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**REVIEW ARTICLE**

# THE CORRELATION BETWEEN REAL GROWTH DOMESTIC PRODUCT AND UNEMPLOYMENT IN ETHIOPIA

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**ABSTRACT**

Okun found that amid the period 1947-1957 remained a reverse correlation between economic progressas well as unemployment within US. Okun assessed that a 3 per cent increment in genuine GNP would lead to a one per cent diminish within the unemployment rate. Here the impartial think about stands to see the link of economic growth and joblessness rate from 1984-2019. The strategy which connected on this ponder is amended Dickey-Fuller test and auto-regressive distributed lag model. The consider result inferred, there's critical positive short run relationship between economic growth and joblessness in Ethiopia; in lengthy it is unswerving but immaterial. The researcher prescribes that the government ought to increment economic growth which basically to capture more unemployment rate, this moreover offer assistance the government to dodge a positive relationship between those two variables.



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## INTRODUCTION

The connection amidjoblessnessas well as output growth was first noticed and described by (Okun, 1962) and then a law was a common tool for policymakers. It has always been debated but after the great recession a serious reconsideration was triggered when using Okun's law and measured data due to large discrepancies between predicted changes in unemployment. In the new circumstances, the question arose whether or not this scientific rule of thumb was still valid. Countries generally follow fiscal policies to stimulate output growth plus reduce the idleness rate. For this reason every country wants positive economic growth. Ethiopia has experienced rapid and sustained economic growth for over a decade now, with growth rates exceeding global levels, since the mid-2000s onward. It has developed into one of the world's fastest growing countries. It contributes, therefore, in addition to economic theory and other studies, to the researcher's eagerness to examine its relationship with unemployment, which is included as dependent variable in this analysis. Negative sign would be considered to be the coefficient of this variable. In addition, many conclude that the information proved acceptable to some degree through Okun's law.

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As well, certain outcomes ensure the law of Okun has a tendency to have greater accuracy for short-run prospects, instead of long-run. Predictors ensure that this is factual because of unpredicted situations which can disturb Okun's coefficient (Abu, 2016). In isolation, Okun's rule is mostly suitable to prognosticators by way of a method for short-run movement analysis concerning joblessness and output growth, instead of actuality for long-run inquiry and precise numerical estimates. Some literatures suggest Okun's liaison is objectively unwavering in the long run; on the other hand the relationship can vary noticeably in the short run, depending on the country. Consequently, quite a few economists note that the law of Okun is not suitably applicable to each region. The Okunpercentage is likely differ from residence to residence, the same economic policies do not operate universally and they must be balanced with the policies of the specific area to achieve the preferred marks (Irfan, Sulaiman, Jalil, & Hussain, 2010). All long-term and short-term findings, according to (Hamza & Kaushik, 2015), indicate that unemployment has a negative impact on economic growth. The relationship between economic growth and the annual unemployment rate varies among countries, the Okun coefficients are thought to be unpredictable and change over time. Such disparities largely owing to a higher increase in technological setup and innovation, the replacement rate, labor market policy and structural change, tax tools available to the government,

international antagonism, labor law and strategy. For this reason, this paper, motivated primarily by the theoretical as well as empirical departures, adds to ward present macroeconomic literature through observing the cogency of Okun's rule in Ethiopia grounded on figures commencing yearly time series.

**Significance of the study:** The value of Okun's rule is created for economic policy; the aforementioned can be thriving intricate. The bond amid output progress and idleness is of countless importance for economists on behalf of the sustainable improvement of living standards. After output is greater than its natural level, politicians will agree that they will not help the intensively creating new jobs with a view to sustaining a maintainable progress that motivation not causes price rises. Okunlaw helps policymakers create new work ideas in order to boost a country's living standards; policymakers generate new ideas in order to achieve the GDP growth rate. The paper allows the understanding of joblessness besides the impact on nationwide performance, this one helps us to evaluate and quantify economic series. In addition, it will give us a hand in managing the eccentricity in output growth and mounting unemployment, igniting production development.

