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# The Effect of Labour Market Reforms on Unemployment and Wages in OECD Countries: Panel TSLS Fixed Effects Estimation

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***Abstract:*** The Western industrialised OECD economies are legislating many labour market reforms in the wake of automation of the production processes to protect the labour interests, especially wage hiring and firing conditions and tackling the unemployment issues. This paper analyses how far these labour market regulations impact the wage rate and unemployment in 17 OECD countries using panel data for the period 2000 to 2022 applying the two-stage least squares fixed effects regression method. The estimated results show that while the rigid reforms have discouraged labour supply and increased unemployment problems, the flexible labour market has increased labour demand in the OECD countries. The total factor productivity and research and development expenditure have a positive impact on unemployment rates in the OECD countries. The technological changes lead to an increased demand for skilled labour, which leaves unskilled labour unemployed. The de-unionisation has discouraged labour supply and weakened the worker bargaining powers. The employment protection laws have no significant impact on wages in OECD countries.

***Keywords:*** OECD countries, labour market reforms, supply-demand mismatch, technological change, two-stage least squares fixed effects regression

## Introduction

The labour market operates with the supply and demand for labour wherein the supply of labour is provided by employees/individuals and demand by employers/entrepreneurs. In a liberal economy, the governments regulate the functioning of the labour markets with employment protection legislation, tax wedge, unionisation, unemployment benefits, etc. Such labour market regulations that enhance and secure the working environment are generally referred to as labour market institutions. The labour market regulations that

started in the second half of the 19th century with strong industrialisation growth in Western Europe and North America, expanded to comprehensive labour codes, rules for trade unions and collective bargaining, unemployment insurance, active labour market programmes and employment legislations in developed countries, subsequently expanded to developing countries also with liberalisation, privatisation and globalisation in the 20th century.

The high job creation and low unemployment in the United States relative to Europe raised questions about whether Europe's more stringent labour regulations, more powerful unions, more extensive collective bargaining and more generous unemployment insurance regimes contribute to the employment performance in developed countries. However, empirical studies on the impact of labour market regulations on employment and wages are rather scanty. Studies by the European Commission and the Organisation of Economic Cooperation and Development (OECD) countries blame labour market regulations for increasing unemployment. They point out that more rigid labour market institutions negatively impact job creation and increase unemployment. Moreover, the slowing economic growth in the world's leading economies such as the United States, European Union and OECD countries has made it worse for other economies around the world.

With changing production technologies and methods of production, continuous labour reforms are taking place throughout the world. The Western industrialised OECD economies are at the forefront of legislating labour market reforms. The labour market regulations are aimed at protecting labour interests especially wages hiring and firing conditions and most importantly tackling the unemployment situation in the wake of globalisation and automation of the production processes. In some economies, the labour market legislations are rigid while in some economies they are flexible. A more flexible labour market reduces the labour market regulations will eventually worsen the working environment of the labourers. This reduces the labourers' willingness to work and therefore increases unemployment. That is, the supply of labour in the market reduces. On the other hand, the demand for labour by firms increases due to the relaxation of labour market regulations. As a result, there is a supply-demand gap in the labour market hence the increase in unemployment in OECD countries in recent years. How far these labour market regulations impact the wage rates and unemployment is a question for empirical investigation.

The objective of this paper is to examine the impact of labour market reforms on unemployment and wage payments in OECD countries. In the empirical

analysis, this paper uses data from 17 OECD countries over a period of 22 years (2000 to 2022) obtained from the OECD and World Bank sources. The variables considered are labour market regulation indicators like union density, tax wedge and employment protection, unemployment rate, hourly pay for work, and macroeconomic variables total factor productivity, annual GDP growth rate, research and development expenditure and fertility rate. In the empirical analysis, the two-stage-least-squares (2SLS) method is used for the estimation of simultaneous systems of labour demand and labour supply. The simultaneous equation model facilitates the estimation of the effect of labour market reforms on the wage (hourly pay for work) and the unemployment rate. The labour demand function used is the unemployment function which has independent variables labour market regulations measured union density, employment protection legislation and tax wedge, and demand shocks measured by GDP growth, total factor productivity growth, research and development expenditure and labour productivity growth. The labour supply function is the wage function represented by total hourly pay for time work which has independent variables labour market regulations measured by union density, employment protection legislation and tax wedge, and supply shocks measured by the fertility rate.

