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THE STUDY OF THE RELATIONSHIP BETWEEN MACROECONOMIC FACTORS AND THE COUNTRY'S ECONOMIC DEVELOPMENT IN THE CASE OF FRANCE

Ashirova Gulchehra
TSUE Asistant

Abstract
This study examines the relationship between key macroeconomic factors and the economic development of France, with a focus on GDP per capita as the primary indicator of growth. Using Stata software, we analyzed the impact of several variables, including industry output, foreign direct investment (FDI), unemployment rate, exchange rate, and interest rate on GDP per capita. Two econometric models were employed: Ordinary Least Squares (OLS) to assess the direct linear relationships, and a Vector Autoregression (VAR) model to capture dynamic interactions between the variables.

Introduction

France, as one of the leading economies in Europe, has experienced significant economic changes since the early 1990s. The country's macroeconomic performance during this period has been influenced by a multitude of factors, including industrial output, foreign direct investment (FDI), inflation rates, and unemployment, all of which contribute to GDP per capita growth. This study utilizes data from 1991 to 2023 to explore the intricate relationships between these macroeconomic variables and France's overall economic development.

From 1991, France's GDP per capita was around $21,675.70, a reflection of its robust industrial output and growing exports, which stood at approximately $270 billion.

LITERATURE REVIEW

The relationship between macroeconomic factors and economic development has been a subject of extensive analysis in various economic studies. For France, a developed economy with significant industrial and export capacities, understanding how variables like GDP per capita, exports, unemployment, interest rates, FDI, inflation, and industry growth interrelate is crucial for effective policymaking and long-term economic stability.

Several studies, such as those by **Benhmad (2020)** and **Georgoutsos & Kouretas (2021)**, have examined the impact of macroeconomic uncertainty on GDP growth, with particular emphasis on the dynamic relationships between inflation, unemployment, and interest rates. These studies have utilized Vector Autoregression (VAR) models to identify how shocks in one variable can propagate through the economy, which aligns with the methodology employed in this study.

METHODOLOGY

The selected variables for this hypothesis test include GDP per capita (GDPpercapita) as the dependent variable, with Inflation, FDI, Unemployment, Export, Exchange rate, and Industry serving as independent variables in our model. This approach aims to examine the relationship between these factors and their impact on GDP per capita and overall economic growth in France.

The following models have been developed to analyze the correlation between economic growth and various economic indicators in France.

Our hypothesis is as follows:

H10 : There is no link between GDP per capita and Export

H1a : There is a link between GDP per capita and Export,

H20 : There is no link between GDP per capita and Inflation

H2a : There is a link between GDP per capita and Inflation

Particularly, analysing the empirical study of factors affecting Argentina's economic development for 1991-2023, we developed an econometric model and equations using multi-factor time series to construct econometric equations. To study the relationship between factors and the economic development of France, the following models are derived:

Stationarity Test

We applied the Augmented Dickey-Fuller (ADF) test to assess stationarity. This test indicates whether variables revert to a long-term trend after a shock or behave as a random walk. If variables follow a random walk, any regression between them will be misleading, as OLS will not yield consistent parameter estimates. Thus, all series must be stationary at the same level. The ADF test can be formulated as an equation.

$$Yt= \beta 1 + \beta 2\ t + \delta Yt{-}1 + ai \sum_{i}^{m} \quad Yt{-}1{+}\varepsilon t$$

The hypothesis tested is as follows:

- **H_0**: $\delta = 0$, indicating a unit root is present, meaning the data are non-stationary.
- **H_1**: $\delta < 0$, indicating no unit root is present, meaning the data are stationary.

Additionally, before proceeding with predictions, we applied the five Gauss-Markov conditions to evaluate the alignment and distribution of the indicators. This step was crucial for addressing potential issues with heteroskedasticity, residual autocorrelation, and ensuring the reliability of regression models.

Veriables	Test statistic	1% critic value	5 %critic value	10 %critic value	Number of Obs	MacKinnon approximate p-value
GDPpercapita	-5.470	-3.709	-2.983	-2.623	30	0.00
Export	-5.965	-3.709	-2.983	-2.623	30	0.00
Inflation	-5.540	-3.709	-2.983	-2.623	30	0.00
Unemployment	-4.316	-3.709	-2.983	-2.623	30	0.00
FDI	-5.563	-3.709	-2.983	-2.623	30	0.00
Industry	-5.077	-3.709	-2.983	-2.623	30	0.00
Exchange rate	-5.059	-3.709	-2.983	-2.623	30	0.00

Result and Discussion

Table 1: Results of the Dickey-Fuller test on GDPPC and on Independent variables

Among global researchers, the Dickey-Fuller test is widely regarded as an essential test for checking the stationarity of data in time series analysis. This test helps to determine whether the statistical data are stationary or non-stationary. If the data are non-stationary, it provides an opportunity to convert them into stationary data through differencing. This feature demonstrates the test's advantage over others in verifying stationarity.

