The Relationship between CPI and Employment and National GDP: Empirical Research Based on French Data

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Abstract. With the development of economy and society, many new economic concepts have been proposed, but the development of GDP has always been an important factor in measuring a country's economic level. If people want to develop GDP, it must understand what factors will have an impact on GDP. If people blindly only stimulate GDP without considering other influencing factors, it may have the opposite effect on the economy. In this article, the data of France, a traditional Western economic powerhouse, from the first quarter of 1998 to the third quarter of 2023 is selected as a reference to explore the impact and connection of CPI and employment on GDP. The study uses the VAR model to model and analyze the data, and uses impulse response diagrams to examine the degree of impact and depth of the connection between these two factors on GDP. The study finally analyzes the reasons why its factors affect GDP, providing reference value for future economists.

Keywords: CPI, GDP, employment, VAR, France, Linkage and impact.

1 INTRODUCTION

In the economic society, GDP and CPI are a method widely used in economic research to analyze and predict the future domestic economic situation [1]. Assist the government in decision-making and introduce a series of measures in line with the national economic development. According to the different needs of each department, the government allocates the funds it needs and the key development parts. GDP is typically described as the total market value of all final goods and services generated within a country over a specific period, such as annually, semi-annually, or quarterly. Additionally, GDP is frequently utilized as a key metric for assessing a nation's development status. And to judge the country's employment status and an important aspect of economic development [2]. Therefore, It is very helpful for understanding and developing GDP.

Countries often use a series of monetary policies and fiscal policies to stabilize the low level of inflation, an important indicator in the economy and society. CPI is usually considered to be a concrete reflection of the domestic inflation level and the measures taken by the government. Whether it has its characteristics of rapid response [3]. When

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a country's GDP is developing at a high speed, if the development of the country's productivity cannot keep up with the growth of its demand, it will cause the country's inflation rate to rise, which will cause the country's CPI to rise [4]. Therefore, by studying the relationship between CPI and GDP, it can also explore the country's development situation and whether it has found a balance between economic growth and price stability.

According to neoclassical economic theory and Okun's law, GDP growth rate and employment growth rate usually show a consistent trend [5]. Economic growth leads to an increase in employment and a reduction in unemployment [6]. The government usually affects employment levels by regulating GDP growth. For example, Governments can use a range of policies to promote economic growth and thereby increase employment. To sum up, the relationship between GDP and employment rate is very close. Economic growth often leads to an increase in employment, and changes in employment rate will in turn affect the healthy development of the economy. Changes in the employment rate are also inseparable from the growth in the number of employed people, which shows the importance of the number of employed people in GDP growth [7].

To sum up, this article aims to study the impact and extent of CPI and employment on GDP development.

2 LITERATURE REVIEW

2.1 Theoretical Research

Radzi, H. M., & Bakar, A. S. A used neoclassical theory and classical theory to point out that under normal circumstances, price increases, that is, inflation, will affect the level of economic development, but the actual situation must also be considered. The impact of inflation on economic development must be considered from both sides [4]. Evaluating from other aspects, appropriate inflation will also stimulate economic development.

2.2 Empirical Research

Dr. Abu Sufian Abu Bakar used the ARIMA and VAR models to predict the GDP and CPI of the Malaysian economy. Data on Malaysia's GDP and CPI start from 1960 to 2021. Use the fitted model to predict Malaysia's GDP and model for approximately the next five years [4]. The results show that both GDP and CPI are on an upward trend, and the relationship between GDP and CPI is concluded. The impact of GDP on CPI is about 31%, while the impact of CPI on GDP is only 6%. It can be seen that there is a strong connection between GDP and CPI

