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Investigating the causal relationship between economic growth, inflation, and unemployment in South Korea

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Abstract

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Policymakers and economists consistently implement monetary and fiscal policy to control economic growth, inflation, and unemployment due to the fact that these three factors directly influence people's living standards. Every country has a different economic characteristic structure. Economic growth and inflation have a strong correlation in some countries, while other countries have a strong correlation between economic growth and unemployment. Therefore, investigating the causal relationship among economic factors can provide us with a better understanding of how economic phenomena affect each other. In South Korea, economic growth, inflation, unemployment have been in balance since the 1998 Korean economic crisis. Hence, investigating the economic growth, inflation, and unemployment of South Korea will enlighten how these three economic indicators affect each other in a country that developed rapidly and had several economic crises. To investigate such a model, the Vector Autoregressive Model (VAR) is used with the data between the years 1980 and 2019 in order to verify whether Okun's law or/and the Philips curve hold in South Korea. The research also determines if there is either a bi-directional or uni-directional relationship if economic growth, inflation, and unemployment have a causal relationship. The research demonstrates that GDP is the main factor in South Korea that influences the other economic factors. This research paper can contribute to academia, since it has a vital outcome which shows that the mobility of the unemployment rate in South Korea is directly correlated to the movement of GDP.

1. Introduction

GDP, inflation, and unemployment are at the core of the goals of macroeconomic policies. The sharp or smooth change of these three economic factors directly influences societies and might cause social and economic problems. For instance, if economic growth persists at too rapid a rate, inflation might accelerate, or if economic growth is lagging, then unemployment may increase. Namely, economic growth, inflation, and unemployment significantly impact economic development. Therefore, governments and policymakers examine GDP, inflation, and unemployment. (Cashell, 2006; Tenzin, 2019).

Braumann (2000) found that high inflation harms the real economy. High inflation causes a sharp decline in real money holdings, a decline in output, private consumption, and real wages. On the other hand, Rogoff (2003) remarked that deflation triggered falling prices, output, profits, and employment. Overall, both high inflation and deflation hurt the countries' economies.

Powell (1973) indicated that unemployment affects people's living standards at the moment and in the future. Unemployment also causes the children of unemployed families not to have enough education opportunities. Some of the children drop out of school primarily to work. Another impact of chronic unemployment is that educated and well-trained workers lose skills as the period of unemployment grows longer.

Low economic growth (e.g., Yemen and Venezuela) (Worldbank, 2020) can lead to social and economic problems. In the OECD report, Department for International Development noted that economic growth (mostly high growth) reduces poverty, improves life quality, creates jobs, and drives human development (Great Britain DFID, 2008).

With the importance of these factors, scholars have researched how these macroeconomic indicators are interrelated. William Phillips was one of the scholars investigating those three core macroeconomic factors to understand the causal relationship. He asserted that unemployment and inflation have an inverse relationship. When the unemployment level is low, inflation will rise due to a worker's spendings. When the unemployment level is high, inflation will drop due to the lack of spending (Clark & Douglas, 1997). However, since Phillips made this claim, many scholars have analyzed it in various countries and found that the Phillips curve is not valid for every country.

Arthur Melvin Okun is also another scholar who delved into economic growth and unemployment. He claimed that economic growth and unemployment have a negative relationship. Similar to the Phillips curve, empirical studies show that Okun's law has held in some countries, but not in all of them (Prachowny, 1993). Therefore, empirical research to analyze a causal relationship between economic growth, inflation, and unemployment is significant for future economic development.

For many decades, as mentioned above, academics, policymakers, and economists have tried to find how macroeconomic instruments affect each other. In this tradition, checking South Korean economic indicators' relationship remains essential because South Korea is one of the miraculous economies that developed rapidly and joined the developed country's club from the underdeveloped country's league within 30 years. However, in the development path, South Korea had economic recessions in its history in 1968, 1974, 1979, and 1991. In 1998, the economic crisis in Southeast Asia crushed South Korea's economy, and the inflation rate went up to 7.5% from 4.4%, as the unemployment rate rose to 7% in 1998, up from 2.6% in 1997. Besides, the economic growth rate shrank to -5.1% in 1998 (Park, 2005). Therefore, this research may provide us with a better understanding of how macroeconomic factors work in such a country which developed quickly while experiencing severe economic crises.