## Review of Literature

Di Tella and MacCulloch (2002) attempt to explain the effect of labour market flexibility and labour force participation on the performance of the labour market. The panel data used on hiring and firing restrictions is survey data of business people in 21 OECD countries covering the period 1984-1990. Lazear's parsimonious reduced form model is used in the estimation, controlling country and time-fixed effects, and in the dynamic panel data estimation, GLS and GMM techniques are employed. The estimated results show that increasing labour market flexibility increases both the employment rate and the rate of participation in the labour force. In the short run, the estimated effects are larger in the female labour market relative to the labour market for males, although both groups have similar long-run coefficients. The results are viewed as more labour market flexibility leads to lower unemployment rates and lower rates of long-term unemployment.

Huang *et al.* (2013) focus on the unemployment driven by labour market reforms in Europe in 15 European countries over the period 1985 to 2009. The paper analyses the impact of labour market regulations on wage payments and

unemployment rates using the 2SLS method. It is hypothesised that labour supply is discouraged by decreases in union density, replacement rate, and tax wedge while de-unionisation and tax system reforms enhance labour demand. The estimated results show that the replacement rate is the only measure of labour market regulation that affects labour supply, but not the demand side. Further, the effect of labour market institutions on the behaviour of labour demand outweighs the effect on labour suppliers, which pushes up the wage rate and mitigates the unemployment problem. Thus, when adopting labour market reforms particular attention needs to be paid to the adjustment of the replacement rate in order to avoid overly depressing labour supply to lowering the unemployment rate without hurting wage payments or discouraging labour supply.

Zribi, Temmi and Zrelli (2014) examine the impact of policies aimed at increasing labour market flexibility on unemployment, especially youth unemployment after the Great Recession. It is observed that the youth unemployment rates in most countries are at least twice as high as the total unemployment rate. The unbalanced panel dataset of 92 countries over the period 2000 to 2010, taken from the International Labour Organisation, World Development Indicators and Fraser Institute Economic Freedom of the World databases, has been divided into two subgroups of 32 developed and 60 developing countries. The static and dynamic models are estimated using the feasible generalised least squares (FGLS) and GMM methods. The estimated results show that most of the macroeconomic and demographic variables and labour market flexibility indicators reduce general and youth unemployment rates. The effect of labour market regulations in developed countries is significantly higher than in the developing countries. Collective bargaining, mandated cost of worker dismissal and conscription do not seem to play an important role in youth unemployment.

Turrini, Koltay, Pierlni, Goifard and Kiss (2014) analyse the determinants and impact of labour market reforms in the European Union with reference to the 2008 crisis. They note that European Union countries with similar institutional settings tend to follow analogous reform patterns. In these countries, reforms are more frequent when the environment is characterised by unsatisfactory labour market outcomes, notably high and growing unemployment, and a high initial level of regulations or fiscal burden on labour. The LABREF database on the EU over the period 2000-2011 which contains a large set of information on reform characteristics has been used. In the empirical

estimation, pooled regression analysis with Impulse Response Function (IRF) and Least Squares Dummy Variables (LSDV) methods have been applied. The effect of selected reforms on aggregate labour market outcomes has been found supportive of common priors: tax and benefit reforms tend to be followed, after a time lag, by improved activity rates and lower unemployment. Further, it is observed that the overall reform activism has increased during the crisis period.

Gur (2015) studies factors that affect unemployment in the BRIC (Brazil, Russia, India and China) countries, the recent attention-grabbing emerging markets of the world. The panel fixed effects regression has been applied for the estimation of the BRIC country data collected from the World Bank, OECD and Bloomberg database, for the period 2001-2012. The estimated results show that the most important cause of increasing unemployment in the BRIC countries is inflation followed by population growth. Further, growths in gross domestic product, trade volume, total investment and industrial product are the main economic factors that lead to a reduction of unemployment in BRIC economies.

## Data and Methodology

In this paper, panel data of 17 OECD countries spanning over 22 years from 2000 to 2022 collected from the OECD database and WB indicators is used in the empirical analysis applying the panel 2SLS fixed effects regression method. The 17 OECD countries considered are Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. The dependent variables are the unemployment rate and total hourly pay for time worked. The independent variables are labour market regulation variables, demand shock variables, and supply shock variables.

