THE EUROPEAN UNION AND TURKEY: A REVIEW OF THEIR COMMONALITIES AND DISPARITIES USING CLUSTER ANALYSIS

Turkay Yildiz

Izmir Institute of Technology, Gulbahce kampusu, 35430 Urla, Izmir, Turkey

Abstract. Turkey has enjoyed considerable economic growth over the past decade and has a positive economic outlook and strong growth prospects. The country benefits from being located between Europe and the major energy producers in the Middle East in the so-called strategic energy corridor. The issue of Turkey's accession to the EU has long been on the political agenda in Europe. Indeed, Turkey has made considerable efforts to become a full EU member state. However, the accession negotiations for EU membership continue, while Turkey has recently refused to open new accession chapters with the EU and instead has turned its attention to other regional developments. Turkey has strengthened its swtrategic ties with a wide range of countries including those in Europe and the Middle East. It also plays an influential role in a geography that stretches across the former Soviet Union nations. In this paper, the path of Turkey's accession issues is reviewed and the direction of its economy based on the measure of GDP per capita is forecast using an autoregressive integrated moving average model. In addition, the cluster analysis technique is adopted in order to measure the possible standing of Turkey among EU members, the similarities between EU members, and the current path to becoming an EU member state.
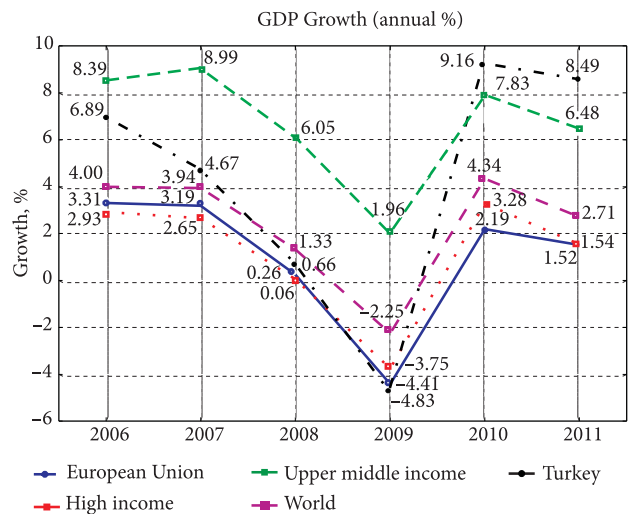
Keywords: economic review, transformation, cluster analysis, business, Turkey and the EU, GDP forecast.

JEL Classification: A10, C38, C53, N00, N70.

Introduction

Turkey has experienced dramatic economic growth over the past decade, and its economic outlook remains positive despite the impact of the global economic crisis. A stable government and continuous structural reforms have encouraged a stronger banking sector and stronger fiscal discipline, and these measures have transformed the economy of Turkey, which needed to receive assistance from the International Monetary Fund approximately 10 years ago, to an economic powerhouse regionally and globally. In 2011, Turkey's GDP grew by approximately 8.5%, one of the highest rates of growth in the world (see Figures 1, 2 and Table 1). Turkey's economy is slowed to 2.2% growth in 2012. In 2013, the economy is expected to expand by 3%.

Although Turkey has low public debt, strong fiscal discipline, and falling unemployment, the rapid growth of its economy and increased domestic demand have led the current account deficit to soar to approximately 10% of GDP.
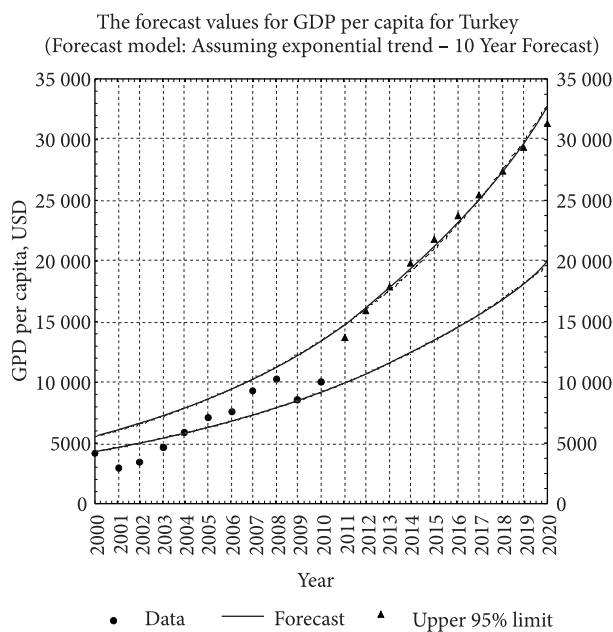

Fig. 1. GDP Growth (annual %).

Source: The World Bank.

Table 1. GDP Growth (annual %) (Data source: The World Bank)

Econo-mies/ region	2006	2007	2008	2009	2010	2011	2012
European Union	3.31	3.19	0.26	-4.41	2.19	1.52	-0.3
High income	2.93	2.65	0.06	-3.75	3.28	1.54	1.3
Upper middle income	8.39	8.99	6.05	1.96	7.83	6.48	5.3
World	4.00	3.94	1.33	-2.25	4.34	2.71	2.2
Turkey	6.89	4.67	0.66	-4.83	9.16	8.49	2.2

Fig. 2. Turkey's GDP forecast model (assuming an exponential trend)

Table 2. Forecast values and their 95% prediction limits

Year	Forecast	Upper 95.0% Limit
2011	10793.3	13765.2
2012	11480.2	15922.5
2013	12167.0	17905.1
2014	12853.9	19826.8
2015	13540.8	21728.7
2016	14227.7	23629.9
2017	14914.6	25541.0
2018	15601.5	27468.2
2019	16288.3	29415.0
2020	16975.2	31384.0

Chronic dependency on energy imports is a major reason for this ballooning current account deficit, an imbalance that is seen as a sign of an overheating economy (Acaravci and Ozturk 2009).

Consequently, the current account deficit remains the main liability of the Turkish economy. For instance, even though the International Monetary Fund revised its forecast for Turkey's current account deficit to 8.8% of GDP for 2012 from a September estimate of 7.4%, it is expected to reach a ratio of more than 9%. Further, despite seeming to be well equipped to withstand any future economic storm, Turkey's current account deficit must be reduced in the coming period through a long-term strategy to reduce its dependence on imported energy, which costs the country approximately $50 billion per annum, and imports of intermediate goods that feed its industrial production. Moreover, analysts agree that the current account imbalance is unsustainable in the long run, especially in a country such as Turkey that is financed primarily by short-term inflows.

In order to apply an exponential trend model to forecast the future values of GDP per capita for Turkey, the present study uses an autoregressive integrated moving average (ARIMA) model for a dataset that covers 12 time periods (2000–2011). The model assumes that a parametric model that relates the most recent data values to previous data values and previous noise provides the best forecast for future data (see Figure 2 and Table 2). The outlook of Turkey's economy is depicted using GDP forecasts based on past GDP values. By considering such a GDP indicator, forecasting techniques can thus be applied to predict future GDP values.

For periods beyond the end of the time series, Table 2 shows the upper limits for the forecasts at a 95% confidence interval, assuming the fitted model is appropriate for the data.

The Turkish public seems to be increasingly skeptical about the EU in general and the country's accession in particular. In November 2006, one study showed that after criticism from the EU regarding the continued lack of reforms in Turkey, only a third of the Turkish population supported Turkey joining the EU (Yildiz *et al.* 2008). As stated by Yildiz *et al.* (2008), Turks are also beginning to view the EU in a more critical light, accusing member states of hypocrisy, double standards, and discrimination. In addition, Lejour and de Mooij (2005) claimed that although the country's accession generates economic benefits for Turkey, it does not greatly influence EU member states or countries in Central and Eastern Europe.

The remainder of this paper is organized as follows. Section 2 reviews the literature on Turkey's accession to the EU and discusses the strategic importance of Turkey. Section 3 introduces the data and methods used for the cluster analysis and presents the empirical findings. The paper is concluded in Section 4.

1. Literature review

1.1. Turkey and the EU

In 1959, Turkey applied for associate membership of the European Economic Community (now the EU), which was granted four years later. However, its application for full membership was not made until 1987 because of political developments in Eastern Europe and the Soviet Union (Hoekman, Togan 2005). Nas (2008) stated that Turkey's application for full membership has been met with continued opposition from most European governments and the European public. Nevertheless, on October 3, 2005, EU foreign ministers reached an historic agreement on a framework of accession negotiations with Turkey, which marked the official opening of negotiations towards full membership (Nas 2008).

According to Nas (2008), full accession talks are expected to last much longer than those held with other EU member states because of the geographical circumstances peculiar to Turkey. The country is located between the Black Sea to the north, the Aegean Sea, Greece, and Bulgaria to the west, the Mediterranean Sea, Cyprus, Syria, Iran, and Iraq to the south, and Georgia, Armenia, and Azerbaijan (Nahcivan) to the east. This unique location provides different political and strategic challenges (Kalaycioglu 2005). Rabasa (2008) emphasized that Turkey influences the interests of western (particularly US) security in an area where the Middle East, the Balkans, and the Caucasus intersect. Moreover, Rabasa (2008) acknowledged the additional importance of Turkey because of the coexistence of Islam with secular democracy, globalization, and modernity.

