World Academy of Science, Engineering and Technology
International Journal of Social and Business Sciences
Vol:18, No:9, 2024

The Effect of the Hourly Compensation on the Unemployment Rate: Comparative Analysis of United States, Canada and the United Kingdom Using Panel Data Regression Analysis

Ashiquer Rahman, Hares Mohammad, Ummey Salma

***Abstract*—**A country's hourly compensation and unemployment rates are two of its most crucial components. They are not merely statistics but they have profound effects on individual, families, country, and the economy. They are inversely related to one another. The increased hourly compensation in the manufacturing sector can have a favorable effect on job changing issues. Moreover, the relationship between hourly compensation and unemployment is complex and influenced by broader economic factors. In this paper, in order to determine the effect of hourly compensation on unemployment rate, we use the panel data regression models and evaluate the expected link between hourly compensation and unemployment rate. We estimate the fixed effects model (FEM), evaluate the error components model (ECM), and determine which model (the FEM or ECM) is better through pooling all 60 observations. We then analyze and review the data by comparing countries (United States, Canada and the United Kingdom) using panel data regression models. Finally, we provide result, analysis and a summary of this extensive research on how the hourly compensation affects unemployment rate. Additionally, this paper offers relevant and useful guideline for the government and academic community to use an econometrics and social approach for the hourly compensation on unemployment rate to eliminate the problem.

***Keywords*—**Hourly compensation, unemployment rate, panel data regression models, dummy variables, random effects model, fixed effects model, the linear regression model.

I. Introduction

THIS paper highlights the direct association between hourly compensation and the unemployment rate. There are numerous variables that can affect the complex relationship between hourly compensation and the unemployment rate.

Unemployment can have a negative impact on the person himself as well as on society or the surrounding environment [7]. Some social issues arise from unemployment due to its lower hourly compensation, lower community output and income. This is due to reduced job opportunities which can be caused by a slow economy, reduced individual potential, and loss of work skills, decreased income taxes and low levels of community welfare [8]. The economy of a country can be said to be growing if the economic activities of its people directly affect the increase in the production of goods and services. By knowing the level of economic growth, it is possible for the government to make plans regarding state revenues and future development to achieve a society's welfare [9]. It is difficult to say for sure without more research, but this might influence the unemployment rate. A number of variables, such as hourly compensation, minimum earnings, labor productivity, and the human development index, might have an impact on the unemployment issue. It is anticipated that as a nation's hourly compensation grows, the unemployment rate will decline. One of the key indicators in resolving the unemployment issue is efforts to increase the hourly compensation

A. Research Aim

The research aims to define the effect of the hourly compensation on unemployment rate to identify the economic growth and the relationship each other to makeup shortfall for best practices. The objective is also to illustrate the FEM, assess the ECM, and ascertain whether FEM or ECM is more desirable for data analysis and evaluation by comparing three different countries (USA, UK, Canada) using the panel data regression.

The paper addresses the question of "how the hourly compensation effect on Unemployment rate relatively to meet the stable economic system?". The question is related to the adoption of blanching economic system and fulfillment of the economic disparity.

B. Source and Methodology

This paper studies the relationship between hourly compensation and the unemployment rate in the United States, Canada and the United Kingdom. Since each country provides only 20 observations, data can be applied to this case by using dummy variable technique using EVIEWS programming to test the difference of intercepts and slopes in each country. We used annual data from 1980 to 1999 of the United States, Canada and the United Kingdom. There are 20 observations for each country, so 60 observations in total. There are 20 observations for each country, so 60 observations in total. We used the secondary data that collected from from Damodar N. Gujarati, Basic Econometrics, 4th Edition (table 16.5, p.655) [6].

II. Literature Review

Compensation is the remuneration received by an employee

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in return for their contribution to the organization [1]. Two of the most common types of compensation are salaries and hourly pay and employees who are paid by the hour are eligible for overtime pay equal to their base wage plus 50% [2]. Typically, the opponents of minimum hourly compensation emphasize its potential negative effect on employment. The compensation should negatively correlate with unemployment rate because if firm pays more compensation, labors will have more incentive to continue working, so unemployment rate is low. This applies particularly if there are sources of alternative income (e.g. benefits) for the unemployed, and the individual workers maximize their worth considering labor, pay, and other sources of revenue, all of which go into calculating their marginal product [5]. But when firms reduce compensation for labors, unemployment rate will be higher because labors have little incentive continuing their jobs. Hence, Urrutia et al. [3] demonstrate that only the inflation rate, out of the five independent variables, has no significant link with the dependent variable, with a p-value of 0.178, which is more than the level of significance of 0.01. If the null hypothesis is accepted there is no significant relationship between the dependent and independent variable. Meanwhile, GDP shows a negative connection with the Unemployment Rate but a significant linear association with the unemployment rate based on their Pearson coefficient of determination [3].

