IS SECTORAL SHIFTS HYPOTHESIS VALID IN THE TURKISH ECONOMY?

Sami TABAN
Osmangazi University, Faculty of Economics and Administrative Sciences, Turkey
staban@ogu.edu.tr
Muhsin KAR
Yıldırım Beyazıt University, Faculty of Political Sciences, Turkey
mkar@yildirim.edu.tr
Selim KAYHAN
University of New Orleans, United States
skayhan@uno.edu
Tayfur BAYAT
Inonu University, Faculty of Economics and Administrative Sciences, Turkey
tafur.bayat@inonu.edu.tr

Abstract
The aim of this study is to analyze reasons of unemployment and the validity of sectoral shift hypothesis developed by Lilien for the Turkish economy between years 2005 and 2014. The causal linkage between variables is analyzed by Toda–Yamamoto Granger causality, frequency domain causality and asymmetric causality test methods.
The results obtained from all tests show that the main reasons of unemployment in the Turkish economy are the cyclical factors. It is not possible to speak about validity of sectoral shifts hypothesis in the economy. The intensity and direction of interactions between macroeconomic variables may differ due to time frequencies. The existence of causality may disappear in the long run while it exists in the short run. Also conventional causality analysis methods do not decompose the causality into positive and/or negative shocks and so they could not explain the direction of causality. In order to test causation linkage between variables and to find direction of causality in different shock types we employ recently developed causality analysis methods which would increase the quality of the study.

Keywords: *Lilien index, sectoral shifts, unemployment, Turkish economy*

JEL Classification: *I25, I24, R10, P48*

I. INTRODUCTION

One of the most debated issues in the labor economics literature is the answer of the question: Which factors cause fluctuations in unemployment rate? A numbers of economists investigated the different economic variables in order to explain existence of unemployment and to find a policy implication to solve unemployment problem. Although there are a lot of sights to explain which factors are effective, it is possible to classify them into two categories. One of them belongs to classics. According to classical approach, shocks related to aggregate demand like monetary and fiscal policy shocks are the main sources of the fluctuations. The unemployment existed due to aggregate demand shocks is called as cyclical unemployment. Second approach claims that main source of unemployment fluctuations is structural change in the economy like a development in production technology, volatility in input prices, innovation of new products and competition in the supply of existing productions. The labor force supply harmonizes to structural changes in the economy slowly while supply demand changes fast. This would disrupt supply-demand balance in the sector. That is why structural changes in the economy induce the fluctuations in the unemployment rate.

The U.S. television manufacturers had to stop the production in U.S.A. because they could not compete with South Asian producers like Japan in 1990s. This made workers who expert in TV manufacturing unemployed. Finally they had new skills and found another job in a different sector, some of them found a job in chemical sector and others found a job in services sector or construction sector. This is the famous example of Thomas L. Friedman's (1999) book "Lexus and Olive Tree: Understanding the Globalization" to explain development of human capital. It also describes the possible change formation of labor demand and sectoral shift of labor.

Lilien (1982) endeavors to hypothesize the unemployment type occurs because of structural change in the economy. Lilien's hypothesis named, sectoral shifts hypothesis, implies that a change in industrial combination of labor demand is effective on both total employment and unemployment. According to hypothesis, the source of high unemployment is the fast structural changes in the labor demand. A reduction in military spending, increasing competitiveness, and development in manufacturing industry such as automation and shocks in oil prices might change labor force demand very fast. If the labor force settles change in labor demand slowly, probably unemployment rate would increase and as a result of the shocks, temporary and structural unemployment level would fluctuate in the time period.

Lilien (1982) tries to explain the unemployment rate of U.S.A. between 1948 and 1980 by using sectoral demand shocks. Lilien employees sectoral shift hypothesis in order to explain high unemployment rate in U.S.A. experienced in 1960s and 1970s. According to Lilien, the reason of high unemployment rate in U.S.A. is sectoral shifts in employment due to factors listed above. According to him, sectoral shift as a result of all factors mentioned above are the source of high unemployment rate in the economy.

High and chronic unemployment rate has been an important problem for several years for also the Turkish economy. It is clear that the rate has not been fallen below 8 % for 25 years period except for a short period in the second half of 1990s. But the employment increased during the period. Also important modification in the economy has been achieved in especially production range, manufacturing technology and shares of sectors in total production. Fiscal and monetary policies implemented by the ruling governments in order to achieve to reduce the rate were not successful in the long time period.

On the other hand, the share of sectors in total employment might be another issue related to unemployment rate problem of the Turkish economy. It has changed during these years. All the explanations about the labor sector of the Turkish economy brings another question. Is sectoral shifts hypothesis valid in the Turkish economy?

The main aim of this study is to investigate the validity of sectoral shift hypothesis between years 2005 and 2014. The contribution of this study is twofold. First of all, in this period Turkey experienced high unemployment rate problem and by investigating sectoral shift hypothesis we discuss the sources of unemployment. The results might have policy implications to help to reduce unemployment rate permanently. On the other hand, the intensity and direction of interactions between macroeconomic variables may differ due to time frequencies. The existence of causality may disappear in the long run while it exists in the short run. Also conventional causality analysis methods do not decompose the causality into positive and/or negative shocks and so they could not explain the direction of causality. In order to test causation linkage between variables and to find direction of causality in different shock types we employ recently developed causality analysis methods which would increase the quality of the study.

This study consists of six sections. In the following section, the related literature is presented. In the third section, employment statistics related to the Turkish economy is interpreted by using basic quantitative analysis methods. The econometric methods are described in the fourth section. Empirical results are presented in the fifth section. Finally, some concluding remarks are offered in section 6.

