The Differentiated Driving Forces of Consumption and Export to Economic Growth in China

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Abstract. After the reform and opening up, Chinese economy has made huge achievement. However, in the past decade, due to the deterioration of external macroeconomic conditions, the economic growth of emerging economies in the world has slowed down significantly, and China is no exception. Based on this, the author takes the growth of export growth, GDP and consumption in China as the research objects, and collects data on the nominal GDP, consumption, investment, government expenditure and export growth rates from 2011 to 2024(the first quarter). Based on the GDP expenditure method and by establishing an OLS model, the results indicate that the growth rate of gross domestic products is significantly associated with the growth rate of consumption and export. Over the past thirteen years, each unit increase in consumption growth has led to a 0.2953934 unit rise in GDP growth, compared to a 0,1880651 unit increase for export growth. This demonstrates that GDP growth depends more on consumption than exports in China, supporting the strategic focus on domestic economic cycles and both domestic and international dual cycles.

Keywords: Economic Growth, Export, Consumption.

1 Introduction

After the reform and opening up, what it is noticeable that the volume of foreign trade of China has witnessed high speed achievement, growing from a total volume of 35.5 billion RMB in 1978 to 41681.5 billion RMB in 2023. Additionally, the nominal GDP of China has also risen from 367.9 billion RMB to 12605.82 billion RMB. However, Over the past decade, with the transformations in the international circumstance and the adjustment of domestic policies, economic growth rate has progressively decelerated, and the growth rate of GDP declined from 9.3% in 2011 to 5.2% in 2023, indicating a downward tendency year by year. This has drawn considerable attention to the question of whether economic growth can sustainably depend on exports and investment in China. In classical economics, it is generally believed that exports, investment, and consumption jointly drive the economic growth of an economy, which is more vividly called the "three horses". Shen and others calculated the driving effect of consumption, investment and exports on economic growth. They believed that the composition of economic growth drivers has undergone significantly changes

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before and after Chinas accession WTO. The driving effect of consumption has been declining, while the driving effect of exports has been increasing [1]. Shi and Huang believed that China's demand structure imbalance is extremely serious. Even compared with various East Asian economies that pursue export- and investment-driven strategies, China's high investment rate and low consumption rate are still very significant [2]. In addition, Liu and An believed that it is necessary to expand the driving effect of consumption and transform economic growth to a coordinated drive of "three horses" [3]. Overall, for a long time, economic growth has predominantly been driven by exports and investment, with consumption contributing significantly less to overall economic expansion compared to these two factors. In addition, many Chinese scholars have realized the importance of consumption to China's economic growth. Obviously, these people believe that China's economic growth momentum needs to be adjusted from relying on exports and investment to consumption. Out of scientific skepticism, the author cannot help but wonder if China's previous model of economic growth driven by investment and exports is really unsustainable? Does consumption provide greater marginal utility for economic growth compared to exports and investments? To this end, the author collected data on Growth rate of export, consumption, investment, government spending and gross domestic product from 2011 to 2024(the first quarter), and established a linear regression equation by ordinary least square. Due to the limitation of China's investment data, the author can only find data on China's fixed investment. For the sake of rigor, this article investigates and juxtaposes the impact of consumption and exports on economic growth.

The remainder of the article is organized as follows: The second section discusses the findings from global scholars regarding the causal relationship between exports or consumption and economic growth. The third section outlines the data and model employed in this study, followed by the conclusion in the fourth section.

2 Literature Review

In the world, economists have extensively studied the causal relationship between consumption, export and economic growth. For example, Mensah et al. conducted an empirical study on the relationship between Ghanas exports and economic growth from 2010 to 2019, proved the long-term relationship between Ghanas exports and economic growth, and believed that export-led growth is a sustainable way for Ghanas long-term economic growth[4]. In addition, a study collected data on exports, imports and population to gross domestic product (GDP) in Indonesia, Malaysia, Singapore, Brunei Darussalam and the Philippines from 2000 to 2019 and used quantitative descriptive methods and panel data regression analysis. The results showed that exports have a positive and significant impact on GDP[5]. According to the research of Ali et al., they proved that economic growth is the driving force of exports.[6]. According to the research of Ming-Hsien et al., if exports promote economic growth, their impact is positive, as they can encourage economic growth via the Keynesian aggregate demand effect [7]. To be specific, an increase in exports means that foreign countries spend more on domestic goods and services, which leads to more foreign

exchange in the country, allowing more intermediate products to be imported, thereby increasing capital formation rate, employment rate and profits. According to a study, the paper not only use secondary data from the Central Bank of Nigeria and the National Bureau of Statistics Statistical Bulletin for the decade ending 2018, but also analyze the data using the ordinary least squares method in SPSS. The result indicates a positive correlation between exports and gross domestic product (GDP).