This view of the geopolitical and strategic importance of Turkey is widely shared by European leaders. At a meeting of EU heads of state and government members, Turkey's strategic importance was underlined by statements by the Council (Kramer 2000). Indeed, Turkey's clear eligibility for accession to the EU has defined how EU institutions, particularly the European Parliament, have approached the country in the past decade (Collins 2003). Tiersky (2010) acknowledged that viewing Turkey as a potential member state led to congruence between the strategic interests of the EU and its normative goals. In addition, Tiersky (2010) stated that Turkey has always been crucial to European security interests, both during the Cold War, when it stood as a bulwark against Soviet expansionism, and subsequently as a beacon of democracy (Tiersky 2010). In fact, Turkey has for centuries been a part, and sometimes a critical part, of the political, economic, and security system in Europe (Khalilzad 2000). With one of the few growing economies in the region and a renewed assertiveness locally (Whitman, Juncos 2011), Turkey's role as a regional power has also become more important in recent years. For example, it has played an important role as a mediator between Syria and Israel and in the Middle East peace process (Whitman, Juncos 2011). Further, as Turkey has become more capable and assertive in diplomatic, economic, and military terms, it has developed into a more important strategic partner for the west in the troubled regions of the world, from the Balkans to Central Asia and the Middle East (Khalilzad 2000). In summary, the size, location, and strategic importance of Turkey distinguish it from previous EU accession candidates (Tiersky 2010).

Politically, based on the size of the Turkish population, there have been some concerns that Turkey's influence on decision-making in European institutions would be overly significant (Nas 2008). In addition, other issues have also lead to protracted negotiations (Nas 2008). These issues include the fear of the increased migration of workers from Turkey, the alignment of key sectors in areas such as agriculture, transport, energy, and the environment, and the management of the EU's new external borders. According to Tiersky (2010), European policymakers are worried that the accession of Turkey would affect the market for goods and services, labor markets, the budgetary projections in the EU, and EU foreign policy.

Aydin and Acar (2010) stated that the possible enlargement of the EU to include Turkey is not just a political issue, but also has two important economic consequences for both the EU and the country. First, the large disparities in real wages between the two regions offer incentives for Turkish labor to migrate to the EU. Second, the regional mobility of capital would cause the rate of return values to converge towards growth rates at the steady state. Kibris and Müftüler-Bac (2011) expressed that, especially for the least developed countries on the continent, the process of EU enlargement, which has led the EU to double its size in the past six years, is testament to its increasing attractiveness. However, with each new enlargement, EU accession has become more difficult. In addition, open-ended accession is a new mechanism for integrating a candidate country (Ugur 2010). As argued by Ugur (2010), unlike previous enlargements, however, this mechanism does not specify the deadline for becoming a member and may suggest important exemptions that restrict the membership entitlements of new members. Consequently, current and future candidates may be less committed to regional reforms, while the EU may delay before deciding the date of accession and the entitlement package associated with it.

Moreover, despite the importance of Turkey in terms of foreign policy and its compliance with membership criteria, recent prospects for Turkish membership have worsened (Gerhards, Hans 2011). The progress of Turkey's accession to the EU slowed in 2010 because of its persistent refusal to implement the Additional Protocol to the Association Agreement on the access of Cypriot ships and

planes to Turkish ports and airports (Whitman, Juncos 2011). Turkey's accession also depends on the internal dynamics of the EU and the willingness of the EU to accept Turkey (Müftüler-Bac 2008). In addition, as acknowledged by Gerhards and Hans (2011), most citizens of EU member states are opposed to Turkish membership, believing that Turkey would be a powerful player in the future of the EU because of its large population (Pahre, Ucaray-Mangitli 2009). Others argue that this degree of power would negatively affect the EU. Pahre and Ucaray-Mangitli (2009) explored whether these claims were influenced by the spatial models of EU policies and found that the preferences of Turkey are sufficiently outside the mainstream of the EU to have little influence on daily policy under agreement, co-decision, consultation, and cooperation procedures.

1.2. Trade, the EU, and Turkey

Alba and Park (2005) proposed that Turkish membership would remain one of the most important issues facing the EU in coming years. The authors also highlighted the substantial opposition to Turkish entry because of the large income gap between Turkey and the EU and the economic costs that Turkish membership may impose on existing members. This implies that the narrowing of the income between Turkey and the EU over time would weaken the opposition to Turkish membership and vice versa (Alba, Park 2005). As noted by Lammers (2006), from a macroeconomic point of view, full membership for Turkey would be an advantage: where incumbent states are concerned, the disadvantages in terms of their GDP values seem to be low. In other words, Turkey's accession to the EU brings about economic benefits for Turkey without significantly affecting EU member states or countries in Central and Eastern Europe (Lejour, de Mooij 2005).

Indeed, it has been argued that the accession of Turkey would improve the welfare of EU members. For example, EU countries would benefit from welfare gains from comparative advantages and the growth effects of integration, while the migration of Turkish labor to the EU would affect overall EU welfare (Togan 2004). Some Turkish sectors such as textiles would also expand considerably at the expense of those sectors in Central and Eastern Europe (Lejour, de Mooij 2005). Further, the greatest economic gains would probably be achieved through reforms to national institutions in order to improve the functioning of the public sector and ensure transparency for investors and traders (Lejour, de Mooij 2005).

Through the harmonization of trade legislation, EU companies would be able to use Turkey as a joint investment and as an export base for the Middle East and Eurasia (Togan 2004). Istanbul is fast becoming a location for the headquarters of transnational corporations for operations in the Caucasus and Central Asia. The EU would thus benefit from increased trade in the region (Togan 2004). Finally, Turkish membership would help ensure stability and security in the Balkans and Caucasus, allowing the EU to increase its energy security and reduce defense spending (Togan 2004).

Trade openness in Turkey has been rising in recent decades, especially after its import substitution policies were abandoned in favor of measures of trade integration in the 1980s (Antonucci, Manzocchi 2006). The sum of exports and imports as a percentage of GDP increased from 18% in 1980 to 48% in 2001, when a severe financial crisis led to a contraction of 7.5% of GDP, after a period of sustained growth (Antonucci, Manzocchi 2006). Nevertheless, the EU remains by far the largest trading partner of Turkey, accounting for just over half of its exports and just under half of its imports. Since 1963, the EU has granted Turkey preferential trade status, with the Ankara Association agreements leading to a gradual reduction in import tariffs (especially on the EU side), the adoption of parts of the regulatory body of the EU (the so-called *acquis communautaire*) by Turkey, and the provision for the gradual creation of a customs union, which finally, after several delays, became operational in 1996.

Lejour *et al.* (2004) and Flam (2003) have both analyzed the likely impact on trade by Turkey's accession into the EU. Lejour *et al.* (2004) estimated a gravity model of trade flows for a wide range of countries including goods and services trade and found that the EU model must be included in sectoral regressions to account for the particular intensity of trade relations between EU members (see also Antonucci, Manzocchi 2006). Although the empirical results differed considerably across sectors, the authors estimated that average-weighted sectoral EU–Turkey bilateral trade could increase by 34% if Turkey were an EU member. By adopting a different framework, Flam (2003) highlighted an even greater impact of the accession of Turkey's overall trade volume with the EU (over 46%). Moreover, Philippidis and Karaca (2009) found that common budget transfers would significantly influence the economic conditions of any hypothetical scenario of membership and concluded that EU membership would undoubtedly benefit Turkey. Through governmental stability, numerous constitutional and judicial reforms have been approved for Turkey's eventual membership (Philippidis, Karaca 2009).

2. Data and methods

There have been various previous studies of the EU and of cluster analyses (Pfeifer 2012; Lorcu *et al.* 2012; Darcin *et al.* 2012; Thogersen-Ntoumani *et al.* 2011; Plechanovova 2011;