II. EMPIRICAL LITERATURE

The validity of sectoral shifts hypothesis is tested by a number of studies for different economies. Abraham and Katz (1984, 1986), Davis (1987), Medoff (1983), Loungani, Tave et al. (1990), Palley (1992), Mills, Pelloni et al. (1995), Caporale, Doroodian et al. (1996), Shinn (1997), Brainard and Cutler (1993), Blackley (2000), Aaronson, Rissman, et al. (2004), Heaton and Oslington (2010) investigate the Lilien's sectoral shifts hypothesis for the U.S. economy. An important number of the studies conclude that sectoral shifts have impressive effects on unemployment rate. Samson (1985) and Neelin (1987) investigate the validity of hypothesis for the Canadian economy. Samson (1985) finds results in favor of the sectoral shifts hypothesis while Neelin (1987) implies the invalidity of hypothesis for the Canadian case. According to Neelin, the main reason of the unemployment is aggregate demand shocks which induce sectoral shifts in employment.

Other studies belong to Piselli and D'Italia (2000), Chiarini-Piselli (2000) and Garonna (2000) which analyze the Italian economy. The results of the studies are all in favor of the validity of the hypothesis. Brunello (1991), Sakata (2002), Sakata and Kenzie (2004) test it for the Japanese economy. Brunello's findings do not support the hypothesis. On the other hand, Sakata (2002) implies that sectoral shifts affect unemployment rate in a short time period during the recession periods. Sakata (2002) also tests the hypothesis for men and women employment separately. The hypothesis is valid for the case of men's unemployment rate. Sakata and Kenzie (2004) test the hypothesis by dividing work force into different age groups. According to results, sectoral shifts affect older men workers' unemployment rate in the short term and the power of effect increases in the recession periods. Groeneworld and Hagger (1998) investigate the hypothesis for the Australian economy. They reach results supporting the validity of hypothesis in Australia. The sectoral shifts hypothesis is tested for the Turkish economy by Wigley and Mıhcı (2011). The authors employ vector error correction model (VECM) in order to investigate the validity for 1988-2007 period. The results of the analysis suggest that unemployment occurs due to cyclical change besides sectoral shifts are another reason of unemployment.

III. GENERAL VIEW OF UNEMPLOYMENT IN THE TURKISH ECONOMY

According to survey of TSI (Turkish Statistical Institute), total employment in the economy was 15,7 million people in 1988. It increased in the following years and reached 25,5 million people in 2013. The employment increased 62,3 percentage between 1988 and 2013. It is important to emphasize that the growth rate of employment is faster than growth rate of population in Turkey during the period.

The industrial, construction and service sectors are the main drivers of the increase in employment. The employment in the construction sector was around 1 million people in 1988 and it increased and reached to 1,8 million in 2013. The number of workers in the industrial sector increased more than 2,1 million people. The employment in the service sector was only 3,6 million people in 1988 and it increased significantly and reached to 12,7 million in 2013. The rates of increase in industrial and service sectors are 76,6 % and 249,1 % respectively.

The employment in agricultural sector decreased during the same period. In the agricultural sector, 8,2 million people was employed in 1988, while the number of worker in the sector decreased dramatically to 6 million in 2013. The employment has reduced 27 % during this period. The share of agricultural sector in total employment has decreased continuously during the last three decades also. It was 46,5 % in 1988 and reduced to 23,6 % in 2013. On the other hand, the share of industrial sector increased to 19,4 % in the same period. The share of employment in construction sector increased similarly, from 5,7 % to 7 %. The share of service sector increased steadily and reached to 50 % of total employment in 2013.

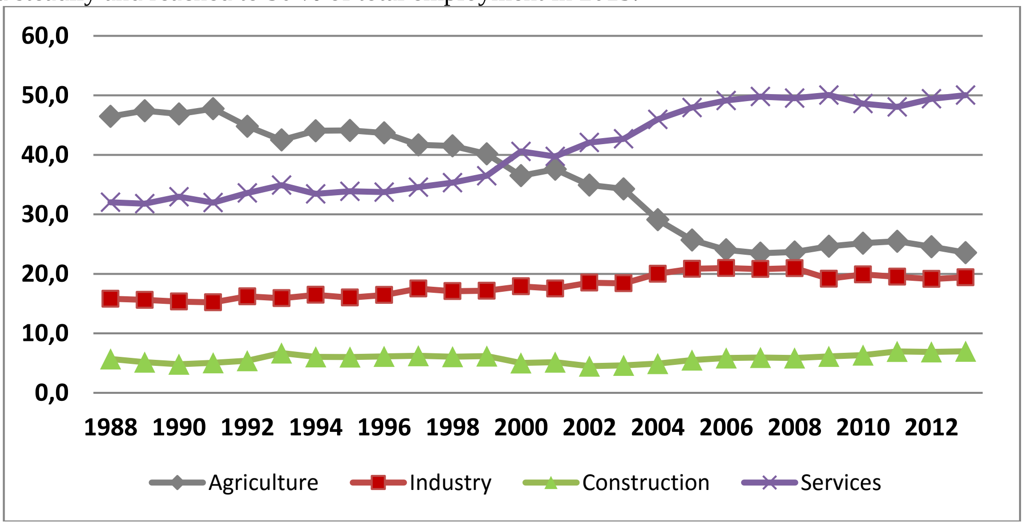

Figure 1 – Shares of manufacturing sectors in total employment in the Turkish economy (%)

The share of each sector in the total employment has to be investigated. The share of industry and construction sectors increased steadily as well as in a small portion during the years. The shares of industry and construction sectors was 15,8 % and 5,7 % in 1988 and they reached to 19,4 % and 7 %, in 2013 respectively. The case in the agricultural sector can be seen in the graph. It decreases continuously during the 25 years. While it was more than 46 %, it drop off and it was 23,6 % in 2013. Despite of decrease in agricultural sector, the services sector increased steadily in this period and reached to 50 % in total employment.

To summarize, there is a remarkable quantitative change in sectoral composition of employment between years 1988 and 2013. The change in structure is from agricultural sector dominant employment to services sector dominant employment. Besides, industry and structure sectors are the other sectors increased their share in total employment during the period.

