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The Effect of Oil Prices on Unemployment: Evidence from Pakistan

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Abstract: *A developing country like Pakistan is heavily dependent on the oil as inputs for almost every industrial sector therefore increase in oil prices, increases inputs cost, consequently increasing production costs and unemployment rate. Existing literature has mostly focused on the relationship between unemployment and oil prices of developed countries, the current study used the data from developing country Pakistan to investigate the relationship between oil prices and unemployment. The current study used monthly data from the period 1991:01–2010:12, making 238 observations of each variable for analysis and employed Toda Yamamoto causality test. The results of current study suggested the significant effect of oil prices on unemployment but found no significant association between real interest rate and unemployment, thus findings of current study are partially consistent with the efficiency wage model. Furthermore, results suggest that real oil prices cause significant changes in the real interest rate in Pakistan. It can be concluded from the results that oil prices can be used in long run to improve the forecasting of unemployment and real interest rate.*

Keywords: Oil prices, Interest rate, Unemployment, Efficiency Wage Model, Toda-Yamamoto

JEL Classification: C32, E24, Q43

1. Introduction

The existing literature has suggested various transmission channels for the possible impact of oil price shocks on economic activity (Brown and Yucel, 2002). The rising oil prices leads to the increase in the prices of petroleum products, energy bills (consumers, industries, government) and production costs, consequently increasing the unit production cost and lowering the productivity level. The decline in productivity directly affects the unemployment rate, real wage rate, product selling price, consumption level, investments, interest rate and inflation rate (Loungani, 1986). This association of oil prices with productivity and unemployment is not only valid for the manufacturing economies but also for the agriculture dependent economies (Uri, 1995). As Pakistan is agricultural country thus this association may also hold for the Pakistan economy.

Unemployment is one of the important macroeconomic issues that all governments and economies face. It has both social and economic implications for all economies; therefore governments try to adopt policies that help in increasing employment rate. Furthermore, policy makers study various factors and phenomena that may have effect on increasing unemployment and come up with new suggestions and polices to improve employment rate. It is believed that developed countries have lower unemployment rate than the developing economies (Fields, 2011), because of the government polices to increase employment, higher

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product demands and resources for production and higher per-capita income. Whereas developing economies have high unemployment rates because of the lower demand of products and most importantly insufficient resources and low per-capita income.

The developing country like Pakistan is heavily dependent on the oil as an input for almost every industrial sector, for instance: transportation sector, cement sector, electricity generation sector etc. In other developing countries electricity is generated mainly from cheap and renewable resources like water, wind, nuclear energy etc but in Pakistan more than 50% of electricity is generated by using oil, therefore increase in oil prices, increases input costs, consequently resulting in the growth of production cost and unemployment rate (Loungani,1986). Furthermore, internal factors of economies such as population, per-capita income, technological advancement, job opportunity, demand for products and ability to invest locally can also play important role in increasing employment rate.

There are several macroeconomic, global and local factors that affect unemployment rate, but as economy like Pakistan is heavily dependent on oil as major input for production, therefore the current study aim is to investigate the relationship between oil prices and unemployment. The current study used the efficiency wage model proposed by Carruth et al., (1998) which theoretically relates the oil prices (real), interest rate (real) and unemployment rate.

2. Theoretical background

The causal relationship between oil price shocks and economic activity has been studied comprehensively in literature with contradictory results (Lardic and Mignon, 2008). The oil price shocks have different impacts on both oil exporting and oil importing countries. The increase in oil prices is considered good for oil exporting and bad news for oil importing countries, while expecting reverse effect for oil price decrease. In literature existing studies has found various transmission mechanisms for possible impact of oil price shocks on economic activity. First is the classic supply size effect, according to which, increase in oil prices leads to decline in the output level, because oil is considered as the basic input of the production (Beaudreau, 2005). Higher oil prices would result in the higher output costs, results in lowered production rate and declined growth rate, which results in lowering of real wage rates, closing of production plants and increase in unemployment rate (Brown and Yucel, 2002). According to supply size effect, oil price shocks increases the marginal cost of production thus leads to the increase in production costs. High production costs make it infeasible for the firms to continue production at full or existing production level, resulting in lowering of production level and downsizing, which results in declined economic growth and employment rate. In such situations it is difficult to reallocate the specialized labor and capital immediately from one industrial sector to another, thus labor has to wait for better job opportunities and for economic condition to normalize, which contributes to further adverse effect of oil price shocks on unemployment.

