Okun's Law in Kazakhstan: Test of Pertinence and Analysis of Factors Affecting Real GDP Growth

Adil Sultangazy

May, 2021

Introduction and Motives for the Research

Okun's Law is an empirically observed correlation between changes in GDP and the unemployment rate. According to Wen and Chen (2012), Okun's Law is a method of predicting a decline in GDP at times when the natural rate of unemployment is lower than the current rate. Since its discovery, extensive research has been conducted to test whether it is applicable for economies with varying macroeconomic indicators. Discussion in the field suggests that while this approach has been practical for developed nations, newly emerging countries tend to deviate from this tendency due to rapid changes in growth (Ball et al., 2019; Lal et al., 2010; Pehlivanoglu & Tanga, 2016).

Despite the broad coverage of the topic in the academic literature, little data is available about the relevance of Okun's Law in Kazakhstan. In fact, the developing country has only been mentioned in comparative research by Ball et al. (2019). Conducting more detail-oriented research by including variables other than GDP and unemployment has the potential to introduce an alternative view on the matter. Moreover, the derived results can be further used to formulate efficient monetary policies aimed to stimulate economic growth by alleviating unemployment.

This paper explores the pertinence of Okun's Law in Kazakhstan by using two models to first observe the impact of the unemployment rate on GDP and then estimate the effect of other economic variables. The employed models established that while Okun's coefficient fails to interpret changes in the growth rate, variables such as foreign direct investment influence changes in GDP. The findings showed evidence that the unemployment rate alone is not representative of GDP in Kazakhstan and multiple macroeconomic variables should be considered.

Literature Review

Various research has been conducted around the globe to study the gravity of Okun's Law. Using a co-integration approach, Lal et al. (2010) explored the relationship between GDP and unemployment in Pakistan, India, Bangladesh, Sri Lanka, and China between 1980 and 2006. The developing countries were selected based on common labor conditions and the situation regarding climate, natural resources, and geographical location. In their findings, the authors reveal the Non-Accelerating Inflation Rate of Unemployment (NAIRU) principle to be violated as the natural rate of unemployment becomes ambiguous from frequent vacillations both in employment and inflation rate. This asymmetry can hinder the use of Okun's Law to alleviate unemployment rates through policy-making (Wen & Chen, 2012). Moreover, the research suggests similar results may be found in other developing countries, which in turn add context to the expectations regarding our model. Nevertheless, the difference in the methods applied and variables examined should be taken into consideration.

Another research paper written by Ball, Furceri, Leigh, and Loungani (2019) examines and contrasts how Okun's Law performs in two categories of countries: developing and advanced. To determine whether the country is advanced or not, they referred to the International Monetary Fund's (IMF) WEO categorization. In their work, the authors used 71 countries: 29

advanced and 42 developing (including Kazakhstan). Regarding the data (WEO), its time period is between 1980 and 2015 but for some developing countries it starts later. Based on the data, the authors found that Okun's Coefficient in developed countries is about twice that in developing countries (-0.4 and -0.2, respectively). For example, the coefficient in Kazakhstan is equal to -0.115 whereas in the United States it is equal to -0.426. Therefore, these findings suggest that on average, the unemployment level is less responsive to GDP fluctuation in developing countries than in developed countries.

The tendency of Okun's Law to be inapplicable in developing countries is further discussed by Pehlivanoglu and Tanga (2016) in the framework of testing the correlation in Turkey, Brazil, Russia, India, China, and South Africa within the period between 1990 and 2014. The authors discovered Okun's Law to be inefficient in forecasting unemployment trends based on economic growth in Turkey, South Africa, and Brazil. Similar to Lal et al. (2010), key findings note that, compared to developed states, emerging economies observe dynamic growth and constantly evolving macroeconomic indicators. This means that the relationship between the level of production and unemployment rate cannot be viewed in a vacuum, and other variables influence the latter as well. In our model, explanatory variables, i.e. exchange rate, net migration, foreign investment, etc., are included to investigate this correlation. According to macroeconomic theory, foreign direct investment and employment rate observe a positive correlation with GDP, while the effect of exchange rate remains ambiguous (Abel et al., 2013). For Kazakhstan, an increase in oil prices should have a positive effect due to oil export. Apart from that, being categorized as a developing country, positive net migration is expected to be beneficial for economic growth as well. Based on this knowledge, the models analyze the data and test it against the theory.