Another important question is about the change in unemployment rate in the same period. The unemployment rate of the Turkish economy between 1988 and 2013 is shown in graph 2. According to graph, unemployment was 8 % in 1988 and it increased to 9 % in 1993. The decrease in employment in agricultural, industrial and service sectors is the main reason of the increasing unemployment rate during the sub-period. The contraction compared to previous year was 9,8 %, 6,8 % and 1,2 % in agricultural, industrial and service sectors, respectively.

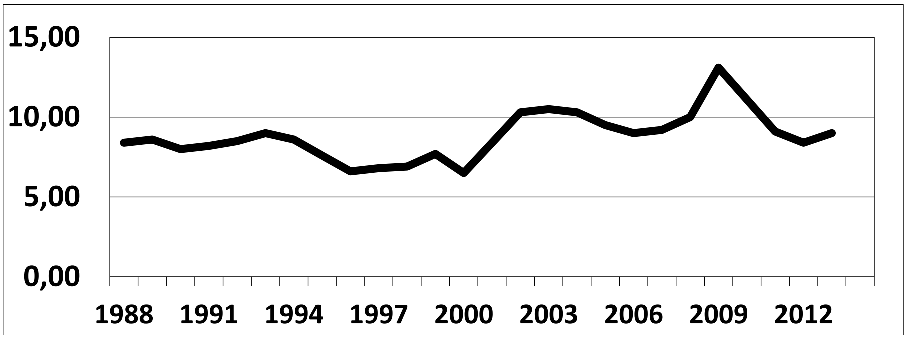

Figure 2 – Unemploment rate in Turkey (%)

The unemployment rate of the Turkish economy fluctuates between 7 and 8 % until 2000s. The fact that agricultural sector contains hidden unemployment and the dominancy of agricultural sector in total employment during these years explain why the unemployment rate is low during the last decade of 20^{th} century.

The unemployment rate was 8,4 % in 2001. The economic crisis occurred in 2001 and it caused an employment reduction in service and industrial sectors. Between 2002 and 2008, employment in agricultural sector decreased continuously and share of the sector in total employment dropped off. While it was 38 % in 2002, it reduced to 24 % in 2008. The reduction is one of the factors that increases unemployment rate in the Turkish economy. The unemployment rate was 10,3 % in 2002. In the following years, the unemployment rate fluctuated around 9 – 10 % level. The year when global financial crisis began, in 2008, it was 10 % and the rate increased to 13,1 % in the following year. The main reason of high unemployment rate was the reduction in production as a side effect of global crisis. After the crisis the economy recovered and employment rate of sectors increased. The unemployment rate was 11,1 % in 2010. But in the following years it decreased to 9,1 and 8,4 %. Because the Turkish government decided to take some policy actions to reduce current account deficit and the growth rate of the economy decreased in 2013. The choice of the government has induced to decrease in growth of employment. So the unemployment rate was 9 % in 2013.

The graphical analyses made above strengthen the argument that sectoral shift in labor force is one of the main drivers of unemployment rates for the Turkish economy. Because unemployment rate has been high while structural change in the economy despite of policies implemented in order to reduce unemployment rate and sectoral shifts in labor force have been occurred. It is clear that labor force employed in agricultural sector shifted to services sector. When we take the need of specialized labor force demand in service sector into account, it is reasonable to explain existence of unemployment problem for the shifting workforce even in the longer time periods due to lack of education requirements.

IV. METHODOLOGY

IV.1. Bootstrap Based Hacker and Hatemi-J (2005, 2006) Toda-Yamamoto (1995) Linear Granger Causality Test

In a standard Granger causality analysis, zero restrictions based on the Wald principle are imposed on the lagged coefficients obtained from the estimation of Vector Autoregressive (VAR) model. However, the Wald statistic may lead to nonstandard limiting distributions depending upon the co-integration properties of the VAR system that these nonstandard asymptotic properties stem from the singularity of the asymptotic distributions of the estimators (Lütkepohl, 2004). The Toda and Yamamoto (1995) (TY, hereafter) procedure overcomes this singularity problem by augmenting VAR model with the maximum integration degree of the variables. In addition to this advantage, the TY approach does not require testing for co-integration relationships and estimating the vector error correction model and is robust to the unit root and co-integration properties of the series.

The standard Granger causality analysis requires estimating a VAR (p) model in which p is the optimal lag length(s). In the TY procedure, the following VAR (p+d) model is estimated that d is the maximum integration degree of the variables.

$$y_t = v + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \cdots + A_{p+d} y_{t-(p+d)} + \mu_t . \quad (1)$$

where yt is vector of k variables, v is a vector of intercepts, μ_t is a vector of error terms and A is the matrix of parameters. The null hypothesis of no-Granger causality against the alternative hypothesis of Granger causality is tested by imposing zero restriction on the first p parameters. The so-called modified Wald (MWALD) statistic has asymptotic chi-square distribution with p degrees of freedom irrespective of the number of unit roots and of the co-integration relations.

Hacker and Hatemi-J (2006) investigate the size properties of the MWALD test and find that the test statistic with asymptotic distribution poorly performs in small samples. $\otimes$ the Kronecker product,

$C = p \times n(1+n(p+d))$ a selector matrix, S_U variance-covariance matrix of residuals, $\hat{\beta} = vec(\hat{D})$ and vec is the column-stacking operator as the MWALD test statistics;

$$MWALD = (C\hat{\beta})'[C((Z'Z)^{-1} \otimes S_U)C']^{-1}(C\hat{\beta}) \sim \chi_p^2$$

Monte Carlo simulation of Hacker and Hatemi-J (2006) shows that the MWALD test based on the bootstrap distribution has much smaller size distortions than those of the asymptotic distribution. Hacker and Hatemi-J (2006) extends the TY approach based on the bootstrapping method developed by Efron (1979). In this new approach that is so-called the leveraged bootstrap Granger causality test, the MWALD statistic is compared with the bootstrap critical value instead of the asymptotic critical value.