Second, the demand side effect discusses the adverse effect of oil price shocks on investment and consumption. The major input for the industries is capital that comes from the investments of local and foreign investors. When economic activities are at decline, investors withdraws their investments from markets and take money out of the country and invest in higher profitable and growing economies, resulting in further lowering of production and economic activities in the country (Brown and Yucel, 2002).In order to meet the high production costs, firms starts to downsize and offer lower wages to the workers. Because of

the higher unemployment labor agrees to work at lower wages, consequently the consumption of the labor decreases in order to meet consumption expenses with lower wages, resulting in the lowering of consumer goods demand.

The wealth transfer effect is the third transmission channel. The basic emphasis of this effect is on the transfer of wealth to oil exporting countries in the form of oil payments (Brown and Yucel, 2002); which results in the increase in purchasing power of oil exporting countries and lower purchasing power of oil importing countries. The shift of wealth from importing countries results in the reduction of consumer demands, while increase in consumer demands for oil exporting countries. Consequently the demand for world product by the oil importing countries decreases and oil exporting countries increases; at net, the total demand of world goods decreases because the magnitude of reduction in demand is greater than the increase in demand. The reduction in purchasing power of oil importing countries leads to increase in savings, resulting in lowering of interest rates in oil importing countries. The investment in oil exporting countries increases because savings flow from oil importing countries to higher interest rate countries (oil exporting countries); due to excess supply of funds interest rate falls. Consequently aggregate demand of the oil exporting countries increases. Brown and Yucel (2002) argued that when oil prices are sticky downward, reduced level of spending furthers lowers the GDP growth in oil importing countries. To increase consumer spending new equilibrium point would be established at lower prices consumer goods. If new equilibrium level is not established then saving level would further increase, resulting in higher investments than consumption, further decreasing the GDP level. Horwich and Weimer (1984) suggested that monetary and fiscal policy can be efficiently used to stimulate the aggregate demand in oil importing countries without lowering the price levels in order to restore equilibrium level of consumption.

Brown and Yucel (2002) studied the impact of monetary policy on unemployment rate and argued that oil price shocks increases the vulnerability of the monetary policy errors, especially when monetary authorities try to control the inflation brought by the increasing oil prices by adopting deflationary monetary policy (increasing the interest rates). The increase in interest rate further slows down the growth and nominal GDP. In such situations downward sticky wage rates would contribute further in the reduction of productivity. Thus unemployment rate would rise; consumer consumption rate would fall, resulting in the further slowdown of the GDP growth than the actual oil price rise. Similarly, high interest rate would stimulate further increase in the savings and reduction in investments because of the uncertainty associated with the aggregate demand and productivity.

The fourth transmission channel is real balance effect put forward by Pierce and Enzler (1974); and Mork (1994). They argued that increase in oil prices leads to increase in money demand. When monetary authorities, due to any reason, fail to meet the growing money demand, interest rate raises result in slowing down of growth rate.

The fifth transmission effect proposed by the Tang et al., (2009) is the inflation effect. In this transmission channel Tang et al., (2009) established a relationship between oil price stocks and domestic inflation. According to them, whenever domestic inflation is caused by the oil price shocks, authorities try to control the inflation through deflationary monetary policy, resulting in a decreasing long term output and higher unemployment rate.

