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The Relationship between Unemployment and Growth: Evidence from Turkish Manufacturing Industry

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İşsizlik ve Büyüme Arasındaki İlişki: Türk İmalat Sanayi Örneği

Abstract

The aim of the study is to examine the short and the long-run relationship between the unemployment and the manufacturing industry in Turkey for the period between 2005:Q and 2017:Q4. For this purpose, firstly the combined cointegration technique, which is developed by Bayer and Hanck (2012), is applied to reveal the long-run relationship. For the short run relationship, on the other hand, the symmetric and the asymmetric causal relationships among the variables are investigated using the Hacker and Hatemi-J (2006) and Hatemi-J (2012) methods. The findings show that the variables are not cointegrated. In other words, there is no long-run relationship between the unemployment rate and the manufacturing industry growth. According to the symmetric causality test of Hacker and Hatemi-J (2006), no causality is detected. However, Hatemi-J (20012) asymmetric causality test suggests that there is only one unidirectional causality. The direction of the causality is from the negative shocks of the unemployment rate to the negative shocks of the manufacturing industry. The results support the jobless growth phenomenon for the manufacturing sector in Turkey.

Keywords : Unemployment, Manufacturing Industry, Combined Cointegration, Asymmetric Causality.

JEL Classification Codes : J10, J60, O11, O14, O40.

Öz

Bu çalışmanın amacı, Türkiye'de 2005:Q1-2017:Q4 dönemi için imalat sektöründeki büyüme ile işsizlik oranı arasındaki kısa ve uzun dönem ilişkiyi araştırmaktır. Bu bağlamda, imalat sanayi ve işsizlik oranı arasındaki uzun dönemli ilişki için Bayer ve Hanck (2012) tarafından geliştirilen birleştirilmiş koentegrasyon yaklaşımından yararlanılmıştır. İlgili değişkenler arasındaki kısa dönemli ilişkinin incelenmesi için Hacker ve Hatemi-J (2006) simetrik ve Hatemi-J (2012) asimetrik nedensellik testleri kullanılmıştır. Elde edilen bulgular serilerin eşbütünleşik olmadığını göstermiştir. Bir diğer ifadeyle, işsizlik oranı ve imalat sanayi büyümesi arasında uzun dönemde ilişki yoktur. Bunun yanısıra, değişkenler arasında kısa dönem simetrik ilişki de tespit edilememiştir. Asimetrik nedensellik sonuçlarına göre ise imalat sektöründen işsizlik oranına doğru herhangi bir nedensellik gözlenemezken, işzilik oranındaki negatif şokların imalat sanayindeki negatif şokların nedeni olduğu tespit edilmiştir. Elde edilen bulgular ışığında Türkiye'de imalat sektörü için istihdam yaratmayan büyüme olgusunun var olduğu söylenebilir.

Anahtar Sözcükler : İşsizlik, İmalat Sanayi, Birleştirilmiş Koentegrasyon, Asimetrik Nedensellik.

1. Introduction

Along with its economic and social effects, the unemployment is a global phenomenon. Additionally, it is the major cause as well as the consequence of the extensive poverty. Hence, especially for the developing economies, higher rate of employment is one of the most important aims to achieve. In the economics literature, according to Kreishan (2011: 228), it is a generally accepted view that the higher growth rate of Gross Domestic Product (GDP) increases employment and reduces unemployment. The economic growth could be defined as an increase in the amount of goods and services produced over a given period. From Aksoy's (2013) point of view, higher economic growth with the increase in the investment and the production, are expected to increase the demand for production factors, such as labor, capital etc. (Aksoy, 2013: 75). Okun (1962) is the first person who has studied about the relationship between the unemployment and the economic growth. He suggests that the GDP decreases by 3 percent as a result of a 1 percent increase in the unemployment over the natural unemployment rate (Okun, 1962: 89-104). This suggestion, which is also known as Okun's Law, has received wide acceptance in the economics literature.

According to Barışık et al. (2010), although the total value of the global economy nearly doubled in the last decades, the expected decrease in the unemployment rate couldn't be reached. They also suggest that this situation indicates that the relationship between the economic growth and the unemployment rate has gradually weakened (Barışık et al., 2010: 89). On the other hand, Demirgil (2010) argues that, after the recent global crisis, economic growth does not seem to create employment as much as it did before (Demirgil, 2010: 140). Aksoy (2013) states that the weakening relationship between the economic growth and the employment is also the case for the Turkish economy (Aksoy, 2013: 74). After the economic imbalances of the 1990s, the Turkish economy has experienced the most devastating crisis of its modern history. In 2001, the GDP decreased by 5.7% and the unemployment rate reached to 10% in the same period. In the following years, the country's economy experienced a steady growth. Between 2002 and 2017, excluding 2009 when is the impacts of the global crisis reached its peak, the average growth of the Turkish economy was 6.5%. However, the unemployment rate remained unchanged in this period. For instance, when the economy grew by 7.4 points in 2017, the unemployment rate was 10.9 percent. Hence, it is observed that the unemployment rate remained high, even though the economic recovery was in place.