Table 3. Indicators selected for cluster analysis

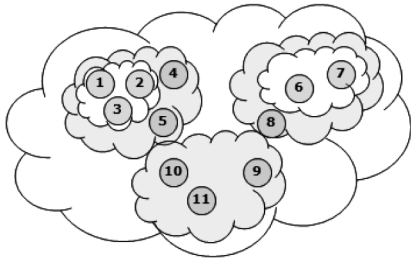|	
Environment (Env) Env1. Cereal production (metric tons) Env2. CO2 emissions (metric tons per capita) Env3. Crop production index (1999-2001 = 100) Env4. Electric power consumption (kWh per capita) Env5. Electricity production from nuclear sources (% of total) Env6. Electricity production from oil, gas and coal sources (% of total) Env7. Energy imports, net (% of energy use) Env8. Energy related methane emissions (% of total) Env9. Food production index (1999-2001 = 100) Env10. Fossil fuel energy consumption (% of total) Env11. Livestock production index (1999-2001 = 100) **Economic Policy & Debt (Econ)** Econ1. Agriculture, value added (% of GDP) Econ2. Exports of goods and services (% of GDP) Econ3. External balance on goods and services (% of GDP) Econ4. Final consumption expenditure, etc. (% of GDP) Econ5. GDP per capita growth (annual %) Econ6. General government final consumption expenditure (% of GDP) Econ7. Gross domestic savings (% of GDP) Econ8. Gross national expenditure (% of GDP) Econ9. Gross savings (% of GDP) Econ10. Household final consumption expenditure, etc. (% of GDP) Econ11. Imports of goods and services (% of GDP) Econ12. Industry, value added (% of GDP) Econ13. Manufacturing, value added (% of GDP) Econ14. Services, etc., value added (% of GDP) Econ15. Trade (% of GDP) **Financial Sector (Fin)** Fin1. Broad money (% of GDP) Fin2. Claims on central government, etc. (% GDP) Fin3. Claims on other sectors of the domestic economy (% of GDP) Fin4. Consumer price index (2005 = 100) Fin5. Deposit interest rate (%) Fin6. Domestic credit provided by banking sector (% of GDP) Fin7. Domestic credit to private sector (% of GDP) Fin8. Financing via international capital markets (gross inflows, % of GDP) Fin9. Inflation, consumer prices (annual %) Fin10. Inflation, GDP deflator (annual %) Fin11. Market capitalization of listed companies (% of GDP) Fin12. Money and quasi money (M2) as % of GDP Fin13. Stocks traded, total value (% of GDP) Fin14. Wholesale price index (2005 = 100) **Health (Hlth)** Hlth1. Death rate, crude (per 1,000 people) Hlth2. Health expenditure, total (% of GDP) Hlth3. Life expectancy at birth, total (years) Hlth4. Nurses and midwives (per 1,000 people) Hlth5. Out-of-pocket health expenditure (% of total expenditure on health) Hlth6. Physicians (per 1,000 people) Hlth7. Population growth (annual %) **Infrastructure (Infra)** Infra1. Fixed broadband Internet subscribers (per 100 people) Infra2. ICT goods exports (% of total goods exports)Infra3. ICT goods imports (% total goods imports) Infra4. ICT service exports (% of service exports, BoP) Infra5. Internet users (per 100 people) Infra6. Mobile cellular subscriptions (per 100 people) Infra7. Motor vehicles (per 1,000 people) Infra8. Passenger cars (per 1,000 people) Infra9. Pump price for diesel fuel (US$ per liter) Infra10. Pump price for gasoline (US$ per liter) Infra11. Research and development expenditure (% of GDP) Infra12. Secure Internet servers (per 1 million people)	Infra13. Technicians in R&D (per million people) Infra14. Telephone lines (per 100 people) Infra15. Vehicles (per km of road) **Labor and Social Protection (Lbr)** Lbr1. Contributing family workers, total (% of total employed) Lbr2. Economically active children, total (% of children ages 7-14) Lbr3. Employers, total (% of employment) Lbr4. GDP per person employed (constant 1990 PPP $) Lbr5. Labor force with primary education (% of total) Lbr6. Labor force with secondary education (% of total) Lbr7. Labor force with tertiary education (% of total) Lbr8. Labor force, female (% of total labor force) Lbr9. Labor force, total Lbr10. Long-term unemployment (% of total unemployment) Lbr11. Net migration Lbr12. Part time employment, total (% of total employment) Lbr13. Unemployment, total (% of total labor force) Lbr14. Unemployment, youth total (% of total labor force ages 15-24) Lbr15. Vulnerable employment, total (% of total employment) Lbr16. Wage and salaried workers, total (% of total employed) **Private Sector and Trade (Prv)** Prv1. Average number of times firms spent in meetings with tax officials Prv2. Cost of business start-up procedures (% of GNI per capita) Prv3. Credit depth of information index (0=low to 6=high) Prv4. Export value index (2000 = 100) Prv5. Export volume index (2000 = 100) Prv6. Food exports (% of merchandise exports) Prv7. Food imports (% of merchandise imports) Prv8. Fuel exports (% of merchandise exports) Prv9. Fuel imports (% of merchandise imports) Prv10. Import value index (2000 = 100) Prv11. Import volume index (2000 = 100) Prv12. International tourism, expenditures (% of total imports) Prv13. International tourism, receipts (% of total exports) Prv14. Losses due to theft, robbery, vandalism, and arson (% sales) Prv15. Management time dealing with officials (% of management time) Prv16. Manufactures exports (% of merchandise exports) Prv17. Manufactures imports (% of merchandise imports) Prv18. Merchandise exports by the reporting economy, residual (% of total merchandise exports) Prv19. Merchandise imports by the reporting economy, residual (% of total merchandise imports) Prv20. Merchandise trade (% of GDP) Prv21. Net barter terms of trade index (2000 = 100) Prv22. Profit tax (% of commercial profits) Prv23. Strength of legal rights index (0=weak to 10=strong) Prv24. Total tax rate (% of commercial profits) **Public Sector (Pblc)** Pblc1. Cash surplus/deficit (% of GDP) Pblc2. Central government debt, total (% of GDP) Pblc3. Customs and other import duties (% of tax revenue) Pblc4. Expense (% of GDP) Pblc5. Goods and services expense (% of expense) Pblc6. Grants and other revenue (% of revenue) Pblc7. Military expenditure (% of GDP) Pblc8. Other expense (% of expense) Pblc9. Other taxes (% of revenue) Pblc10. Revenue, excluding grants (% of GDP) Pblc11. Social contributions (% of revenue) Pblc12. Subsidies and other transfers (% of expense) Pblc13. Tax revenue (% of GDP)

Source: The World Bank.

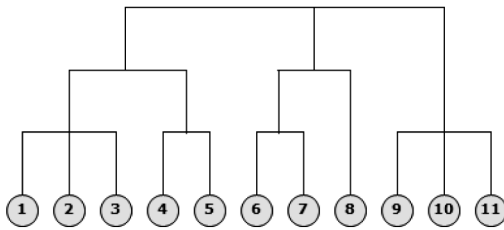**Fig. 3.** Clouds of data and a sample cluster structure

Fig. 4. A sample spanning tree from single linkage clustering

Hierarchical clustering algorithm:
1. Assign each item to a cluster (N items result in N clusters each containing one item)
2. Let the distances between the clusters be the same as the distances between the items they contain
3. *repeat*
4. Find the closest pair of clusters and merge them into a single cluster
5. Compute distances between the new cluster and each of the old clusters
6. *until* All items are clustered into a single cluster of size N

Fig. 5. Hierarchical clustering algorithm (Dressler 2008)

Odehnal, Michalek 2011; Davo *et al.* 2011; Ungureanu, Ersoz 2010; Akyuz *et al.* 2010; Zivadinovic *et al.* 2009; Skuodis 2009; Aggelopoulos *et al.* 2009; Saar *et al.* 2008; Gertsbakh *et al.* 2008; Damaskopoulos *et al.* 2008; Tapio *et al.* 2007; Fischer, Schornberg 2007; Sengul, Sengul 2006; Gertsbakh, Yatskiv 2006; Cuervo, Menendez 2006; Buckwalter 2005; Radosevic 2004; Eising 2004; Schwarz, Vorauer-Mischer 2003; Quadrado *et al.* 2001; Smulders *et al.* 1996). This section describes the underlying details of the data and methods used to assess Turkey's positioning among EU countries. The cluster analysis technique was adopted to group countries into clusters. More details are presented in the following subsections.

2.1. Data

World Bank data were used as the basis of the presented cluster analysis. These annual data comprise a comprehensive collection of country-specific economic and development indicators countries. From the database, selected important indicators were taken into consideration under the following major titles: the environment, economic policy and debt, financial sector, health, infrastructure, labor and social protection, private sector and trade, and public sector (see Table 3).

2.2. Methods

Based on an initial set of unclassified data, cluster analysis constructs a sensible and informative classification using the values of the observed variables (Everitt 2002). Single linkage clustering was used in the present analysis. The distance between two clusters was defined as the minimum distance between a pair of individuals (Everitt 2002). As explained by Larose (2005), clustering refers to the grouping of records, observations, or cases into classes of similar objects and clustering differs from classification in that there is no target variable for clustering.

As pointed out by Larose (2005), clustering algorithms seek to segment the entire dataset into relatively homogeneous subgroups or clusters, in which the similarity of the records within the cluster is maximized and the similarity to records outside this cluster is minimized (see Figures 3 and 4).

Johnson (1967) stated that hierarchical clustering starts with a set of N items to be clustered and an N × N distance (or similarity) matrix. In an iterative procedure, as depicted in Figure 5, it searches for the closest (most similar) pair of clusters and merges it into a single cluster. Then, it computes the distances (similarities) between the new cluster and each of the old clusters to update the similarity matrix. These two steps are repeated until all items are clustered into a single group of size N. In order to generate k clusters, the algorithm can be stopped after N k iterations (Dressler 2008).

In each iteration, the minimum distances between the members of all established clusters are computed and the two closest clusters are merged accordingly. The algorithm terminates if the whole dataset is merged into a single cluster (Dressler 2008). For optimal performance, clustering algorithms, just like algorithms for classification, require the data to be normalized so that no particular variable or subset of variables dominates the analysis (Larose 2005). Analysts may use either the min–max normalization or Z-score standardization (Larose 2005).

2.3. Clustering analysis for Turkey and the EU

In this section, the targeted number of groups is determined by evaluating the data and distances between various clusters. The optimal number of targeted clusters is chosen by taking into account the distances between clusters using agglomeration plots. In addition, cluster group numbers are sorted and values placed into ascending or descending order. For instance, in Table 4, Turkey ranks number 1, which is cluster group 1 for the Env4 variable. This implies that in addition to sharing its group with Romania, the electric power consumption per capita (Env4) of Turkey is lower than EU members. For the Env11 Livestock production index, Turkey appears in the

Table 4. Environmental indicators

Environment (Env[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Env1 – 2009	28	4	2	7.14%	Poland
Env2 – 2007	28	8	2	10.71%	Romania, Lithuania
Env3 – 2009	28	5	2	85.71%	Greece, Ireland, Portugal, Italy, Malta, Slovenia, UK, Spain, Czech Rep., Poland, Netherlands, Romania, France, Germany, Hungary, Slovak Rep., Sweden, Bulgaria, Austria, Belgium, Denmark, Finland, Luxembourg
Env4 – 2008	28	9	1	7.14%	Romania
Env5 – 2008	28	7	1	50%	Austria, Denmark, Greece, Ireland, Italy, Luxembourg, Portugal, Estonia, Cyprus, Latvia, Malta, Poland, Netherlands
Env6 – 2008	28	10	8	25%	Ireland, UK, Italy, Netherlands, Luxembourg, Greece
Env7 – 2008	28	10	7	14.29%	Slovak Rep., Austria, Greece
Env8 – 2005	28	11	3	35.71%	Sweden, Spain, Luxembourg, Belgium, Ireland, Bulgaria, Portugal, Italy, Denmark
Env9 – 2009	28	9	7	3.57%	–
Env10 – 2008	28	7	3	35.71%	Greece, Ireland, Italy, Luxembourg, Netherlands, UK, Estonia, Cyprus, Poland
Env11 – 2009	28	11	11	7.14%	Latvia

Env1: Cereal production (metric tons), Env2: CO2 emissions (metric tons per capita), Env3: Crop production index (1999–2001 = 100) Env4: Electric power consumption (kWh per capita), Env5: Electricity production from nuclear sources (% of total), Env6: Electricity production from oil, gas and coal sources (% of total), Env7: Energy imports, net (% of energy use), Env8: Energy related methane emissions (% of total), Env9: Food production index (1999-2001 = 100), Env10: Fossil fuel energy consumption (% of total), Env11: Livestock production index (1999–2001 = 100).

