

ECONOMICS IN CORPORATE FINANCE AND MANAGEMENT

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PREFACE

These texts, which emerged with a joint study, are trainings on both theoretical and practical education in the field of social sciences, economic and applied sciences and some other disciplines who are interested and educated in this subject. the joint work in question also plans to shed light on a current project plan.

Since our study emerges with the continuing education competence in different universities, we must work in order to pass to the literature.

Assoc. Prof. Dr. Mehmet DAG

Dr. Sahin AY

CHAPTER 1

COMPARISON OF MULTIPLE GROUP HIGH LEVERAGE POINTS DIAGNOSTICS FOR LOGISTIC REGRESSION MODELS

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INTRODUCTION

Suspicious observations are frequently encountered in logistic regression analysis. The basis of outlier, influential observation and high leverage point diagnostic measures developed to evaluate the model fit in logistic regression analysis is based on single or multiple logistic regression measures introduced to the literature since the 1970s (Hosmer & Lemeshow, 1980; Pregibon, 1981; Jennings, 1986; Copas, 1988; Imon & Hadi, 2008, 2013; Roy & Guri, 2008; Nurunnabi, Imon & Nasser, 2010; Syaiba & Habshah, 2010; Ahmad, Midi & Ramli, 2011; Sarkar, Midi & Rana, 2011; Ahmad, Ramli & Midi, 2012; Norazan, Sanizah & Habshah, 2012; Coskun & Alpu, 2019). However, the two most popular sources in both fields are Cook (1977) for linear regression and Pregibon (1981) for logistic regression.

High leverage points, one of the suspicious observations, are points that are far from the center of the x space. High leverage points are divided into good leverage points and bad leverage points. Good leverage points are those that are far from the majority of the data and contribute to parameter estimates (Habshah, Norazan & Imon, 2009). Bad leverage points are influential observations that are far from the majority of the data and have negative effects on parameter estimates.

The presence of high leverage points causes more problems in the logistic regression model (Syaiba & Habshah, 2010). Imon (2006) stated that high leverage points not only cause incorrect parameter estimates but also cause masking problems. Masking occurs when an

outlier cannot be identified, usually due to another nearby observation. Swamping occurs when good observations are incorrectly identified as outliers due to the presence of another observation subset that is usually located remotely (Rancel & Sierra, 1999).

Detection of high leverage points and diagnostic measures that depend on the leverage matrix has gained a wide range of usage in linear regression. The diversity of the studies in linear regression guides the methods that can be enhanced for logistic regression (Jennings, 1986). In logistic regression, as in linear regression, high leverage points can be commonly determined by graphical methods, diagonal elements of the leverage matrix, deviance components, MCD (minimum covariance determinants), and MVE (minimum volume ellipsoid) (Rousseeuw, 1984).

In the following part of the study, brief information about logistic regression is given. Chapter 2 discusses some diagnostic measures that are commonly used to identify high leverage points in the logistic regression model. In Chapter 3, each of the logistic regression diagnostic measures that have been developed based on the removal of multiple high leverage points from the dataset is compared with traditional diagnostic measures on either the original Brown dataset with two explanatory variables or the modified Brown datasets. In Chapter 4, a simulation study is performed with logistic regression models using various explanatory variables. For each model, the performance of diagnostic measures is considered by contaminating

one explanatory variable and all explanatory variables with specific contamination ratios. The results are interpreted in Chapter 5.

1. LOGISTIC REGRESSION

The multiple logistic regression model, written as,

$$E(Y|X) = \pi(X),$$

$$\pi(X) = P(Y = 1/X = x) = \frac{e^{\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k}}{1 + e^{\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k}} \quad (1)$$

satisfies the condition $0 \leq \pi(X) \leq 1$. The model is also indicated by Equation (2) (Ryan, 1997).

$$Y = \pi(X) + \varepsilon. \quad (2)$$

This form is represented by an S-shaped curve. The nonlinear logistic regression function can be linearized with the $\pi(X)$ logit transformation,

$$g(X) = \ln\left(\frac{\pi(x)}{1-\pi(x)}\right) = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k. \quad (3)$$

With the logit transformation, a linear function of the β parameters is obtained. The only assumption, the linearity of the relationship between the explanatory variables, is provided by this transformation. While the probability value varies between 0 and 1, according to x values, logit can take values between $-\infty$ and $+\infty$. The matrix representation is expressed by Equation (4),

$$g(X) = X\beta. \quad (4)$$

Here X is the $(n \times p)$ dimensional explanatory variable matrix with $p=k+1$. Y is an $n \times 1$ dimensional vector of binomial response variables

and $\beta' = (\beta_0, \beta_1, \dots, \beta_k)$ is the regression parameters vector. The error term for the logistic regression model in Equation (2),

$$\varepsilon = \begin{cases} 1 - \pi(x), & y = 1 \\ -\pi(x), & y = 0 \end{cases} \quad (5)$$

has a binomial distribution with zero mean and $\pi(x)[1-\pi(x)]$ variance (Nurunnabi et al., 2010). In linear regression, the residuals, $e_i = y_i - \hat{y}_i$ are the difference between the observed and the predicted value of the response variable for a given i th observation.

Although the maximum likelihood method, which is frequently used in the estimation of the parameters of a logistic regression model, has good optimality properties under ideal conditions, it is very sensitive to bad observation values (Pregibon, 1981; Salsas, Guillen & Alemany, 1999; Ahmad et al., 2011). For this reason, the importance of high leverage points and their diagnostic measures have been studied in detail for the logistic regression literature (Hosmer & Lemeshow, 1980; Imon, 2006; Syaiba & Habshah 2010; Norazan et al. 2012; Imon & Hadi, 2013). Recently, the distance from the mean (DM) measure has been used to identify high leverage points. Even if this method accurately identifies high leverage points, its main limitation is that it exposes some good leverage points to the swamping effect. According to Syaiba & Habshah (2010), the bad effect of high leverage points on parameter estimations in the logistic regression model makes the identification of high leverage points very important. They developed a new diagnostic measure to identify the high leverage points. For this measure, firstly suspicious observations

were identified with a robust approach. Then, the group deleted potential diagnostic measure was used to confirm. The performance of the proposed measure was evaluated with the datasets and simulation studies in the literature. This proposed diagnostic measure was named as robust logistic diagnostic (RLGD). The performance of the diagnostic measure was examined with the datasets and simulation studies in the literature.

According to Hosmer & Lemeshow (1980), the leverage measure in logistic regression contains a component that can make the high leverage points misleading and too small, and this situation creates a problem in the correct determination of the observations. Based on this idea, Imon & Hadi (2013) developed a multiple high leverage points determination method. The performance of the proposed method was evaluated over several well-known datasets and simulation studies.

Some measures used in the diagnosis of high leverage points for logistic regression are the diagonal elements of the leverage matrix (h_{ii}) and the DM. These diagnostics may be unsuccessful owing to the masking or swamping impacts if the dataset has more than one suspicious observation (Imon & Hadi, 2008; Syaiba & Habshah, 2010; Ahmad et al., 2011). The use of a regression model, and especially parameter estimates based on this model, requires that the model is compatible with the data. It is critical to diagnose these suspicious observations.

2. DIAGNOSTICS OF HIGH LEVERAGE POINTS

Leverage is only a concept related to the explanatory variable. High leverage points can be considered as outliers in the x-direction. High leverage points in the x-direction in logistic regression can be good or bad leverage points. Good leverage points are located further away from the rest of the sample in the x space but lie almost along the regression line, passing through the other points of the sample. Good leverage points are not effective in estimating the regression coefficients, but undoubtedly, they have a large impact on summary statistics such as R^2 and the standard error of the regression coefficients. However, bad leverage points cause serious problems in inferential statistics (Norazan et al., 2012).

According to Croux, Flandre & Haesbroeck (2002), the most dangerous outliers, called bad leverage points, are observations that are both misclassified and inconsistent with other observation points in the x-direction. Good leverage points arise when the probability value of $P(Y = 1 / x_i)$ for $y=1$ is large, while bad leverage points arise when the probability value of $P(Y = 1/x_i)$ for $y=0$ is small (Ahmad, Ramli, & Midi, 2010).

2.1. Diagnostics for a Single High Leverage Point in Logistic Regression

2.1.1. Leverage matrix

The main diagonal of the leverage matrix developed based on the distances of each x explanatory variable value from the mean in linear regression is used for diagnosing of high leverage points. The leverage

matrix provides the basis for outliers, high leverage points, and influential observation diagnostic measures in both linear and logistic regression (Hosmer, Lemeshow & Sturdivant, 2013). Pregibon (1981) describes the leverage matrix for logistic regression as,

$$H = V^{1/2}X(X^T VX)^{-1}X^T V^{1/2} . \quad (6)$$

Here k is the number of the explanatory variable, while $p=k+1$, X is the $(n \times p)$ dimensional explanatory variable matrix. V is defined as a diagonal matrix with diagonal elements in Equation (7),

$$V(y_i|x_i) = v_i = \hat{\pi}_i(1 - \hat{\pi}_i). \quad (7)$$

With the similarity approach to linear regression, Pregibon (1981) showed that logistic regression residuals can be defined as,

$$\hat{\epsilon}_i = y_i - \hat{\pi}_i \approx (1 - h_{ii})y_i \quad i = 1, 2, \dots, n. \quad (8)$$

Thus, h_{ii} is defined as in Equation (9),

$$h_{ii} = \hat{\pi}_i (1 - \hat{\pi}_i)x_i^T (X^T VX)^{-1}x_i = v_i \cdot b_i \quad (9)$$

Based on the similarity approach in Equation (8) for logistic regression. Where b_i ,

$$b_i = x_i^T (X^T VX)^{-1}x_i \quad (10)$$

is expressed by Equation (10), while h_{ii} , is the main diagonal of the leverage matrix, and $\hat{\pi}_i$, is the response variable estimation values (Imon & Hadi, 2008).

The suggested threshold value for the leverage matrix in logistic regression is shown as,

$$c^*p/n. \tag{11}$$

in Equation (11) (Hoaglin & Welsch, 1978; Belsley, Kuh & Welsch, 1980). Here k is the number of explanatory variables, $p=k+1$ and c is a constant value such as 2 or 3.

2.1.2. Distance from the mean -DM

The leverage matrix described by Pregibon (1981) is a very popular diagnostic measure for logistic regression as well as for linear regression. According to Imon & Hadi (2013), observations with a large h_{ii} value that are known as high leverage points also have disadvantages. The leverage value for linear regression is a monotonically increasing function of the distance of the explanatory variable values from the mean. However, Hosmer & Lemeshow (1980) pointed out that the extreme points in the variable space may not necessarily be high leverage points if their weights are very small.

When the i th leverage value is defined as in Equation (9) for the logistic regression model, it is seen that the b_i quantity, which creates an increase with the distance from the mean, may become very small when the $\hat{\pi}_i$ value is very close to zero. This makes the method for determining the high leverage point over the size of h_{ii} in logistic regression rather useless (Imon & Hadi, 2013).

Regarding this situation, Hosmer & Lemeshow (1980) suggested considering b_i if only distance measurement is concerned, but a diagnostic measure depending on these quantities was not suggested. Imon (2006) proposed the use of b_i in determining the high leverage

points in his study (Syaiba & Habshah, 2010). Also, he stated that it is difficult to form a theoretical distribution of b_i but that a threshold value of the confidence interval type will not cause any problems. Since the threshold measure in Equation (13) depends on the median distances from the mean, b_i is named as the diagnostic measure DM. DM is expressed as, (in Equation 12)

$$DM = b_i = x_i^T (X^T V X)^{-1} x_i. \quad (12)$$

The recommended threshold value measure for DM is expressed as (Imon & Hadi, 2013),

$$DM > Median(b_i) + 3MAD(b_i). \quad (13)$$

2.2. Diagnostics for Multiple High Leverage Points in Logistic Regression

2.2.1. Deletion distance from the mean-DDM

DDM is a generalized version of the diagnostic measure DM (Equation 12), calculated by deleting a single observation from the dataset, and proposed by Imon and Hadi (2013) for the diagnosis of multiple high leverage points in logistic regression.

In the method proposed by Hadi & Imon (2008) for determining multiple leverage points, the dataset is divided into two groups, like the calculation of the GSPR (Generalized Standardized Pearson Residuals) diagnostic measure (Hadi & Imon, 2008). It is assumed that d observations from n observation sets are removed from the dataset before estimating the model. The remaining $(n-d)$ observations in the dataset are indicated by R, and suspicious observations deleted

from the dataset are indicated by D. The representations of the X, Y, V matrices, whose last row is the D observation set, are as in Equation (14).

$$\mathbf{X} = \begin{bmatrix} X_R \\ X_D \end{bmatrix} \quad \mathbf{Y} = \begin{bmatrix} Y_R \\ Y_D \end{bmatrix} \quad \mathbf{V} = \begin{bmatrix} V_R & 0 \\ 0 & V_D \end{bmatrix} \quad (14)$$

When an observation group denoted by D is removed from the dataset, the parameter estimate is denoted by $\hat{\boldsymbol{\beta}}_{(-D)}$. Thus, the estimation values for the logistic regression model are calculated using Equation (15).

$$\widehat{\pi}_{i(-D)} = \frac{\exp(\mathbf{x}_i' \hat{\boldsymbol{\beta}}_{(-D)})}{1 + \exp(\mathbf{x}_i' \hat{\boldsymbol{\beta}}_{(-D)})} \quad i = 1, 2, \dots, n \quad (15)$$

By removing the D observation group from the dataset, variances $v_{i(-D)}$ and leverage values $h_{ii(-D)}$ are obtained from Equation (16) and Equation (17), respectively.

$$v_{i(-D)} = \hat{\pi}_{i(-D)}(1 - \hat{\pi}_{i(-D)}) \quad (16)$$

$$h_{ii(-D)} = \hat{\pi}_{i(-D)}(1 - \hat{\pi}_{i(-D)}) \mathbf{x}_i^T (\mathbf{X}_R^T \mathbf{V}_R \mathbf{X}_R)^{-1} \mathbf{x}_i \quad (17)$$

Using the results obtained from these calculations, as well as a linear regression-like approach, DDM is calculated for all data with Equation (18) after the deletion of a suspicious observations group.

$$DDM = b_{i(-D)} = \mathbf{x}_i^T (\mathbf{X}_R^T \mathbf{V}_R \mathbf{X}_R)^{-1} \mathbf{x}_i, \quad i = 1, 2, \dots, n. \quad (18)$$

Here $b_{i(-D)}$ is the i th diagonal element of the $\mathbf{X}(\mathbf{X}_R^T \mathbf{V}_R \mathbf{X}_R)^{-1} \mathbf{X}^T$ matrix. The threshold value measure for DDM is proposed as,

$$\text{Median}(b_{i(-D)}) + 3MAD(b_{i(-D)}) \quad (19)$$

in Equation (19). Observations satisfying the $DDM > Median(b_{i(-D)}) + 3MAD(b_{i(-D)})$ condition are high leverage points. Since this rule is based on the median of deletion distances from the mean, the DDM diagnostic measure is also called MDDM (Imon & Hadi, 2013).

2.2.2. Robust deviance component-RobDEVC

Norazan et al. (2012) proposed a measure (named RobDEVC) for diagnosing bad leverage points. Depending on the idea that the maximum likelihood estimator is not robust against outliers, the proposed RobDEVC diagnostic measure is a developed version of the DEVC (Ahmad et al., 2011) diagnostic measure based on the robust deviance component.

For the RobDEVC method, a robust initial estimate is first obtained using the Mallows estimator. Probability values are calculated with Equation (20) by using $\hat{\beta}^{rob}$ coefficient estimates.

$$\hat{\pi}_i^{rob} = \frac{\exp(x_i^T \hat{\beta}^{rob})}{1 + \exp(x_i^T \hat{\beta}^{rob})}. \quad (20)$$

Thus, the robust DEVC diagnostic measure, RobDEVC, is expressed by Equation (21),

$$RobDEVC = rdc_i = \begin{cases} 2 \log \left(\frac{1}{1 - \hat{\pi}_i^{rob}} \right), & y_i = 0 \\ 2 \log \left(\frac{1}{\hat{\pi}_i^{rob}} \right), & y_i = 1 \end{cases}. \quad (21)$$

The threshold value for the RobDEVC diagnostic measure is proposed as in Equation (22), like the DEVC diagnostic measure.

$$\text{Median}(rdc_i) + 3MAD(rdc_i) \quad (22)$$

In the case of $\text{RobDEV}C > \text{Median}(rdc_i) + 3MAD(rdc_i)$, the i th observation is defined as the bad leverage point (Norazan et al., 2012).

3. REAL DATA EXAMPLE

In this section, logistic regression diagnostic measures developed depending on the exclusion of more than one suspicious observation from the dataset are each compared with traditional diagnostic measures using the original Brown dataset or modified Brown datasets.

In the original Brown (1980) cancer dataset, which is frequently used in the diagnosis of suspicious observations in logistic regression, a value of $y=0$ for the response variable LNI (lymph node involvement) indicates that the patient has lymph node involvement, and a value of $y=1$ indicates that no lymph node involvement is experienced. The original dataset consists of five explanatory variables, two continuous (AP-blood acid phosphate level and AGE-patient's age), and three categorical (X-ray, Stage, and Grade). The original dataset contains only one questionable observation (24th observation) (Norazan et al., 2012).

In the study, the performance of the bad leverage point diagnostic measure RobDEV C was evaluated on the original Brown dataset. The response variable LNI and the continuous explanatory variables AP and AGE were used for this diagnostic measure. The dataset is given in Brown's (1980) study.

The Brown dataset, modified by Imon & Hadi (2013), similar to Imon & Hadi (2008), was used to evaluate the performance of the DDM diagnostic measure.

3.1. Results of DDM for Brown data

The DDM multiple high leverage point diagnostic measure was compared with h_{ii} and DM diagnostic measures over Imon and Hadi's (2013) modified Brown dataset. Analysis results are given in Table 1.

Table 1: Comparison of DDM with h_{ii} and DM high leverage point diagnostics on the modified Brown dataset of Imon and Hadi (2013)

Threshold	0.067	0.149	0.579		0.067	0.149	0.579
Index	h_{ii}	DM	DDM	Index	h_{ii}	DM	DDM
1	0.025004	0.105746	0.234489	31	0.022219	0.094874	0.150888
2	0.021873	0.093528	0.142081	32	0.020909	0.089801	0.120366
3	0.024144	0.102381	0.206682	33	0.025004	0.105746	0.234489
4	0.023336	0.099223	0.182012	34	0.023733	0.100776	0.193955
5	0.024144	0.102381	0.206682	35	0.024568	0.104037	0.220194
6	0.024568	0.104037	0.220194	36	0.025004	0.105746	0.234489
7	0.025916	0.109318	0.265432	37	0.019801	0.085557	0.102391
8	0.020060	0.086540	0.105708	38	0.018885	0.087616	0.584617
9	0.021873	0.093528	0.142081	39	0.017556	0.077489	0.130616
10	0.022219	0.094874	0.150888	40	0.017809	0.081445	0.410242
11	0.020060	0.086540	0.105708	41	0.019101	0.082918	0.097142
12	0.018178	0.079556	0.104077	42	0.017169	0.076875	0.213852
13	0.019322	0.083746	0.098108	43	0.017228	0.076716	0.176757

14	0.018892	0.082142	0.096961	44	0.017556	0.077489	0.130616
15	0.025454	0.107506	0.249569	45	0.018338	0.080125	0.101122
16	0.024568	0.104037	0.220194	46	0.01739	0.077024	0.146720
17	0.024144	0.102381	0.206682	47	0.018338	0.080125	0.101122
18	0.017390	0.077024	0.146720	48	0.018892	0.082142	0.096961
19	0.017178	0.076770	0.200703	49	0.017197	0.076717	0.188338
20	0.018208	0.083779	0.480269	50	0.018892	0.082142	0.096961
21	0.023336	0.099223	0.182012	51	0.018030	0.079039	0.107817
22	0.017657	0.077798	0.123740	52	0.017296	0.078175	0.291358
23	0.018362	0.084660	0.505180	53	0.026141	0.128047	1.474170
24	0.062830	0.365112	5.767958	54	0.072696	0.440551	7.060192
25	0.030607	0.153700	1.978118	55	0.088441	0.573708	9.307004
26	0.017197	0.076717	0.188338	56	0.104372	0.727586	11.867466
27	0.028967	0.121279	0.377081	57	0.119988	0.902186	14.741577
28	0.024144	0.102381	0.206682	58	0.134869	1.097507	17.929339
29	0.024144	0.102381	0.206682	59	0.148678	1.313550	21.430750
30	0.028967	0.121279	0.377081	60	0.161159	1.550315	25.245810

When the values in the first column of Table 1 are examined, it is seen that the diagnostic measure h_{ii} has diagnosed observations 54, 55, 56, 57, 58, 59, and 60 for the threshold value of 0.067 and has failed to diagnose the other three observations (24, 25, 53). When the DM column is examined for the threshold value (Equation 14) suggested by Imon (2006) for DM, it was found that this diagnostic measure correctly diagnosed 9 observations (24, 25, 54, 55, 56, 57, 58, 59, 60), whereas it was observed that it could not identify the 53rd high

leverage point. This diagnostic measure was found to be successful in diagnosing all high leverage points (24, 25, 53, 54, 55, 56, 57, 58, 59, 60) in the dataset for the threshold value for DDM (Equation 20) for the calculated value of 0.579. However, DDM also identified the 38th observation as the high leverage point.

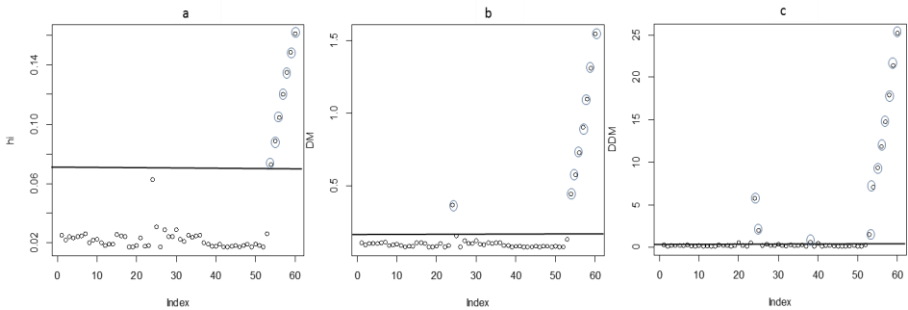


Figure 1: Index plots for (a) h_{ii} , (b) DM, and (c) DDM high leverage point diagnostic measures

In the study where Imon & Hadi (2013) proposed the DDM diagnostic measure, DDM did not diagnose the 38th observation as the high leverage point for the threshold 0.579. The DDM value obtained for only the 38th observation in this study is different from the DDM value obtained by Imon & Hadi (2013) for this observation.

3.2. Results of RobDEVC measure for Brown data

The analysis results of the comparison of the RobDEVC bad leverage point diagnostic measure with the DEVC and DR diagnostic measures over the original Brown dataset with two continuous explanatory

variables are given in Table 2. There is only one outlier in this dataset. This point is also a bad leverage point (Norazan et al., 2012).

Table 2: Comparison of RobDEVC, DR, and DEVC diagnostic measures over the original Brown (1980) dataset with two explanatory variables

Threshold	± 2	3.11	3.469		± 2	3.11	3.469
Index	DR	DEVC	RobDEVC	Index	DR	DEVC	RobDEVC
1	-0.674069	0.454369	0.321125	29	-0.72225	0.521643	0.383022
2	-0.691865	0.478676	0.407530	30	-0.67345	0.453540	0.264196
3	-0.687070	0.472065	0.349046	31	-1.00226	1.004517	0.793645
4	-0.891798	0.795303	0.595771	32	-0.74796	0.559441	0.503986
5	-0.835733	0.698450	0.503592	33	1.58237	2.503898	3.146964
6	-0.789317	0.623022	0.441820	34	1.52797	2.334703	2.857005
7	-0.678175	0.459921	0.309538	35	1.75040	3.063907	3.654070
8	-0.887556	0.787756	0.736661	36	-0.69124	0.477808	0.336533
9	1.304034	1.700505	2.039493	37	-0.91637	0.839746	0.797868
10	-1.070052	1.145012	0.898730	38	-1.20784	1.458874	2.555553
11	-0.867026	0.751734	0.705890	39	-1.16301	1.352582	1.575048
12	-1.003864	1.007744	1.108827	40	-1.00628	1.012599	1.742578
13	-1.111661	1.235791	1.182158	41	-1.07407	1.153626	1.132629
14	1.627886	2.650013	2.537138	42	1.41337	1.997629	1.454483
15	-0.650935	0.423717	0.293757	43	1.07646	1.158756	0.904098
16	-0.974105	0.948881	0.659444	44	1.36404	1.860610	1.569094
17	-0.876138	0.767618	0.550664	45	1.05753	1.118362	1.095540
18	-1.018521	1.037384	1.303488	46	1.24623	1.553080	1.271123
19	-1.251354	1.565887	2.008884	47	1.08048	1.167447	1.139040
20	-1.292979	1.671795	2.661952	48	1.62789	2.650013	2.537138

21	-0.682922	0.466382	0.361983	49	1.38216	1.910372	1.443045
22	0.928116	0.861399	1.047976	50	1.374457	1.889131	1.862330
23	1.126944	1.270003	0.672562	51	1.18031	1.393134	1.287691
24	-1.942022	3.771449	9.312856	52	1.34071	1.797502	1.187190
25	0.861899	0.742870	0.159239	53	1.09778	1.205120	0.341194
26	1.209319	1.462453	1.108895				
27	-0.656633	0.431167	0.251895				
28	-0.777516	0.604531	0.439625				

When the DR column is examined in Table 2, it is seen that this diagnostic measure fails to identify the suspicious observation in the dataset for the ± 2 threshold value (Christensen, 1997). The nonrobust version of the RobDEVC diagnostic measure, DEVC, identified this suspicious observation for the 3.11 threshold. The RobDEVC diagnostic measure, using the robust Mallows estimator for the estimation of beta coefficients, identified the 24th observation and also the 35th observation. The results of these diagnostic measures are given graphically in Figure 2.

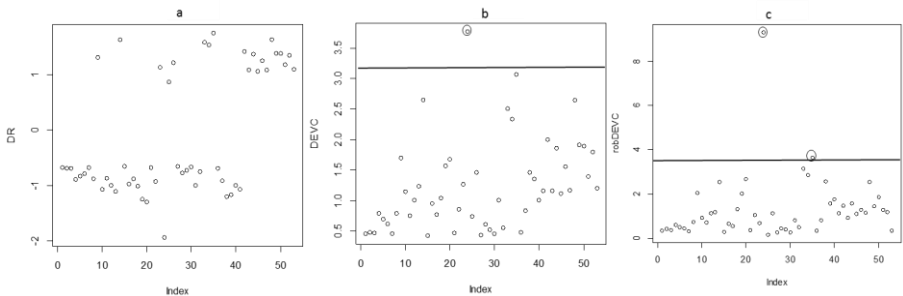


Figure 2: Index plots for (a) deviance residuals (DR), (b) DEVC, and (c) RobDEVC diagnostic measures

The expected situation here is that the RobDEVC diagnostic measure will only diagnose the 24th observation. Norazan et al. (2012) performed their analysis on the same dataset with the S-Plus program to see if the RobDEVC diagnostic measure was successful. In the R software used in our study, the threshold value for the RobDEVC diagnostic measure is calculated smaller due to the difference in the calculation of Mallows estimators. Therefore, the RobDEVC diagnostic measure is considered to also diagnose the 35th observation as a bad leverage point.

4. SIMULATION STUDY

The datasets for the simulation are of different sample sizes ($n=20, 30, 50, 100,$ and 1000), and the values of the explanatory variables in the logistic regression model are generated from the normal distribution $N(0,1)$. The values of the regression coefficients in the model were fixed as $\beta_0 = 1$ and $\beta_1 = 2$ for a single explanatory variable model. The response values were generated to perform Equation (23) by obtaining probability values $\pi(x) = \frac{e^{\beta_0 + \beta_1 x}}{1 + e^{\beta_0 + \beta_1 x}}$ (Norazan, Sanizah & Habshah, 2012; Kordzakhia, Mishra & Reiersolmoen, 2001).

$$y_i = \begin{cases} \beta_0 + \beta_1 x_1 + \dots + \beta_k x_k + \varepsilon_i < 0 & \text{ise } 0 \\ \beta_0 + \beta_1 x_1 + \dots + \beta_k x_k + \varepsilon_i \geq 0 & \text{ise } 1 \end{cases} \quad i = 1, 2, \dots, n \quad (23)$$

For different contaminated sample sizes, the contamination ratios were taken as 10%, 20%, and 30%. It is ensured that the set of values to be contaminated according to the contamination ratio is randomly generated in such a way that they are in a different order in each generated sample. The explanatory variables were contaminated to

$+4\sigma$ for mild leverage points, and $+7\sigma$ for extreme leverage points. For each combination of sample size and contamination ratio, 1000 repetitions were performed. The simulation studies were carried out for various explanatory variables. The performance of diagnostics was first considered by contaminating one explanatory variable, and then contaminating all explanatory variables in each model.

In the RobDEVC diagnostic measure simulation, the Norazan et al. (2012) simulation scenario was used. The explanatory variable values for the logistic regression model used in the analysis are generated from the normal distribution $x_i \sim N(0,1)$, and the error terms $\varepsilon_i \sim \Lambda(0,1)$ are generated from the logistic distribution. For the single explanatory variable logistic regression model, $\beta_0 = 1$ and $\beta_1 = 2$ were fixed for two explanatory variable models, $\beta_0 = 1, \beta_1 = 2, \beta_2 = 2$; and for five explanatory variable models, $\beta_0 = 1, \beta_1 = 2, \beta_2 = 2, \beta_3 = 2, \beta_4 = 2, \beta_5 = 2$ were fixed. The response variable values were derived by using Equation (23) (See Coskun, 2017).

The high leverage points in the dataset are generated from the $U(5,7)$ uniform distribution. To make a bad leverage point, the response variable values for these observations were changed to $y=0$ (Norazan et al., 2012).