The panel 2SLS fixed effects method consists of a set of structural equations and an estimated reduced-form equation. The structural disturbance terms u should satisfy the usual stochastic assumptions such as zero mean, constant variance and zero covariance. The reduced form disturbance terms v should also satisfy the same since v's are linear combinations of u's. In the structural equations, the variables in the model are of two kinds: exogenous variables and endogenous variables. The exogenous variables are variables that are determined outside the system and the endogenous variables are variables that are determined within the system of equations. The endogeneity problem arises in a multiple regression model when the explanatory variables are correlated with the error term, for several reasons including omitted variable bias, measurement error

and simultaneity/reverse causation (*x* causes *y*, *y* causes *x*). With endogeneity, the OLS estimation, which assumes independence of explanatory variables from the error term, will produce inconsistent estimates. Simultaneous causality bias can be eliminated with instrumental regression. When there are two or more instruments for an endogenous variable, the two-stage least squares estimation method is applied. The 2SLS method is a reduced-form equation expressing endogenous variables in terms of instrumental variables or exogenous variables that remove the simultaneous equation bias and can give consistent estimates. The instruments say z, must satisfy two conditions: (i) instrument relevance: $cov(x,z) \neq 0$, and (ii) instrument exogeneity $cov(x,u) = 0$, where $z$ is the instrument, $x$ is the endogenous variable and u is the error term. That is, the instrumented variable $z$ must be correlated with explanatory variable $x$ and at the same time must not be correlated with error term $u$. This implies that $z$ affects $y$, the independent variable, only through $x$. The identification and selection of appropriate instruments is a challenging task.

## Panel Two Stage Least Squares Method

The structural equation is specified as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u \tag{1}$$

where $y$ is the dependent variable, $x_1$ is the endogenous variables, $x_2$ is the exogenous variables, β's are parameters to be estimated and $u$ is the error term. By instrumenting the endogenous variables $x_1$ with m instrumental variables, along with all exogenous variables, the reduced form estimating equation can be written as:

$$y_1 = \beta_2 x_2 + \delta_1 z_1 + \ldots + \delta_m z_m + v \tag{2}$$

Substituting the value of x1 from reduced form estimation in the structural equation:

$$y = \beta_1(\hat{x}_1 + v) + \beta_2 x_2 + u \tag{3}$$

$$y = \delta z + (u + v\beta_1) \tag{4}$$

where $z = [x_x, x_2]$ *and* $\delta = \begin{bmatrix} \beta_1 \\ \beta_2 \end{bmatrix}$.

$$\text{Let } \alpha = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} = (z'z)^{-1} z'(\delta z + u + v\beta_1) \tag{5}$$

$$\alpha = \delta + (z'z)^{-1} z'(\delta z + u + v\beta_1) = \delta + (z'z)^{-1} z'u \tag{6}$$

$$Plim\ \alpha = \delta + Plim\left(\frac{1}{n}(z'z)^{-1}\right) Plim\left(\frac{1}{n} z'u\right) \tag{7}$$

$$\text{As } Plim\left(\frac{1}{n} z'u\right) = 0,\ Plim\ \alpha = \delta \tag{8}$$

This is the two-stage least squares (2SLS) estimation procedure which is consistent and $\alpha$ is the consistent estimator of $\delta$.

In simultaneous equations methods, the identification of structural equations and endogeneity and exogeneity of variables are tested with specification tests. The Durbin and Wu-Hausman tests of endogeneity are performed to determine whether the regressors in the model are exogenous or not. The difference between the Durbin and Wu-Hausman tests is that the former uses estimates of the variance of the error term assuming the variables being tested are exogenous, while the latter uses estimates of the error variance assuming the variables being tested are endogenous. The idea of the Wu-Hausman test for endogeneity is to see whether the estimates of OLS and IV methods are different (Hausman, 1978). The test is to estimate an auxiliary regression in the first stage:

$$x_1 = \delta_1 z_1 + \delta_2 z_2 + v \tag{9}$$

The residuals $\hat{v}$ of equation (9) are then included as an additional explanatory variable in equation (1):

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \gamma_1 \hat{v} + \varepsilon \tag{10}$$

Then test the hypothesis whether $\gamma_1$ equals zero or not. This implies that $x_1$ could be correlated with $u$ through $v$. The null hypothesis is that the residual $\hat{v}$ is zero and therefore $x_1$ is exogenous. Therefore, if $\gamma_1 = 0$, then $x_1$ is an exogenous variable and when $\gamma_1 \neq 0$, then $x_1$ is an endogenous variable.