TABLE I
ANNUAL DATA FROM 1980 TO 1999 OF THE UNITED STATES, CANADA AND THE UNITED KINGDOM

Unemployment Rate and Hourly Compensation						
Obs	United States		Canada		UK	
	COM_US	UN_USA	COM_CAN	UN_CAN	COM_UK	UN_UK
1980	55.6	7.1	49	7.2	43.7	7
1981	61.1	7.6	54.1	7.3	44.1	10.5
1982	67	9.7	59.6	10.6	42.2	11.3
1983	68.8	9.6	63.9	11.5	39	11.8
1984	71.2	7.5	64.3	10.9	37.2	11.7
1985	75.1	7.2	63.5	10.2	39	11.2
1986	78.5	7	63.3	9.2	47.8	11.2
1987	80.7	6.2	68	8.4	60.2	10.3
1988	84	5.5	76	7.3	68.3	8.6
1989	86.6	5.3	84.1	7	67.7	7.2
1990	90.8	5.6	91.5	7.7	81.7	6.9
1991	95.6	6.8	100.1	9.8	90.5	8.8
1992	100	7.5	100	10.6	100	10.1
1993	102.7	6.9	95.5	10.7	88.7	10.5
1994	105.6	6.1	91.7	9.4	92.3	9.7
1995	107.9	5.6	93.3	8.5	95.9	8.7
1996	109.3	5.4	93.1	8.7	95.6	8.2
1997	111.4	4.9	94.4	8.2	103.3	7
1998	117.3	4.5	90.6	7.5	109.8	6.3
1999	123.2	4	91.9	5.7	112.2	6.1

Hourly compensation is in U.S. dollars, index 1992 = 100 [6]

Moreover, the population shows a negative connection with the Unemployment Rate but a significant linear association with the unemployment rate based on their Pearson coefficient of determination [4]. Indeed, the Compensation factors e.g. wage, incentive, payment can influence the unemployment rate. Any change in those factors can cause the unemployment rate to rise or fall [4].

Most of the countries in the world still pursue economic growth and strive for the well-being of society to achieve a social welfare. In order to achieve welfare, we should ensure the equal distribution of income throughout society in terms of increase hourly compensation rate. Specifically. Specifically, there is an increase in employment opportunities that is not matched by higher compensation rate, a faster-growing workforce, which will contribute to the rise in unemployment. Due to unemployment, the level of productivity and income of the community is reduced, resulting in poverty and social problems [9]

III. FRAMEWORK

The linear regression model is set as follows [6]:

$$Y_{it} = \beta_1 + \beta_2 X_{it} + U_{it} \quad (1)$$

where $Y;_t$ is civilian unemployment rate, and $X;_t$ is manufacturing hourly compensation in U.S. dollars (index, 1992 = 100). i denotes country-the United States, Canada and the United Kingdom and t denotes time period. In this case, i = 3 and t = 20.

A. Comparative Study

We used annual data from 1980 to 1999 from the United States, Canada, and the United Kingdom. There are 20 observations for each country, so 60 observations in total [6]. The descriptive figures (Figs. 1-19) are presented below.

	UNEM_US	COMP_US	UNEM_CAN	COMP_CAN	UNEM_UK	COMP_UK
Mean	6.500000	89.62000	8.820000	79.39500	9.155000	72.96000
Median	6.500000	88.70000	8.600000	87.35000	9.250000	75.00000
Maximum	9.700000	123.2000	11.50000	100.1000	11.80000	112.2000
Minimum	4.000000	55.60000	5.700000	49.00000	6.100000	37.20000
Std. Dev.	1.499825	19.69626	1.600855	16.85469	1.916542	26.81228
Skewness	0.533552	-0.028148	-0.022845	-0.353441	-0.173230	-0.060263
Kurtosis	2.941241	1.872130	1.987845	1.588359	1.619206	1.445254
Jarque-Bera	0.951803	1.062717	0.855454	2.077011	1.688855	2.026469
Probability	0.621325	0.587806	0.651989	0.353983	0.429803	0.363043
Observations	20	20	20	20	20	20