Sector adjustment effect is the sixth transmission channel put forward by Beaudreau (2005). This channel explains the role of oil price shocks in increasing relative production cost of some industrial sectors and its implications on labor. As argued by Beaudreau (2005) no work can be done without energy, therefore it must be taken as an essential primary production factor. Consequently, when oil price shocks are for long term then it would be having major implications on the production cost and thus on unemployment rate. The industrial sector using oil as a primary source of energy would switch to any other relatively low price energy source, due to increase in production cost because of increasing oil prices, which results in the change in production setup, consequently requiring different labor skills than before. As the skills cannot be developed in days and new job search is time consuming, which ultimately results in unemployment. Each worker possess industry specific skills, other industrial sectors cannot absorb the unemployed labor of another industry. Consequently when oil prices affect intensive labor relating sector then it causes higher reallocation and unemployment of labor.

The seventh transmission channel proposed by Brown and Yucel (2002) is unexpected effect, which explains the uncertainty associated with direction of oil prices and its impact on the economy. Brown and Yucel (2002) argued that classical supply size model can explain the inverse relationship between GDP growth and oil price shocks. It can explain the direct relation between inflation and oil price shocks. On the other hand, alone real balance effect cannot explain the above two relationships.

3. Efficiency Wage Model

Two most distinct theories, Phelp's (1994) structuralist approach and equilibrium unemployment theory (Pissarides, 2000) endogenise the natural rate as the potential candidates for inducing shift in natural unemployment rate. Structuralist approach emphasizes on the importance of the input prices (such as capital, oil) as important determinants of medium term employment (Phelp's, 1994; and Carruth et al., 1998). Structuralist theories used efficiency wage models of the labor market and argued that higher oil prices effect employment rate negatively. As the oil prices increase, higher share of the input costs are spent on it resulting in the squeezing of the real wage rate. According to efficiency wage model squeezing of wage rate is only applicable in the economy when unemployment rate is high, if it is not the case then labor will with hold the jobs for some time or will quit later.

According to the classical model of macroeconomics actual employment represents the equilibrium amount at which labor required equates the labor supplied under the supposition of perfectly flexible prices and wages. Similarly the real wage rates will adjust according to the number of jobs to the number of qualified applicants. Hence at equilibrium no involuntary unemployment exists (Borjas, 1996). Brown and Yucel (2002) proposed that business cycle movements have greater impact on equilibrium unemployment rate than classical model. Hamilton (1988) presented a general equilibrium model of unemployment and the business cycle. According to Hamilton (1988) at real wage rate and perfectly flexible prices unemployment can exist. In exploratory business cycle aspects of model, Hamilton argued that with the increase in energy prices, consumption of energy using products decreases, because of relative higher product cost. Consequently the demand for product fall and can cause structural and cyclical unemployment.

According to Carruth et al., (1998) oil prices can affect the unemployment through real prices of factors of production. Carruth et al., (1998) proposed the efficiency wage model, this model provides framework to explore the relationship between unemployment and two input prices (i.e. real interest rate and real oil prices). The efficiency wage model is attractive because of following three reasons. First, this model provides theoretical justification of relationship between unemployment and factors of production including real oil prices. Second, this model does not assume that all unemployment is voluntary, rather unemployment can be involuntary. Third, this model avoids considerations made by the classical and neoclassical theories that movements in wages are too small as compared to the employment which is too large. Efficiency wage model do not involve any specific supposition regarding elasticity of labor supply. Thus, the basic idea of motivation of this paper is that changes in the labor demand stimulated by input prices changes are the causes of changes in labor market equilibrium. In this study efficiency wage model proposed by Carruth et al., (1998) is used. The Carruth et al efficiency wage model starts from the Shapiro and Stiglitz (1998) wage model equation.

$$\log w = \log b + e + e \cdot d[1 - a(U)](1 - d) \quad \text{----------1}$$

In equation 1 'w' represents wage rate, 'b' represents the level of unemployment benefits, 'e' represents the on-the job work level efforts, 'd' represents the successful shirking probability, 'U' represents the unemployment rate 'a(U)' represents the unemployed worker probability for finding work.