The primary goal of the paper is to find out if the economic growth creates employment or the jobless growth exists for the Turkish manufacturing industry. In order to investigate the relationship between the unemployment rate and the manufacturing industry growth, quarterly data is used for the period of 2005-2017. For the long-term relationship, the combined cointegration test, which is developed by Bayer and Hanck (2012), is applied. The existence of the causal relationship between the manufacturing industry growth and the unemployment is tested by the Hacker and Hatemi-J (2006)'s causality test. In addition, to take the asymmetric structure into account, Hatemi-J (2012) asymmetric causality method is carried out. The evidence shows that there is no short or long-run symmetric relationship between the unemployment rate and the manufacturing industry growth. Besides, the asymmetric causality test result suggests that the manufacturing industry growth is not the cause of the unemployment rate. These findings support the jobless growth phenomenon for the Turkish manufacturing industry. On the other hand, we found unidirectional causal link running from the negative shocks of the unemployment rate to the negative shocks of the manufacturing industry growth.

There is a significant body of research exists on the symmetric relationship between unemployment and the aggregate output in Turkey. However, there is no such study that takes the disaggregated output and the asymmetric relationship into account in the economics literature to the best of our knowledge. On the other hand, this paper separates itself by taking the manufacturing sector as the most important component of the industry sector and employing the Bayer and Hanck method as a relatively new cointegration test. In addition, this study is expected to make a significant contribution to the economics literature by offering an understanding of the asymmetric causal relationship between the unemployment and the manufacturing industry growth in Turkey.

The literature review follows this section. In Section 3, the data and the econometric methods are presented. Results and discussions are revealed in Section 4 and finally, in Section 5 a brief summary of this study and suggestions are discussed.

2. Okun's Law

As stated in the first section, the first study about the relationship between the output and the unemployment dates back to the work of Arthur Okun, which is published in 1962. Okun (1962) estimated that a 1% decrease in the unemployment rate would reduce approximately 3% more of the output for the period between 1947 and 1960 in the U.S economy (Okun, 1962: 89-104). Okun (1962) estimated two models, namely the "difference version" and the "gap version". Alternative specifications such as the "dynamic version" and the "production function approach" have been used in other studies (Apap & Gravino, 2014: 3).

2.1. The First Difference Version

In the first difference version, the Okun coefficient is estimated by using a simple linear regression model. The rate of change in the unemployment is used as the dependent variable. It is shown as following:

$$\Delta U_t = \alpha + \beta \Delta Y_t + \varepsilon_t \tag{1}$$

Where ΔU is the percentage change in unemployment rate, ΔY is the real output growth and ε is the error term. $\boldsymbol{\beta}$ indicates the responsiveness of the unemployment rate in accordance with changes in output and it is also known as the "Okun coefficient" (Anderton et al., 2014: 6). α is simply a constant term that denotes the change of the unemployment rate when there is no change in real output (Apap & Gravino, 2014: 3). It follows that, $-\alpha/\beta$

represents the minimum level of output growth needed to maintain a constant unemployment rate (Knotek, 2007: 75).

2.2. The Gap Version

The gap version links the gap between the actual and natural rate of unemployment to the gap between actual and potential output (Okun, 1962: 92). The gap version is formulized as follows (Ball et al., 2013: 4):

$$U_t - U^* = \beta(Y_t - Y^*) + \varepsilon_t \tag{2}$$

Where U^* represents natural rate of unemployment, Y_t is the actual real GDP level, Y^* shows potential output, ε is the error term and β is called Okun coefficient and takes a value that is assumed to be less than zero (Alamro & Al-dalaien, 2014: 7). This coefficient tells us to what degree the fluctuation of total production affects the employment rate (Goussakov & Stjernström, 2017: 11).

2.3. The Dynamic Version

Okun made an observation that both past and current levels of output could affect the current level of unemployment rate. In the common form of dynamic versions, both the current and the past real output growth and past changes in the unemployment rate take place in the equation as an explanatory variable (Knotek, 2007: 76).

For example, the dynamic version contains one lag of the real output growth and one lag of the change in unemployment rate (Knotek, 2007: 77):

$$\Delta U_t = \beta_0 + \beta_1 \Delta Y_t + \beta_2 \Delta Y_{t-1} + \beta_3 \Delta U_{t-1} + \varepsilon_t \tag{3}$$

Where ΔU_t is the change in the unemployment rate, ΔY_t shows real output growth. ΔY_{t-1} and ΔU_{t-1} are the lagged values of the real output growth and the lagged value of the change in the unemployment rate respectively. β_0 denotes the constant term. Finally, ε_t is the white noise residual (Goussakov & Stjernström, 2017: 12).