The study by Ahmad et al. (2011) was used to determine sample sizes and contamination ratios for RobDEVC. For this diagnostic measure, different sample sizes were determined as $n=40, 60, 80, 100, \text{ and } 200$. Ahmad et al. (2011) used the contamination ratios as 5%, 10%, and 15% for different contaminated sample sizes. However, in this

simulation, a contamination ratio of 20% was also included to examine how the simulation results behaved at higher contamination ratios. The simulation studies were carried out for one, two, and five explanatory variables.

4.1. Simulation results in which a single explanatory variable is contaminated

4.1.1. The results of DDM with a single contaminated explanatory variable

The simulation results obtained in the case of extreme suspicious observations in the dataset for different sample sizes and contamination ratios are given in Table 3. The simulation results obtained in the case of mild suspicious observations are given in Table 4.

Table 3: The DDM results of a single explanatory variable contaminated with extreme leverage points

		Single explanatory variable		Two explanatory variables		Five explanatory variables	
Sample size	CR (%)	CIR	SR	CIR	SR	CIR	SR
20	10	1	0.097940	1	0.066889	0.99450000	0.055444
	20	1	0.056063	0.998250	0.034813	0.9907500	0.031937
	30	1	0.021143	0.993167	0.015643	0.96883333	0.013143
30	10	1	0.092741	1	0.067185	0.99666667	0.051629

	20	1	0.051000	0.997500	0.033917	0.98866667	0.027333
	30	1	0.020000	0.991667	0.011286	0.961888889	0.009095
50	10	1	0.089778	0.999800	0.061311	0.99720000	0.045955
	20	1	0.046600	0.999800	0.031050	0.986600	0.023025
	30	1	0.018143	0.996733	0.010514	0.957066667	0.007371
100	10	1	0.083578	1	0.058022	0.99630000	0.048755
	20	1	0.045275	0.999850	0.030600	0.9877500	0.023837
	30	1	0.016071	0.999100	0.010086	0.951966667	0.006743
1000	10	1	0.082534	1	0.055776	0.99758000	0.052295
	20	1	0.042743	0.999980	0.027799	0.99066000	0.026558
	30	1	0.013891	0.999763	0.008647	0.957473333	0.008286

CR: contamination ratio; **CIR:** correct identification ratio; **SR:** swamping ratio.

Considering Table 3, the correct identification ratio of DDM is 1 for all sample sizes and different contamination ratios. The swamping ratio for DDM decreases as the contamination ratio increases for all sample sizes. It has been seen that the swamping ratio is almost the same for each combination of sample size and contamination ratio.

When the findings for one explanatory variable are compared with the findings for two and five explanatory variables, it is seen that the correct identification ratio and the swamping ratio of DDM decrease as the number of explanatory variables increases.

Table 4: The DDM results of a single explanatory variable contaminated with mild leverage points

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
20	10	0.989500	0.097944	0.940500	0.066944	0.814000	0.056389
	20	0.972250	0.056250	0.886750	0.035313	0.755750	0.033062
	30	0.927667	0.021286	0.800833	0.016214	0.630167	0.014714
30	10	0.990333	0.092889	0.941000	0.067481	0.779000	0.052185
	20	0.979000	0.051000	0.880667	0.034375	0.676333	0.028875
	30	0.935667	0.020190	0.770000	0.011952	0.541222	0.010095
50	10	0.992400	0.089778	0.931400	0.061489	0.740400	0.046667
	20	0.979500	0.046625	0.887700	0.031575	0.630700	0.024675
	30	0.947733	0.018200	0.766267	0.011057	0.465000	0.009343
100	10	0.991700	0.083578	0.939500	0.058178	0.724700	0.049800
	20	0.984050	0.045313	0.888400	0.030988	0.601050	0.025975
	30	0.952333	0.016186	0.779800	0.010629	0.424833	0.009257
1000	10	0.993790	0.082556	0.944660	0.055914	0.696160	0.053538
	20	0.985240	0.042801	0.896475	0.028109	0.575790	0.029252
	30	0.957977	0.013983	0.783447	0.009094	0.422423	0.011950

Considering Table 4, for each combination of sample size and contamination ratio, the correct identification ratio of DDM increases

as the sample size increases and decreases as the contamination ratio increases.

Comparing the results for the single explanatory variable model to other models, it is observed that all ratios of the DDM decrease as the number of explanatory variables increases.

When the simulation results in Table 3 and Table 4 are compared, it is seen that DDM performs better in single explanatory variable models when there are extreme suspicious observations.

4.1.2. The results of RobDEVC with a single contaminated explanatory variable

The simulation results regarding the performance of the RobDEVC diagnostic measure in the presence of extreme suspicious observations in the dataset are given in Table 5. The simulation results regarding the performance of RobDEVC in the presence of mild suspicious observations in the dataset are given in Table 6.

Table 5: The RobDEVC results of a single explanatory variable contaminated with extreme leverage points

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
40	5	1	0.086263	0.976500	0.080868	0.743000	0.178526
	10	1	0.048000	0.655250	0.049917	0.396000	0.161222
	15	0.986667	0.086941	0.279167	0.048471	0.236333	0.164206

	20	0.540000	0.154875	0.099500	0.068813	0.150875	0.180812
60	5	1	0.076070	0.979667	0.065807	0.670000	0.137105
	10	1	0.033704	0.625833	0.040037	0.293167	0.131204
	15	0.993111	0.083176	0.198667	0.040255	0.157111	0.141353
	20	0.510000	0.170625	0.058167	0.057042	0.103417	0.162333
80	5	1	0.070118	0.990500	0.057013	0.642000	0.126526
	10	1	0.026069	0.608125	0.033542	0.261875	0.124014
	15	0.996000	0.083500	0.158417	0.038059	0.133000	0.130441
	20	0.492625	0.183000	0.052500	0.056094	0.086437	0.152391
100	5	1	0.067800	0.990600	0.053032	0.630200	0.119253
	10	1	0.024833	0.595300	0.031811	0.248500	0.115600
	15	0.997133	0.069082	0.142667	0.035047	0.128800	0.128553
	20	0.496900	0.196938	0.040550	0.053913	0.080300	0.144325
200	5	1	0.060984	0.996500	0.047542	0.606500	0.105405
	10	1	0.016750	0.552200	0.026439	0.229900	0.100783
	15	0.999966	0.056347	0.118400	0.032076	0.116300	0.113565
	20	0.530125	0.225038	0.030025	0.048994	0.069625	0.130650

Examining Table 6, when there are extreme suspicious observations in the dataset, the correct identification ratio of the RobDEVC for the single explanatory variable model increases as the sample size increases at contamination ratios of 5%, 10%, and 15%. RobDEVC performs worse when compared to other contamination ratios in a contamination ratio of 20% for all sample sizes.

Furthermore, it is also seen that the correct identification ratio of RobDEVC decreases as the number of explanatory variables increases.

Table 6: The RobDEVC results of a single explanatory variable contaminated with mild leverage points

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
40	5	1	0.048053	0.885000	0.058868	0.705500	0.164026
	10	0.979250	0.075972	0.375750	0.041806	0.362750	0.135417
	15	0.702500	0.168235	0.109167	0.047971	0.201167	0.138206
	20	0.024000	0.160813	0.034375	0.063531	0.122375	0.146812
60	5	0.999667	0.038649	0.870000	0.049754	0.671667	0.125632
	10	0.985000	0.064444	0.344167	0.035537	0.303000	0.109056
	15	0.740333	0.182255	0.082222	0.037843	0.165222	0.110529
	20	0.010583	0.173646	0.028000	0.050813	0.094833	0.122021
80	5	0.999500	0.031421	0.880000	0.043434	0.662000	0.116316
	10	0.991125	0.058069	0.323000	0.029417	0.298875	0.099500
	15	0.776000	0.198162	0.076750	0.035721	0.148667	0.100044
	20	0.003188	0.162922	0.028188	0.049813	0.092625	0.115000
100	5	0.999800	0.027895	0.885600	0.040358	0.660000	0.107705
	10	0.992600	0.057489	0.314600	0.028578	0.288200	0.092178
	15	0.823333	0.206753	0.070600	0.033259	0.150267	0.095623

	20	0.002850	0.167475	0.023200	0.045163	0.087200	0.105450
200	5	0.999500	0.022426	0.883100	0.036721	0.650600	0.092458
	10	0.994850	0.031100	0.312950	0.023456	0.287150	0.076589
	15	0.861267	0.227918	0.070967	0.028741	0.139567	0.082665
	20	0.000300	0.174706	0.020600	0.039638	0.079050	0.093812

In Table 6, when RobDEVC simulation findings for one explanatory variable model are examined in the case of mild suspicious observations in the dataset, it is seen that the correct identification ratio takes approximately 1 at a contamination ratio of 5% for all sample sizes. As the contamination ratio increases for all sample sizes, the correct identification ratio of RobDEVC decreases, and the swamping ratio increases.

Compared to the two and five explanatory variable models, we observe that the correct identification ratio of RobDEVC decreases for all sample sizes and contamination ratios when the number of explanatory variables increases.

RobDEVC indicates the best performance for a single explanatory variable logistic regression in the presence of mild suspicious observations.

4.2. Simulation results with all explanatory variables contaminated

4.2.1. The results of DDM with all contaminated explanatory variables

The simulation results are given in Table 7 when there are extreme suspicious observations in the dataset, and the simulation results are given in Table 8 when there are mild suspicious observations.

Table 7: The DDM results of all explanatory variables contaminated with extreme leverage points

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
20	10	1	0.097940	1	0.066889	1	0.055444
	20	1	0.056063	1	0.034812	1	0.031937
	30	1	0.021143	0.999000	0.015643	1	0.013143
30	10	1	0.092741	1	0.067185	1	0.051629
	20	1	0.051000	1	0.033917	1	0.027333
	30	1	0.020000	1	0.011286	1	0.009095
50	10	1	0.089778	1	0.061311	1	0.045956
	20	1	0.046600	1	0.031050	1	0.023025
	30	1	0.018143	1	0.010514	1	0.007371
100	10	1	0.083578	1	0.058022	1	0.048756
	20	1	0.045275	1	0.030600	1	0.023837
	30	1	0.016071	1	0.010086	1	0.006743

1000	10	1	0.082534	1	0.055776	1	0.052294
	20	1	0.042743	1	0.027798	1	0.026559
	30	1	0.013891	1	0.008647	1	0.008284

Considering Table 7, for each logistic regression model, DDM diagnoses almost all the suspicious observations in the dataset, that is, the correct identification ratio is 1. When one, two, and five explanatory variable models are compared, it is seen that the swamping ratio decreases as the number of explanatory variables increases.

Table 8: The DDM results of all explanatory variables contaminated with mild leverage points

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
20	10	0.989500	0.097944	0.999500	0.066889	1	0.055444
	20	0.972250	0.056250	0.996750	0.034812	1	0.031937
	30	0.927667	0.021286	0.987667	0.015643	0.999333	0.013143
30	10	0.990333	0.092889	0.999667	0.067185	1	0.051629
	20	0.979000	0.051000	0.998833	0.033917	1	0.027333
	30	0.935667	0.020190	0.994333	0.011286	0.999778	0.009095
50	10	0.992400	0.089778	1	0.061311	1	0.045956
	20	0.979500	0.046625	0.999700	0.031050	1	0.023025
	30	0.947733	0.018200	0.998200	0.010514	1	0.007371
100	10	0.991700	0.083578	1	0.058022	1	0.048756

	20	0.984050	0.045313	0.999800	0.030600	1	0.023837
	30	0.952333	0.016186	0.999000	0.010086	1	0.006742
1000	10	0.993790	0.082556	0.999960	0.055776	1	0.052294
	20	0.985240	0.042801	0.999835	0.027800	1	0.026558
	30	0.957977	0.013983	0.999260	0.008647	1	0.008284

According to Table 8, when there are mildly suspicious observations in the dataset, the correct identification ratio of DDM increases as the sample size increases, and decreases as the contamination ratio increases, for all combinations.

Additionally, it is observed that as the number of explanatory variables increases, the correct identification ratio of DDM increases, and the swamping ratio decreases. In case all variables are contaminated with mild suspicious observations, the DDM for five explanatory variable models provides the best performance.

When the simulation results in Table 7 and Table 8 are compared, it is seen that DDM performs better when there are extreme suspicious observations in the dataset.

4.2.2. The results of RobDEVC with all contaminated explanatory variables

The simulation results of the RobDEVC are given in Table 9 for extreme suspicious observations in the dataset. The simulation results regarding the performance of RobDEVC in the presence of mild suspicious observations are given in Table 10.

Table 9: The RobDEVc results of all explanatory variables contaminated with extreme suspicious observations

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
40	5	1	0.086263	0.998000	0.118868	0.830000	0.193868
	10	1	0.048000	0.997500	0.061861	0.851750	0.150306
	15	0.986667	0.086941	0.954000	0.041970	0.839167	0.105029
	20	0.540000	0.154875	0.712750	0.034156	0.768375	0.067344
60	5	1	0.076070	1	0.110719	0.978000	0.187368
	10	1	0.033704	1	0.048129	0.988833	0.135944
	15	0.993111	0.083176	0.979111	0.023274	0.965778	0.075529
	20	0.510000	0.170625	0.721500	0.030812	0.862917	0.045604
80	5	1	0.070118	1	0.098658	0.997000	0.180776
	10	1	0.026069	1	0.039083	0.998875	0.104986
	15	0.996000	0.083500	0.988167	0.020485	0.985000	0.056426
	20	0.492625	0.183000	0.72956250	0.025609	0.882437	0.025370
100	5	1	0.067800	1	0.094084	1	0.170811
	10	1	0.024833	1	0.035089	1	0.085878
	15	0.997133	0.069082	0.994667	0.013047	0.989933	0.038223
	20	0.496900	0.196938	0.722050	0.030087	0.87895	0.015750
200	5	1	0.060984	1	0.091989	1	0.144132
	10	1	0.016750	1	0.027039	1	0.053406
	15	0.999966	0.056347	0.999533	0.005570	0.999967	0.013323
	20	0.530125	0.225038	0.726875	0.022118	0.949675	0.002412

According to Table 9, the correct identification ratio of RobDEVc for each combination of sample size, and contamination ratios of 5%, 10%, and 15% in all models, increases as the sample size increases, and decreases as the contamination ratio increases.

Increasing the number of explanatory variables, the correct identification ratio of this diagnostic measure decreases for contamination ratios of 5%, 10%, and 15%, and its correct identification ratio increases for contamination ratios of 20%. The swamping ratio increases by increasing the number of explanatory variables.

Table 10: The RobDEVC results of all explanatory variables contaminated with mild suspicious observations

Sample size	CR (%)	Single explanatory variable		Two explanatory variables		Five explanatory variables	
		CIR	SR	CIR	SR	CIR	SR
40	5	1	0.048053	0.999500	0.036158	0.986500	0.072605
	10	0.979250	0.075972	0.899500	0.038861	0.699500	0.040389
	15	0.702500	0.168235	0.294000	0.055353	0.339333	0.032647
	20	0.024000	0.160813	0.025875	0.078781	0.153875	0.040968
60	5	0.999667	0.038649	1	0.025789	0.999333	0.031982
	10	0.985000	0.064444	0.929167	0.034185	0.631833	0.017629
	15	0.740333	0.182255	0.260000	0.049196	0.118111	0.020725
	20	0.010583	0.173646	0.011833	0.084625	0.034250	0.036146
80	5	0.999500	0.031421	1	0.020776	0.999500	0.018724
	10	0.991125	0.058069	0.947000	0.022986	0.577750	0.010583
	15	0.776000	0.198162	0.239500	0.060985	0.061333	0.019529
	20	0.003188	0.162922	0.005250	0.087468	0.007937	0.029812
100	5	0.999800	0.027895	1	0.017863	1	0.013978
	10	0.992600	0.057489	0.962300	0.022611	0.565800	0.008067

	15	0.823333	0.206753	0.242667	0.060671	0.034333	0.016941
	20	0.002850	0.167475	0.000950	0.087087	0.002200	0.026012
200	5	0.999500	0.022426	1	0.015374	1	0.006305
	10	0.994850	0.031100	0.992150	0.013550	0.681350	0.003494
	15	0.861267	0.227918	0.271100	0.072812	0.005400	0.014112
	20	0.000300	0.174706	0	0.097231	0	0.011994

Evaluating Table 10, the correct identification ratio of RobDEVc for sample size $n=40$ is the highest in a single explanatory variable model.

5. CONCLUSION

The DDM diagnostic was compared with the single suspicious observation diagnostics h_{ii} and DM on the modified Brown dataset of Imon & Hadi (2013). The h_{ii} and DM diagnostic measures did not diagnose all high leverage points in the dataset, and furthermore, the DM diagnostic measure identified more observations than the h_{ii} diagnostic measure. DDM identified all suspicious observations in the dataset but also swamped one observation. Imon & Hadi (2013) show in their study that the DDM diagnostic measure diagnoses all observations. However, although the results obtained using the Imon & Hadi (2013) dataset in the study are all the same, the DDM value for the observation that is stated to be swamped differs from the value obtained in this study.

The performance of the RobDEVc diagnostic measure was compared with the DR and the multiple outlier diagnostic measure DEVc on the original Brown dataset (1980) with two explanatory variables. We

observed that the DEVC diagnostic measure identified the suspicious observation in the dataset, while the DR suggested for the identification of one suspicious observation could not diagnose this observation. The RobDEVC diagnostic measure identified this observation and swamped one observation as well. The results obtained in the study by Norazan et al. (2012) are different from the results obtained in the study. In this study, it was concluded that the DR and DEVC diagnostic measures could not diagnose the suspicious observation, while RobDEVC correctly diagnosed it. In the study by Norazan et al. (2012), the threshold value for this diagnostic measure is not the same, although the same values are obtained. For this reason, Norazan et al. (2012) concluded that the DEVC failed to correctly diagnose the suspicious observation. The observations diagnosed for RobDEVC are similar, but not identical, to the results obtained in this study. This is due to the difference between the results obtained from the S-Plus statistical software and the R program.

According to the DDM simulation results, the correct identification ratio of this diagnostic measure in the single explanatory variable model takes a value of 1 for each combination of sample size and contamination ratio. The swamping ratio of DDM decreases as the contamination ratio increases in all sample sizes. When increasing the number of explanatory variables, the correct identification ratio and swamping ratio of DDM decrease. The DDM diagnostic measure performs better in single-explanatory models when there are extremely bad leverage points in the dataset.

According to the findings, in the case of all explanatory variables contaminated with extremely suspicious observations, the DDM diagnostic measure for each logistic regression model diagnoses almost all of the suspicious observations. When increasing the number of explanatory variables, the swamping ratio of DDM decreases. DDM performs best when all explanatory variables are contaminated with extreme suspicious observations. Imon & Hadi (2013) also compared DDM with h_i and DM in their simulation study, and concluded that DDM outperformed other diagnostic measures by diagnosing all suspicious observations.

According to the simulation results in which only one explanatory variable is contaminated, the correct identification ratio of RobDEVC increases as the sample size increases at 5%, 10%, and 15% contamination ratios. For a contamination ratio of 20%, this diagnostic measure performs poorly across all sample sizes. In case the number of explanatory variables increases, the correct identification ratio of RobDEVC decreases, and the swamping ratio increases. This diagnostic measure performs best when all explanatory variables are contaminated with extreme suspicious observations, although it gives similar results when all explanatory variables are contaminated. According to Norazan et al. (2012), this diagnostic measure can also identify good leverage points and outliers in the dataset.

For one contaminated explanatory variable, when the results of DDM and RobDEVC are compared, both diagnostic measures perform better in the case of extreme suspicious observations in the dataset and

model with a single explanatory variable. RobDEVC correctly diagnoses data at certain contamination ratios, while DDM also shows success at higher contamination ratios. The swamping ratio of the DDM is also lower than that of RobDEVC.

For all contaminated explanatory variables, when comparing DDM and RobDEVC, both diagnostic measures show the best performance in the case of extreme suspicious observations in the dataset. Increasing the number of explanatory variables, the correct identification ratio of DDM increases, and the swamping ratio decreases. However, when increasing the number of explanatory variables of RobDEVC, its correct identification ratio decreases, and its swamping ratio increases. In the case of extreme suspicious observations in the dataset, the correct identification ratio of the DDM takes the value of 1 for almost all combinations of sample size and contamination ratio.

When the simulation results are evaluated in general according to certain sample sizes and contamination ratio combinations, the diagnostic measures developed to identify a single bad leverage point fail when there are multiple high leverage points in the dataset. Therefore, in any case, it is more appropriate to use multiple diagnostic measures for high leverage point diagnosis in the dataset.

The success of each high leverage point measure to identify these points differs in accordance with factors such as mild or extreme suspicious observations, the contamination ratio, the number of explanatory variables, and sample size.

Although there is no generally accepted high leverage point diagnostic measure in the literature, it is not sufficient to examine the suspicious observations in the dataset with one of the high leverage point diagnostic measures alone. Based on sample size and contamination ratio, researchers are advised to use more than one of the high leverage point diagnostic measures.

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CHAPTER 2

INVESTIGATING THE NEXUS TOURISM RECEIPT AND EXCHANGE RATE FOR TURKEY: NEW EVIDENCE FROM FOURIER COINTEGRATION TEST

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INTRODUCTION

Tourism, which has a labor-intensive structure, is one of the largest and fastest-growing sectors in the world (Wamboye et al. 2020). The tourism sector is important for many economies of the world, as it positively affects economic growth and employment (Shah and Zaman, 2014: 29). Tourism encourages economic growth and development with its positive effects on the new job and employment opportunities and tax revenues (Tang, 2011: 2). In addition, tourism receipts are accepted as an alternative form of export as an invisible export item. Tourism activities constitute approximately 40 percent of all service production globally (Dincer et al., 2015). Tourism's foreign exchange earnings reduce the current account deficit and provide external balance (Mahmoudinia et al., 2011: 130; Belloumi, 2010: 550). In this context, countries implement policies to increase tourism receipts to benefit more from the positive effects of tourism. One of the most important policies to be considered in the increase of tourism receipts is the policies regarding the real exchange rate. An increase in the real exchange rate is expected to increase the country's tourism receipts, while a decrease in the real exchange rate is expected to have the opposite effect. Therefore, regardless of the exchange rate system applied, the effects of changes in the exchange rate on tourism receipts are an issue that attracts the attention of policymakers (Öncel et al., 2016: 125).

This study aims to examine the relationship between real exchange rate and tourism receipts theoretically and empirically for Turkey. Unlike other studies in the literature, this study used Fourier-based unit root and cointegration tests, which can reveal slow structural changes in economic variables. There are various reasons for choosing Turkey as the country to be analyzed. There are many reasons for analyzing Turkey. First of all, Turkey is the fifth country in the world according to the number of tourists and the eleventh country in terms of tourism income (WTO, 2020). In addition, the fact that Turkey has an important current account deficit problem and tourism receipts are an important source for reducing Turkey's current account deficit is another reason. The last reason is that Turkey's geopolitical location, nature, and historical and cultural background are important attractions for various tourist groups (Akay et al., 2017: 67). The plan for the rest of the work is as follows. The second section presents the theoretical framework for the relationship between the real exchange rate and tourism receipts. The third chapter presents the applied studies in the related field. The fourth chapter gives the framework for the application of the study and the results of the application. The last section is about the results of the study.

1. THEORETICAL FRAMEWORK

Tourism contributes to international trade in two ways. First, business travelers contribute to the growth of domestic and local market economies with their expenditures. Secondly, tourists and visitors coming to a country for vacation contribute to the economy (Dincer et

al., 2015). All kinds of expenditures made by the tourists coming to the country constitute the tourism income of that country. The tourists' expenditures increase the demand for foreign currency in their own countries and the supply of foreign currency in the countries they visit. Thus, tourists can affect exchange rates through foreign exchange supply and demand.

In addition to the impact of the tourism sector on exchange rates, changes in exchange rates also impact tourism receipts. The increase in exchange rates has a decisive role in the receipts obtained from the tourism sector depending on the international relative pricing of touristic goods and services (Karadağ and Bağcı, 2019). The decision about which country tourists will go to is directly affected by the exchange rate between the home country and the destination country. Changes in exchange rates affect the number of tourists visiting a country and their spending habits and length of stay. Since the depreciation of the local currency against other currencies will make tourism in international destinations more expensive, it decreases tourist expenditures; increases travel budgets and shortens the average length of stay. In other words, there is a decrease in the departure of domestic residents out of the country for touristic purposes (Shah and Zaman, 2014: 37). Tourists traveling from a country where the local currency depreciates will spend more for those making travel arrangements. Tourists coming to a country where the national currency depreciates will spend less on foreign currency, and the country's tourism trade balance will deteriorate immediately after the depreciation. Finally, in a country where the local currency depreciates,

the tourist exit of the residents will decrease, and the number of tourists coming to the country will increase. The decrease in the touristic outflow will lead to a decrease in the foreign exchange demand, and the increase in the tourist entry will lead to an increase in the foreign exchange supply, which will positively affect the trade balance (Dogru et al., 2019: 13). In summary, changes in the exchange rate have an impact on tourism by affecting consumer behavior. The relationship between tourism and exchange rates is since the depreciation (appreciation) of the local currency makes travel cheaper (expensive) for foreign visitors (Irاندوست, 2019).

2. APPLIED LITERATURE

Tourism is a sector with high added value due to its positive contributions to the economy. Socher (1986), Hazari and Ng (1993), Hazari (1995), Hazari and Nowak (2003), and Hazari and Sgro (2004) evaluate tourism as a traded service within the framework of international trade theory (Cheng et al. 2013: 884). International tourism is an important source of income for many countries. Many economic, social, technological, demographic, and environmental factors affect tourism receipts. Since this study deals with the effect of the real exchange rate, which is one of the economic factors affecting tourism receipts, on tourism receipts, this subsection summarizes the applied studies in the relevant field (see Table 1).

Table 1: Some Studies Examining the nexus Tourism Receipts and Exchange Rate

Author(s)	Countries/ Period	Methodology	Conclusion
Arslan and Çetiner (2020)	Turkey 2008-2019	Johansen cointegration test, Impact-response analysis	REER \uparrow →TR \uparrow
Irاندoust (2019)	European Countries 1995-2016	Hidden cointegration analysis	Depreciation and appreciation in the real exchange rate affect tourism demand differently in terms of signs and dimensions.
Öncel et al. (2016)	Turkey 2003-2015	Johansen cointegration test, Toda-Yamamoto test	REER \uparrow →TR \uparrow
Şen and Şit (2015)	Turkey 2000-2012	Frequency Distribution, Toda-Yamamoto, Bootstrap-based Toda-Yamamoto tests	REER \leftrightarrow TR
Shah and Zaman (2014)	Oman 1995-2001	Engle-Granger cointegration test, ARDL	TR \leftrightarrow GDP REER→TR REER - GDP
Cheng et al. (2013)	USA 1973-2010	VAR analysis	REER \uparrow →TR \uparrow
Mahmoudinia et al. (2011)	17 MENA countries 1995-2007	Panel cointegration test	TR \leftrightarrow GDP REER→TR REER→GDP
Tang (2011)	Malaysia 1974-2009	ARDL, VECM	REER→TR REER→GDP

Belloumi (2010)	Tunisia 1970-2007	Johansen co-integration test, VECM	TR→GDP
Dristakis et al. (2004)	Greece 1960:Q1- 2000:Q4	VAR analysis, Granger causality test	REER→TR GDP→REER

3. METHODOLOGICAL CONSTRUCTION

This study examines the relationship between tourism receipts and real exchange rates for Turkey in the 1989-2019 period. The series used in the analysis are data obtained from the Association of Turkish Travel Agencies (TURSAB), the World Bank's World Development Indicators (WDI), and the Bruegel Data Base. GDP deflator has been used in the realization of the nominal tourism receipts data. All analyzed variables are in logarithmic transformation.

3.1. Unit Root Test and Results

The first stage of the empirical application is the Fourier ADF unit root tests developed by Enders and Lee (2012) to determine the stationarity levels of the variables of real exchange rate and tourism income. Equation (1) shows the model estimated for the Fourier ADF test (Enders and Lee, 2012: 196).

$$y_t = \alpha_0 + \sum_{k=1}^n \alpha_k \sin(2\pi kt/T) + \sum_{k=1}^n \beta_k \cos(2\pi kt/T) + \rho y_{t-1} + \gamma t + \varepsilon_t \quad (1)$$

As in the ADF test, the null hypothesis in the Fourier ADF test indicates that the variable contains a unit root. The significance of trigonometric terms is important in this test. If the trigonometric terms are not significant, it is interpreted that the structural changes are not effective, and in this case, it is more appropriate to use the ADF test instead of the Fourier ADF test. Table 2 shows the unit root test results.

Table 2: Fourier ADF and ADF Unit Root Test Results

Variables	Freq.	Min SSR	Optimal lag	F-ADF	F(k)	ADF- test stat.	ADF (Prob)
lnTR	0,7	0.5130	7	-1.6539	0.4436
lnREER	0.6	0.1272	7	-2.7638	11.9245	-1.7999	0.3734
Δ lnTR	3.6	0,7148	1	-5.8421	0.0000
Δ lnREER	1,1	0.2121	5	-6.4170	11.1991	-7.0859	0.0000

Note: The critical values used to test the significance of trigonometric terms are 10.35, 7.58, and 6.35 for the 1%, 5%, and 10% significance levels, respectively. The critical values for F-ADF test statistics are -4.42, -3.81,-3.49 for 1%, 5% and 10% significance levels, respectively.

Since the trigonometric terms related to the tourism receipts data in Table 2 are not significant, the ADF test results are valid instead of the Fourier ADF test. However, for the real exchange rate variable, the trigonometric terms are significant. The FADF and ADF test results in Table 2 show that the tourism receipts and the real exchange rate series contain unit roots and are stationary when the first difference is taken. Omay (2015) stated that if the frequency number is fractional, the structural change is permanent. While Omay (2015) allowed the number of frequencies to be measured fractionally with a value between 0 and 2, Bozoklu et al. (2020), this range can be tested from 0 to 5. In

addition, the fact that the frequencies in the Fourier function in Table 2 are fractional shows that there are permanent breaks in both tourism receipts and the real exchange rate.