**Theoretical and Empirical Literature Review:** Okun (1962)is analyzed the relationship in the United States of the post-war years between employment rate and economic growth. He revealed, in his prediction, that a 3 percent upsurge in output growth was correlated with a one percentage point reduction in unemployment rate. Essentially, the Okun's law states that the unemployment rate remains unchanged if GDP grows rapidly, whether growth is very small, or negative. This is commonly called the law of Okun, and is peculiar in that it is mathematical and not just economic theory. A comprehensive series of works stress the connection between variations in idleness and progress in a nation's production. Nonetheless (Hassan & Qusayfalah, 2016), among others contend this correlation not constantlygripsince production progress happens in double diverse means.

The main method stems from the growing efficiency of labor, which does not prime to ward work formation. Another technique is through swelling the amount of manual labor which can clue to employment progress, therefore dropping the unemployment. In light of these two means of creating output progress, more than a few economists have been investigative the decisiveness of the correlation amid production growth and unemployment. A work which is conducted by (Ting & Ling, 2011) looked at the Malaysian economy's relationship with Okun. The ARDL approach was used and the authors found the coefficient of -1.8 per cent of an Okun at 1 per cent significance level. Stephan (2012) like wise establishes confirmation in Britain and France about Okun's relationship. Conversely, for the period 1980-2006, (Lal, Sulaiman, Anwer, & Adnan, 2010) examined the relationship of Okun in Asian countries. The research used a co-integration methodology from Engle-Granger to investigate the long-term relationship between production growth and unemployment, and a short-run dynamic correction method for errors. The results propose that the Okun law is not applicable to completely Asian nations. Additionally, (Arewa & Nwakanma, 2012)apply the approaches of change and gap to check the applicability of Okun's correlation in Nigeria for the dated 1981 to 2011. No confirmation was established to support the inverse output-to-unemployment correlation.

## METHODOLOGY

***Source of Data and Type:*** This work uses secondary source for all variables under consideration from 1984 to 2019, which is for about 36 years. The information was sourced from World Development Indicators as well as annual report and published studies. The data from WDI can be reliable because many studies have employed the data published by this institution. Moreover, the researcher used the same data source for consistence purpose. For completion of data, the researcher benefited from e-views-v-10.0 econometric software package for running of this study.

***Model Specification based on theory***

**The Harrod-Domar**, concluded:-The sum of labor and capital depends on economic growth. Adam Smith only understood three development factors: property, labor, and capital.

**Davide Ricardo: -** output is a function of capital, land, labor force and technical know-how. Solow and Swan model: -theyfocus on a closed economy where production is generated by labor and capital factors.

**The growth version of Okun's law: -**Increases in output have to lead to a drop in the unemployment rate, and a drop in output is related with expand in the unemployment rate.

By using above theory as an initial; with a minor change the model's functional form is as follows:

$$RGDP_t = f(UNR_t) \quad (1)$$

Where UNR is the rate of unemployment, f is the function of real Gross Domestic Product (RGDP).

Mathematical Model form:-

$$RGDP_t = \beta_0 + \beta_1 UNR_t \quad (2)$$

t = time period (1984-2019),

The model's econometric form is defined below: Therefore, a model with an error term is preferred to a model with no error term.

$$RGDP_t = \beta_0 + \beta_1 UNR_t + e \quad (3)$$

Where: - e is stochastic disturbance term, $\beta_0$is the intercept term, and $\beta_1$ is an approximation of parameter representing the UNRt coefficient. Not all is controllable; the model has made from various sources to consider the effect of other shocks (the terms of the error).Hence, based on the basic econometric model, which is considers the importance of other stochastic factors adopted in the present study. The a priori expectation is determined by economic theory principles. Log transformation lessens the hetroscedasticity hassle when you consider that it compresses the scale of size of variables (Gujarati, 2004).

$$RGDP_t = \beta_0 UNR_t^{\beta_1} e^{\mu t} \quad (4)$$

The models ' linear log forms may be described as:

$$LnRGDP_t = \beta_0 + \beta_1 LnUNR_t + \mu_t \quad (5)$$

$Ln$ Signifies the logarithmic expressions of $UNR_t$ and $RGDP_t$, $\mu_t$ is the error term, and the parameters $\beta_1$ is the long run elasticity's of the independent variables; and the constant term $\beta_0$, is a value that the dependent variable assumes when values of all the independent variables are zero or near zero. Moreover, some observations of economic growth are negative, therefore to change them to logarithmic form, this study was applied the following equation (Mathias & Carsten, 2007) .

