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The Impact of the Logistic Sector on Competitiveness in the Presence of Structural Breaks: A Study on Turkey

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Abstract

The main aim of this paper, based on the importance of the logistics sector for economic growth and, accordingly, competitiveness, is to explain the impact of the logistics sector on competitiveness by testing its relationship with macroeconomic factors. In accordance with this aim, principally, some research literature has been given a place. A cointegration model with structural breaks has been used to analyze the effects of the logistics sector, exports, imports, the industry production index and oil prices on GDP, which is an indication of competitiveness. For two different pairs of structural breaks and the two cointegration relationships there is a mutual positive relationship between the logistics sector and the GDP. Along with this, while export, import and industrial production index affect the GDP, the finding that oil prices reduce the performance of the logistics sector has been reached.

Keywords: Logistics; Transportation; Competitiveness; International trade; Cointegration; Structural breaks.

1. Introduction

Currently, as a result of mounting competition, the manufacturing industry has become increasingly dependent on the service industry. The competitive superiority of companies operating in the manufacturing industry is now dependent on the success of the services corresponding to the product produced rather than the product itself. However, the factors that add value to most manufacturing are the planning, controlling, supplying and purchasing of processes and production. Being successful with respect to these factors requires an efficient service industry (Porter, 1990). Logistics services gain importance at that point and lead companies to increase their efficiency, decrease their production costs, and gain more competitiveness in the international markets.

The logistics sector is of strong importance to the national economy in terms of microeconomics and macroeconomics. The fact that service suppliers operating in the logistics sector are integrated into the operations of the serviced companies—for example, taking orders before production, controlling stocks, supplying raw material and production processes and fulfilling post production operations such as distribution, clearance, insuring and packing—helps them gain competitive superiority via speed and flexibility. Hence, the logistics sector is of strong importance with regard to companies operating in all industrial sectors. On the other hand, when considered in terms of the macroeconomic point of view, the logistics sector is one of the sectors that provides the most foreign currency inflow. The logistics sector, which is vital to international trade, is important to employment and creates added value to numerous sectors with operations components. Today, the logistics sector has become one of the main factors for a country to gain its competitive superiority.

When the utilization of land, labor and capital, which are the main production factors, is taken into account, it is observed that logistics services are related to elements such as inflation, interest rates and energy costs: the delivery of products from the production point to the consumption point is of strong importance to the gross national product of developed countries that have completed the industrialization process. These countries have been spending billions of dollars for transportation, warehouses, and storage services. Therefore, development of a company's logistics function encourages efficiency in the country and creates a positive impact by decreasing the costs of products and services, which is important to providing high standards of living, sovereign debt, par of exchange, international competitiveness, investment capital and economic growth. Consequently, effective and efficient implementation of logistics operations creates a macroeconomic impact. Strategies aimed at increasing logistics performance are important not only for companies but also for the social economic welfare and competitiveness of the country (Kujawa, 2003).

Due to the reasons mentioned, this study has aimed to test the long-run relationship between the logistics sector and macroeconomic factors in the presence of structural breaks and to show the impact of such on competitiveness. In this context, the size of the logistics sector in Turkey for the 1998-2011 period and macroeconomic factors, such as GDP *(Gross Domestic Produce)*, exports, imports, industrial production index and oil prices, have been used as variables.

The most important reason for writing this paper is that an insufficient number of studies have considered the relation between the logistics sector and macroeconomic factors as a whole in the foreign literature and in Turkey. When the foreign literature is examined, it is observed that the studies are aimed mainly at determining the effect of

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the logistics sector on the relationship between the development of the logistics sector and GDP or economic growth. The fact that any empirical study on the relationship between the competitiveness and the logistics sector has not been encountered in the literature was a primary motivation for writing this paper. By contributing to the literature, this study will hopefully be the starting point for empirical studies concentrating on the logistics sector in Turkey. Another dimension of the study's contribution to the literature is related to the econometric method used. In the various studies, cointegration analysis has generally been used. However, the fact that probable structural breaks in the time series have not been taken into account motivated the use of a different econometric method. From this point of view, by using the Johansen *et al.* (2000) approach, which makes it possible to analyze the structural breaks in the cointegration tests, the long-run elasticities of the model are estimated in the presence of structural breaks.

In what follows, primarily the concept of competitiveness is explained and by defining the logistics sector its relation with competitiveness is discussed. After giving information about the overall structure of the Turkish logistics sector, the literature related to the effects of the logistics sector on competitiveness is considered. Next, the econometric method is explained and empirical findings are presented. Finally, the study concludes with an evaluation of these findings and policy recommendations.

2. Theoretical Backround and Literature Review

There are many definitions made on competitiveness. According to the definition of the OECD the competitiveness is defined as " the degree of a country to be able to produce goods and services in accordance with the free-market conditions, along with this, of the citizens to be able to correct and increase their real incomes in the long term". The World Economic Forum defines the competitiveness as the ability to sustainably access to the high growth rates in per capita income of a country (Sala-I Martin, 2008).

When the volume of international trade is considered as an indicator of competitiveness in terms of the economies of the countries, the competitiveness relationship of the logistics sector appears more clearly. The competitiveness of the industrial sectors has been associated with increase of the export volume. But the realization of the export is not possible without the logistics activities. Besides, the supply of raw materials and semi-manufactured products that companies operating in the industrial sector realize from different countries is also been realized through logistics operations. (Çekerol and Kurnaz, 2011). The effectiveness of the logistics services means that the industrial companies and industrial sectors and consequently the country gain competitive power. The effectiveness of the logistics services means that the industrial companies and industrial sectors and consequently the country gain competitive power. Therefore, the logistics sector is a sector at the key position in achievement of the competitiveness at the level of both company, sector and the country.