The dynamic version has several characteristics in common with the original first difference version. However according to Knotek (2007) the dynamic version differs from the first difference version since it no longer only captures the contemporaneous correlation between changes in the unemployment rate and real output growth. Besides, the dynamic version in not as restrictive in terms of the timing of the relation between the output growth and changes in unemployment (Knotek, 2007: 77).

2.4. The Production-Function Version

Okun also noted another absence that the unemployment rate is also affected by the idle resources (Javed, 2012: 11). In a country's production process to produce output there must be an optimum combination of inputs (Alamro & Al-dalaien, 2014: 7). According to the economic theory, the components of the input should be the labor, the capital and the technology. Thus, the output is the function of the capital, the labor and the technology. The production function is written as (Prachowny, 1993: 332):

$$y = \alpha(k + c) + \beta(\gamma n + \delta h) + \tau \tag{4}$$

Where, y is the output, k is the capital input and c is its utilization rate. n represents the number of workers, h is the number of hours that they work. α and β are output elasticities and γ and δ are the contributions of workers and weekly hours to the total labor input respectively. Finally, τ is disembodied technology factor (Prachowny, 1993: 332).

3. Literature Review

Several studies investigating the relationship between output and unemployment empirically have followed Okun's study. Most of these studies have supported the validity of the relationship between the output and the unemployment rate. However, the estimated Okun coefficient vary substantially across countries and regions.

Neftçi (1984) predicted the asymmetric relationship between the economic growth and the unemployment rate in the U.S using quarterly data for the period between 1948 and 1981. Neftçi (1984) used the framework of finite state Markov process and revealed that there is an asymmetric relationship between related variables. In other words, the increase in the unemployment rate is more severe in the period of recession than the decrease in the period of expansion. Prachowny (1993), investigated the Okun coefficient for the U.S economy using two different datasets for the potential output and the NAIRU. Prachowny (1993) used three variables namely unemployment rate, economic growth and weekly working hours. He found that the marginal contribution of a 1 point reduction in the unemployment rate is only about 0.6% increase in the output. Moosa (1999), estimated the Okun coefficient in the post-war U.S economy for the period between 1947:1 and 1992:2. He applied a dynamic autoregressive distributed lag (ADL) approach and found that the Okun coefficient is around -0.38. More recently, Moosa (2008) studied the validity of the Okun's law in four Arab countries (Algeria, Egypt, Morocco, and Tunisia). He observed that the output growth does not turn into employment gains for the related countries. It means that the Okun coefficient is statistically insignificant.

Lee (2000) evaluated the validity of Okun's law based on the post-war data for 16 OECD countries. The sample period for all countries is 1955-1996 except for Germany which is 1960-1996. Lee's results show that the tradeoff between the economic growth and the unemployment rate is rather small after the 1970s since there is a structural break in 1970s and also the findings differ from country to country. Viren (2000) considered asymmetric behavior for 20 OECD countries covering the period of 1960-1997. He carried out non-linear Okun curve using a threshold model estimator. According to Viren's (2000) evidence, output growth has a strong effect on unemployment when unemployment is low, and output is high, and vice versa. Thereby, the effect of output growth on unemployment can be close to zero in bad times. Sögner and Stiassny (2002) predicted Okun's law for 15

OECD countries considering structural breaks. The period of this empirical study is 1960-1999. The estimated Okun coefficient varies between -0.12 and -0.82. The lowest reaction to the unemployment on the GDP growth is found in Japan and the strongest reaction is found in the Netherlands.

Huang and Lin (2006) examined the relationship between the GDP growth and the unemployment using the quarterly data for the period of 1948-2004. They implemented the flexible nonlinear inference approach and confirmed the validity of Okun's law for the U.S economy. Kreishan (2010) investigated the relationship between the economic growth and the unemployment rate in Jordan using annual data covering the period 1970-2008. His findings suggest that Okun's law is not valid for Jordan. Sodipe and Ogunrinola (2001) investigated the employment and economic growth relationships for the Nigerian economy. They estimated the elasticity of economic growth using ordinary least square (OLS) approach and found that the employment elasticity of economic growth is positive and significant. This indicates that the jobless growth phenomenon does not exist in the Nigerian economy. Javeid (2012) researched association between the unemployment rate and the GDP growth using annual data for the period 1981-2005 for Pakistan. He employed Engle-Granger cointegration technique and error correction model. The findings of cointegration test show that the economic growth and the unemployment rate have an equilibrium in the long-run. Moreover, in the short-run, 1% of economic growth causes 3.1% decrease in the unemployment rate. Jardin and Stephan (2012) studied non-linear Okun's law in a panel framework for 16 European countries. They enjoyed a semi-parametric approach using quarterly data from 1984 to 2009. Their estimations support that the unemployment reacts strongly to the output in the early recession phases and during the period of expansion. By contrast, in the middle of recessions and during the period of recoveries, the impact of the output on the unemployment tends to be weaker.