In this study, the nexus between GDP, inflation, and unemployment is analyzed from 1980 to 2019 in South Korea to check whether Okun's law and the Phillips curve theory apply to the South Korean economy or not, using Phillips-Peron unit root testing, Johansen cointegration testing, vector autoregression model (VAR), and Granger causality testing.

2. Literature review

Fisher (1993), Cetintas (2003), and Gillman, Harris, Matyas (2004) studied the relationship between economic growth and inflation, and found out that inflation negatively affects economic growth. Barro (1995) researched inflation and economic growth in around 100 countries during the period between 1960–1990 and inferred from the empirical result that the effects of inflation on economic growth and investment are significantly negative. Andres and Hernando (1997) studied the nexus between inflation and economic growth in OECD countries during the 1960–1992 period. The research did not find a relationship between inflation and the GDP growth rate, yet it found a statistically significant negative relationship between inflation and GDP per capita level. Mubarik (2005) alleged that the above 9% threshold value shows a negative relationship between inflation and economic growth, yet the below 9% is no causal relationship in Pakistan. Vaona and Schiavo (2007) observed the long-run relationship between inflation and economic growth using 167 countries between the years 1960 and 1999.

Hsing (1989) worked on the data of six industrialized nations from 1964 to 1986, and the empirical result demonstrated an inverse relationship between inflation and unemployment in the U.S., Canada, Italy, Japan, the U.K., and West Germany. Skare and Caporale (2014) explained that their empirical research showed that in the short-run, the inflation Granger causes employment positively, yet in the long-run inflation-employment relations become negative. Ortansa (2014) exam-

ined the nexus between inflation and youth unemployment in Romania and found that the Phillips Curve exists in Romania. Al-zeaud (2014) alleged that the research could not show a causal relationship between inflation and unemployment in Jordan. N'Guessan (2018) remarked that in the long-run, unemployment growth causes the increasing price level; namely, the relationship between inflation and unemployment exists, and it is positive.

Kreishan (2011) proposed that economic growth and unemployment are unrelated in Jordan. Therefore, he clarified that Okun's law is not observed in Jordan. Al-Wadi and Khrais (2016) conducted scientific research about economic growth and unemployment relationship in MENA countries between the years 1990–2016, and the result was that there is an insignificant relationship between unemployment and economic growth in MENA countries. Soylu, Cakmak, Okur (2018) researched the nexus between unemployment and economic growth in Eastern European Countries between the years 1992–2014, and the result is that unemployment and economic growth are related to each other. Dayioglu and Aydin (2020) found that economic growth and unemployment are strongly correlated in Turkey.

Özdemir, Mercan, Erol (2012) studied the nexus between inflation, economic growth, unemployment, and minimum wage, and the result showed that in the long run, an increase in the minimum wage and inflation induces an increase in unemployment, but an increase in economic growth decreases unemployment. Senturk and Akbas (2014) asserted that there is a strong correlation between the industrial production index, inflation, and unemployment. Mohseni and Jouzaryan (2016) investigated the effect of inflation and unemployment on economic growth in Iran during the 1996–2012 period, and they discovered that inflation and unemployment have a significant impact on economic growth in Iran.