Nowadays, as the result of increased competition, the manufacturing industry has become independent on the service sector at a gradually increasing rate. The competitive advantage of the companies operating in the manufacturing industry is now dependent on the success in the sectors related with the manufactured product rather than the manufactured product itself. As examples of services related with the product, delivery in time, distribution, and after-sales service can be mentioned. However, the factors that play a role in many companies creating added value can be expressed as planning the manufacturing and the process which is invisible, control, procurement, purchasing. Achieving success in these factors requires the effectiveness of the service sector (Porter, 1990). The logistics services gain importance at this point, causes the companies to increase their productivity, to reduce the production costs, and to achieve greater competitiveness in the international markets.

In recent years, the logistics sector, which has an important place in Turkey and in the world and creates one of the largest revenue items in countries' economies because of its direct relationship with foreign trade, has been affecting economic growth and competitive superiority. Yet, in spite of its importance, few studies consider the logistics sector. One of the most important reasons for this absence is the lack of data necessary for such empirical studies. As the current data are related to the types of transportation, the existing empirical studies are limited to the logistics sub-sector.

In the literature, there are few empirical studies that examine the economic impact of the logistics sector. The best of these studies are the ones evaluating the relationship between economic growth and the logistics sector. Liu, Liu *et al.* (2006) used two variables, namely, logistics and GDP, to analyze the relationship between the development of the logistics sector and growth in GDP. Traffic turnover data have been used because the data have not distinctly defined the logistics sector in China or, moreover, accounted for the fact that logistics in general includes transportation, storage, distribution and loading services. Transportation, however, accounts for an important share of these logistics services. According to the empirical evidence obtained by implying unit root and cointegration tests, econometric analyses have concluded that growth in the logistics sector has positively affected GDP and increased the growth rate between the years 1953 and 2004 (Liu *et al.*, 2006).

Wang and Wang (2010b) examined the correlation between direct foreign investments and GDP, and the impact of direct foreign investments on economic growth was discussed. Annual data and time series analyses were carried out for the 1998-2008 period. GDP was used as the dependent variable and foreign investments were used as an independent variable. As a result of the research, it was confirmed that direct investments in the logistics sector are related to economic growth (Wang and Wang, 2010a).

In a notable study, Ana Wang (2010) analyzed the relationship between logistics and regional economic growth. GDP was used as a dependent variable, and Cargo turnover was used as an independent variable. The data covered the 1990-2009 period. As a result, it was shown that there is a meaningful relationship between regional logistics operations and economic growth (Wang Ana, 2010). In her study, Shuang (2009) examined the relationship between the logistics sector in China and economic growth. In the study, GDP was the dependent variable. In the logistics

sector, five independent variables, namely, added value, employment, new fixed capital investments, load volume, and live load, were determined. As a result of the study, it was confirmed that all the independent variables have a positive effect on economic growth and that the largest effect was created by the added value of the logistics sector and load turnover (Liu Shuang, 2009).

Aibin *et al.* (2010) presented the relationship between the logistics sector in the Xuzhou region and economic growth between the years 2000 and 2009. GDP was used as the dependent variable, and load volume was used as the descriptor of the load capacity. Annual data were used. As a result of the study, it was expressed that there is a relationship between economic growth in the Xuzhou region and logistics.

A majority of the studies conducted in Europe and the U.S. analyze the correlation between economic growth and the transportation sector. For instance; Alises *et al.* (2014) studied the changes in the relationship between road tonne-kilometers and the gross domestic product (GDP) in the UK and Spain between 1999 and 2007. The purpose of the study was to compare and contrast the decoupling trends which had emerged in recent years. According to the study results, the demand for road transport was reduced in both countries when more services were offered in the framework of the GDP. In Spain, developments in logistics and supply chain management spurred changes in the intensity of road transport. These changes were not as successful as they were in the UK.

Brunel (2005) did another study on the correlation between economic growth and freight. This study divided the freight density on the roads into four factors. The data collected by a panel in Europe anticipated that these four factors would differentiate the levels of coupling and decoupling. The two factors of coupling are the increasing distance of transport and the increasing modal share of road transport. The two factors of decoupling are the decreasing share of industry in the GDP and the decreasing weight of industrial production. The findings of the study by Brunel (2005) are consistent with a majority of the results of similar studies.

Puertas *et al.* (2013) conducted a study to examine the effects of logistics performance on European Union (EU) exports between 2005 and 2010. The aim was to determine if there were any advances in the EU member states. The studies which used Heckman's model to make estimations of gravity models for all EU member states (26 countries) proved that logistics was more important in countries that were mainly export countries, rather than those that are mainly import. The results were the same in 2005 and 2010. These results raised interest in study's findings about the countries doing mainly export. Based on the components of the LPI, competence and tracking has recently become even more important. This goes hand-in-hand with the low domestic demand in Europe and the search for new international markets.

A review of the relevant research literature indicates that there are few empirical studies aimed at determining the economic impact of this sector. Ateş and Işık (2010) conducted one of these relevant studies. The study analyzed the effect of the improvement in logistics services on export led growth in Turkey. The study concluded that there was no correlation between the logistics sector and exportation in the short term. However, there was an indication of Granger causality relation between the logistics sector and export in the long term. Moreover, there was a two-way causality relationship between the revenue of the logistics sector and the production index of these industries. Thus, there was a Granger causality relationship between the logistics sector and export in the long term.

