ANALYSIS OF THE FACTORS AFFECTING LABOUR SUPPLY

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Abstract

According to classical economists, the wage that determines the labor supply is the real wage rate. It is accepted in classics that the substitution effect is bigger than the income effect. In Keynesians, the factor that determines the labor supply is accepted as the nominal wage. This circumstance causes to labor suppliers to fall into error. Monetarist economists accept the labor supply as the function of the expected wage. With reference to them, the selection between working and relaxation is made based on the expected wage level. The sum of employees and unemployed in a country is called as the labor supply. In this context; in this research that made an econometric analysis of the factor determine the labor supply in Turkey case, the labor supply was used as the affected factor. The influencing factors are Inflation (CPI), Manufacturing Industry Production Index (Q), Labor Cost Index (W), Unemployment Rate (IO), Labor Productivity (PL), GDP Growth Rate (GR) and Real Export (RX) variables. According to the econometrical results of the research, there is a long termed relationship between inflation, unemployment rate, real exportation, labor productivity, real wage, growth, and labor supply.

Keywords: Labor supply, structural VAR, Turkey
Jel Classifications: E24, J22

EMEK ARZINI ETKİLEYEN FAKTÖRLERİN ANALİZİ

Öz

Klasik iktisatçılara göre emek arzını belirleyen ücret, reel ücret haddidir ve klasiklerde ikame etkisinin gelir etkisinden büyük olduğu kabul edilir. Keynesyen iktisatta ise emek arzını belirleyen unsur nominal ücret kabul edilir. Bu durum emek arz edenlerin para yanılgısı içine düşmelerine neden olur. Monetarist iktisatçılar emek arzını beklenen ücretin fonksiyonu kabul ederler ve onlara göre çalışma ve dinlenme arasındaki tercih beklenen ücret düzeyine göre yapılır. Literatürde emek arzının belirleyenlerine dair sınırlı sayıda çalışma bulunmaktadır. Çalışmada, emek arzını belirleyen faktörlerin neler olduğu, belirleyici faktörler ile ilişkisinin niteliği, derinliği ve yönü araştırılmıştır. Bu bağlamda; Türkiye örneğinde emek arzını belirleyen faktörlerin ekonometrik analizinin yapıldığı bu çalışmada etkilenen faktör olarak emek arzı; etkileyen faktörler olarak Enflasyon (TÜFE), İmalat Sanayi Üretim Endeksi (Q), İşgücü Ücret Endeksi (W), İşsizlik Oranı (İO), Emek Verimliliği (PL), RGSYH Büyüme oranı (GR) ve Reel İhracat (RX) değişkenlerinin tanımlayıcı istatistik sonuçları kullanılmıştır. Çalışmanın ekonometrik sonuçları göstermektedir ki emek arzı belirleyenlerinden enflasyon, işsizlik oranı, reel ihracat, emek verimliliği, reel ücret, büyüme ve emek arzı arasında uzun dönemli ilişki bulunmaktadır.

Anahtar Kelimeler: Emek arzı, yapısal VAR, Türkiye
Jel Kodları: E24, J22

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Introduction

One of the primary economic goals of the modern economies is to increase the number of the person who is employed in labor supply. Employment is defined in a broad sense as the use of all the production factors; in the strict sense as the use of labor factor. Use of production factor affects the good and services production capacity of the countries, accordingly, income per capita level of countries are directly affected. This interaction is not only economic but also it makes itself felt as social as well.

The employees constitute the total labor supply with the people who are not employed. Employment increase manifests itself as unemployment reduction in the labor supply at the same time. The main goal of the economic structures is to provide the enhancement of the part of labor supply that contributes to the production. In this context, determination of the factors specifies the labor supply will be the loadstar for the solution of the problems seen in unemployment and employment issues of the countries.