IV.2. Frequency Domain Causality Test Developed by Breitung ve Candelon (2006)

While conventional time domain causality tests produce a single test statistic for the interaction between variables in concern, frequency domain methodology generates tests statistics at different frequencies across spectra (Ciner, 2011: p.5). This is contrary to the implicit assumption of the conventional causality analysis that a single test statistic summarizes the relation between variables, which is expected to be valid at all points in the frequency distribution. Frequency domain approach to causality thereby permits to investigate causality dynamics at different frequencies. Hence, it seems to be very meaningful to carry out frequency domain causality to better understand temporary and permanent linkages between variables.

To test for causality based on frequency domain, Geweke (1982) and Hosoya (1991) defined causality;

$$M_{y\to x}(\omega) = \log\left[\frac{2\pi f_x(\omega)}{|\psi_{11}(e^{-i\omega})|^2}\right] = \log\left[1 + \frac{|\psi_{12}(e^{-i\omega})|^2}{|\psi_{11}(e^{-i\omega})|^2}\right] \quad (2)$$

if $|\psi_{12}(e^{-i\omega})|^2 = 0$ that y does not cause x at frequency ω. If components of z_t are I (1) and co-integrated, $\Theta(L)$ has a unit root. Breitung and Candelon (2006) investigate the causal effect of $M_{y\to x}(\omega) = 0$ if $|\psi_{12}(e^{-i\omega})|^2 = 0$. The null hypothesis is equivalent to a linear restriction on the VAR coefficients. $\psi(L) = \Theta(L)^{-1}G^{-1}$ and $\psi_{12}(L) = -\dfrac{g^{22}\Theta_{12}(L)}{|\Theta(L)|}$, with g^{22} as the lower diagonal element of G^{-1} and $|\Theta(L)|$ as the determinant of $\Theta(L)$, it follows y does not cause at frequency ω if

$$|\Theta_{12}(e^{-i\omega})| = \left|\sum_{k=1}^{p}\theta_{12,k}\cos(k\omega) - \sum_{k=1}^{p}\theta_{12,k}\sin(k\omega)i\right| = 0 \quad (3)$$

with $\theta_{12,k}$ denoting the (1,2)-element of Θ_k. Thus for $|\Theta_{12}(e^{-i\omega})| = 0$,

$$\sum_{k=1}^{p}\theta_{12,k}\cos(k\omega) = 0 \quad (4)$$

$$\sum_{k=1}^{p}\theta_{12,k}\sin(k\omega) = 0 \quad (5)$$

Breitung and Condelon (2006) applied to linear restrictions (4) and (5) for $\alpha_j = \theta_{11,j}$ and $\beta_j = \theta_{12,j}$. Then the VAR equation for x_t can be implied as

$$x_t = \alpha_1 x_{t-1} + ... + \alpha_p x_{t-p} + \beta_1 y_{t-1} + ... + \beta_p y_{t-p} + \varepsilon_{1t} \quad (6)$$

and the null hypothesis $M_{y\to x}(\omega) = 0$ is equivalent to the linear restriction with $\beta = [\beta_1, ..., \beta_p]'$

$$H_0: \quad R(\omega)\beta = 0 \quad (7)$$

and

$$R(\omega) = \begin{bmatrix} \cos(\omega) & \cos(2\omega) & ... & \cos(\mathrm{p}\omega) \\ \sin(\omega) & \sin(2\omega) & ... & \sin(\mathrm{p}\omega) \end{bmatrix} \quad (8)$$

The causality measure for $\omega \in (0, \pi)$ can be tested a Standard F-test for the linear restrictions imposed by Eq. (4) and Eq. (5). The test procedure follows an F- distribution with (2, T-2p) degrees of freedom.

IV.3. Asymmetric Causality Test Developed by Hatemi J. and Roca (2014)

P_{1t} are P_{2t} two co-integrated variables (Hatemi-J and Roca, 2014:p.7)

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i} \quad (16)$$

and

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i} \quad (17)$$

While t=1,2,…,T, $P_{1,0}$ and $P_{2,0}$ are constant parameters, $\varepsilon_{1i}, \varepsilon_{2i} \sim iid(0,\delta^2)$. Positive and negative change in each variable is determined as $\varepsilon_{1i}^{+} = \max(\varepsilon_{1i},0)$, $\varepsilon_{2i}^{+} = \max(\varepsilon_{2i},0)$, $\varepsilon_{1i}^{-} = \min(\varepsilon_{1i},0)$ and $\varepsilon_{2i}^{-} = \min(\varepsilon_{2i},0)$. That means $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$.

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad (18)$$

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (19)$$

The cumulative aggregate of positive and negative shocks occurred in each variable is $P_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1t}^{+}$, $P_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1t}^{-}$, $P_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2t}^{+}$ ve $P_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2t}^{-}$, respectively (Hatemi-J and Roca, 2014:p.8). $P_t^{+} = (P_{1t}^{+}, P_{2t}^{+})$ vector is employed in order to test causality between positive shocks. It is possible to note the vector as a VAR (L) model with k lags.

$$P_t^{+} = v + A_1 P_{t-1}^{+} + A_2 P_{t-2}^{+} + ... + A_L P_{t-k}^{+} + u_t^{+} \quad (20)$$

In the equation, v represents constant parameters vector, u_t^{+} represents 2x1 residuals vector and A_r is a 2x2 matrices of parameters while r=1, 2, …, k (Hatemi-J, 2012:p.451). Optimal lag length k is identified by test statistics developed by Hatemi-J (2003, 2008).

$$HJC = In(\left|\hat{\Omega}_f\right|) + k2T^{-1}(m^2 InT + 2mIn(InT)) \quad (21)$$

If lag length is k, variance-covariance matrices of residuals is $\left|\hat{\Omega}_f\right|$. On the other hand, m is the number of equation in the VAR model and T is the size of sample (Hatemi-J and Roca, 2014:p.9). The null hypothesis of the test is that column k and row j of A_r matrices equals to zero. In order to obtain Wald statistics please see Lütkepohl (2005). If the test statistics is higher than critical values, the null hypothesis which implies absence of causality is rejected.