3.2. Cointegration Test and Results

The analysis method of this study is the Fourier Engle-Granger cointegration test developed by Yilanci (2019) to determine the cointegration relationship between the variables. This method uses Fourier functions to capture and model structural changes to determine the long-term relationship and extends it with the Fourier function of the Engle-Granger cointegration test. Equation (2) presents the extended model with a deterministic variable vector (Yilanci, 2019: 3).

$$y_{1t} = \alpha_0 + \gamma_k \sin\left(\frac{2\pi kt}{T}\right) + \delta_k \cos\left(\frac{2\pi kt}{T}\right) + \beta' y_{2t} + u_t \quad (2)$$

α_0 is the standard deterministic term containing a constant with or without linear terms; T is the number of observations; k represents the Fourier frequency selected using the value that minimizes the sum of the residual squares (Yilanci, 2019: 3). This method re-estimates the model with the minimum residual sum of squares and applies the ADF unit root test. Table 3 presents the results of the cointegration tests applied to determine the long-run relationship between tourism receipts and the real exchange rate in Turkey.

Table 3: Fourier Engle-Granger Cointegration Test Results

Fourier Engle-Granger test statistic	Frequency value	Minimum SSR Value	Critical Values		
			%1	%5	%10
-5.993	5	0.8018	-4.906	-4.302	-3.988

According to the Fourier Engle-Granger test statistic, the null hypothesis states that no cointegration relationship between the variables is rejected compared with the critical values at all significance levels in Yılanç (2019). This situation indicates that the changes in the real exchange rate have a long-term effect on Turkey's tourism receipts.

3.3. Estimation of Long-Run Coefficients

After the Fourier Engle-Granger cointegration test, the methods used to estimate the size of the cointegration relationship between tourism receipts and the real exchange rate are Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR). While FMOLS and DOLS techniques can correct errors caused by autoregression, internality problems, and sample bias, the CCR method can eliminate deviations from the traditional least-squares method. Table 4 presents the analysis results for FMOLS, DOLS, and CCR methods.

Table 4: Long-run coefficient estimates

Dependent variable: lnTR						
	FMOLS		DOLS		CCR	
Variables	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
lnREER	3.9112	0.0000	3.9001	0.0000	3.8510	0.0000
C	-7.5623	0.0037	-7.5362	0.0003	-7.2996	0.0030
@sin	-0.3822	0.0137	-0.2947	0.0065	-0.3815	0.0139
@cos	0.0448	0.7671	-0.0026	0.9810	0.0445	0.7684

Not: @sin (sine) and @cos (cosine) represent trigonometric terms.

FMOLS, DOLS, and CCR test results are highly congruent in statistical significance and close numerical values of the estimated coefficients. According to empirical findings, a 1% increase in the real exchange rate leads to approximately 3.9% of tourism receipts. In other words, an increase in the real exchange rate affects tourism receipts positively. In addition, the estimated coefficients are statistically significant at the 5% significance level.

CONCLUSIONS

Tourism is an important source of foreign exchange income for countries with potential due to its contribution to the economy. For these reasons, countries develop and implement policies to increase tourism receipts. It is important to investigate the relationship between tourism receipts and real exchange rate in Turkey, one of the important tourism centers with its geopolitical location, historical and cultural background.

This study empirically investigated the relationship between the real exchange rate and tourism receipts with Turkey Fourier unit root and cointegration tests. According to the study results, an increase in the real exchange rate in Turkey increases tourism receipts. With the rise in the exchange rate, Turkey will become more attractive in tourism, and tourism receipts will increase by increasing the tourism demand. The decrease in the exchange rate will decrease the tourism demand to Turkey and lead to a decline in tourism receipts. Implementation of policies to further increase tourism receipts in Turkey will also reduce the current account deficit.

Since the link between exchange rate changes and tourism have an important role for economies, policy makers' development of policy tools to stimulate the sector will contribute to increasing tourism receipts. Increasing activities to promote cultural and natural resources, encouraging investments in this field, and improving the quality of those employed in the sector may be appropriate policies. Future studies can analyze whether the impacts of changes in the exchange rate on Turkey's tourism receipts vary according to the trading countries.

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CHAPTER 3

TESTING THE RELATIONSHIP BETWEEN SERVICE CONFIDENCE INDEX AND STOCK MARKET: A CASE STUDY IN BORSA ISTANBUL

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INTRODUCTION

Being optimistic or pessimistic about the future expectations of individuals creates different economic results. While the optimistic expectation encourages individuals to spend more, the pessimistic expectation necessitates reducing the expenditures and being more cautious. This situation will enable companies in the real sector to be affected financially. Therefore, regular monitoring of their expectations will provide important data to market participants (Olgaç and Temizel, 2008).

Consumer confidence is strongly associated with traditional macroeconomic variables (Garner, 1991). The emotions and thoughts of consumers are affected by many economic factors such as GDP, exchange rates, consumer price index, as well as psychological, social and political factors. For this reason, the course of stock prices, which is one of the indicators of the general economic situation in a country, can affect the future expectations of consumers (Jansen and Nahuis, 2003).

One of the most discussed and researched topics in finance is the factors that affect stock prices and the type and degree of interaction of these factors with stock prices. Today, with the increasing importance of stock markets, the fact that many individual and institutional investors make serious transactions in these markets and the growth of their trading volumes has led to an increase in research on stock markets (Uzun and Güngör, 2017).

Investor sentiment is an important factor influencing financial decisions. Investor sentiment is a phenomenon influenced by beliefs about future cash flows and investment risk (Kıyılar and Akkaya, 2016). For this reason, it should not be ignored that stock markets are affected by investor sentiment. When investors fear that the economy will deteriorate, they are also afraid of the stock market falling and thus losing money. In this case, investors cause the market to fall by selling their stocks (Chen, 2011).

Confidence indices among survey-based criteria are frequently used both in Turkey and in other countries as one of the investor sensitivity indicators. Consumer confidence index (CCI), real sector confidence index, sectoral confidence indices and financial services confidence index are among the important indices in Turkey. Sectoral confidence indices take a value from 0 to 200, a value above 100 indicates that the current situation and future expectations of the sector are optimistic, while a value below 100 indicates that they are pessimistic. It is expected that the expectations regarding the sector will affect the companies in the sector and that the investors will use the confidence indices as the predictors of the future (Süsay and Eyüboğlu, 2021).

Optimistic and pessimistic expectations in the sector may affect other sub-sectors. In this context, investigating the effect of service sector expectations on stock market returns will be useful to reveal whether investors can use the service confidence index as an estimator of the future returns of stocks (Eyüboğlu and Eyüboğlu, 2018). In this study, the relationship between the service confidence index, which

represents investor sentiment, and the Borsa Istanbul transportation index will be analyzed.

1. LITERATURE REVIEW

The relationship between confidence indices and stock returns attracts the attention of many researchers. Monitoring and measuring the results by using different confidence indices and stock market indices in studies enriches the literature and can provide support for investors' investment decisions.

Süsay and Eyüboğlu (2021), using monthly data between 2011:01 and 2020:05, investigated the effect of service confidence index on BIST service sector sub-indices by cointegration analysis. In the study, a cointegration relationship could not be determined between the service confidence index and the BIST service sector sub-indices.

Jiang and Jin (2020) examined the effect of investor sentiment on stock market volatility with panel data analysis for the period 2012:01 - 2018:12. In the study, stock returns are positively affected by investor sentiment.

Kaya (2020) examined the relationship between BIST-100 and CCI, consumer expectation index and consumption tendency index using monthly data in the 2002:01 and 2019:04 periods with VAR analysis. According to the findings obtained in the study, causality was determined from BIST-100 to indices representing investor sentiment.

Cangöz and Erdoğan (2019) examined the relationship between various confidence indices and Borsa Istanbul sector indices in Turkey for the period 2011:01 – 2019:06. In the study, asymmetric causality between sectoral confidence indices and Borsa İstanbul sector indices has been revealed.

Gökalp (2019) examined the effect of CCI on stocks in Turkey with the VECH model, using monthly data in the 2002:12 and 2018:12 periods. In the study, the spillover effect from the CCI to the BIST-100 index was determined.

Eyüboğlu and Eyüboğlu (2018) examined the effect of service confidence index on the BIST services sector sub-indices with cointegration analysis for the period 2011:01 and 2017:12. In the study, a positive relationship was revealed between the service confidence index and stock returns.

Köse and Akkaya (2016) examined the effect of the CCI and its sub-indices on the BIST-100 index with regression analysis and VAR analysis using monthly data in the 2007:01 and 2016:03 periods. In the study, it has been determined that the CCI affects stock returns.

Usul, Küçüksille and Karaoğlu (2017) examined the effect of consumer and real sector confidence indices on BIST-100 index with the KSS cointegration test, using monthly data in the 2007:01 and 2017:01 periods. In the study, a cointegration relationship was determined between confidence indices and stock returns, and it was revealed that confidence indices positively affected the BIST-100 index.

Canöz (2018) examined the relationship between CCI, Bloomberg HT CCI and BIST-100 index using monthly data in the 2004 and 2017 periods with causality test. In the study, causality from BIST-100 index to CCI was determined.

Hsu, Lin and Wu (2011) examined the causal relationship between CCI and stock market index using monthly data between 1999 and 2007 in 21 selected countries. In the study using panel data analysis, bidirectional causality was determined between the CCI and the stock market index.

Chen (2011) examined the effect of investor sentiment on the S&P500 during market fluctuations in 1978:01 and 2009:05 periods by using monthly data with regression analysis. In the study, it was revealed that low consumer confidence affected the S&P500 index more in the bear market.

Oprea and Brad (2014) examined the effect of CCI on BET-C index and BET index by regression analysis using monthly data in the 2002 and 2011 period. In the study, it was determined that the changes in investor sentiment affected the stock returns.

Olgaç and Temizel (2008) examined the effect of CCI on the IMKB30 with the Johansen cointegration test using monthly data in the 2004:01 and 2007:05 periods. In the study, a cointegration was determined and it was concluded that the IMKB30 index affected the CCI.

Kandır (2006) examined the effect of the CCI on stock returns of 28 selected IMKB financial sector companies, using monthly data for the

2002:02 and 2005:06 periods, with regression analysis. In the study, it has been revealed that the majority of financial sector stocks are affected by the CCI.

Korkmaz and Çevik (2009) examined the effect of real sector confidence index on the IMKB100 for the 1987:12 - 2008:10 period with the two-stage EGARCH model. In the study, the feedback effect was determined between the return of the IMKB100 and the confidence index.

Aydoğan and Vardar (2015), using monthly data in the period 2004:01 and 2014:01, examined the relationship between the 6 selected sector indices in Borsa Istanbul and the CCI with the VAR model and generalized impact-response analysis. In the study, it has been determined that investor sentiment affects indices and that investors invest under the influence of rational and irrational factors.

Jansen and Nahuis (2003) examined the relationship between stock returns and consumer confidence in 11 selected countries between 1986 and 2001. In the study, it was determined that the changes in stock returns and CCI for nine countries were positively related.

2. DATA AND METHODOLOGY

In this study, it was aimed to reveal the effect of service confidence index on Borsa Istanbul transportation index by cointegration test, and Borsa Istanbul transportation index was determined as the dependent variable and the service confidence index as the independent variable.

In the data set of the study, there are 36 observations on a monthly basis in the 2017:01 and 2019:12 periods.

Data on the transportation index were obtained from Borsa Istanbul, and data on the service confidence index were obtained from Turkish Statistical Institute (TUIK). In the analysis, the natural logarithms of the data were taken and the tests were applied on these data, and the information about the variables is given in Table 1.

Table 1: Variable Information Used in the Study

Variable	Description of the Variable	Analysis Period	Source of Data
lnGUVEN	Service Confidence Index	Between 2017-01 and 2019-12	TUIK
lnULASTIRMA	Borsa Istanbul Transportation Index	Between 2017-01 and 2019-12	Borsa Istanbul

The fact that the series are not stationary is a problem in terms of econometric studies. The results of regressions using non-stationary time series are not reliable. The reason why the series becomes stationary is to provide the assumptions of the error term (Işık, Acar and Işık, 2004).

In this context, in time series analysis, the series must be stationary in order to obtain meaningful relationships between the variables used. The stationarity test is to test whether the series contains a unit root. ADF unit root test is done using three different equations as follows. (1) a random walk process with no constant term and no stochastic

trend; Equation (2) describes a random walk process with a constant term, and equation (3) a random walking process with both a constant term and a stochastic trend. For these three equations, the null hypothesis of $\delta=0$ is tested. If the H_0 is rejected and the $H_1 \delta<0$ is accepted, the Y_t series becomes stationary. If the series that are not stationary at the level become stationary when their first difference is taken, these series are called first-order integrated, that is, I(1) series (Malik, Chaudhry, Sheikh and Farooqi, 2010).

$$\Delta Y_t = \delta Y_{t-1} + \mu_t \quad (1)$$

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \mu_t \quad (2)$$

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \mu_t \quad (3)$$

In the study, in order to determine whether there is a long-term cointegration relationship between the service confidence index and Borsa Istanbul transportation index, the existence of unit root in the series was investigated, and then Vector Autoregressive (VAR) analysis proposed by Hall (1991) was applied to determine the optimum lag length.

There are methods developed by Engle & Granger (1987), Johansen (1988), Johansen and Juselius (1990) to determine the cointegration relationship between time series. According to the method proposed by Engle & Granger (1987), if the error term resulting from the linear regression relationship between non-stationary variables is stationary at the level, it is concluded that these two series are cointegrated. However, if the number of variables is more than two, Engle &

Granger (1987) method is insufficient in separating these relationships and increases the risk of error, since three or more cointegration vectors may emerge between the variables. Another approach for linear combinations of non-stationary variables to be stationary in the long run and for modeling and estimating the long-term relationship between time series was developed by Johansen (1988). In the cointegration test, the model of the series that are stationary in the first difference is based on Vector Autoregression (VAR) analysis, which includes the level and lagged values of the variables in the model (Tari and Yildirim, 2009).

In the Johansen approach, trace test and maximum eigenvalue test are used to reveal the cointegration relationship, and it is decided whether there is a cointegration relationship by comparing the calculated statistics with the critical values. These statistics are shown as follows (Brooks, 2008). In the trace statistics equation (6) given below, λ_i represents the i th largest eigenvalue of the Π matrix. The maximum eigenvalue statistics given in equation (7), on the other hand, examines the existence of r cointegration relations versus $r+1$ cointegration relations.

$$\lambda_{iz}(r) = -T \sum_{i=r+1}^g 1n(1 - \hat{\lambda}_i) \quad (4)$$

$$\lambda_{mak}(r, r + 1) = -T1n(1 - \hat{\lambda}_{r+1}) \quad (5)$$

Granger (1988) stated that when the variables are cointegrated, it would be more appropriate to perform the causality analysis between the series with VECM. Optimum lag length is indicated by p while the error correction coefficient is ECT. In cases where statistically significant ECT coefficient is negative, it shows that the series will converge in the long run, even if short-term deviations occur in the series with a cointegration relationship (Akpolat and Altıntaş, 2013).

3. ECONOMETRIC ANALYSIS AND EMPIRICAL RESULTS

In order to determine whether there is a cointegration relationship between the service confidence index and the Borsa Istanbul transportation index, the Augmented Dickey-Fuller (ADF) test was first applied to these series. For the unit root test, using Schwarz information criterion, appropriate lag lengths with the smallest absolute value were determined.

Table 2: ADF Test Results

Variables	At Level		At First Difference	
	Constant	Constant & Trend	Constant	Constant & Trend
lnGUVEN	-1.0302	-1.1690	-4.9513*	-4.8875*
lnULASTIRMA	-2.7992	-2.5994	-2.7588	-2.9570*

* Significant at the 5% level

It is seen that the series in which the ADF test was applied are not stationary at the level. In order to determine whether the indices are integrated in the first order, the stationarity tests were repeated at the

first difference of the series and it was concluded that the series were stationary when their differences were taken, in other words, the series were integrated at the same order $I(1)$.

Whether there is a cointegration relationship between the series that are stationary in the first difference or not was examined according to the cointegration test developed by Johansen (1988) and Johansen & Juselius (1990). At the beginning of cointegration test, an unconstrained VAR model should be estimated with the variables included in the model and the appropriate lag number should be determined.

Table 2: Determining The Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	38.81771	NA	0.000368	-2.231376	-2.140679	-2.200860
1	103.2519	117.1531*	9.46e-06*	-5.894057*	-5.621965*	-5.802506*
2	106.0118	4.683460	1.02e-05	-5.818899	-5.365412	-5.666315
3	38.81771	NA	0.000368	-2.231376	-2.140679	-2.200860

When creating a VAR model, the most appropriate lag length can be determined according to various information criteria. According to the information criteria given in Table 2, the most appropriate lag length was determined as 1.

There should be no autocorrelation problem between the error terms in the VAR model and their variances should be constant. The serial

correlation LM and White variance test results of the VAR (1) model are given in Table 3.

Table 3: Diagnostic Tests

Lag Length	Autocorrelation		Heteroskedasticity	
	LM-statistic	p-value	Chi-sq	p-value
1	5.003952	0.2869	12.89076	0.3770
2	5.685490	0.2239		

According to the diagnostic tests, no heteroskedasticity and autocorrelation problems were detected in the model. In addition, in order to examine whether the VAR model satisfies the stability condition, characteristic roots were evaluated and it was determined that the roots were within the unit circle as seen in Figure 1.

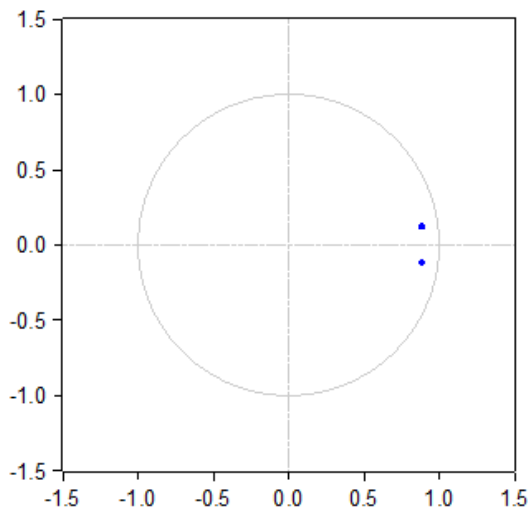


Figure 1: Stability Condition of VAR Model

The cointegration test results are given in Table 4, when the trace test and maximum eigenvalue statistics are examined according to critical values, it is determined that there is 1 cointegration vector. In other words, the H_0 stating that there is no cointegration vector between the variables was rejected by the trace and maximum eigenvalue tests.

Table 4: Cointegration Test Results

Trace Statistic

Hypoth. of CE(s)	Number	E.value	Trace Stat.	%5 Cr. Value	Prob.
None *		0.230830	15.50882	15.49471	0.0498
At most 1 *		0.176094	6.585764	3.841466	0.0103

Maximum E.value Statistic

Hypoth. of CE(s)	Number	E.value	Max. E.value Statistic	%5 Cr. Value	Prob.
None		0.230830	8.923059	14.26460	0.2926
At most 1 *		0.176094	6.585764	3.841466	0.0103

The degree of the long term relationship between the variables was determined by the normalized cointegration equation, and the existence of a long-term positive relationship between the variables was determined. Accordingly, a 1% increase in the service confidence index provides an increase of 31.7% in the Borsa Istanbul transportation index.

Table 5: Normalized Cointegration Vector

Cointegration Equation-Variables	Cointegration Equation-Coefficients
LNULASTIRMA(-1)	1.0000
LNGUVEN(-1)	-31.7111
	(11.326)
	[-2.79970]*
C	142.1115

* Significant at the 5% level

Since the series is not stationary at the level and is cointegrated, the ECM was used for causality testing. After the Johansen cointegration analysis, the error correction coefficient was determined as -0,0229 according to the ECM established to determine the deviation in the long term relationship between the variables.

Table 6: ECM Estimation Results

Dependent Variable	Independent Variables		Constant	ECM _{t-1}
	D(LNULASTIRMA) _{t-1}	D(LNGUVEN) _{t-1}		
D(LNULASTIRMA)	-0.4132 (0.1655)	0.5519 (0.7220)	0.0447 (0.0193)	-0.0229 (0.0080)*
D(LNGUVEN)	-0.0397 (0.0413)	0.1772 (0.1802)	0.0011 (0.0048)	0.0010 (0.0020)

The negative result of this term indicates that short-term deviations converge to equilibrium, in other words, the error correction mechanism works. The value of $ECM_{t-1} = -0,0229$ indicates that the deviation from the long-term balance due to the short-term shock is compensated by approximately 0,2% each year.

CONCLUSION

Investor sentiment, which reflects beliefs about future cash flows and investment risk, is an important consideration in financial decisions. In this study, effect of the service confidence index on Borsa Istanbul transportation index was examined. According to the Johansen cointegration test performed, the cointegration relationship representing the long term relationship was determined between the service confidence index and the Borsa Istanbul transportation index. Accordingly, the degree of long-term relationship between the variables has been determined by the normalized cointegration equation, and a 1% increase in the service confidence index provides a 31,7% increase in the Borsa İstanbul transportation index.

It has been determined that the findings obtained in the study in terms of the effects of confidence indices on stock returns are in parallel with the literature (Jiang and Jin, 2020; Kaya, 2020; Gökalp, 2019; Eyüboğlu and Eyüboğlu, 2018; Köse and Akkaya, 2016; Usul, Küçüksille and Karaoğlu, 2017; Canöz, 2018; Hsu, Lin and Wu, 2011; Chen, 2011; Oprea and Brad, 2014; Olgaç and Temizel, 2008; Kandır, 2006; Korkmaz and Çevik, 2009; Aydoğan and Vardar, 2015; Jansen and Nahuis, 2003).

In this context, it is considered that stock investors can benefit from confidence indices in their investment decisions.

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CHAPTER 4
**THE IMPACT OF UNCERTAINTY AND INSTABILITY ON
INFLATION¹**

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¹ This research part is based on the study titled "The Impact of Economic Policy Uncertainty and Political Instability on Macroeconomic Variables", which is accepted as a PhD Thesis in Anadolu University, Social Sciences Institute, Department of Economics.

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INTRODUCTION

Bernoulli discussed the concept of uncertainty in the economic in the utility principle or expected utility hypothesis in 1738. The expected utility hypothesis remained an occasional hypothesis used by economists and statisticians alike for the next two centuries. Barrois used Bernoulli's expected utility hypothesis in study on insurance theory in 1834. However, it seems that the expected utility hypothesis was generally neglected until 1947. Since then, Von Neumann and Morgenstern have made this hypothesis a respected and even popular one. Von Neumann and Morgenstern prove that Bernoulli's expected utility hypothesis can be derived as a theorem by making a few simple assumptions about how rational individuals will make decisions under uncertainty (Borch, 1963, p. 2).

Regarding the approach to the concept of uncertainty in economic thought, the idea that a future event cannot be fully reached by using past or present experiences was reached by Boisguilbert in the late 17th century, by Cantillon and A. Smith in the mid-18th century, and by Condillac in the third quarter of the 18th century. Cantillon emphasizes that a merchant who trades goods daily buys goods from the farmer at a certain price and can sell these goods in the city at an uncertain price. The trader hopes to make a profit as a result of this activity. However, since the fluctuations in the prices of consumer goods cannot be fully predicted, the trader is faced with uncertainty (Alada, 2004, p. 8). At least four different approaches can be

mentioned in the concept of uncertainty in economic analysis (Lawson, 1988, p. 48).

The first of these approaches is the one based on the possibility that uncertainty can be measured numerically. In this approach, external reality takes the form of a common probability distribution associated with the rational expectations hypothesis. In this approach, the predicted and learned basic reality is defined as the correct probability distribution or objectively understood basic reality while economic agents consider it as a subjective probability distribution (Lawson, 1988, p. 44). In the second approach, which argues that uncertainty is based on the probability of being numerically measurable, what is meant by probability is based on expectations and mental design, not the real world. This approach is used by J. Savage and M. Friedman with the Maximization of Expected Utility hypothesis. In the third approach, which argues that uncertainty is based on a probability that cannot be measured numerically, or that there is no information about probability, they accept probability, expectations and mental design, but argue that this probability is independent of uncertainty. This is the approach that Keynes brought to economics and used in the macro sense, often called Keynesian uncertainty. The fourth approach, which H. Knight brought to economics, but which economics did not emphasize much, is the approach that divides uncertainty into two as numerically measurable and unmeasurable uncertainty. In this approach, the uncertainty that can be measured numerically is based on a statistical probability and this approach is a priori. Uncertainty that cannot be measured numerically is considered as a situation that

is not based on measurable probability or cannot occur by chance. When the idea of approach to the concept of uncertainty is examined in detail, it is seen that there are approaches that advocate different ideas about uncertainty, such as Shackle's approach to the concept of uncertainty and Hutchison's approach to uncertainty. Thus, it is not enough to gather the approaches related to uncertainty under only four groups and it is possible to expand these groups further (Alada, 2000, p. 12).

The first two definitions of uncertainty are mostly used in the literature because they contain statistical information that does not contradict with econometric estimation methods and are compatible with optimization calculations. According to the views that argue that uncertainty is a measurable possibility, uncertainty is based on an ergodic basis. If a stochastic process is ergodic, then the averages of time and space intersect for an infinite realization. It tends to converge with the probability of one of the averages of time and space for the infinite realization of ergodic processes. In the ergodic framework, which includes calculated statistical forecasts, information about the future is based on the present occurrence of past or future events. More clearly, it is emphasized that the future is a reflection of the past (Davidson, 1996, p. 28). In the intellectual framework created by the acceptance of an ergodic process, it can be considered as a correct attitude to predict that there may be a certain margin of error in the decisions to be made about the economy and to determine the expectations according to these statistical averages (Davidson, 1996, p. 29).

Economic Policy Uncertainty for the USA

The monthly EPU index for the USA is based on 10 leading newspapers, including the Wall Street Journal, New York Times, Dallas Morning News, San Francisco Chronicle, Boston Globe, Los Angeles Times, Washington Post, Chicago Tribune, Miami Herald and USA Today. The digital archives of each newspaper have been scanned to get the monthly count of articles containing words such as economics or economic, uncertain or uncertainty, one or more words of USA congress, budget deficit, The Federal Reserve, law, regulation, or White House since January 1985.

The total number of articles in the same month and newspaper and raw numbers were determined and a monthly EPU series was obtained for each newspaper. The level value series of each newspaper from 1985 to 2010 were converted into one unit standard deviation and then taken as the monthly average for 10 newspapers. Finally, the obtained series of 10 newspapers from 1985 to 2009 were normalized to an average of 100 (Baker, Bloom, & Davis, 2015, p. 4).

1. DEFINITION OF POLITICAL INSTABILITY

In order to reveal the relationship between socio-economic factors and political instability, it is extremely important to clarify the definition of political instability. There are various definitions of political instability, each measured differently. In general, these definitions are processed under two basic categories: definitions focusing on government changes and definitions focusing on social unrest (Alesina and Perotti, 1996, p. 3).

1.1. Definitions Focusing on Government Changes

Focusing on government changes while describing political instability, Lipset defines political instability as the continuation or continuity of a particular type of political system. According to Lipset's definition, a state ruled by the same regime for 25 years or more is considered stable. Government changes are classified as major and minor changes in themselves. Minor changes refer to adjustments within the cabinet, while major changes include significant changes in the partisan composition and ideological structure of the government (Lipset, 1959, p. 72). It is emphasized that there are approaches that argue that the increase in the events of containing violence or non-containing violence is related to the frequency of occurrence of instability and that this is an indicator of political instability. (Sanders, 1981, p. 5). Miljkovic and Rimal (2008) expand Lipset's definition of political instability, emphasizing that in addition to developments in the political system, a change in government itself is also a sign of political instability. Carmignani (2003) emphasizes that instead of the actual government change, it is tried to make the possibility of government change observable, which cannot be observed, by taking into account the tendency towards government change, and there is an effort to associate it with the change in voter behavior or various economic and institutional changes.

Definitions of political instability that focus on government changes have the advantage that it is not possible to hide government changes in various country groups, making it easier to collect consistent data

sets about these country groups. Siermann (1998) argues that using definitions based on government changes to measure political instability may result in either overestimating or underestimating real political instability by making measurements based on such definitions. Underestimating real political instability in such an approach may result in ignoring large-scale events that may be directly caused by government changes. For example, until recently, most political scientists agreed that Iran is not politically stable. However, since a party with a different ideological structure did not come to power in Iran according to the definition of government change, and the government did not change, it should be considered that Iran is politically stable according to the definition of political instability based on government change. On the other hand, when some government changes are not as a result of instability but as a result of a democratic system, this approach may result in overemphasis on political instability. For instance; governments in Italy and Japan change frequently due to the disintegration of political coalitions. This does not necessarily lead to the conclusion that government changes are political instability; but according to the definition based on government changes, these changes can be considered as political instability.

1.2. Definitions Focusing on Social Unrest

Focusing on the degree of social unrest in defining political instability, Siermann (1998) stated that political instability can be measured depending on the frequency of occurrence of certain socio-political

events; However, it is revealed that this method is difficult to apply. According to this approach, signs of civil disobedience are considered a threat to the political power of the incumbent government. Therefore, the number of violent political events is taken into account when defining political instability. Social unrest can affect not only a change in the political system, but also individual property rights (Miljkovic and Rimal, 2008, p. 2455). The degree of political stability in a country that has the power of political institutions is associated with political instability according to the definition of political instability by Huntington (1968). In cases where the degree of social tension is high, the motivation of the society to oppose the government increases.

Confusion can grow quickly when political institutions are weak. According to Gurr's (1971) broader definition of political instability, it is emphasized that if a society's expectations are not met, political instability may arise and these expectations may be related to very different issues. Society does not always have to completely overthrow the government system or replace government leaders in order to meet expectations or solve problems that arise. Sometimes all a government has to do is just change certain policies. Gurr (1971) argues that the process of changing a policy can be considered as political instability.

2. LITERATURE

Economists agree that the welfare of societies struggling with high and constantly fluctuating inflation is adversely affected. Therefore,

policy makers and central banks are also making significant efforts to control inflation and ensure price stability. However, countries with weak institutional structures, social polarization, and political instability are sensitive to political shocks that cause monetary and fiscal policies to fail. Failure to implement monetary and fiscal policies results in higher inflation volatility (Aisen and Veiga, 2008, p. 208).