In the case of Turkey, Barışık et al (2010) applied Markov-Switching approach for the period 1988-2008 and found that the economic growth does not create employment in Turkey. In addition, Demirgil (2010) also found that the Okun's law does not work for Turkey during the period 1989-2007 as well. Kanca (2012) revealed the relationship between the unemployment rate and the economic growth for the period of 1970-2010. According to his results, there is a unidirectional causality from the economic growth to the unemployment rate. Ceylan and Şahin (2010) investigated whether Okun's relation is symmetric or not for the Turkish economy using annual data for the period 1950-2007. To test the asymmetric relationship, they employed TAR and M-TAR models. The evidence from the analyses suggests that the Okun's law is valid in the long-run and the relationship is asymmetric.

Tanrıöver and Biçer (2015) researched the existence of jobless growth in the Turkish economy. To analyze the existence of the long-run asymmetrical relationship between the output gap and the unemployment rate gap, they applied Beveridge-Nelson decomposition method. They used monthly data for the period between 2005 and 2015. According to the findings of the Okun's gap approach, the output growth that is appeared in the contraction period of business cycle reduce the unemployment rate less than in the expansion of business cycle or it generates less employment. Arı (2016) investigated the long-run relationship between the economic growth rate and the unemployment rate in Turkey over the period 1980-2014. Her study's results show that there is no cointegration relationship in the long-run and there is also no causality between the growth rate and the unemployment rate.

Literature review indicates that there are numerous studies that investigate the relationship between economic growth and unemployment rate. Notwithstanding, there is a limited study which focuses on the disaggregated relationship between the related variables in the empirical literature. As an example to this, Aksoy (2013) investigated aggregate and disaggregate dynamic relationship between the employment and the economic growth over the period of 1988:Q4-2010:Q4 for the Turkish economy. The results of Toda-Yamamoto (1995) test show that the relationship between the employment and the growth vary from industry to industry. To sum up, his findings revealed that, an increase in the employment creates economic growth more than the increase in the employment which caused by the output. Anderton et al. (2014) examined the Okun relationship for the various expenditure components of the GDP using quarterly data over the period 1996-2013 for 17 Eurozone countries. The evidence of panel regression suggests that unemployment is particularly sensitive to movements in the consumption component of the GDP while movements in foreign trade (exports and imports) have a much lower impact on unemployment (Anderton et al., 2014: 17). Apap and Gravino (2014) employed a regression analysis and found that there exists a negative and significant relationship between the output and the unemployment in Malta. Accordingly, in the period between 1993 and 2012, the unemployment rate has been more sensitive to the developments in the services sector than to those in the manufacturing sector. Pesliakaite (2015) reviewed the relationship between the unemployment and both expenditure and production components of the GDP of Lithuania. The sample covers the period of 1996:Q1-2014:Q4. Results of the regression pointed out that the GDP growth that is driven by the labor-intense private consumption, contributes most to a change in the unemployment rate (Pesliakaite, 2015: 94). Moreover, changes in the activity of the construction, the services, and the agriculture sectors contribute much more to the unemployment as compared with the manufacturing sector.