V. EMPIRICAL ANALSIS

In this study, we employ employment data belonging agricultural, industrial, services and construction sectors between January 2005 and October 2014 in order to calculate Lilien index which is used to investigate sectoral shifts:

$$\sigma_t^2 = \sum_{i=1}^{N} (e_{it} / E_T).(\Delta \log(e_{it}) - \Delta \log(E_t))^2 \quad (22)$$

e_{it} shows the number of workers in each sector in t time and i=1,2,…,N, $E_t = \sum_{i=1}^{N} e_{it}$ shows the total employment in the economy.

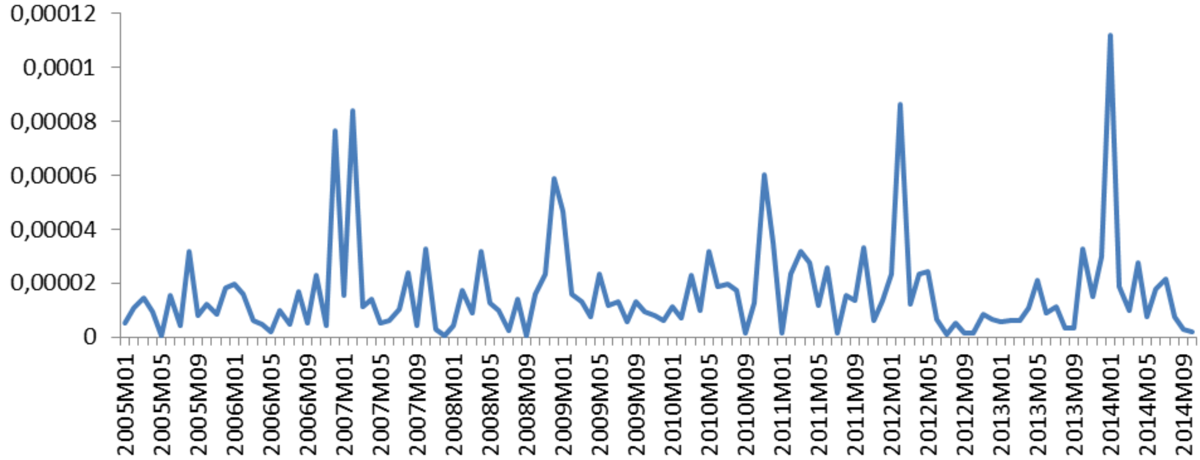

Figure 3 – Lilien Index

As suggested by Sakata (2002) we include export (US dollar) (X) variable in order to investigate the effects of external shocks, industrial production index (IPI) instead of gross domestic product (Romer and Romer, 1989) in order to test validity of Okun rule, deflated M2Y (MS) to see effects of monetary shocks and currency substitution and lastly unemployment rate (U) into model.

The data belongs the Turkish economy are collected from the Turkish Statistical Institute data base. Natural logarithmic series are used and seasonality is checked.

Table 1. ADF (1979) and PP (1988) Unit Root Test Results

	Variables	ADF	PP	Variables	ADF	PP
		Level			*First Difference*	
Constant	**IPI**	-1.227 (1) [0.660]	-2.035 (3) [0.271]	**IPI**	-22.597 (0) [0.000]***	-24.324 (4) [0.000]***
	L	-9.613 (0) [0.000]***	-9.681 (3) [0.000]***	**L**	-11.525 (1) [0.000]***	-50.836 (30) [0.000]***
	MS	-2.072 (0) [0.256]	-2.221 (7) [0.199]	**MS**	-11.5325 (0) [0.000]***	-11.545 (2) [0.000]***
	U	-3.061 (12) [0.032]**	-2.486 (6) [0.121]	**U**	-22.023 (12) [0.006]***	-3.935 (62) [0.002]***
	X	-1.786 (1) [0.385]	-2.070 (2) [0.257]	**X**	-18.804 (0) [0.000]***	-19.542 (3) [0.000]***
Constant+Trend	**IPI**	-2.356 (1) [0.400]	-5.431 (7) [0.000]***	**IPI**	-22.498 (0) [0.000]***	-24.215 (4) [0.000]***
	L	-9.593 (0) [0.000]***	-9.643 (2) [0.000]***	**L**	-11.481 (1) [0.000]***	-51.716 (30) [0.000]***
	MS	-3.028 (0) [0.128]	-2.959 (4) [0.148]	**MS**	-11.684 (0) [0.000]***	-11.713 (4) [0.000]***
	U	-3.100 (12) [0.111]	-2.503 (6) [0.326]	**U**	-23.961 (12) [0.004]***	-3.851 (60) [0.017]**
	X	-2.406 (1) [0.374]	-4.182 (6) [0.006]***	**X**	-18.780 (0) [0.000]***	-19.754 (4) [0.000]***

Notes: *, ** and *** shows that stationary is significant level %10, %5 ve %1 respectively. The numbers in parentheses shows optimal lag length according to Schwarz information criteria. In the table probability values are reported in brackets. For the ADF test: * shows the results of Dickey Fuller test in the case of zero lag length and lag length chosen due to SIC criteria.** For the ADF test, the Mac Kinnon (1996) critical values for with constant -.3.485, -2.885, -2.579 at the 1 %, 5 % and 10 % levels. The critical values for with constant and trend are -4.035, -3.447 and -3.148 at the 1 %, 5 % and 10 % levels, respectively.

According to unit root test results, time series belong variables have unit root in level except Lilien index. The first differentials of series do not contain unit root and becomes stationary. For this reason, we employ first differential of series except Lilien index in the analyses.