The criterion for this test is as follows: the test statistic value must be smaller than all critical values (1%, 5%, and 10%). Additionally, the MacKinnon p-value should be less than 0.05.

Table 2: Matrix of correlation

Variables	(1)	(2)	(3)	(4)	(5)
(1) GDPpercapita	1.000				
(2) Inflationrate	0.056	1.000			
	(0.755)				
(3) FDI	-0.148	0.132	1.000		
	(0.412)	(0.465)			
(4) industry	0.985*	0.138	-0.194	1.000	
	(0.000)	(0.442)	(0.278)		
(5) Exchangerate	-0.548*	-0.063	-0.108	-0.465*	1.000
	(0.001)	(0.727)	(0.551)	(0.006)	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

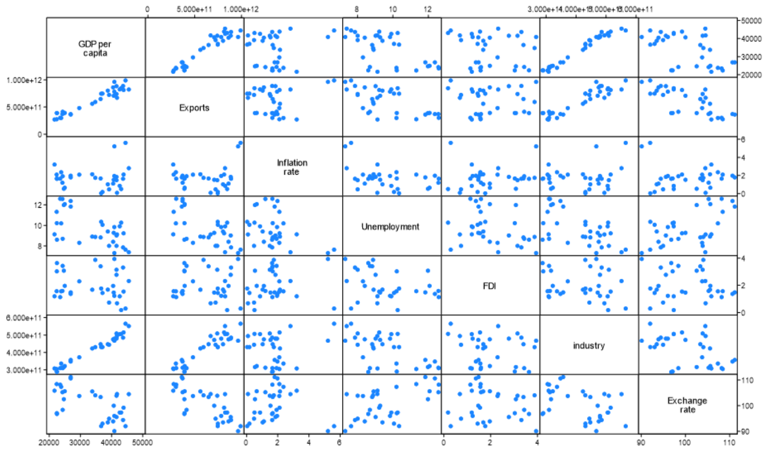

Figure 1: Matrix of correlations

GDP per capita and Industry: There is a strong positive correlation (0.985) between GDP per capita and industry, which is statistically significant at the 1% level (p=0.000). This high correlation suggests that industry output plays a significant role in influencing GDP per capita, supporting economic theories that emphasize the industry sector's contribution to economic growth.

Exchange Rate Correlations:

- **GDP per capita and Exchange Rate**: There is a moderate negative correlation (-0.548) between GDP per capita and exchange rate, significant at the 1% level (p=0.001). This suggests that fluctuations in the exchange rate have a notable impact on GDP per capita, aligning with research indicating that exchange rate volatility can influence economic stability and growth.

Table 3: Results of simple regression analysis. Linear regression

lnGDPpercapita	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnInflationrate	-.015	.005	-2.91	.007	-.026	-.005	***
lnFDI	.021	.008	2.58	.016	.004	.038	**
lnindustry	1.188	.029	40.49	0	1.128	1.248	***
lnExchangerate	-.4	.102	-3.92	.001	-.609	-.191	***
Constant	-19.514	1.09	-17.90	0	-21.747	-17.28	***

Mean dependent var	10.405	SD dependent var	0.263
R-squared	0.989	Number of obs	33
F-test	623.009	Prob > F	0.000
Akaike crit. (AIC)	-133.995	Bayesian crit. (BIC)	-126.512

*** *p<.01*, ** *p<.05*, * *p<.1*

This table presents the results of a linear regression analysis, where GDP per capita is the dependent variable (lnGDPpercapita), and several independent variables are analyzed for their impact on GDP per capita. Here's a breakdown of the results:

Table 4: Breusch-Pagan test

	chi2(1)	Prob > chi2
GDP per capita	**0.49**	**0.4855**

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The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity assesses whether the variance of the residuals (error terms) from a regression model is constant, i.e., if the model violates the assumption of homoskedasticity (constant variance). Here's the analysis based on the test results provided:

Hypotheses:

- **Null Hypothesis (H_0)**: The variance of the residuals is constant (homoskedasticity).
- **Alternative Hypothesis (H_1)**: The variance of the residuals is not constant (heteroskedasticity).