Fig. 1 Descriptive Statistics of the USA, Canada and UK

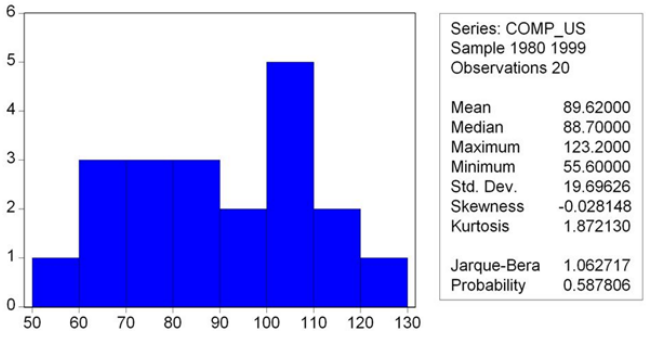

Fig. 2 Compensation in USA

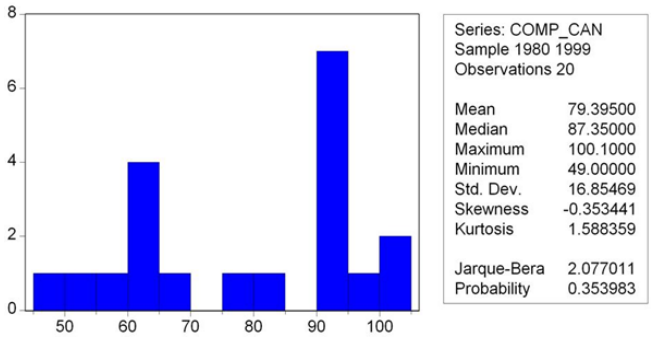

Fig. 3 Compensation in Canada

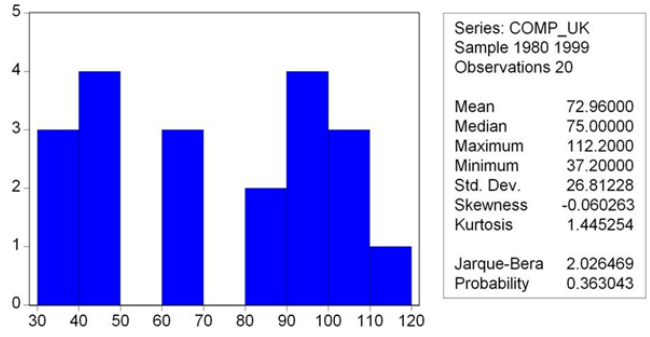

Fig. 4 Compensation in UK

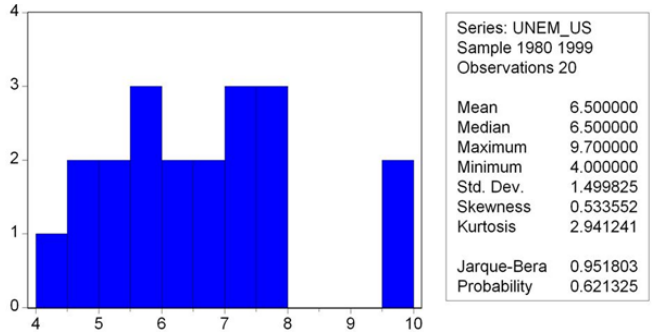

Fig. 5 Unemployment in USA

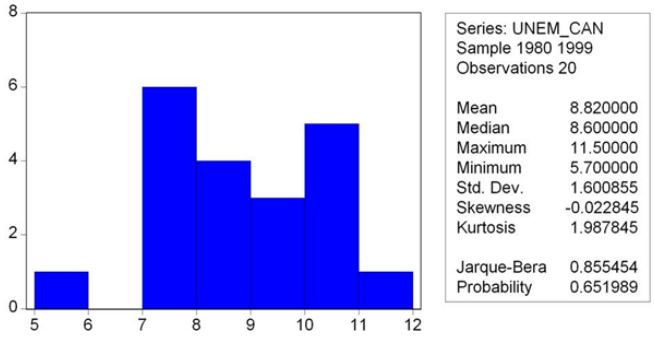

Fig. 6 Unemployment in Canada

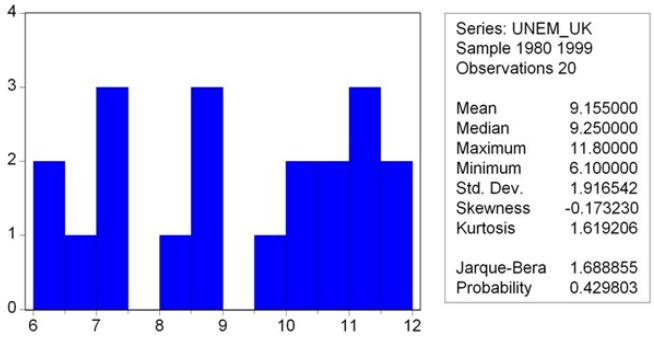

Fig. 7 Unemployment in UK