11th cluster with Latvia. Although Turkey and Latvia are in the last cluster, their livestock production indexes are higher than other member countries.

Further, as shown in Table 4, for the Env3 variable, Turkey belongs to the second of the five clusters, which is represented by the majority of European countries (85.7%). This implies that Turkey is not significantly different from the listed countries in this regard. For Env1, Env4, and Env11, Turkey shares its cluster with Poland, Romania, and Latvia.

For Env10, an important environmental indicator, Turkey is in the third cluster of the seven clusters in total. Although there exists a strong tendency in Turkey towards reducing fossil fuel usage, there is no simple short cut for eliminating its use. It is well known that fossil fuels have limited potential and, at the current rate of exploitation, they are expected to be depleted within the next few centuries. However, despite its eastern and southern neighboring countries, Turkey has limited fuel oil reserves, and most of its high-quality coal reserves have already been used (Sahin 2008). By contrast, Turkey is a leading country for wind energy potential, one of the renewable energy sources being promoted to reduce the amount of carbon dioxide in the atmosphere (Sahin 2008). It is expected that this source will be one of the main driving forces for future industrial development in Turkey (Sahin 2008).

According to Econ1 in Table 5, Turkey is placed in the last group, as it has the highest percentage of GDP value added for agriculture among the 28 countries. Further, for Econ 2, Econ11, and Econ15, Turkey has the highest ranked cluster number. Finally, Turkey's percentage of GDP is low along with the countries within its cluster in exports of goods and services (Econ2), imports of goods and services (Econ11), and trade (Econ15) in comparison with other member countries.

By taking into consideration Turkey's essential economic policy and debt indicators, Kizilaslan *et al.* (2007) reported that Turkish gross national income seems to be in the range of critical development based on the country's population density and forest areas. Moreover, in terms of its development, agricultural self-sufficiency rate, and urban population being in the range of sustainable development, Turkey is expected to produce effective policies for hazardous and critical values (Kizilaslan *et al.* 2007). Kavalsky (2006) found that considerably reducing agricultural subsidies and reducing the ability to fund off-budget subsidies by public banks contribute to sustainable fiscal improvement. However, the deficit in the pension system has grown rapidly, offsetting much of this gain (Kavalsky 2006). Moreover, Kavalsky's (2006) report to the World Bank further showed that agricultural reforms have reduced and that rationalized subsidies and price supports have replaced state marketing agencies with private commodity exchanges, thereby reducing food costs for consumers.

For Fin3, Fin7, Fin8, Fin11, and Fin12, Turkey tops the grouping numbers in cluster number 1, whereas for

Table 5. Economic policy and debt indicators

Economic Policy & Debt (Econ[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Econ1 – 2008	28	8	8	3.57%	–
Econ2 – 2008	28	10	1	28.57%	Greece, Spain, France, Italy, UK, Romania, Portugal
Econ3 – 2008	28	10	4	28.57%	Estonia, Poland, Slovenia, Malta, UK, Slovak Rep., France
Econ4 – 2008	28	5	4	42.86%	Italy, France, Poland, Romania, Latvia, Bulgaria, Malta, Lithuania, Cyprus, UK, Portugal
Econ5 – 2010	26	7	7	3.85%	– (Excluded: Malta, Cyprus)
Econ6 – 2008	28	8	2	3.57%	–
Econ7 – 2008	28	5	2	42.86%	Portugal, UK, Cyprus, Lithuania, Malta, Bulgaria, Latvia, Romania, Poland, France, Italy
Econ8 – 2008	28	8	5	32.14%	France, Slovak Rep., Slovenia, UK, Malta, Poland, Estonia, Spain
Econ9 – 2008	28	9	5	32.14%	Hungary, Ireland, Italy, Poland, Latvia, Spain, Estonia, France
Econ10 – 2008	28	7	6	3.57%	–
Econ11 – 2008	28	4	1	42.86%	France, Italy, UK, Spain, Greece, Germany, Portugal, Finland, Romania, Poland, Sweden
Econ12 – 2008	28	6	4	71.43%	UK, Latvia, Belgium, Portugal, Romania, Netherlands, Denmark, Italy, Sweden, Spain, Estonia, Hungary, Germany, Austria, Bulgaria, Ireland, Lithuania, Poland, Finland
Econ13 – 2008	28	5	3	46.43%	Netherlands, Portugal, Denmark, Bulgaria, Spain, Belgium, Malta, Estonia, Poland, Lithuania, Italy, Sweden
Econ14 – 2008	28	5	2	53.57%	Bulgaria, Slovenia, Poland, Lithuania, Finland, Hungary, Ireland, Romania, Estonia, Austria, Spain, Germany, Sweden, Italy
Econ15 – 2008	28	7	1	21.43%	France, Italy, Spain, Greece, UK

Econ1: Agriculture, value added (% of GDP), Econ2: Exports of goods and services (% of GDP), Econ3: External balance on goods and services (% of GDP), Econ4: Final consumption expenditure, etc: (% of GDP), Econ5: GDP per capita growth (annual %), Econ6: General government final consumption expenditure (% of GDP), Econ7: Gross domestic savings (% of GDP), Econ8: Gross national expenditure (% of GDP), Econ9: Gross savings (% of GDP), Econ10: Household final consumption expenditure, etc: (% of GDP), Econ11: Imports of goods and services (% of GDP), Econ12: Industry, value added (% of GDP), Econ13: Manufacturing, value added (% of GDP), Econ14: Services, etc:, value added (% of GDP), Econ15: Trade (% of GDP).

Table 6. Financial sector indicators

Financial Sector (Fin[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Fin1 – 2010	12	5	4	50%	Hungary, Estonia, Poland, Lithuania, Latvia
Fin2 – 2010	25	7	3	32%	Germany, Belgium, France, Spain, UK, Ireland, Portugal
Fin3 – 2009	26	7	7	15.38%	Czech Rep., Poland, Romania
Fin4 – 2010	28	4	4	3.57%	–
Fin5 – 2009	11	4	4	9.09%	–
Fin6 – 2010	25	9	2	20%	Poland, Lithuania, Czech Rep., Bulgaria
Fin7 – 2010	25	8	1	8%	Romania
Fin8 – 2010	6	3	1	66.67%	Bulgaria, Latvia, Romania
Fin9 – 2010	28	5	5	3.57%	–
Fin10 – 2010	26	9	9	3.85%	–
Fin11 – 2010	26	3	1	88.46%	Slovak Rep., Latvia, Estonia, Bulgaria, Italy, Lithuania, Ireland, Austria, Slovenia, Romania, Hungary, Czech Rep., Greece, Portugal, Poland, Germany, Finland, Belgium, Denmark, France, Spain, Netherlands
Fin12 – 2010	24	4	1	58.33%	Romania, Latvia, Lithuania, Poland, Estonia, Hungary, Bulgaria, Czech Rep., Slovenia, Denmark, Sweden, Finland, Greece
Fin13 – 2010	26	6	3	3.85%	–
Fin14 – 2010	25	5	4	8%	Latvia

Fin1: Broad money (% of GDP), Fin2: Claims on central government, etc: (% GDP), Fin3: Claims on other sectors of the domestic economy (% of GDP), Fin4: Consumer price index (2005 = 100), Fin5: Deposit interest rate (%), Fin6: Domestic credit provided by banking sector (% of GDP), Fin7: Domestic credit to private sector (% of GDP), Fin8: Financing via international capital markets (gross inflows, % of GDP), Fin9: Inflation, consumer prices (annual %), Fin10: Inflation, GDP deflator (annual %), Fin11: Market capitalization of listed companies (% of GDP), Fin12: Money and quasi money (M2) as % of GDP, Fin13: Stocks traded, total value (% of GDP), Fin14: Wholesale price index (2005 = 100).

Fin4, Fin5, and Fin10, Turkey has significant dissimilarities among the clustered countries (Table 6). In Turkey, the financial sector reforms in the early 1980s were unsuccessful; however, by the late 1990s, the banks and government agreed on a strategy to reform the sector (Effron 2006). These strategies created strong agency regulation and supervision for banks, aligned prudential regulations with international standards, strengthened the agency failed bank resolution (entity deposit insurance), and restructured and privatized public banks (Effron 2006). Kavalsky (2006)

also reported that private investment and a surge in exports following trade liberalization helped Turkey grow rapidly during the 1980s. However, a mixture of public investment in infrastructure and populist policies such as generous pensions for civil servants and large agricultural subsidies gradually led to an imbalance in public accounts and high inflation (Kavalsky 2006). In Turkey, following significant growth and a rising primary surplus after 2001 as well as three volatile financial crises, extra budgetary funds were eliminated and fiscal controls streamlined (Kavalsky 2006).

Table 7. Health indicators

Health (Hlth[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Hlth1 – 2009	28	6	1	3.57%	–
Hlth2 – 2009	28	12	3	10.71%	Latvia, Lithuania
Hlth3 – 2009	28	8	1	17.86%	Lithuania, Latvia, Romania, Bulgaria
Hlth4 – 2006	25	6	1	68%	Greece, Cyprus, Romania, Bulgaria, Portugal, Poland, Latvia, Malta, Austria, Italy, Estonia, Spain, Lithuania, Slovenia, Germany, France
Hlth5 – 2009	28	8	3	42.86%	Austria, Ireland, Czech Rep., Sweden, Romania, Finland, Spain, Italy, Belgium, Estonia, Portugal
Hlth6 – 2006	22	7	1	4.55%	–
Hlth7 – 2010	28	10	9	7.14%	Cyprus

Hlth1: Death rate, crude (per 1,000 people), Hlth2: Health expenditure, total (% of GDP), Hlth3: Life expectancy at birth, total (years), Hlth4: Nurses and midwives (per 1,000 people), Hlth5: Out-of-pocket health expenditure (% of total expenditure on health), Hlth6: Physicians (per 1,000 people), Hlth7: Population growth (annual %).