Data and Model

The country - Kazakhstan - is chosen for the investigation of real GDP and unemployment rate relationship to test if the Okun's coefficient is efficient for low and low-middle-income countries. The data were taken from stat.gov.kz (The Bureau of National statistics of Kazakhstan Republic), macrotrends.net, statista.net, fred.stlouisfed.org, and from freecurrencyrates.com. The study is composed of 2 models: to examine the relationship of GDP to unemployment, and to study the correlation between GDP and other dependent variables.

The original dataset for unemployment was proposed to be quarterly to study causal and correlation effects between GDP and unemployment. Since the data was limited to the number of observations of 2018 and 2019 years, annual data from 1992 to 2019 were selected for unemployment and other significant variables for the following models. The total number of observations is n = 28.

The second model was proposed since Okun's coefficient may not be a pure estimator of economic growth for developing countries (Pehlivanoglu & Tanga, 2016). From the limited sample of 28 observations, the most significant variables were selected to be included in the second model to examine the correlation between real GDP and variables other than unemployment. For the oil-exporting and low middle-income country, we presume the factors most affecting the real GDP growth are oil price movements, USD/KZT exchange rate, inflation rate, direct foreign investments, net migration, and employment to population ratio. Also, to examine the quadratic effect of change in unemployment on real GDP growth and the interaction effect of inflation rate and change in oil price we included *lunemp2 and linfloilp* variables in our model.

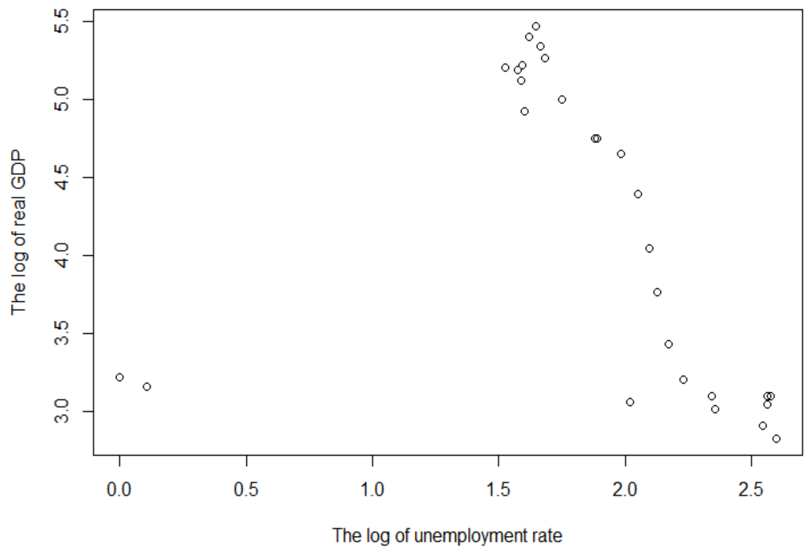
It is important to note that the data is limited to 28 observations, and most variables that were originally proposed to be included in the model have significantly fewer number of observations and were rejected to be provided by The Bureau of National Statistics of Kazakhstan Republic.

The collected data represents dependent random variables that are linked with each other through time series; therefore, we used continuous variables in the log form to approach the stationarity condition as much as possible. Moreover, the Okun's Law relationship implies the use of percentage changes or logarithmic transformations in both dependent and explanatory variables.

