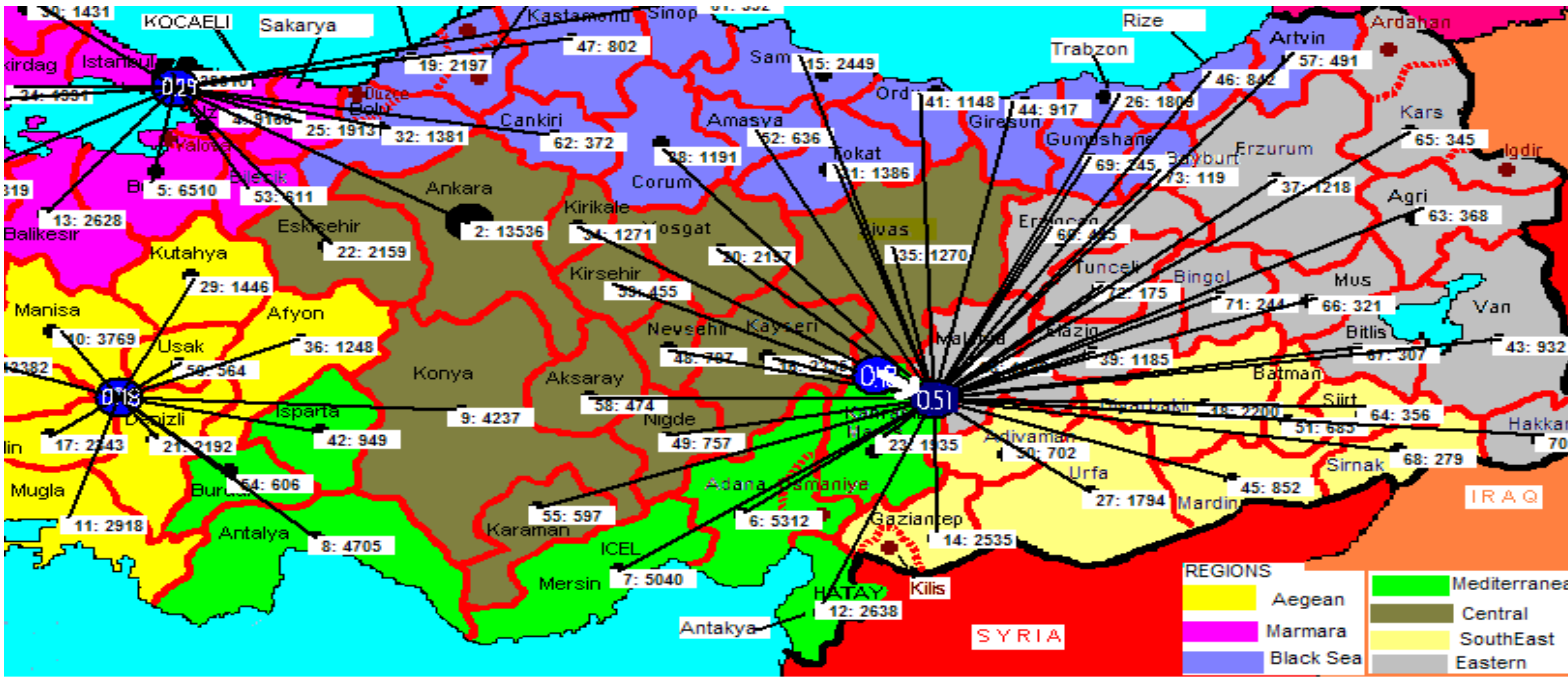
The introduction of the social GAP scenario exerts a significant effect on the location of the central and eastern centers of the triple Social Gravity System of



Map 8.4 The impact of the social GAP scenario on the triple Social Gravity System of Turkey

Turkey by forcing the first one to move roughly 120 km away from Konya city towards lake Tuz and the second one to move roughly 100 km away from Elazig city along the southeastern direction. The location of the western center in Istanbul remains intact (see map 8.4). The

above center relocations are accompanied by the strengthening of the eastern center and the weakening of the other two ones.



Map 8.5 The impact of the economic GAP scenario on the triple Economicl Gravity System of Turkey

Finally, the introduction of the economic GAP scenario has a limited overall spatial effect on the triple Economic Gravity System of Turkey. Actually it leaves intact the location of the northwestern and southwestern centers and forces the eastern center to move almost 60 km along the southeastern direction to the borders of K.Maras with Malatya. The eastern center is strengthened accounting now for 51% of system's total transport cost.

Conclusively, the GAP scenarios examined strengthen even more the position of the province of Malatya as the Economic Gate to the eastern and southeastern Turkey and the Middle East in general.

C9. CONCLUSIONS

Internal Geo-Economic Dynamics

In comparison with E.U. standards Turkey exhibits severe and in some cases sustained regional disparities. The majority of Eastern and Southeast Region provinces as well as some of Black Sea Region provinces exhibit repulsive socio-economic images and complex administrative problems.

To tackle the above problems Turkey has introduced during the last two decades significant investment enhancing measures among which the most important are:

(a) the Southeastern Anatolia Project (GAP in its Turkish acronym) and
(b) a law enhancing employment and investments (law numbered 4325) which introduces significant incentives for investments in the priority and least developed regions of the country.

Besides Istanbul and Izmir, the two traditional socio-economic development poles of the late Ottoman period, Ankara emerged as a third one immediately after the establishment of the Turkish State. During the last three decades a fourth socio-economic development pole emerged in the province of Adana, in southeastern Turkey. Besides the above four provincial poles, which exhibit a highly attractive socio-economic profile, most of the provinces surrounding them are characterized also by a moderately attractive profile.