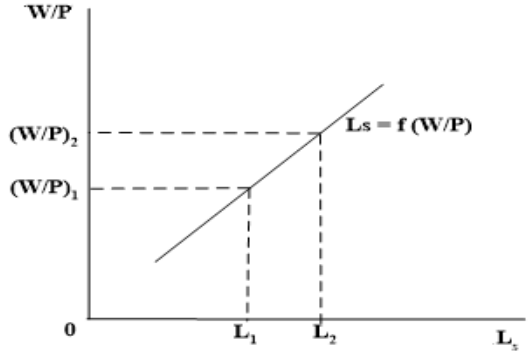
Within the scope of this research, econometric analysis of the factors that affect the employment was made for Turkey case. In the first chapter of the study, the theoretical framework relating to labor supply can be seen. The second chapter shows the theoretical and empirical literature about the determinants of the labor supply. There is an econometric application in the third and fourth parts of the study. Finally, the conclusion part completes the paper.

1. Theoretical Framework

The sum of employees and unemployed in a country is called as the labor supply. Demographical status, educational background, features of the national labor market, productiveness, income level and working hours are accepted as the determining factors (Böheim and Taylor, 2001).

The theories created on labor supply have been grounded on the working and non-employment preferences of the individual. People pursue the maximum benefit goal while making this selection. The goals mentioned are either increasing the income or increasing the free time to relax. People consider the real wage, namely the wage that will increase their purchasing power while making the decision for working. The income and purchasing power will increase when the real wage increases, this is because people want to work more. It can be said under this circumstance that the labor supply is a positive direction function of the real wage. In other words, labor supply increases if real wage increases; if the real wage declines, labor supply declines as well. This is shown in Graphic 1.

Graphic 1. *Individual Labor Supply Curve*



In Graphic 1, (W/P) represents the real wage; L_s represents the labor supply. When the real wage increases, namely, when it is moved from $(W/P)_1$ to $(W/P)_2$, labor supply will increase. In other words, it is passed from L_1 to L_2. There occur two types of impacts on the labor supply when the real wage increases; substitution effect and income effect. In case of increasing the will to work multiplies in parallel with the real wage is called as substitution effect. The fact of decreasing the work time by increasing the free time is called as 'income effect'.

Whether the labor supply increases at the end of real wage increases ride on the 'net effect' that will arise as the result of comparing the substitution and income effects. If the substitution effect that causes to increase the labor supply bigger than the income effect that causes to decrease the labor supply, the labor supply increases and labor supply curve becomes a positively sloped line. If the income effect is bigger than substitution effect, the labor supply declines. The supply curve that occurs in this opposite situation is called as 'backward-bending labor supply curve'.

According to classical economists, the wage that determines the labor supply is the real wage rate. It is accepted in classics that the substitution effect is bigger than the income effect. In Keynesians, the factor that determines the labor supply is accepted as the nominal wage. This circumstance causes to labor suppliers to fall into error. Monetarist economists accept the labor supply as the function of the expected wage. With reference to them, the selection between working and relaxation is made based on the expected wage level.

2. Literature Review

The studies that include the determinants of employment and unemployment constitute the labor supply as well as not directly bear the name of labor supply are as follows;

Aydıner and Onaran (2010) reviewed the determinants of employment in Turkey case in 1973-2001 period via panel data analysis. It is determined with reference to the research findings that real wages and income have a positive effect on the employment. Commercial openness has a negative effect on the employment.

Bhattarai (2002) reviewed the determinants of labor supply in England case in 1991-1997 periods via panel data analysis. According to the research findings, there are wages; gender, marital status and work experience among the factors determine the labor supply.

Bashier and Wahban (2013) investigated the determinants of employment for Jordan case via Corrected Least Squares Method. With reference to research findings; GDP, foreign investments, and trade affect the employment positively.

Bhaumik et al. (2004) reviewed the determinants of employment for Egypt, India, South Africa and Vietnam cases via regression analysis. It was determined at the end of the research that technology transfer and foreign direct investments have an impact on the employment.

Böheim and Taylor (2001) examined the determinants of employment for England case in 1991-1998 period via panel data analysis method. With reference to research findings, about 40% male and females prefer to work for different wages and hours. The general run of them prefers fewer hours to work.

Comola and Mello (2009) analyzed the determinants of employment in Indonesia in 1996-2004 period via EKK method. With reference to research findings; age, educational background, average school experience, gender, and income have determinative effects on employment.