The identification test of the simultaneous equations method uses the order condition. In order to identify a given model, the order condition states that K-k ≥ $m$-1, where $M$ is the number of endogenous variables in the model, $m$ is the number of endogenous variables in a given equation, $K$ is the number of exogenous variables in the model, and k is the number of exogenous variables in a given equation. The equations may be under-identified, exactly-identified or over-identified. The 2SLS is usually used for estimating over-identified equations.

Exogeneity cannot be tested as it involves a correlation between the instrumental variable and an unobserved error. If there is more than one instrument, then whether some of them are uncorrelated with the structural error can be tested. The Sargan test is used to test for over-identifying restrictions. The test hypothesis is that whether all the instruments ($z's$) are uncorrelated with $u$ against the alternative at least one $z$ is correlated with $u$. The logic underlying the test is that the residuals should be independent of the instruments as required by the estimation procedure. The Sargan test procedure consists of (i) estimating the structural equation by 2SLS and obtaining the residuals $\hat{u}$, (ii) regress $\hat{u}$ on all exogenous variables and obtain the $R$-square ($R^2$), and (iii) calculate $nR^2 \sim \chi^2$ (chi-square) distribution with the number of over-identifying parameters equal to the number of instruments less the number of endogenous variables in the equation. If the test statistic exceeds the critical value, the null hypothesis is rejected and at least some of the IVs are not exogenous. *A* high $R^2$ in step 2 would indicate that the residuals are not independent of the instruments leading to a rejection of the model specification or instruments.

## Empirical Results

The empirical models of structural and reduced form equations for labour supply and labour demand functions are estimated using the panel 2SLS fixed effects regression method. The labour supply (Ls) and labour demand (Ld) are expressed as functions of wage, labour market regulations (LMR) consisting of three measures - union density, employment protection and tax wedge - with supply shocks (fertility) and demand shocks - GDP growth rate, technological shocks (R&D expenditure), total factor productivity and labour productivity respectively. Thus:

$$\text{Labour supply: } \frac{\tilde{L}_S}{\bar{L}} = f_S \text{ (Wage,LMR,S)} \tag{11}$$

$$\text{Labour demand: } \frac{\tilde{L}_d}{\bar{L}} = f_d \text{ (Wage,LMR,D)} \tag{12}$$

where is $\tilde{L}$ equilibrium employment rate and $\bar{L}$ is total labour force. By definition, the unemployment rate is the percentage of the total labour force that is unemployed but actively seeking employment and willing to work. Hence:

$$\text{Unemployment rate} = \left(1 - \frac{\tilde{L}}{\bar{L}}\right) \tag{13}$$

At equilibrium, there exists labour supply function and labour demand functions from which an expression for wage rate is derived, which may then be considered as the transformed labour supply function. Similarly, an expression for the unemployment rate is derived and considered as the transformed labour demand function. Thus:

$$\text{Labour supply function: Wage} = \phi_s \text{ (Unemployment, } LMR,S) \quad (14)$$

$$\text{Labour demand function: Unemployment} = \phi_d \text{ (Wage, } LMR,D) \quad (15)$$

The equations (14) and (15) are empirically specified as:

$$\text{Wage} = \beta_0 + \beta_1 \, Unemp + \beta_2 \text{ Union} + \beta_3 \text{ EPL} + \beta_4 \text{ Tax} + \beta_5 \text{ Fertility} + u_1 \quad (16)$$

$$\text{Unemployment} = \alpha_0 + \alpha_1 \text{ Wage} + \alpha_2 \text{ Union} + \alpha_3 \text{ EPL} + \alpha_4 \text{ Tax} + \alpha_5 \text{ R\&D} + \alpha_6 \text{ GR} + \alpha_7 \text{ TFP} + \alpha_7 \text{ LP} + u_2 \quad (17)$$

The equations (17) and (18) are simultaneous equations and are to be estimated by the 2SLS method. The wage rate and unemployment rate are the two endogenous variables in the model.