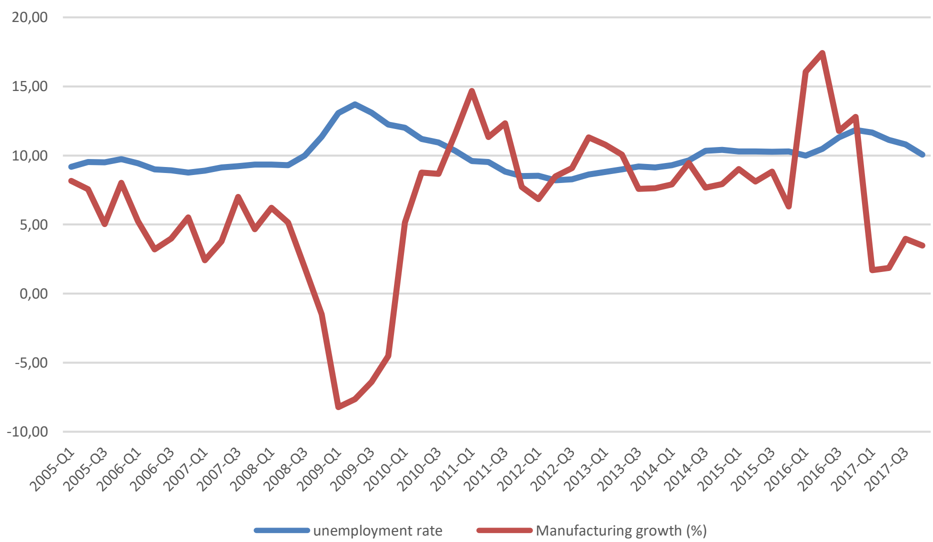
4. Data and Econometric Methodology

4.1. Data

In this study, we investigated the relationship between the unemployment rate (u) and the manufacturing industry growth (m) in the Turkish economy. The quarterly data covers the period between 2005 and 2017. The seasonally adjusted unemployment rate obtained from Turkish Statistical Institute (TSI) while the manufacturing industry from Central Bank of the Republic of Turkey (TCMB). The TSI has been calculating new unemployment series for Turkish economy since 2005. Thus, 2005 was selected as the starting date of the data. The manufacturing series are deflated with the consumer price index to make real and the manufacturing industry growth was calculated by using the year-on-year percentage point change in the output.

The data that is presented in Fig. 1 indicates that the period has been characterized by one recession. In 2009, the Turkish economy experienced a mild recession due to the global crisis. Between 2009:Q1 and 2009:Q4 the average growth value of the manufacturing production decreased to -6.7 %, while the unemployment rate rose to 13% in the same period. In the following years, the manufacturing industry began to expand by following a fluctuating course, but the unemployment rate showed a slight reduction. Survey data indicate that the changes in the manufacturing industry are sharper than the unemployment rate. According to Fig. 1, one may say that there is no relationship between the manufacturing industry growth and the unemployment rate.

Figure: 1
Unemployment Rate and Manufacturing Growth



4.2. Econometric Methodology

4.2.1. Unit Root Tests

A common assumption for many time series is that the data are stationary. "A time series is stationary if its mean and variance are constant over time and the value of the covariance between the two-time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed" (Gujarati, 2003: 797). In time series analyzes it is crucial to work with stationary data in order to avoid spurious relationship between the series. Therefore, in this study, Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests are employed to analyze whether the data are stationary or not.

4.2.1.1. Augmented Dickey Fuller Unit Root Test

To detect the presence of a possible unit root in the series the ADF test by Dickey and Fuller (1979, 1981) is employed. The general form of the ADF test is presented as:

$$\Delta Y_t = \beta Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t \tag{5}$$

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t \tag{6}$$

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \gamma \text{trend} + \varepsilon_t \tag{7}$$

Where Δ is the first difference form, α is constant, ε is the white noise residual and γ is the coefficient on a time trend. p is the lagged value of the ΔY_t that is included to allow the serial correlation in the residuals. The unit root test is carried out to test the null hypothesis of β=0 against the alternative hypothesis of β<0. If the absolute value of the computed t-statistics for β exceeds the absolute critical value given in MacKinnon (1990), the null hypothesis which suggests that the Y is not stationary must be rejected against its alternative (Taban & Aktar, 2008: 1542). If, on the other hand, it is less than the critical value, then the Y is non-stationary. In this case, the same regression must be repeated for the first difference of the series (Cetin & Taban, 2009: 49).

4.2.1.2. Phillips Perron Unit Root Test

Phillips Perron (PP) unit root test is employed to analyze whether the data is stationary or not. PP is a non-parametric and robust unit root test to any possible heteroscedasticity in the error term. The constant with trend model that is suggested by Phillips and Perron (1988) is shown as below;

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \upsilon_t \tag{8}$$

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \gamma \text{trend} + \upsilon_t \tag{9}$$

Where Δ is the first difference form, α is the constant, υ is the error term and γ is the coefficient on a time trend.

PP unit root test is employed in order to check stationarity. Phillips and Perron's test statistics can be viewed as Dickey-Fuller statistics that is more robust to a serial correlation by using the Newey-West (1987) heteroscedasticity and autocorrelation consistent covariance matrix estimator (Konstantakis et al. 2015: 41). According to Konstantakis et al. (2015) one advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of a heteroscedasticity in the error term, while another one is that the user does not have to specify a lag length for the test regression (Konstantakis et al. 2015: 41).

4.2.2. Cointegration Test

If two variables (unemployment rate and manufacturing industry growth i.e.) are not stationary in their levels but are stationary in their first or higher differences, performing co-integration tests for both variables is theoretically possible. Hence the long-run relationship between the unemployment rate and the manufacturing industry growth is investigated by using the tests for cointegration developed by Bayer and Hanck (2012).