Dolado and Jimeno (1996) analyzed the reasons for unemployment in Spain in 1971-1994 period via VAR approach. According to the research findings, the crises have happened over the last two decades have increased the unemployment rate and negatively affected the employment.

Gül (2014) reviewed the determinants of employment in Turkey case in 2004-2008 via economic analysis. According to research findings, the quality of education level of human capital and

entrepreneurship potential positively affect the employment growth. Moreover, developing the innovation levels of companies has a positive effect on employment. Spatial neighborhood relationship affects the employment as well.

Kızılgöl (2012) reviewed the determinants of participation of women in labor supply in Turkey case in 2002-2008 period via logit model analysis. According to the research findings; education, income, dependency ratio, property, and age are accepted as the dominant factors in decisions of women to participate in the labor supply. Furthermore, while the number of children decreases the participation to labor supply in the urban area, the number of children increases the participation to labor supply in the rural area.

3. Data Set and Method

In application part of the study, the factors determine the labor supply, the relationship, depth and direction of these factors with causal factors are analyzed. The variables used in research and their definitions are as follow. Labor supply (LS) variable was used as the dependent variable. Independent variables toward determining the labor supply can be defined as; Consumer Price Inflation (CPI), Manufacturing Industry Production Index (Q), Labor Cost Index (W), Labor Productivity (PL), Unemployment Rate (IO), GDP Growth Rate (GR) and Real Import (RX). Labor Cost Index (W), Labor Productivity (PL) variables were obtained from employment statistics of Turkey Statistical Institute. All other variables were collected from Data Distribution System of Central Bank of the Republic of Turkey. The export variable was turned into real by using GDP deflator. The review period of the research includes the quarter data of 2005-2015 period.

The application part of the study is to determine whether there is a significant relationship between labor supply and the factors determine the labor supply with reference to theoretical and practical literature via cointegration test. Even though there are various cointegration tests (single equation and system approach) in literature, the most frequently used cointegration test is Johansen cointegration test that is utilized in case of the series are stationary at the same level.

Johansen cointegration test that was developed by Johansen (1988) and Johansen-Juselius (1990) can be adapted to the series that are stationary from the same level. VAR models analyze all the variables within a system integrity without discriminating the internal and external variables (Tarı and Yıldırım, 2009: 100; Ozgen and Guloglu, 2004: 95).

The Bivariant VAR model is as follows;

$$y_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i}\, y_{t-i} + \sum_{i=1}^{p} \beta_{2i}\, x_{t-i} + \upsilon_{1t} \qquad (1)$$

$$x_t = Y_1 + \sum_{i=1}^{p} \delta_{1i}\, y_{t-i} + \sum_{i=1}^{p} \delta_{2i}\, x_{t-i} + \upsilon_{2t} \qquad (2)$$

x_t and y_t show the variables interactive with each other; p shows the lag length; u represents random error terms with zero average, normal distribution, constant variance and non-autocorrelation (Çelik et al., 2013:172)

After determining a long-term relationship between the series, Granger causality test can review whether there is a short-term relationship (Mucuk and Alptekin, 2008:167). This test is based upon the estimation of a VAR model such as the one below (Şentürk and Dücan, 2014:73);

$$Y_t = \alpha_0 + \sum_{i=1}^{n} a_i Y_{t-i} + \sum_{j=1}^{m} b_j X_{t-j} + \varepsilon_t \quad (3)$$

$$X_t = \beta_0 + \sum_{i=1}^{n} c_i X_{t-i} + \sum_{j=1}^{m} d_j Y_{t-j} + \mu_t \quad (4)$$

In here, α_0 and β_0 parameters refer the constant terms. Causality can be specified by estimating the equations above and also testing the zero hypotheses below against the alternative hypothesis (Afzal and Hussain, 2010:135).

$$H_0 = b_j = d_j = 0 \quad (5)$$

$$H_1 = b_j \neq d_j \neq 0 \quad (6)$$

Three kinds of causality relationship can arise by using the equations above. If b_j or d_j is statistically significant, there is one-way causality from X to Y or Y to X. If both b_j and d_j are statistically significant, there is two-way causality. If neither b_j nor d_j is statistically significant, X and Y are not the reasons of each other (Afzal and Hussain, 2010:135).