According to Shapiro and Stiglitz wage model, equilibrium wage is equal to the sum of benefits earned by unemployed labor, efforts required by the job, shirking detection rate and probability of finding work by unemployed. Carruth et al., (1998) assumed that for the production three main factors (i.e. labor, capital and energy) and used and real input prices are associated together with relation

$$\mu = C(w, r, p) \quad \text{----------2}$$

In equation 2 'μ' represents technology, 'C' represents the cost function, 'w' represents wage rate, 'r' represents interest rate and 'p' represents oil prices. The equation 2 suggests that with the improvement in technology the economy acquires benefits. These benefits come for the improvement in the production process leads to increase in output. The increase in output benefits are passed to the economy via increase in employment opportunity, increase in employment and wages 'w', increase in capital demand, investments and interest payments and oil prices increase due to greater demand, providing benefits to oil owners 'p'.

In order to include the effect of unemployment 'b' Carruth et al., (1998) adjusted it with technology in equation 2 as 'b(μ)'. Carruth et al., (1998) justified it as that government adjusts real income of the economy by updating laws to increase unemployment benefits. So, if unemployment increases in the country it would not reduce the production by lowering the demand for product by employed labor. Equilibrium unemployment rate is derived from equation 1 and 2.

$$= (r, p, b(\mu), e, d) \quad \text{----------3}$$

The equation 3 shows that equilibrium unemployment rate is dependent on real interest rate, oil prices, benefits of being unemployed, exogenous efforts and detection parameters. The increase in oil prices leads to lowering of profit and even to losses, consequently business starts to close. According to Carruth et al., (1998), there are three main factors of production. As oil prices and interest rates are fixed and influenced by international markets, therefore only wage rates are in control of firms. In order to reduce production costs to remain in business downsizing is done by the firms.

Equilibrium model suggest that firms can only reduce labor at the time of increasing oil prices to remain in business. As no shirking condition suggest inverse relationship between unemployment and wages. As unemployment will increase, wage rate will fall because of lower number of jobs and higher number of applicants. Thus firms would pay higher fixed oil prices payments and lower wages to maintain breakeven point. Similarly, when real interest rate increases, then firms only have one option to reduce wage rate in order to maintain breakeven point. Carruth et al., (1998) suggest unemployment as "discipline device" because high input costs (oil prices and interest rates) are adjusted by lowering the wage rate and increasing unemployment.

In this paper Carruth et al., (1998) model is used to investigate the relationship between unemployment and input prices of oil and interest rate for Pakistan.

4. Previous Studies

Most of the empirical studies have tested the structuralist view such as Bianchi and Zoega (1998) showed that unemployment rate shows infrequent shift in its position around its mean. But the shifts timing coincides with fluctuation in the real input prices.

Phelps (1994, ch. 17) used pooled data of OECD economies and shown that increase in real input prices, increases the unemployment rate. Carruth et al., (1998) argued that in long run relationship exist between real oil prices, real interest rate and unemployment rate by using USA data. Loungani (1986) used dispersion index of 36 years (1947 to 1982) for 28 USA industries to examine reallocation of labor caused by the oil price shocks. The results showed that the oil price increase in 1950s and 1970s is one cause of the labor allocation is USA, resulting in higher unemployment rate.

Hamilton (1983) used granger causality for the data of USA from 1948 to 1980. The results showed positive correlation of oil price change with real GNP growth. Hamilton further extended the data to 1988:2, in order to get the significant correlation of oil price change with unemployment but got marginal significant correlation and found asymmetry in effect. This showed that from 1948 to 1988:2 oil price changes is not the possible cause of the unemployment in USA but both moved in the opposite direction during observed time period. Burbidge and Harrison (1984) used four developed countries data (Canada, U.K, Japan and Germany) and used VAR to investigate the impact of oil price shocks on selected macroeconomic variables. The results showed that there is little evidence relating the effects of oil price change on industrial production. This shows that during period of 1979 to 1980 unemployment in selected four countries was not due to lower production rate.