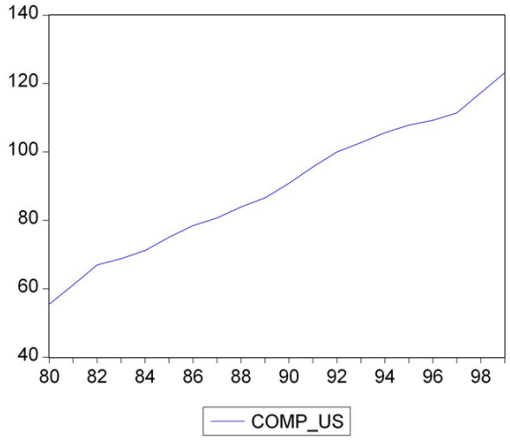

Fig. 8 Compensation in USA

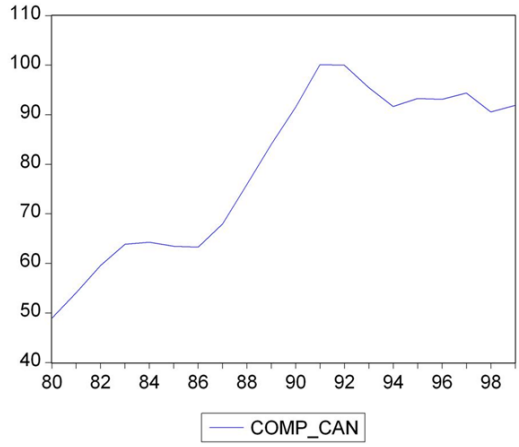

Fig. 9 Compensation in CANADA

B. Model Estimation and Hypothesis Testing

The usual Ordinary Least Squares (OLS) regression is assigned to estimate (1) and 60 observations are pooled disregarding the space and time dimensions. The results are as follows:

$$\hat{Y} = 12.439 - 0.053X \quad (2)$$
$$\text{Se} \quad (0.818) \quad (0.010)$$
$$t \quad (15.202) \quad (-5.424)$$
$$R^2 = 0.3366, \; d = 0.4806$$