Table 8. Infrastructure indicators

Infrastructure (Infra[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Infra1 – 2009	28	7	1	3.57%	–
Infra2 – 2009	24	4	1	62.50%	Belgium, Lithuania, Greece, Italy, Bulgaria, Slovenia, Portugal, Denmark, Luxembourg, Austria, France, Estonia, Latvia, Germany
Infra3 – 2009	24	5	2	62.5%	Cyprus, Slovenia, Luxembourg, Greece, Latvia, Bulgaria, Estonia, Portugal, Italy, Austria, France, Denmark, Germany, Romania
Infra4 – 2010	27	5	1	81.48%	Greece, Malta, Cyprus, Lithuania, France, Portugal, Luxembourg, Latvia, Austria, Poland, Spain, Slovenia, UK, Czech Rep., Hungary, Bulgaria, Estonia, Italy, Belgium, Germany, Slovak Rep.
Infra5 – 2009	28	7	1	10.71%	Romania, Cyprus
Infra6 – 2009	28	11	1	7.14%	Cyprus
Infra7 – 2008	24	8	1	4.17%	–
Infra8 – 2008	25	8	1	4%	–
Infra9 – 2010	28	14	14	3.57%	–
Infra10 – 2010	28	10	10	3.57%	–
Infra11 – 2007	28	8	8	3.57%	Cyprus, Slovak Rep., Bulgaria, Romania, Poland, Greece, Malta, Latvia, Lithuania
Infra12 – 2010	28	10	1	42.86%	Romania, Bulgaria, Greece, Slovak Rep., Italy, Hungary, Latvia, Portugal, Lithuania, Poland, Spain
Infra13 – 2007	24	8	1	12.5%	Romania, Poland
Infra14 – 2009	28	7	2	28.57%	Lithuania, Romania, Poland, Finland, Bulgaria, Latvia, Hungary
Infra15 – 2008	24	7	2	20.83%	Lithuania, Ireland, Romania, Slovenia

Infra1: Fixed broadband Internet subscribers (per 100 people), Infra2: ICT goods exports (% of total goods exports), Infra3: ICT goods imports (% total goods imports), Infra4: ICT service exports (% of service exports, BoP), Infra5: Internet users (per 100 people), Infra6: Mobile cellular subscriptions (per 100 people), Infra7: Motor vehicles (per 1,000 people), Infra8: Passenger cars (per 1,000 people),Infra9: Pump price for diesel fuel (US$ per liter), Infra10: Pump price for gasoline (US$ per liter), Infra11: Research and development expenditure (% of GDP), Infra12: Secure Internet servers (per 1 million people), Infra13: Technicians in R&D (per million people),Infra14: Telephone lines (per 100 people), Infra15: Vehicles (per km of road).

In addition, the Banking Regulation and Supervisory Authority established an independent regulatory and supervisory framework that was closely aligned with EU standards (Kavalsky 2006). Although this measure strengthened the banking system, private sector credit as a percentage of GDP remained low compared with the OECD average and little progress was made towards the privatization of public banks (Kavalsky 2006).

As shown in Table 7 for Hlth4 and Hlth5, Turkey's group is represented by 68.0% and 42.9% of the countries, respectively. For Hlth6 and Hlth1, Turkey is placed in the first cluster; indeed, Turkey's death rate (Hlth1) is the lowest among member countries, while it has the lowest number of physicians per 1,000 people (Hlth6) among members.

Yenimahalleli-Yasar and Ugurluoglu (2011) explained that the conditions for receiving bonuses for health services and the debt premium would continue to shrink actual health coverage, while out-of-pocket payments and expenses would continue to affect access to services. In particular, Yenimahalleli-Yasar (2011) pointed out that meeting health objectives seems to take a long time, as many factors, both related and unrelated to health policy, are responsible for the low level of health improvements in Turkey, whose GDP per capita and education level (especially among women) is low. Thus, additional investment in the prevention of social policy issues and other health matters is an important issue (Yenimahalleli-Yasar 2010). In addition, Yildirim *et al.* (2011) reported shortages in medical staff, the unequal distribution of resources across the nation, and the lack of systematic information on results, thereby limiting the selection of providers for many people.

For Infra4, Turkey shares the top cluster with 21 members (81.5%), whereas for Infra1, Turkey has the lowest rank (Table 8). Kavalsky (2006) provided a general summary of how Turkey's regulatory frameworks and institutions have been established and energy, telecommunications, and railways improved. Following the EU approach to liberalization, Turkey liberalized its telecommunications sector. However, there remain huge opportunities for Turkey to benefit from the adoption and implementation of a legislative, regulatory, and institutional framework in the telecommunications sector (Akdemir *et al.* 2007). In addition, according to Kavalsky (2006), private investment is growing in power and public services, but quantifiable gains in effectiveness have not yet emerged.

Table 9. Labor and social protection indicators

Labor and Social Protection (Lbr[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Lbr1 – 2009	28	11	11	3.57%	–
Lbr2 – n.a.	–	–	–	–	–
Lbr3 – 2009	28	9	7	21.43%	Cyprus, Hungary, Portugal, Ireland, Spain
Lbr4 – 2008	28	10	3	25%	Hungary, Poland, Czech Rep., Lithuania, Latvia, Portugal
Lbr5 – 2006	26	7	5	3.85%	–
Lbr6 – 2006	26	9	3	11.54%	Malta, Spain
Lbr7 – 2006	26	9	1	26.92%	Romania, Portugal, Czech Rep., Italy, Slovak Rep., Malta
Lbr8 – 2009	28	8	1	3.57%	–
Lbr9 – 2009	28	10	6	3.57%	–
Lbr10 – 2009	28	10	5	28.57%	Luxembourg, Lithuania, UK, Netherlands, Poland, Latvia, Estonia
Lbr11 – 2010	28	12	2	10.71%	Bulgaria, Lithuania
Lbr12 – 2009	28	7	2	50%	Lithuania, Slovenia, Greece, Estonia, Cyprus, Poland, Latvia, Portugal, Romania, Malta, Spain, Finland, France
Lbr13 – 2009	28	7	5	10.71%	Estonia, Lithuania
Lbr14 – 2009	27	7	4	66.67%	Bulgaria, Czech Rep., Luxembourg, UK, Portugal, Finland, Poland, Romania, Belgium, France, Ireland, Sweden, Italy, Greece, Hungary, Estonia, Slovak Rep.
Lbr15 – 2009	28	7	7	3.57%	–
Lbr16 – 2009	28	11	1	3.57%	–

Lbr1: Contributing family workers, total (% of total employed), Lbr2: Economically active children, total (% of children ages 7-14) Lbr3: Employers, total (% of employment), Lbr4: GDP per person employed (constant 1990 PPP $), Lbr5: Labor force with primary education (% of total), Lbr6: Labor force with secondary education (% of total), Lbr7: Labor force with tertiary education (% of total), Lbr8: Labor force, female (% of total labor force), Lbr9: Labor force, total, Lbr10: Long-term unemployment (% of total unemployment), Lbr11: Net migration, Lbr12: Part time employment, total (% of total employment), Lbr13: Unemployment, total (% of total labor force), Lbr14: Unemployment, youth total (% of total labor force ages 15–24), Lbr15: Vulnerable employment, total (% of total employment), Lbr16: Wage and salaried workers, total (% of total employed).

From Table 9, the Lbr1 and Lbr15 indicators show that Turkey has the highest rate of contributing family workers but also the highest group of vulnerable employees among member states. In addition, Turkey is in the first cluster (i.e., lowest rates) for Lbr7, Lbr8, and Lbr16. For Lbr7, Turkey shares a cluster with Romania, Portugal, Czech Republic, Italy, Slovak Republic, and Malta.

Hoekman and Togan (2005) stated that Turkey's age composition is one of its most important characteristics; owing to a high birth rate, the population is relatively young. This high proportion of young people could be an advantage for Turkey, because it includes a significant proportion of the workforce, but it imposes a heavy burden on the education

system and employment generation is a major social issue (Hoekman, Togan 2005). Additionally, the share of employment in agriculture in Turkey is extremely high (34.5%) among candidate countries. Most self-employed and part-time employees work in agriculture, and fixed-term employment is dominant in the construction sector (Hoekman, Togan 2005). Its possible accession to the EU would thus have a profound impact on Turkey and EU countries, and this impact would be largely determined by the peculiarities of the structure of the population and Turkish labor markets (Hoekman, Togan 2005).