Effects of shocks that will occur in erro terms of the variables in models are measured by Action-Reaction functions. The clarification degree of a shock occurred in error term of a variable can be specified by Variance degradation method.

4. Application Results

Characteristics of time series are reviewed first to econometrically analyze the relationships between the variables. Table 1 shows the descriptive statistics results of Labor Supply (LS), Inflation (CPI), Manufacturing Industry Production Index (Q), Labor Cost Index (W), Unemployment Rate (IO), Labor Productivity (PL), GDP Growth Rate (GR) and Real Export (RX) variables.

Table 1. *Descriptive Statistics*

	LS	CPI	RX	IO	PL	W	GR
Mean	22480.19	1.668880	182.1998	42.27424	9701227.	106.0250	1.006289
Median	22105.17	1.637775	181.1576	41.81666	9858500.	99.60000	3.852627
Maximum	27216.00	7.048151	251.0812	46.93333	11178000	177.5000	14.79257
Minimum	18637.33	-2.224149	137.9886	37.63333	7890000.	54.60000	-16.29992
Std. Dev.	2515.400	2.183860	24.65609	2.437878	714139.1	35.53551	8.781477
Skewness	0.323437	0.426655	0.924624	0.139854	-0.610203	0.439035	-0.177873
Kurtosis	1.837680	2.935618	4.000874	2.153968	3.125683	2.090612	1.682194
Jarque-Bera	3.243962	1.342519	8.106024	1.455678	2.759506	2.929655	3.415807
Probability	0.197507	0.511065	0.017370	0.482951	0.251641	0.231118	0.181245
Sum	989128.3	73.43073	8016.792	1860.067	4.27E+08	4665.100	44.27673
Sum Sq. Dev.	2.72E+08	205.0775	26140.68	255.5597	2.19E+13	54299.20	3315.916
Observations	44	44	44	44	44	44	44

It is assumed in time series econometric approach that the variables are stationary. This is a required assumption for efficient and consistent estimations (Kara et al., 2012: 84). It was researched whether the series is stationary before founding the relationship between the factors determine the labor factor. ADF unit root test was used to review the steady state of the variables, test results are below;

Table 2. *ADF Unit Root Test Results*

Variables	ADF-t statistic (Level-Trends)	ADF-t statistic (First Difference)	Stability degrees
LS	0.4879 (4)	-3.004 (4)	I(1)
W	5.7345 (2)	-3.325769 (4)	I(1)
PL	-1.5700 (4)	-3.402256 (4)	I(1)
CPI	1.965796 (8)	-3.794410 (4)	I(1)
Q	-2.216891 (5)	-3.307970 (4)	I(1)
GR	-2.371704 (4)	-11.08179 (2)	I(1)
RX	-2.972530 (5)	-7.091192 (0)	I(1)
İO	0.191238 (9)	-3.334265 (4)	I(1)
significance level	-3.610453 -2.938987 -2.607932	-3.615588 -2.941145 -2.609066	%1 %5 -%10

The values in parenthesis are optimal lag lengths determined based on AIC. The variables have constant terms. Since the variables do not contain a trend, the Table does not show the results with trends.

As is seen in Table 1, LS, W, Pl, CPI, Q, GR, Rx and IO variables are not stationary at level; however, the same variables are stationary when the first difference is taken. In other words, all the variables are difference I(1) stationary.

Before mentioning VAR model that will be estimated, the proper lag length was determined.