$$n=60, \; df=58$$

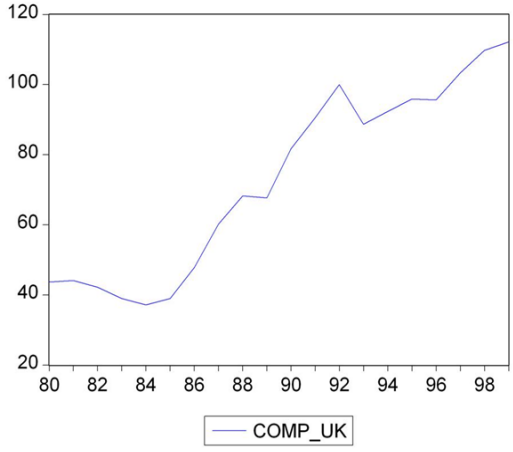

Fig. 10 Compensation in UK

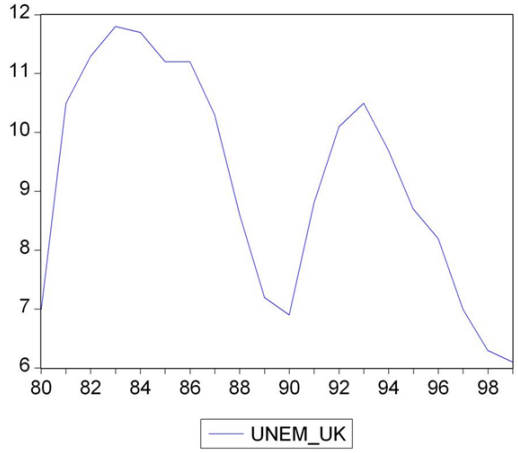

Fig. 13 Unemployment in UK

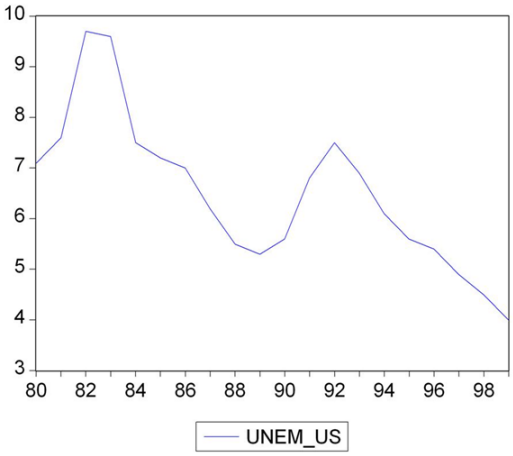

Fig. 11 Unemployment in USA

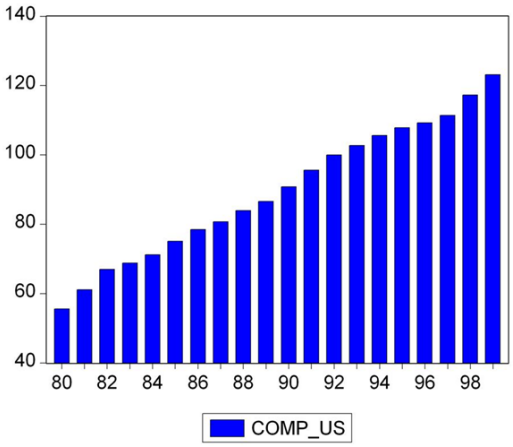

Fig. 14 Compensation in USA

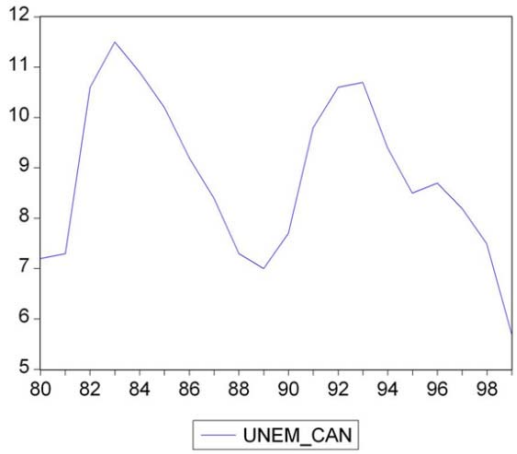

Fig. 12 Unemployment in CANADA

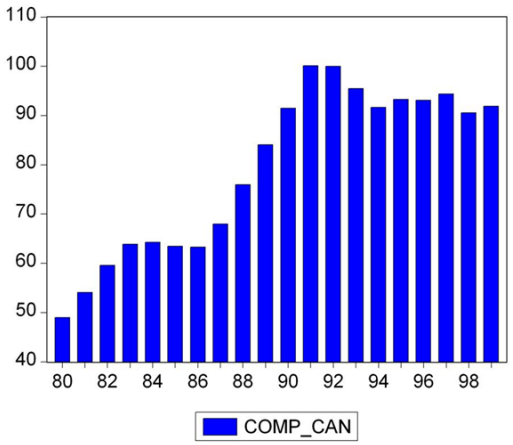

Fig. 15 Compensation in CANADA

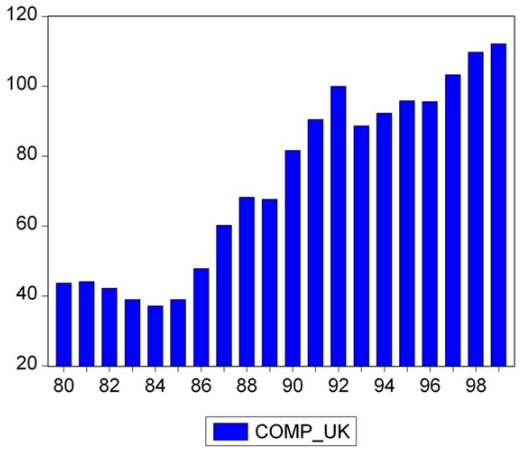

Fig. 16 Compensation in UK

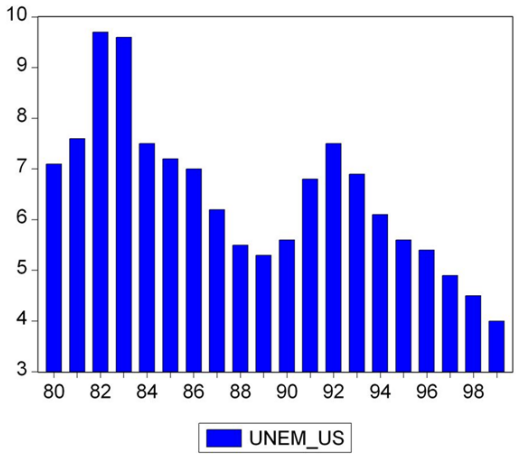

Fig. 17 Unemployment in USA

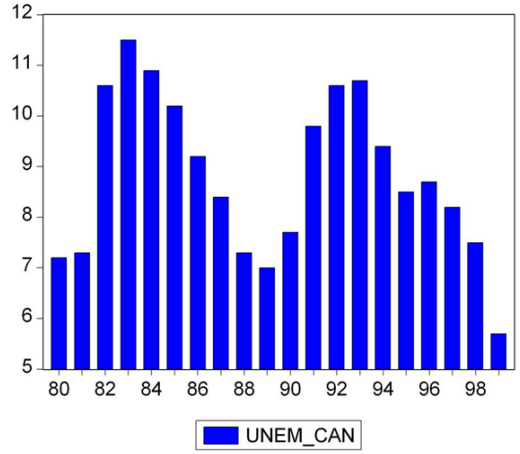

Fig. 18 Unemployment in CANADA

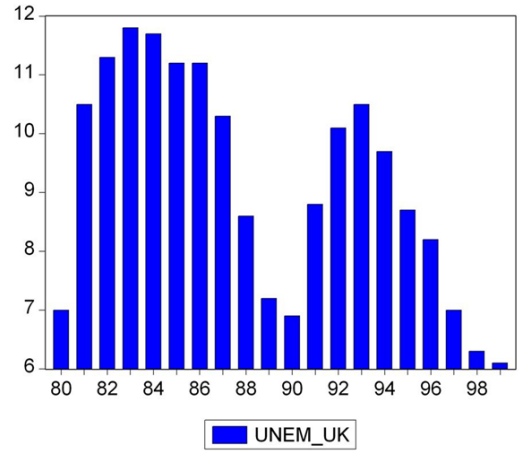

Fig. 19 Unemployment in UK

Clearly, compensation is negatively correlated with unemployment rate as expected and t statistic is statistically significant but R^2 value is quite low. Also, Durbin-Watson statistic suggests that perhaps there is autocorrelation in the data. However, there are highly restricted assumption in (1) because the differences across each country's data, such as intercept and slope, are not considered. So, the regression results in (2) may not capture the different characteristics between the cross-sectional units. If this is to be the case, maybe each country's data cannot be pooled.

Dependent Variable: COMP_CAN
Method: Least Squares

Sample: 1980 1999
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	35.04565	19.79667	1.770280	0.0984
COMP_UK	0.677207	0.212031	3.193905	0.0065
COMP_US	-0.254197	0.316892	-0.802157	0.4359
UNEM_CAN	5.425354	1.964540	2.761642	0.0153
UNEM_UK	-0.346303	1.656802	-0.209019	0.8374
UNEM_US	-4.147652	2.671800	-1.552381	0.1429

R-squared	0.918729	Mean dependent var	79.39500
Adjusted R-squared	0.889704	S.D. dependent var	16.85469
S.E. of regression	5.597576	Akaike info criterion	6.525869
Sum squared resid	438.6600	Schwarz criterion	6.824589
Log likelihood	-59.25869	F-statistic	31.65284
Durbin-Watson stat	0.930694	Prob(F-statistic)	0.000000

Fig. 20 The Least Squares Regressions Results

One way to take into account the individuality of each country is to let the intercept and slope coefficients vary across countries. So the fixed effects model (FEM) is set by using dummy variables as in (3) to test whether the intercepts and slope Coefficients are statistically different.