4.2.2.1. Bayer and Hanck (2012) Cointegration Test

Engle-Granger (1987) cointegration test is based on estimating residuals of a long-run regression model. In the later years, various cointegration tests were developed, such as the system-based test of Johansen (1988), the error correction model (ECM)-based F-test of Boswijk (1994) and ECM-based t-test of Banerjee et al (1998) (Govindaraju & Tang, 2013: 314). But these cointegration tests are not perfect or completely robust. In order to enhance the power of cointegration tests, Bayer and Hanck (2012) proposed a new test which combines various individual cointegration test results to provide more accurate findings (Govindaraju & Tang, 2013: 314). In this context, Bayer and Hanck (2012) suggested combining the computed significance level (p-values) of the individual cointegration tests with the following Fisher's formulas (Govindaraju & Tang, 2013: 315):

$$\mathrm{EG-JOH} = -2\left[\ln(\mathrm{p_{EG}}) + \ln\left(\mathrm{p_{JOH}}\right)\right] \tag{10}$$

$$\mathrm{EG-JOH-BO-BDM} = -2\left[\ln(\mathrm{p_{EG}}) + \ln\left(\mathrm{p_{JOH}}\right) + \ln(\mathrm{p_{BO}}) + \ln(\mathrm{p_{BDM}})\right] \tag{11}$$

Where p_{EG}, p_{JOH}, p_{BO} and p_{BDM} are the p-values of Engle-Granger (1987), Johansen (1988), Boswijk (1994) and Banerjee et al (1998) cointegration tests respectively. If the calculated Fisher statistics exceed the critical values supplied by Bayer and Hanck (2012), the null hypothesis of no cointegration could be rejected (Govindaraju & Tang, 2013: 315).

4.2.3. Causality Test

Granger (1969) suggested a time-series data-based test to reveal possible causality. "In the Granger-sense x is a cause of y if it is useful in forecasting y. In this framework 'useful' means that x is able to increase the accuracy of the prediction of y with respect to a forecast, considering only past values of y" (Foresti, 2006: 3).

There are three different types of situations in which a Granger-causality test can be applied (Foresti, 2006: 3):

- In a simple Granger-causality test there are two variables and their lags.
- In multivariate Granger-causality test more than two variables are included, because it is supposed that more than one variable can influence the results.
- Finally, Granger-causality can also be tested in a VAR framework. In this case the multivariate model is extended to test for the simultaneity of all included variables.

In this context, we employed the Hacker and Hatemi-J (2006) and Hatemi-J (2012) causality procedures to test the potential causality between the series.

4.2.3.1. Hacker and Hatemi-J (2006) Symmetric Causality Test

In this study, we analyzed the symmetric causal relationship between the unemployment rate and the manufacturing industry growth by employing the Hacker and Hatemi-J (2006) causality test. This test is based on Toda-Yamamoto (1995) approach and VAR(p+dmax) process of the variable is estimated as in the following equation (Hacker & Hatemi-J, 2006: 2-3):

$$y_t = v + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \cdots + A_{p+d} y_{t-(p+d)} + \varepsilon_t \tag{12}$$

Where y_t denotes the vector of k independent variables, v is the constant vector, A is an n x n matrix of parameters for lag r and finally, ε_t represents the error vector. In addition, p is the optimal lag length of VAR model and d is the maximum order of integration of the variables. The Hacker and Hatemi-J (2006) argues that the bootstrap distribution is a better alternative to the chi-square distribution which Toda-Yamamoto (1995) uses in their causality test (Hacker & Hatemi-J, 2006: 3). "The bootstrap method, developed by Efron (1979), is based on resampling the data to estimate the distribution of a test statistic. Using this distribution may reduce bias in inference by providing more reliable critical values" (Hacker & Hatemi, 2006: 8). Besides, this method considers autoregressive conditional heteroscedasticity (ARCH) and is not sensitive to normality assumption.

4.2.3.2. Hatemi-J (2012) Asymmetric Causality Test

We employed the asymmetric causality approach to investigate the relationship between positive and negative shocks of the variables. Previously published papers on causality tests assumed that the impact of a positive shock is the same as the impact of a negative shock and according to Hatemi-J (2012), this assumption is too restrictive, because the people respond differently to a positive shock compared to a negative one of the same absolute magnitude in the financial markets (Hatemi-J, 2012: 448). Besides, investors tend to react more to the negative news than the positive news and it is inevitable to take the asymmetric structure into account due to the existence of the asymmetric information in markets (Hatemi-J, 2012: 448). To allow for the asymmetry in the causality, Hatemi-J (2012) suggests that the test for causality ought to be performed by using cumulative sums of positive and negative components of the underlying variables and in order to investigate the causal relations between two integrated variables such as y1t and y2t, equations are defined as below (Hatemi-J, 2012: 449):

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i} \tag{13}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i} \tag{14}$$

Where y1t and y2t are the initial values. Positive and negative shocks can be shown as following: $\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0)$, $\varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0)$, $\varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0)$ and $\varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0)$. Therefore, one can express $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$. In the light of this information, the equalities from (13) and (14) can be expressed as following (Hatemi-J, 2012: 449):