Önder and Kuzu (2014) analyzed the long-term correlation between the developments in the logistics sector and economic growth. In their study, they used these methods: Unit Root Test, Engle-Granger Cointegration Test and Granger Causality Test. The study used two variables: GDP (for economic growth) and Turnover Index of Transportation and Storage (for logistic development). The study findings indicated that the two variables were cointegrated. Moreover, there was a long-term Granger causality relationship between the developments in logistics and economic growth. They also found that economic growth had a major influence on the developments in the logistics sector. Eventually, there was another long-term Granger causality relationship between the logistics sector and economic growth.

3. Data and Methodology

In the study, the size of the logistics sector between the years 1998 and 2011 and GDP, exports, imports, and an industry production index have been used as macro factors, and oil prices have been used as the variable. The difficulty in obtaining data for the logistics sector has created adversity. The fact that the logistics sector is a newly emerging sector prevents the data about the sector from being well kept. When the literature is analyzed, it is observed that “transportation, storage and communication” data have been used to identify the sector. Thus, in this study, transportation, storage and communication data have been used as the proxy variables. Apart from this, various data such as employment and foreign investments identifying the logistics sectorare used, but long-term data have not been able to be reached.

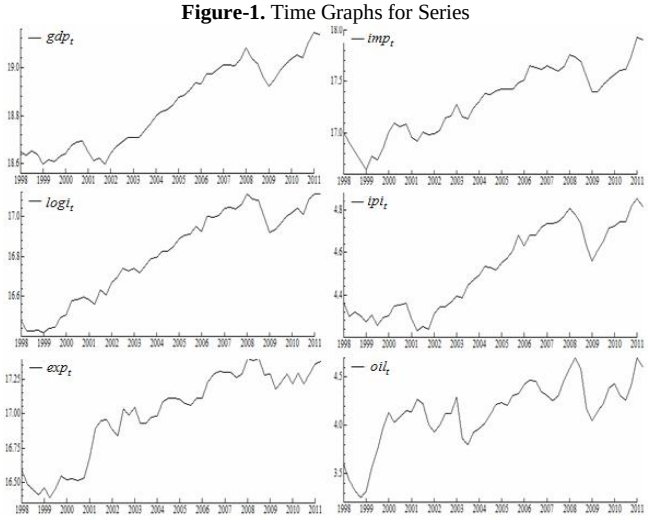
GDP is considered the most important macroeconomic indicator of both the country and competitiveness. It is thought that there is a correlation between GDP and the logistics sector. Yet, the parity is at least as important as the existence of the correlation. The politics, which will be applied for the improvement of the sector, can be determined according to the parity. Exports and imports are in a direct correlation with the logistics sector. As foreign trade companies constitute the source of demand, exports and imports have an important role in the improvement of the sector. Production activities in industry are important for the logistics sector. The efficiency of the logistics sector comes into prominence, particularly in supplying of raw materials and semi-products from foreign countries and integrating them into production. Thus, industry-production is included within the scope of the model. Oil prices are another variable in the scope of the model. The fact that the most important share belongs to transportation companies in the services submitted in the Turkish logistics sector makes us think that there is a correlation between petrol prices and improvement of the sector.

As there is no clear data about the size of the logistics sector, as Lean and Jinghi (2010) stated, "transportation, storage and communication" data representing the logistics sector have been used as proxy variable (Lean and Jinghi, 2010). Export and import data are added to model as FOB (Free On Board) value. In CIF (Cost, Insurance and Freight) value, freight and insurance costs are included. As freight costs are included in the data representing transportation, storing and communication, FOB value has been preferred, and the fact that the same values exist in the scope of two variables has been hampered.

GDP, transportation, storage and communication data from the Turkish Statistical Institute (TUIK) representing sector size and the industry production index have been used along with export (FOB) and import (FOB) data from the Central Bank of the Turkish Republic (TCMB) and oil prices from the (International Financial Statistics IFS, 2015). Quarterly data including the 1998:1 to the 2011:2 periods have been used. As the data representing the logistics sector start in 1998, the starting period of the time series has been determined to be 1998:1.

The base year is 2005. Fixed GDP is indicated by gdp_t ; the size of the logistics sector is indicated by $logi_t$; FOB export values are indicated by exp_t ; FOB import values are indicated by imp_t , the industry-production index is indicated by ipi_t ; and oil prices (barrel) are indicated by oil_t . All variables have been used in logarithmicform and seasonally adjusted. Figure 1 shows the time graphs for the series used in the study.

Figure-1. Time Graphs for Series



In this study, the Johansen *et al.* (2000) multivariate cointegration approach is considered in the long-run modeling of the economic impact of the logistics sector in Turkey with structural breaks. Yet, as is known, the implementation of the cointegration approach depends on the integration degrees being balanced. Accordingly, the determination of the integration degrees of the series, between which the cointegration relationship is searched, with the unit root test of them has become important. From this point on, the Johansen *et al.* (2000) approach is used to consider the possible structural breaks in the time series, and the Lee and Strazicich (2003) tests are used as the unit root test with multiple structural breaks.