Table 1. Literature review of the relationship between inflation and unemployment

Author	Sample	Period	Methodology	Result
Furuoka (2007)	Malaysia	1973–2004	VECM	INF→UE
Furuoka (2008)	Philippines	1980–2006	VECM	×
Kogid, Asid, Mulok, Lily, Loganathan (2011)	Malaysia	1975–2007	ARDL	INF→UE
Zaman, Khan, Ahmad, Ikram (2011)	Pakistan	1975–2009	VECM	INF→UE
Umaru and Zubairu (2012)	Nigeria	1984–1997	OLS	×
Ul-Haq, Khan, Khan, Ahmed (2012)	Pakistan	1974–2010	VECM	INF→UE
Mahmood, Bokhari, Aslam (2013)	Pakistan	1992–2011	VECM, FEVD	INF→UE
Touny (2013)	Egypt	1974–2011	VECM	UE→INF (positively)

Cioran (2014)	Romania and the EU	1997–2013	regression model	INF→UE (negatively)
Israel (2015)	France, Germany, the UK, the US	1956–2004	ARDL	INF↔UE
Okafor, Chijindu, Ugochukwu (2016)	Nigeria	1989–2014	ECM	INF→UE (negatively)
Ștefan and Bratu (2016)	the US	1961–2013	VAR	INF→UE

Note: INF: inflation; UE: unemployment

→: unidirectional relation; ↔: bidirectional relation; ×: no relation

Table 2. Literature review of the relationship between GDP and unemployment

Author	Sample	Period	Methodology	Result
Aghion and Howitt (1992)	OECD countries	1974–1989	cointegration analysis	GDP → UE (negatively)
Baretto and Howland (1993)	Japan	1953–1982	regression estimation	×
Marinkov and Geldenhuys (2007)	South Africa	1970–2005	ECM and VECM	GDP ↔ UE
Lin and Huang (2008)	the US	1948–2006	smooth-time-varying-parameter	GDP ↔ UE
Ceylan and Sahin (2010)	Turkey	1950–2007	TAR and M-TAR	GDP ↔ UE (in the long run)
Akram et al. (2014)	Pakistan	1972–2012	OLS	×
Lozanoska and Dzambaska (2014)	Macedonian	2005–2012	OLS	×
Phiri (2014)	South Africa	2000–2013	MTAR	GDP ↔ UE
Ruxandra (2015)	Romania	2007–2013	ANOVA	GDP ↔ UE
Makun and Azu (2015)	Fiji	1982–2012	ECM	GDP ↔ UE (in the long run)

Note: UE: unemployment; GDP: Gross Domestic Product;

→: unidirectional relation; ↔: bidirectional relation; ×: no relation

Table 3. Literature review of relationship between GDP and inflation

Author	Sample	Period	Methodology	Result
Barro (1996)	100 countries	1960–1990	regression equation	GDP ↔ INF (negatively)
Nell (2000)	South Africa	1960–1990	VAR	GDP ↔ INF (negatively)
Erbaykal and Okuyan (2008)	Turkey	1987–2006	ARDL	GDP ↔ INF (negatively)

Munir (2009)	Malaysia	1970–2005	TAR	GDP ↔ INF (negatively)
Datta and Mukhopadhyay (2011)	Malaysia	1971–2007	Granger causality	×
Kigume (2011)	Kenya	1963–2000	Granger causality	×
Sa'idu and Muhammad (2015)	Nigeria	1986–2010	Granger causality	GDP → INF

Note: INF: inflation; GDP: gross domestic product

→: unidirectional relation; ↔: bidirectional relation; ×: no relation

3. Empirical analysis

The South Korean consumer price index, unemployment, and real gross domestic product will be examined in terms of the causal relationship using econometric time-series models, the augmented Phillips-Perron unit root test, Johansen cointegration test (Intercept [no trend] in CE), and VAR model.

3.1. Data and methodology

The research has identified the influential variables to analyze unemployment, real gross domestic product, and consumer price index (2015 = 100) in South Korea during the 1980–2019 period. The data is taken from the World Bank. In the study, the real gross domestic product represents GDP, and consumer price index represents inflation, and the unemployment rate represents unemployment. In the research, the annual data set is analyzed.