Table 2. Toda-Yamamoto Granger Causality Test Results

Hypothesis	Lag Length $k + d_{\max}$	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
U≠> L	7	2.502 (0.868)	18.245	13.400	11.334
U≠>MS	3	2.277 (0.937)	9.420	6.063	4.653
U≠> IPI	6	24.280 (0.000)***	16.655***	11.752**	9.791*
U≠> X	3	30.300 (0.000)***	9.338***	6.208***	4.783***
L≠> U	7	3.224 (0.780)	18.124	13.303	10.976
L≠> MS	6	1.636 (0.949)	17.698	12.089	9.821
L≠> IPI	6	2.504 (0.868)	16.170	11.460	9.567
L≠> X	6	2.506 (0.867)	15.619	11.381	9.357
IPI≠> U	6	12.001 (0.061)*	16.587	11.764**	9.643*
IPI≠> L	6	3.224 (0.780)	15.870	11.559	9.516
IPI≠> MS	3	4.041 (0.257)	11.645	6.507	4.821
IPI≠> X	6	27.197 (0.000)***	16.628***	12.098**	10.106*
MS≠> U	3	0.128 (0.937)	9.858	6.162	4.690
MS≠> L	6	2.616 (0.855)	18.570	12.296	10.028
MS≠> IPI	3	8.347 (0.039)**	11.589	6.610**	4.803*
MS≠> X	4	9.069 (0.059)*	17.536	12.090	9.972
X≠> U	3	2.491 (0.476)	9.906	6.272	4.767
X≠> L	6	4.434 (0.618)	16.375	11.651	9.411
X≠> IPI	6	10.200 (0.114)	16.280	11.899	9.787*
X≠> MS	4	6.086 (0.192)	16.558	11.796	9.673

Note: *.** and *** show the existence of causality in %10, %5 and %1 significance level, respectively. The AIC was used to determine the optimal lag lengths for VAR (p+d) models. Values in parentheses show the probability values distributed asymptotically.

According to Toda-Yamamoto Granger causality analysis results, there is a bi-directional causality between unemployment and industrial production index and also between export and industrial production index. On the other hand, there is a uni-directional causality running from unemployment to export. Also Money supply variable has an impact on industrial production index and export. Results are significant both statistically and economically. Because a decrease in unemployment increases industrial production index or vice versa.

Similarly, there is a bi-directional causality between export and unemployment due to openness degree of economy. The existence of causality running from money supply to industrial production index is another interesting result. It implies that monetary policies implemented in this period are effective on real side of the economy via interest rate and exchange rate channels. On the other hand, there is no causation linkage between Lilien index and other variables. All the results imply that variables belonging to real side of the economy does not affect shift of labor between sectors and sectoral shifts variable does not affect unemployment rate and other variables.

Table 3. Breitung and Candelon (2006) Frequency Domain Causality Test Results

	Long Term		Medium Term		Short Term	
ω_i	0.01	0.05	1.00	1.50	2.0	2.50
U ≠> L	0.398	0.396	1.243	2.041	0.750	1.620
U ≠>MS	0.538	0.547	0.233	0.953	0.324	1.794
U≠> IPI	6.677*	6.618*	6.429*	0.766	1.806	4.651
U≠> X	2.736	2.597	1.273	10.283*	1.074	2.794
L ≠> U	0.019	0.020	0.278	0.190	2.293	0.192
L ≠> MS	0.440	0.442	2.088	2.727	2.701	3.450
L ≠> IPI	0.225	0.222	0.555	0.683	0.859	0.635
L≠> X	0.000	0.000	1.895	0.477	1.435	0.149
IPI≠> U	8.769*	8.758*	2.232	0.356	1.374	8.400*
IPI≠> L	0.508	0.506	1.015	1.473	0.168	0.171
IPI≠> MS	0.028	0.028	2.179	1.186	1.677	0.646
IPI≠> X	2.502	2.494	0.498	4.352	4.168	8.832*
MS≠> U	0.752	0.748	1.096	0.612	1.751	1.195
MS≠> L	1.503	1.488	0.525	0.041	0.473	0.937
MS≠> IPI	0.629	0.637	1.772	4.685	2.056	0.134
MS≠> X	2.847	2.835	5.873	3.053	2.594	0.063
X≠> U	9.613*	9.685*	0.864	1.936	2.165	5.273
X≠> L	2.740	2.728	1.523	0.842	0.117	0.531
X≠> IPI	10.373*	10.427*	5.189	3.053	1.008	5.834
X≠> MS	0.023	0.023	1.037	0.463	1.247	0.497

Notes: The lag lengths for the VAR models are determined by SIC. F- distribution with (2, T-2p) degrees of freedom equals 5.99.

Results of frequency domain causality analysis developed by Breitung and Candelon (2006) are similar to results obtained from Toda – Yamamoto Granger causality analysis. The relation between unemployment rate and industrial production index is bi-directional and it appears in the long run. On the other hand, bi-directional causality between export and unemployment rate is valid in the medium term and long term. The causation linkage between industrial production index and export variables is also bi-directional. While industrial production index affect in the short term, effect of export on index occurs in the long run. On the other hand, there is no causation linkage between Lilien index and other variables. The result imply that shift of employment between sectors does not affect any variables as well as unemployment rate. Similarly, there is no causal relationship between money supply and other macroeconomic variables. It is possible to imply that monetary policy does not affect real side of the economy neither in the short nor long term.

Results belonging to asymmetric causality analysis developed by Hatemi-J and Roca (2014) are presented in appendix 1 in order to not to save space. According to asymmetric causality analysis, there is a bi-directional causality between unemployment rate and export. It means that a positive shock in unemployment rate affects export value positively. A positive shock in export value affects unemployment rate negative, a negative shock in export value affect unemployment rate positive. On the other hand, a negative shock in Lilien index affects both export value and industrial production index negatively. There is a bi-directional causality between export and industrial production index variables. A reduction in index would increase export value, while a reduction in export would increase index.

According to asymmetric causality test results, there is bi-directional causality between money supply and industrial production index and export value variables. An increase in money supply would affect both export value and industrial production index negatively while a positive shock in index and export would cause a contraction in money supply.