Lee and Strazicich (2003) Minimum LM Unit Root Test with Two Structural Breaks, which implies trend stability in its alternative hypothesis and enables a non-stationarity null hypothesis to be tested in the presence of two structural breaks based on the LaGrange multipliers (LM) unit root test, was proposed by Schmidt and Phillips (1992). The Lee and Strazicich (LS) test, which considers Models A and C identified in Perron (1989), can be implemented in any Y_t variable by taking the following regression into account:

$$\Delta Y_t = d'\Delta Z_t + \phi\tilde{S}_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\tilde{S}_{t-i} + \eta_t \qquad t = 1,2,...,T \qquad (1)$$

where Z_t is an exogenous variables vector, $\tilde{S}_t = y_t - \tilde{\psi}_x - Z_t\tilde{\delta}$, $t = 2,...,T$ is a coefficient vector that has been obtained from the regression of $\tilde{\delta}$ ΔY_t over ΔZ_t , and $\tilde{\psi}_x$ shows the values obtained from $Y_1 - Z_1\tilde{\delta}$ to imply the first observations of Y_1 and Z_1 , Y_t and Z_t . The fact that $\Delta\tilde{S}_{t-i}$, which expresses lagged differences, is discussed is added to the model to overcome the serial correlation problem. Model A enables two level breaks, which are defined by $Z_t = [1, t, D_{1t}, D_{2t}]'$, where $D_{jt} = 1$ for $t \geq T_{Bj} + 1$, $j = 1,2$ and zero otherwise. T_{Bj} denotes the time period when a break occurs. Model C enables two levels and the occurrence of trend breaks, which can be defined as $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $DT_{jt} = t$ for $t \geq T_{Bj} + 1$, $j = 1,2$ and zero otherwise Here, nonstationarity can be tested by taking into account the t -ratio of ϕ , which is shown in equation(1). Denoting the break fractions as $\lambda_j = TB_j / T$, the LM test statistic can be defined as

$$\mathrm{LM} = \inf_{\lambda} \tilde{\tau}(\lambda). \quad (2)$$

For Models A and C, critical values are given in Lee and Strazicich (2003).

For the periods during which the time series of a long-run equilibrium relationship is searched are analyzed, Johansen *et al.* (2000) have developed an alternative cointegration test for the situations where they include one or two structural fractions. This approach is an alternative application of the cointegration analysis, which is based on the vector error correction model (VECM) developed by Johansen (1988) and Johansen and Juselius (1990).

Y_t is an endogenous variables vector of

$$Y_t = [gdp_t \quad logi_t \quad exp_t \quad imp_t \quad ipi_t \quad oil_t] \quad (3)$$

Given that Y_t is a p -dimensional vector of I(1) processes with r cointegrating relationships, the VECM model proposed by Johansen *et al.* (2000) can be defined as

$$\Delta Y_t = \alpha \begin{pmatrix} \beta \\ \gamma \end{pmatrix}' \begin{pmatrix} Y_{t-1} \\ tE_t \end{pmatrix} + \mu E_t + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \sum_{i=1}^{k} \sum_{j=2}^{q} \Psi_{j,i} D_{j,t-i} + \sum_{m=1}^{d} \Phi_m W_{m,t} + \varepsilon_t, \quad (4)$$

Where Δ is the first difference operator, k is lag length, $t = \ldots, -1, 0, 1, \ldots$ $E_t = [E_{1t} \quad E_{2t} \quad \ldots \quad E_{qt}]'$ is a vector of q dummy variables with $E_{j,t} = 1$ for $T_{j-1} + k \le t \le T_j \; (j = 1, \ldots, q)$ and zero otherwise. Where the first k observation of $E_{j,t}$ is effective, the subsample is set to zero. $D_{j,t\text{-}i} = 1$ is an indicator dummy variable for the i -th observation in the j -th period—that is, $D_{j,t\text{-}i} = 1$ if $t = T_{j\text{-}1+i}$ (j=2,...,q, t=...,-1,0,1,...) and zero otherwise. Intervention dummies, $W_{m,t} \; (m = 1, \ldots, d)$, are included to render the residuals well behaved, following Hendry and Mizon (1993). The β is the cointegrating vector and represents the long-run relationship. The α is a vector representing the speeds of adjustment toward the long-run equilibrium. $\gamma = [\gamma_1 \quad \gamma_2 \quad \ldots \quad \gamma_q]$ is a matrix of $(p \times q)$ dimensional long-run trend parameters. The short-run parameters are μ of order $(p \times q)$, Γ_i of order $(p \times p)$ for $i = 1, \ldots, k$, $\Psi_{j,i}$ of order $(q \times 1)$ for $j = 2, \ldots, q$ and $i = 1, \ldots, k$, and Φ_m of order $(q \times 1)$ for $m = 1, \ldots, d$. The innovations ε_t are assumed to be independently and identically distributed with zero mean and symmetric and positive definite variance-covariance matrix Ω—that is, $\varepsilon_t \sim iid(0, \Omega)$.

Equation (3), which is a linear trend model in which the trend and level of the cointegration relationship shows a difference from period to period, is called $H_l(r)$. The likelihood ratio test against the $H_l(p)$ alternative r cointegration relationship $H_l(r)$ hypothesis is

$$LR\{H_l(r) | H_l(p)\} = -T \sum_{i=r+1}^{p} \ln(1 - \hat{\lambda}_i) \quad (5)$$

where $\hat{\lambda}_i$ are squared sample canonical correlations and $1 \ge \hat{\lambda}_1 \ge \ldots \ge \hat{\lambda}_p \ge 0$.

In a cointegration relationship, there is no linear trend, but if only a breaking level exists, the model given in equation (3) can be transformed as in Johansen *et al.* (2000) and called $H_c(r)$ (Eryiğit and Karaman, 2010); (Çetin and Eryiğit, 2013). The critical values for either $H_l(r)$ and $H_c(r)$ models are derived from Γ - distribution as proposed in Johansen *et al.* (2000).

Given the cointegration rank, further restrictions on the VECM can be tested by likelihood ratio (LR) testing. Harris and Sollis (2003) discussed these restrictions within a standard framework. In this study, LR tests are extended with the models proposed by Johansen *et al.* (2000) as in Dawson and Sanjuan (2005) and Çetin and Eryiğit (2013).