3.2. Unit root test

As can be seen in Figure 1, in 1998, consumer price and unemployment rose sharply, while the GDP declined due to the 1998 Korean economic crisis (called the IMF crisis). However, except for the 1998 crisis, the consumer price and GDP of South Korea have steadily increased, and unemployment has remained around 3.5%. This empirical study specifies whether the variables are stationary or non-stationary. The Phillips-Perron unit root test is used for this empirical study.

Firstly, $I(0)$ ¹ in intercept, the intercept-trend test is applied for real GDP, consumer price index, and unemployment. GDP and consumer price index were non-stationary (has unit-roots) in both intercept and trend-intercept tests. However, unemployment was non-stationary in the trend and intercept test, even if it

¹ Unit root test in level.



Figure 1. The graph of GDP, unemployment, and consumer price between 1980 and 2019

Source: Author.

was stationary in the intercept test. Therefore, unemployment is considered as a non-stationary series. Subsequently, the first difference ($I(1)^2$) test is performed for all three non-stationary variables. Three variables became stationary after the first difference in the Phillips-Perron unit root (see Table 1A in Appendix).

² Unit root test in first difference.

3.3. Cointegration analysis

Three variables are non-stationary and become stationary after taking the first difference using the Phillips-Perron unit root test. That fulfills the conditions of the cointegration test, which is used to prevent spurious regression. Therefore, this empirical study uses the Johansen cointegration test to find whether variables have long-run relationships. Firstly, the six lag lengths are analyzed, which is necessary to test Johansen cointegration. The result of the lag length is viewed in Table 2A (Appendix).

To determine the best-fit lag length, all six lags are observed by using selection criteria. LR, FPE, AIC, and HQ pointed out that the second lag is the best fit for the model.

After specifying the lag length, the Johansen cointegration test is applied to determine whether variables take joint actions in the long-run, using Intercept (no trend) in CE and test VAR.

Table 4AB. Result of Johansen cointegration test. Null hypothesis: there is no cointegration between GDP, inflation, and unemployment

Unrestricted cointegration rank test (trace)				
Hypothesized no of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None*	0.498573	38.62826	29.79707	0.0037
At most 1	0.244964	12.39696	15.49471	0.1389
At most 2	0.044238	1.719366	3.841465	0.1898

Note: Trace test indicates 1 cointegrating eqn (s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Unrestricted cointegration rank test (trace)				
Hypothesized no of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 Critical value	Prob.**
None*	0.498573	26.23129	21.13162	0.0088
At most 1	0.244964	10.67760	14.26460	0.1711
At most 2	0.044238	1.719366	3.841465	0.1898

Note: Max-eigenvalue test indicates 1 cointegrating eqn (s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Source: Author.

According to Table 4, trace and maximum eigenvalue statistics have one cointegrating equation, which means that our variables are cointegrated, and the long-run relationship exists among variables.

In an econometric analysis, to stabilize non-stationary variables, it is necessary to take the first or second differences of variables. However, taking first or second difference of series might cause to lose the long-run relation among series. Therefore, even if the series are non-stationary, it could be assumed that the series might have a stable linear combination, and to specify that econometrically, a cointegration test is used. If non-stationary variables have cointegrations, then those variables are cointegrated, and the levels of series, which are statistically significant, are not spurious regressions (Tari, 2014, 405).

3.4. Result of VAR analysis

There is a lot of discussion about whether the VAR model should be stationary or not because data is lost by taking first or second difference of series. Sims (1980), and Cooley & LeRoy (1985) claimed that the aim of applying VAR analysis is to estimate the relationship among variables rather than parameter estimation.

In accordance with Sims (1980) as well as Cooley and LeRoy (1985), in this empirical research, variables are used without taking the first difference. The VAR model is analyzed from the point of stabilization.

The Inverse Root of AR Characteristic Polynomial shows that AR roots are between -1 and +1. It proves that the VAR model is stabilized, and any shock will die out in the long-run.