Edwards and Tabellini (1991) try to empirically reveal the political economy models of inflation with the weak government approach and myopic government approach. Inflation is an inevitable result of the political struggle between different groups in the weak government model while inflation occurs as a deliberate result of the strategic behavior of the politicians in the myopic government model.

In the data set, in which alternative definitions of inflation tax are used, the political developments of 76 countries are examined. The implications of the myopic government model are that countries with more unstable political environments tend to rely more on inflation taxes; however, there is no evidence that strongly supports the weak government model hypothesis. Grilli et al. (1991) focuses on the role of specific institutions in striving to provide constraints and incentives that shape policy makers' actions. Election processes and political traditions influence governments' policies to avoid budget deficits and debt. Central bank independence allows low inflation to occur without any obvious cost to real economic performance and regardless of political institutions. Cukierman, Edwards and Tabellini (1992) argue

that the importance of seigniorage with respect to other sources of government income significantly differs between countries. Countries with more unstable and polarized political systems have much less efficient tax structures. Therefore, these countries with political instability tend to earn seigniorage income more intensely. In the established model, after controlling for other variables, it is concluded that political instability is positively related to seigniorage.

Beetsma and Van Der Ploeg (1996) investigate whether there is a positive relationship between inflation and income inequality when political instability and polarization are used as proxy variables. None of the variables including crises, strikes, revolts, revolutions and coups, constitutional changes and the average number of assassinations per capita are meaningful in democratic countries. In addition, none of these variables can eliminate the strong positive link between inflation and income inequality. The coefficients of these variables, which are used as proxy variables in the model established for non-democratic countries, are meaningful and consistent with theoretical expectations. Income inequality is not a meaningful determinant in explaining inflation for non-democratic countries. Campillo and Miron (1996) state that institutional features such as the degree of openness, the resistance of the financial sector to inflation and the independence of the central bank are among the potentially important determinants of inflation, but they argue that there are other factors that determine inflation as well. According to the existing literature, some interesting results are obtained in the model that is established as the issue of time consistency, optimal tax consideration

and the degree of previous inflation experience are important determinants of the inflation rate for countries, apart from the independence of the central bank. It has been revealed that institutional regulations play almost no role in determining inflation outcomes when other factors are held constant. Therefore, central bank independence and exchange rate regulation are not considered empirically important determinants of the inflation rate. In the model where political instability is used as a proxy variable for some possible effects, it becomes difficult for policy makers to keep inflation low when political instability is higher. Countries with political instability tend to be confronted with more illegal actions that increase the optimal inflation tax. The possible effects of political instability are not excluded in any of the established models, and the expected sign of the coefficients is always positive. Gasiorowski (1998) examines the relationships between political instability and macroeconomic indicators. The relationship between inflation and growth, which are two important indicators as macroeconomic variables, and four different measures of political instability, nonviolent turmoil, violent turmoil, coup and government changes are examined. First, whether there is a simultaneous relationship between political instability and macroeconomic indicators; Afterwards, the direction of causality between the variables is tried to be determined. It has been determined that nonviolent turmoil clearly leads to higher inflation and lower growth. There is some evidence that coups cause lower inflation and that reverse causality may work. In other words, it is concluded that high inflation may reduce the probability of a coup.

Lower economic growth is associated with higher degrees of violent turmoil, greater likelihood of coups and government changes; but the direction of causality in these variables is not clear. According to the findings, it is argued that there is a process that primarily runs from political instability to macroeconomic variables, contrary to the widely accepted idea that weak economic conditions will create turmoil and instability in the relationship between macroeconomic variables and political instability. Desai, Olofsgard and Yousef (2005), taking into account the interaction between political structure and inequality in explaining inflation, include fiscal balance, gross domestic product growth, per capita gross domestic product, financial depth, openness and instability variables in the model as determinants of inflation. Gastil and Polity indices are used for political structure in the model. These two indices determine the degree of political openness and political competition in a country. When income inequality is associated with political structure, the coefficients of inequality, political structure and association term are significant. The relationship between income inequality and inflation is determined depending on the political structure. While inequality has a positive correlation with inflation in more democratic political systems, a reverse correlation tendency emerges in non-democratic systems. Boschen and Weise (2004) test whether the political factors affecting the central bank's commitment to low inflation are correlated with the average inflation rates among countries, using the time consistency model of monetary policy of KPBG (Kydland and Prescott, 1977; Barro and Gordon, 1983). In addition, they try to find an answer to the

question of whether political and institutional variables explain the differences in inflation dynamics between countries. The frequency of government changes, which represent political instability, the ideological orientation of the ruling party, and the central bank independence index are used as political variables. Each of these variables is used as a proxy variable representing the difficulty or weakness of the central bank's commitment to low inflation. When an adverse price shock occurs, an independent central bank is much more likely to resist pressures than a government-dependent central bank. Policy makers in countries where governments change frequently may tend to tolerate increased unemployment in order to keep inflation stable. Similarly, left-wing governments going for elections saying unemployment and labor unions are their main economic concerns are less sensitive to increases in inflation than when right-wing governments act decisively against inflation. Sakamoto (2005) argues that minority, coalition and stability are political variables that measure the strength and stability of governments. Minority; the dummy variable representing the majority or minority status of the government, the coalition; the number of parties in power and stability represents the average length of stay of the three most recent governments in the period prior to the current year. Measuring the degree of central bank independence is used to show that anti-inflationary monetary policy is sustainable despite political intervention or without political intervention. Stable governments cause higher inflation than those that remain in power in the short run while coalition governments allow lower inflation to occur than

single-party governments. Although the sign of the minority coefficient is negative, that is, lower inflation, and the coefficient of the central bank independence is positive, that is, higher inflation, these coefficients were not found to be significant. Aisen and Veiga (2006) examine the political and economic determinants of inflation. After controlling the economic structures and economic variables of the countries, it was found that political instability causes higher inflation. Moreover, the effect of political instability on inflation is much stronger in countries with medium and low inflation in the case of high inflation. Higher economic freedom and democracy are also associated with lower inflation. Albanesi (2007) measures the variable of political instability as the frequency of change in power. This measurement takes values between 0 and 1, and 0 represents the state of perfect stability. Central bank independence is measured based on indicators that include the power of the central bank governor, independence in setting targets and policy implementation, and the existence of treasury lending limitations. Although the political instability variable was not significant in the model, a positive correlation was found between the inflation tax and income inequality. Jones and Olson (2013) estimate the relationship between uncertainty and inflation with the DCC-GARCH model. The results show that the relationship between uncertainty and inflation became positive in the late 1990s and early 2000s. Leduc ve Liu (2016) concluded that unemployment is higher and inflation is lower in times of uncertainty that cause lower demand for consumption and spending. Istiak and Alam (2019) emphasize that economic policy uncertainty has a

significant asymmetric effect on inflation expectations. The impact of these asymmetric effects on inflation differs depending on whether the relevant period is before or after a financial crisis.

3. METHOD, MODEL AND RESULTS

In this part of the study, after giving information about the method, how the data were obtained and the details of the data will be presented. The determinants of the inflation variable and the model to be used in this section will be introduced and the estimation results will be interpreted.

Panel data estimation is considered an efficient analytical method for handling econometric data. It has become a frequently used method in social sciences since panel data analysis cover N ; cross section (countries, households, firms, individuals, etc.) and T ; time series data (annual, quarterly, monthly, etc.). The combined panel data matrix set consists of a time series for each individual in the data set (Asteriou and Hall, 2007, p. 344).

A simple linear model with an explanatory variable for panel data can be represented as;

$$Y_{it} = \alpha + \beta X_{it} + u_{it} \quad (1)$$

Both Y and X variables have i and t subscripts for $i = 1, 2, \dots, N$ cross-section and $t = 1, 2, \dots, T$ time period (Asteriou and Hall, 2007, p. 344).

The System Generalized Moments Method developed by Arellano and Bover (1995) and Blundell and Bond (1998) was used in this study. The main factor behind the preference of this method is that estimators will not be consistent and effective if the time period is short in level or difference GMM, so instead of making one-by-one estimations, the lagged values of the instrumental variables can be used in the difference equation.

Akkuş (2017) classified the variables that point to social and economic tensions; **violence and tension**, variables pointing to opposition to power and ways to achieve it; **anti-government and protest**, variables that represent situations that arise within the regime; **instability regime** through factor analysis method. In this study, these three variables classified by Akkuş (2017) as political instability variables will be used. Data on economic variables were obtained from World Bank's World Development Indicators (WDI) and International Monetary Fund's International Financial Statistics (IFS) databases. The data set consists of annual data based on economic and political instability variables for 33 countries³.

Descriptive statistics of inflation and explanatory variables are presented in Table 1.

³ Bahrain, Philippines, Hungary, Romania, Turkey, Bangladesh, South Africa, Malaysia, Russia, Oman, Brazil, India, Mexico, Sri Lanka, Jordan, Bulgaria, Iran, Egypt, Sudan, Venezuela, Czech Republic, Qatar, Pakistan, Saudi Arabia, Vietnam, China, Colombia, Peru, Chile, Indonesia, Kuwait, Poland, Tunisia

Table 1. Descriptive statistics for inflation and explanatory variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Inflation rate	660	16.05054	92.72963	-4.863278	2075.887
GDP per capita	659	7217.297	11095.04	229.955	96077
Trade openness	660	72.78605	39.00869	14.6102	220.407
Broad money supply	656	21.81331	48.26995	-11.0922	1102.383
Violence and tension	660	-1.22E-08	0.9367232	-3.238761	1.767277
Anti-government and protest	660	5.03E-09	0.9710251	-0.5933078	11.32243
Instability regime	660	-3.85E-09	0.9269482	-2.370898	1.592657
Economic Policy Uncertainty	660	105.8355	31.95843	71.3287	172.247
Year	20			1994	2013
Country	33				

Considering the determinants of inflation in the literature, the model to be estimated for inflation is as follows;

$$inf_{it} = \delta inf_{i,t-1} + \beta X_{it} + u_{it} \quad (2)$$

The dependent variable inf_{it} represents the inflation rate, X_{it} is independent variable vector and u_{it} is the error term. The explanatory variables of the model are inf_{t-1} ; lagged of inflation rate, $gdppercap$; gross domestic product per capita, $money$; broad money supply, $trap$; trade openness, $violten$; violence and tension, $gopro$; anti-government and protest, $instregim$; instability regime, EPU ; Economic Policy Uncertainty.

The aim of the empirical model is to reveal the determinants of inflation and to investigate the effects of political instabilities that may arise within the countries themselves and the economic policy uncertainty in the USA on the inflation rates of developing countries.

Correlations between explanatory variables are presented in Table 2.

Table 2. Correlation matrix between variables

	l.inf	gdppercap	trop	money	violten	gopro	instregim	EPU
l.inf	1							
gdppercap	-0.049	1						
trop	-0.094	0.256	1					
money	0.173	-0.088	-0.15	1				
violten	-0.028	0.320	0.523	-0.147	1			
gopro	-0.018	-0.029	-0.073	-0.042	-0.017	1		
instregim	0.030	-0.148	-0.004	-0.004	0.003	-0.006	1	
EPU	-0.073	0.212	0.051	-0.194	-0.096	0.237	0.074	1

As the correlation matrix is examined, although it is observed that the highest correlation is between the violence and tension variable and trade openness, it is observed that there are no high correlations to raise suspicion of multicollinearity problem, the correlation between the variables is at a reasonable level and there is no correlation that will adversely affect the analysis results.

Table 3. Blundell and Bond (1998) Two-Stage System GMM estimation results

Variables	(1)	(2)	(3)
	Model 1	Model 2	Model 3
l.inf	-0.0101*** (0.00360)	-0.00960** (0.00355)	-0.00790*** (0.00129)
gdppercap	0.00222* (0.00123)	0.00252* (0.00131)	-0.00197** (0.000758)
trop	0.526*** (0.176)	0.525*** (0.178)	0.481*** (0.0443)
money	2.246***	2.232***	2.327***

	(0.0316)	(0.0197)	(0.0298)
violten	-15.41***	-16.71***	
	(3.481)	(3.252)	
gopro	0.754	0.985	
	(2.893)	(2.566)	
instregim	8.355**	8.940**	
	(3.822)	(3.780)	
EPU	0.0680		0.602***
	(0.0997)		(0.0515)
Year Dummy	Yes	Yes	Yes
Period	1994-2003	1994-2003	1994-2003
Number of Countries	33	33	33
Number of instrumental variables	31	31	30
Number of observations	296	296	296
Wald chi square, prob.	0.000	0.000	0.000
AR(2), prob.	0.194	0.203	0.215
Hansen test, prob.	0.408	0.486	0.363
	(4)	(5)	(6)
Variables	Model 1	Model 2	Model 3
l.inf	0.227***	0.205***	0.456***
	(0.0352)	(0.0266)	(0.0326)
gdppercap	-2.01e-05*	-1.90e-05*	-4.93e-05***
	(1.11e-05)	(1.10e-05)	(9.27e-06)
trop	0.00197	0.00245	0.00471**
	(0.00475)	(0.00474)	(0.00201)
money	0.141***	0.141***	0.413***
	(0.0223)	(0.0201)	(0.0191)
violten	-1.988***	-2.130***	
	(0.286)	(0.240)	
gopro	-0.00261	0.00343	
	(0.102)	(0.0967)	
instregim	-0.901***	-0.906***	
	(0.198)	(0.200)	

EPU	0.00541 (0.00463)		0.0173*** (0.00471)
Year Dummy	Yes	Yes	Yes
Period	2004-2013	2004-2013	2004-2013
Number of Countries	33	33	33
Number of instrumental variables	31	31	31
Number of observations	328	328	328
Wald chi square, prob.	0.000	0.000	0.000
AR(2), prob.	0.145	0.166	0.215
Hansen test, prob.	0.343	0.366	0.416

*** p<0.01, ** p<0.05, * p<0.1 Values in parentheses are standard errors. 1st and 2nd lag of inf as predetermined variable for the first period, year dummy and other explanatory variables are used as exogenous variables. 2nd and later lag of inf are used as a predetermined variable, but the collapse process is applied and year dummy and other explanatory variables are used as exogenous variables for the second period.

Aisen and Veiga (2006), Cukierman, Edwards, and Tabellini (1992) argue that the expected coefficient sign of gross domestic product per capita should be negative. The reason why the *gdppercap* coefficient sign is expected to be negative is due to the fact that tax collection practice is more inefficient in less developed countries trying to use technology and this situation is thought to increase seigniorage revenues. The *gdppercap* variable has a positive coefficient in model 1 and model 2, which includes political instability variables while it has negative coefficient values in model 3, which includes only EPU from the USA for the 1994-2003 period. However, it is determined that the *gdppercap* coefficient for the 2004-2013 period is significant in all established models and the coefficient value is positive. The main reason behind the positive coefficient of *gdppercap* in model 1 and

model 2 for the 1994-2003 period is the hypothesis that if people increase their consumption expenditures, the general level of prices will increase in response to the demand that will occur in the market, and therefore this increase in demand will increase the inflation rate.

Rogoff (2003) argues that higher commercial activities allow higher integration with the world and at the same time increase competition in the domestic market and therefore more monetary policies are applied. Rogoff (2003) argues that if the effect of monetary policy on real activities is less, the tendency of central banks to fight inflation will also decrease. Narayan, Narayan, and Mishra (2011) concluded that trade openness is statistically significant and has a positive effect on inflation. Similarly, Kaufman and Segura-Ubiergo (2001) argue that more commercial activities cause more social and economic inequalities in countries. The resulting inequality allows the public to raise social expenditures in order to balance the social cost of international integration. In order to avoid economic and political crises, governments choose to make more social expenditures to eliminate economic inequality and to provide more economic equality to compensate for trade openness. It has a significant and positive coefficient in all other models while the trade openness variable is found to be statistically insignificant in model 1 and model 2 for the 2004-2013 period. The main reason behind the positive openness variable is that governments support commercial activities as they want to get a larger share from world trade, and governments also encourage higher consumer expenditures to compensate for social

inequality. As a result of this situation, the emergence of higher inflation is inevitable.

Friedman (1956) emphasized that money supply has both a short and long run effect on inflation in the quantity theory of money. Empirical studies concluded that there is a positive relationship between money supply and inflation after the quantity theory of money approach was introduced (Jiang, Chang, & Ling li, 2015, p. 250). The relations between money supply and inflation are discussed by using two different estimation techniques. Findings revealed the existence of a bidirectional causality relationship between the two variables, and it was concluded that the effect of money supply on inflation was also positive (Hall et al., 2009, p. 766). It was concluded that money supply growth was statistically significant and money supply growth increased inflation in all models established for both 1994-2003 and 2004-2013 periods.

The variable of violence and tension has a statistically significant and negative coefficient sign in model 1 and model 2 for both the 1994-2003 period and the 2004-2013 period. In the models with the EPU emerging in the USA, the effects of violence and tension in developing countries on inflation were less than in the cases without the EPU in the USA for both periods. However, in both periods and in all models, it was concluded that events of violence and tension in developing countries reduced the inflation rate.

The anti-government and protest variable has a negative coefficient value in model 1 in which the EBP emerging in the USA is taken into

account for the 2004-2013 period while it has a positive coefficient in the other period and all other models. The anti-government and protest variables could not be found to be statistically significant in any model for both 1994-2003 and 2004-2013 periods.

The instability regime is found to be statistically significant in all models. The instability regime has a positive coefficient in both model 1 and model 2 for the 1994-2003 period while the instability regime has a negative coefficient in both models for the 2004-2013 period. The instability regime has a greater effect on the inflation rate in model 2 without EPU compared to model 1 with EPU in the USA for the 1994-2003 period. It is observed that the instability regime reduced inflation for the 2004-2013 period while the size of this effect is realized at a very low level compared to the 1994-2003 period.

EPU in the model 1 is not found statistically significant for both the 1994-2003 period and the 2004-2013 period. On the other hand, in model 3, in which there are no violence and tension, anti-government and protest, and the instability regime, the EPU variable is found to be statistically significant and it is concluded that the EPU increases the inflation rates in developing countries.

CONCLUSION

The determinants of inflation have been revealed based on the standard New Keynesian Phillips Curve used by Deniz, Tekçe and Yilmaz (2016) in their study and Aisen and Veiga (2006), Telatar et al. (2010). It is concluded that the effect of violence and tension in developing countries on inflation in the models with the EPU variable

in the USA is at a lower level than in the absence of EPU in the USA for both periods. However, it is concluded that events of violence and tension in developing countries reduce the inflation rate in all models for both periods. In addition, the effect of the anti-government and protest variable on inflation is not found significant in any model. The instability regime in developing countries increase inflation for the 1994-2003 period; However, it is concluded that the instability regime reduce the inflation rate for the 2004-2013. As the variables of political instability in developing countries and the EPU in the USA are included in the models for both the 1994-2003 period and the 2004-2013 period, no significant effect of the EPU on inflation is found. It is concluded that the EPU in the USA increases the inflation rate in developing countries when the political instability variables are not included in the model.

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CHAPTER 5

**THE BEHAVIOR OF VOTERS TO PARTICIPATE IN
GENERAL ELECTIONS ACCORDING TO THE ECONOMIC
VOTING THEORY IN TURKEY: SPATIAL PANEL DATA
ANALYSIS**

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INTRODUCTION

The higher the political participation in a country, the higher the democracy will be. There are different stages of political participation. This study is based on the level of participation in the elections of political participation. Participation in elections reflects the simplest stage of political participation. Every citizen who meets the conditions to vote in this form of participation is required to vote at the time of the election. This participation which is very simple to implement is of great importance for democracy. For this reason every voter should see participating in the elections as a civic duty. Voting is one of the most important rights of every Turkish citizen over the age of 18. It can be considered a great chance for a person to have the right and freedom to direct their own future. Individuals who are aware of these chances and vote will contribute to the functioning of democracy in the country by directing politics. Individuals who are not aware of this situation will ignore the future of their country and therefore their own future by not taking advantage of this right granted to them. Lamprinou (2013) stated in his study that election participation and voting which are the cornerstones of the democratic political process have decreased in almost all European countries in the last decade. In Turkey in the general elections of 2007, 2011, 2015 and 2018 (elections in the years including the analysis period), there was no significant decrease in the participation rates of the regions in the elections. In the general elections of 2015 and 2018, a very low decrease was observed in the election participation rates in some regions. In the general elections of 2015 there was a very low decrease in participation in the elections in

most regions, except for the eastern and southeastern regions. In the general election in 2018, there was a low decrease in participation in the elections in Ağrı, Kars, Iğdır, Ardahan region, Van, Muş, Bitlis, Hakkari region, Şanlıurfa, Diyarbakır region and Mardin, Batman, Şırnak, Siirt region. Participation in the general elections in Turkey's 26 subregions is generally high, but there are regional differences. The regions with the lowest voter turnout are Ağrı, Kars, Iğdır, Ardahan region, Şanlıurfa, Diyarbakır region and Van, Muş, Bitlis, Hakkari region respectively. It is important to eliminate regional differences in the rate of participation in the elections.

In this study first of all, the conceptual dimension and stages of political participation, the theory of economic voting and the factors affecting political participation are explained. In the following stage a literature survey was conducted. Finally the spatial dependence of behavior of participating in the general election according to the economic voting approach and the effect of socioeconomic factors on the behavior of participating in the general election were determined by spatial panel data analysis using annual data for the 2008-2019 period. The effect of the economic voting theory on the participation behavior of the voters in the general elections was interpreted according to the results of the analysis. Thus the validity of economic voting was determined on the basis of socioeconomic factors affecting the behavior of participating in the elections.

1. CONCEPTUAL DIMENSION AND STAGES OF POLITICAL PARTICIPATION

Many definitions of political participation have been made. Some of these definitions are included within the scope of the study. These definitions can be listed as follows: Huntington and Nelson (1976) “an activity done by civilians designed to influence the decision-making of the government”, Kışlalı (1987) “citizens acts of influencing the decisions and practices of the state at various levels”, Kapani (1998) “a concept that determines their situation, attitude and behavior towards political system of members of the community”, Verba (1995) “an activity that has the intent or effect to influence government actions by directly influencing the making or implementation of public policy or indirectly by influencing the choice of those making those policies”, Çukurçayır (2000) “citizens' decision-making processes towards the political system, their socio-economic development processes and their efforts to be effective on the sharing of the products resulting from these processes”, Munroe (2002) “the degree to which citizens exercise their right to engage in political activities (such as to protest, speak freely, vote, influence or be more energetically involved)”, Riley et al. (2010) “a set of rights and duties that include formally organized civic and political activities (such as voting or joining a political party)”, Diemer (2012) “participation in traditional mechanisms in the political system, such as voting in elections and joining political organizations” (Lamprianou, 2013: 22-23; Atabey and Hasta, 2018: 486-487). The

general view in definitions of political participation is that political participation is a form of behavior that aims to shape politics.

Since the 1970s, political participation has been handled in traditional and nontraditional ways in research. Traditional political participation is more structured and legal. Examples of these forms of participation are being a member of a political party, voting, lobbying, campaigning, attending political meetings and communicating with authorities. Unconventional political participation is illegal protest based actions. According to Bourne (2010) examples of these forms of participation are participating in a protest march, participating in a petition, boycotting, participating in a strike, participating in a political demonstration and shooting at the security forces during the demonstration (Lamprianou, 2013: 25).

There are different stages of political participation. Political participation may be very low or very high while political participation may not be at all. The stages of political participation have been classified by various scholars. The classification styles of some of the thinkers commonly included in the literature are briefly (since the scope of the study is limited) included here.

Dahl (1963: 57-59) identified the stages of political participation as four groups. These stages are interest (following political events), caring (importance given to political events), knowledge (having knowledge about political events), action (interfering in political events and influencing political decisions).

Milbrath (1965: 18-19) defined the stages of political participation in three groups as audience, transition and gladiator. Here the stages of political participation are determined according to whether the action is easy or difficult. While the audience is the easiest stage of political participation, the gladiator is the most difficult stage. Transition stage refers to the transition from the easy stage to the difficult stage of political participation. Actions such as voting, wearing a party badge (party membership), convincing people to vote for a party, discussing political issues, being open to political stimuli (person's interest in political participation) are included in the "audience" stage. Actions such as attending a political rally, providing financial support to a political party or political party candidate, having a relationship with a political person (such as party leader, party member) are included in the "transition" stage. Actions such as being a position in a political party (such as an active membership), being a candidate for a political party, being a part of the political party's election campaign, participating in the political party's strategy determination meetings and providing a source of political funds are included in the "gladiator" stage.

Nie and Verba (1972) identified the stages of political participation as six groups. These stages are as follows: those who do not participate in politics (even those who do not vote), those who only vote, limited personal participation (aimed at solving personal problems), participation at the community level (aimed at solving social problems), participation in campaigns (those who take active roles in election campaigns), those who take part in the political party (participate in all activities) (Turan, 1986: 74).

Olsen (1982: 62) evaluated political participation in six stages. The first stage is cognitive participation. Cognitive participation refers to the way of having knowledge and ideas on political issues. The second stage is expressive participation. Expressive participation refers to policy discussions. The third stage is electoral participation. Electoral participation means choosing a party, being registered with a party and voting. The fourth stage is organizational participation. Organizational participation refers to membership and activities in political but nonpartisan organizations or non-political special interest organizations. The fifth stage is partisan participation. Partisan participation refers to running a party campaign, donating money to a party, volunteering work for a political party or serving on a party committee. The sixth stage is government participation. Government participation refers to writing a letter to a public official or performing an elective office.

2. THE THEORY OF ECONOMIC VOTING AND FACTORS AFFECTING POLITICAL PARTICIPATION

Economic voting theory refers to the investigation of whether voting is affected by past, present and future economic conditions (Doyle ve Walsh, 2005: 3-4). Alcoe (2001) argued that when the economic conditions are good, the voters reward the government and when the economic conditions are bad, the voters punish the ruling party. This is the simplest form of economic voting theory (Sezgin, 2007: 22-23).

There are economic voting forms such as retrospective, prospective, sociotropic and pocketbook. In retrospective voting, voters vote for or against the political power by taking into account the economic conditions in the past. While adaptive expectations theory is effective in retrospective voting, rational expectations theory is effective in prospective voting. According to the rational expectations theory individuals make the best decision by acting rationally. In prospective voting individuals can make rational decisions about their future. According to the adaptive expectations theory individuals look at where they have been rather than where they are going. In retrospective voting individuals focus on the problems of the past. In the sociological psychological approach it is argued that the importance of prospective voting is much less than retrospective voting. Retroactive voting is based on three conditions. The first is per capita income, unemployment and inflation rates. The second is that economic indicators were published close to the election. Third the votes of the ruling party are affected by the economic situation. In sociotropic voting, individuals evaluate the economy as a whole. They take into account indicators such as gross domestic product, unemployment and inflation. In pocketbook voting, individuals vote according to their personal financial difficulties (such as being laid off) or their expectations of personal well-being in the future (Jackson, 1999: 12-13).

Political participation is affected by many factors such as socioeconomic, demographic, psychological, political and legal factors. Since the socioeconomic factors affecting the participation rate in the

general election were investigated in the study, only the socioeconomic factors affecting the political participation were explained within the scope of the data included in the analysis (the data were determined according to the current data set of Turkish Statistical Institute (TSI)).

In the literature, it is generally accepted that income and education level have a positive and significant relationship with political participation. Huntington and Dominguez (1975) argue that political participation will be high in societies with high socioeconomic development level and socioeconomic status. They stated that there are a large number of educated individuals working in occupations with high status and income in economically developed societies. Accordingly, the political participation of individuals with a high level of education, status of the occupations and income level is higher than individuals with low level of education, status of the occupations and income. Educated individuals have the knowledge and skills to change the economic and social structure of the country in the direction they want, thus increasing political participation. Individuals with a high level of education generally work in occupations with high income and status, and these factors increase political participation (Huntington ve Dominguez, 1975: 43-44; Turan, 1986: 49). According to Verba, Schlozman, and Brady (1995) while education level has a positive direct effect on political participation, income level has a positive indirect effect (as the income level increases, knowledge and skills in business life increase, so interest in politics increases) (Schlozman, 2002: 435). Kalaycıoğlu put forward two views regarding the relationship between urbanization and political participation. According to the first view, urbanization is

a part of modernization. Educational opportunities provided by urbanization increase political participation by creating the opportunity to follow political events and make political decisions. Accordingly, as the number of people living in cities and modern societies increases, political participation increases. According to the second view, there is an easily understood political structure in small places. Verba et al. (1963) argue that the complex political structure in large settlements reduces the participation of individuals in the political decision-making process. Accordingly, it can be thought that political participation is higher in small settlements than in large settlements (Kalaycıoğlu, 1983: 23-24).

3. LITERATURE REVIEW

Alelaimat (2019) investigated the effect of socioeconomic factors (age, gender, regional affiliation, family income) on the voting of students (300 students per university, 150 male and 150 female, a total of 900 students were surveyed) in Jordan at three universities (Al-Al Bayt in the north, Jordanian in the center and Mu'tah University in the south) in the 2018-2019 period by quantitative method. In study older students, students with high income families, students at Jordanian University, and male students were found to have a higher rate of voting.

Özdemir (2019) investigated the effects of socioeconomic factors (such as gender, age, education, income, marital status and occupation) on political participation for Çankırı by questionnaire method (a questionnaire was applied to 400 participants).

Yiğit and Sezgin (2019) investigated the effect of neighborhood relations at the provincial level on political parties in the 2000-2015 general parliamentary elections in Turkey with Moran I and Geary C tests. According to the results of the analysis, most of the political parties converge in the elections in 2002, 2007, 2011 and 2015 according to their vote rates within the scope of neighborhood relations.

Gokce et al. (2017) investigated the political participation levels of the undergraduate of Kilis 7 Aralık University in Turkey by the survey method. According to the results of the survey individual differences such as age, gender, education and occupation have an effect on political participation. The majority of students are passive in behaviors such as being a member of nongovernmental organizations, having knowledge of the agenda and expressing their wishes in public places. The reason for this situation is that students do not see politics as a tool to solve problems and news about the agenda is not objective.

Yoon (2017) investigated the relationship between participation in the presidential elections in South Korea in 2012 and 2017 and socioeconomic factors, participation in social activities, basic occupations (income level in basic occupations) using the Ordinary Least Squares (OLS) method.