Trying to model the economic variables and mutual interaction of the logistics sector for Turkey has created an expectation that there may be more than one cointegrating relationship between the variables. The realization of such a situation carries the problem of the simultaneous identification of long-run relationships. Pesaran and Shin (2002) defend the idea that the problem may be overcome by exactly identifying the simultaneous models. According to this defense, under the expectation of two cointegrating relationships, exact identification of simultaneous equations requires at least two linear restrictions to be placed per cointegrating vector.

In this case, in accordance with economic expectations, by placing linear restrictions, the exact identification of null hypothesis may be tested with the LR procedure. For example, for the $H_l(r)$ model, under the assumption that two cointegrative vectors exist in the presence of two levels and trend breaks, the long-run coefficient matrix is

$$\begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = \begin{bmatrix} \beta_{1,Y_1} & \beta_{1,Y_2} & \beta_{1,Y_3} & \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \beta_{2,Y_1} & \beta_{2,Y_2} & \beta_{2,Y_3} & \gamma_{21} & \gamma_{22} & \gamma_{23} \end{bmatrix} \quad (6)$$

By adding suitable linear restrictions to this long-run coefficient matrix, identification of the simultaneous relationships exactly and accurately brings the interpretation of the coefficients as the long-run elasticities (Johansen, 2005).

4. Empirical Result

The results of Lee and Strazicich (2003) unit root tests shown in Table 1. When Table 1 is analyzed, it is observed that all series are nonstationary at this level. This result is important for the next part of the analysis because the fact that all series are integrated at the first degree means that there is no imbalance problem for the cointegration tests in terms of the integration degrees of the variables.

Table-1. Lee and Strazicich (2003) Unit Root Test Results

Series	*Model*	*Lag*	*Break Periods*	λ	*t-statistics*	*5 % Critical Values value*
gdp_t	C	3	2003:2 2008:2	0.4 0.8	-5.34	-5.65*
$logi_t$	C	5	2001:1 2008:2	0.2 0.8	-5.46	-5.71
exp_t	C	5	2000:4 2008:4	0.2 0.8	-5.26	-5.71
imp_t	C	5	2001:1 2008:2	0.2 0.8	-5.43	-5.71
ipi_t	C	5	2003:2 2008:1	0.4 0.8	-5.45	-5.65
oil_t	C	1	2002:3 2008:2	0.4 0.8	-5.12	-5.65

* Critical Values were taken from Lee and Strazicich (2003)

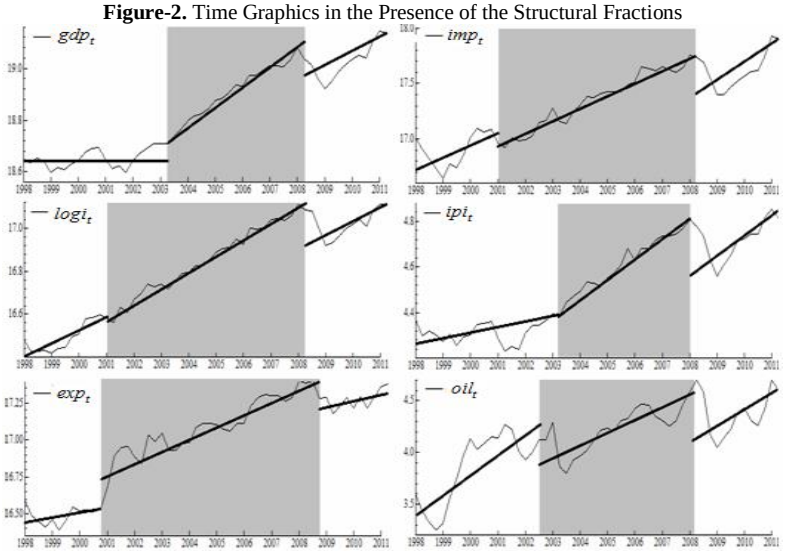
Figure 2 shows the time graphics with the structural breaks again. It is observed that structural fractions coincide with economic progress and crisis periods. As seen in Figure 2, although GDP has a fluctuating course, it has a positive trend with the structural break in 2003. It shows a descending slope but a positive trend with the fraction in 2008. When the condition of the logistics sector is considered, it shows a positive trend after 1998 and, with the structural break in 2001, a positive trend with a rising slope. Its slope descends with the structural break in 2008, but the positive trend seems to continue.

In exports, the positive trend, which continues until the structural break in 2001, is seen to have a rising slope with the break in that year. With the break in 2008, the slope descends, and the positive trend proceeds. When imports are analyzed, the positive trend continues until the break in 2011 and has a rising slope after the break in 2008.

The positive trend that continues with a rising slope until the break in 2003 continues after 2008 with a positive trend. In addition, the positive trend before the break in 2002 proceeds after the break with a descending slope until the break in 2008. With the break in 2008, a positive trend is seen. The structural break in 2002 may be considered to reflect the privatization of Petrol Ofisi and TÜPRAŞ (Turkish Petrolium Rafineries Co.) in the second quarter of 2002.

When considered in general, the structural breaks widely coincide with developments in the Turkish economy. As is known, there was a financial crisis originating from the banking sector in the last quarter of 2000. TCMB transferred liquidity to the banking system to ease the adverse effects of the crisis, and that excess liquidity flew abroad by means of capital accounts and led interest rates to increase gradually. As for the first quarter of 2001, annual accumulated interest increased to the 65% level, and the 2001 crisis, one of the largest crises in Turkey, occurred. After the 2001 crisis, the Transition to Strong Economy Program was implemented. In March 2003, economic stability measures were taken and began to be applied. Within this framework, with a rise in public revenue, a decrease in government expenditures was initiated and a savings plan was proposed (Göktaş, 2008).