VI. CONCLUSION

Unemployment is one of the important macroeconomic variables to measure performance of an economy. For this reason, it is important to find out reasons of change in unemployment rate for policymakers who wants to stabilize the economic growth. In this study we aim to investigate validity of sectoral shifts hypothesis which claim that sectoral shift of the employment induce the unemployment by employing data belonging to the Turkish economy between years 2005- 2014. We employ Toda – Yamamoto Granger causality test, frequency domain causality test developed by Breitung and Candelon (2006) and asymmetric causality test developed by Hatemi-J and Roca (2014).

Results obtained from three causality tests are compatible. According to results, there is a bi-directional causality between unemployment rate and export variables. Frequency domain causality test results imply that causation linkage between unemployment rate and export is valid in long and medium term. Asymmetric causality test results emphasize that an increase in export value reduces unemployment rate vice versa. This result indicates that the Turkish economy's production and employment structure is export-oriented. Result implying that an increase in unemployment rate would increase export value is significant statistically and but it is insignificant economically. It is rational to expect a reduction in export value in the case of an increase in unemployment rate.

Toda – Yamamoto and frequency domain causality analysis results show that there is bi-directional causality between industrial production index and unemployment rate and it is valid in the long term. It is possible to conclude that Okun rule is valid in the economy. It occurs in the long run because of lag between change in employment and change in production.

According to asymmetric causality tests results, there is a uni-directional causality running from industrial production index to unemployment rate and a positive change in index causes a reduction in unemployment rate. All results indicate that an increase in index might affect unemployment rate positively after a while.

Asymmetric causality analysis different from other causality analyses show that there is a uni-directional causality running from Lilien index to industrial production index and export. According to the results, a decrease in Lilien index would decrease export and industrial production index. It would affect unemployment rate negative through export channel. To summarize, results obtained from analyses employed in the study show that the main sources of the actual unemployment problem in the economy are industrial production index and export value rather than structural shifts in the employment.

This result might imply that high unemployment rate problem in the Turkish economy is related to cyclical. But sectoral shifts may have an indirect effect on unemployment via export value and industrial production index. The export-led growth policy was selected instead of import substitution policy by the beginning of 1980s. That is why export value is an important indicator to show up economic performance. So the relation between Lilien index and export value might make sense. So in order to increase industrial production index via enhancing export value policymakers have to take into account Lilien index. At least they might provide workers vocational training in order to settle themselves to sector where they transfer quickly. So quicker adaptation would increase production and induce higher export value.

VII. REREFERNCES

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VIII. APPENDIX

Table 4. Hatemi J-Roca Asymmetric Causality Test Results for Unemployment Rate

Direction of Causality	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
$(U)^+ \neq> (L)^+$	0.003 (0.956)	9.169	4.162	3.065
$(U)^+ \neq> (L)^-$	1.466 (0.226)	7.244	3.983	2.823
$(U)^- \neq> (L)^-$	0.222 (0.637)	8.644	4.505	3.109
$(U)^- \neq> (L)^+$	0.010 (0.921)	6.916	4.219	2.988
$(U)^+ \neq> (MS)^+$	1.117 (0.555)	16.307	7.445	5.234
$(U)^+ \neq> (MS)^-$	0.222 (0.638)	9.307	5.006	3.142
$(U)^- \neq> (MS)^-$	0.772 (0.380)	9.072	4.486	3.123
$(U)^- \neq> (MS)^+$	0.021 (0.885)	7.647	4.127	2.865
$(U)^+ \neq> (IPI)^+$	1.087 (0.581)	11.000	6.886	4.942
$(U)^+ \neq> (IPI)^-$	0.283 (0.595)	6.739	3.743	2.702
$(U)^- \neq> (IPI)^-$	0.104 (0.748)	9.920	4.269	2.713
$(U)^- \neq> (IPI)^+$	0.043 (0.835)	7.585	3.922	2.596
$(U)^+ \neq> (X)^+$	5.133 (0.077)*	10.730	6.779	4.640*
$(U)^+ \neq> (X)^-$	0.029 (0.865)	6.702	4.141	2.948
$(U)^- \neq> (X)^-$	0.183 (0.669)	9.570	4.074	2.719
$(U)^- \neq> (X)^+$	1.965 (0.161)	7.846	3.966	2.581

Table 5. Hatemi J-Roca Asymmetric Causality Test Results for Lillien Index

Direction of Causality	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
$(L)^+ \neq> (U)^+$	1.086 (0.297)	7.927	4.352	2.941
$(L)^+ \neq> (U)^-$	0.336 (0.562)	8.019	3.989	2.829
$(L)^- \neq> (U)^-$	1.162 (0.281)	7.729	4.075	2.915
$(L)^- \neq> (U)^+$	0.637 (0.425)	9.016	4.672	3.080
$(L)^+ \neq> (MS)^+$	0.010 (0.922)	12.265	4.820	2.913
$(L)^+ \neq> (MS)^-$	0.843 (0.359)	11.370	4.282	2.448
$(L)^- \neq> (MS)^-$	1.749 (0.186)	9.191	3.867	2.577
$(L)^- \neq> (MS)^+$	0.261 (0.610)	11.704	5.006	2.756
$(L)^+ \neq> (IPI)^+$	0.996 (0.318)	8.566	4.090	2.832
$(L)^+ \neq> (IPI)^-$	0.150 (0.699)	8.043	3.708	2.448
$(L)^- \neq> (IPI)^-$	3.999 (0.046)**	9.718	4.896	2.750*
$(L)^- \neq> (IPI)^+$	0.202 (0.653)	8.686	3.761	2.524
$(L)^+ \neq> (X)^+$	0.155 (0.694)	7.746	4.084	2.846
$(L)^+ \neq> (X)^-$	0.386 (0.535)	6.453	3.764	2.629
$(L)^- \neq> (X)^-$	5.709 (0.017)**	7.494	4.387**	3.018*
$(L)^- \neq> (X)^+$	0.025 (0.874)	6.836	3.585	2.505