Eser and Sarışahin (2016) investigated the factors affecting political participation by applying a questionnaire to 800 undergraduate students at Süleyman Demirel University in Turkey. According to the results of the survey there is a positive relationship between income, education level, gender and political participation. According to the Mann

Whitney U Test the level of political participation of men is higher than that of women. While the level of income has a greater effect on political participation in men, the level of education has a greater effect on political participation in women.

Gündem (2016) investigated the spatial effects of the vote rates (voters' behaviors) of political parties in the 1 November 2015 elections in Turkey using Moran I and LISA (Local Indicators of Spatial Association) methods. He also examined the determinants of the voting rates of political parties. According to the results of the analysis right parties clustered in the central and interior parts of Turkey while left parties clustered in the eastern and western parts. While income and mosques per hundred thousand people have a positive effect on the vote rate of the Justice and Development Party, unemployment has a negative effect. Higher education graduates have a positive effect on the vote rate of the Republican People's Party. Unemployment has a negative effect on the vote rate of the Nationalist Movement Party. While income has a negative effect on the vote rate of the Peoples' Democratic Party, unemployment has a positive effect.

Russell (2016) investigated the effects of individual factors on the behavior of participating in elections and non-traditional political activities (protest activities) in Turkey, using Turkey Values Survey data for the years 1996, 2007 and 2011 with logistic and linear regression analyzes. In the study logistic regression analysis was used for the effect of individual factors on the behavior of participating in the election and linear regression analysis was used for the effect of

individual factors on the behavior of participating in non-traditional political activities. According to the results of the analysis while the level of education has a negative effect on the behavior of participating in the elections, it has a positive effect on the behavior of participating in non-traditional political activities. Political trust has a positive effect on the behavior of participating in the elections and has a negative effect on the behavior of participating in non-traditional political activities. Association membership is positively related to the behavior of participating in non-traditional political activities and participating in elections. Economic stability is positively related to participation in elections (for 2007 and 2011 only), protection of freedom of speech is positively related to participation in non-traditional political activities.

Kaya et al. (2015) investigated the spatial clustering of the vote rates of the political party who entered the parliament in the general elections 2011 in Turkey using the *Gi* statistics of Getis and Ord and Local Indicators of Spatial Association (LISA) of Anselin method which are local spatial autocorrelation methods. According to the results of the analysis the regions where the votes of the political parties are clustered are different. The Justice and Development Party which has the lowest cluster in terms of the number of districts came to power alone. This shows that while the support that the political parties receive should be regionalized, the support they cannot receive should not be regionalized.

Cutts et al. (2014) investigated the effect of local election campaign expenditures on voting behavior in England in 2010 by spatial analysis.

According to the results of the analysis the increase in any political party campaign in a region increases the support given to the political party (such as votes) in the neighboring regions.

Beren (2013) interviewed randomly selected individuals from Şanlıurfa city center and the districts of Harran, Suruç and Siverek in order to determine the factors affecting the preferences of voters. According to the results of the interview, demographic, ideological and security related factors are effective on voter preferences in Siverek and Harran district center and Harran villages while cultural, feudal and demographic factors are effective in Suruç district center and villages of Siverek. In the study it was determined that feudal, demographic, cultural and security related factors were more effective in voter preferences.

Pigon (2013) investigated the impact of socioeconomic factors (unemployment, employment, education, age, marriage, political knowledge and interest in politics etc.) on the participation rate in the presidential and parliamentary elections in Poland in 2010 and 2011 with macro and microeconomic models (ordinary least squares and logistic regression analyses). According to the results of the models, while bad economic conditions (such as high unemployment, low employment) negatively affect participation in the elections, gender, marital status and marriage rate do not affect. The elderly and young population participate more in the election compared to the middle-aged population. Having a favorite party, having knowledge and interest in politics increases participation in the elections.

Burnett and Lacombe (2012) investigated the voting behavior in the 2004 presidential elections in the United States (USA) using spatial econometric analysis using the SDM (Spatial Durbin Model-) model. According to the results of the analysis voting behavior spreads among the states because the spatial coefficient is significant. In the analysis, it was determined that similar states showed a tendency to cluster.

Campante and Chor (2012) investigated the relationship between the schooling and political participation for 25 countries using 1975 and 2000 data with ordinary least squares and logistic regression analyzes. According to the results of the analysis while political participation is more sensitive to education in countries with high natural resources (not much human capital), it is less sensitive to education in countries with high human capital. In addition, political participation is less sensitive to education in countries where individuals work in qualified occupations and where human capital is more valuable in production. In other words, as a result of the increase in human capital in these countries, the tendency to political activities is at a lower level.

Coleman (2012) investigated the participation rate in the presidential elections (1920, 1940, 1960, 1968, 1980, 1992, 2000 and 2008 presidential elections) in 48 states in the USA from 1920 to 2008 under the influence of social cohesion by spatial analysis. According to the results of the analysis the spatial autocorrelation of participation in presidential elections in neighboring states in all eight elections is statistically significant. In this case participation in the presidential elections spreads among the states.

Seabrook (2009) investigated geographic clusters in party preferences in 48 states in the 2004 and 2008 presidential elections in the USA with Local Indicators of Spatial Association (LISA) analysis. According to the results of the analysis, there is spatial autocorrelation in the US presidential elections from 2004 to 2008. According to the LISA result, Democratic support is seen as a smaller and higher number of clusters than Republican support. Unlike the Republican cluster which gathered in rural areas, the Democratic cluster was concentrated in densely populated urban areas.

Kaya (2008) investigated the regional differences of political party preferences and political participation during election periods in Turkey by evaluating the election results dataally. According to the result reached in the study there are differences in political party preferences and political participation in terms of east and west regions and south and north regions. Accordingly although the rate of participation in the elections differ according to years generally increases from west to east and from south to north. Election turnout is high in regions with high per capita income and urbanization, low unemployment, dependent young population and dependent population. While the Justice and Development Party has been successful in all regions in Turkey, the Republican People's Party, the Nationalist Movement Party and the independents have been successful in some regions.

Çınar (2007) investigated the relationship between city size and vote preference in eight local elections in Turkey in the 1963-1999 period with a spatial scale. The change in voting preference with the change of

the spatial scale (ten thousand and fifty thousand scales accepted as thresholds in urbanization literature) was tested. According to the results of the study the success of right parties, left parties and independents in small and big cities is regular and changes according to election periods. While small cities are more conservative than big cities in voting preference, big cities are variable according to the conjuncture. When the spatial scale changes, the success of the right and left parties is determined by the conjuncture in the election period. The effect of the big city scale on the electoral success of right or left parties is not certain.

Gallego (2007) investigated the impact of various social factors on four political activities using European Social Survey data for twenty-four countries with logistic regression analysis. According to the results of the analysis while age, education and social class are the main causes of the deterioration (inequality) in political participation, the variables related to gender, minority membership and occupation are less related to political participation. It has been determined that socioeconomic inequalities in voting are clearly visible in most European countries.

Sezgin (2007) investigated the effect of economic factors on the popularity of the political power (trust in political power) according to the voters in Turkey using the survey data related to the popularity function with the least squares method. According to the results of the analysis while inflation (with a lag of one period) and unemployment (with a lag of two period) have a negative effect on the popularity of political power, there is a positive effect of gross national product (with

a lag of four period) and industrial production (with a lag of two period). It has been concluded that the gross national product has a positive effect on voters with good expectations for the future while unemployment and inflation have no effect.

Martikainen et al. (2005) investigated the relationship between participation in the 1999 presidential elections and four socioeconomic factors (income, social class (working class, middle class, entrepreneur, farmer, students, retired) age, education level) for three age groups (25-34, 35-54 and 55-69 age groups) in Finland using logistic regression analysis. When the result of the analysis is evaluated, participation in the elections is high in the youngest age group according to social classes, in the middle and old groups according to income level, in the youngest age group according to home ownership and in those with the highest education level. While income and length of residence are important determinants of the participation of older voters, education is an important determinant of the participation of young voters. Social class is the determinant of electoral participation in all age groups. Election turnout is lower among lower social classes and youth and higher among the elderly.

Lewis-Beck and Steigmaier (2000) investigated the voting status of the voters according to the economic performance in the elections of the countries by evaluating the studies on the subject. According to the results of the study voters participate in the elections for the purpose of reward or punishment according to the economic performance of the political power. When evaluating the economy, voters consider all

economic indicators. In the study, it was emphasized that economic voting is not known much in Third World countries and that the reward and punishment paradigm can be extended to the transitional democracies in Africa.

Blank (1974) investigated the effects of environmental factors (immigration, regional trust, foreign nationality), characteristics of the political system (party competition, party bureaucracy, electoral structure, electoral offices per capita) and socioeconomic factors (income, increase in income, taxes per capita, welfare per capita, education expenditures) on voting behavior for 50 states of the United States using multiple correlation analysis. According to the results of the analysis the effect of environmental factors and the characteristics of the political system on voting behavior is more than the effect of socioeconomic factors. Environmental factors are less associated with voting behavior in southern states, while socioeconomic factors are less associated in non-southern states.

4. DATASET AND METHOD

In the analysis, the spatial dependence of the behavior of participating in the general election for the 26 sub-regions (between border neighbour regions) of Turkey, the spillover effect of the behavior of participating in the general elections in the border neighbour regions and the effect of socioeconomic factors on the behavior of participating in the general elections were investigated by spatial panel data analysis. In the analysis the rate of participation in the general elections was used as an indicator of the behavior of participating in the elections.

Socioeconomic factors affecting the participation rate in the general elections are determined as per capita gross domestic product, unemployment, inflation (Consumer Price Index), the share of college and faculty graduates in the total population and urbanization rate within the scope of the current data set of TSI. For all variables the annual data of the TSI for the period 2008-2019 were used according to the second level Nomenclature of Units For Territorial Statistics (NUTS2). The fact that the data on the number of college and faculty graduates started in 2008 and that the data on the gross domestic product per capita were not available after 2019 were effective in determining the period. The findings obtained in the analysis were obtained with the Stata 16.0 package program.

Three types of data are used in the analysis of econometrics, namely cross section data, time series and panel data. If the spatial effect (relationship between spaces according to their location) is ignored in the cross sectional data (in the data of the place such as country, region, province), the results obtained by econometric methods become ineffective and biased results. For this reason spatial econometric methods have been developed (Anselin, 1988: 7-15; LeSage ve Pace, 2009: 1). Spatial models that are valid for cross section data over time have also been developed for panel data. Spatial econometrics is a branch of science in which the concept of spatial effect is included in regression models for cross section and panel data. Spatial effect is the effects that occur by the inclusion of distances in the modeling process, it consists of spatial interaction (autocorrelation or dependency) and spatial structure (heterogeneity or variability) (Anselin, 2001, 311).

While spatial autocorrelation (dependency) is expressed as the similarity of the values of the locations, spatial heterogeneity (variability) is expressed as the structural instability in the non-constant error variance or model coefficients (Anselin ve Bera, 1998: 241).

In spatial econometrics the usually spatial weight matrix is defined to show the neighborhood relationship. This matrix is created according to the distances between the positions and the weights depending on the common boundary. Waldo Tobler (1970) explained the basic law of geography as “everything is related to everything else, near things are more related to each other than distant things”. For this reason a spatial weight matrix was created by using weights depending on the common boundary in the analysis. In the literature two spaces with a common border (full physical proximity) are defined as neighbors. In the analysis a spatial econometric model is created and estimated according to these weights (Tobler, 1970: 237; Ord 1975, 120).

The spatial econometric model may include the spatial lag dependent variable or the spatial autoregressive process in the error term. While the model that includes the spatially lag dependent variable is defined as the Spatial Lag Model or the Spatial Autoregressive Model (SAR), the model that includes the spatial autoregressive process in the error term is defined the Spatial Error Model (SEM) (Elhorst, 2003: 245). Spatial panel data models are classified as spatial fixed effects panel data models and spatial random effects panel data models. In spatial panel data models unlike panel data models, the spatial effect is included in the model with the spatial weight matrix. In spatial panel

data models Hausman test is used to test random effects models against fixed effects models as in panel data models.

5. ANALYSIS RESULTS

First of all, the validity of the random effects model against the fixed effects model was investigated with the Hausman test² for the SAR, SEM and SDM models. As a result of the Hausman test of the SAR and SDM models, the null hypothesis (the random effects model is valid) was rejected and the fixed effects model was found to be valid. In the following stage, spatial dependence of general election participation behavior in border neighbour regions was investigated by the likelihood ratio (LR) test according to spatial regression models³ (SAR, SEM and SDM). According to the LR test results of the three models (the probability value of spatial coefficients (rho in SAR and SDM models, lambda coefficient in SEM model) is less than 0.05. Therefore null hypothesis was rejected), there is spatial dependence between the border neighbour regions. The signs of the coefficients of the independent variables are in the expected direction and the coefficient values are very close to each other in the SAR and SEM models. Most of the independent variables in the SDM model are statistically insignificant. According to the Hausman test while the fixed effects model is valid in the SAR and SDM models, the random effects model

² SAR, SDM and SEM models Hausman test results: SAR model chi-square 566.67 probability value 0.0000, SDM model chi-square 258.41 probability value 0.0000, SEM model chi-square 10.42 probability value 0.0643.

³ SAR, SDM and SEM models LR test results: SAR model rho value 0.0037, SDM model rho value:0.001, SEM lambda value 0.0043.

is valid in the SEM model. The SAR model is similar to the SDM model in terms of the Hausman test result and the SEM model in terms of the significance of the coefficients of the independent variables. For these reasons it is thought that the SAR model is the most suitable model for operation. The fact that the behavior of participating in the general election in all three models is spatial dependence relative to the regions bordering is indicative of the accuracy of the analysis method. For these reasons the SAR model was considered to be the most appropriate model for the study. In all three models the spatial dependence of the behavior of participating in the general election according to the border neighbour regions is an indicator of the accuracy of the analysis method.

The variables in the analysis tables are given in abbreviations for ease of use. The model was created logarithmically to make the interpretation of the coefficients easy. Variables are preceded by the symbol "ln", indicating that they are logarithmic. Accordingly the participation rate in the general election as $\ln \text{gep}$, per capita gross domestic product as $\ln \text{lpcgdp}$, the unemployment rate as $\ln \text{lu}$, the consumer price index as $\ln \text{lcp}$, the rate of graduates from colleges and faculties in the total population as $\ln \text{lcfg}$ and the urbanization rate as $\ln \text{lu}$ are abbreviated.

Since it is the most suitable model for analysis, only the results of the SAR model are included in the study. According to the SAR model results in the table below there is a spatial dependence of the behavior of participating in the general elections between the border neighbour

regions. The sign of the spatial rho coefficient is positive. Accordingly an increase in the rate of participation in the general election in a region creates an increase in other border neighbour regions to this region. The behavior of participating in the general election shows a spreading effect among border neighbour regions. While per capita gross domestic product and the share of faculties and college graduates in the total population positively affect the participation rate in the general election, unemployment rate and consumer price index affect negatively. Urbanization rate has no effect. The results of the analysis support the opinions in the literature. It is dominant in the literature that political participation will increase when the income and education level are high. In line with expectations when the per capita gross domestic product and the proportion of graduates from colleges and faculties in the total population increase, the rate of participation in the general elections increases. Economic factors such as gross domestic product per capita, inflation and unemployment rate reflect the economic situation of a region. It is expected that good economic conditions in a region will increase participation in the general election. In line with expectations when unemployment and inflation rates decrease, the rate of participation in the general election increases. There are opinions in the literature that living in large settlements will increase or decrease political participation. According to the results of the analysis the fact that the urbanization rate has no effect on the participation rate in the general election may indicate that the effect of economic factors and education level on the participation rate in the general election is more dominant than urbanization.

Table: SAR Model Results

Dependent Variable: Participation Rate in The General Elections (Ingep)	
Variables	Coefficients
rho	0.0008514 (2.91)***
lnpcgdp β₁	0.0322326 (3.50)***
lnu β₂	-0.0097202 (-2.03)**
lnspi β₃	-0.0146786 (-2.63)***
lncfg β₄	0.0249951 (2.32)**
lnu β₅	-0.0129372 (-1.11)
LR Test SAR vs. OLS (Rho=0): 8.4501 Probability Value: 0.0037 The values in parentheses at the top of the table show the z table values. Hausman test: chi-square 566.67 probability value 0.0000	
Tests	Test Statistics Value
Moran MI	0.4929 (0.0000)***
Geary GC	0.4928 (0.0000)***
Getis-Ords GO	-2.0855 (0.0000)***
***, **, * indicate the significance level at 1%, 5% and 10%, respectively. The values in parentheses in Moran I, Geary GC, Getis-Ords GO tests give probability values.	

$$\text{Ingep} = 0.0008514 + 0.0322326 \text{ lnpcgdp} - 0.0097202 \text{ lnu} - 0.0146786 \text{ lnspi} + 0.0249951 \text{ lncfg} - 0.0129372 \text{ lnu}$$

CONCLUSION

It can be said that the behavior of participating in the elections is the simplest and most important stage of political participation. In order for democracy to work in the country, every citizen must not waste their right to vote. Voters do not vote especially because there is no party they see close to them. If the economic conditions in the country are bad and individuals do not have a party that they believe will fix the

economy, they may not want to vote. These voters who do not vote can be described as “despairing voters”. Individuals with a low level of education may not vote because they are not aware that they can change the socioeconomic structure of the country by voting. Again, individuals with a low level of education may be uninterested in political participation due to their lack of sufficient information. All individuals who do not vote will accept the choice of others. At this point it is important to determine the factors that affect political party preference of voters as well as socioeconomic factors that affect the participation in the elections of voters. In addition to the spatial dependence of the voting rates of the political parties, the spatial dependence of participation rate in the elections of voters should also be investigated. There are few studies in the literature in which the spatial analysis of the vote rates of political parties in general elections for Turkey is made. However no studies were found in which the spatial analysis of participation rates in the general election was made for Turkey. In this respect it is thought that the study will contribute to the literature.

According to the results of the analysis, there is a spatial dependence of the behavior of participating in the general elections. The spatial coefficient is in the positive direction. Accordingly an increase in the rate of participation in the general elections in a region creates an increase in the rate of participation in the general elections in the border neighbour regions to this region. Again, according to the analysis while gross domestic product per capita has a positive effect on the participation rate in the general election, unemployment and consumer

price index have a negative effect. In other words when the economic conditions are good, the participation rate in the general election increases. According to the theory of economic voting when the economic conditions are good, the voters go to vote in the general elections to reward the political power, otherwise punish them (vote for opposition parties). According to the results of the analysis voters in Turkey go to vote to reward the political power, but not to punish it. Because if the economic conditions are bad, the participation rate in the general election decreases. In other words if the voter does not believe that there is a political party that will fix the economy when the economic conditions are bad, they do not go to vote. Accordingly voters do not apply the prospective voting method and do not take into account the policy promises of political parties. Voters adopt retrospective and socio-tropical voting method. In other words it takes into account recent economic indicators (such as gross domestic product per capita, inflation and unemployment) and the general economic situation. If the economic indicators show that the country's economy is improving, the voters vote, otherwise they punish the political power by not voting (partisans may be voting in any case). Voters who apply such a form of punishment accept the preferences of others. Voters shape their future in line with the preferences of others. According to the results of the analysis the level of education positively affects the rate of participation in the general election. As the level of education increases, individuals become more conscious and become more aware of the importance of going to vote. In general individuals with a high level of education work in professions with high income and status, and as the level of education

increases, the economic situation of individuals is better than individuals with a low level of education. In this case it can be said that the level of education affects the economic conditions. According to the results of the analysis urbanization has no direct effect on the participation rate in the general elections. However considering that the economic conditions will be better in urban areas than in rural areas, it is expected that the rate of participation in the general elections will be high especially in cities where the gross domestic product per capita is high. Due to the similarity of the socioeconomic structures of the border neighboring regions when there is an increase in the participation rate in the general election due to the socioeconomic conditions in a region, an increase is observed in the border neighboring regions with similar socioeconomic conditions. Thus the behavior of participating in the general election shows a spatial spread. The rate of participation in the general election in Turkey is not at a low level. In recent years it has not shown a downward trend as in European countries. However there are differences in participation rates in the general elections between regions. This is due to the socioeconomic development differences of the regions. In order to ensure democracy in the country, it is important to ensure the socioeconomic development of the regions and to eliminate the interregional development differences in order to ensure the full participation rate in the general elections. Thus, the rate of participation in the general elections in economically developed regions will increase and the rate of participation in the general elections in the border neighbour regions to these regions will increase.

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CHAPTER 6

**INNOVATION VALUE CHAIN IN SMES: EVALUATION OF
TECHNOLOGICAL INNOVATION EFFICIENCY IN THE
CONTEXT OF LEADERSHIP**

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INTRODUCTION

Innovation is a very important tool in increasing the competitiveness and efficiency of enterprises. Businesses that can reduce their costs through innovation; price advantage, awareness against competitors and superior quality can achieve advantages. SMEs, which are competitors of large-scale enterprises; they must benefit from innovation in their products, processes, marketing methods and techniques, organizational structures. In the study, It is included in determining the attitudes of SMEs towards innovation, identifying in-house and non-business factors that hinder innovation practices, and in this context, leadership understanding is also mentioned.

SMEs continue to develop rapidly in Turkey in technology. The number of technological SMEs is increasing and the capacity for innovation, which plays an increasingly important role in economic development, is constantly being developed. If the outlook of SMEs in Turkey is reflected proportionally; When both industry and services sectors are taken into account together, it is seen that such enterprises create 99.8% of total enterprises, 76.7% of total employment, 38% of investments, 26.5% of added value, 10% of exports and 12–13% of bank loans (OECD, 2005).

In modern economic globalization, the fiercely competitive market environment and changing customer demand require technological SMEs to constantly innovate. Research on technology innovation ability, efficiency evaluation and development of technological SMEs has become an important research topic. It aims to provide a reference

and basis for businesses to improve their innovation capabilities and for macro departments to make policy.

What are the main factors that determine the speed and direction of technological development? If the important role of technological development in economic and social development is remembered, this is an important question and its reflections in the field of politics will be extremely important.

Studies on today's developed countries; it points out that being open to new ideas, the existence of effective regulations that promote technological development and protect private property, and practices such as 'smart' state intervention in the economy have positive effects on this process.

Although it differs from one technology to another, the most remarkable feature of the spreading process is that it is gradual (Lors&Hall, 2005). In other words, when new technologies are introduced, very few users leave old technologies and start using new technologies. The fact that new technologies with technical and economic advantages over old technologies were not immediately adopted by the entire user population has led to different explanations in the technology writing. The epidemical propagation model indicates that users do not immediately embrace innovations because they have incomplete knowledge of the features of new technologies.

information may be available as follows: (i) information on the learning process that enables the effective use of selected new technology or design, and (iv) the slowing of the spread of new

technologies as a result of improving the performance of older technologies and competing with new technologies.

Innovation in the Oslo Guide (OECD, 2005:50), "... in-house applications, workplace organization or external relations are defined as a new or significantly improved product (goods or services), or process, a new marketing method or the realization of a new organizational method". As pointed out in the definition, innovations are classified as product and service, process, marketing, organizational innovations. there is harmony in the organization, performance is expected to be high.

In this context, the increase in the value alignment of the person and organization, the increase of the performance of the individual and the positive results for the organization are expressed by the Business Compliance Theory (Argyris, 1957; Dawis and Lofquist, 1984).

Yetim ve Yetim (2006) carried out his work on SMEs in Mersin on a total of 1140 employees. As a result of the research, they suggested that the perception of paternist leadership positively affects the employee's job satisfaction. In his thesis on 214 employees in 17 different banks, the Assistant (2010) stated that paternist leadership, together with all sub-dimensions, positively and meaningfully affects job satisfaction.

In recent years, the Regional Innovation System (or Strategy) approach has been developed and discussed, claiming that a systemic approach at the national level alone will be inadequate to manage the technological change process. Described by Asheim and Coenen

(2005) as 'an institutional structure that supports innovation activities from within the production structure of a region', the Regional Innovation System (BYS) is a system that is not completely independent of the UYS and should not actually be considered as an alternative to UYS.

The concept of "innovation" was put forward by Schumpeter in 1912, an economist, from which the theory of technological innovation and change was put forward. Innovation ability refers to the ability of an enterprise to accept new ideas, improve new technology and create new products (Burns & Stalker 1961). The survey found that external knowledge, leadership and teamwork are the key factors affecting technological innovation for small software enterprises (Jeremy Rose et al. 2015).

Because it is a multidimensional concept, information is used in different forms for different purposes in different contexts. The concepts of data and information are often confused and sometimes used interchangeably (Lewis et al, 1995:599). In the writing of information technologies and systems, there is a third concept of knowledge in addition to these two concepts, which at first glance evokes the meaning that the other two concepts are loaded. However, these three terms differ from each other in meaning. Each of them is the products that appear as output at different stages of the information processing process.

One of the most important reasons why businesses invest in IT is that it makes it possible to create knowledge that will be obtained, stored

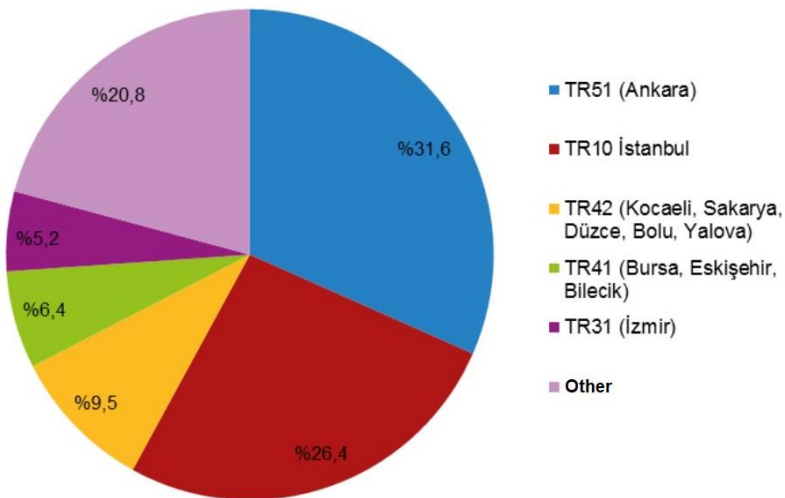
and ready for use through these technologies. In general, information research by enterprises can be seen as only part of an organization's work to adapt itself to the external environment in order to continue its activities and become more competitive. The information requirement of the enterprises is shaped according to the structure of the environmental conditions in which the organization is located and the competitive strategy to be followed. One of the most important steps in meeting the information needs determined by enterprises accurately and timely is the creation of a comprehensive network of information systems (Carniero, 2000:89).

Information management also constitutes the cultural aspect of operating in the market for businesses and IT is needed to create this culture in the market. Information technologies are now seen as having a decision-based role in top information management for all businesses and are considered the most important tool in achieving market objectives, ensuring competitive advantage and making decisions.

In order to develop technology, it is necessary to first warn R&D projects. In order to replicate R&D projects, R&D support, support of pre-need and project determination studies, initiatives that bring companies together, environments where interaction between companies and companies and academic organizations are provided should be developed (KIPER; 2004:112-113).

to The Statistical Regional Units Classification (IBBS) Level 2, the region with the highest R&D expenditures in 2019 was TR51 (Ankara) with 31.6%, followed by tr10 (Istanbul) region with 26.4% and TR42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova) region with 9.5%.

D expenditures ibbs 2. Distribution by level, 2019



Source: <https://data.tuik.gov.tr/Bulten/Index?p=Research-and-Development-Activities-Survey-2019-33676>

From the perspective of innovation value chain, which evaluated the efficiency of SMEs by using the additive decomposition two-stage DEA model, and considering the nature of enterprise ownership, life cycle, region and industry. It is pointed out that the innovation achievements of enterprises cannot be easily divided into the stage of technology R&D and the stage of technology digestion. Therefore, the

dynamic two-stage DEA can be used to measure the efficiency of a system with two-stage structure and shared output (An QX et al. 2020).

Above literature provides an important reference for the study. First, research methods about technology innovation of traditional literature are diverse, but most of them pay more attention to the initial investment and the final output and regard the internal process of technology innovation as a "black box". It ignores the operation mechanism and innovation value process of internal technology innovation, and fails to refine the internal research and development process of enterprises, so it is impossible to correctly investigate the internal technology R&D and its influence. Secondly, the innovation value chain is used to divide the internal technology innovation process.

Based on the two-stage DEA model, it can correctly distinguish R&D efficiency from transformation efficiency, also for the technical effectiveness and scale effectiveness. Finally, from the perspective of regional and enterprise size heterogeneity, the results are more comprehensive, objective and accurate through proceeding multi-dimensional comparison and analysis.

MATERIALS AND METHODS

TWO-STAGE DEA MODEL

In a competitive environment, measuring the performance of production units and determining sources of inactivity are

prerequisites for improving the performance of any production unit (Vincova, 2005:24). The concept of effectiveness and measurement of effectiveness, which is an evaluation criterion that shows how effectively or adequately inputs are used for the purposes determined by the enterprise, has become very important. Therefore, academicians focus on studies on VZA methodology used to measure effectiveness.

VZA, which was introduced to the literature by Charnes, Cooper and Rhodes in 1978, is a simple but also powerful method. The widespread use of VZA is due to the measurement of the relative efficacy of KVBs without priority weights on inputs and outputs. Today, VZA is widely used by many researchers in different fields such as education, banking, agriculture, information technology and information systems, computer industry, power plants, air transportation, stock market and supply chain (Kuah et al., 2010: 168).

In real economic activities, there is often a situation that DMU unit can be decomposed internally (Halkos et al. 2014). For example, the technology R&D process is not a simple linear process from the initial input to the final output.

Based on the Fare's model, it assumes that there are n DMUs, and any DMU_i can be divided into two stages. In the first stage, there are m inputs $X^1_i = (x^1_{i,1}, x^1_{i,2}, \dots, x^1_{i,m})^T$. The outputs in the first stage are also the inputs in the second stage $Y^2_i = (y^2_{i,1}, y^2_{i,2}, \dots, y^2_{i,n})^T$. The outputs in the second stage $Z^3_i = (z^3_{i,1}, z^3_{i,2}, \dots, z^3_{i,q})^T$. $W^1_i = (w^1_{i,1}, w^1_{i,2}, \dots, w^1_{i,m})$, $W^2_i = (w^2_{i,1}, w^2_{i,2}, \dots, w^2_{i,n})$, $W^3_i = (w^3_{i,1}, w^3_{i,2}, \dots, w^3_{i,q})$ are the weights of the input variables of the first stage, the intermediate stage and the

output variables of the second stage.