Figure-2. Time Graphics in the Presence of the Structural Fractions



The 2008 crisis arising from the collapse ofthe U.S. real estate market, whose effects were felt worldwide, had a considerable impact from the first quarter of 2008 until the last quarter of 2008. The crisis was first felt in the form of market stagnation. The structural fraction in the industry-production index in the first quarter of 2008 shows this situation. The rise in the exchange rate followed the demand, loan costs rose, and an increase was observed in the current deficit. The rise in the exchange rate and the rise in loan costs led to debts of the real sector, which financed imports with foreign debt (Ümit, 2011). The cause of the structural breaks experienced in GDP, imports, the logistics sector and oil prices can be explained with these formatives. As for exports, a structural break may be observed in the last quarter. The main reason for this break may be explained bythe global nature of the crisis and shrinking demand in the EU countries, which held 64% percent of Turkish exports (Ergün and Gökdemir, 2010).

In consideration of these finding and the presence of the structural fractions, the cointegrations of Johansen *et al.* (2000) have become applicable. Table 2 shows the trace statistics for the 2001:1–2008:2 and 2003:2–2008:2 pairs of structural breaks. Here, because all structural breaks are level and a trend breaks, model $H_l(r)$ is preferred to model $H_c(r)$. In addition, for two different pairs of breaks, lag length has been determined as two (k=2).[1] Additionally, there is no misspecification problem in either model.[2]

Table-2. Johansen *et al.* (2000) Trace Statistics for Model $H_l(r)$

Pairs of Breaks	$H_0(H_1)$	*Model* $H_l(r)$
2001:1 – 2008:2	$r=0\,(r\geq 1)$	223.96 (179.36)
	$r=1\,(r\geq 2)$	155.41 (140.89)
	$r=2\,(r\geq 3)$	104.14 (106.42)
	$r=3\,(r\geq 4)$	67.68 (76.03)
	$r=4\,(r\geq 5)$	34.54 (49.49)
	$r=5\,(r\geq 6)$	15.17 (26.44)
2003:2 – 2008:2	$r=0\,(r\geq 1)$	215.95 (181.30)
	$r=1\,(r\geq 2)$	146.61 (143.05)
	$r=2\,(r\geq 3)$	98.10 (108.62)
	$r=3\,(r\geq 4)$	59.41 (78.09)
	$r=4\,(r\geq 5)$	27.59 (51.19)
	$r=5\,(r\geq 6)$	12.78 (27.18)

*, ** show significance levels of 1% and 5%, respectively.

When Table 3 is analyzed, it is seen that there are two cointegrating vectors in the system for both pairs of breaks. Accordingly, two long-run equations must beidentified. Yet, before the identification tests are applied, it is important to find the endogenous and exogenous variables with VECM restrictions tests.

[1]The minimum value of Akaike Information Criterion (AIC) was adopted to select the optimum laglength.
[2]Multivariate normality test statistics for skewness, kurtosis and joint are 0.33 (*p-value* =0.86), 0.01 (*p-value* = 0.93) and 1.34 (*p-value*=0.93), respectively, for the pair of breaks 2001:1–2008:2 and 0.14 (*p-value* =0.97), 0.28 (*p-value* = 0.60) and 0.85 *(p-value* = 0.97), respectively, for the pair of breaks 2003:2– 008:2. These results imply that both models are normally distributed.

Table-3. VECM Restrictions Test Statistics

Pairs of Breaks	*Nul Hypothesis*	H_0	LR *-statistics*
	Individual Exclusion		
2001:1-2008:2	gdp_t	$\beta_{gdp} = 0$	10.37 (0.01)*
	$\log i_t$	$\beta_{logi} = 0$	6.08 (0.04)
	exp_t	$\beta_{exp} = 0$	7.63 (0.02)
	imp_t	$\beta_{imp} = 0$	16.10 (0.00)
	ipi_t	$\beta_{ipi} = 0$	10.42 (0.01)
	oil_t	$\beta_{oil} = 0$	6.23 (0.04)
2003:2-2008:2	gdp_t	$\beta_{gdp} = 0$	7.18 (0.03)*
	$\log i_t$	$\beta_{logi} = 0$	11.10 (0.00)
	exp_t	$\beta_{exp} = 0$	9.02 (0.01)
	imp_t	$\beta_{imp} = 0$	7.72 (0.02)
	ipi_t	$\beta_{ipi} = 0$	6.26 (0.04)
	oil_t	$\beta_{oil} = 0$	8.80 (0.01)
	Weak Exogeneity		
2001:1-2008:2	gdp_t	$\alpha_{gdp} = 0$	9.57 (0.01)
	$\log i_t$	$\alpha_{logi} = 0$	19.14 (0.00)
	exp_t	$\alpha_{exp} = 0$	4.46 (0.11)
	imp_t	$\alpha_{imp} = 0$	5.72 (0.06)
	ipi_t	$\alpha_{ipi} = 0$	5.93 (0.05)
	oil_t	$\alpha_{oil} = 0$	2.86 (0.24)
2003:2-2008:2	gdp_t	$\alpha_{gdp} = 0$	6.36 (0.04)
	$\log i_t$	$\alpha_{logi} = 0$	21.96 (0.00)
	exp_t	$\alpha_{exp} = 0$	2.14 (0.34)
	imp_t	$\alpha_{imp} = 0$	5.67 (0.06)
	ipi_t	$\alpha_{ipi} = 0$	5.82 (0.05)
	oil_t	$\alpha_{oil} = 0$	5.64 (0.06)

Table 3, shows the exclusion and weak exogeneity test statistics. According to these statistics and in the presence of the 2001:1-2008:2 and 2003:2-2008:2 structural breaks, all variables exist in the cointegration space. In addition, for both pairs of breaks, the fact that GDP and logistics variables exist in the model endogenously is an interesting result. Therefore, it is correct to group the GDP and logistics variables on the left side of the equations.