As shown in Table 10, Prv7 and Prv12 are indicators in which Turkey ranks in the first cluster. Under the Prv7

Table 10. Private sector and trade indicators

Private Sector and Trade (Prv[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Prv1– n.a.	–	–	–	–	–
Prv2 – 2010	27	8	7	11.11%	Poland, Italy
Prv3 – 2010	27	4	3	70.37%	Belgium, Denmark, France, Sweden, Poland, Slovak Rep., Finland, Greece, Spain, Ireland, Italy, Netherlands, Portugal, Czech Rep., Estonia, Latvia, Hungary, Romania
Prv4 – 2010	25	7	4	8%	Bulgaria
Prv5 – 2010	27	7	4	18.52%	Latvia, Czech Rep., Slovenia, Hungary
Prv6 – 2009	28	9	3	42.86%	UK, Austria, Romania, Hungary, Italy, Luxembourg, Ireland, Belgium, Estonia, Poland, Portugal
Prv7 – 2009	28	5	1	7.14%	Hungary
Prv8 – 2009	28	11	4	39.29%	Poland, Austria, Slovenia, Czech Rep., France, Italy, Spain, Slovak Rep., Portugal, Latvia
Prv9 – 2009	28	10	5	10.71%	Finland, Greece
Prv10 – 2010	25	10	6	16%	Poland, Latvia, Czech Rep.
Prv11 – 2010	27	9	5	11.11%	Hungary, Slovenia
Prv12 – 2010	27	8	1	25.93%	Romania, Czech Rep., Slovak Rep., Lithuania, Hungary, Greece
Prv13 – 2010	27	9	7	7.41%	Spain
Prv14 – n.a.	–	–	–	–	–
Prv15 – n.a.	–	–	–	–	–
Prv16 – 2009	28	9	7	32.14%	France, Romania, Poland, Austria, Germany, Hungary, Italy, Luxembourg
Prv17 – 2009	28	8	5	14.29%	Finland, Italy, Cyprus
Prv18 – 2010	28	7	4	7.14%	Spain
Prv19 – 2010	28	4	2	3.57%	–
Prv20 – 2009	28	8	2	21.43%	Spain, Cyprus, UK, Italy, France
Prv21 – 2010	25	8	4	8%	Greece
Prv22 – 2010	27	7	6	33.33%	Greece, Slovenia, Portugal, Austria, Finland, Sweden, Hungary, Poland
Prv23 – 2010	27	7	2	3.70%	–
Prv24 – 2010	27	10	6	33.33%	UK, Latvia, Lithuania, Netherlands, Poland, Portugal, Finland, Romania

Prv1: Average number of times firms spent in meetings with tax officials, Prv2: Cost of business start-up procedures (% of GNI per capita), Prv3: Credit depth of information index (0 = low to 6 = high), Prv4: Export value index (2000 = 100), Prv5: Export volume index (2000 = 100) Prv6: Food exports (% of merchandise exports), Prv7: Food imports (% of merchandise imports), Prv8: Fuel exports (% of merchandise exports), Prv9: Fuel imports (% of merchandise imports), Prv10: Import value index (2000 = 100), Prv11: Import volume index (2000 = 100) Prv12: International tourism, expenditures (% of total imports), Prv13: International tourism, receipts (% of total exports), Prv14: Losses due to theft, robbery, vandalism, and arson (% sales), Prv15: Management time dealing with officials (% of management time), Prv16: Manufactures exports (% of merchandise exports), Prv17: Manufactures imports (% of merchandise imports), Prv18: Merchandise exports by the reporting economy, residual (% of total merchandise exports), Prv19: Merchandise imports by the reporting economy, residual (% of total merchandise imports), Prv20: Merchandise trade (% of GDP), Prv21: Net barter terms of trade index (2000 = 100), Prv22: Profit tax (% of commercial profits), Prv23: Strength of legal rights index (0 = weak to 10 = strong), Prv24: Total tax rate (% of commercial profits).

indicator, Turkey shares its cluster with Hungary; these two countries show the lowest rates of food imports among other member countries. Under the Prv12 indicator, Romania, Czech Republic, Slovak Republic, Lithuania, Hungary, and Greece are in the same cluster; these nations have the lowest rate (as a percentage of total imports) among other members.

The transformation of the Turkish economy and its current trade patterns are similar to those of other emerging market economies. After the adoption of a business strategy directed outwards in the 1980s, Turkey was able to increase its share of world exports from 0.36% in 1980 to 0.60% in 2000. Meanwhile, the average growth of exports exceeded 20% after the financial crises in 2001 (Saygili, Saygili 2011). The Turkish economy features a relatively large share of value added in agriculture (14.2%). This share is smaller than those for Bulgaria and Romania, where the agricultural sector comprises 28.2% and 19.3% of total value added, respectively (Lejour, de Mooij 2005). It is much larger, however, than in the Accession-10, where the agricultural sector is responsible for 6.9% of value added on average, and the EU-15 where it is only 2.5%. One reason for the large agricultural sector in Turkey is the substantial amount of agricultural support by the Turkish government (Lejour, de Mooij 2005). The trade liberalization in the 1980s and 1990s, which allowed Turkey to expand business contacts with global production networks, resulted in a transfer of resources from traditional sectors such as textiles and agriculture to non-traditional high technology-intensive sectors such as transport vehicles and consumer electronics (Saygili, Saygili 2011). Trade liberalization has thus been an important aspect of economic policy in Turkey since the early 1980s. It also led to the formation of the customs union between Turkey and the EU in 1995, which not only covers trade in industrial goods and processed agricultural products but also covers the harmonization of technical legislation, the abolition of monopolies, and the protection of intellectual property (Lejour, de Mooij 2005).

Apart from agriculture, Turkey also has relatively large textiles, trade services, and transport services sectors. These sectors are labor-intensive and have relatively low productivity levels. Further, the tourism sector is important for the Turkish economy. However, compared with the Accession-10, Turkey has a low share in the machinery and equipment, transport equipment, and business services sectors (Lejour, de Mooij 2005).

For Pblc4, Pblc10, and Pblc11, Turkey stands in the first cluster with the lowest rates of these indicators among other members. For the Pblc1 indicator, Turkey is in the sixth cluster alongside Latvia, Czech Republic, Poland, Cyprus, Slovenia, Belgium, Italy, the Netherlands, Hungary, and Malta (see Table 11).

Kavalsky (2006) reported that the private sector in Turkey requires a substantial increase in foreign direct investment to be more competitive and technologically

Table 11. Public sector indicators

Public Sector (Pblc[x] – Data year)	N	Targeted number of groups	Turkey's group number	% represented by Turkey's cluster	Countries belonging to Turkey's cluster (Turkey's similarities with countries)
Pblc1 – 2009	25	7	6	44%	Latvia, Czech Rep., Poland, Cyprus, Slovenia, Belgium, Italy, Netherlands, Hungary, Malta
Pblc2 – 2009	24	8	2	41.67%	Czech Rep., Lithuania, Slovak Rep., Denmark, Latvia, Sweden, Spain, Germany, Poland
Pblc3 – 2009	25	4	4	4%	–
Pblc4 – 2009	25	7	1	4%	–
Pblc5 – 2009	25	5	3	64%	Germany, Poland, Austria, Czech Rep., Luxembourg, France, Portugal, Slovak Rep., Netherlands, Latvia, Denmark, Bulgaria, Lithuania, Hungary, Ireland
Pblc6 – 2009	18	5	4	16.67%	Slovak Rep., Bulgaria
Pblc7 – 2009	27	7	6	11.11%	UK, Latvia
Pblc8 – 2009	25	10	5	28%	Bulgaria, Italy, Lithuania, Greece, Luxembourg, Poland
Pblc9 – 2008	28	6	4	17.86%	Austria, Italy, Cyprus, Denmark
Pblc10 – 2008	28	8	1	3.57%	–
Pblc11 – 2008	28	6	1	3.57%	–
Pblc12 – 2008	27	10	4	7.41%	Malta
Pblc13 – 2008	28	7	3	60.71%	Lithuania, Romania, Poland, Slovenia, Greece, Austria, Finland, Portugal, Sweden, France, Italy, Netherlands, Bulgaria, Ireland, Hungary, Luxembourg

Pblc1: Cash surplus/deficit (% of GDP), Pblc2: Central government debt, total (% of GDP), Pblc3: Customs and other import duties (% of tax revenue), Pblc4: Expense (% of GDP), Pblc5: Goods and services expense (% of expense), Pblc6: Grants and other revenue (% of revenue), Pblc7: Military expenditure (% of GDP), Pblc8: Other expense (% of expense), Pblc9: Other taxes (% of revenue), Pblc10: Revenue, excluding grants (% of GDP), Pblc11: Social contributions (% of revenue), Pblc12: Subsidies and other transfers (% of expense), Pblc13: Tax revenue (% of GDP).

advanced (Basti, Bayyurt 2008). For Turkey, increasing R&D, improving intellectual property rights, and strengthening the institutional framework for technical standards and finance are necessary to gain in self-sufficiency. In addition, progress in the management of public procurement, fiscal transparency, and energy and banking regulation should reduce corruption. The poverty rate is also declining based on the trend in GDP per capita growth, and poverty monitoring is improving. However, there is a lower employment rate for women compared with men; employment, in particular, has been very slow. Moreover, the financial terms of the retirement system is considered to be unsustainable, although the regional distribution of income does not seem to be damaged. In addition, there has been a sharp decline in infant mortality (45%) and a rapid increase in school enrollment (98% gross of 84%), especially girls at secondary level. Literacy has also developed for both men and women.

Conclusion

This paper reviewed the path of Turkey's accession efforts to the EU and used cluster analysis to determine the significance of trade ties and the country's possible standing compared with other nations. The cluster analysis technique was used to measure Turkey's similarities with other member countries. Recent data on the economic and development indicators of countries from the World Bank was used for the cluster analysis.

From the World Bank database, indicators on the environment, economic policy and debt, financial sector, health, infrastructure, labor and social protection, private sector and trade, and public sector were taken into consideration. To form the clusters, the procedure began with each observation in a separate group. It then combined the two closest observations in order to form a new group. After recalculating the distance between the groups, the two closest were combined. This process was repeated until only the targeted number of groups remained.

Turkey is playing an increasingly influential role in the region because of not only its growing economic power but also its increased strategic importance. Further, with its stable government and strategic location, Turkey is becoming a crucial partner of the west in terms of helping solve many global-scale conflicts and problems. From an economic point of view, Turkey has seen promising growth and is aiming for the highest standards of living with a constantly increasing purchasing power in years to come. Indeed, while Turkey is still negotiating to join the EU, the eurozone is struggling with sovereign debt.

References

Acaravci, A.; Ozturk, I. 2009. Balance of payments constrained growth in Turkey: Evidence from ARDL bound testing approach, *Transformations in Business & Economics* 8(2): 57–65.

Aggelopoulos, S.; Arabatzis, G.; Pauloudi, A. 2009. Agri-environmental policy of EU: The case of organic farming in Greece, *Fresenius Environmental Bulletin* 18(6): 1018–1024.

Akdemir, E.; Basci, E.; Togan, S. 2007. Telecommunications policy reform in Turkey, *The World Economy* 30(7): 1114–1138. http://dx.doi.org/10.1111/j.1467-9701.2007.01032.x

Akyuz, K. C.; Yildirim, I.; Balaban, Y.; Korkut, S. 2010. Analysis of forest product trade relationships between Turkey and European Union member states, *African Journal of Biotechnology* 9(16): 2353–2359.