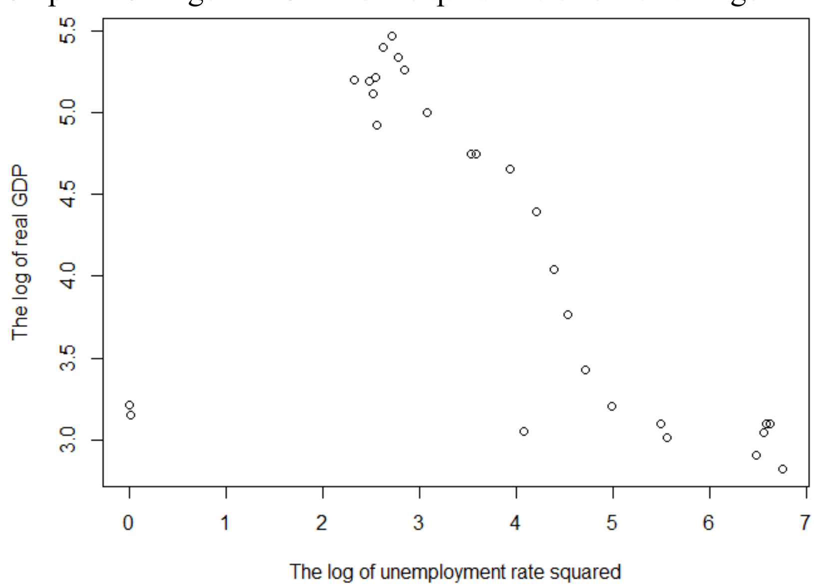
Table1: Classification and description of variables

Dependent Variable		mean	max	min	stdev
lrgdp	real GDP in the log from	4.129	5.467	2.826	0.987
Explanatory Variables		mean	max	min	stdev
lunemp	unemployment rate in the log form	1.870	2.600	0.000	0.626
loilp	oil price in the log form	3.635	4.712	2.448	0.712
lcurr	KZT/USD exchange rate in log form	4.775	5.932	1.554	0.975
linfl	inflation rate in the log form	2.842	7.994	1.633	1.823
linve	foreign investments in the log form	1.140	2.846	-2.303	1.314
migr	net migration per thousand population	-5.186	1.890	-17.868	7.662
lempl	employment to population ratio in the log form	4.179	4.260	4.130	0.034
Quadratic and Interaction effects on variables		mean	max	min	stdev
lunemp2	squared unemployment rate in the log form	3.876	6.759	0.000	1.838
lunemplcurr	The product of unemployment rate in the log form and log of currency rate	9.223	12.817	0.000	2.874

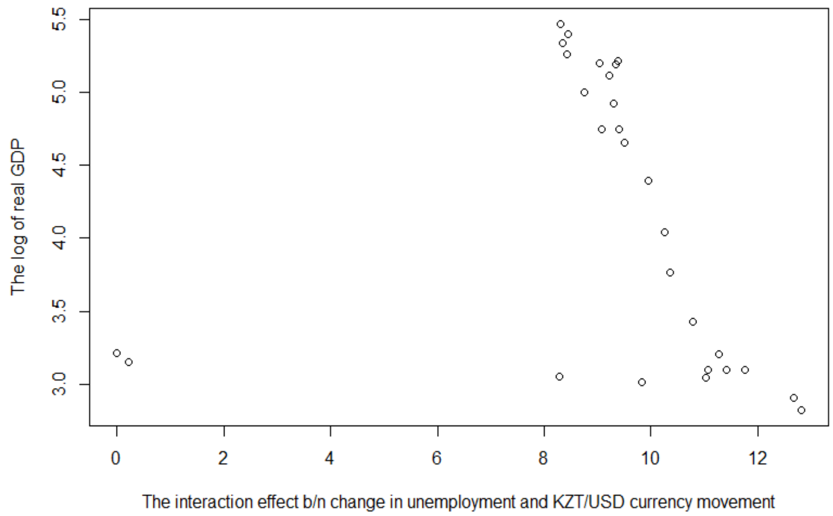
Graph 1. Change in rGDP to change in unemployment rate



Graph 2. Change in rGDP to the quadratic effect of change in unemployment rate



Graph 3. Change in rGDP to the interaction effect of changes in unemployment rate and USD/KZT currency rate



The Ordinary Least Squares(OLS) regression model is used in this research to study Okun's coefficient in the Kazakhstan economy and examine the factors affecting the change in real GDP. The following equations represent two models, where the real GDP is dependent variable:

Model 1:

$\widehat{lrgdp} = \beta_0 + \beta_1 lunemp + \varepsilon$

Model 2:

$\widehat{lrgdp} = \beta_0 + \beta_1 lunemp + \beta_2 loilp + \beta_3 lcurr + \beta_4 linfl + \beta_5 linve + \beta_6 migr + \beta_7 lempl + \varepsilon$

Model 2(quadratic and interaction effects included):

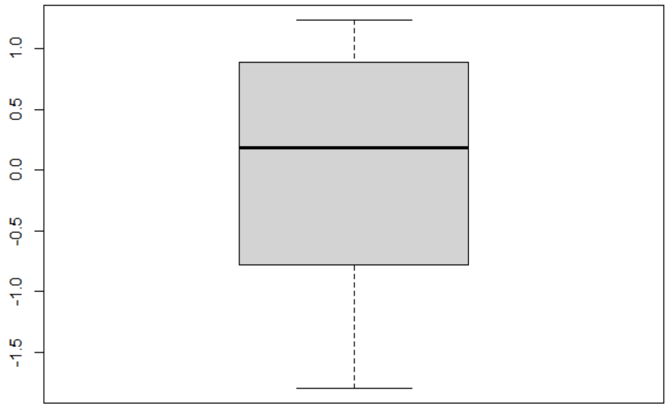
$\widehat{lrgdp} = \beta_0 + \beta_1 lunemp + \beta_2 loilp + \beta_3 lcurr + \beta_4 linfl + \beta_5 linve + \beta_6 migr + \beta_7 lempl + \beta_8 lunemp2 + \beta_9 lunemplcurr + \varepsilon$

Pre-tests

Part 1: Regression on Unemployment

First, we run the bivariate test on unemployment to study Okun's coefficient. Since we have only one explanatory variable, we didn't need to check for multicollinearity. However, we had to verify if no outliers were present in the model. The boxplot of residuals for a simple regression model under Figure 1. Thus, for the robustness of results, no outliers condition is established.

Figure 1. Boxplot of residuals for simple regression model



Next, we had a problem of dependent variables and heteroscedasticity between observations. The explanatory variable unemployment represents dependent random variables that are linked through each by time series that violates assumptions 1 and 4 for Simple Linear Regression(SLR) model. Thus, we used the unemployment rate in logarithmic form and presume that there might be the effects of heteroscedasticity in the result.

Finally, we expect SLR assumptions 1 through 4 to be partially held in our regression model. SLR.1 and SLR.4 are concerned by the nature of time series; SLR.2 and SLR.3 hold by the assumption that the logarithmic transformation of the dataset is normally distributed. It is important to note that despite numbers of observations being fewer to completely satisfy the Central Limit Theorem (CLT), we will use z-test normal distribution in our hypothesis tests.

To study the Okun's coefficient on unemployment and verify its significance, the following hypothesis test is formulated:

null hypothesis: H_o: $\beta_1=0$ vs alternative hypothesis: H_1: $\beta_1\neq 0$

where β_1 represents the best linear predictor (BLP) on *lunemp.*

Part 2: Regression on the whole sample

As the Okun's coefficient is established, we need to run the preliminary test on the whole sample including the rest of the considered variables. The Table 3 contains more detailed information regarding the correlation coefficients between variables of the correlation matrix. As it was expected, the highest correlation was detected between *lunemp* and *lempl* variables, which is -0.935. Thus, to avoid multicollinearity problem and satisfy assumption 3 on multivariate linear regression(MLR) we excluded *lempl* explanatory variable from our model. Also, for the robustness of results, all the outliers were excluded from the regression and the residuals boxplot were built. See residuals boxplot for multiple regression model under Figure 2.

Moving further, as in model 1, we have the problem of heteroscedasticity and not iid sample dataset. Though the heteroskedasticity between observations will present, we transformed all the variables into the log form except net migration, which is already a difference between i+1 and i observations, to minimize the heteroskedasticity between explanatory variables and reach the normality between observations.

Moreover, to verify multivariate normality assumption the residuals to fitted values plot was drawn. From Figure 2, it can be revealed that residuals are symmetrically distributed across the fitted value plot.