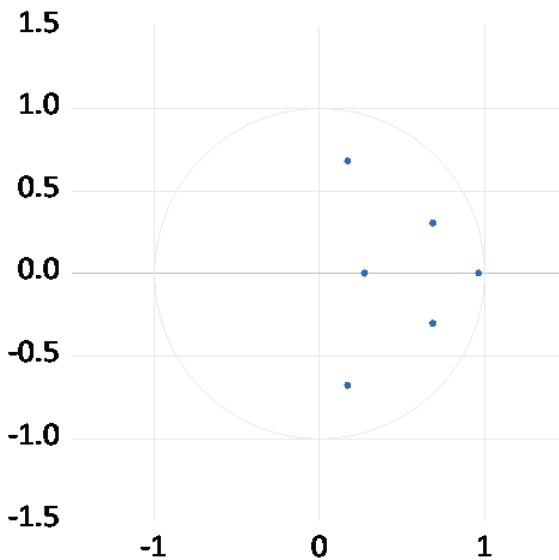


Figure 2. The result of inverse roots of AR characteristic polynomial

Source: Author.

3.5. Impulse response function (IRF)

The impulse response function is to indicate that the response of variables (endogenous variables) to the shock that happens in other endogenous variables in a dynamic VAR system. The IRF is used to analyze the effect of one standard deviation of the shock from one innovation variable on current or future endogenous variables (Amri, Nazamuddin, 2018). In the study, innovation variables are GDP, inflation, and unemployment.

LNGDP denotes logarithmic real GDP, LNINF denotes logarithmic Consumer Price Index, and UNEMP denotes unemployment. Before the model is implemented, the logarithm was taken for real GDP and Consumer Price Index to have a result in percentage, but unemployment data does not need logarithmic transformation since it is collected in percentage.

The response of LNGDP indicates how GDP responds to the standard deviation shock of variables. GDP responds positively to the shock of inflation by one standard deviation (LNINF) during the given period of time. However, GDP responds positively to the shock of unemployment (UNEMP) in the first third period by 1 standard deviation. After that, GDP responds negatively to the shock of unemployment. Furthermore, GDP responds positively to the shock of GDP by 1 standard deviation.

The response of LNINF result shows that inflation responds negatively to the shock of unemployment by one standard deviation in the second, seventh, eighth, ninth, and tenth periods; in other periods, responses of inflation is positive to the shock of unemployment. Inflation responds mostly positively to the shock of GDP by one standard deviation in every period except the first period. Finally, the response of inflation to the shock of inflation is positive by one standard deviation in every given period.

Unemployment responds negatively to the shock of GDP in the first period. Subsequently, the response of UNEMP indicates that unemployment responds positively to the one standard deviation shock of GDP during the other given periods. Unemployment responds positively to the shock of inflation in all periods. Unemployment responds positively to the shock of unemployment except for the period of second, seventh, eighth, ninth, tenth when unemployment's response is negative to the shock.

3.6. Variance decomposition analysis (VCD)

Variance decomposition determines how much variability in the dependent variable is lagged by its variance and other variables' variances. Additionally, it explains which of the independent variables is more robust in explaining the dependent variables' variability over time. In VCD, the order of the variables is of paramount

importance. The order should be from exogenous to endogenous (Tari, Koc, Abasiz, 2019, 485).

Variance decomposition of LNGDP illustrates that GDP in the first period can explain its own variance by 100%. However, in the 10th period, inflation and unemployment can explain the variance of GDP by 8.74% and 4.59%, respectively, while the GDP can explain its own variance by 86.68%. In other words, unemployment and inflation are the causes of the variance of the GDP.

As shown in variance decomposition of LNINF, in the first period, inflation accounts for 99.65% variation of its own variance, as GDP explains about 0.35% of inflation variation in the short-run. However, GDP is able to account for more and more in the process of periods, and in the 10th period, GDP accounts for 73.15% of inflation variation in the long-run, while inflation can explain 25.98% of its variation. Therefore, it can be said that there is a relationship between GDP and inflation, and GDP has a significant impact on inflation.