As stated before, when two cointegrations are in a system, identification of the simultaneous equations will be possible only by using at least two restrictions per equation (Pesaran and Shin, 2002). To identify long-run relationships, the long-run coefficient matrix for $H_1(r)$, where two cointegrations and structural breaks are in the system, may be restated as follows:

$$\begin{bmatrix}\beta\\ \gamma\end{bmatrix}' = \begin{bmatrix}\beta_{1,gdp} & \beta_{1,logi} & \beta_{1,exp} & \beta_{1,imp} & \beta_{1,ipi} & \beta_{1,oil} & \gamma_{1,1} & \gamma_{1,2} & \gamma_{1,3}\\ \beta_{2,gdp} & \beta_{2,logi} & \beta_{2,exp} & \beta_{2,imp} & \beta_{2,ipi} & \beta_{2,oil} & \gamma_{2,1} & \gamma_{2,2} & \gamma_{2,3}\end{bmatrix}. \quad (7)$$

In this context, to identify the long-run relationships, a restriction matrix must be formed in line with the economic expectations, and its accuracy must be tested. The restriction matrix null hypothesis can be formed as follows:

$$\begin{bmatrix}\beta\\ \gamma\end{bmatrix}' = \begin{bmatrix}-1 & \beta_{1,logi} & \beta_{1,exp} & \beta_{1,imp} & \beta_{1,ipi} & 0 & \gamma_{1,1} & \gamma_{1,2} & \gamma_{1,3}\\ \beta_{2,gdp} & -1 & 0 & 0 & 0 & \beta_{2,oil} & \gamma_{2,1} & \gamma_{2,2} & \gamma_{2,3}\end{bmatrix}. \quad (8)$$

In a case where the restriction matrix given in the null hypothesis is identified correctly, and because all variables have been used in logarithmic form, the long-term coefficient estimations may be used as long-run elasticities (Johansen, 2005).

Table 4 and Table 5 show the long-run elasticities and short-run adjustment coefficients for the pairs of breaks in 2001:1–2008:2 and 2003:2–2008:2, respectively. In addition, for the null hypotheses, identification restrictions placed for both pairs of breaks are correct and cannot be rejected. Accordingly, it may be concluded that the restrictions under the economic expectations are correct.

Table 4, shows the identified equations for the 2001:1–2008:2 structural breaks. According to the first equation, a 1% increase in the logistics sector creates a 0.03% increase in GDP. On the other hand, a 1% increase in exports creates a 0.16% increase in GDP, a 1% surge in imports leads to a 0.27% increase in GDP and a 1% increase in the industrial-production index causes a 0.28% surge in GDP. According to the second equation, although a 1% increase in GDP leads to a 0.43% increase in the logistics sector, a 1% increase in oil prices creates a 0.05% decrease in the logistics sector. However, the short-run adjustment coefficients imply that long-run disequilibrium will disappear in approximately two quarters.

Table 5, shows the identified equations for the 2001:1–2008:2 structural breaks. In these, some results such as those in identified equations in the presence of the 2001:1–2008:2 structural breaks have been obtained. According to the first equation, a 1% increase in the logistics sector creates a 0.08% surge in GDP. On the other hand, a 1%

increase in exports causes a 0.13% increase in GDP, a 1% surge in imports creates a 0.24 % increase in GDP and a 1% increase in the industry production index causes a 0.43% increase in GDP. According to the second equation, a 1% increase in GDP creates 0.44 % increase in the logistics sector, and a 1% increase in oil prices leads to a 0.06% decrease in the logistics sector. On the other side, the short-run adjustment coefficients mean that long-run disequilibrium will disappear in two quarters, as is seen in the 2001:1–2008:2 structural breaks.

Table-4. Identified Long-run Coefficient Matrix for the 2001:1 - 2008:2 pair of breaks

Identified Equations	β_{gdp}	β_{logi}	β_{exp}	β_{imp}	β_{ipi}	β_{oil}	α_{gdp}	α_{logi}	γ_1	γ_2	γ_3	$\chi^2_{(2)}$
GDP	1	0.034	0.157	0.269	0.276	0	-0.572	-	-0.002	0.007	0.004	5.49 (p=0.06)
Logistics	0.434	1	0	0	0	-0.051	-	-0.552	0.019	0.010	0.013	

Table-5. Identified Long-run Coefficient Matrix for the 2003:2 – 2008:2 pair of breaks

Identified Equations	β_{gdp}	β_{logi}	β_{exp}	β_{imp}	β_{ipi}	β_{oil}	α_{gdp}	α_{logi}	γ_1	γ_2	γ_3	$\chi^2_{(2)}$
GDP	1	0.084	0.127	0.242	0.425	0	-0.541	-	-0.001	0.003	0.004	0.93 (p=0.63)
Logistics	0.437	1	0	0	0	-0.063	-	-0.571	0.015	0.016	0.019	

For the identified equation for the 2003:2–2008:2 structural breaks, the first of the two differences observed is the surge that the logistics sector created in GDP. The 0.03% surge in the identified equation for the first pair of breaks becomes 0.08% in the second pair of breaks. Another difference is the effect that the industry-production index had on GDP. Although, for the 2001:1–2008:2 structural breaks, the impact that the industry production index created on GDP was 0.28, it has been assumed to be 0.43% in identified equations for the 2003:2–2008:2 breaks.