Earlier, Lowinger et al (1985) examined the association between world financial market interest rate and oil prices. They concluded that only high fluctuations in the oil prices have significant impact on the world financial market interest rate as compared to low fluctuations in oil prices, suggesting that world financial interest rates have non-negligible sensitivity towards the oil prices.

Gisser and Goodwin (1986) used the same data as Hamilton (1983) to investigate the relationship between oil price and its effects on macroeconomic variables before and after 1973. The result was consistent with the findings of Hamilton (1983) and Burbidge and Harrison (1984). They also found that no significant correlation exist between oil price change and unemployment. Mory (1993) used annual data from 1951 to 1990, results showed asymmetric effect of oil price change on unemployment and output. Uri (1996) used data of USA agricultural sector form 1947 to 1995 and used granger causality. The results showed significant correlation between oil price change and unemployment. Lee et al., (1995) reported the statistically significant relationship between real oil price change with unemployment and GNP growth over the different time periods. They also reported that the effect oil price change is greater on unemployment and GNP growth in those economies where oil prices remain stable for some time before price increase.

Sadorsky (1999) argued that in explaining the variance in the forecast error variance of real stock return is largely explained by oil prices fluctuation as compared to the interest rate. The results further concluded that oil prices fluctuations has asymmetric effects on the whole economy. Steidtmann (2004) suggested that during 1970s rise in oil prices are considered as increase in the interest rate, indicating that increase in high oil prices results in inflation which translates into increasing interest rate and recession in the economy.

Ewing and Thompson (2007) proved negative significant correlation of oil price change with unemployment in USA. Andrepoulos (2009) used Markov Switching Vector Auto Regression (VAR) on data from 1953:2 to 2007:2 in order to investigate the causality between unemployment and real input prices (capital and oil). The result showed that real oil price has predicting power only in long run whereas; real interest rate has predicting power only in expansion time.

Manera and Cologni (2008) analyzed the impact of oil price shocks on macroeconomic variables by employing structural co-integrated VAR model. The results suggested that oil price shocks have impact on the interest rates, resulting in the increase in inflation. In order to decrease the effect of inflation governments switches to concretionary monetary policy.

Papapetrou (2001) used monthly data of Greek economy from 1989:1 to 1996:6 and employed VAR analysis. The results showed negative relation between oil price change and unemployment. The results also concluded that oil price change is significantly correlated with employment and economic activity, explaining the significant portion of changes in the output and employed growth. Rabalo and Salvado (2008) conducted study by using Portuguese economy data. They used VAR analysis was used with different time intervals. The results suggested significant effect of oil price change on unemployment for time interval 1968 to 1985. For time interval of 1986 to 2005 the significance of relation falls considerably, showing ability of oil price change fall considerably in explaining unemployment rate.

Rafiq et al., (2009) conducted a study to investigate the impact of oil price volatility on Thai economic activities by using VAR. they used GDP growth rate, investment, interest rate, inflation, unemployment rate, trade balance and budget deficit as main macroeconomic variables. From the results of Granger causality, impulse response function and variance decomposition they proved that during pre-crisis period oil price volatility has significant impact on the unemployment and investment.

Dogrul and Soytas (2010) used monthly data of Turkish economy from the period of 2005:1 to 2009:8 and used newly develop technique Toda-Yamamoto for investigating relationship between unemployment rate and input prices (real interest rate, real oil price). The results showed that real oil price change and real interest rate explains the unemployment rate in long run. They also concluded that in Turkey energy and capital can be replaced by labor as factor of production. Their study also put forward a question that whether Carruth et al., (1998) model can hold in other developing economies as in Turkey. This question is the main motivation of this study. Van Wijnbergen (1985) argued that unemployment in developed countries due to oil price shocks of 1974 was neoclassical and in developing countries was Keynesian. Thus, it suggests that the nature of oil price effect can be different in different economies at different time period. Hence, individual study by using developing country can made addition to the literature.

Gunu (2010) analyzed the impact of oil prices shocks on Nigerian economy by using VAR. They examined the impact of crude oil price volatility on four macroeconomic variables (i.e. real GDP, unemployment, money supply and CPI). They found that oil prices have significant impact on real GDP, unemployment and money supply but no significant impact on consumer price index.