It has been observed from the result of variance decomposition of UNEMP that from the first period to the 10th period, GDP (LNGDP) has a significant effect on unemployment in both the short and long-run. GDP explains roughly 76.67% of unemployment variation in the given periods, as unemployment accounts for approximately 29.07% in the first period and 18.86% in the 10th period of its variation. In addition, inflation (LNINF) explains 7.15% of unemployment variation in the first period and explains 4.47% of unemployment variation in the 10th. Hence,

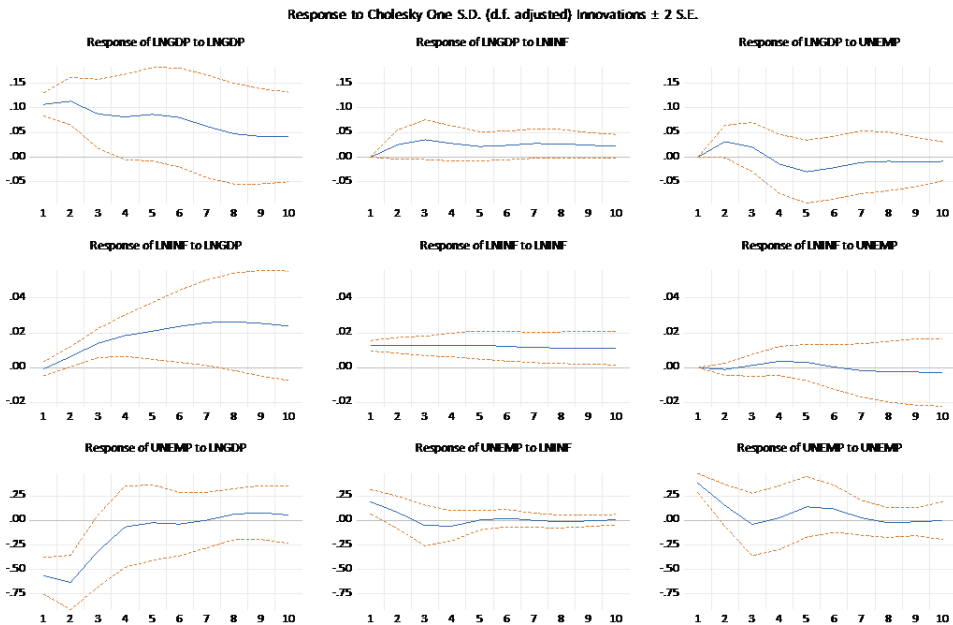


Figure 3. Impulse response graphs among variables

Source: Author.

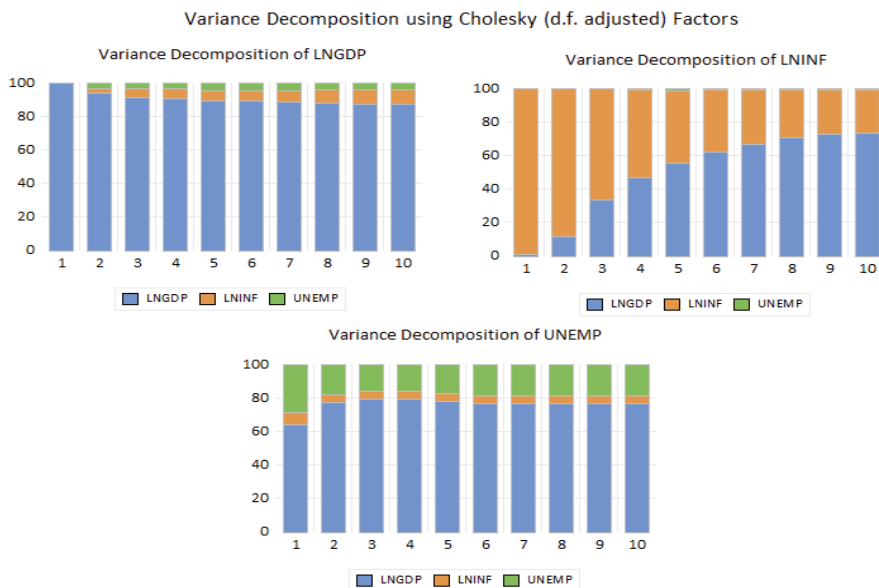


Figure 4. Graphs of variance decomposition

Source: Author.

it can be predicted that inflation also has a little bit of impact on unemployment, but the effect of inflation on unemployment decreases over the period.