In the equations determined for both of the structural break periods, it is seen that the elasticity value of the logistics sector for GDP is lower than the value of GDP elasticity for logistics. This situation can be explained with economic crisis periods indicated by structural breaks. Logistics sector is one of the sectors that is mostly affected by the consumption, production, employment contractions caused by the economic crises defined as "creating results that that the suddenly and unexpectedly occurring events will seriously shake the economy of the country from the macro-angle and the companies from the micro-angle (Aktan, 2001). The sector is being affected more quickly by the negativites experienced in the markets compared to the other sectors as of its structure. The volume of trade is one of the most important factors affecting the logistics sector of which demand structure is defined as "derivative demand" (Rodrigue, 2006).

5. Conclusion

The logistics sector has an increasingly important share in service sector and is one of the critical factors in competitiveness. In addition to determining the competitiveness of other sectors, the logistics sector is a segment with competitiveness. In the industry sector, particularly, competitiveness is associated with an increase in export volumes. Exports, on the other hand, remain weak without logistics activities. However, raw materials and semi-product that are provided from different countries by companies in the industry sector are realized only with the logistics sector. The strength of the logistics services implies the strength of industry companies and sectors and, correspondingly, a country's obtaining competitiveness. Therefore, the logistics sector is critical to obtaining competitiveness for companies, sectors and countries. The logistics sector, in a mutual correlation withall industry sectors, creates competitiveness both for itself and the industry sectors, which increases the competitiveness of a company.

The Turkish the logistics sector has great potential. Turkey and the other E7 countries of China, India, Russia, Brazil, Indonesia, and Mexico are considered to be countries with emerging economies over the next ten years. The Turkish logistics sector is ranked 27th in the 2012 Global Logistics Performance Index and 2nd relative to the other E7 countries, after China.

In the study where the impact of the logistics sector on competitiveness is researched, GDP data, transportation as a supplement of the logistics sector, storage and communication data, export figures, import figures, the industry-production index and oil prices have been determined to be relevant variables. In the model, whether the logistics sector in Turkey is cointegrated with the variables has been researched by means of the Johansen *et al.* (2000) cointegration test. Cointegration is useful for the linear combinations of nonstationary variables that are stationary in the long run. From this point of view, the fact that there is cointegration between variables means that there is a real long-run relationship between the variables.

According to the results of the study, a 1% increase in the logistics sector creates a 0.03% surge in GDP. On the other hand, a 1% increase in exports causes GDP to increase by 0.16%; a 1% percent surgein imports leads to a 0.27% increase in GDP and a 1% increase in the industry-production index creates a 0.26% increase in GDP. In addition, a 1% increase in GDP causes a 0.43% increase in the logistics sector, and a 1% increase in petrol prices causes a 0.05% decrease in the logistics sector. According to these findings, exports, industry production and imports affect GDP positively in the long run. In terms of the economy, the fact that exports and the industry production index affect GDP positively is significant, but the effect of imports on GDP may seem insignificant. It is possible to explain the impact of imports on GDP, which seem to be insignificant, with the term "import dependent export." Gradually rising imports causes exports to increase, and this interaction ends up increasing GDP. When it is thought that the ratio of exports to imports represents the competitiveness of the country, it may be concluded that the

competitiveness of Turkey in foreign markets and imports—particularly the dependence on imports—is significant relative to exports.

As a result of the study, to increase the average economic growth rate and grow the logistics sector, the growth capacity of exports and industry must increase, and a significant amount of imports is required to achieve this goal. Notably, with respect to the tax advantages in the third world, the term "inward processing," which enables raw materials and semi-products to be supplied on the condition that they will be processed and exported afterwards, may explain this dynamic. This customs regime, which is an important incentive element in Turkey, is widely used, and the necessary raw materials and semi-products for export are supplied at alower price. In this way, production and exports increase. At this point, in the case of imports being focused on exports, it could be stated that this circumstance triggers economic growth and the development of the logistics sector. However, in the long term, dependence on exports will decrease productivity in the industrial sectors. For this reason, it is necessary that economic policies should be applied to reduce the dependence of exports on imports, and main and sub-industrial firms should increase their collective skills by taking part in common research and development and innovation activities.

The geographical location of Turkey bears an important impact on both competitiveness and the logistics sector. Turkey, with the goal of being the production and transfer center of the Eurasian region, should implement policies to move the manufacturing industry toward creating greater value-added, being more capable of responding to external demands, using environmentally friendly technologies, reducing dependence on investment and intermediate goods on imports and sustaining competitiveness.

Oil prices have always had an important impact on the competitiveness of the economy and the logistics sector, and the spike in oil prices observed over the last several years has put pressure on the economy in general. A slight increase in oil prices increases the transportation costs in the foreign trade made with European countries, where road transportation is dominant. To reduce costs and realize quality and safe freight transportation by improving combined transport applications, implementation of policies aimed at increasing the shares of railway and maritime transport and beginning the corridor approach in planning transportation will play a great role in developing the logistics sector.

Consequently, there is a positive relationship between the logistics sector and the variables of GDP, and an increase (decrease) of one of these variables increases (decreases) the other. Although there is a reciprocal relationship between the logistics sector and GDP, GDP has greater impact on the logistics sector. According to this conclusion, with the increase in economic growth, it has become possible to state that the logistics sector in Turkey will experience growth as well.

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