Empirically, in the first stage of estimation, the reduced form equations of labour supply (wage) and labour demand (unemployment rate) are derived. Then, the endogenous variables on all exogenous variables present in the model are regressed obtaining the predicted values for the wage rate and unemployment rate:

$$\text{Wage} = \delta_0 + \delta_1 \text{ Union} + \delta_2 \text{ EPL} + \delta_3 \text{ Tax} + \delta_4 \text{ Fertility} + \delta_5 \text{ R\&D} + \delta_6 \text{ GR} + \delta_7 \text{ TFP} + \delta_7 \text{ LP} + \varepsilon_1 \quad (18)$$

$$\text{Unemployment} = \delta_0 + \delta_1 \text{ Union} + \delta_2 \text{ EPL} + \delta_3 \text{ Tax} + \delta_4 \text{ Fertility} + \delta_5 \text{ R\&D} + \delta_6 \text{ GR} + \delta_7 \text{ TFP} + \delta_7 \text{ LP} + \varepsilon_2 \quad (19)$$

In the second stage of estimation, the structural form equations are estimated regressing the original model by replacing two endogenous variables, wage rate and unemployment rate with their predicted values. The empirical estimation obtained thus in this stage are the 2SLS estimates:

$$Wage = \beta_0 + \beta_1 \hat{Unemp} + \beta_2 Union + \beta_3 FPL + \beta_4 Tax + \beta_5 Fertility + u_1 \quad (20)$$

$$Unemployment = \alpha_0 + \alpha_1 \hat{Wage} + \alpha_2 Union + \alpha_3 EPL + \alpha_4 Tax + \alpha_5 R\&D + \alpha_6 GR + \alpha_7 TFP + \alpha_7 LP + u_2 \quad (21)$$

Table 1 presents the descriptive statistics of the variables used in the empirical analysis of the effect of labour market regulations on wages and unemployment.

**Table 1: Descriptive Statistics of Variables**

| *Variable* | *Description* | *Mean* | *Std. dev.* |
|---|---|---|---|
| Wage rate | Total hourly pay for time worked (US$) | 14.401 | 6.58 |
| Unemployment rate | Share of labour force that is without work but seeking employment (%) | 7.202 | 3.09 |
| Union density | Ratio of wage and salary earners that are trade union members to the total number of wage and salary earners (%) | 32.103 | 20.56 |
| Employment protection legislation | The procedures and costs involved in dismissing or hiring workers (score 1-6 with 6 being the most protected level) | 2.094 | 0.91 |
| Tax wedge | Difference between what employee takes home in earnings and what it costs to employ them - measure of the extent to which tax on labour income discourages employment (percent of labour cost) | 39.110 | 10.04 |
| GDP growth rate | Growth rate of annual GDP (%) | 1.631 | 2.49 |
| R&D expenditure | Gross domestic expenditure on research and development (% of GDP) | 2.093 | 0.81 |
| Total factor productivity | The residual of GDP growth that cannot be explained by growth in labour and capital inputs (%) | 0.528 | 1.53 |
| Labour productivity | Real GDP produced by an hour of labour work (%) | 1.296 | 1.66 |
| Fertility rate | Number of births per woman | 2.007 | 0.88 |

The estimated results of the panel fixed effects and random effects reduced form regression models are presented in Table 2. Among the measures of labour market regulations, the union density and tax wedge are the most important factors in determining wage payment and the unemployment rate. In the fixed effects estimates, the tax wedge has a significant positive impact on wages. A 10% increase in tax wedge would increase wages by about 2%, thus decreasing labour supply. The union density has a negative impact on unemployment, a percentage increase in union membership decreases unemployment by around 1%. The employment protection legislations have contradictory effects on wages and unemployment in fixed and random effects models but are insignificant in both estimations. It seems more rigid labour market regulations with improved working conditions may provide more effects to the legislative measures.