In short, GDP can significantly account for the variation of inflation and unemployment. unemployment and inflation cannot explain the variation of each other and GDP as significantly as GDP does.

3.7. Granger causality test

The Granger causality test is used to find a causal relationship among variables. In the Granger causality test, endogenous variables are treated as exogenous.

If the probability value in Granger causality is higher than 0.05, then “H₀: Granger does not Granger cause” cannot be rejected. However, if the probability value is not higher than 0.05, the null hypothesis is rejected and said that it is statistically significant, which means a uni-directional causal relationship between variables.

According to Table 5, the result revealed a uni-directional causality running from GDP (LNGDP) to inflation (LNINF) as measured by the consumer price index. That means that GDP Granger causes inflation.

Unemployment and GDP have a bi-directional relationship. It means that unemployment (Unemp) Granger causes GDP, while GDP Granger causes unemployment.

Table 5. The result of the Granger causality test

VAR Granger causality/block exogeneity Wald tests Included observations: 38				
Dependent variable: LNGDP				
Excluded	Chi-sq	df	Prob.	
LNINF	2.718780	2	0.2568	
UNEMP	8.838180	2	0.0120	P < 0.05
All	11.58053	4	0.0208	P < 0.05
Dependent variable: LNINF				
Excluded	Chi-sq	df	Prob.	
LNGDP	9.199977	2	0.0101	P < 0.05
UNEMP	0.690348	2	0.7081	
All	31.58383	4	0.0000	P < 0.01
Dependent variable: UNEMP				
Excluded	Chi-sq	df	Prob.	
LNGDP	6.193881	2	0.0452	P < 0.05
LNINF	0.004934	2	0.9975	
All	6.564654	4	0.1608	

Note: Null hypothesis: independent variable does not Granger cause dependent variable

Source: Author.

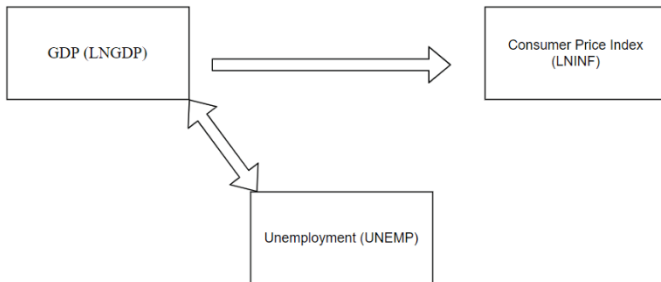


Figure 5. The direction of VAR Granger causality/Block exogeneity Wald tests

Source: Author.

4. Research findings and discussion

Many scholars and articles indicate that inflation and unemployment have a vital relationship in many different countries. For instance, Ştefan and Bratu (2016), Okafor et al. (2016), and Israel (2015) state that inflation plays a vital role in the

economy and impacts unemployment in many different developed countries. In South Korea, inflation does not have an impact on unemployment, and vice versa. Firstly, this might be because South Korea's population density is on the decline. Secondly, in South Korea, part-time jobs are pretty popular amongst workers (mainly amongst young workers), and unemployed people have part-time jobs until they find decent jobs. Finally, the density of the young population has been decreasing; therefore, youth unemployment does not significantly influence the total unemployment rate (Lee, 2017, 1, 7, 8).

In Korea, as has been found in other articles, inflation and economic growth have a uni-directional relationship from GDP to inflation. When GDP increases, inflation also goes up, and vice versa. It is because when GDP grows in South Korea, people's income accelerates. With more income, Koreans tend to spend more because South Korea is a consumer society (UKEssays, 2018).