$$y = \ln(x + \sqrt{x^2 + 1}) \quad (5)$$

***Stationary:*** In stationary time series shockwaves will be impermanent and over time their consequence will be removed as the series return to their long run mean values (Bekhet & Al-Smadi, 2015). It has three things.

$$1.\ E(Y_t) = E(Y_{t-s}) = \mu \quad (6a)$$

$$2.\ E[(Y_t - \mu)]^2 = E[(Y_{t-s} - \mu)]^2 = \delta^2 \quad (6b)$$

$$3.\ Cov(Y_t, Y_{t-s}) = Cov(Y_{t-j}, Y_{t-j-s}): E[(Y_t - \mu)(Y_{t-s} - \mu)] = E[(Y_{t-j-s} - \mu) = \gamma \quad (6c)$$

It must be said that all $\mu, \delta^2, \gamma$ have to be constant. However, if $\mu, \delta^2, \gamma$ are not constant over time, the variable will not be static. The tricky using non-stationary variables are spurious regression. Uncertainty the time series facts has constant mean, variance & covariance then it is supposed to be stationary. It is very vital to mark unquestionable data is stationary if not it will provide spurious outcomes. Mean and variance of non-stationary time series data is not constant and hinge on time. Non stationary time series will give spurious outcomes that means signs of coefficient are not consistent. As a result, the researcher solves this problem by transforming non-stationary variables to stationary variables. There are many tests for unit roots that are more powerful than ADF test statistic. These tests are Kwiatkowski-Phillips-Schmidt-Shin (KPSS), Ng-Perron (NP), KPSS and NP test statistics require more data. It is for this reason that this study was applying ADF test statistic. Augmented Dicky-Fuller (ADF) test is castoff to understand the stationary of all variable, and it is also apply for order of integration. According to (Dickey & Fuller, 1979)propose the Augmented Dickey-Fuller (ADF) test. Three different regression equations are used to test for the presence of a unit root with the ADF test.

•Without drift and trend

$$\Delta X_t = \gamma X_{t-1} + \sum_{i=1}^{p} \beta_i \Delta X + e_t \quad (7a)$$

•With intercept

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \sum_{i=1}^{p} \beta_i \Delta X + e_t \quad (7b)$$

•With drift and trend

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \theta T + \sum_{i=1}^{p} \beta_i \Delta X_{t-i} + e_t \quad (7c)$$

Where, $\Delta$ is difference operator, $\alpha_0$ is drift term, P is the lag order of the auto-regressive process, T = trend term/trend variable, t = time subscribe, $\beta_i$ = is a measure of lag length, $\gamma = \delta - 1$ , the coefficient of $X_{t-1}$which measures the unit root, e = the error term / is the white noise, $\theta$ = the coefficient on a time trend series, $\Delta X_t = X_t - X_{t-1}$, are first difference of$X_t$, $X_{t-1}$ = Are lagged values of order one of $X_t$, $\Delta X_{t-i}$= are changes in lagged values, $\Delta X_{t-1} = X_{t-1} - X_{t-2}$, $\Delta X_{t-2} = X_{t-2} - X_{t-3}$, the null and alternative hypotheses can be written as follows:

$H_o$: $\gamma = 0$, has unit root problem.
$H_a$: $\gamma < 0$, has not unit root problem.

Based on the above ADF unit toot test here the researcher use the following format for ( $LnRDGP_t$) and ( $LnUNR_t$ in order to test the null hypothesis that the coefficient of lagged $LnRDGP_t$ is zero which means that there is a unit root. The alternate hypothesis is that it is less than zero, i.e., there is no unit root.