**Table 2: Panel Regression Estimates of Wage and Unemployment Rates**

| *Variable* | *Fixed effects* | | *Random effects* | |
|---|---|---|---|---|
| | *Wage rate* | *Unemployment rate* | *Wage rate* | *Unemployment rate* |
| Union density | -0.119 | -1.442* | -0.175 | -0.044*** |
| | (0.07) | (0.14) | (0.06) | (0.02) |
| Tax wedge | 0.215** | -0.268 | -0.289** | 0.106** |
| | (0.10) | (0.19) | (0.13) | (0.65) |
| EPL | -1.093 | 1.692 | 0.283 | -0.834 |
| | (1.28) | (2,42) | (1.56) | (0.64) |
| TFP | 1.137* | 1.023* | 0.710 | 1.271* |
| | (0.21) | (0.38) | (0.50) | (0.22) |
| LP | -0.073 | -0.378 | -0.836* | -0.087 |
| | (0.14) | (0.27) | (0.35) | (0.16) |
| R&D expenditure | 0.631 | 3.164* | 6.704* | -0.308 |
| | (0.695) | (1.31) | (1.22) | (0.52) |
| GDP growth rate | -0.806* | -0.694* | -0.476* | 0.918* |
| | (0.08) | (0.16) | (0.19) | (0.08) |
| Fertility rate | -5.441* | 5.920* | -0.756* | 0.309 |
| | (0.96) | (1.78) | (1.38) | (0.57) |

*Note:* Standard errors are in parentheses. *, **, *** Significant at 1, 5, 10% levels.

The macroeconomic shock variables like total factor productivity and R&D expenditure have positive effects on both wages and unemployment, whereas the effects of GDP growth rate, and labour productivity on wages and unemployment are negative. An increase in fertility rate decreases the wage rate while increasing the unemployment rate. The technological shocks push up the wage rate but also increase the unemployment problem. Specifically, a percentage increase in TFP tends to increase wage payments and the unemployment rate equally by about 1%. A one percentage increase in R&D increases unemployment by 3%, implying a rapid improvement in technologies such as automation observed in many OECD countries in the 21st century have increased the wage payments along with high unemployment rates. The growth in GDP in the OECD has a negative impact on wage payments and has reduced the unemployment problem in OECD countries. The supply shock represented by the fertility rate increases labour supply which in effect reduces wage payments and increases the unemployment problem in the OECD countries.

In the random effects on reduced-form estimates union density and tax wedge have a negative effect on the wage rate, while union has a negative impact

on unemployment rate and tax wedge shows has a positive effect on unemployment rate. This shows that more labour market flexibility will boost the wage rate and undermine the unemployment rate. However, the labour market regulations have a differential impact on the market players. Hence, reforming labour markets with legislation need an understanding of how reforms alter both labour demand and labour supply decisions. Further, technological shock (TFP and R&D) pushes up the wage rate as well as the unemployment problem. A one percentage increase in R&D tends to increase wages by 6.7% and TFP increases unemployment by 1.27%. The growth in GDP in the OECD has a negative impact on both wage payments and the unemployment rate. An increase in supply shock variable fertility rate increases the labour supply which in effect reduces wage payments and increases the unemployment problem in OECD countries.

The estimates of the panel two two-stage least squares fixed effects (2SLS) method are presented in Table 3. The empirical random effects estimation of the labour supply function and demand function are mostly insignificant. However, the estimation of random effects is necessary to choose between fixed and random effects estimations. For this, the Hausman specification test is used where the null hypothesis is that the preferred model is the random effects model and the alternative hypothesis is fixed effects as the appropriate model. If the chi-square value is significant (Prob.>chi2 smaller than .05), the null hypothesis of the random effects model is rejected and the fixed effects model is accepted. The Hausman test for wage rate and unemployment rate equations reports chi-square values of 397.06 and 8.71 with respective Prob>chi2 as 0.0000 and 0.46. As both Prob>chi2 for wage and unemployment specifications are less than 0.5, the fixed effects model is used for discussion.

In the panel 2SLS fixed effects coefficient estimates of the wage equation, the unemployment rate is significant at 1% level and is positively related to wage payments. A 1 percentage increase in the unemployment rate increases wages by the same proportion. The labour market regulation variables union density and tax wedge are statistically significant at 1% and 5% levels respectively. The union density is negatively related to the wage rate, specifically a percentage increase in union membership decreases the wage rate by 1.5%. The tax wedge of labour market regulation is also negatively related to wage rate. A 10% increase in tax wedge would decrease wage payments by 4.4%, implying an employee can have more take-home earnings. However, the employment protection variable is not significant implying changes in employment protection legislation