Table 5: White test result

Source	chi²	df	p-value
Heteroskedasticity	20.370	14	0.119
Skewness	16.330	4	0.003
Kurtosis	0.100	1	0.748
Total	36.810	19	0.008

The White test is used to detect heteroskedasticity, non-linearity, and specification errors in regression models. The table presented shows the results of Cameron & Trivedi's decomposition of the IM-test, which breaks down the sources of potential model mis-specifications into heteroskedasticity, skewness, and kurtosis components.

Heteroskedasticity: The p-value is above the standard significance level (e.g., 0.05), meaning we fail to reject the null hypothesis of no heteroskedasticity.

Table 6: Breusch-Godfrey autocorrelation test result

BreuschвЂ“Godfrey LM test for autocorrelation chi2	df	Prob>Chi2
1.875	1	0.171

H0: no serial correlation

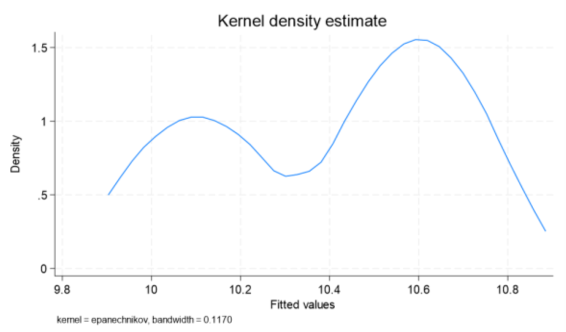
The null hypothesis (H0) for the Breusch-Godfrey test is that there is no serial correlation (autocorrelation) in the residuals of the model.

- The p-value of 0.171 is greater than the common significance level (e.g., 0.05).
- Therefore, we **fail to reject the null hypothesis**, meaning there is no significant evidence of autocorrelation in the residuals of the model.

This suggests that the model does not suffer from serial correlation, implying that the residuals are not correlated over time.

Table 7: The Shapiro-Wilk W test result

Variable	Obs	W	V	z	Prob>z
qoldiq	33	0.948	1.764	1.180	0.119



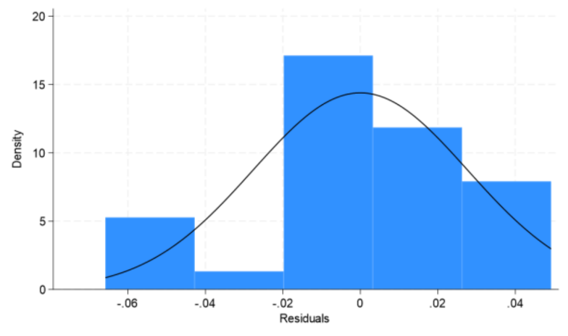


Figure 2: Karnel density estimate **Figure 3: Normal distribution of residuals test**

The Shapiro-Wilk test is used to check whether a dataset is normally distributed. The null hypothesis (H0) of the Shapiro-Wilk test is that the data are normally distributed.

- The p-value is 0.119, which is higher than the common significance level (e.g., 0.05).
- Therefore, we **fail to reject the null hypothesis**. This suggests that the variable "qoldiq" does not show significant deviation from a normal distribution, implying that the data are consistent with normality.

Table 8:VIF (Variance inflation factor) test

	VIF	1/VIF
lnindustry	1.408	.71
lnExchangerate	1.334	.75
lnFDI	1.155	.865
lnInflationrate	1.082	.924
Mean VIF	1.245	.

Based on this test, we can conclude that the data for "qoldiq" likely follow a normal distribution.

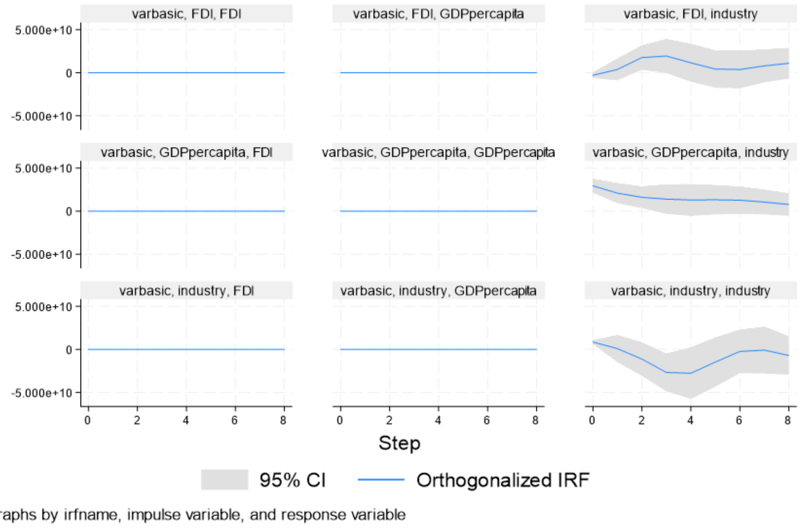


Figure 3: Varbasic graphs by irfname, impulse variable and response variable

VIF measures multicollinearity, which occurs when independent variables in a regression model are highly correlated. A VIF value greater than 10 is often considered a sign of high multicollinearity, which can make coefficient estimates unreliable.