Alba, J. D.; Park, D. 2005. An empirical investigation of purchasing power parity (PPP) for Turkey, *Journal of Policy Modeling* 27(8): 989–1000. http://dx.doi.org/10.1016/j.jpolmod.2005.06.012

Antonucci, D.; Manzocchi, S. 2006. Does Turkey have a special trade relation with the EU?: A gravity model approach, *Economic Systems* 30(2): 157–169. http://dx.doi.org/10.1016/j.ecosys.2005.10.003

Aydin, L.; Acar, M. 2010. Economic and environmental implications of Turkish accession to the European Union: A CGE analysis, *Energy Policy* 38(11): 7031–7040. http://dx.doi.org/10.1016/j.enpol.2010.07.022

Basti, E.; Bayyurt, N. 2008, Efficiency performance of foreign-owned firms in Turkey, *Transformations in Business & Economics* 7(3): 20–30.

Buckwalter, D. W. 2005. Transportation regions and the eastward integration of Europe, *Tijdschrift Voor Economische En Sociale Geografie* 96(1): 31–47. http://dx.doi.org/10.1111/j.1467-9663.2005.00437.x

Collins, R. 2003. *Embracing Cyprus: The Path to Unity in the New Europe*. London, GBR: I. B. Tauris, 92.

Cuervo, M. R. V.; Menendez, A. J. L. 2006. A multivariate framework for the analysis of the digital divide: evidence for the European Union-15, *Information & Management* 43(6): 756–766. http://dx.doi.org/10.1016/j.im.2006.05.001

Damaskopoulos, T.; Gatautis, R.; Vitkauskaite, E. 2008. Extended and dynamic clustering of SMEs, *Inzinerine Ekonomika – Engineering Economics* (1): 11–21.

Darcin, M.; Sozen, A.; Cipil, F.; Kurt, B. 2012. A multiple variables data analysis on the relationship between Turkey's socioeconomic and transportation indicators, *Energy Education Science and Technology Part A – Energy Science and Research* 29(2): 1217–1232.

Davo, N. B.; Mayor, M. G. O.; De La Hera, M. L. B. 2011. Empirical analysis of technological innovation capacity and competitiveness in EU-15 countries, *African Journal of Business Management* 5(14): 5753–5765.

Dressler, F. 2008. *Self-Organization in Sensor and Actor Networks*. Hoboken, NJ, USA: Wiley, 216–218.

Effron, L. 2006. *IEG Review of World Bank Assistance for Financial Sector Reform*. Herndon, VA, USA: World Bank Publications, 45.

Eising, R. 2004. Multilevel governance and business interests in the European Union, *Governance – an International Journal of Policy and Administration* 17(2): 211–245.

Everitt, B. S. 2002. *Cambridge Dictionary of Statistics*. West Nyack, NY, USA: Cambridge University Press, 7–348.

Fischer, C.; Schornberg, S. 2007. Assessing the competitiveness situation of EU food and drink manufacturing industries: An index-based approach, *Agribusiness* 23(4): .473–495.

Flam, H. 2003. Turkey and the EU: politics and economics of accession, *CESifo Working Paper 893*. CESifo, Munich.

Gerhards, J.; Hans, S. 2011. Why not Turkey? Attitudes towards Turkish membership in the EU among citizens in 27 European countries, *JCMS: Journal of Common Market Studies* 49(4): 741–766.
http://dx.doi.org/10.1111/j.1468-5965.2010.02155.x

Gertsbakh, I., Yatskiv, I. 2006. Dynamic classification: economic welfare growth in the EU during 1995–2004, in Zanasi, A.; Brebbia, C. A.; Ebecken, N. F. F. (Eds.). *Data Mining VII: Data, Text and Web Mining and Their Business Applications.* Southampton: Wit Press/Computational Mechanics Publications. http://dx.doi.org/10.2495/DATA060061

Gertsbakh, I.; Yatskiv, I.; Platonova, O. 2008. Constructing social and economic indicators for EU countries using dynamic classification: case studies, in Zanasi, A.; Gomar, D. A.; Ebecken, N. F. F.; Brebbia, C. A. (Eds.). *Data Mining Ix: Data Mining, Protection, Detection and Other Security Technologies.* Southampton: Wit Press.
http://dx.doi.org/10.2495/DATA080151

Hoekman, B. M.; Togan, S. 2005. *Turkey: Economic Reform and Accession to the European Union.* Herndon, VA, USA: World Bank Publications.
http://dx.doi.org/10.1596/978-0-8213-5932-0

Johnson, S. C. 1967. Hierarchical clustering schemes, *Psychometrika* 32(3): 241–254. http://dx.doi.org/10.1007/BF02289588

Kalaycioglu, E. 2005. *Turkish Dynamics: Bridge Across Troubled Lands.* Gordonsville, VA, USA: Palgrave Macmillan, 3.

Kavalsky, B. G. 2006. *World Bank in Turkey, 1993–2004: An IEG Country Assistance Evaluation.* Herndon, VA, USA: World Bank Publications, p xiii.
http://dx.doi.org/10.1596/978-0-8213-6573-1

Khalilzad, Z. 2000. *Future of Turkish-Western Relations: Toward a Strategic Plan.* Santa Monica, CA, USA: RAND Corporation.

Kibris, A.; Müftüler-Bac, M. 2011. The accession games: a comparison of three limited-information negotiation designs, *International Studies Perspectives* 12(4): 399–427.
http://dx.doi.org/10.1111/j.1528-3585.2011.00437.x

Kizilaslan, N.; Gürler, A. Z.; Kizilaslan, H. 2007. An analytical approach to sustainable development in Turkey, *Sustainable Development* 15(4): 254–266.
http://dx.doi.org/10.1002/sd.316

Kramer, H. 2000. *Changing Turkey: Challenges to Europe and the United States.* Washington, DC, USA: Brookings Institution Press, xii.

Lammers, K. 2006. The EU and Turkey—economic effects of Turkey's full membership, *Intereconomics* 41(5): 282–288.
http://dx.doi.org/10.1007/s10272-006-0198-z

Larose, D. T. 2005. *Discovering Knowledge in Data: An Introduction to Data Mining.* Hoboken, NJ, USA: Wiley, 16–150.

Lejour, A. M.; de Mooij, R. A. 2005. Turkish delight: does Turkey's accession to the EU bring economic benefits?, *Kyklos* 58(1): 87–120.
http://dx.doi.org/10.1111/j.0023-5962.2005.00279.x

Lejour, A. M.; de Mooji, R. A.; Capel, C. H. 2004. Assessing the economic implications of Turkish accession to the EU, *CPB Document 56.* CPB, Netherlands Bureau for Economic Policy Analysis, The Hague.

Lorcu, F.; Bolat, B. A.; Atakisi, A. 2012. Examining Turkey and member states of European Union in terms of health perspectives of millennium development goals, *Quality & Quantity* 46(3): 959–978.
http://dx.doi.org/10.1007/s11135-011-9648-1

Müftüler-Bac, M. 2008. Turkey's accession to the European Union, *The Impact of the EU's Internal Dynamics International Studies Perspectives* 9(2): 201–219.
http://dx.doi.org/10.1111/j.1528-3585.2008.00327.x

Nas, T. 2008. *Tracing the Economic Transformation of Turkey from the 1920s to EU Accession.* Leiden, NLD: Martinus Nijhoff.

Odehnal, J.; Michalek, J. 2011. An empirical analysis of the business environment of selected European Union regions, *Politicka Ekonomie* 59(2): 242–262.

Pahre, R.; Ucaray-Mangitli, B. 2009. The myths of Turkish influence in the European Union, *JCMS: Journal of Common Market Studies* 47(2): 357–384.
http://dx.doi.org/10.1111/j.1468-5965.2009.00808.x

Pfeifer, M. 2012. Comparing unemployment protection and social assistance in 14 European countries. Four worlds of protection for people of working age, *International Journal of Social Welfare* 21(1): 13–25.
http://dx.doi.org/10.1111/j.1468-2397.2010.00765.x

Philippidis, G.; Karaca, O. 2009. The economic impacts of Turkish accession to the European Union, *The World Economy* 32(12): 1706–1729.
http://dx.doi.org/10.1111/j.1467-9701.2009.01207.x

Plechanovova, B. 2011. The EU Council enlarged: North-South-East or core-periphery?, *European Union Politics* 12(1): 87–106. http://dx.doi.org/10.1177/1465116510390720

Quadrado, L.; Heijman, W.; Folmer, H. 2001. Multidimensional analysis of regional inequality: the case of Hungary, *Social Indicators Research* 56(1): 21–42.
http://dx.doi.org/10.1023/A:1011893713456

Rabasa, A. 2008. *Rise of Political Islam in Turkey.* Santa Monica, CA, USA: RAND Corporation, 4–52.

Radosevic, S. 2004. A two-tier or multi-tier Europe? Assessing the innovation capacities of central and east European countries in the enlarged EU, *Journal of Common Market Studies* 42(3): 641–666.
http://dx.doi.org/10.1111/j.0021-9886.2004.00522.x

Saar, E.; Unt, M.; Kogan, I. 2008. Transition from educational system to labour market in the European Union a comparison between new and old members, *International Journal of Comparative Sociology* 49(1): 31–59.
http://dx.doi.org/10.1177/0020715207088586

Sahin, A. D. 2008. A review of research and development of wind energy in Turkey, *CLEAN – Soil, Air, Water* 36(9): 734–742.
http://dx.doi.org/10.1002/clen.200700143

Saygili, H.; Saygili, M. 2011. Structural changes in exports of an emerging economy: Case of Turkey, *Structural Change and Economic Dynamics* 22(4}: 342–360.