•No drift and trend

$$\Delta LnRDGP_t = \gamma LnRGDP_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnRGDP_{t-i} + \varepsilon_t \quad (8a)$$

•With intercept but no trend

$$\Delta LnRDGP_t = \alpha_0 + \gamma LnRGDP_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnRGDP_{t-i} + \varepsilon_t \quad (8b)$$

•With intercept and trend

$$\Delta LnRDGP_t = \alpha_0 + \theta T + \gamma LnRGDP_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnRGDP_{t-i} + \varepsilon_t \quad (8c)$$

*ADF test for ( $LnUNR_t$), to test the null hypothesis:-*

•Without drift and trend

$$\Delta LnUNR_t = \gamma LnUNR_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnUNR_{t-i} + \varepsilon_t \quad (9a)$$

•With intercept but not trend

$$\Delta LnUNR_t = \alpha_0 + \gamma LnUNR_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnUNR_{t-i} + \varepsilon_t \quad (9b)$$

•With drift and trend

$$\Delta LnUNR_t = \alpha_0 + \theta T + \gamma LnUNR_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LnUNR_{t-i} + \varepsilon_t \quad (9c)$$

Then, if t-statistics is greater than ADF critical value, then null hypothesis will reject. It depicts that series is stationary. If t-statistics less than ADF critical value, then null hypothesis will not reject. It indicates that series is non- stationary. The unit root tests on the unemployment, real gross domestic product, are performed including the three common options.

***The Autoregressive Distributed Lag Model:*** ARDL bounds test is relatively more efficient in small sample data sizes as is the case in this study. This approach provides unbiased estimates of the long-run model.

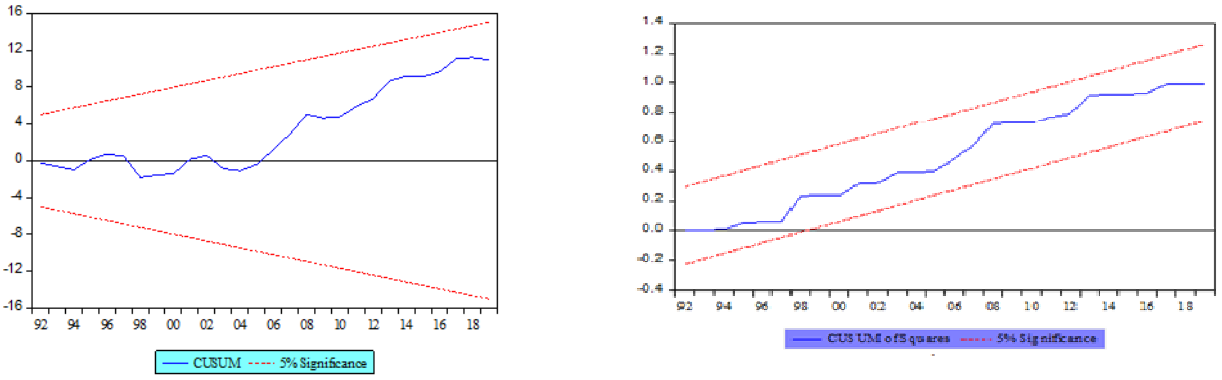
**Table 1. Testing to Co integration Results**

| *f-statistic* | | | *inference* | | |
|---|---|---|---|---|---|
| *16.95487** | | | *yes* | | |
| *Critical value bounds of the F-statistic unrestricted intercept and no trend* | | | | | |
| | | | *F-statistic* | | |
| K=1 | Sign-level | 99% | | 95% | |
| | | I(0) | I(1) | I(0) | I(1) |
| | | 6.84 | 7.84 | 4.94 | 5.73 |

**Table 2. Diagnostic Test**

| *Diagnostic Test* | *F- Statistics/ LM F-statistic* | *P-value* |
|---|---|---|
| *(Breusch–Pagan test statistics)* | *0.962473* | *0.4574* |
| *Breusch-Godfrey Serial Correlation LM Test)* | *0.3840* | *0.2992* |
| *Ramsey's RESET Test* | *2.184374* | *0.1328* |