Askari and Krichene (2010) found that monetary policy variables i.e. exchange rate and interest rate have significant impact on oil markets. They suggested that exchange rate and interest rate influence the oil market and have significant impact on the oil demand. Furthermore, Carlstrom and Fuerst (2005) investigated the movement US federal fund rate against the oil prices increase and showed that increase in oil prices translates into in inflation rate.

Van and Ni (2011) investigated the impact of oil prices on inflation, interest rate and money. They suggested that oil prices have significant impact and granger causes changes in interest rate and inflation.

Ran and Voon (2012) investigated the impact of oil price shocks on the small open economies by using panel data of Hong Kong, Singapore, South Korea and Taiwan. They used real gross domestic product, unemployment rate, gross price level, import price, interest rate and oil import consumption as main macroeconomic variables. They employed VAR/VECM and did not found significant impact of oil price shocks on macroeconomic variables, where as they found significant positive impact on the unemployment after three time lags.

5. Data and Measurement of Variables

The current study used monthly data from the period 1991:01–2010:12, where 1991:01 represents the earliest date monthly data and 2010:12 represents the ending month's data, making 238 observation of each variable for analysis. Three variables used in this study for which five economic indicators data was collected from International Monetary Fund's statistical data, World Bank data and economic survey of Pakistan. The economic indicators used for measuring three main variables of the study are Unemployment rate (%), world oil prices, T-bill rates (%), GDP deflator as inflation (%) and GDP deflator.

This study used the measurement of two variables (unemployment and real interest rate) as done by Carruth et al., (1998) and Blanchard and Gali (2007) measurement of real oil prices. The measurement of each variable is given as

- Unemployment rate is taken as percentage of labor unemployed
- Real oil prices is the log value world oil prices subtracted from log value of GDP deflator
- Real interest rate is the six months T-bill rate in percentage subtracted by GDP deflator inflation in percentage

6. Research Methodology

Numerous models can be used to predict the relationship between unemployment and two input prices. Most commonly used model is the Vector Autoregression (VAR) model because it is free from presumptions as used in other models (Sims, 1972). VAR model use applications which increase the possibility of measuring interrelation between variables (such as Granger causality). Granger causality is used to determine the unidirectional, bidirectional relationship or independence between variables. This model aims to decide whether the past value of independent variables (X), helps in predicting the value of explanatory variable (Y_{t+1}), then X granger causes the Y. Before testing the granger causality, integration and co-integration of the time series is checked. The integration is done to check the stationarity of the series through unit root tests. The co-integration of the series is checked through co-integration test. In VAR model degree of freedom is missed because the variables imported are in first difference. Other important aspect of the VAR model is that it makes variables to be estimated thus, making interpretation of co-efficient difficult. As granger causality test base on VAR model, so problem will also occur in the results as well.

In order to overcome the problems of VAR model Toda and Yamamoto (1995) presented a new model Toda Yamamoto model to check the causality without checking for the integration and co-integration. Toda Yamamoto causality test is for the series that have arbitrary order of integration and limits all the problems associated with conventional co-integration tests. There are four steps involve in Toda Yamamoto test. First step is to determine the maximum order of integration (represented by d_{max}) for the length of all series by using unit root tests. Second step involves the determination of optimal lag in the VAR model (represented by K), by using the information criteria such as Akaike Information Criteria. Third step is the estimation of VAR in level with the modified order of P= K + d_{max} The last step is the testing of Wald test for Granger causality.

7. Empirical results and Discussion

The Toda Yamamoto test starts with determining the degree of series integration. This was done by using two unit root tests i.e. Augmented Dickey and Fuller (ADF) test (1979) and Phillips and Perron (PP) test (1988).