Abdullah Ghazo models and forecasts Jordan's GDP and CPI. This study uses the Box-Jenkins (JB) method to analyze from 1976 to 2019. The ARIMA model was used to analyze the data, and the optimal ARIMA model order was obtained for analysis. The results of the stationary analysis of its data were tested using two important indicators in time series analysis, AIC and SIC, and it was found that the results met the

assumptions of its model. Its research shows that compared with 2019, domestic GDP is expected to decline in 2020, and CPI will show an opposite trend to GDP. This means that there will be a situation of economic stagflation [1]. After 2020, both the domestic market and the consumer price index will eventually rise, indicating cost-push inflation due to economic conditions. This also means that there is a clear correlation between CPI and GDP

AKKEMIK, K. Ali studied the relationship between employment, GDP, real wages and a series of important factors affecting economic development in Turkey. The elasticity of employment relative to real GDP for most economies as defined is estimated at 0.7% and for employment as defined by manufacturing at 0.5%. In addition to these findings, their variance decomposition analysis based on time series analysis found that GDP accounts for approximately half of the variance in total employment [9]. The results studied in this paper illustrate that output shocks manifest themselves over four labor market cycles. After four periods, the growth of gross domestic product, or GDP, has had a direct and huge impact on domestic employment, although the response is not rapid. It can be seen that employment and GDP are also closely related.

2.3 Review

Through existing research, it is not difficult to find that the impact of employment on GDP is mostly positive and has a strong correlation with economic development. However, the relationship between CPI and GDP development is more complicated and has two sides. Some scholars point out that appropriate inflation will stimulate economic development and is beneficial to GDP, but other studies point out that inflation will lead to the economy moving toward stagflation is not conducive to economic development. However, these studies and discussions have provided this article with research ideas and model methods to use the VAR model to explore the impact and extent of its two factors on GDP development.

3 RESEARCH DESIGN

3.1 Model Introduction

VAR is a statistical model used to analyze multivariate time series:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + A_3 y_{t-3} + \cdots + A_p y_{t-p} + u_t \quad (1)$$

The model is constructed by treating each endogenous variable as a function of the past values of all endogenous variables in the system. The VAR model is a generalization of the univariate autoregressive model, which can capture the interrelationships between multiple variables and is widely used in prediction.

It has three time series variables：y_t，x_{1t}和x_{2t}，They will form a vector z_t=$\begin{matrix} y_t \\ (x_{1t} \\ x_{2t} \end{matrix}$）Then the form of the first-order var model (var(1)) is z_t=C+$A_1 z_{t-1}$+u_t，The specific formula for expansion is:

$$\begin{pmatrix} y_t \\ x_{1t} \\ x_{2t} \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ x_{1,t-1} \\ x_{2,t-2} \end{pmatrix} + \begin{pmatrix} u_{yt} \\ u_{x1t} \\ u_{x2t} \end{pmatrix} \quad (2)$$

$C = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix}$, is the constant vector. $A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$, is the coefficient matrix. And u_t=$\begin{pmatrix} u_{yt} \\ u_{x1t} \\ u_{x2t} \end{pmatrix}$, is the error term vector.

This model can be derived to higher order modes：Z_t=c+$\sum_{i=1}^{p} A_i Z_{t-i}$+$u_t$，It is currently being discussed in practical applications. Choose an appropriate number of lags p and estimate sequence matrix A_1 very important.

3.2 Data Source

In economics research, the OECD is a relatively authoritative world organization with a large amount of data. Its data covers most countries and has a certain degree of authority. It can be used as data support for studying important indicators such as GDP, CPI, and employment. The data used in this study are France's total quarterly GDP data from the first quarter of 1998 to the fourth quarter of 2023, as well as per capita CPI and total employment data, covering 103 periods of data. Using stata's data analysis software, the data is processed with a lag of one period from the original data to avoid collinearity. At the same time, a VAR model is constructed for the processed data to explore the impact of employment numbers and CPI on national GDP.

3.3 ADF Inspection：

Before building a VAR model, the first thing people need to consider is whether the characteristics of the data conform to the assumptions of the model. This requires a unit root test on the data to determine whether the data is stationary and does not have a unit root. If it does not have stationary characteristics, it means that it must be correct. To eliminate stationarity and unit roots in the collected non-stationary data, the data must be processed with differential terms.