Finally, we expect the MLR assumption to be held. MLR.1 is held by the normality of logarithmic transformation of the dataset. MLR.2 is held by the symmetrically distributed residuals; MLR.3 is held by the no multicollinearity condition that was discussed earlier; MLR.4 we propose that heteroscedasticity is present across explanatory variables by the nature of time series. Therefore, the regression will be run under heteroscedasticity-consistent standard errors using the "Fit1" function in R-studio.

Unlike part 1, to verify significant variables that are affecting *lrgdp*, we will formulate two hypothesis tests: inference on coefficients and global significance hypothesis test.
Inference on coefficients:

null hypothesis: H_o: $\beta_i=0$ vs alternative hypothesis: H_1: $\beta_i\neq 0$,

for i=1,2,...,7 where β_i represents the best linear predictor (BLP) on *lunemp, loilp, lcurr, linfl, linve, migr, lempl* (respectively).
Global significance hypothesis test:

null hypothesis: H_0: $Hs\beta=0$ vs alternative hypothesis: H_1: $Hs\beta\neq 0$

where Hs is a matrix of k*(k+1), k= number of explanatory variables, and β is a vector of coefficients.

Figure 2 .Residuals vs Fitted model for the whole sample

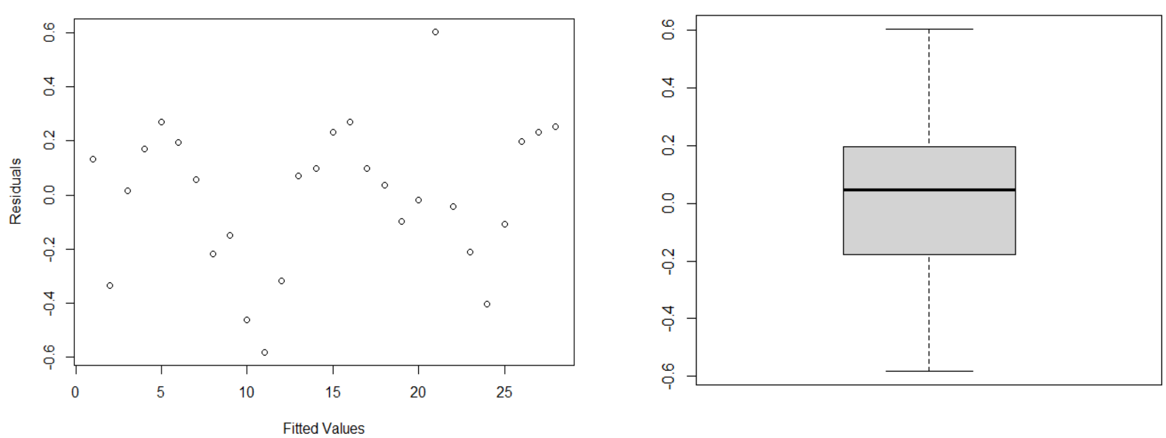


Table 3. Correlation matrix for the whole sample

	lunemp	lempl	linfl	linve	lcurr	migr	loilp
lunemp	1.00000000	-0.935376235	-0.5382818	0.146986665	0.4959127	-0.03905158	-0.1277925
lempl	-0.93537623	1.000000000	0.5325256	-0.009247684	-0.4063192	0.07772129	0.1843123
linfl	-0.53828182	0.532525610	1.0000000	-0.578326242	-0.8577120	-0.71372218	-0.4617150
linve	0.14698667	-0.009247684	-0.5783262	1.000000000	0.5260082	0.71375519	0.5452696
lcurr	0.49591273	-0.406319168	-0.8577120	0.526008214	1.0000000	0.68004894	0.4927335
migr	-0.03905158	0.077721287	-0.7137222	0.713755193	0.6800489	1.00000000	0.7573062
loilp	-0.12779254	0.184312290	-0.4617150	0.545269634	0.4927335	0.75730617	1.0000000