GDP and unemployment have a strong correlation in South Korea. GDP predominantly directs unemployment, as is seen in the result of VCD (Figure 4). In South Korea's economy, GDP is the main economic driving factor influencing some economic factors flat-out, such as inflation and unemployment. The Korean government should balance between unemployment and inflation, because low economic growth might trigger joblessness, yet high economic growth might cause relatively high inflation. Thus, investigating and monitoring the main economic factors is of paramount importance in South Korea.

5. Conclusion

In the study, the causal relationship between unemployment, inflation, and economic growth was analyzed using the South Korean real gross domestic product data, South Korean consumer price index data, and South Korean unemployment rate data between the years 1980 and 2019.

The result of the VAR model demonstrated that GDP affects inflation, but there is no reverse relationship. In the variance decomposition, it is clearly seen that GDP has an enormous impact on inflation; when the GDP increases or decreases, inflation follows the path of GDP and increases or decreases in the standard economic conditions. During economic recessions, GDP decreases, while inflation rises in South Korea.

There is an incredibly significant nexus between unemployment and GDP. Figure 4 illustrates that to understand and notice the change in unemployment, we have to analyze the GDP, because without the GDP, unemployment cannot be readily explained in South Korea, which means that the movement of unemployment is steered by the GDP.

The nexus between unemployment and GDP is powerful. In future research, threshold regression analysis could be used to determine whether the economic

growth threshold level has a positive or negative effect on unemployment. That sort of analysis would be worthwhile due to the fact that the economic growth of South Korea has been diminished by the effect of the iron logic of diminishing returns.

To sum up, for many years, economists, policymakers, and economic agents have tried to solve the riddle of inflation and unemployment. Those two factors always influence people's life and living standards in no time, and those two economic phenomena are a strong relationship with economic growth. Hence, economic agents and policymakers need to monitor South Korea's economic growth closely in order to shun the overheated economy and maintain sustainable economic growth. Because South Korea's economic growth directly impacts inflation and unemployment, overheated economic growth might disturb the balance of these indicators. Otherwise, the reinless economy could be overheated, and overheating economy may cause many issues in South Korea.

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Appendix

Table 1A. Phillips-Perron unit root test

Variables	Intercept	Trend and Intercept
GDP I(0)	0.9991	0.4125
GDP I(1)	0.001***	0.001***
INFLATION I(0)	0.8055	0.8190
INFLATION I(1)	0.0005***	0.0031***
UNEMPLOYMENT I(0)	0.0444	0.1858
UNEMPLOYMENT I(1)	0.0000***	0.0000***

Note: *p < 0.1, **p < 0.05, ***p < 0.01

Null hypothesis: GDP, inflation, unemployment have a unit root

Source: Author.

Table 2A. VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1150.658	NA	8.57e + 24	65.92332	66.05664	65.96934
1	-1000.294	266.3586	2.67e + 21	57.84540	58.37866*	58.02948
2	-985.9231	22.99408*	1.99e + 21*	57.53846*	58.47167	57.86061*
3	-978.8957	10.03911	2.30e + 21	57.65119	58.98434	58.11139
4	-974.4988	5.527548	3.18e + 21	57.91422	59.64732	58.51249
5	-971.6313	3.113371	5.03e + 21	58.26464	60.39769	59.00097

Note: Endogenous variables: GDP CONSUMER_PRICE_INDEX UNEMPLOYMENT

Exogenous variables: C

* indicates lag order selected by the criterion

Source: Author.

Table 3A. Roots of characteristic polynomial

Root	Modulus
0.966518	0.966518
0.687878 - 0.302327i	0.751384
0.687878 + 0.302327i	0.751384
0.173314 - 0.679572i	0.701324
0.173314 + 0.679572i	0.701324
0.275465	0.275465

Note: Endogenous variables: LNGDP LNINF UNEMP

Exogenous variables: C

Source: Author.