Table 1. Weak Stationarity Test

Variables	Test statistic	P value
Raw		
GDP	-4.281	0.0034
Emp	-2.124	0.5326

CPI	-3.074	0.1126
Growth rate		
GDP	-9.824	0.000
Emp	-10.747	0.000
CPI	-6.080	0.000

From the Stata analysis results in Table 1, it can see that in the original data, both variables do not meet the hypothesis test that there is no unit root in the data, because their p-values are greater than 0.05, which means that it must reject the null hypothesis. Then logarithm processing is performed on the data. After logarithm, it can be seen that the p value of the data is infinitely close to 0, so it is believed that the data has the characteristics of stability. This means that the VAR model can be constructed.

4 MODEL

4.1 Identification

In order to achieve good model fitting results, finding the optimal lag order is a particularly important step in the VAR model, and it is necessary to analyze and evaluate the lagged LR statistics and information. A special symbol (*) will appear after the best order data, indicating the best lag sequence for the data used.

Table 2. Selection-order

Lag	FPE	AIC	HQIC	SBIC
0	6.1e-10	-12.7043	-12.6707	-12.621
1	5.5e-10	-12.8056	-12.6712	-12.4723
2	2.7e-10	-13.5371	-13.3019	-12.9538
3	7.5e-11	-14.8007	-14.4647	-13.9675
4	5.5e-11	-15.121	-14.6842	-14.0377*
5	4.8e-11	-15.266	-14.7284*	-13.9328
6	4.7e-11*	-15.2883*	-14.6499	-13.7051
7	5.4e-11	-15.1522	-14.413	-13.319
8	6.5e-11	-14.9948	-14.1548	-12.9117
9	7.5e-11	-14.86	-13.9192	-12.5269
10	8.4e-11	-14.7788	-13.7371	-12.1957
11	9.6e-11	-14.6735	-13.531	-11.8404
12	1.1e-10	-14.5557	-13.3124	-11.4726

As can be seen from Table 2, it is not difficult to see that there are * symbols in the lags of the fourth, fifth and sixth periods, which indicates that the number of lags in these three periods has certain expectations. The comparison of AIC differences is to determine the optimal lag. order requirements. The difference between lag six and lag seven is 0.136 and the difference between lag five and lag four is 0.145 so starting with lag six is a better choice.

Once the order of the VAR model is determined, it is essential to check for stationarity. If the VAR model is non-stationary, the impulse response function will fail to

converge to zero, which means that the per capita CPI and employment in each period have a long-term impact on GDP. Afterwards, the applicability of the model is determined by performing a unit root test, using the roots to draw a unit circle. In the figure, all roots are clearly inside the circle, which means that there is no need to re-estimate the lag order and the three-variable VAR (6) is a stable

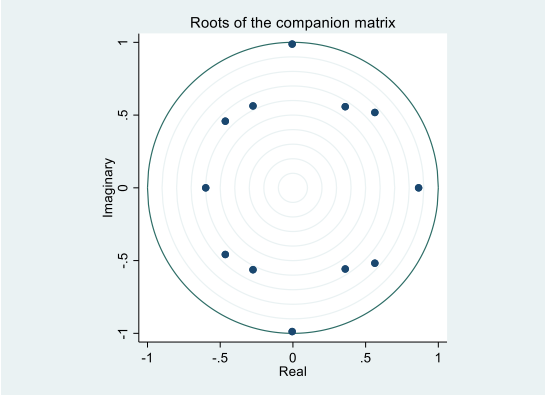

Fig. 1. Model stationary

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4.2 Impulse Response

Impulse response analysis is a crucial phase in fitting models using vector autoregressive techniques. It explains how independent variables like GDP and inflation (INF) respond to external shocks.