Among the provinces lacking yet the infrastructure and the socio-economic profile attractiveness necessary to allow them to act as development poles, Malatya appears to be the province possessing the strongest geo-economic advantages and the capability to act as the Economic Gate to the Eastern and Southeast Regions.

Regional distribution of the social, economic and industrial power in Turkey exhibits significant imbalances. The simple Social Gravity Center of the country is located near Ankara a fact underlying the socially attractive position of the capital of Turkey. The Economic Gravity Center of Turkey is located 200 km west of Ankara, in the province of Eskisehir, a fact underlying the imbalanced distribution of economic power, with the western provinces of the country possessing a far greater portion of it than the eastern ones. The regional distribution of the industrial power of Turkey is characterized by even greater imbalances. Actually, the Industrial Gravity Center of the country is located in the province of Kocaeli around 350 km west of Ankara.

Due to the large size of the country, the geographically not central position of the above three Gravity Centers (all three of them are lying to the west and significantly away of the geographical center of the country) and the regional development policies introduced, the development of a general dual Geo-Economic Gravity System, hierarchically subordinate to the previous one, is quite possible since it carries with it strong geo-economic advantages. In such an event, two areas appear to possess the necessary geo-economic advantage:

(b) the Bursa-Istanbul-Kocaeli triangle which accommodates the western center in all three dual Gravity Systems examined (social, economic and industrial) and
(c) the Kayseri-Malatya-Adana triangle which accommodates the eastern center in all three dual Gravity Systems examined.

Although the appearance of a general triple Geo-Economic Gravity System is not so possible as the dual one, there exist sectoral possibilities mainly associated with distribution (supply) activities exhibiting a relatively low inventory (or establishment and operations) cost as compared to the transport one. In such an event, the areas possessing the necessary geo-economic advantage to accommodate this type of centers are:

(a) the Istanbul province which accommodates the northwestern center in all triple Gravity Systems examined,
(b) the Izmir-Denizli-Usak triangle which accommodates the southwestern center of the triple System in all cases examined and
(c) the Kaiseri-Malatya-Adana triangle which accommodates the eastern center of the triple System in all cases examined.

External Geo-Economic Dynamics

The rapid geographical expansion of the E.U. towards the East, in combination with its principal dogma of economic convergence on the one hand and the rapid growth of the Russian economy on the other hand, seem to drastically alter the current geo-economic equilibrium defined here as the spatial distribution of the Geo-Economic Gravity Centers of Europe.

During the first half of the 20th century Germany possessed significant geo-economic advantages in the context of Europe. These geo-economic advantages were due to a synergy of three main factors:

(a) its dominating socio-economic power,
(b) its central position in Europe both geographically and economically and
(c) the under-developed economies of the eastern Europe and the Balkan countries.

The notion of "economic centrality", which is a key characteristic of a gravity center, refers to a favorable for an area distribution of economic power around it, in the sense that the economic power of the area appropriately combined with the external economic powers towards any direction can out-weight the external economic powers towards the opposite direction. In the case of Germany, its socio-economic centrality is examined along the two principal, for Europe, directions: East-West and North-South.

During the second half of the 20th century the geo-economic power balance along the East-West direction exhibits signs of weakening stability. As an example, in 1980 the combined GDP of Germany (East and West) and of all countries lying east of it only marginally out-weighted the combined GDP of all countries lying in the opposite (west) direction. The prospect of a sustained growth for Russian and Turkish economies in combination with the economic convergence policies of E.U. that will benefit most its eastern members, are expected to strengthen again the geo-economic position of Germany by making the power balance along the East-West axis more stable.

On the other hand, the heavy territorial losses of Germany during WW I and WW II, weakened the geographical and economic centrality of this country. These lost territories are characterized by a significant geo-economic value which is now emerging to the benefit of Poland. Indeed, in 2004, the simple Social Gravity Center of Europe was located in Wroclaw, the eastern center of the dual Economic Gravity System was located in Poznan and in 2003 the eastern center of the triple Trade Gravity System was located again in Wroclaw.

The prospect of a sustained population and economic growth for the two eastern European powers, Russia and Turkey, is expected to alter significantly the structure of the Geo-Economic Gravity Systems of Europe. This prospect is expected to favor the emergence of dual and even triple Gravity Systems in order to cover effectively the demand for services and products of an enormous geographical area. According to the previous analysis the emergence of a competitive (not hierarchically subordinate to the simple Gravity System) dual or triple Gravity System will weaken the geo-economic significance of Germany and will strengthen that of France, Turkey and Ukraine. Actually, in all dual and triple Gravity Systems examined, one of the centers was always located in France (the northern part of it). Furthermore, the introduction of the Dynamic Development Scenarios for Turkey has no effect on the position of the centers located in France.

The assumption of a sustainable economic convergence trend at a European level will bring the regional distribution of economic power indices closer to the regional distribution of population. This prospect in combination with the ability of Ukraine to accommodate the eastern center of the triple Social Gravity System will enhance the geo-economic significance of this country. Furthermore, if this prospect is combined with the Dynamic Development Scenarios for Turkey, then the impact on the geo-economic balance of powers in Europe as this is determined by the triple Gravity System will be dramatically altered in favor of Ukraine and Turkey which will compete for the dominance over the eastern center of the System. Actually, according to the preceding analysis, the Dynamic Development Scenarios for Turkey cause the relocation of the eastern center of the triple Economic Gravity System from Poland to Ukraine and the relocation of the eastern center of the triple Social Gravity System from Ukraine to Turkey.

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