**Table 3 2SLS Panel Regression Estimates of Wage and Unemployment Rates**

| *Variable* | *2SLS fixed effects* | | *2SLS random effects* | |
|---|---|---|---|---|
| | *Wage rate* | *Unemployment rate* | *Wage rate* | *Unemployment rate* |
| Wage rate | - | -0.909*** | - | 2.825 |
| | | (0.33) | | (2.56) |
| Unemployment rate | 0.949*** | - | 0.606*** | - |
| | (0.17) | | (0.22) | |
| Union density | -1.495*** | -1.444*** | -0.048 | -0.685 |
| | (0.13) | (0.48) | (0.06) | (3.08) |
| Tax wedge | -0.442** | -0.031 | -0.189 | 1.137 |
| | (0.20) | (0.22) | (0.13) | (4.19) |
| EPL | 1.828 | 1.462 | -1.257 | -2.218 |
| | (2.58) | (2,85) | (1.58) | (6.53) |
| TFP | - | 2.077*** | - | -0.716 |
| | | (0.53) | | (8.22) |
| LP | - | -0.42 | - | 2.11 |
| | | (0.33) | | (9.05) |
| R&D expenditure | - | 3.539* | - | -2.05 |
| | | (1.95) | | (4.20) |
| GDP growth rate | - | -1.44*** | - | 0.385 |
| | | (0.27) | | (5.28) |
| Fertility rate | 6.265*** | - | -1.671 | - |
| | (2.13) | | (1.42) | |
| *Test statistics* | *Wage equation* | | *Unemployment equation* | |
| Hausman test | 397.06 | | 8.71 | |
| Chi-square value | [0.00] | | [0.46] | |
| Endogeneity test | 9.90 [0.001] | | 32.28 [0.00] | |
| Sargan statistic | 8.43 [0.03] | | 0.00 | |

*Note:* Standard errors are in parentheses. p-values in square brackets.

*, **, *** Significant at 1, 5, 10% levels.

may not have any significant impact on wages. On the whole, the labour market regulations in the OECD have discouraged workers from joining the labour market due to a decline in the work environment.

The supply shock variable fertility rate is statistically significant and positively related to the wage rate. An increasing fertility rate shifts the labour supply outward and increases wage payments. Specifically, a 1% increase in fertility rate increases wages by 6.26%. The Sargan statistic reports a p-value of 0.03. The null hypothesis of the Sargan statistics test for overidentification i.e. all instruments (z's) are uncorrelated with u is rejected, implying there is at least

one z correlated with u in the labour supply equation. Thus, the wage equation is over-identified. The endogeneity test reports a p-value of 0.001, rejecting the null hypothesis that variables are exogenous, the unemployment rate is an endogenous variable in the wage equation.

In the fixed effects estimates of the unemployment equation in Table 3, the wage rate is significant at 1% level and is negatively related to the unemployment rate. A 1 percentage increase in the wage rate would decrease the unemployment rate by almost equally. Among the labour market regulation variables, only union density is statistically significant. An increase in trade union membership has a negative impact on the unemployment rate. Specifically, a 1 percentage increase in union density would decrease the unemployment rate by 1.4%. The other two measures of labour market regulation, tax wedge and employment protection, are insignificant. The effect of demand shocks is mixed. The GDP growth rate has a statistically significant negative effect on the unemployment rate. A 1 percentage increase in GDP growth would decrease unemployment by 1.4%. The total factor productivity (TFP) and expenditure on research and development are positively related to the unemployment rate. A 1 percentage increase in total factor productivity leads to a 2% increase in the unemployment rate. The labour productivity is negatively related to the unemployment rate and is statistically insignificant. This shows that the decreasing demand for unskilled labourers outweighs the increasing demand for skilled labourers. The Sargan test statistic is 0.00 for the labour demand function, showing that the unemployment equation is exactly identified, and hence the validity of instruments cannot be tested. The endogeneity test reports a p-value of 0.00, rejecting the null hypothesis that variables are exogenous. Thus, the wage rate is an endogenous variable in the unemployment equation.

## Conclusion

With changing production technologies and methods of production, continuous labour reforms are taking place throughout the world. The Western industrialised OECD economies are at the forefront of legislating labour market reforms. The labour market regulations are aimed at protecting labour interests especially wages hiring and firing conditions and most importantly tackling the unemployment situation in the wake of globalisation and automation of the production processes. In some economies, the labour market legislations are rigid while in some economies they are flexible. A more flexible labour market reduces the labour market regulations will eventually worsen the working

environment of the labourers. This reduces the labourers' willingness to work and therefore increases unemployment. That is, the supply of labour in the market reduces. On the other hand, the demand for labour by firms increases due to the relaxation of labour market regulations. As a result, there is a supply-demand gap in the labour market hence the increase in unemployment in OECD countries in recent years. How far these labour market regulations impact the wage rates and unemployment is a question for empirical investigation. This paper examines the effects of labour market reforms on unemployment and wage payments in 17 OECD countries using panel data for the period 2000 to 2022. The labour market regulations are measured by the union density, tax wedge, and an index of employment protection laws. Treating wage rates and unemployment rates as endogenous variables, this paper applied the panel two-stage least squares fixed effects regression method in the empirical analysis.