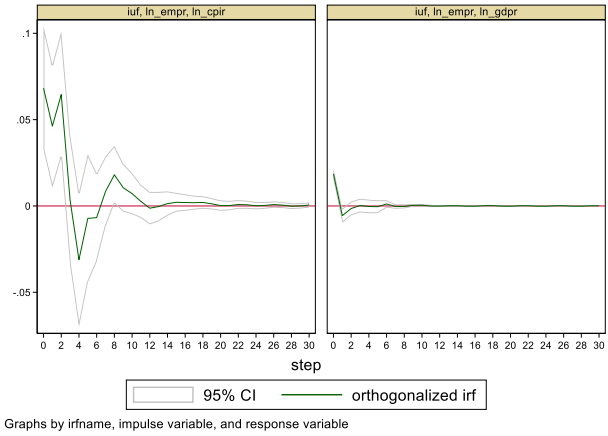

Fig. 2. Impulse (Emp) and response

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In today's society, inflation is no longer a completely negative term. Although the lessons of many financial crises tell us, such as the Asian financial crisis, the threat of inflation is not small. But in recent years, More and more countries are increasing the inflation rate to stimulate economic development. Does this mean that as long as the size and scope of inflation are controlled, that is, the changes in CPI are grasped, the inflation rate can also drive economic growth. At the same time, the growth of employment is also closely related to GDP growth [8]. Many studies have shown that a country's GDP development prospects can be explored through the unemployment and employment numbers of a country [9]. People must look at its impulse response diagram to determine whether there is a real connection between the two.

First, the impulse response of GDP to total employment. It is not difficult to see from the figure2 and figure3 that the response of GDP to total employment is very small. When GDP changes by one percent unit, total employment remains basically unchanged. However, the impact of total employment on GDP is not 0. It can be seen from the figure that in periods 0-2, GDP responded quickly to changes in employment, with a response level of around 0.2, indicating that it has an impact on GDP. The impact is not small, and most of it is positive. Subsequently, its impact gradually approaches 0, indicating that the impact of employment on GDP is mainly concentrated in the short term. And its impact on GDP is unidirectional and positive.

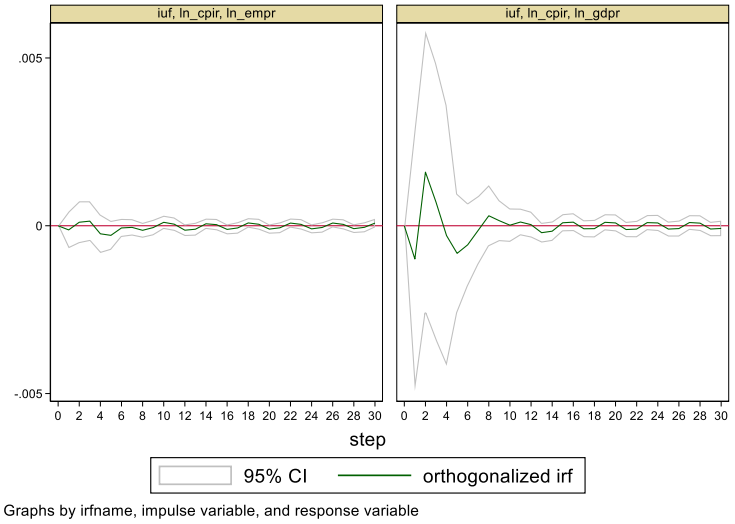

Fig. 3. Impulse (CPI) and response

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Secondly, it is the impulse response of GDP to CPI. From Figure 3 and Figure 4, it can find that the response of GDP to CPI is mainly concentrated between periods 0-8. In period 0-2, domestic GDP responded quickly, but to the increase in CPI, the response

of GDP was negative. Then it quickly rose to positive in period 2-4, but the response value at its highest point was only about 0.02, indicating that CPI has little impact on GDP. But the opposite is the impact of GDP on CPI. In period 0-2, CPI responded quickly to changes in GDP, and the degree was as large as about 0.2. Then in period 0-4, its response changed in a negative direction, and reached a peak of about 0.3, which means that GDP has a greater impact on CPI. The impact is complex, not linear, and its degree of impact is also large.