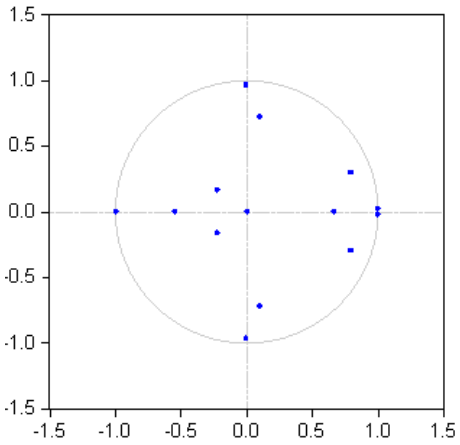
Table 3. *Optimal Lag Length*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1469.140	NA	2.67e+23	73.80699	74.10254	73.91385
1	-1202.283	426.9706	5.16e+18	62.91415	65.27859	63.76906
2	-1072.547	162.1705	1.15e+17	58.87734	63.31064	60.48028
3	-970.0996	92.20240	1.58e+16	56.20498	62.70717	58.55597
4	-829.6072	77.27083*	9.32e+14*	51.63036*	60.20142*	54.72939*

Not: AIC means Akaike Information Criterion; SW shows Schwartz Criterion; HQ shows Hannan-Quinn Criterion; FPE represents the Final Prediction Error Criterion. It started to deferment level by 6 deferments.

It is observed when Table 3 is analyzed that minimum value is provided in 4 deferments for all the values. 4 periods deferment is the best fit deferment level for the model. Unit circle analysis of AR Characteristic Polynomial has evaluated whether VAR model with four deferments is steady. Figure 1 shows the result obtained.

Figure 1. *The position of Inverse Roots of AR Characteristic Polynomial in Unit Circle*



Since none of the reverse roots of AR characteristic polynomial can be seen without the unit circle, VAR model established has no problem in terms of stationarity. Cointegration analysis can be conducted after completing the analysis of VAR model that is made by accepting the model is stationary.

Since the variables are stationary at the same level, Johansen cointegration methodology was utilized to determine the relationship between the series. It was accepted that the optimal lag length of the model is 5 to be able to estimate VAR model. Cointegration relationship between the variables was researched by Johansen cointegration by estimating VAR model with 5 deferments. Results are above;

Table 4. *Johansen Cointegration Test Results*

Unrestricted Cointegration Rank Test (Trace)				
Hypothesis LS, CPI, RX, İO, PL, GR	**Eigenvalues**	**Trace Statistic**	**0.05 Critical Value**	**Mac Kinnon Probability**
$r \leq 0$	0.971047	302.3676	125.6154	0.0000
$r \leq 1$	0.824220	160.6848	95.75366	0.0000
$r \leq 2$	0.612329	91.14401	69.81889	0.0004
$r \leq 3$	0.455909	53.24005	47.85613	0.0143
$r \leq 4$	0.373237	28.89453	29.79707	0.0633
$r \leq 5$	0.225122	10.20704	15.49471	0.2651

As is seen in Table 4, since trace statistical value is bigger than the critical value ($r \leq 0$, $r \leq 1$, $r \leq 2$, $r \leq 3$), there are four cointegrator vectors between the variables. With reference to the results, there is a long termed relationship between inflation, the rate of unemployment, labor productivity, real wage, growth and labor supply at 5% significance level.

Table 5. *Normal Distribution Test*

Component	**Jarque-Bera**	**df**	**Prob.**
1	0.374147	2	0.8294
2	0.286139	2	0.8667
3	13.37943	2	0.0012
4	0.806499	2	0.6681
5	0.940795	2	0.6248
6	1.305706	2	0.5206
7	3.652618	2	0.1610
Joint	20.74533	14	0.1083

Jargue-Bera statistics show that the error terms in model display a normal distribution.

Table 6. *Autocorrelation Test*

Lags	LM-Stat	Prob
1	92.93625	0.0002
2	75.31521	0.0092
3	51.40801	0.3796
4	65.24972	0.0600
5	68.00178	0.0374
6	55.25596	0.2503
7	50.35526	0.4196
8	41.26569	0.7759
9	41.84287	0.7559
10	49.36137	0.4587
11	49.40019	0.4571
12	41.08918	0.7818

LM test was conducted for autocorrelation of surpluses in VEC (2) model. There is no autocorrelation.

Table 7. *Heteroscedastic Test*

Chi-sq	df	Prob.
812.1872	784	0.2357

The white heteroscedastic test was applied for heteroscedastic and the Ho hypothesis called ‘the variance is not stable by the time’ was denied.

After being determined the long termed relationship between the series, Granger Causality test (Granger: 1980, 1981:121-130) was conducted to analyze the short termed relationship and also found whether the variables in the system affect each other.