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{1} \varepsilon_{1i}^{+} + \sum_{i=1}^{1} \varepsilon_{1i}^{-} \tag{15}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{1} \varepsilon_{2i}^{+} + \sum_{i=1}^{1} \varepsilon_{2i}^{-} \tag{16}$$

Positive and negative shocks of each variables can be shown in the cumulative form as $y_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}$ and $y_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}$, $y_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}$ and $y_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-}$ respectively. Next, the test for casual relationship between only positive cumulative shocks is introduced (Hatemi-J, 2012: 449):

$$y_t^{+} = \alpha + A_1 y_{t-1}^{+} + \cdots + A_p y_{t-1}^{+} + u_t^{+} \tag{17}$$

Where y_t^{+} is the 2x1 vector of the variables, α is the 2x1 vector of the intercepts and u_t^{+} is a 2x1 vector of the error terms. The critical value is calculated by using a bootstrap algorithm with leverage corrections. In both Hacker and Hatemi-J symmetric causality test and Hatemi-J asymmetric causality approach, information criterion, which proposed by Hatemi-J (2003) is considered to select the optimum lag lengths.

5. Empirical Results

The results of the unit root tests are reported in Table 1. ADF and PP test statistics for both variables show that the null hypothesis cannot be rejected in any level forms. Hence, the variables are not stationary at level. For this reason, the variables are transformed into the first difference and the null hypothesis of unit root is rejected at the 1% level. Both tests provide evidence supporting the stationarity of u and m at first difference. Thus, the variables are I (1).

Table: 1
The Unit Root Tests Results

Variables	ADF test	PP test
u	-0.2700 (2)	-0.0923
Du	-3.6256 (1)***	-3.4747***
m	-0.9929 (4)	-1.7172*
Dm	-4.8357 (3)***	-6.8334***

*Note: The numbers in the parenthesis ( ) indicate the optimal lag order selected by the Akaike Information Criterion (AIC). D is first difference operator. * and *** denote the significance levels at the 10% and 1% respectively.*

Since the variables are integrated at I (1), the combined cointegration test that is developed by Bayer and Hack (2012) could be applied. Before testing the cointegration, it is essential to determine the appropriate lag length. The results of the lag selection criterion are shown in Table 2. In the study, AIC criterion was considered and the result shows that lag 2 is suitable for the empirical analysis.

Table: 2
The Lag Order Selection

VAR Lag Order Selection Criteria						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**HQIC**	**SBIC**
0	-222.929		40.2973	9.37203	9.40149	9.44999
1	-155.348	135.16	2.8502	6.72282	6.81121	6.95672
2	-139.546	31.603*	1.74518*	6.23109*	6.37841*	6.62093*
3	-136.323	6.4463	1.80742	6.26346	6.46971	6.80923
4	-133.512	5.6226	1.90831	6.31299	6.57817	7.01469

*Note: * indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
HQIC: Hannan-Quinn information criterion
SBIC: Schwarz information criterion

Table 3 shows the result of the combined cointegration test. The Fisher statistics for both Engle-Granger & Johansen (EG-JOH) and Engle-Granger, Johansen, Boswijk & Banerjee-Dolado-Mestre (EG-JOH-BO-BDM) tests fail to reject the null hypothesis of no-cointegration. Therefore, there is no long-run equilibrium between the manufacturing industry growth and the unemployment rate in Turkey over the period 2005:Q1-2017:Q4. The findings suggest that the growth in the manufacturing industry does not affect the employment rate. In other words, one may say there exists jobless growth in Turkey.

Table: 3
Bayer-Hanck Cointegration Test Results

Model Specification	**Fisher Statistics**	**Fisher Statistics**	**Decision**
	EG-JOH	EG-JOH-BO-BDM	
$F_u = f(u, m)$	5.5327521	12.076767	NO cointegration
$F_m = f(m, u)$	6.1092774	16.399025	NO cointegration
Significance Level	**Critical Values**	**Critical Values**	
Significance level at 1%	17.304	33.969	
Significance level at 5%	11.229	21.931	
Significance level at 10%	8.678	16.964	

Note: EG-JOH is the combination of two cointegration tests proposed by Engle and Granger (EG, 1987) and Johansen (JOH, 1988). However, EG-JOH-BO-BDM is the combination of four cointegration tests proposed by Engle and Granger (EG, 1987), Johansen (JOH, 1988), Boswijk (BO, 1994) and Banerjee et al. (BDM, 1998).

At this stage, we investigated the causality between the unemployment rate (u) and the manufacturing industry growth (m) using the Hacker and Hatemi-J (2006) causality test. The causality results are presented in Table 4. The null hypothesis of no causality cannot be rejected any level of significance neither from manufacturing industry to unemployment nor from the unemployment to the manufacturing industry.