Table 6. Hatemi J-Roca Asymmetric Causality Test Results for Industrial Production Index

Direction of Causality	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
$(IPI)^+ \neq> (U)^+$	0.308 (0.857)	11.965	7.155	5.144
$(IPI)^+ \neq> (U)^-$	5.356 (0.069)*	11.468	5.891	4.651*
$(IPI)^- \neq> (U)^-$	0.094 (0.759)	8.021	4.302	2.859
$(IPI)^- \neq> (U)^+$	1.033 (0.596)	13.734	8.192	5.759
$(IPI)^+ \neq> (MS)^+$	0.171 (0.679)	8.935	5.067	2.964
$(IPI)^+ \neq> (MS)^-$	17.451 (0.000)*	17.845	8.666	5.003
$(IPI)^- \neq> (MS)^-$	0.350 (0.554)	11.271	4.838	2.382
$(IPI)^- \neq> (MS)^+$	3.242 (0.198)	19.223	7.223	4.492
$(IPI)^+ \neq> (L)^+$	0.066 (0.797)	8.234	4.549	2.977
$(IPI)^+ \neq> (L)^-$	0.193 (0.660)	8.730	4.371	2.887
$(IPI)^- \neq> (L)^-$	0.027 (0.868)	6.799	3.699	2.487
$(IPI)^- \neq> (L)^+$	0.368 (0.544)	7.856	4.388	2.650
$(IPI)^+ \neq> (X)^+$	0.469 (0.494)	8.924	4.244	2.850
$(IPI)^+ \neq> (X)^-$	2.850 (0.241)	11.362	7.273	5.405
$(IPI)^- \neq> (X)^-$	0.141 (0.708)	7.304	4.117	2.484
$(IPI)^- \neq> (X)^+$	27.322 (0.000)***	12.217***	6.931**	4.738*

Table 7. Hatemi J-Roca Asymmetric Causality Test Results Money Supply

Direction of Causality	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
$(MS)^{+} \neq> (U)^{+}$	0.195 (0.907)	17.884	7.463	4.984
$(MS)^{+} \neq> (U)^{-}$	1.168 (0.280)	10.408	4.389	2.822
$(MS)^{-} \neq> (U)^{-}$	0.355 (0.551)	7.044	4.082	2.704
$(MS)^{-} \neq> (U)^{+}$	0.124 (0.724)	11.769	4.793	3.023
$(MS)^{+} \neq> (L)^{+}$	0.569 (0.451)	12.249	4.314	2.632
$(MS)^{+} \neq> (L)^{-}$	0.766 (0.381)	6.103	3.892	2.757
$(MS)^{-} \neq> (L)^{-}$	0.119 (0.730)	8.029	3.685	2.480
$(MS)^{-} \neq> (L)^{+}$	2.053 (0.152)	9.369	4.298	2.559
$(MS)^{+} \neq> (IPI)^{+}$	0.175 (0.676)	9.839	4.575	2.868
$(MS)^{+} \neq> (IPI)^{-}$	6.846 (0.009)***	9.378	4.328**	2.590*
$(MS)^{-} \neq> (IPI)^{-}$	0.000 (0.988)	10.100	4.579	2.761
$(MS)^{-} \neq> (IPI)^{+}$	1.599 (0.206)	7.351	3.752	2.681
$(MS)^{+} \neq> (X)^{+}$	0.004 (0.952)	10.221	4.129	2.666
$(MS)^{+} \neq> (X)^{-}$	6.272 (0.012)**	10.141	4.032**	2.822*
$(MS)^{-} \neq> (X)^{-}$	0.500 (0.480)	8.944	4.113	2.612
$(MS)^{-} \neq> (X)^{+}$	1.069 (0.301)	6.428	3.612	2.783

Table 8. Hatemi J-Roca Asymmetric Causality Test Results Export

Direction of Causality	MWALD	%1 Boostrap Critical Value	%5 Boostrap Critical Value	%10 Boostrap Critical Value
$(X)^{+} \neq> (U)^{+}$	0.520 (0.771)	10.944	7.251	5.377
$(X)^{+} \neq> (U)^{-}$	13.099 (0.001)***	10.340***	7.127**	5.037*
$(X)^{-} \neq> (U)^{-}$	0.559 (0.455)	8.025	4.604	3.028
$(X)^{-} \neq> (U)^{+}$	6.683 (0.035)**	12.238	7.632	5.739*
$(X)^{+} \neq> (MS)^{+}$	0.198 (0.656)	8.823	4.289	2.860
$(X)^{+} \neq> (MS)^{-}$	9.424 (0.002)***	13.002	5.184**	3.115*
$(X)^{-} \neq> (MS)^{-}$	0.641 (0.423)	7.603	3.830	2.630
$(X)^{-} \neq> (MS)^{+}$	3.857 (0.050)*	12.732	3.927	2.429*
$(X)^{+} \neq> (IPI)^{+}$	0.542 (0.462)	8.224	4.090	2.834
$(X)^{+} \neq> (IPI)^{-}$	1.587 (0.208)	8.239	4.349	3.062
$(X)^{-} \neq> (IPI)^{-}$	0.038 (0.846)	9.434	3.649	2.493
$(X)^{-} \neq> (IPI)^{+}$	16.567 (0.000)***	9.341***	4.297**	2.855*
$(X)^{+} \neq> (L)^{+}$	0.138 (0.710)	10.079	4.756	3.152
$(X)^{+} \neq> (L)^{-}$	0.025 (0.875)	8.834	4.620	3.047
$(X)^{-} \neq> (L)^{-}$	0.687 (0.407)	7.158	4.069	2.669
$(X)^{-} \neq> (L)^{+}$	1.339 (0.247)	8.349	4.625	3.038

Notes: ≠> indicates null hypothesis which claims absence of causality between variables. Values in pharathesis shows asymptotic probability values. ***,** and * show causation linkage between variables in %1, %5 ve %10 significance level, respectively. Number of bootstrap process is 10.000.