Schwarz, W.; Vorauer-Mischer, K. 2003. Regional development in the EU 15 – spatial heterogeneity, temporal discontinuity, options in regional politics. Results of an empirical analysis,

Mitteilungen der Osterreichischen Geographischen Gesellschaft 145: 7–34.

Sengul, H.; Sengul, S. 2006. Food consumption and economic development in Turkey and European Union countries, *Applied Economics* 38(20): 2421–2431. http://dx.doi.org/10.1080/00036840500427726

Skuodis, M. 2009. The welfare regimes of the new European Union member states in the typology of traditional European social models, *Filosofija–Sociologija* 20(2): 130–143.

Smulders, P. G. W.; Kompier, M. A. J.; Paoli, P. 1996. The work environment in the twelve EU-countries: Differences and similarities, *Human Relations* 49(10): 1291–1313. http://dx.doi.org/10.1177/001872679604901002

Tapio, P.; Banister, D.; Luukkanen, J.; Vehmas, J.; Willamo, R. 2007. Energy and transport in comparison: Immaterialisation dematerialisation and decarbonisation in the EU15 between 1970 and 2000, *Energy Policy* 35(1): 433–451. http://dx.doi.org/10.1016/j.enpol.2005.11.031

Thogersen-Ntoumani, C.; Barkoukis, V.; Grano, C.; Lucidi, F.; Lindwall, M.; Liukkonen, J.; Raudsepp, L.; Young, W. 2011. Health and well-being profiles of older European adults, *European Journal of Ageing* 8(2): 75–85. http://dx.doi.org/10.1007/s10433-011-0186-4

Tiersky, R. 2010. *European Foreign Policies: Does Europe Still Matter*? Blue Ridge Summit, PA, USA: Rowman & Littlefield Publishing Group, 75–119.

Togan, S. 2004. Economic aspects of the accession of Turkey to the European Union, *Intereconomics* 39(6): 300–303. http://dx.doi.org/10.1007/BF03031714

Ugur, M. 2010. Open-ended membership prospect and commitment credibility: explaining the deadlock in EU–Turkey accession negotiations, *JCMS: Journal of Common Market Studies* 48(4): 967–991. http://dx.doi.org/10.1111/j.1468-5965.2010.02082.x

Ungureanu, C. I.; Ersoz, F. 2010. Commonalities and disparities among the EU candidate countries, *Romanian Journal of Economic Forecasting* 13(3): 173–186.

Whitman, R. G.; Juncos, A. E. 2011. Relations with the Wider Europe, *JCMS: Journal of Common Market Studies* 49: 187–208. http://dx.doi.org/10.1111/j.1468-5965.2011.02189.x

Yenimahalleli-Yasar, G. 2010. 'Health transformation programme' in Turkey: an assessment, *The International Journal of Health Planning and Management* 26(2): 110–133. http://dx.doi.org/10.1002/hpm.1065

Yenimahalleli-Yasar, G.; Ugurluoglu, E. 2011. Can Turkey's general health insurance system achieve universal coverage?, *The International Journal of Health Planning and Management* 26(3): 282–295. http://dx.doi.org/10.1002/hpm.1079

Yildirim, H. H.; Hughes, D.; Yildirim, T. 2010. Markets, modernisation and national interest: three faces of patient choice policy in Turkey, *Health* & *Social Care in the Community* 19(2): 168–177.

Yildiz, K.; Muller, M.; Chomsky, N. 2008. *European Union and Turkish Accession: Human Rights and the Kurds*. Pluto Press. eBook. 260 p.

Zivadinovic, N. K.; Dumicic, K.; Casni, A. C. 2009. Multivariate analysis of structural economic indicators for Croatia and Eu 27, in Demiralp, M.; Baykara, N. A.; Mastorakis, N. E. (Eds.). *Proceedings of the 2nd Wseas International Conference on Multivariate Analysis and Its Application in Science and Engineering*.

APPENDIX A

The output summarizes the statistical significance of the terms in the GDP forecasting model. Terms with P-values less than 0.05 are statistically significantly different from zero at the 95% confidence level. The P-value for the MA(1) term is less than 0.05, so it is significantly different from 0. The estimated standard deviation of the input white noise equals 1288.77.

Table A1. Forecast summary

Statistic	Estimation Period
RMSE	1080.5
MAE	714.988
MAPE	9.22991
ME	73.429
MPE	1.32238

Table A2. ARIMA model summary

Parameter	Estimate	Stnd. Error	t	P-value
MA(1)	0.888969	0.104862	8.47752	0.000029

Backforecasting: yes
Estimated white noise variance = 1.66092E6 with 8 degrees of freedom
Estimated white noise standard deviation = 1288.77
Number of iterations: 5

Each of the statistics is based on the one-ahead forecast errors, which are the differences between the data value at time t and the forecast of that value made at time t-1. The first three statistics measure the magnitude of the errors. A better model will give a smaller value. The last two statistics measure bias. A better model will give a value close to 0.

Table A3 shows the forecasted values for GDP per capita. During the period where actual data is available, it also displays the predicted values from the fitted model and the residuals (data-forecast).

Table A3. Forecast table for GDP per capita for Turkey, Model: ARIMA(0,2,1)

Year	Data	Forecast	Residual
2000	4189.48		
2001	3036.73		
2002	3553.07	3650.24	−97.1664
2003	4567.5	4155.79	411.712
2004	5832.69	5215.93	616.759
2005	7087.72	6549.6	538.119
2006	7687.13	7864.38	−177.249
2007	9246.03	8444.11	801.921
2008	10297.5	10092.0	205.463
2009	8553.74	11166.3	−2612.6
2010	10106.4	9132.49	973.901

Table A4 compares the results of fitting different models to the data. The model with the lowest value of the Akaike Information Criterion (AIC) is model J, which has been used to generate the forecasts.

Table A4. The results of fitting different models to the data. The model with the lowest value of the Akaike Information Criterion (AIC) is model J

Model	RMSE	MAE	MAPE	ME	MPE	AIC	HQC	SBIC
A	1230.73	1170.99	18.4719	591.691	6.8026	14.2307	14.2307	14.2307
B	1137.53	831.051	14.1565	−1.81899E-13	−3.21728	14.2551	14.2323	14.2912
C	2655.09	2277.95	42.6477	1.07486E-12	−18.4153	15.9503	15.9275	15.9865
D	1105.81	915.34	14.3977	47.0927	−1.17507	14.3803	14.3347	14.4527
E	1524.25	1311.99	17.9322	1027.98	14.3924	14.8403	14.8175	14.8765

Model	RMSE	MAE	MAPE	ME	MPE	AIC	HQC	SBIC
F	1230.74	1064.57	16.7931	537.951	6.18486	14.4126	14.3898	14.4487
G	1217.52	925.152	16.2444	184.854	3.53411	14.391	14.3682	14.4271
H	1126.8	871.136	14.8596	65.5959	0.274016	14.4179	14.3723	14.4902
I	1291.7	890.162	15.5084	−182.71	−1.80629	14.5092	14.4864	14.5454
J	1080.5	714.988	9.22991	73.429	1.32238	14.1522	14.1294	14.1883
K	1230.73	1170.99	18.4719	591.691	6.8026	14.2307	14.2307	14.2307
L	1138.94	933.037	15.7502	176.923	0.533303	14.2575	14.2347	14.2937
M	1062.8	801.821	11.1286	−29.6912	−1.77805	14.301	14.2554	14.3733
N	1150.68	795.94	12.1119	422.814	6.684	14.4599	14.4142	14.5322

Models: A: Random walk, B: Random walk with drift = 591.691, C: Constant mean = 6741.64, D: Exponential trend = exp(8.00346 + 0.122037 t), E: Simple moving average of 2 terms, F: Simple exponential smoothing with alpha = 0.9999, G: Brown's linear exp. smoothing with alpha = 0.5697, H: Holt's linear exp. smoothing with alpha = 0.2613 and beta = 0.2266, I: Brown's quadratic exp. smoothing with alpha = 0.3994, J: ARIMA(0,2,1), K: ARIMA(0,1,0), L: ARIMA(1,0,0), M: ARIMA(0,2,2), N: ARIMA(0,1,2)

The Table A5 summarizes the results of five tests run on the residuals to determine whether each model is adequate for the data. An OK means that the model passes the test. One * means that it fails at the 95% confidence level. Two *'s means that it fails at the 99% confidence level. Three *'s means that it fails at the 99.9% confidence level. Note that the currently selected model, model J, passes 5 tests. Since no tests are statistically significant at the 95% or higher confidence level, the current model is considered probably adequate for the data.

Table A5. The results of five tests run on the residuals

Model	RMSE	RUNS	RUNM	AUTO	MEAN	VAR
A	1230.73	+	+	+	+	+
B	1137.53	+	+	+	+	+
C	2655.09	+	*	*	***	+
D	1105.81	+	+	+	+	+
E	1524.25	+	+	+	+	+
F	1230.74	+	+	+	+	+
G	1217.52	+	+	+	+	+
H	1126.8	+	+	+	+	+
I	1291.7	+	+	+	+	+
J	1080.5	+	+	+	+	+
K	1230.73	+	+	+	+	+
L	1138.94	+	+	+	+	+
M	1062.8	+	+	+	+	+
N	1150.68	+	+	+	+	+

Key:

RMSE : Root Mean Squared Error
RUNS : Test for excessive runs up and down
RUNM : Test for excessive runs above and below median
AUTO : Box-Pierce test for excessive autocorrelation
MEAN : Test for difference in mean 1st half to 2nd half
VAR   : Test for difference in variance 1st half to 2nd half
+   : not significant (p >= 0.05)
*   : marginally significant (0.01 < p <= 0.05)
** : significant (0.001 < p <= 0.01)
***: highly significant (p <= 0.001)

Turkay YILDIZ. PhD in Supply Chain Systems and Logistics (Dokuz Eylul University) and MA in Logistics Management (Izmir University of Economics). Research fellow. Currently works at Izmir Institute of Technology. Research interests: business management, trade, global supply chain systems, global logistics, operations research.