The table 1 shows the results of ADF and PP tests. The result shows that ADF and PP are significant at 1% level of the critical value. Thus, it suggests that all the series are integrated in level I(0). The maximum order of the integration visible is 0. Toda Yamamoto argued that the most important step of test is the selection of maximum order of integration. In this case maximum order of integration is 0. The second step in Toda Yamamoto is the selection of optimal length of lag in VAR model. This is done by running VAR model at level and then information criteria are used to select the optimal length of lag (K). In this case Final Prediction Error (FPE), Likely hood (LK), Akaike Information Criteria (AIC) and Schwarz

Information Criterion (SC) are used. Initial three criteria give the minimum value at the lag length of 2 but SC shows minimum value at lag 1 as shown in table 2. Therefore the lag length of 2 is selected because three information criterions are giving the same results. In next step maximum order of integration for augmented optimal lag is calculated and it is 2 (P= 0+2).

Table 1: Unit root tests results

		ADF	ADF GLS	PP
Levels				
Intercept	Oil Price	-3.45775*	-2.574714*	-3.457630*
	Unemployment	-3.45763*	-2.574674*	-3.457630*
	Interest rate	-3.45763*	-2.574674	-3.457630*
Intercept and trend	Oil Price	-3.99708*	-3.463800*	-3.996918*
	Unemployment	-3.99692*	-3.463900*	-3.996918*
	Interest rate	-3.99692*	-3.463900*	-3.996918*
First difference				
Intercept	Oil Price	----------	-2.574797*	
	Unemployment	----------	----------	----------
	Interest rate	----------		
Intercept and trend	Oil Price	----------	----------	----------
	Unemployment	----------	----------	----------
	Interest rate	----------	----------	----------

Source: Authors calculations

Table 2: Lag order selection

Lag	LogL	LR	FPE	AIC	SC
0	-1121.17	NA	3.531727	9.775418	9.820263
1	-214.362	1782.081	0.001437	1.968366	2.147744*
2	-199.479	28.86106*	0.001365*	1.917205*	2.231117
3	-196.873	4.984108	0.001444	1.972811	2.421256
4	-191.643	9.869411	0.001492	2.005591	2.58857
5	-183.943	14.32855	0.001509	2.016896	2.734408
6	-181.861	3.82034	0.001604	2.077051	2.929097
7	-176.484	9.724424	0.001656	2.10856	3.095139
8	-174.283	3.924416	0.001758	2.167677	3.28879
9	-168.597	9.987379	0.001812	2.196496	3.452142
10	-160.828	13.44419	0.001834	2.207198	3.597378
* 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					
SC: Schwarz information criterion					

Source: Authors calculations

Final step involve the estimation of VAR model at augmented optimal lag of 2 and then running Wald test of Granger causality. The main purpose of granger casualty is to show the direction of causality between variable and Toda Yamamoto approach enable us to investigate the long run Granger causality between variables.

The results in table 3 showed two significant relationships. One result shows that oil price Granger causes the unemployment in Pakistan in long run. Hence oil price can be considered as one of the main cause of the unemployment and can also be used to predict the unemployment in long run. Second significant relation is from oil price to interest rate. This shows that the oil price has effect in long run on the interest rate. In the long run increase in oil prices will result in the rise of interest rate in country. Thus, the information relating the oil prices can be used to forecast unemployment and interest rate.

Table 3: Toda-Yamamoto causality test

Dependent variable: Unemployment			
Excluded	Chi-square	Degree of freedom	Probability
Real interest rate	0.09444	2	0.9539
Real oil prices	2.996339	2	0.2235
All	3.074406	4	0.5455
Dependent variable: Real interest rate			
Excluded	Chi-square	Degree of freedom	Probability
Unemployment	0.129223	2	0.9374
Real oil prices	2.646683	2	0.2662
All	2.70568	4	0.6082
Dependent variable: Real oil prices			
Excluded	Chi-square	Degree of freedom	Probability
Unemployment	0.414896	2	0.8127
Real interest rate	1.733383	2	0.4203
All	1.779774	4	0.7762

Source: Authors calculations

The positive link from oil prices to unemployment also confirms that findings of this paper are in-line with the Papapetrou (2001) for Greece, Rabalo and Salvado (2008) for Portugal during time period of 1968 to 1985 and Dogrul and Soytas (2010) for Turkey. Similarly, Anderopoulus (2009) suggested that oil prices can forecast the unemployment but only in recession time. Thus, our findings support half of the hypothesis that an input price has effect on the unemployment. The result shows that significant effect of oil prices on unemployment exists but no significant association exit between real interest rate and unemployment. Thus results are partially in lined with the efficiency wage model in term of oil prices effect on unemployment.