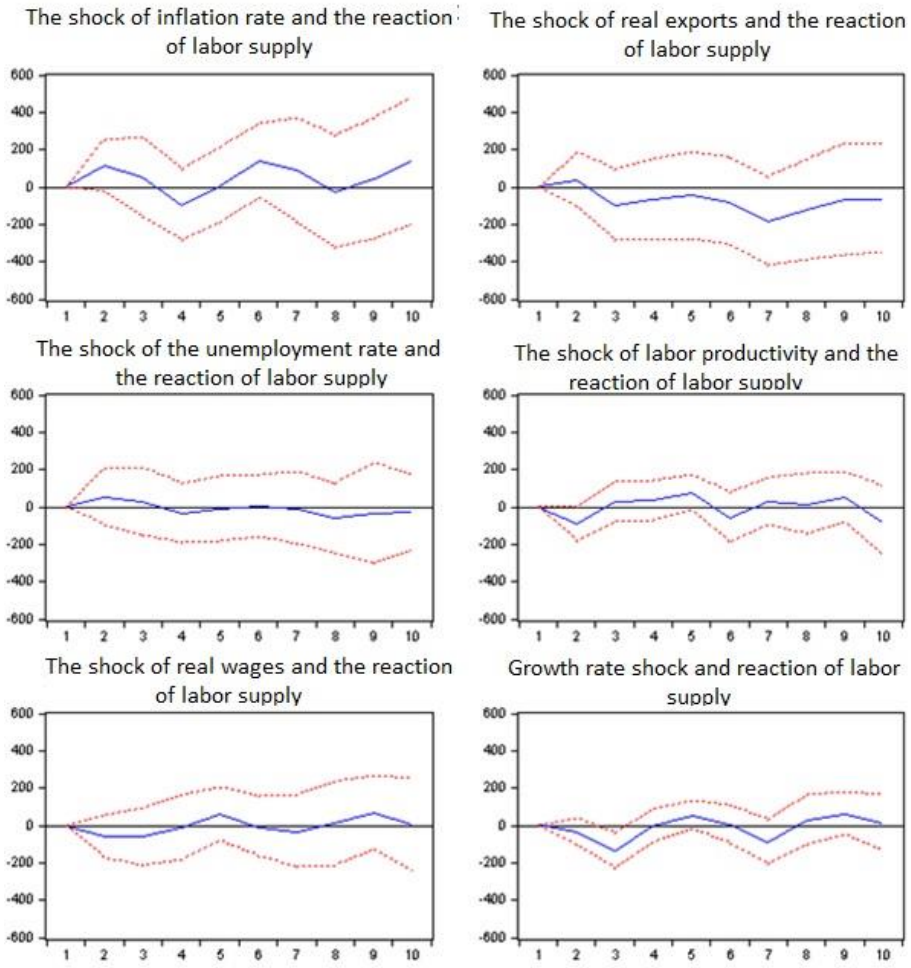
Table 8. *Granger Causality Analysis Results*

Direction of Causality	Observation	F istatistic	Possibility	Decision
Inflation is not the reason for labor supply.	40	3.03722	0.0319	**Denied**
Labor Supply is not the reason for inflation rate.		1.72271	0.1701	Cannot be denied
Real Export is not the reason for labor supply.	40	3.88990	0.0113	**Denied**
Labor Supply is not the reason for real Export.		4.14902	0.0083	**Denied**
Unemployment Rate is not the reason for labor supply.	40	2.42734	0.0688	Cannot be denied
Labor Supply is not the reason for unemployment rate.		2.86966	0.0393	**Denied**
Labor Productivity is not the reason for labor supply.	40	8.26250	0.0001	**Denied**
Labor Supply is not the reason for labor productivity.		3.82801	0.0122	**Denied**
Wage is not the reason for labor supply.	40	1.44082	0.2440	Cannot be denied
Labor Supply is not the reason for wage.		3.94888	0.0105	**Denied**
Growth is not the reason for labor supply.	40	8.99898	0.0000	**Denied**
Labor Supply is not the reason for growth.		1.74527	0.1653	Cannot be denied

It is seen when the results in Table 8 are analyzed that there is a one-way causality relationship from Inflation to labor supply. There is a two-way causality relation between labor supply and exportation. It is found a one-way causality relation from the labor supply to the rate of unemployment. There is a two-way causality relationship between the labor supply and labor productivity. A one-way causality relation is seen from the labor supply to the wage. Finally, it is possible to say that there is a one-way causality relation from growth rate to the labor supply. The conclusions obtained show similar results to practical literature.