Certain scholars have researched the causal correlation between domestic consumption and economic growth, with many asserting that economic growth is mainly driven by domestic consumption rather than exports. For example, A study used the Autoregressive Distributed Lag (ARDL) cointegration boundary test to determine the impact of domestic demand on economic growth under closed and open economic systems, and they found that from 2000 to 2018, under the open economic system, the short-term and long-term impacts of domestic demand and exports on economic growth in Indonesia were positive and significant, and the impact and contribution of domestic demand was much greater than that of exports. Therefore, the study believes that for Indonesia to achieve sustainable economic growth, it should balance the export-led and domestic demand-led growth strategies[8]. According to the research of Tsen, there is a two-way causal relationship between domestic demand and economic growth in China [9]. Furthermore, Ebo used the least squares method in SPSS statistical software to analyze Nigeria in 2018 and found that there is a positive correlation between exports and gross domestic product (GDP), and that exports have a positive impact on economic growth[10].

In general, both consumption and exports can contribute to economic growth. For avoiding the mutual influence between variables, such as investment and consumption growth will increase imports, this paper does not consider the impact of imports on GDP to prevent the underestimation of the contribution of exports to GDP.

3 Methodology

3.1 Subject

The economic growth of an economy is mainly measured by GDP, and there are three ways to calculate GDP: output method, income method, and expenditure method. However, in this article, both the collected data and the establishment of the model are based on the GDP expenditure method. The formula is as follows:

$$Y=C+I+G+(X-M) \tag{1}$$

In formula (1), Y is gross domestic product, I is investment, C is consumption, G is government expenditure, X is export, and M is import.

First of all, the export rate and net export rate in Table 1 represent the percentages of exports as well as net exports relative to GDP. However, net exports are exports minus imports, and generally only account for a very small proportion of GDP, with an average of 4.2% in the past four years and a maximum of only 4.8% in 2022. In fact, exports in 2022 were 1793.26-billion-yuan, accounting for 19.8% of GDP that

year, about 4 times the net export rate. Obviously, since the proportion of net exports to GDP is noticeably lower than the proportion of exports to GDP, and considering the presence of imports, scenario can arise where large imports and large exports or small imports and small exports result in similar net export scales. This is also the main reason why the author chose export growth rate as the research object instead of net export growth.

Table 1. China's GDP, exports and net exports (statistics at current prices).

Year	Gross Domestic Products (million RMB)	Export (million RMB)	Net Export (million RMB)	Export Rate (%)	Net Export Rate (%)
2023	126091650	23772600	5788300	18.9	4.6
2022	121020720	23965400	5863000	19.8	4.8
2021	114367000	21732800	4368700	19.0	3.8
2020	101598600	17932600	3709600	17.7	3.7

3.2 Data

The empirical study in this paper uses China's quarterly data on nominal GDP, exports, consumption, investment (due to data collection constraints, all investments in this paper are China's fixed investment) and government expenditure from 2011 to the first quarter of 2024. The explanatory variables in this paper are the nominal growth rate of export, consumption, investment and government expenditure. The explained variable is the nominal growth rate of GDP, and the processing method of growth rate in this paper is to compare the data of the same quarter but different years. For example, the data in the first quarter of this year is compared with the data in the first quarter of last year using natural logarithms to eliminate the impact of quarterly changes. The data are all from the National Bureau of Statistics of China. Table 2 reports the statistical data of each variable in China.

Table 2. Statistical indicators.

Statistical Index	Mean	Median	Maximum	Minimum	Standard Division	Observation Number
GDP Growth (%)	3.41	3.63	8.43	-2.45	1.54	49
Consumption Growth (%)	3.43	4.26	12.68	-9.50	3.16	49
Investment Growth (%)	2.02	2.97	23.32	-22.68	8.06	49
Export Growth (%)	2.37	2.37	15.65	-6.81	3.71	49
Government Spending Growth (%)	3.43	2.87	40.28	-31.57	12.30	49

Figure 1 presents the trajectories of GDP, export and consumption growth rates from January 2011 to November 2023. The blue line shows the GDP growth rate, the red line the consumption growth rate, and the green line the export growth rate. Initially, all three growth rates exhibit moderate volatility. From 2011 to 2019, GDP growth remained relatively stable, hovering around 5%-10%. Consumption growth rates exhibit slightly higher variability, typically between 5 and 15 percent. The export growth rate fluctuates the most, with distinct peaks and troughs, but generally remains between 0 and 15%. There was a significant deviation around early 2020, when all three growth rates plummeted, coinciding with the onset of the COVID-19 pandemic. This period marked a sharp downturn, particularly in exports, which fell sharply to below -20 percent. This downturn was followed by a rapid recovery at the end of 2020, particularly in exports, which surged to over 30 per cent, indicating a possible quick rebound due to the resumption of global trade and economic activity. After 2020, the growth rates of GDP, consumption and exports stabilize, but the variability is lower than the pre-2020 levels. GDP growth fell slightly and remained mostly below 5%. Consumption growth is closely related to GDP, while export growth is more volatile but generally on a downward trend. Overall, Figure 1 reflects a strong similarity in the trends of GDP, consumption and exports.