The results of this paper are in lined with the transmission channels consideration given in the existing researches.

Firstly, classic supply size effect postulates that increase in oil price leads to decrease in output level because of higher production cost and consequently leads to unemployment. As results show that rise in oil prices cause unemployment in long run. The rise in production

cost makes the producer to reduce the production cost, which can only be done by reducing the wage rate and number of labor. Thus, as classic size effect states that rise in oil prices increase the unemployment rate is confirmed by results.

Second transmission channel is demand size effect; it states the adverse effect of oil prices on consumption and investment. As discussed above oil price rise leads to unemployment and fall in wage rate. Thus the amount to spend with labor decreases and unemployed labor has nothing to spend. Thus the consumption level of employed and unemployed labor decreases. Results also show that an oil price has significant effect on the interest rate. With the increase in interest rate cost of borrowing also increases, this makes investor reluctant to borrow money and invest in the economy. Consequently, lowering of borrowing due high interest rate leads to reduction in investment. Thus both the decrease in consumption and investment is proved by results.

Third channel is wealth transfer effect; it deals with the purchasing power of the oil importing and exporting countries. The results show that increase in oil prices leads to unemployment. The unemployed labor has nearly zero purchasing power. Consequently, the demand for products in oil importing countries decreases considerably as compared to the oil exporting countries.

Fourth channel is real balance effect; it deals with the increase in money supply in order to meet the increase in oil payments. The increase in demand for money in the market for oil payments leads to increase in the interest rate in the country. Thus results also show that increase in oil prices leads to increase in interest rate.

Fifth channel is inflation effect, as results shows that increase in oil prices increases interest rate, which also results in the inflation in the country.

Sixth channel is the sector adjustment effect, results shows that increase in oil prices results in increasing unemployment and interest rate. Due to high oil prices industry switch from oil to other lower price input, that leads to the change of setup. Due to which skills required for running new setup changes and different skill labor is required to run the new setup, resulting in the unemployment of labor. The main example in Pakistan is the cement industry that switched from oil to the coal because of higher input cost. Thus the unemployed labor has to search for new jobs in other industrial sectors that require different skills. Thus labor has to wait for the economy to come back to normal position or has to work at lower wages or has to develop new skills which take time.

8. Conclusions

The main aim of this paper was to investigate the relationship between unemployment and oil prices by using the efficiency wage model of Carruth et al., (1998). Previous studies mostly investigated the relationship for the developed countries. As suggested by Van Wijnbergen (1985) oil prices and unemployment has different nature of association in different counties. Similarly, Dogrul and Soytas (2010) also put forward a question that whether the results of their research findings are same in other developing countries or not? So, these two reasons are the main motivations of this paper. This study used the Toda-Yamamoto causality test for investigating the relationship between unemployment and two input prices (real interest rate and real oil prices). The results showed that oil price Granger causes the unemployment in Pakistan in long run, confirming the findings of Papapetrou

(2001) for Greece, Rabalo and Salvado (2008) for Portugal during time period of 1968 to 1985 and Dogrul and Soytas (2010) for Turkey. Similarly, Andreopoulos, (2009) suggested that oil prices can forecast the unemployment but only in recession time. Thus, our findings support half of the hypothesis that an input price has effect on the unemployment. The result also showed that significant effect of oil prices on unemployment exists but no significant association exists between real interest rate and unemployment. Thus results are partially in lined with the efficiency wage model in term of oil prices effect on unemployment.

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