Table 4. Correlation matrix for the whole sample including the quadratic and interaction effects

	lunemp	lempl	linfl	linve	lcurr	migr	loilp	lunemp2	lunemlcurr
lunemp	1.00000000	-0.935376235	-0.5382818	0.146986665	0.4959127	-0.03905158	-0.12779254	0.94604327	0.95143704
lempl	-0.93537623	1.000000000	0.5325256	-0.009247684	-0.4063192	0.07772129	0.18431229	-0.94186034	-0.90672648
linfl	-0.53828182	0.532525610	1.0000000	-0.578326242	-0.8577120	-0.71372218	-0.46171497	-0.33034470	-0.72192321
linve	0.14698667	-0.009247684	-0.5783262	1.000000000	0.5260082	0.71375519	0.54526963	-0.07441944	0.25002932
lcurr	0.49591273	-0.406319168	-0.8577120	0.526008214	1.0000000	0.68004894	0.49273352	0.22715256	0.71131726
migr	-0.03905158	0.077721287	-0.7137222	0.713755193	0.6800489	1.00000000	0.75730617	-0.30887291	0.18854850
loilp	-0.12779254	0.184312290	-0.4617150	0.545269634	0.4927335	0.75730617	1.00000000	-0.34938845	0.03658914
lunemp2	0.94604327	-0.941860343	-0.3303447	-0.074419440	0.2271526	-0.30887291	-0.34938845	1.00000000	0.84073587
lunemlcurr	0.95143704	-0.906726478	-0.7219232	0.250029322	0.7113173	0.18854850	0.03658914	0.84073587	1.00000000

Results and Inference

Part 1: Regression on Unemployment

The simple linear regression model on unemployment was run using the “Fit1” function in R-Studio under heteroscedasticity-consistent standard error. The conducted research and analysis reveal regression results of our first model under Table 4.

Table 4. Summary of regression model for unemployment

	beta_hat	StdError	t-stat	P-value
Intercept	4.9978917	0.9537402	5.240307	0.0000001603095
lunemp	-0.4646851	0.4622813	-1.005200	0.3148005464532

R-squared = 0.087

Simple linear regression for Model 1:

$\widehat{lrgdp}$= *4.9978917 - 0.4646851 * lunemp + ε*

To begin with, the R-squared shows that the model explains 8.7% of the real GDP change in Kazakhstan. The only explanatory variable unemployment is in the log form, thus we consider the change in real GDP as a percentage change in unemployment.

From the table above, we can see that the coefficient on change in unemployment, that is the logarithm of unemployment (*lunemp*) is negative and between 0 and -1. Looking at the t-statistics and p-value that are -1.0052 and 0.3148 respectively, the effect of change in unemployment on the real GDP growth rate is insignificant; and thus, we fail to reject the null hypothesis H0:$\beta 1=0$, though the negative sign of $\beta 1$ confirms the theory that an increase of unemployment has a negative effect on real GDP growth.

Part 2: Regression on the whole sample

The second part of our study entails the multiple linear regression(MLR) model on the whole sample. As a simple linear regression(SLR) model from part 1, the MLR model was built under heteroscedasticity-consistent standard error using the "Fit1" function in R-Studio. Highly correlated variables were excluded from the model for the robustness of regression. The regression results are shown in Table 5.

Table 5. Summary of regression model for the whole sample

	beta_hat	StdError	t-stat	P-value
Intercept	2.192781467	1.57873990	1.3889441	0.164849749658
lunemp	-1.018690990	0.21330952	-4.7756471	0.000001791303
linfl	-0.090559317	0.08806254	-1.0283523	0.303784152011
linve	0.188805282	0.08600159	2.1953696	0.028137096861
lcurr	0.522049824	0.10869478	4.8028969	0.000001563864
migr	-0.008595707	0.02823212	-0.3044656	0.760773228573
loilp	0.370336273	0.30641027	1.2086288	0.226805490153

R-squared = 0.866 WaldG = 780.0059 p-value ≈ 0

Multiple linear regression for Model 2**:**

$\widehat{lrgdp}$ = 2.192781467 - 1.018690990 * *lunemp* + 0.370336273 * *loilp* + 0.522049824 * *lcurr* - 0.090559317 * *linfl* + 0.188805282 * *linve* - 0.008595707 * *migr* + ε

Compared to the first model, the R-squared of MLR is greater and explains slightly more than 86% of the change in real GDP in Kazakhstan. Since all the variables listed in the model are in the logarithmic form except net migration(*migr*), the table above includes real GDP's percentage change caused by the change in the above-listed variables.