Table: 4
Hacker and Hatemi-J Symmetric Causality Test Results

Null Hypothesis	**MWALD**	**Bootstrap CV at 1%**	**Bootstrap CV at 5%**	**Bootstrap CV at 10%**
$m \nRightarrow u$	0.377	10.076	6.332	4.807
$u \nRightarrow m$	0.369	10.245	6.519	4.988

Note: The symbol $\nRightarrow$ means represents Granger non-causality, CV represents critical value. To test VAR (p+dmax) a fixed one lag augmentation used, because of the maximum order of integration all of the variables. The optimal lag order selected by Hatemi-J Criterion (HJC) and the number of bootstrap replication 10000.

The evidence of the Hatemi-J (2012) asymmetric causality test are reported in Table 5. According to the asymmetric causality test results, the null hypothesis of no causality from the positive shocks of the manufacturing industry growth to the positive shocks of the unemployment rate cannot be rejected at any conventional significance level or vice versa. Similarly, there is also no causality between the positive shocks and the negative shocks. However, the null hypothesis can be rejected at 5% significance level in which direction of the causal link is running from the negative shocks of the unemployment rate to the negative shocks of the manufacturing industry growth.

Table: 5
Hacker and Hatemi-J Symmetric Causality Test Results

Null Hypothesis	Test Value	p	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%
$m^+ \nRightarrow u^+$	0.300	2	10.671	6.539	5.027
$u^+ \nRightarrow m^+$	1.002	2	10.312	6.447	4.866
$m^- \nRightarrow u^-$	4.352	2	10.409	6.595	5.030
$u^- \nRightarrow m^-$	7.519**	2	10.605	6.701	5.010
$m^+ \nRightarrow u^-$	0.091	2	11.212	6.864	5.066
$u^- \nRightarrow m^+$	2.019	2	11.001	6.841	4.997
$m^- \nRightarrow u^+$	1.354	2	10.795	6.615	4.891
$u^+ \nRightarrow m^-$	1.263	2	10.429	6.517	4.953

*Note: The symbol $\nRightarrow$ means represents Granger non-causality, CV represents critical value. "+" and "-" refer the cumulative positive and negative sums respectively. ** indicates rejection of null hypothesis 5% significance level. p denotes optimum lag order of VAR model. To test VAR (p+dmax) a fixed one lag augmentation used, because of the maximum order of integration all of the variables. The optimal lag order selected by Hatemi-J Criterion (HJC) and the number of bootstrap replication 10000.*

6. Conclusion

In this study, the dynamic and the static relationships between the manufacturing industry growth and the unemployment rate are investigated over the period of 2005:Q1-2017:Q4 in Turkey. Before analyzing the dynamic and the static relationships between the series the stationarity properties are examined with the ADF and the PP unit root tests. The unit root tests show that both the unemployment rate and the manufacturing industry are stationary at their first differenced level. Next, Bayer-Hanck (2012) cointegration test is applied to determine the long-run relationship between the series. The findings of the combine cointegration test indicate that the null hypothesis of no cointegration cannot be rejected. In other words, there is no long-run relationship between the unemployment rate and the manufacturing industry growth.

The study estimates the dynamic relationship by using both the symmetric and the asymmetric causality methods. The evidence of the symmetric causality test confirmed that there is not any relationship between the variables. According to the asymmetric causality test, there is no causality from the negative and the positive shocks of the manufacturing industry growth to the positive and negative shocks of the unemployment rate separately. On the contrary, the null hypothesis of no causality can be rejected at 5% significance level in which direction of the causal link is running from the negative shocks of the unemployment rate to the negative shocks of the manufacturing industry. In the light of this information one may say, the manufacturing industry which is the most capital-intense sector in the economy does not create employment or at least does not have any effect on unemployment rate.

The industry is the locomotive sector of growth in any developing economies and it is also the engine of the foreign trade. The manufacturing industry is the principal and the dynamic sub-sector of the industry sector. Considering the high need for imported intermediate goods, the industry is inevitable susceptible to the economic crises, which affect the exchange rate, in the context of the employment and foreign trade. The manufacturing industry is a major part of the GDP. Thus, taking measures to reduce foreign dependency could minimize the adverse effects of the fluctuations in the exchange rate. On the other hand, the small-scale factories have a limited capacity of creating substantial amount of employment and value-added. Hence, helping small and medium-sized factories to achieve economies of scale, what is expected to provide more stable, manageable and foreseeable structure, and providing supports, such as tax exemptions in the times of economic crises, to large-scale factories could be the vital steps to lower the unemployment rate over time. Finally, in this paper, we focused on the manufacturing industry alone and to make a comparison, it can be useful to include the agriculture or the services industries to the main model.

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