In the first stage, the input-oriented DEA-BCC model is adopted to solve the optimal value of input/output efficiency index by taking input-minimization and output maximization as the evaluation criterion. According to Charnes-Cooper model transformation, the linear expression of the first stage efficiency model can be obtained as (1).

$$\begin{aligned} \min E_1 &= \sum_{i=1}^m W_i^1 X_i^1 + \eta_1 \quad (1) \\ \text{s. t. } &\begin{cases} \sum_{j=1}^n W_j^2 Y_j^2 - \sum_{i=1}^m W_i^1 X_i^1 + \eta_1 \leq 0 \\ \sum_{j=1}^n W_j^2 Y_j^2 = 1 \end{cases} \end{aligned}$$

Wherein: η_1 refers to the reward to scale characteristic of DMU. If $\eta_1=0$, it indicates that DMU is in the best production scale state, that is, the scale return is unchanged; $\eta_1 \neq 0$ indicates that DMU is a state of increasing or decreasing return to scale.

In the second stage, the output oriented DEA-BCC model is adopted to solve the optimal value of the output/input efficiency index by minimizing the output maximization input as the evaluation standard. According to Charnes-Cooper model transformation, the linear expression of the second-stage efficiency model can be obtained as (2).

$$\begin{aligned} \max E_2 &= \sum_{k=1}^q W_k^3 X_k^3 - \eta_2 \quad (2) \\ \text{s. t. } &\begin{cases} \sum_{k=1}^q W_k^3 Z_k^3 - \sum_{j=1}^n W_j^2 Y_j^2 + \eta_2 \leq 0 \\ \sum_{j=1}^n W_j^2 Y_j^2 = 1 \end{cases} \end{aligned}$$

Wherein: η_2 refers to the reward to scale characteristic of DMU. If $\eta_2=0$, it indicates that DMU is in the best production scale state, that is, the scale return is unchanged; $\eta_2 \neq 0$ indicates that DMU is a state of increasing or decreasing return to scale.

According to the above model results, E_1 is the efficiency value of the first stage, E_2 is the efficiency value of the second stage, then the overall efficiency value of DMU $E=E_1 \times E_2$. Therefore, the whole stage will be efficiency only if the efficiency values of each sub-stage are valid, that is $E=E_1 \times E_2=1$.

TWO-STAGE TECHNOLOGY INNOVATION PROCESS

Research on technology innovation is an important topic that scholars pay attention to, but most of them are based on traditional DEA and stochastic frontier analysis (SFA). In recent years, based on the innovation value chain theory (Hansen & Birkinshaw 2007).

In other words, it is the transformation process of innovation achievements and a continuation of the technology R&D process in the market. Through two stage decomposition of innovation value chain, it solves the "black box" problem in the previous innovation process, which only examines the input and output results of

INPUT AND OUTPUT INDEX SYSTEM

According to the theory of innovation value chain, enterprise innovation can be divided into two stages. The first stage is the technology R&D stage, which requires a large amount of financial and human resources investment. In other words, R&D funds and R&D staff are the main driving forces for the technology R&D of enterprises and can be used as the investment indicators in the technology R&D stage. The intermediate output results of enterprise technology R&D stage are mainly intangible assets represented by patents, Copyrights, etc.

We use the production staff and total fixed assets of the enterprise as the input indicators in the second stage. The economic output of the commercialization process is mainly reflected in the operating income of new products and operating profit. To sum up, the evaluation index system is shown in Table 1.

Table 1 Technology innovation and input-output indicators

Stage	Primary indicator	Secondary indicator	Code
Technology R&D stage	R&D input	R&D Expenses (million)	Rd_fee
		Number of R&D staff (person/year)	Rd_staff
	R&D output (Intermediate output)	Increase of intangible assets (million)	Intangible
Achievement transformation stage	Commercial input (Intermediate input)	Number of Employees (person/year)	Staff
		Total fixed assets(million)	Fix
		Operating Income(million)	Income
	Commercial output	Operating Profit(million)	Profit

DATA SOURCES AND PROCESSING

In this article, considering the latency of Technological innovation output of a total of 169 companies in Turkey, data latency is taken into account. For example, the input process of the first stage uses 2015-2017 data, the intermediate output is the data of 2016-2018, the intermediate output is the input data of the second stage, and the economic output is the data of the second stage. the second phase uses 2017-2019 data.

According to the use requirements of DEA model, input-output data cannot be negative. Since there may be negative values in the two indicators of operating profit and intangible assets added value in the original data, the negative values can be dimensionless by using the addition model and the original data of the indicators with negative values can be collected between $[0,1]$. The specific formula is as follows: $y_{ij}=0.1+(x_{ij}-m_j)/(M_j-m_j)\times 0.9$. Among the formula, $M_j=\max(x_{ij})$, $m_j=\min(x_{ij})$, $y=[0,1]$, $(i=1, 2, 3, \dots, n)$.

DESCRIPTIVE ANALYSIS

The study conducted a descriptive statistical analysis of the data of all sample companies, and obtained the maximum, minimum and mean values of each indicator. The samples were also classified by province, which results are shown in Table 2.

Table 2. Comparison of the mean values of the indicators of enterprises in different regions

Province	Obs	Rd fee	Rd staff	Intangible
İstanbul	33	48.76	274.07	8.07
Ankara	32	92.48	265.54	5.57
İzmir	25	100.72	236.05	14.06
Bursa	25	69.40	285.45	13.72
Kocaeli	16	55.09	309.78	11.35
Tekirdağ	6	48.57	313.04	18.90
Adana	6	47.90	388.72	30.62
Aydın	5	39.00	347	6.97
Antalya	5	44.05	208.07	3.33
Balıkesir	4	49.90	366.76	31.50
Zonguldak	4	60.57	205	4.16
Manisa	4	24.46	189.92	-0.14
Konya	4	57.37	192.83	0.97
Max	34	56.80	2694	11.47
Average	169 (Total)	1047.10	275.55	325.88
Minimum	4	5.48	27	-57.47
Province	Total assets (million)	Fix	Staff	Income
İstanbul	906.97	201.01	638.59	565.99
Ankara	1052.90	72.19	625.22	484.25
İzmir	1656.31	230.83	561.49	754.00
Bursa	981.37	133.59	665.20	561.38
Kocaeli	1108.21	163.25	737.93	643.01
Tekirdağ	1238.10	163.18	729.04	532.13
Adana	1458.80	250.52	905.19	802.42
Aydın	811.13	157.66	808.27	545.50
Antalya	801.87	163.18	485.33	513.28
Balıkesir	2271.64	357.04	853.92	734.90
Zonguldak	1047.28	131.44	477.58	397.57
Manisa	725.45	150.93	442.67	337.29
Konya	561.47	93.02	449.67	326.32
Max	9963.24	3237.14	6859	4306.00
Average	1124.73	174.45	644.62	553.70
Minimum	85.20	0.59	64	0.19

RESULTS AND DISCUSSION

The study use MaxDEA8 software to calculate the annual the overall technology innovation efficiency, the technology R&D efficiency and the transformation efficiency of innovation achievements. In the first stage, the input-oriented, in the second stage, the output-oriented BCC model is adopted.

TECHNOLOGY INNOVATION EFFICIENCY IN TWO STAGES

Table 3 shows the average of total technology innovation efficiency, pure technology efficiency, and efficiency of scale of 169 companies from 2015 to 2017. In terms of overall efficiency of technology innovation, the overall efficiency of listed companies on Technology Board is relatively low with a top average of 0.2509 and shows some downward trends from year to year. From Table 3 it can be seen that the conversion efficiency of innovation achievements is in the range of [0.5693, 0.7564]; this is generally higher than the technology R&D efficiency range in [0.3391, 0.3937], which indicates that listed companies have technology R&D efficiency. While the stage of commercializing technological achievements into economic output is relatively efficient, it can bring objective economic benefits and profits for businesses.

Table 3 two stage technology innovation efficiency in 2015-2017

	Total technology efficiency	Technology R&D efficiency	Achievement transformation efficiency
2015	0.2509	0.3391	0.7564
2016	0.2205	0.3937	0.5693
2017	0.2115	0.3736	0.5764

REGIONAL HETEROGENEITY

Technological innovation ability of enterprises differs according to regions. Table 4 shows the average results of technological innovation productivity of different provinces. As can be seen from the table, the overall technology innovation efficiency of companies is generally low, with a three-year average of only 0.2275. The highest rate is in the province of Manisa with 0.2997, and the lowest rate is in the province of Antalya with 0.1554. In addition, technology innovation efficiency is generally higher in Ankara, Zonguldak and Bursa provinces than the others. From the point of view of the sub-stage of technology innovation, the technology R&D efficiency of various provinces is in the range of [0.2744, 0.5141], generally lower than the range of transformation efficiency of innovation achievements [0.4809, 0.7144].

Comparing with the technology R&D efficiency, the commercialization efficiency of enterprise innovation results is generally higher. It illustrates that the enterprise can accurately grasp the market demand, and technology innovation outcomes are easy to be introduced into the market, and bring higher economic output

benefits. From regional perspective, the technology R&D efficiency and the transformation efficiency of innovation achievements of Ankara-Zonguldak and Bursa are relatively high, which belong to the "double high" operation state.

Table 4 Two-stage technology innovation efficiency in major provinces

	Province	Total efficiency	technology R&D stage			achievement transformation stage		
			TE	TPE	TE	TPE	TE	TPE
	İstanbul	0.2513	0.4051	0.4491	0.9037	0.6168	0.7627	0.7855
	Ankara	0.2690	0.3984	0.4438	0.9053	0.6864	0.7936	0.8545
	İzmir	0.2429	0.4322	0.4009	0.8347	0.7144	0.8036	0.8793
	Bursa	0.2705	0.4367	0.3854	0.8884	0.6008	0.7622	0.7669
	Kocaeli	0.2962	0.4233	0.4118	0.9009	0.6881	0.7883	0.8258
	Tekirdağ	0.2629	0.3747	0.4121	0.9021	0.5811	0.7663	0.7213
	Adana	0.2283	0.3227	0.3823	0.8657	0.6449	0.7140	0.8845
	Aydın	0.2566	0.3809	0.4399	0.8569	0.5326	0.7179	0.7225
	Antalya	0.1554	0.2960	0.3375	0.8593	0.6033	0.7132	0.8437
	Balıkesir	0.2556	0.4539	0.5698	0.8463	0.4809	0.7342	0.6280
	Zonguldak	0.2574	0.3791	0.3378	0.9054	0.6061	0.7520	0.7873
	Manisa	0.2997	0.5141	0.5502	0.9195	0.6384	0.7852	0.8022
	Konya	0.1652	0.2744	0.3020	0.9147	0.6356	0.7045	0.8903
	Average	0.2575	0.3840	0.4148	0.8848	0.6100	0.7537	0.7917

SCALE HETEROGENEITY

Table 5 illustrates the transformation stage of innovation achievements of different companies. It can be seen that the average transformation efficiency of innovation achievements ranges at [0.6044, 0.7422], is higher than the technology R&D efficiency ranges at [0.3203, 0.5948]. The mean efficiency of them is greatly different. Observing the average efficiency value of technology R&D efficiency and the transformation efficiency of innovation achievements of different size enterprises, it can be found that the average efficiency of small

enterprises is the highest which range at [0.5358, 0.7422], followed by medium-sized enterprises, and the largest enterprises is the worst in range of [0.2575, 0.6271]. From the perspective of efficiency decomposition, the pure technology efficiency (PTE) in the technology R&D stage is declining as the scale of the enterprise becomes larger.

Table 5 Two-stage technology innovation efficiency of different sizes enterprises

	Year	technology R&D stage			achievement transformation stage		
		TE	TPE	SE	TE	TPE	SE
Large enterprise	2015	0.2157	0.2619	0.8796	0.7424	0.7945	0.9347
	2016	0.2802	0.3571	0.8203	0.5857	0.7445	0.7863
	2017	0.2767	0.3420	0.8424	0.5531	0.7905	0.6707
Medium enterprise	2015	0.3157	0.3384	0.9418	0.7344	0.7790	0.9401
	2016	0.3911	0.4452	0.8661	0.5262	0.7011	0.7404
	2017	0.3925	0.4421	0.8890	0.5526	0.7855	0.6521
Small enterprise	2015	0.5133	0.5518	0.9463	0.8207	0.8291	0.9895
	2016	0.5592	0.6271	0.8746	0.6787	0.7542	0.8963
	2017	0.5350	0.6054	0.8865	0.7272	0.8492	0.8393
Average	Large	0.2575	0.3203	0.8474	0.6271	0.7765	0.7972
	Medium	0.3664	0.4086	0.8989	0.6044	0.7552	0.7775
	Small	0.5358	0.5948	0.9025	0.7422	0.8108	0.9084

TOBIT REGRESSION ANALYSIS

Furthermore, the range of the technology R&D efficiency of listed companies of the first stage in 2015 to 2017 is only [0.3391, 0.3937], which is the main reason for the overall low efficiency of technology innovation. Therefore, Tobit regression method is adopted to conduct an in-depth analysis of the factors affecting the technology R&D efficiency. Set the model with the technology R&D efficiency as the dependent variable TE, and the majority shareholder's shareholding ratio (Share), institutional shareholding (Invest), enterprise size (Size), and region (Region) as independent variables.

$$TE = \beta_0 + \beta_1 \textit{Share} + \beta_2 \textit{Invest} + \beta_3 \textit{Size} + \beta_4 \textit{Region}$$

In the formula, the *Share* is used to measure the shareholding proportion of the largest shareholder. Using the sum of the shareholding ratios of funds, securities trader, insurance capital, and QFII to represent the institutional shareholding of *Invest*. *Region* is a dummy variable, which as Ankara, Zonguldak, İstanbul, Kocaeli, İzmir, Bursa and Tekirdağ are set to 1, and others are set to 2.

Tobit model was used for regression analysis. The study found from the table 6 that the coefficient of *Share* is positive, indicating that the shareholding ratio of major shareholders plays a promoting role in the enterprise's technology R&D efficiency. As the major shareholders hold the largest shareholding ratio, they will pay more attention to future development. The coefficient of *Invest* is 0.3036, indicating that institutional shareholding is also conducive to promoting corporate technology R&D and innovation. As a venture capital in the capital market, institutional shareholding can be very keen to capture companies with technology innovation capabilities. The large proportion of institutional shareholding tend to have higher technology innovation capabilities. From the perspective of the regression coefficients of *Size* and *Region*, small enterprises in Ankara-Zonguldak, Bursa province have higher technology R&D efficiency.

Table 6 Regression results of Tobit model

Explanatory variables	Coefficient	S.E.	Z value	P value
Shareholding ratio (Share)	0.2193	0.0304	7.213	0.000
Institutional shareholdings (Invest)	0.3036	0.0548	5.540	0.000
Enterprise size (Size)	-0.0681	0.0325	-2.095	0.022
Area (Region)	0.0716	0.0319	2.244	0.011
Constant term (Constant)	0.2767	0.0692	3.998	0.001

Note: *** means significant at the 0.01 level.

CONCLUSIONS

In our study, the provinces where the companies are among the technology companies from the companies registered in the Turkish Capital Market were evaluated by using the Data Envelopment Analysis used to measure the effectiveness of the decision units in case of multiple input variables and output variables.

the two-stage DEA method, the study analyzes the technology R&D efficiency, the transformation efficiency of innovation achievements, and the overall technology innovation efficiency of technological SMEs. The tobit model is used to further test the influencing factors when the conclusion of technology R&D efficiency is to be low.

The company sizes of the companies selected within the scope of the sample differ from each other. Especially large companies can achieve low unit costs for R&D expenditures with the advantage of size. On the other hand, these companies can make high levels of R&D investments by ignoring the costs because they have the advantage of providing easier resources. In this case, companies may have a disadvantage resulting from the scale and operate at reduced returns

on a scale.

In the two-stage analysis method, technology R&D efficiency was found to be lower and success conversion efficiency higher; This indicates that R&D achievements have a better market application prospect and corporate R&D capability needs to be strengthened. Second, considering the lower-stage efficiency, the relatively low pure technical efficiency of companies' technology R&D indicates that the enterprise has insufficient technical reserves and limited R&D capacity. In the success transformation phase, the high commercialization efficiency indicates that the company's reputation in the product market is also high.

Based on the above conclusions, the policy implications are as follows: first, listed companies should pay more attention to the R&D efficiency of enterprise technological innovation. We should increase investment in human and financial resources for technological innovation, introduce advanced and key innovation technology in the industry, and improve our capacity for independent innovation. It also pays more attention to the protection and incentive of technological achievements, such as, scientific and technological papers, etc., to enhance the innovation vitality of enterprises. Second, efforts should be made to introduce and cultivate scientific and technological talents. To improve their professional ability and innovation strength, and the core competitiveness of enterprise innovation. Third, due to the existence of heterogeneous factors, local governments need to introduce preferential and incentive policies for technological

innovation in light of local conditions, and enterprises should also choose corresponding innovation strategies based on regional environmental advantages. Fourth, the establishment of diversified property rights structure and effective incentive mechanism for innovation, that will stimulate innovation vitality of enterprises, promote the innovation efficiency. Meanwhile, the government should also strengthen the soil cultivation of enterprise technological innovation, strengthen the intellectual property protection mechanism, to ensure a good external institutional environment for enterprise innovation.

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CHAPTER 7

**EVALUATION OF THE FINANCIAL STATUS OF
SCHOOLS IN TERMS OF HUMAN RESOURCES
MANAGEMENT**

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INTRODUCTION

The financing of education is the economic accumulation needed for use in the education of the country. Controlling the existing economic power is possible through the process of sourcing, directing resources, using resources efficiently. (Gungor and Goksu, 2013).

Between 1969 and 1980, the process up to higher education was advanced with state funding. After 1981, education covering higher education began to be considered as a semi-public area. A financing model has emerged in which students also contribute. The privatization process, which started with higher education in the first place, has gradually moved to other levels.

Within the 2001-2023 vision plan, it is planned to increase the number of private schools by supporting them (Karakütük, 2016). There are in-kind and cash shortages in the field of education and these difficulties reduce the quality of the education. Inadequate education funding is among the reasons for the lack of quality education, decreased school achievements and lack of desired achievements in social cultural and sporting studies. The task of finding the necessary resources needed by the school and efficient use of the resources found was given to the headmaster (Alpay, 2011).

One of the leading sectors of recent years is the education sector for businesses and employees, which we can count as a subbranch of management consultancy. First of all, the trainings requested by the companies to support quality and similar certification studies have

also intensified over time on issues other than certification. There are many factors affecting the field of education (Atar, Dovuskaya, Ozyol, Sagduyu, 2021).

The management of school funding, which includes many positive and negative phenomena, is a challenging process. In this process, it is important for school administrators to manage events and developments in their relations with themselves and their environment, such as a good communication specialist. On the other hand, the projects to be carried out in the school, the work to be done, determines the current economic situation of the school. (Şişman, 2014).

The resources allocated to education directly affect all stakeholders of education. Personnel expenses, construction expenses of educational institutions, maintenance, repair expenses, technological material expenses, training equipment expenses, etc. directly affect the quality of education. The restriction in one of the relevant areas will directly affect other stakeholders. Fair, equitable, equitable distributions should be made in the provision of resources without discrimination of the central provincial.

The resources allocated by our country from national income for education are limited when looking at the resources allocated by developed countries for education. Depending on factors such as rapid population movements due to migration, young population, geographical face measurement characteristics of our country, clutter

in residential areas, the amounts allocated to education are inefficient in the name of education and are small. It is the principals who will find opportunities to facilitate these conditions and improve the negative conditions. The biggest source of funding they have is donations to schools. In-kind and cash donations emerge as the biggest force school principals use to fund schools (Başaran, 1994, s.157).

Problems in schools are forcing school principals to find financial support from public resources, local governments, philanthropists in the surrounding area, private institutions and organizations. A school principal who does not have a copier working, whose computer is broken, the door handle is broken, the roof of the school building is flowing, and the paints are poured in the classrooms cannot be expected to sit in his room and write down the shortcomings only in official writing to a higher office.

It is expected to solve the existing deficiencies in the school by finding in-kind and cash benefits. In this process, there may be negativity such as demanding, not receiving what they demand, spending their time in these jobs other than education, experiencing negativity with people, staying in a position where they will be personally offended, being personally and institutionally indebted in return for benefits.

Nowadays, educational contents have diversified from purchasing to export education methods from classroom environment to computers

at home. After the training planning, which is generally organized by the human resources departments of the companies, has taken its place in the operating budget has observed a rapid increase in the number of institutions providing training services.

The focus of this article is not only to evaluate the general financial situation of education in the context of human resources, but also what the educational need in schools is in the business context and how it should be determined.

Literature

Investment in education in developing economies is crucial in planning the country's future and ensuring that it achieves the projected goals. In OECD countries with this understanding, it has been observed that financial investment in education increased significantly between 2001 and 2010. For example, according to 2003-2012 data, average national expenditures per student in the 6-15 age group in OECD countries increased by 40%.

Human resources, which will introduce scientific innovations and improve the quality of life of society, can only be developed with a qualified and modern education. The qualified training process can be ensured in good planning and continuity. Education policies indexed to the managers' individual do not provide continuity and hinder economic efficiency.

Unfortunately, the education policies put forward are short-lived in our country, causing our resources to be spent unplanned and our schools in need of resources to experience economic difficulties. Due to the lack of long-term planning and the inability to prioritize, due to the allowances used in unnecessary areas, schools are unable to realize their founding objectives and the quality of education cannot be improved. Due to financial shortages, students are not able to get quality education and continue their journey in difficult conditions and shortcomings compared to their peers.

It covers school funding, the provision of educational services and the distribution and use of money for student success, Odden and Piccus (2000). Financial resources in education are classified in public, private and mixed form.

Public funding is a process that promotes increased opportunity in education and the benefit of education for society. In this approach, the training and the needs of the market are harmoniously combined and the necessary manpower training is aimed at the country.

The private financing approach argues that paying the price of parents who benefit from education will increase its effectiveness in use, increase accountability in the education process and take into account individual preferences. However, this approach increases inequality in education, as well as highlighting the individual benefit in education and causing the neglect of social benefit.

In the mixed financing model, in-kind and cash support is provided from both the state budget, parents and public institutions, institutions and voluntary organizations. In this way, every segment that benefits from education follows the quality of the education. Also, in the event of a narrowing of one source, this vulnerability is met through another channel.

In this approach, it is thought that deficiencies and problems that will improve the quality of education can be addressed (Kurul, 2012). With the increase in student numbers in the last quarter of the 20th century, they argued that families should participate in school funding because schools were not able to provide the desired quality education. (Bray, 2003, s.32).

Passenger (2007) found that there are 13 different non-budget sources in Turkey with the support of central budget revenues and special administration directorates. The author exemplified these resources as follows: Social Assistance and Solidarity Fund, Ministry of Interior, support of legal entities, bank salary promotions, and resources obtained through the work of school family associations.

Ozer, et.al. (2015) in the study, which examined the income sources, expenses and budget management problems of the schools, they found that the most important burden affecting the budget in primary schools was maintenance and repair works, and that this area ranged from building maintenance to computer maintenance, garden wall to doorhandle.

The authors recommended that a school budget should be prepared to strengthen school funding, including a share of the central budget and financial support from parents. They recommended that the municipal budget be allocated to schools, that the textbooks covered by the ministry be paid to students with good economic conditions and that this resource be transferred directly to the school, that school buildings, garden walls, school web pages be used for advertising purposes provided that the legal framework is drawn, and that the school garden be used for multipurpose purposes.

The functioning of schools is essential for the success of education system as a whole. Of course, the school cannot be considered as a business, but it cannot be ignored that the school has a business dimension and the various tasks that school administrators have to do in this dimension.

School management's business-related jobs are differentiated day by day and require a significant amount of financial resources. Apart from the personnel expenses of the schools, there are important expense items that are effective in achieving their goals such as security services, cleaning expenses, maintenance, and repair of technological devices. For example, cleaning among these needs is one of the important problems for primary schools, and schools have serious difficulties in providing a clean environment for their students (Korkmaz, 2005: 433).

It is a necessity to establish supportive studies between educational institutions and enterprises on personnel training.

What Does the Data Mean in the Information System of Schools?

School funding data shows how much money is spent per student in your area and how this amount compares to the state average.

Needing attention;

How much the school or district spends has to be compared with the district / state average. If the school or district spends less than the average, more detailed information should be learned to determine why.

When comparing averages of school-level spending, it is important that some factors, such as the level of experience of teachers and administrators, the types of curriculum offered, and student characteristics, may influence the comparisons.

The distribution of expenses (education, student and staff expenditures, administrative, and other) needs to be examined one by one.

The US Census Bureau reported in 2006 (based on 2004 state-based data) that the national average was \$ 8,287 per student per year. New Jersey was the highest with \$ 12,981, while the state with the least spent was Utah with \$ 5,008.

Matters to be Considered by Parent

More information should be obtained about where the money is going at the school or school district.

How is the level of funding of the school and school district compared to other schools and regions?

How does the district compare to other regions in school funding?

How much money does the school receive from local sources (fundraising and grants)?

What impact will the economic decline have on the school district's budget?

What type of investment tools does the school district use to invest funds? Are funds safe?

How much does income vary from year to year?

Are parents and community members active in raising funds for the school and school district?

Does the school or school district have a nonprofit foundation?

How can I join?

Other Factors to Consider

The 2006 EdTrust report notes that there are severe disparities between federal and state funding allocations and within regions.

Low-income and minority students suffer the most, as schools that serve the most disadvantaged students often spend less money.

The report reveals that it needs to be worked on to improve education more comprehensively.

Finance is just one of the many factors affecting student achievement, along with the quality of school leadership and teachers, staff training, class size, aligning state standards on curriculum and accountability, and parental involvement.

The Quality Counts 2006 report found that factors such as spending per student and student demographics have less of an impact on student achievement than the state's history of raising expectations and standards.

While the majority of school finance systems are based on student enrollment, it is the average daily attendance (ADA) based fund in a handful of states, including California, Kentucky, Idaho, Illinois, Mississippi, Missouri, and Texas. ADA funding is designed to provide an incentive for students to attend school regularly.

Understanding school spending can be complex and it can be difficult to track where the money goes. "Getting to the Truth," a 2007 comprehensive research project examining California's system called the state's way of distributing money to schools "complex and illogical."

What is a Good School Finance System?

A good system will align money and resources with net student learning, according to "Funding Student Learning", a five-year in-depth report published in October 2008 on K-12 school funding from the National Working Group on Funding Student Learning.

It focuses on goals and outcomes rather than setting funding levels by school or district. The report reveals that most states need to improve their school financial systems because they are not in line with the results expected from schools.

As a parent, you can ask the school board how they analyze the budget in terms of the complex school financing system. A meeting can be held to make school funding equal among schools or easier for citizens to understand. There can be talk about payment categories.

These Categories;

Teaching expenditures, costs related to teachers providing education to students,

Student and staff support percentage of funds spent on the cost of health, psychology, counseling and therapy departments at school.

Staff support, school libraries, media centers, and education costs,

Management costs expenditures for the administration of both schools and school districts.

Management includes head office expenditures such as budgeting, payroll, purchasing, planning and research.

The "other" category includes operations (utilities, maintenance and security), food service and the salaries of support personnel such as bus drivers and cafeteria employees.

Information System

Establishing an information system can be seen as the first step to be taken in providing the information needed for management in schools. The underlying concept of the information system is data. Data is an important resource today in the information age. It is necessary to obtain the information required for each sector in a timely, adequate and reliable manner. Otherwise, there are critical consequences.

After the second half of the twentieth century, with the great development in technology and especially in the computer sector, major changes have occurred in almost every field of humanitarian activities in social life. This technological change has profoundly affected human behavior, lifestyles, political, political and economic orders.

The concept that the real technological development underlies this change has brought to the forefront is the concept of knowledge. Now, it is of great importance to obtain accurate and reliable information for all kinds of activities that will facilitate human life at every moment of life and to use it instantly. In this context, the efficiency, productivity,

correct and effective use of information technologies and information management systems have to established already in schools; in this context, the use and management of databases will provide many competitive advantages in schools. In this context, with the analysis of the data, it will be possible to reach more accurate results about where the resources are spent in terms of accounting, and they will be able to shed light on education and business management policies with suggestions.

Human Resources Management

The term human resources encompasses all employees in an enterprise, from top managers to unskilled workers in the lowest position. A large number of people work in every business, with various educational levels, different positions and status. Regardless of the level of education, duty and status, regardless of the department they work in, every individual is within the scope of human resources management. The term human resources also includes an external workforce that is outside of the business that could potentially be utilized. All the studies to ensure the happiness and psychological satisfaction of these people (employees, managers or consumers) fall under the scope of HRM (Bayraç, 2008; Çalışkan, 2010: 100-116).

Human resources require a strong structure that includes marketing capacity and organizational knowledge, experience, skills, decision-making and creativity, organization, structuring and rewarding of

these talents to connect stakeholders that interact with all products and services and to ensure sustainability.

The rapidly developing and spreading world of imitation human resources cannot be imitated. For this reason, good organization of human resources is vital for businesses. The emphasis on human resource management has grown further after the realization that this unit is critical to the success of an organization.

Human Resources is one of the building blocks of institutions. In this context, it is necessary to place the right people in the right positions to achieve a job. The way to do this is through the right Human Resources Management, and the right training for the right Human Resources Management. Schools have financial problems.

The conclusion is that one or the only solution to the problem is education, but within a certain methodology and plan, the training needs (content) and scale (scope) should be accurately determined.

The human resources plan must be sensitive to changes both inside and outside the organization. Technological innovations should be capable of responding to changing conditions such as changes in socio-cultural life, the state of the labor market, legal changes, court decisions and political regulations (Ünsalan, Şimşeker, 2010).

In this context, human resources management is an important approach that can be used to gain a competitive advantage in human resources and to maintain this advantage.