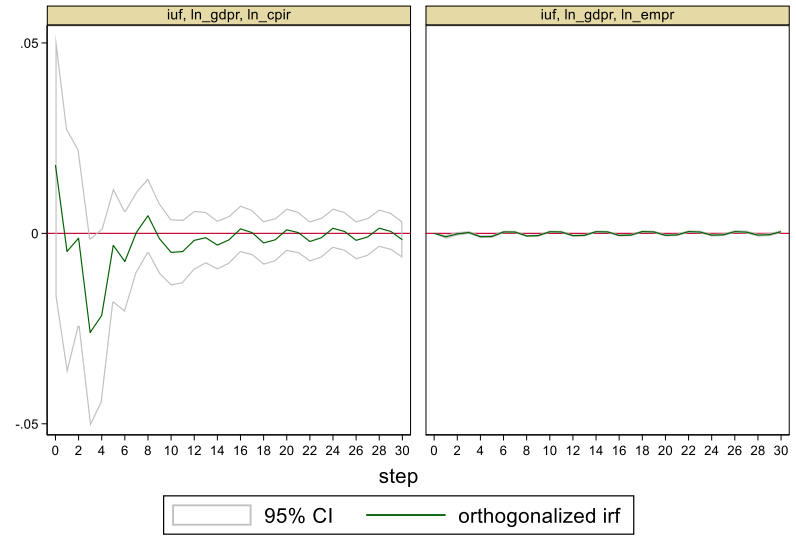

Fig. 4. Impulse (GDP) and response

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5 DISCUSSION

Compared with other studies, this article uses the VAR model to focus on exploring the relationship between France's CPI and the employment population and domestic GDP. Most of the existing research focuses on using this model to analyze and predict a country's GDP. Although the purpose of most economic research and analysis is to focus on the development status and speed of GDP [10]. However, it is also particularly important to explore the impact of various factors on GDP, which will help provide a reference for people to study a series of issues and phenomena that arise when GDP develops in the future.

The study found that CPI, employment and GDP are closely related. This shows that policymakers must have a good grasp of the degree of inflation, understand domestic economic development information, maintain CPI within a reasonable range by

adjusting interest rates and money supply, and avoid the negative impact of high inflation on the economy. Moderate inflation can help stimulate consumption and investment and promote economic growth. At the same time, if people want to boost GDP growth, it is also important to increase the number of jobs. It is also important to formulate and implement policies that are conducive to employment, such as tax cuts, employment subsidies and training programs. , encourage companies to expand recruitment. This not only increases the number of jobs, but also increases residents' income, further promoting consumption and economic development. By comprehensively applying the above means, policymakers can effectively use CPI and employment data to formulate and adjust policies, thereby promoting sustained GDP growth.

6 CONCLUSION

The issue this study wants to discuss is the relationship between the two factors CPI, total employment and GDP and their impact. The study is primarily based on French data. Although it is one-sided, France, as one of the European economic powers, has Data research also has a certain degree of representativeness. Through the research results, it can find that GDP has a great impact on CPI. In the short term, the two are positively correlated. The reason may be that when GDP grows, economic activities increase and consumer and business demand rises, which may push prices up, causing CPI to rise. This phenomenon is called demand-pull inflation. After the short-term development ends and the domestic economic situation stabilizes, the impact of GDP on CPI gradually turns negative, because excessive CPI growth will harm the development of the domestic economy and the country It must be intervened. At the same time, the study also found that the impact of the employed population on GDP is close to a positive linear impact. The reason may be that more employed people mean more labor is invested in the production process, thereby improving overall productivity and increasing total output. This directly drives GDP growth, and an increase in employment is usually accompanied by an increase in income. As more people gain income, their spending power increases, increasing demand for goods and services, further boosting economic growth.

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