*Source: e-views-v-10*




Source: e-viwes-v-10

**Figure 1. CUSUM and CUSUM square**

The Wald test or F-statistic in ARDL bounds test approach is used to test the existence of long-run relationship. To decide whether the variables have co-integration or no co-integration or inconclusive, researcher have to compare the calculate F-statistics (Wald test) value with critical values reported in the paper of (Omaniyi & Olawal, 2015). Where, $Y_t'$ is a vector, $(X_t')'$ are allowed purely $I(0)\ or\ I\ (1)\ or\ cointegrated$; $\delta$ and $\beta$ are coefficients; $\gamma$ is the constant; $i = 1, \ldots\ldots, K; p$ ;is optimal lag order used for dependent variables; $q$ is optimal lag orders used for independent variable; $\varepsilon_{ti}$ is a vector of error terms- unobservable zero mean white noise vector process. Following is the bound test co-integrations models. So, the model can be framed as an equation.

The common method of ARDL (p, q) is such as:

$$Y_t' = \gamma_{0i} + \sum_{i=1}^{p} \gamma_i\, Y_{t-i} + \sum_{j=0}^{q} \partial_i' X_{t-i} + \varepsilon_{ti} \quad (10)$$

Then based on the general form, the researcher develops the following equation for the targeted variables.

$$D(Ln(RGDP_t)) = \beta_1 + \alpha_{11} Ln(RGDP_{t-1}) + \alpha_{21} Ln(UNR_{t-1}) + \sum_{i=1}^{p} \theta_{1i}\, D(Ln(RGDP_{t-i})) + \sum_{i=1}^{q} \theta_{2i}\, D\big(Ln(UNR_{t-i})\big) + \varepsilon_{1i} \quad (11)$$

Where, 'D' is difference operator; $\beta_j (j = 1,2)$ denotes intercept; $p$ ;is optimal lag order used for dependent variables; $q$ is the maximum lag length for independent variable; $i$ lags number; $\theta_{jk}\,(j,k = 1,2)$ denotes the short run coefficients of the variables; $\alpha_{jk}\,(j,k = 1,2)$; denotes the long run coefficients of the variables; and $\varepsilon_{jt} (j = 1,2)$ presents the serial independent random error with mean zero a finite covariance matrix. The null hypothesis of co-integration states that there is no co-integration against the alternative hypothesis of there exist co-integration between variables.If there is an evidence of long-run relationship of the variables, the following long-run ARDL ($q, p$) model was estimated (Abdulbaset, Veronika, Vladmir, & Denis, 2013) .

$$D\big(Ln\,(RGDP_t)\big) = \beta_1 + \sum_{i=1}^{p} \theta_{1i}\, (Ln(RGDP_{t-i})) + \sum_{i=1}^{q} \theta_{2i}\, \big(Ln(UNR_{t-i})\big) + \varepsilon_{ti} \quad (12)$$

All variables are as previously defined. The researcher uses error correction model to attain the short-run dynamic coefficients and estimate the adjustment speed related with the short-run estimations. The adjustment speed displays the adjustment speed from the short-run to the long-run stability among variables (Bekhet & Al-Smadi, 2015).

$$\Delta Y_t = a_0 + b_1 \Delta X_t - \lambda \mu_{t-1} + \varepsilon_t \quad (13)$$

$b_1$= impact multiplier, $\lambda$= adjustment effect. Impact multiplier measures the instant impact that change in $X_t$ will have on change in $Y_t$ and adjustment result shows how much of imbalance is being amended.

$$\mu_{t-1} = Y_{t-1} - \beta_1 - \beta_2 X_{t-1} \quad (14)$$

On equation (14), $\beta_2$ present long run response.

$$D\big(Ln\,(RDGP_t)\big) = \theta_0 + \sum_{i=1}^{p} \theta_{1i}\, D(Ln(RGDP_{t-i})) + \sum_{i=1}^{q} \theta_{2i}\, D\big(Ln(UNR_{t-i})\big) + \Omega ECM_{t-1+} \varepsilon_t \quad (15)$$

Then Error correction model ( $ECM_{t-1}$) represents:-

$$ECT_{t-1} = Ln(RGDP_{t-i}) - [\theta_0 + \sum_{i=1}^{q} \theta_{1i}(Ln(RGDP_{t-i})) + \sum_{i=1}^{q} \theta_{2i}(Ln(UNR_{t-i})) \quad (16)$$

**Estimation Results**

***Lag Length Determination:*** The selection of lag order was preparedwith a maximum of 2 lags to badgecorrection in the model and to completewell-acted residuals. Thereafter, ARDL bounds test was performed using maximum 2 lag.