It can be noted that the WaldG statistics is 780.006, which is much greater than the F-statistics for 1% and 5% significance levels; thus, the corresponding p-value is about 0, and the null hypothesis for global significance test: H0:Hsβ=0 is rejected.

However, considering the inference on coefficients, we can see the difference in p-values among explanatory variables. The p-values for both *lunemp* and *lcurr* explanatory variables are about 0.000 and thus are statistically significant. The estimated coefficients on these variables are -1.018 and 0.522 respectively that confirms the relationship between the unemployment rate and currency rate to real GDP stated by the macroeconomic theory.

The p-values for variables *linfl*, *migr* and *loilp* are 0.304, 0.761, and 0.227 respectively. The p-values for the following variables are above 20% significance level, and thus are statistically insignificant for estimating the change in real GDP. Also, the estimated coefficients on inflation and migration are about 0, which is inconsistent with the theory that witnesses a positive relationship between real GDP and inflation, and a negative between real GDP and migration.

Lastly, the p-value for *linve* explanatory variable is 0.0281, that is, it is statistically significant at 5% significance level and insignificant at 1% significance level. The coefficient is positively signed which is consistent with the theory that implies a strong correlation between foreign direct investment and real GDP growth.

To sum up, the multiple regression model for the whole sample is statistically significant in the context of a global significance test with a p-value of about 0. In terms of inference on coefficients, we rejected the null hypothesis for the estimated coefficients on *lunemp* and *lcurr* at 1% significance level and rejected the null hypothesis for the estimated coefficient on *linve* at 5% significance level.

Considering the quadratic and interaction effects on change on rGDP, the model 2 was repeatedly run including 2 additional variables under heteroscedasticity-consistent standard error using the"Fit1" function. The regression results on model 2 including the interaction and quadratic effects are under Table 6, Table7 and Table8.

Table 6. Summary of regression model for the whole sample including both quadratic and interaction effects on variables

	beta_hat	StdError	t-stat	P-value
Intercept	3.51430866	1.31982351	2.6627111	0.00775139412
lunemp	2.70115026	0.70926266	3.8083921	0.00013987338
linfl	-0.34769190	0.08914998	-3.9000783	0.00009616157
linve	0.05236504	0.04408170	1.1879088	0.23486934590
lcurr	0.61502855	0.58119668	1.0582107	0.28995938838
migr	-0.03289184	0.03492769	-0.9417125	0.34633987460
loilp	0.25376339	0.15511192	1.6360019	0.10183919720
lunemp2	-0.64703586	0.59645280	-1.0848065	0.27800737386
luneml curr	-0.54552131	0.36360221	-1.5003245	0.13353035681

R-squared = 0.955 WaldG = 1764.735 p-value ≈ 0

Table7. Summary of regression model for the whole sample including quadratic effect

	beta_hat	StdError	t-stat	P-value
Intercept	4.91368622	1.08929819	4.510873	0.0000064561242528
lunemp	3.22300873	0.67720381	4.759289	0.0000019427596047
linfl	-0.44894768	0.07133173	-6.293800	0.0000000003097864
linve	0.07935949	0.04445185	1.785291	0.0742141292663945
lcurr	-0.25075217	0.13154966	-1.906141	0.0566319540203619
migr	-0.08206935	0.01791195	-4.581820	0.0000046094690511
loilp	0.28370430	0.16057008	1.766857	0.0772522568045095
lunemp2	-1.51896922	0.24641659	-6.164233	0.0000000007082570