Action-reaction functions were used to specify the reaction of the labor supply considering a shock with a standard error that can occur in factors determine the labor supply. Results relating to action-reaction analyses are shown in Figure 2 below.

Figure 2. Action-Reaction Analysis Results



As is seen in Figure 2, the effect of changes in inflation and labor productivity on labor supply is more explicit. In addition to this, the effects of other variables on labor supply are in the tendency to turn into average in a little while.

Variance discrimination results obtained from VAR model with four deferments are as follow;

Table 9. *Variance Discrimination Table*

Period	S.E.	LS	TUFE	RX	IO	PL	W	GR
1	317.6821	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	479.4124	86.90305	5.366056	0.652112	1.083926	3.870785	1.583081	0.540986
3	516.4439	75.48014	5.513402	4.147973	1.247256	3.554156	2.736613	7.320461
4	539.3788	71.95992	8.359849	5.302346	1.499597	3.612352	2.553291	6.712645
5	561.0927	69.71978	7.733843	5.524936	1.417070	5.087212	3.429488	7.087665
6	602.4232	65.78062	11.83909	6.539787	1.231521	5.444643	3.013672	6.150670
7	647.8819	57.99761	12.06002	13.86710	1.089162	4.898940	2.845771	7.241395
8	678.0313	57.14634	11.17787	15.92423	1.839584	4.523157	2.618100	6.770719
9	693.5742	55.30365	11.07800	16.11673	2.051965	4.797959	3.406547	7.245152
10	724.5532	53.11514	13.87804	15.53394	2.070195	5.605027	3.122296	6.675360

It is observed when the variance discrimination table is reviewed that while a significant part of labor supply variable is explained by itself, the clarification level started to decrease as from the second period. Mostly the inflation rate is effective in this change in variance oıf labor supply. The clarification level that was 5% in the second quarter exceeded 10% as from the sixth quarter. About 6th quarter, respectively the inflation, real export, growth rate, labor productivity, income level and unemployment rate variables affect the change in the variance of labor supply. The total effect of these variables at 35% level.

5. Conclusion

Labor supply is composed of the sum of employed and unemployed. Within this scope, the main factors that affect the labor supply at the individual and total level are the selection made between working and free time. The selection mentioned is made by the wage level. According to classical economists, real wages assign the labor supply and as the real wages increase the labor supply increases at the same time. While Keynesians accept the nominal wages as the determinants, Monetarist economists mention that the expected wages are the determinants.

The inflation rate, exportation, labor productivity and economic growth rate are the determinants of the labor supply, except the wages. Indeed, the variables mentioned are closely associated with the wage variable that directly affects the labor supply and expressed in different theories. Because the people will make decisions on labor supply by considering the benefit that they gain at the end of working or non-employment. Being the wages high and at the size to increase the welfare level can arise by the effect of all the variables affect the labor supply.

In this research that made an econometric analysis of the factor determine the labor supply in Turkey case, the labor supply was used as the affected factor. The influencing factors are CPI, Manufacturing Industry Production Index; Labor cost Index, Labor Productivity, Unemployment Rate, Real GDP Growth Rate and Real Export variables. According to the econometrical results of the research, there is a long-term relationship between inflation, unemployment rate, real exportation, labor productivity, real wage, growth, and labor supply.

It is determined that the variable that affects the labor supply at most is the inflation rate. This circumstance expresses that inflation has more determiner for increasing and decreasing the labor supply. Inflation reduces the real purchasing power of the people. Therefore, following policies that can repress the inflation will be a rational attitude to reduce the adverse effect of inflation on the labor supply and also provide to increase the real value of the wages of employees.

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