$$Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \alpha_3 D_{3i}\ \beta X_{it} + \gamma_1 (D_{2i} X_{it}) + \gamma_2 (D_{3i} X_{it}) + U_{it} \quad (3)$$

where $D_{2i} = 1$ if the observation belongs to Canada, 0 otherwise and $D_{3i} = 1$ if the observation belongs to the United Kingdom, 0 otherwise. Therefore, the United States is the comparison country. The results of estimating (3) are as follows:

Dependent Variable: COMP_CAN
Method: ML - ARCH

Sample: 1980 1999
Included observations: 20
Convergence not achieved after 100 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	39.53689	25.99599	1.520884	0.1283
COMP_UK	0.676588	0.360829	1.875093	0.0608
COMP_US	-0.273641	0.462906	-0.591138	0.5544
UNEM_CAN	5.642006	1.787513	3.156343	0.0016
UNEM_UK	-1.319517	2.702167	-0.488318	0.6253
UNEM_US	-3.413556	3.738991	-0.912962	0.3613
Variance Equation				
C	3.836805	4.066900	0.943422	0.3455
ARCH(1)	-0.229198	0.153653	-1.491662	0.1358
GARCH(1)	0.983846	0.315311	3.120240	0.0018

R-squared	0.914141	Mean dependent var	79.39500
Adjusted R-squared	0.851697	S.D. dependent var	16.85469
S.E. of regression	6.490754	Akaike info criterion	6.414537
Sum squared resid	463.4287	Schwarz criterion	6.862616
Log likelihood	-55.14537	F-statistic	14.63955
Durbin-Watson stat	0.985248	Prob(F-statistic)	0.000075

Fig. 21 ML-ARCH Regressions Results

$$\hat{Y} = 11.524 - 2.181\,D_{2i} + 1.029D_{3i} - 0.056X_{it} + 0.049(D_{2i}\,X_{it}) + 0.009(D_{3i}\,X_{it}) \quad (4)$$

se (1.510) (2.173) (1.778) (0.016) (0.025) (0.020)
t (7.627) (-1.004) (0.578) (-3.400) (1.951) (0.463)

$R2 = 0.5582$, $d = O.6764$

$n = 60$, $df = 54$

As you can see from the model above, all t statistics of the dummy variables added are not statistically significant at (0.05) level of significance suggesting that, the intercepts and slope coefficients of Canada and the United Kingdom are not statistically different from the United States

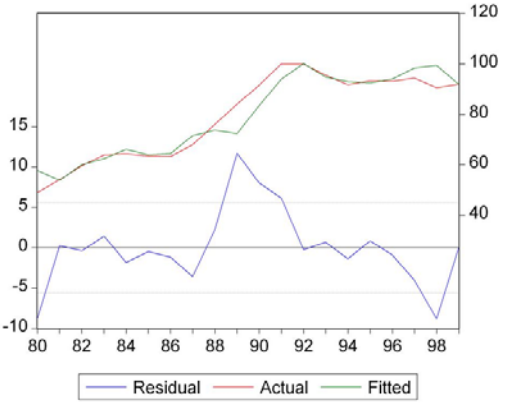

Fig. 22 Residual, Actual, Fitted of the statistics

If the comparison country is changed, regression model (3) will yield different results. Let $D_{2i} = 1$ if the observation belongs to the United States, 0 otherwise and $D_{3i} = I$ if the observation belongs to the United, 0 otherwise; i.e. Canada is a comparison country, the estimation is as follows:

$$Y = 9.342 - 2.181D_{2i} + 3.211D_3 - 0.006X_{it} - 0.049(D_{2i}X_{it}) - 0.040(D_{3i}X_{it}) \quad (5)$$

se (1.561)(2.173) (1.822) (0.019) (0.025) (0.022)
t (5.981)(1.004) (1.762) (-0.341) (-0.463) (-1.758)

$R^2 = 0.5582$, $d = 0.6764$

$n = 60$, $df = 54$

Then let D2i = 1 if the observation belongs to the United States, 0 otherwise and D3; -1 if the observation belongs to Canada, 0 otherwise; i.e. the United Kingdom is a comparison country, the estimation is as follows:

$$Y = 12.554 - 1.029D_{2i} - 3.211D_{3i} - 0.046X_{it} - 0.009(D_{2i}\,X_{it}) + 0.040(D_{3i}\,X_{it}) \quad (6)$$

se (0.938) (1.778) (1.822) (0.012) (0.020) (0.022)
t (13.376) (-0.578) (-1.762) (-3.847) (-0.463) (1.758)