R-squared = 0.951 WaldG = 874.802 p-value ≈ 0

Table 8. Summary of regression model for the whole sample including interaction effect

	beta_hat	StdError	t-stat	P-value
Intercept	2.461025016	0.86973422	2.8296288	4.660204e-03
lunemp	2.139112416	0.48974490	4.3678095	1.254989e-05
linfl	-0.263008068	0.03731164	-7.0489550	1.802558e-12
linve	0.040539660	0.05007494	0.8095798	4.181817e-01
lcurr	1.218927060	0.14610553	8.3427852	0.000000e+00
migr	0.002961636	0.02012107	0.1471908	8.829814e-01
loilp	0.238824234	0.15896494	1.5023705	1.330015e-01
lunemlcurr	-0.900494744	0.13911464	-6.4730409	9.605006e-11

R-squared = 0.953 WaldG = 4003.592 p-value ≈ 0

To begin with, the R-squared value in all three cases is above 95% compared to the 86.6% of MLR model mentioned earlier. We may assume that interaction and quadratic effects on variables have positive effects on the robustness of the linear regression, however we observe the variation of p-values depending on whether the quadratic and interaction effects were implemented in the model jointly or separately.

The p-values for *lunemp2* and *lunemlcurr* for the case of joint inclusion of effects in the model are 0.278 and 0.133, respectively, while the p-values for separately included effects are 0.000. Comparing the 2 types of inclusions with each other and with the original model of MLR for the whole sample, the separate usage of interaction and quadratic effects can be considered as a strong tool to acquire a linear regression model with high R-squared value and statistically significant variables.

Conclusions

The paper tested the relevance of Okun's Law in Kazakhstan and established the relationship between rGDP growth rate and significant macroeconomic factors proposed earlier by using two models. The first was set to analyze the relationship between rGDP and unemployment rate while the second model examined the correlation between rGDP and other variables that might affect economic growth. As for hypotheses, we failed to establish a statistical significance of Okun's coefficient for the Kazakhstani economy in the first model, though the results in the second model established the statistical significance for *lunemp*, *lcurr* and *linve* variables and supported the relationship stated by the macroeconomic theory. Possible explanations for the unsupported hypothesis may arise due to heteroscedasticity between observations mentioned in the preceding sections. Also, it is significant to note that the deviations in the result might be caused by the outlying observations shown in Graph 1 but not revealed in the boxplot of residuals in Figure 1.

This research also contributes to the study of significant factors affecting the change in rGDP by analyzing the quadratic and interaction effects among variables. Thus, it may offer new perspectives for building the multiple regression models for developing and oil-exporting economies, Kazakhstan in particular.

The models proposed to study factors affecting rGDP growth have the following limitations. Firstly, the data has a limited number of observations. The significant values for hypothesis tests were calculated by the assumption that the logarithm transformation of the sample random variables are iid and converges in distribution to standard normal distribution (CLT). Secondly, though all the calculations were done under the heteroscedasticity-consistent standard errors to deal with heteroskedasticity between variables, the proposed model does not deal with the heteroscedasticity b/n observations that are present by the nature time series. Therefore, further research is needed to deal with the shortage of datasets and heteroscedasticity among observations.

References:

Abel, A., Bernarke, B., & Croushore, D. (2013). *Macroeconomics* (8th ed., pp. 42-425). Pearson.

Ball, L., Furceri, D., Leigh, D., & Loungani, P. (2019). Does One Law Fit All? Cross-Country Evidence on Okun's Law. *Open Economies Review, 30*(5), 841-874. https://doi.org/10.1007/s11079-019-09549-3

Lal, I., Muhammad, S., Jalil, M., & Hussain, A. (2010). Test of Okun's Law in Some Asian Countries: Co-Integration Approach. *European Journal Of Scientific Research, 40*(1), 73-80. https://doi.org/10.2139/ssrn.1562602

Pehlivanoglu, F., & Tanga, M. (2016). An Analysis on the Validity of Okun's Law: Case of Turkey and BRICS. *International Journal Of Economic Studies, 2*(3), 31-44. Retrieved 1 May 2021, from https://dergipark.org.tr/en/pub/ead/issue/48239/610671.

Wen, Y., & Chen, M. (2012). Okun's Law: A Meaningful Guide for Monetary Policy?. *Economic Synopses*, *2012*(15). https://doi.org/10.20955/es.2012.15