Financing Education

Financial stress is considered the biggest obstacle to the progress of an individual, school, institution, and company. The consequences of financial stress are classified as follows:

Hechkman, Lim and Montalto, 2014).

Depression

Anxiety

Poor Health

Difficulty Continuing to Complete the Degree

Poor Academic Performance

Having financial education knowledge ensures that the institution is successful in the financial sector.

Financial education also provides information on how to create an appropriate source of income for the individual.

The financing of education is the economic accumulation needed to be used in the education of the country. Controlling the current economic power is possible with the process of providing resources, directing resources, and using resources efficiently. (Güngör and Göksu, 2013).

Aids in kind and in cash (donations) made to schools are essential in effectively replacing the economic infrastructure of education. For this purpose, it is essential to make and realize short, medium and long

term decisions. Donations made to schools within the economic order and education system of our country are up-to-date in order to provide the education service to the society in an efficient and positive manner. Economic resources of schools are covered by the state in our country (Yıldırım, 2013; Karakütük, 2016).

In Spain, where education is localized, the Ministry of Education plans the financing of education. In general, local authorities (municipalities or municipal groups) in the country have no direct school management. The financing of schools is also formed in accordance with localization. Autonomous communities in the country manage public funds in their territories and ensure the allocation and distribution of the amount allocated to education. Funding for schools consists of tax revenue, transfers from the center, and other forms of income available to the communities (OECD, 2017).

Education supports people in adapting to the increasingly complex world, emerging and changing from symbolic and cultural capital. Thus, it strengthens the country by producing individuals who are resistant to problems, productive, prepared for new situations, and able to adapt themselves to new conditions (Kellner, 2002).

Supporting education in a planned, regular and economical way will ensure the existence of a country with high human quality individuals. A planned education will create a strong economy and a strong society for our future. The concept of education is closely related to how the dynamics of the social structure will be in the future. The cultural

structure of the society, the structure of social relations, criminal structure, even health problems and therefore health expenses are related to education. Education teaches people the codes of discipline, way of looking at life, and the concepts of good and bad determined by the society. In the process of shaping the education society, it also prevents social negativities such as violence, extortion, robbery, corruption, and theft (Burrup, Brimley ve Garfield, 1993) .

School Financing

Covers the distribution and use of money for school funding, provision of educational services, and student success Odden and Piccus (2000). Financial resources in education are classified as public, private and mixed. In the public finance approach, the financial resource for education is provided from taxes, while in the private financing approach, this resource is provided by the parents of the students who benefit from the education. Public financing is a process that emphasizes the increase of opportunity justice in education and the benefits of education for society. In this approach, training and need areas in the market are brought together in harmony and the trained manpower training required for the country is aimed. On the other hand, the private financing approach argues that paying parents who benefit from education will increase their efficiency in use, increase accountability in the education process and individual preferences will be taken into account. However, this approach not only increases inequality in education, but it may highlight individual benefit in education and cause the social benefit to be neglected. In the

mixed financing model, in-kind and cash support is provided from both the state budget, parents, public institutions, institutions and voluntary organizations. In this way, every segment benefiting from education follows the quality of education. Moreover, in case of a constriction in one resource, this deficit will be covered by another channel. In this approach, it is thought that the quality of education will increase and the deficiencies and problems can be eliminated (Council 2012).

In the field of school finance, the duty and responsibility is primarily the principal. It is the duty of school administrators to communicate with the institutions and organizations around in the light of needs analysis, to convey the situation of the school to these organizations by making needs analysis, to create trust in this communication process and to provide their assistance as a result.

The school administrator is expected to correctly manage the limited financial resources of the school, to produce alternative solutions to the financial problems encountered, and to achieve the educational goals of the school as a result. In the face of this situation, school administrators resort to various ways to raise funds, and they have difficulties in creating a budget due to the lack of direct resources. This situation requires them to have business and accounting knowledge.

Parent-teacher unions are the most important source of income for schools, but financial expectations from parents may cause the

relationship between school administrators and parents to deteriorate. In this context, it is stated that school administrators should resort to alternative ways such as advertising revenues, allowance system, distribution of books with a fee, allocation of shares from the budgets of local governments, and support them by the senior management in this process, rather than the income obtained from parents in creating resources for school financing (Ateş, Özer, & Demirtaş, 2011).

Education Management in Human Resources

The fact that the public sector has an important place in Turkey makes it necessary to determine and plan the need for manpower in this segment (Kara, 2007, 23-24).

The HRP mainly includes the activities of estimating the quantity and quality of human resources that the organization will need in the future and the ways in which it will provide them, and balancing the supply and demand of the enterprise's human resources (Erdem, 2004, 43).

The survival of an institution is only possible with the investment it makes in people. Today's successful schools or institutions are not limited by the workforce structure and human resources, the narrow characteristics of their countries and regions, and the controllable conditions of the internal market; they aim to live and develop in a common world market with increasingly increasing competition conditions (Yıldız Technical University, Continuing Education Application and Research Center, 2021).

CONCLUSION

When the studies conducted in general are examined, it is revealed that the use of database is directly effective in the HRM process, reduces costs, increases the efficiency of the HR department, provides convenience in terms of planning and increases employee performance.

In addition, it has been observed that schools implement human resources activities and the use of database within these activities, but they are not given sufficient importance. The reason for this can be shown as the inadequacy of human resources experts, insufficient and very expensive consulting firms, insufficient school financing. This situation also negatively affects the use of financing.

An inventory of the knowledge and skills of HR should be made, and it should be ensured that that knowledge-skill can be used easily when and where needed. Training seminars should be organized with the help of consultancy firms and managers should be informed by explaining database applications in the human resources management process. In addition, analysis of the socio-economic and cultural situation of the school environment can be made with parents' meetings and expenditure items can be created in this context. Active participation of an expert accountant in the decision-making process can be ensured.

First of all, the necessity of communicating positively in achieving the objectives of the school should not be forgotten and teacher opinions about the practices should be consulted. The educational needs of the principals should be met in order to better implement HRM functions.

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CHAPTER 8

ECONOMIC VALUE OF LNG TRANSPORT FROM EGYPT TO SOUTHERN EUROPE

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INTRODUCTION

After exploring large gas reserves in the Eastern Mediterranean (EM), Noble Energy together with Israel needed to find a gas market to transport extra gas in form of pipeline or ship. With its increasing demand Europe, a net importer of gas (King & Spalding, 2018), would purchase the EM gas in either form as its diversification policy. The EastMed pipeline project which will transport natural gas from Leviathan and Greek Cypress basins to Europe ran into exclusive economic zone (EEZ) utilization conflict and high construction costs. On the other hand, Egypt's LNG terminals were not fully operating. Israel and Egypt had signed long term agreement to transport spot LNG from Egypt to Europe and Greek Cypress was funded for a liquefaction plant at Vassilikos. According to recent numbers, both capacities meet about 10 percent of Europe's liquified natural gas (LNG) demand. Although Vassilikos terminal project was proposed a decade ago, there was no sufficient gas to operate the terminal even if it existed.

Fortunately, Egypt's LNG terminals started operating again and about 1.4 million tons of LNG was exported from Egypt in the second quarter of 2021 (Fouad, 2021). With fully operating LNG plants at Idku (7 mtpa capacity) and Damietta (5 mtpa capacity), Egypt has a potential to become main LNG supplier to Europe given that both plants have a total of 12 mtpa LNG producing capacity which is equivalent to 16.6 bcm of NG receiving capacity. Thus, the EM has sufficient supply of LNG to transport to Europe and sufficient number

of vessels can be provided from new orders and rented from energy giants such as Shell, BP, Total operating in the region. Europe can receive Egypt's LNG at Cartegana terminal in Spain which has a regasification capacity of 587000 liq m³ (8.7 mtpa) per day. Spain has the largest regasification capacity and the shortest distance to Idku which lowers LNG transport costs.

Europe LNG imports are forecasted to reach 30 percent of total gas imports by 2040 (Ruble 2017). According to the European Commission, LNG import can diversify suppliers and reduce reliance on pipeline gas imports from Russia. LNG can also be stored against any possible supply interruptions due to political or economic disputes with suppliers. The US supports this strategy by exporting LNG to Europe. But as European gas market in high demand depletes the US LNG supply, Europe again will have to be Russia's best friend and Russian bear story would be recollected. This cycle seems to continue until Europe leaves fossil oil for good and swithes to green energy. One exception to break this cycle would be to complete Nabucco NG pipeline and flow NG from Qatar, Iran and Syria through Turkey.

LNG prices can vary depending on wheather conditions, sufficiency of the number of carriers, production, demand, oil prices, hub prices, tariffs. Henry hub natural gas price as of October 2021 is almost doubled (\$5-6/mmbtu) since 2017 when it was oscillating around \$3/mmbtu. By then the US LNG was delivered to Zeebrugge Port for \$5.8/mmbtu-\$8.21/mmbtu (Ruble 2017). The US LNG price to Europe was \$7.3/mmbtu in mid 2021. Spot LNG price of \$26/mmbtu

in Japan/Korea market increased gas price at Dutch TTF to around the same price in September 2021. Increasing crude oil prices can increase Henry Hub prices to around \$10/mmbtu and no projection is available for this winter.

Literature indicates LNG pricing formula for Southern Europe linked to crude oil prices and a trend towards gas-on-gas pricing as the US LNG enters the European gas market. Most LNG contracts have 12-15 percent slopes between weighted average of crude oil prices and LNG prices (Chandra, 2020). For example, \$80 weighted average of crude oil prices is equivalent to LNG prices of \$9.6-\$12/mmbtu for the aforementioned slopes. Nominal Brent crude spot prices are forecasted by EIA (2021) as \$66/b in 2025, \$89/b in 2030, \$132/b in 2040 and 153/b in 2044. Based on these prices future LNG prices can be calculated given that oil prices elsewhere are not significantly different. Energy prices are so volatile that it is impossible to forecast uncontracted spot LNG prices in the long term. Short term Brent indexed forward LNG prices seem to stay around \$10/mmbtu up to end of 2022 (Jaganathan, 2021). Before 2022 winter season, Europe's gas prices rose to four times higher than the US prices due to increasing demand, low stocks of LNG and uncertainties of supplies (Reuters, 2021). This can be translated as an energy crisis. Increasing NG prices will increase LNG demand and therefore will affect LNG prices. But will this price increase close the gap with LNG price? This may sound a vague question for a long distance LNG shipping for example from Louisiana to Europe. However, it makes sense for a short distance from Egypt to Spain. In 2007, for European gas imports from North

Africa and Middle East, 2000 km is estimated as break even distance for LNG and offshore gas pipeline transport cost which is around \$1.5/mmbtu (Zweifel, Praktiknjo & Erdmann, 2017). At about 3000 km distance transportation unit cost of LNG is around \$1.60/mmbtu and that of an offshore pipeline is around \$2.375/mmbtu. In other words, transportation cost of LNG is lower than that of an offshore pipeline for a distance over 2000 km. But transport cost holds only about five percent of total unit cost of LNG.

This chapter evaluates an LNG transport project which includes a pipeline construction extending from Leviathan to Egypt and liquified natural gas transport from Egypt to Europe. Idku and Damietta LNG plants are proposed as two exit points of LNG. Pipeline and shipping distances are measured using Google Earth. Liquified natural gas prices are calculated based on brent crude oil spot price forecasts and costs are categorized as feedgas, liquefaction, shipping and regasification costs. Discovery of gas reservoirs in the Eastern Mediterranean offshores prompted oil company partnerships to construct a pipeline, flow extra gas to liquefaction plants in Egypt so that extracted and processed gas can be liquified before transport and storage. Costs and revenues are estimated to find net present values and internal rate of returns. Economic value of LNG transport from Egypt to Spain is compared with economic value of NG from the same region to Italy.

1. LNG Demand and Regasification Terminals in Europe

After high volumes of LNG imports in 2019, an oscillation is expected in 90-110 bcm/yr through the medium term (IEA 2020). Following methodology of Ripple (2016), (Ruble 2017) estimated that LNG landed price at Zeebrugge Port for \$5.8 per mmbtu to \$8.21 per mmbtu including transport cost based on Henry Hub price of \$3 per mmbtu. According to Federal Energy Regulatory Commission, LNG landed prices in Zeebrugge in December 2016 averaged \$5.58 per mmbtu, which made U.S. LNG exports commercially implausible.

Zeebrugge LNG terminal is about 6000 km to Idku and 6200 km to Damietta. Cartegana LNG terminal is about 3000 km to Idku. Cartegana had a regasification capacity of 240000 m³ per day with three storage tanks (Zweifel, Praktiknjo and Erdmann, 2017), but increased its regasification capacity to 587000 liq m³ (8.7 mtpa) with five tanks as of the end of 2020 (GIIGNL, 2021). This capacity is greater than Belgium's Zeebrugge 566000 liq m³ (6.6 mtpa) and Netherlands' Gate 540000 liq m³ (5.4 mtpa) but less than France's Dunkerque 600000 liq m³ (9.6 mtpa) and UK's Grain 1000000 liq m³ (14.2 mtpa). Italy's Rovigo 250000 liq m³ (5.6 mtpa) and Greece's Revithoussa 225000 liq m³ (5.1 mtpa) do not meet the proposed capacity for regasification.

2. Deals Between Regions' Stakeholders

In 2010, Noble Energy and Israel's energy company Delek proposed the construction of underwater pipelines linking Leviathan gas

deposits and those in the Aphrodite's field with Vassilikos LNG Plant, a terminal with a projected annual capacity of 6.8 bcm annually (Cyriot Ministry of Energy, Industry, Commerce and Tourism 2015; Stratakis and Pelagidis 2019). This is the maximum capacity for a standard LNG chain (Zweifel, Praktijnjo, Erdmann 2017).

In April 2020 Egas and Eni announced that the 5 mnty Segas LNG export terminal at Damietta would resume its operations (Stevenson 2020). One million tone LNG is equivalent to 1,36 bcm NG (Qatar Petroleum, 2020). Therefore, 5 mnty LNG is equivalent to 6,8 bcmy NG. In 2018 Egypt and Cyprus agreed to construct a pipeline from Aphrodite to Idku and Damietta plants for liquefaction and export to Europe. In the same year, Dolphinus, Noble and Delek signed an agreement over 15 years to export \$19.5b worth 85.3 billion cubic feet (bcf) of Israel gas to Egypt for liquefaction and export to Europe (Tawil 2020). The GRC Aphrodite field is expected to start production in 2026 with five wells in initial phase whose output will be 800 mcfy.

3. LNG Terminals in the Eastern Mediterranean

Egypt is the only country known to have Liquefaction plants in the Eastern Mediterranean, namely SEGAS LNG T1, Egyptian LNG T1 and T2 (Kozma 2020). Energy firms and their partner countries delayed their operations due to low energy prices. Idku LNG terminal had stopped its operations until July 2020 (Stevenson 2020), but restarted shipping LNG in 2021.

Idku LNG site accepts up to 175000 m³ LNG carriers and includes two LNG tankers with a capacity 145000 m³ each with 2.5 days of production. Two trains for liquefaction with a capacity of 3.6 mtpa (600 MMSCFD) each. Terminal usually ships LNG to Italy and France (Mahmoud and ELSaadawy, 2021).

After a decade, Damietta also resumed its operations in February 2021. Eni has taken over the feed gas supply contracts and received corresponding liquefaction rights at the plant (GIIGNL,2021). This study presumably ships LNG from Idku and Damietta of Egypt to Cartegana of Spain. Subsequently, Vassilikos terminal joins to the two to reach 14.71 mtpa in the second phase. Vassilikos terminal will be completed in the 1stQ of 2022 (GIIGNL,2021). Total liquefaction capacity of Idku and Damietta as of end of 2020 is 580000 liq m³ (12.2 mtpa). In mid 2021 marginal cost of LNG at Idku was \$6.30/mmbtu, the highest after the US LNG cost to Asia.

Table 1: LNG receiving terminals in the Eastern Mediterranean (IGU 2019)

Country	Terminal name	Start date	Receiving capacity (mtpa)
Egypt	Sumed BW (floating)	2017	5.7
Egypt	Ain Sokhna Hoegh (floating)	2015	4.2
Egypt	Ain Sokhna BW (floating)	2015	5.7
Israel	Hadera Gateway (floating)	2013	3.0
Turkey	Dörtyol (floating)	2018	4.1

4. Economic Evaluation

Capital expenditures (CAPEX) are considered as new pipeline and carrier construction costs and operational expenditures (OPEX)

includes pipeline and LNG operating costs such as working cost, fuel cost for compressors, liquefaction, grid, regasification and shipping costs. Shipping cost includes operating, fuel, port and insurance costs. Asset life of the new carrier is considered as 30 years. Oxford Energy (2018b) used crude oil price \$70/bbl and European hub prices of \$7/MMBtu to forecast a new LNG carrier cost as 55000/day based on \$180m capital cost with five percent operating cost. Crude oil prices is up about 20 percent and LNG capital cost in this study is \$212.4m which is about 20 percent more. Therefore, this study uses a rough LNG carrier cost as 66000/day in the estimations. LNG revenues are estimated by multiplying oil linked LNG price by amount of LNG to be shipped. Project period is assumed to be 2025-2044. Monetary value of time (discount rate) is considered as 5.75 percent. After revenues and costs are discounted at nominal discount rates, net present values are calculated by taking the difference between the two.

4.1. Leviathan-Idku Pipeline Capital and Operating Costs

The proposed project includes a 430km (Google Earth) offshore pipeline with a diameter of 26" (presumed) extending from the Leviathan to Idku. Two 200 km apart 100 MW (134102 horsepower) compressor stations will be needed.

Pipeline construction cost of the pipeline as onshore is estimated from Sadeghi, Horry and Khazaei (2017) formula $0.8(42675)\mu\delta + 3*10^7\alpha + 1500d\alpha$ where μ is the diameter (inches), δ length (km), α number and d power of the compressors per station at 100 MW. Substituting into the formula gives $0.8(42675)26(430)+3*10^7(2)+1500(134100*2)$

which is equal to \$843885200 or approximately \$844m. Construction cost or capital cost of the 430 km offshore pipeline is \$1688m which is twice as much the onshore pipeline.

Working cost $C\tau$ is 3.5 per cent of the capital cost, i.e. $1688m * 0,035 = \$59,1m$. Operating cost for the first year is calculated from $O_p = C\tau + (1 - (1 - \kappa)^{\delta/\eta})NP$. Substituting the values into the formula gives $59,1 + (1 - (1 - 0,005)^{430/200})10000000000 * 0,326 = \$59,1 + \$39,8$ which is equal to \$98,9m. Total operating cost for the 20 year period is \$11514m.

Financing cost is calculated as \$91,5m annually and total financing cost is \$915m over 10 years. Calculations are based on the amount financed $\$1688/2 = \$844m$ at 1.5% fixed interest rate and 10 years. Fixed annual loan payment is calculated by (amount financed)*(capital recovery factor) which gives $844 * (0,015/0.13833276827)$ which is equal to \$91,52m.

4.2. Capital and Operational Costs of LNG Carrier

An LNG value chain consists of three phases, namely upstream, midstream and downstream. Upstream phase is exploration and production, midstream processing and transportation and downstream liquefaction to shipping and distribution to the consumer (US Department of Energy, 2017).

As a general rule of thumb the minimum train size (liquefaction unit) for an economical LNG plant is around 4 to 4.5 mtpa. That is equivalent to a minimum of 195 billion cubic feet per year (bcfy) of

NG requiring a reserve of about 4.5 tcf for a 20 year period (Durr et al. 2005). Idku meets this requirement with 7.2 mtpa liquefaction trains.

A production cost less than one dollar per mmbtu is expedient to make LNG economically feasible. The liquefaction plant is liable for about 50% of total LNG chain cost (Robertson & Nagelvoort 1998). The liquefaction plant contributes \$1.5/mmbtu-\$2.0/mmbtu to LNG delivery cost (Kotzot 2001) and shipping cost \$0.5/mmbtu-\$1.2/mmbtu. From natural gas before liquefaction at the source to after gasification at the destination, the cost portion of liquefaction is 50% of the total (Economides and Wood, 2009). The cost of shipping 39% and onloading-offloading 11% (Economides et al. 2008). Although some recent data would suggest this to be even higher at 80% as the cost for LNG plant has increased from \$600 per mtpa in 2008 to over \$2,000 per mtpa in 2013 (Ernst &Young 2013).

Average annual LNG shipping cost is \$205m. Rental cost for a 140000 metric tons LNG carriers in 2012 was reported to be \$125,000 per day (Pourbozorgi & Çelik 2014). In November 2018, spot charter rates increased to \$200000/day about five times the rate in May 2018. Energy groups including Shell, BP, China National Offshore Oil Corp (CNOOC), Cheniere and Gazprom, utilities Naturgy and Centrica and trading firms such as Gunvor and Trafigura are renting vessels for months or years and sub-letting some of them to competitors, according to half a dozen sources (Cyprus Mail 2019). Vessel charter rates made a peak of \$322500/day on January 2021 according to

Spark Commodities assessments. They've since fallen to \$115250/day first week of February as the market has loosened. Vessels have been diverted back to Europe as Asian prices have softened after high rates.

Capital or investment cost for two vessels with 135000 tons each is assumed to be 360m euros (Zweifel, Praktiknjo, Erdmann 2017) which is \$424,8m at 1€=1.18\$ exchange rate. The cost of a carrier for one trip is calculated for 20 trips per year based on the 30 year asset life. For this study, carrier break even cost: \$693000 per trip which is 66000/day for 10.5 days.

LNG cost estimations for this study is modified from Oxford Energy (2018) and Zweifel, Praktiknjo and Erdmann (2017). LNG cost for Idku-Cartegana route (1559 nautical miles or 2887 km one way) is estimated based on Dual Fuel Diesel Electric (DFDE) carrier with average speed of 19 knots or 35 km/h and vessel size of 170000 m³ liquid LNG about 78 tons. LNG liquid cubic meter is equivalent to 23.12 mmbtu. Therefore, at 98% loading, 166600 m³ liquid LNG is equivalent to 3851792 mmbtu. Thus, daily LNG boil-off at 0.10%/day is equivalent to 3852 mmbtu/day for which opportunity cost of LNG boil-off at the mean LNG price is 3,851.8 mmbtu/day*\$14.17/mmbtu which equals to \$54580/day. Voyage days to Cartegana is 3.67 days each way with three port days and outbound port, destination port and return destination port 3,67 days. Fuel cost is 7,34 days*\$54580/day which is equal to \$400617 (round trip). Assume that heel left at end of return voyage is 4% which is equivalent to 154072 MMBtu. Therefore, LNG delivered at destination is 3686165 mmbtu (initial

loading less boil-off on outward voyage, less boil-off and heel reserved for return (ballast voyage)). 3 port days at \$100000/day cost \$300000 and adding insurance at \$2,600/day gives $2600 \times 10,5$ which equals to \$27300 (allowing for rounding).

There is no certain number of crew for a large standard LNG vessel but has a capacity of 30 crews. Based on the information given from the ship crews, Chief engineers make \$14k-25k/month, 2nd engineers \$7k-10k/month and 4th engineers \$3k/month. Rough average is \$10.5 per person per month. Divided by 30 and multiplied by 10.5 gives \$3675/per person per trip. If 30 crews is assumed, wage cost per trip is 30×3675 which equals to \$110.5k. Average wage cost is \$0.03/mmbtu per trip. So the total cost not including maintenance and salvage is \$1566067 per trip. Table 2 shows LNG transport costs per trip from Egypt to Europe.

Table 2: LNG transport costs per trip

LNG transport costs	USD
Carrier cost	693000
Operating cost	34650
Fuel cost	400617
Port cost	300000
Insurance cost	27300
Wage cost	110500

The total unit cost for transport is $1566067/3686165 = \$0.43/\text{mmbtu}$. Zweifel, Praktijnjo and Erdmann (2017) estimated transport cost from Egypt's Port Said to Cartegana as $\text{€}0.014/\text{m}^3$ of NG based on 10.5 days of trip which is \$0,38/mmbtu at $\text{€}1 = \$1,18$ exchange rate. The 2020 wellhead price at Leviathan was reported as \$4.50/mmbtu. This

rate is used as feedgas cost in this study. Grid cost for UK \$0.29/mmbtu is used from the Oxford Institute for Energy Studies (2018). Regasification cost is €0.015/m³(Zweifel, Praktiknjo and Erdmann, 2017) which is equivalent to \$0.41/mmbtu at 1€=1.18\$. After transport cost is estimated, liquefaction is calculated based on 50% of the other costs.

The updated costs of LNG supply to Europe are given as follows. Idku and Damietta to Cartegana (\$/mmbtu): Feedgas:4.50, Liquefaction:2.82, Transport:0.43, Regasification and Grid: 0.70, wage: 0.03, total unit cost is \$8,48/mmbtu and per cargo total cost is \$8,45*3686165+110500=\$31,26m. Table 3 shows LNG costs and total cost for every year of the project period.

Table 3: LNG Costs

@Year	LNG Export (mt)	Feedgas 4.5\$/mmbtu	Liquify 2.82 \$/mmbtu	Transport 0.43\$/mmbtu	RegasGrid 0.70\$/mmbtu	Total cost (\$million)
2025	7,35	1946	1211	173	244	3574
2026	8,82	2336	1453	208	292	4963
2027	9,56	2530	1574	225	317	5354
2028	10,29	2725	1696	242	341	5751
2029	11,03	2920	1817	260	365	6146
2030	11,76	3114	1938	277	390	6549
2031	12,50	3309	2059	294	414	6948
2032	13,24	3503	2180	311	439	7356
2033	13,97	3698	2301	329	463	7761
2034	14,34	3795	2362	337	476	7975
2035	14,71	3893	2422	346	488	7801
2036	14,71	3893	2422	346	488	7823
2037	14,71	3893	2422	346	488	7850
2038	14,71	3893	2422	346	488	7877
2039	14,71	3893	2422	346	488	7894
2040	14,71	3893	2422	346	488	7926
2041	14,71	3893	2422	346	488	7959
2042	14,71	3893	2422	346	488	7981
2043	14,71	3893	2422	346	488	8013
2044	14,71	3893	2422	346	488	8041

4.3. LNG Pricing and Revenues

Egypt's LNG capacity is about 12 mtpa and Vassilikos to contribute with a capacity of 5 mtpa in the second phase of LNG shipping. 17

mtpa LNG output is only possible with full operation of three LNG plants. In other words, in full operation 23,12 bcm NG must be liquified for an output of 17 mtpa LNG. Revenues are estimated by $(\text{LNG price } \$/\text{mmbtu})/23,12 * (\text{volume of LNG transport})$ where LNG liquid cubic meter is equivalent to 23.12 MMBtu (Oxford Energy, 2018b).

Table 4 shows LNG prices estimated based on nominal brent crude spot prices and LNG revenues based on these prices.

Table 4: LNG prices based on nominal brent crude spot prices

@Year	LNG (mt)	Brent prices (\$/b)	LNG price (\$/mmbtu)	Revenues (million \$)
2025	7,35	66	8,58	3711
2026	8,82	71	9,23	4791
2027	9,56	75	9,75	5482
2028	10,29	80	10,40	6298
2029	11,03	84	10,92	7085
2030	11,76	89	11,57	8007
2031	12,50	93	12,09	8890
2032	13,24	98	12,74	9919
2033	13,97	102	13,26	10897
2034	14,34	106	13,78	11622
2035	14,71	109	14,17	12258
2036	14,71	113	14,69	12708
2037	14,71	118	15,34	13270
2038	14,71	123	15,99	13832
2039	14,71	126	16,38	14170
2040	14,71	132	17,16	14844
2041	14,71	138	17,94	15519
2042	14,71	142	18,46	15969
2043	14,71	148	19,24	16644
2044	14,71	153	19,89	17206

Table 5 shows economic evaluation of LNG at the minimum, mean and maximum prices, 5.75 percent discount rate and different

liquefaction costs. The results indicate that LNG has no economic value at the minimum price.

Table 5: Economic Evaluation of LNG

Price \$/MMBtu	Years		Liquefaction (\$/MMBtu)			
			2.05	2.30	2.55	2.82
8,58 min	2025	NPV	-1.0b	-1.6b	-1.9b	-2.2b
		B/C	0,77	0,69	0,65	0,62
		IRR(%)	-	-	-	-
14,17 mean	2035	NPV	28.1b	21.3b	17.3b	13.4b
		B/C	1.86	1.54	1.40	1.24
		IRR(%)	75.2	54.1	42.8	32.2
19,89 max	2044	NPV	64.3	53.3b	47.0b	40.6b
		B/C	2.26	1.86	1.69	1.54
		IRR(%)	75.5	55.1	44.6	35.3

CONCLUSION

This study investigated economic value of LNG transport project which has two lags. First was a pipeline from wellhead Leviathan extending to Egypt and second was LNG carrier from Idku and Damietta to Cartegana. NPV is estimated as \$13.4 billion, B/C as 1.24 and IRR as 32.2 percent at the mean price. When compared to the offshore EastMed gas pipeline, the NPV of LNG at the mean price is 14.15b higher and at the maximum price \$20.6b higher (Mavruk, Kıral & Fisunoğlu, 2021). At the maximum price LNG transport costs Europe twice as much compared to pipeline transport. Based on oil linked LNG price forecasts and proposed LNG project, break even LNG price seems to be \$10.7/mmbtu for \$2.82/mmbtu liquefaction cost. Consequently, for pipeline construction firms and LNG firms, LNG has a better economic value than an offshore pipeline from the Eastern Mediterranean to Southern Europe.

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CHAPTER 9

THE RELATIONSHIP BETWEEN HEALTH EXPENDITURES AND ECONOMIC GROWTH: PANEL CAUSALITY ANALYSIS

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INTRODUCTION

This study is the final version of the abstract text presented as an oral presentation at the Taras Shevchenko 7th International Congress of Social Sciences held in Ankara between 24-25 November 2021.