$R^2 = 0.5582$, $d = 0.6764$

$n = 60$, $df = 54$

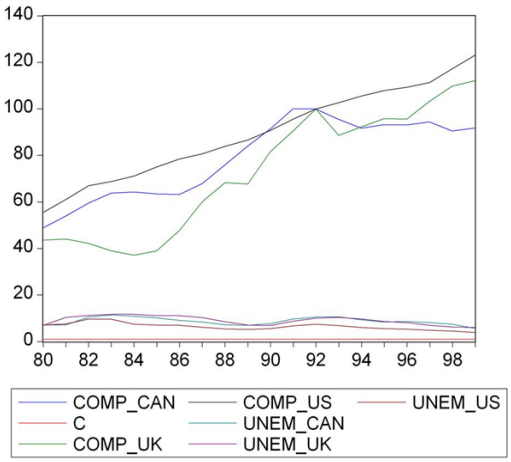

Fig. 23 Pooled Graphical Result of US, Canada and UK

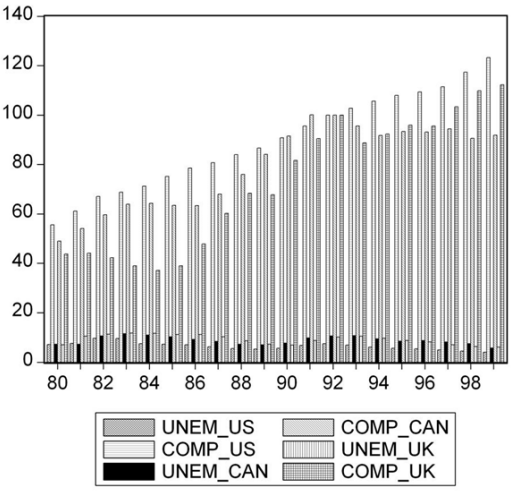

Fig. 24 Comparative Result (Pooled) of US, Canada and UK

All t statistics for dummy variables in both (5) and (6) are

statistically insignificant as in model (4). It can be concluded that the intercepts and slopes of the three countries are not statistically different suggesting that they can be pooled. However, the R^2 value from model (2) is very low compared with model (4). To do a formal test whether model (4) is better, F statistic is calculated as follows:

$$F = \frac{(R^2_{UR} - R^2_R)/\mathrm{q}}{(1 - R^2_{UR})/\mathrm{n-k}} = \frac{(0.5582 - 0.336)/4}{(1 - 0.5582)/54} = 6.771 \quad (7)$$

where q is the number of parameter restrictions. The critical value of F with 4 numerator df and 54 denominator df is 3.16, so F= 6.7713 exceeds the critical value. This proves that model (4) can explain the variation in unemployment rate better than model (2), although coefficients of dummies are statistically insignificant.

IV. Result and Analysis

If we accept that all data sets from the three countries can be pooled and using regression equation (2), it can be concluded that if an hourly compensation in manufacturing increases US$ 1, the unemployment rate will reduce 0.053%. But the interpretation here is subject to some limitations since R^2 is very low. However, if we consider model (4) with higher R^2 value, it would yield similar conclusions except that the unemployment rate will decrease 0.056 percent when there is a US$1 rise in hourly compensation. This time, the intercepts and slopes from different country will change, but these coefficients are statistically insignificant. For example, if there is a US$ 1 increase in compensation, the unemployment rate will drop 0.056, 0.007 and 0.047% in the United States, Canada and the United Kingdom, respectively.

V. Conclusion

This paper investigates the relationship between hourly compensation and the unemployment rate in the United States, Canada, and the United Kingdom. Since each country provides only 20 observations, the parameters from the regression may not be valid. We further examine whether the method of pooling data can be applied to this case by using dummy variable technique to test the difference of intercepts and slopes in each country. Since R^2 value from the regression equation (2) is very low suggesting an invalidity of the model, the assumption that the data from 3 countries can be pooled, which is proved by FEM, may have to be relaxed. Another method to test whether we can use the panel data should be considered, for example, use random effects model (REM) or allow all coefficients vary over individuals as well as time.

Moreover, the hourly compensation (wages or pay) negatively correlated with unemployment since higher hourly compensation encourages workers to stay on the job which will lower the unemployment rate. On the other hand, when hourly compensation rate is low, employees can lose interest in coming to work. As a result of lower labor force participation, the unemployment rate may increase.

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