***ADF Unit Root test of variables at level and 1st difference:*** To limit the degree of integration, a unit root test is supported with Augmented Dickey-Fuller (ADF) test. Tests fail to reject the null hypothesis, implying that *LnUNR*is non-stationary at level on the contrary LnRGDP is stationary at level. For that reason, an ARDL procedure of co-integration test can be applied for this study by considering constant term.

***ARDL Bounds Test Result for Co-integration:*** The estimation of equation tests for the existence of a long-run relationship among the variables is by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, that is:-

$$H_0 : \alpha_{1i} = \alpha_{2i} = 0, no\, long\, run\, relation$$

$H_0 : \alpha_{1i} \neq 0,\ and\ \alpha_{2i} \neq 0,$ For $i = 1,2$, there is long run relationship

From the above table, obviously there is a long run relationship between the variables. This imply that the null hypothesis (Ho) of no co-integration between the variables is not accepted.

*Long run Relationship of Variables*

Calculated long-run coefficients by means of the ARDL method;

LnRGDP = 0.010734LnUNR, (P-value= 0.9762)

The above equation proved that unemployment is positively affecting Ethiopia's economic growth but it is insignificant. Conferring toward economic theory gross domestic product is inversly related to unemployment which is logical as rise in GDP will lead to decrease in unemployment. But here the study proved that there is insignificant positive relationship between the dependent and independent variable. It can be understood as, other things being constant; a percentage change in unemployment rate causes the long run economic growth increase by about 1.07% and this is insignificant.

*D(LnRGDP) = 1.985974 + 0.837181* $D(LnUNR_{t-1})$
[0.0154]+1.148124 $D(LnUNR_{t-2})$[0.0022]
*R- squared= 0.6, Ecm(-1) = -0.969258 [0.0000]*
*F-statistic = 21.02168, Pro = 0.000000*

It is inconsistent with the work of (Hamza & Kaushik, 2015) and (Abu, 2016).

***Short Run Relationship of Variables:*** Note: [ ] are the P-values; and D, represents the difference term. 1.985which is recognized as the Ln RGDP intercept, if other things remaining constant. The result of R Squared shows that the variables referred to above have influence, reflected in the form of a percent is 61% and the rest, i.e., 39% comes from other variables outside of the model. Overall, the results show that F-statistic is 21.02 with a probability of 0.000027 demonstrating impact of the regress or variable. At first and second lag of unemployment rate has a positive and significant impact on economic growth in Ethiopia. The results show that increase in the lag one and two of unemployment rate by one percent leads to 83.72% and 114% increase in economic growth respectively.

The economic growth is regarded as a quantitative change occurring in two directions: one associated with an increased labor productivity, which usually does not lead to the creation of additional jobs and the other direction is linked to an increase of jobs, which reduce the unemployment rate according to the nature of the growth achieved. In fact, here growth which is associated with increased productivity cannot lower the high unemployment rates. According to Keynesian economics analysis, in the short run, in particular through declines, output is powerfully swayed by aggregate demand. In the Keynesian view, aggregate demand does not fundamentally equal the productive ability of the economy; in its place, it is subjective by a host of features and occasionally performs irregularly, touching output, employment, and price rises. It is inconsistent with the study of (Arslan & Zaman, 2014)and (Jonatan, Anthony, & Emily, 2015). We have enough confirmation to conclude that there is no heteroscedasticity, autocorrelation, and Ramsey's RESET test problem since probability > 5% suggestion level. the conspired CUMSUM and CUMSUMSQ graphs stay inside the straight lines, the null hypothesis of correct specification of the model can be established.

**Conclusion and recommendation**

ARDL model shows that there is significant positive short run correlationamidreal output growth and job loss. Likewise, study proved positive long run rapport between those two targeted variables but it is insignificant. Moreover, the study passed all diagnostic tests. To this end, a government should increase economic growth more than the rate of unemployment, even if the result is exhibited positive relationship.

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