- In this table, all VIF values are well below 10, indicating **low multicollinearity**.
- The values of 1/VIF (reciprocal of VIF) are also shown. These values are relatively high (close to 1), further supporting the conclusion that multicollinearity is not a concern in this model.

Table 9: VAR model regression indicators of macroeconomics and economic development

Vector autoregression

Sample: 1993 thru 2023		Number of obs =	31
Log likelihood =	-1073.782	AIC =	70.63112
FPE =	9.72e+26	HQIC =	70.94778
Det(Sigma_ml) =	2.45e+26	SBIC =	71.60253

Equation	Parms	RMSE	R-sq	chi2	P>chi2
GDPpercapita	7	2719.06	0.9107	316.1554	0.0000
FDI	7	.870319	0.4605	19.25698	0.0038
industry	7	3.5e+10	0.8618	193.381	0.0000

	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
GDPpercapita						
GDPpercapita						
L1.	1.802055	.8724354	2.07	0.039	.0921127	3.511997
L2.	-.2718363	.8301466	-0.33	0.743	-1.898894	1.355221
FDI						
L1.	97.20293	569.8184	0.17	0.865	-1019.621	1214.027
L2.	1280.16	559.075	2.29	0.022	184.3929	2375.927
industry						
L1.	-8.38e-08	7.23e-08	-1.16	0.247	-2.26e-07	5.80e-08
L2.	2.48e-08	7.00e-08	0.35	0.723	-1.12e-07	1.62e-07
_cons	4243.437	4549.069	0.93	0.351	-4672.575	13159.45

The provided image displays the results of a Vector Autoregression (VAR) model. Here's a breakdown of the key indicators and analysis relevant to your variables, which seem to involve GDP per capita, Foreign Direct Investment (FDI), and industry output.

Summary of the Results

1. **Log likelihood = -1073.782**: This shows the log-likelihood value, which gives a sense of the model's goodness of fit. A higher value (less negative) suggests a better fit, but it is relative to other models for comparison.
2. **Number of observations = 31**: The dataset spans from 1993 to 2023, and includes 31 observations, likely annual data.

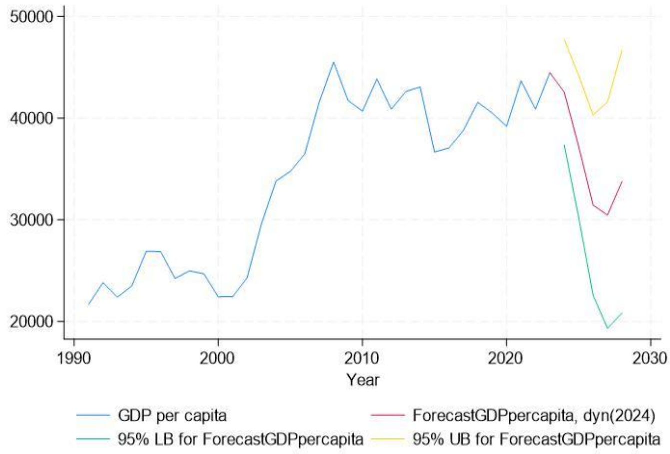


Figure 4: The amount of GDP per capita from 2000 to 2030 (a forecast from 2024 to 2029)

The forecast for GDP per capita from 2024 onwards reflects not just the immediate past, but also interactions between FDI, industry, and GDP over the previous years. Thus, the sharp decline followed by a recovery in GDP per capita could be due to delayed effects from economic shocks (like external investment or structural changes) in earlier periods.

CONCLUSION

Based on the results of our study, we can conclude that Foreign Direct Investment (FDI) has had a positive impact on both short-term and long-term economic development in France. In this regard, the growth of FDI has proven beneficial for increasing GDP per capita, which serves as an indicator of economic development according to the World Bank's methodology. From these findings, we can deduce that one of the key policy strategies for promoting economic growth in France is the expansion of FDI.

Given the positive results of this research, further studies are being carried out to address the remaining issues, which will be explored in future investigations.

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