Economic growth is expressed as the increase in final goods and services produced in a country over time. Economic growth, which is expressed as a continuous increase in the level of real gross domestic product over time, is one of the main macroeconomic targets of countries (Ünsal, 2009:15). The concept of economic growth can be defined as *“the increase in percentage of macro sizes that can be expressed numerically in an economy”* (İktisat Terimleri Sözlüğü, 2011: 70). Determining economic performance is an important step for countries to decide on the right government policies. Economic growth, which is the most important determinant of economic performance, is accepted as the source of wealth and development of nations. It affects economic growth directly and indirectly, as it is effective in the production and consumption processes of individuals to maintain a healthy life. The deterioration in the health conditions of society has negative effects on labor productivity.

Health is defined as the absence of disease and the talent of individuals to realize their potential throughout their lives. The World Health Organization (WHO) defined the concept of health in 1948 “as health is not merely the absence of disease or infirmity, but a state of complete physical, mental and social well-being” (Jakab, 2011: 2). In this context, health is one of the most important assets that individuals

cannot give up. The survival of individuals is based on raising healthy generations and being economically sufficient. Healthy individuals can learn faster and improve their abilities. This situation increases the productivity of individuals and leads to an increase in their welfare level. However, to realize all these situations, it is necessary to make expenditures in the field of health (Agır and Tıraş, 2018a: 1558). Health expenditures, which show the success of the health system, are decisive in shaping government policies.

Health expenditures are defined as all of both private and public expenditures to protect the health or improve health status (Novignon et al., 2012: 2). It is also expressed as individual and social expenditures made as a result of deterioration in health status. The increase in health expenditures ensures an increase in the quality of life of individuals (Şahin and Temelli, 2019: 948). However, investments in the field of health lead to an increase in economic growth (Bloom et al., 2001: 3).

Poor countries, which cannot allocate resources for health expenditures, cannot perform health services and cannot access clean water resources. Financing health expenditures positively affects human capital and increases the productivity of labor on the production function. While a significant majority of the population in the European continent was unhealthy two centuries ago, this situation has changed as a result of economic growth (Acemoğlu, 2007: 203). With the realization of economic growth, resources to improve health conditions were obtained. Prevention of epidemics and positive

developments in health criteria have also increased the labor productivity and average life expectancy of individuals.

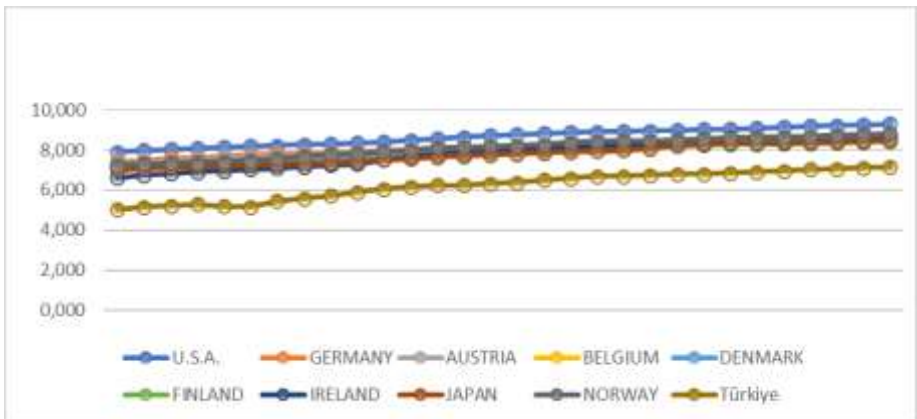
Health expenditures are recognized as a global public good. The health criterion, which is defined as "the average sign of life used in the human development index as a result of qualifying longevity as a health indicator", affects the productivity of labor (İktisat Terimleri Sözlüğü, 2011: 362). Expenditures affecting the health criteria have a global impact beyond the borders of the spending country. The prevention of epidemics, which the World Bank defines as the core of global public goods, and the improvement of general health services, which it describes as complementary, are important because of the cross-border externality effect. Since health expenditures are evaluated in terms of benefits, they are realized in the form of development aids with the support of the World Health Organization (WHO) (Kirmanoğlu, 2009:133).

Health expenditures have increased almost all over the world, especially in developed countries. There are many reasons for the increase in health expenditures. Some of these are expressed as follows (Kamacı and Yazıcı, 2017:57):

- The increase in diseases due to the prolongation of the average life expectancy of individuals,
- The use of high-cost technological machinery and tools in the health sector,
- Being a sector with a high labor intensity,

- Increasing the knowledge of individuals on health.

The Organization for Economic Co-operation and Development (OECD), which was founded in Paris in 1960, is an international organization that aims to contribute to the world economy. OECD countries attach importance to human capital investments to increase their economic growth and development rates. OECD countries allocate more resources to health expenditures within the scope of human capital investments. Accordingly, the investments made in the field of health and a lot of resources allocated increased over the years (Şahin and Temelli, 2019:950). When the statistics of OECD countries are examined, it is determined that there is a continuous increase in health expenditures in the 1990-2019 period. Graph 1 shows the health expenditure per capita in US Dollars in selected OECD countries.



Source: OECD, 2021 (USD/Per capita)

Graph 1: Health Expenditures in Selected OECD Countries

When Graph 1, which shows per capita health expenditures for the period 1990-2019 for selected OECD countries (America, Germany, Austria, Belgium, Denmark, Finland, Ireland, Japan, Norway, Turkey), it is seen that there is an increasing trend in health expenditures. The reason for the increase in health expenditures is the increasing importance given to the global and regional positive contributions of the improvement in health criteria in government policies.

The concept of health is a very important issue in the human development index. Therefore, the relationship between health expenditures and economic growth has a very important place in the scientific literature. When the studies on the direction of the relationship between health expenditures and economic growth are examined, it is seen that there is no consensus. While some of the studies suggest that there is a positive relationship between health expenditures and the concept of economic growth (Kar and Ağır, 2003; Yerdelen Tatoğlu, 2011; Yerdelen Tatoğlu, 2011; Yerdelen, 2012; Selim et al., 2014; Günay and Atılğan, 2020) some studies show that the relationship between health expenditures and economic growth is negative or there is no relationship (Akram et al., 2008; Yumuşak and Yıldırım, 2009; Çetin and Ecevit, 2010; Uçan and Atay, 2016).

There are two important elements in the study of the article titled "The Relationship between Health Expenditures and Economic Growth: Panel Causality Analysis", which examines the relationship between

health expenditures and economic growth. The first of these elements is to determine the direction of the causality relationship between health expenditures and economic growth variables. The second element is the use of the panel causality test by Emirmahmutoğlu and Köse (2011) which is one of the latest methods in the analysis of causality tests between variables. The study, which examines the relationship between health expenditures and economic growth, consists of four main parts. The study started with the introduction part, and in the first part, it consists of theoretical and empirical scientific literature evaluating the performance of health expenditures on economic growth. In the empirical analysis section, the empirical framework including the data set, econometric model and analysis procedure is presented. The study is completed conclusions and evaluations regarding the findings.

1. LITERATURE REVIEW

There are many studies in the literature investigating the relationship between health expenditures and economic growth. When the relevant literature is examined, it has been determined that there is no common consensus on the relationship between health expenditures and economic growth. In this section, where the literature of the study is examined, a summary of the literature consisting of studies on the relationship between health expenditures and economic growth is given.

Gerdtham and Löthgren (2002) analyzed the relationship between economic growth and health expenditures with the help of

cointegration test, using the data of 25 OECD countries for the period 1960-1997. In the results of the study, they found that there is a long-term relationship between the variables.

Bloom et al. (2003) investigated the impact of health on economic growth using data from 104 countries for the period 1960-1990. Life expectancy was used to represent the health indicator variable in the study. In the results of the analyzed, they found that the health indicator has a positive effect on economic growth.

Kar and Ađır (2003) analyzed the data covering the period 1926-1994 and the relationship between economic growth and human capital for Turkey with co-integration and causality tests. In the study, health expenditures and education expenditures were used to represent the human capital variable. In the results of the analysis, they determined that the direction of the causality relationship between the variables was sensitive to the two selected human capital indicators.

Akram et al., (2008) investigated the relationship between health indicators and economic growth for Pakistan in the 1960-2006 period with the help of co-integration and causality tests. With the analyzes made, it has been determined that the relationship between economic growth and health expenditures for the period selected within the scope of the study is not statistically significant.

Dađdemir (2009) researched the relationship between health and economic growth for developing countries with data from the period 1960-2005. In the results of the analyzed, it was found that the

developments in the level of health affect the economic growth performance positively. In addition, he also stated that it would not be correct to explain the developments in the level of health only with the economic growth performance in the study.

Çetin and Ecevit (2010) examined the relationship between health expenditures and economic growth for 15 OECD countries in the 1990-2006 period within the framework of panel regression analysis. In the study, public health expenditures, exports, employment, imports, labor productivity and Real GDP variables were used. In the results of the analysis, it was determined that the relationship between public health expenditures and economic growth for the selected period within the scope of the study was not statistically significant.

Yerdelen Tatoğlu (2011) analyzed the relationship between economic growth and health expenditures with the help of cointegration test, using data from 20 OECD countries for the period 1975-2005. As a result of the analysis, it has been found that the expenditures made in the field of health will increase economic growth both in the short and long term.

In his study, Yardımcıoğlu (2012) investigated the relationship between economic growth and health expenditures. In the study, the relationship between the variables was analyzed using data from 25 OECD countries for the period 1975-2008. In the results of the analysis, it was found that there is a long-term relationship between health expenditures and economic growth. He also detected that there

is a bi-directional causality relationship between the variables in the long run.

Tıraşoğlu and Yıldırım (2012) analyzed the relationship between economic growth and health expenditures by using Turkey's data for the period 2006:01-2012:03. In the study, Lee and Strazicich (2004) unit root test and Gregory and Hansen (1996) cointegration test, which takes structural break into an account, were used. In the results of the analysis, it was found that there is a long-term relationship between the variables.

Badri and Badri (2016) investigated the relationship between economic growth and health expenditures with the Panel GMM method, using data from 24 OECD countries for the period 2006-2013. As a result of the applied analysis, it has been determined that health expenditures have a positive effect on economic growth.

Selim et al., (2014) analyzed the relationship between economic growth and per capita health expenditures for Turkey and 27 EU countries during the 2001-2011 period, using the cointegration method. In the results of the analysis, they found that there is a positive relationship between economic growth and per capita health expenditure in both the short and long run.

Uçan and Atay (2016) investigated the relationship between economic growth and health expenditures in their study by using quarterly data for Turkey's 2006-2014 period. In the study, the relationship between the variables was examined using the ARDL method. In the results of

the analysis, they determined that there was no long-term relationship between the variables.

In their study, Ağır and Tıraş (2018a) analyzed the relationship between economic growth and health expenditures for 172 countries in the 1995-2014 period with the help of panel causality test. In the results of the analysis, they determined that there was a bidirectional causality relationship between the variables.

In their study, Ağır and Tıraş (2018b) examined the relationship between economic growth and health expenditures for 36 OECD countries in the 1995-2014 period using the Emir Mahmutoğlu and Köse Panel Causality Test. In the results of the analysis, they found that there is a causal relationship between economic growth and health expenditures for 28 OECD countries, while there is no causal relationship between economic growth and health expenditures for 8 OECD countries.

In their study, Günay and Atılğan (2020) investigated the relationship between health expenditures and economic growth for 7 OECD countries during the 1985-2018 period with the cointegration test. In the results of the analysis, they have reached that the increase in health expenditures will have a positive effect on economic growth.

When the relevant literature is examined, it is seen that different econometric methods are used for different country examples. However, it is understood that different variables are used to represent economic growth and health expenditure in the studies examined.

When the literature is investigated, it is concluded that the studies do not converge on a common point. This study differs from other studies in terms of country group and time dimension.

2. EMPIRICAL ANALYSIS

In this study, the relationship between health expenditures and economic growth was analyzed within the framework of dynamic panel data methods with the data of 10 selected OECD countries (America, Germany, Austria, Belgium, Denmark, Finland, Ireland, Japan, Norway, Turkey) for the years 1990-2019. The main purpose of the study is to reveal the relationship between health expenditures and economic growth for 10 selected OECD countries.

The variables used in this study, in which the relationship between health expenditures and economic growth are analyzed, were obtained from the World Bank and OECD databases. The logarithms of the variables were taken. The variables used in the study are shown in Table 1.

Table 1: Description of Variables

Variables	Explanation	Source
LKBG	GDP per capita	WB-WDI, 2021
LKBS	Health expenditure per capita	OECD, 2021

Before determining the relationship between health expenditure and economic growth, cross-section dependency and homogeneity test

should be done. These tests show whether there is a relationship between the ten countries in question. In addition, it helps to determine whether the analysis estimates take into account country-specific features (Pesaran and Smith, 1995; Luintel and Khan, 2004). According to these test results, the most appropriate causality test is determined.

2.1. Method

In this study, the relationship between health expenditures and economic growth for 10 selected OECD countries was analyzed with dynamic panel data methods. Before the analysis method, two preliminary tests, namely cross-section dependence and homogeneity, were performed. Cross-section dependence is defined “*as the dependence arising from common shocks, common unobservable components, spatial correlation, and unusual correlation between disturbing term pairs that do not fit a certain common component or spatial pattern in panel data models*” (Ekonometri Terimleri Sözlüğü, 2019:492). For cross-section dependence, the LM test developed by Breusch and Pagan (1980), CD and CD_{LM} test developed by Pesaran (2004), and LM_{adj} tests developed by Pesaran et al. (2008) were used. Cross-section dependency test hypotheses are as follows (Pesaran et al., 2008):

H_0 : There is no cross-section dependency.

H_1 : There is a cross-section dependency.

Homogeneity shows that countries are similar or different from each other. For the homogeneity test, the delta test developed by Pesaran and Yagamata (2008) was applied. Homogeneity test hypotheses are as follows (Pesaran and Yamagata, 2008).

H_0 : Slope coefficients are homogeneous.

H_1 : Slope coefficients are not homogeneous.

The causality relationship between health expenditure and economic growth was investigated by the causality test developed by Emirmahmutoğlu and Köse (2011). Emirmahmutoğlu and Köse (2011) causality test take into account the existence of cross-section dependence. However, this causality test tests whether the coefficients vary from country to country.

2.2. Results

Before analyzing the causality relationship between health expenditures and economic growth in the study, cross-section dependency and homogeneity test are applied. Table 2 shows the cross-section dependence and homogeneity test results. The cross-sectional dependence test results show that there is a cross-sectional dependence between the variables. According to this result, it is concluded that there is the interaction between countries. The homogeneity test results show that the slope coefficient is heterogeneous.

Table 2: Cross-Section Dependency and Homogeneity Tests

Cross-Section Dependency	Test	Statistic	p-value
Breusch and Pagan (1980)	LM	430.009	0.000***
Pesaran (2004)	CD _{LM}	40.584	0.000***
Pesaran (2004)	CD	11.957	0.000***
Pesaran vd., (2008)	LM _{adj}	132.454	0.000***
Homogeneity Tests			
Pesaran and Yamagata (2008)	Δ	15.531	0.000***
Pesaran and Yamagata (2008)	Δ_{adj}	16.371	0.000***

“***” denotes 1% significance level.

The panel Fisher statistics results shown in Table 3 show that there is no causal relationship between economic growth to health expenditures and health expenditures to economic growth for 10 selected OECD countries.

Table 3: Emirmahmutoglu and Köse (2011) Panel Causality Test Results

Country	LKBG→LKBS		LKBS→LKBG	
	Wald Statistic	p-value	Wald Statistics	p-value
U.S.A.	3.280	0.194	4.589	0.101
Germany	0.874	0.646	4.993	0.082*
Austria	1.259	0.262	0.089	0.765
Belgium	0.474	0.491	0.403	0.526
Denmark	0.000	0.983	0.202	0.653
Finland	0.922	0.631	19.221	0.000***
Ireland	4.311	0.038**	1.659	0.198
Japan	0.719	0.396	0.017	0.896
Norway	4.495	0.034**	3.777	0.052*
Turkey	1.320	0.251	0.161	0.688
Panel Fisher	27.141	0.153	41.597	0.611

“***”, “**” and “*” denote 1%, 5% and %10 significance levels, respectively.

When Emirmahmutoğlu and Köse (2011) panel causality test results are evaluated in terms of countries; It has been determined that there is a one-way causality relationship from economic growth to health expenditures in Ireland. It has been determined that there is a one-way causality relationship from health expenditures to economic growth in Germany and Finland. In addition, it was found that there is a bi-directional causality relationship between health expenditures and economic growth in Norway.

3. CONCLUSION

In this study, which was carried out to determine the relationship between health expenditures and economic growth, panel data analysis method was applied for 10 selected OECD countries consisting of America, Germany, Austria, Belgium, Denmark, Finland, Ireland, Japan, Norway and Turkey. In the literature, a common conclusion has not been reached on the direction and sign of the relationship between health expenditures and economic growth. However, it is accepted that health expenditures are important for every country. When the literature investigating the relationship between health expenditures and economic growth was examined, it was determined that different results were obtained according to the country group and time dimension.

In order to analyze the causality relationship between health expenditure and economic growth with the data of 10 selected OECD countries for the period between 1990 and 2019, the homogeneity test with the cross-section dependency test was applied. It has been

determined that there is a cross-section dependency and the slope coefficient is heterogeneous. Considering the results of Panel Fisher statistics, it is seen that there is no causal relationship between economic growth-health expenditure and health expenditure-economic growth. However, when panel causality test results are evaluated in terms of countries; While a one-way causality finding was obtained from economic growth to health expenditures in Ireland, it was observed that there was a one-way causality relationship from health expenditures to economic growth in Germany and Finland. In addition, it was found that there is a bidirectional causality relationship between health expenditures and economic growth in Norway. When the empirical literature is evaluated, there is no consensus on the existence of the relationship between health expenditures and economic growth. However, the effective realization of health expenditures ensures that countries are positively affected both economically and socially. For this reason, the effective realization of health expenditures and making policy recommendations in this direction in selected countries within the scope of the empirical study will contribute to economic growth and development.

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CHAPTER 10

**THE EFFECT OF INNOVATION ON EMPLOYMENT: THE
CASE OF SOUTH KOREA**

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1. INTRODUCTION

Innovation is a development tool in many countries, regardless of country's level of development (developed or developing). Some countries have accepted innovation systems as a development policy and have allocated legal proceedings to support innovation and R&D activities. The economic value created by the innovation-based goods or services emerging from cooperation between the private sector and public organisations and the combination of knowledge and experience contributes to the development of national economies. The global need for information and technology has led to the formation of a new markets. As a result, income generated via producing many goods by heavy industries can be producible with only one brand. With the development of communication and information technologies and the effect of globalization, the produced goods or services have started to find global market opportunities. In this context, the budgets allocated to innovation by many countries and the flow of capital to the private sector have increased significantly in recent years. An innovation-based production mechanism helps the development of the country's economy and increase global competitiveness, while at the same time it reduces unemployment.

In this study, the effect of innovation on employment in South Korea, which is among the developed countries, has been examined.

2. CONCEPTUAL FRAMEWORK FOR INNOVATION AND EMPLOYMENT

Innovation, innovative approaches and research & development activities have gained importance in the global sense, especially after 1950s. Innovation-oriented activities were used as growth tools in some economies, which contribute to the development of countries. When considered developed economies, an increase in research and development expenditures of the governments, private sector and universities are visible.

2.1. The Concept of Innovation and Types of Innovation

Innovation is defined as “yenileşim” in the current Turkish dictionary of the Turkish Language Association (Türk Dil Kurumu, 2019). Innovation can be defined as the appropriate use and production of novelties occurring in socio-economic fields (Oğuztürk, 2011). Not only the production of goods or services, but also internal and external organizations of the enterprises, marketing strategies, all production and post-production processes including a new method can be expressed as an innovation. This shows that innovation covers all management processes and it allows the formation of a wide innovation network. The use of the innovation concepts with business refers to the adoption of innovation to product, process, marketing and business organization in the a company (Tübitak, 2005). Innovation way and purpose have led to the emergence of different types of

innovations. In general, there are four basic types: product, process, marketing and organization (Örtlek, 2015).

2.2. Employment Concept

The concept of employment means to use a job in a task (Turkish Language Institution, 2019). When employment is evaluated in economic terms, it means that workers are involved or employed in the production process. With another economic definition, it is possible to explain employment as the purchase of labor for wages (Güçlüoğlu, 2017). Kasapoğlu and Murat (2018) define employment as follows: The most efficient use of labor, entrepreneur, capital and natural resources in the field of production means employment. Countries produce a number of policies and intervene in the market in order to increase socio-economic welfare. Employment increasing measures are taken by using active and passive employment policy tools (Etcı & Karagöl, 2019). Active policies covers public consultancy, vocational training, activities for disabled people, activities related to the young population, and various incentive policies. Early retirement and unemployment insurance policies are among passive employment policies (Ay, 2012).

3. South Korea Economy and Employment

As of 2019, the population of South Korea is 51,709,098 people. Its gross national product is 1647 billion USD (World Bank, 2019).

Table 1. Import-Export data of South Korea for the period of 2010-2019 (1,000 USD)

Years	Import Value	Export Value	Trade Balance
2019	542,232,610	503,342,947	38,889,663
2018	605,169,190	535,172,391	69,966,799
2017	573,694,421	478,478,296	95,216,125
2016	495,425,940	406,192,887	89,233,053
2015	526,756,503	436,498,973	90,257,530
2014	572,664,607	525,514,506	47,150,101
2013	559,632,434	515,585,515	44,046,919
2012	547,869,792	519,584,473	28,285,319
2011	555,213,656	524,413,090	30,800,566
2010	466,383,762	425,212,160	41,171,602

Source: Ministry of Trade, (2019)

When data in Table 1 is examined, a fluctuating situation is encountered in the change of import and export value of South Korea over the years. A decrease in both import and export values in 2019 is visible. However, imports are higher than exports in all mentioned years.

South Korea ranks 13th out of 141 countries according to the Global Competitiveness Index 2019 data. South Korea ranks above the global average in terms of technology management and proximity to technology (Schwab, 2019). The decrease in demand in the Korean domestic market resulted with an economic crisis and various experienced economic problems negatively affected the research and development activities of enterprises. This situation pushed the Korean administration to apply different policies and led to the

formation of a new innovation policy. As in all economies, the crises in the South Korean economy forced enterprises to invest in research and development activities and innovation. In addition, it has been revealed that the investments made in research and development activities and innovation are cyclical and increase or decrease in parallel with the gross national product (OECD, 2009).

In terms of development policy, South Korea has implemented 5-year development plans. In the development policy which was put into practice in 1962, it was aimed to grow by synchronised growth of public and private sectors. Contribution to the development of the country's economy started with large enterprises and then followed with small enterprises over the years. Economic policies such as stabilization, increasing confidence in the markets, reducing the level of exposure of investors to price fluctuations, improvements in agriculture and global technological transfers to the country have been adopted. In the development of the South Korean economy, it can be mentioned that the efficient use of human capital, continuous monitoring of economic policies, design of strategies, adequate intervention of the political class in the economic field and legal obligations has contributions (Oğuztürk, 2011).

Table 2. Gross National Product of South Korea (Billion \$)

Years	Gross National Product
1990	279,35
2000	561,63
2010	1.094,50
2018	1.619,42
2019	1.647,00

Source: World Bank, (2019).

It is seen that the Gross National Product of South Korea has increased over the years, and in 2019 it reached a value of approximately six times of 1990 value.

Table 3. Ratios of sectors in the Gross National Product of South Korea (%)

	1990	2000	2010	2018
Agriculture, Forestry and Fisheries	8	4	2	2
Industry (Including Construction Works)	36	34	35	35
Goods and Services Import	25	35	49	44
Goods and Services Export	26	33	46	39

Source: World Bank, (2019).

In the proportional distribution of the sectors in the Gross National Product, while the ratio of the industry sector was the highest in 1990, the ratio of imports of goods and services has increased since 2000. The ratio of agriculture, forestry and fishery sectors has decreased over the years.

3.1. South Korea Innovation System

Along with industrial policy in the economic sense, South Korea has also developed policies in the field of science and technology, especially since the beginning of the 1960s. In the period between 1960 and 1980, Korea Science and Research Institute, Korea Ministry of Science and Technology was both established. In the same period, a number of legal policies were followed and the Science and Technology Incentive Law came into force in 1967. Within the scope of this law, tax exemption has been introduced in order to encourage

scientific studies and increase investments in R&D activities. When the studies in the field of science and technology in the period of 1980-2000 are evaluated, the establishment of the National R&D Program and the National Science and Technology Council, the implementation of the 5-year innovation plan, the promotion of the Science and Technology Vision and private sector R&D activities, the contribution of universities to their research were activated regulations in the form of incentives (Arslanhan & Kurtsal, 2010).

The strengths and weaknesses of the Korean innovation system can be listed as follows (OECD, 2009):

- In a short time, the South Korean economy transformed from an agricultural economy to a modern industrial economy. During this transformation, the formation of a strong vision shared among the government, the business world and the country's population accelerated the development of the Korean economy.
- South Korea's geopolitical position, its proximity to the important economies of the world throughout history, and its relations with these economies have affected South Korea significantly. This situation led to the emergence of a strong sense of independence and the desire to be self-sufficient. The awareness resulted by this situation pushed the government to take measures against external influences.
- South Korea has very limited natural resources. Its energy and raw material requirements are mostly compensated by imports. This situation has caused a transformation in investments and

increasing investments in people. Especially modern applications have been started in the field of education.

3.2. Innovation, R&D and Employment in the South Korean Economy

Positioning innovation and R&D activities as a globally economic actor has reflections in almost every field. In South Korea, especially in recent years, the public and private sectors have made necessary investments and made an important development in this field (Oğuztürk, 2011).

Table 4. R&D expenditure in selected countries

Countries	GNP R&D Expenditure (US\$100 million)	GDP R&D Share (%)
S. Korea	697	4.55
USA	5.432	2.79
Japan	1.561	3.21
Germany	1.122	3.04
France	565	2.19
United Kingdom	493	1.66
China	2.605	2.15

Source: Ministry of Science and ICT, (2019).

Considering the R&D expenditures and employment data in this field, while the amount of research and development activities in the gross domestic product in the South Korean economy was 697 million US dollars, this amount enabled South Korea to rank fifth among the world countries in the research and development ranking.

The awareness that increased in innovation and research and development activities in South Korea in the 1970s led to the increase in number of private and public universities. So that, while there were 85 universities in 1970, the number of universities increased to 293 in the 2000s (Çalışır & Gülmez, 2007). South Korean innovation and research and development activities have added new employment areas. The addition of new fields has opened an employment in the field of innovation and research and development. It is feasible to talk about an increase in the number of researchers in the public, private sector and universities (National Science & Technology Information Service, 2019).

Table 5. Budget for research and development (million Won)

Years	Budget for research and development
2010	13.7
2011	14.9
2012	16.0
2013	17.1
2014	17.7
2015	18.9
2016	19.1
2017	19.5
2018	19.7
2019	20.5

Source: National Science & Technology Information Service, (2019).

South Korea puts value to innovation and research and development activities. While the share allocated to research and development activities in the public budget was 13.7 million Won in 2010, this amount reached 20.5 million Won in 2019.

Table 6. Research and development expenditures (100 million Korean Won)

	2014	2015	2016	2017
Private sector	498,545	511,364	539,525	625,634
Universities	57,670	59,989	63,399	66,825
Public Research Institutes	81,127	88,241	91,132	95,432

Source: Ministry of Science and ICT, (2019).

Considering the research and development expenditures in South Korea, it is observable that there exist state research institutes, universities and the private sector. When analysed the research and development activities between 2014 and 2017, it is visible that the highest expenditure was added by the private sector. State research institutes and universities follow the private sector in terms of research and development expenditures.

Table 7. Number of researchers in South Korea (2014-2017)

	2014	2015	2016	2017
Number of researchers	437,447	453,262	460,769	482,796

Source: National Science & Technology Information Service, (2019).

The number of researchers increased regularly since 2014 until 2017 and there were 482,796 people in the last year.

Table 8. Sectoral distribution of researchers in South Korea (2014-2017)

	2014	2015	2016	2017
Private sector	304,808	317,842	321,323	343,367
Universities	99,317	99,870	103,166	102,877
Public Research Institutes	33,322	35,550	36,280	36,552
Total	437,447	453,262	460,769	482,796

Source: Ministry of Science and ICT, (2019).

Table 8 shows the distribution of the total number of researchers between 2014 and 2017 by employment sector. The number of people employed in the field of research and development activities in total in South Korea has increased during this period. While the number of people employed in research and development at universities decreased in 2017, there was an increase for all other sectors and for all years.

Table 9. Number of Researchers (2014–2017)

Countries	2014	2015	2016	2017
South Korea	345.463	356.447	361.292	383.100
United States of America	1.339.931	1.369.267	1.371.290	-
Japan	682.935	662.071	665.566	676.292
Germany	351.923	387.982	399.605	419.617
United Kingdom	276.584	284.483	288.922	289.674
France	271.772	277.631	-	288.579
China	1.524.280	1.619.028	1.6919.028	1.740.442

Source: Ministry of Science and ICT, (2019).

Research and development employment of South Korea compared to developed countries between 2014-2017 is given in Table 9. Between 2014 and 2017, the number of people employed in the field of research and development in developed countries increased in general. Among the selected countries, the number of researchers is highest in China for all years. While South Korea had more researchers from France and the United Kingdom in the 2014-2017 period, its behind China, the United States, Japan and Germany.

Number of female researchers among total researchers in South Korea:

- 80,904 (18.5% of total researchers) in 2014
- 85,652 (18.9% of total researchers) in 2015
- 90,615 (19.7% of total researchers) in 2016
- In 2017, it was 97,042 (20.1% of total researchers) (Ministry of Science and ICT, 2019).

4. CONCLUSION

The budget allocated by the government to research and development activities in South Korea has increased over the years. Likewise, it is possible to mention an increase in the number of researchers during related years. South Korea is a country that puts great importance to research and development. A number of legal arrangements were made to make economic development sustainable through research and development activities, which were determined as a development strategy by the administration. Tax exemptions and subsidies are among the policy tools applied mainly to ensure technological development.

In parallel with the investments made, employment opportunities are emerging in many fields and in many sectors. This shows us that investment in research and development activities and innovation also helps to add employment. In this context, the existence of innovation and research and development activities in developed countries makes new employment areas. In South Korea, it is possible to talk about a

close relationship between innovation, research and development activities and employment, which can be considered as one of the indicators of economic development.

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