The main results of this paper can be summarised as follows. The de-unionisation in OECD countries has discouraged labour supply and increased unemployment problems. In the OECD countries, the workers' bargaining powers in defending their rights have weakened and the reduction in tax wedge has raised wage payments as well as the disposable income of the workers. The labour market regulations have discouraged workers from joining the labour force since regulations make the working conditions tough. Though the flexibility of the labour market has increased the labour demand in the OECD countries, it has also aggravated the unemployment problem among workers. The empirical estimates show that the employment protection laws have no significant impact on wages and employment in the workers in OECD countries. The total factor productivity and research and development expenditure have a positive impact on unemployment rates in the OECD countries. The technological changes that result from an increase in TFP and R&D lead to an increased demand for skilled labour, which leaves the unskilled labour unemployed implying that the aggregate unemployment level increases. One way to address the supply-demand gap in the labour market arising due to labour market regulations in OECD countries is to provide incentives like pensions, bonuses, paid leaves, insurance, etc. for the labourers so that they will be encouraged to join the labour market.

## *References*

Bemel-Verdugo, L., D. Furceri and D. Guillaume (2012) "Labor Market Flexibility and Unemployment: New Empirical Evidence of Static and Dynamic Effects", *Comparative Economic Studies,* 54, 2, 251-273.

Betcherman, Gordon (2013) "Labor Market Institutions: A Review of the Literature", Policy Research Working Paper 6276, Background Paper for the World Development Report 2013, World Bank.

Bhargava, A. (1991) "Identification and Panel Data Models with Endogenous Regressors", *Review of Economic Studies,* 58, 1, 129-140.

Di Tella, R. and R. MacCulloch (2005) "The Consequence of Labor Market Flexibility: Panel Evidence Based on Survey Data", *European Economic Review,* 49, 5, 1225-1259.

Durbin, J. (1954) "Errors in Variables", *Review of International Statistical Institute,* 22, 1/3, 23-32.

Elmeskov, J., J.P. Matin and S. Scarpetta (1998) "Key Lessons for Labour Market Reforms: Evidence from OECD Countries' Experience", Swedish Economic Policy Review, 5, 2, Autumn.

Fialova, Kamila (2011) "Labor Market Institutions and Their Effect on Labor Market Performance in OECD and European Countries", Mimeo, World Bank.

Gur, B. (2015) "An Analysis of Unemployment Determinants in BRIC Countries", *International Journal of Business and Social Science,* 6, 1, 192-198.

Hausman, J.A. (1978) "Specification Tests in Econometrics", Econometrica, 46, 6, 1251-1271.

Huang, E.Li-H. and J. H.-Yi. Huang (2013) "Labor Market Reforms on the Unemployment Rate and Wage Payments in Europe", *Empirical Economic Letters,* 12, 12, 1365-1374.

Sargan, J.D. (1975) "Testing for Misspecification After Estimating Using Instrumental Variables", mimeo, London School of Economics.

Turrini, A., G. Koltay, F. Pierini, C. Goffard and A. Kiss (2015) "A Decade of Labour Market Reforms in the EU: Insights from the LABREF Database", *IZA Journal of Labor Policy,* 4, 12.

Vandenberg, P. (2010) "Impact of Labor Market Institutions on Unemployment: Results from a Global Panel", ADB Economic Working Paper Series No. 219, Asian Development Bank, Manila, Indonesia.

Wu, De-Min. (1973) "Alternative Tests of Independence between Stochastic Regressors and Disturbance", *Econometrica,* 41, 4, 733-750.

Zribi, T. G., H. Temmi and N. Zrelli (2014) "Can Labor MarketFlexibility Affect Unemployment? A Panel Data Analysis", *Journal of Human Resource Management and Labor Studies,* 2, 1, 17-40.