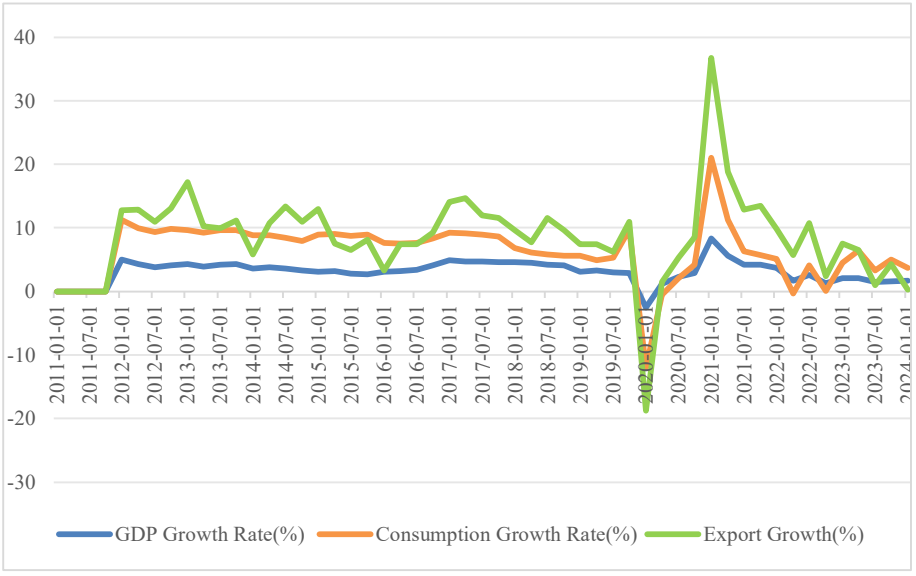

Fig. 1. The trajectories of growth rate of GDP, export and consumption.

3.3 Correlation Coefficient

The growth rates of GDP, export and consumption have similar increasing and decreasing trends, for the sake of academic rigor, it is necessary to calculate the Pearson correlation coefficient between the two. The formula is as follows:

$$\rho = \frac{\mathrm{Cov}(x,y)}{\sqrt{\mathrm{Var}(x)} \times \sqrt{\mathrm{Var}(y)}} \quad (2)$$

Among them, Cov (x, y) denotes the covariance between variables x and y, Var(x) represents the variance of variable x, and Var(y) indicates the variance of variable y. To be specific, variables y and x are the growth rates of GDP and export or consumption, respectively.

Table 3 the correlation coefficients illustrating the relationships between GDP growth rate and two factors: export growth rate (0.6444) and consumption growth rate (0.7531). These values indicate that the GDP growth rate correlates more strongly with consumption growth rate (0.7531) compared to export growth rate (0.6444).

Table 3. Correlation coefficient between GDP and export growth rate.

	GDP Growth Rate
Export Growth Rate	0.6444
Consumption Growth Rate	0.7531

3.4 Model Establishment and Test

In establishing the OLS model, this paper establishes a multivariate OLS linear model, and the model is as follows:

$$y=\beta 1 \cdot c+ \beta 2 \cdot i + \beta 3 \cdot g + \beta 4 \cdot x + \beta 0+ u \quad (3)$$

In this OLS model, c, i, g and x are the growth rates of consumption, investment, government expenditure and export, respectively, and these are all explanatory variables. And y denotes the growth rate of GDP, and it is the explained variable. u is the residual term. β1, β2, β3 and β4 are the regression coefficients of c, i, g and x, respectively. β0 is the intercept of the linear equation. The author imported the statistical data into Stata software and conducted regression modeling to draw conclusions as depicted in Table 4.

Table 4. Model results.

GDP Growth(%)	Coefficient	Standard Error	t	P>|t|	95% Confidence Interval	
Consumption Growth(%)	0.2954	0.0356	8.31	0.000	0.2238	0.3670
Export Growth(%)	0.1881	0.0303	6.21	0.000	0.1270	0.2491
Investment Growth(%)	0.0300	0.0018	1.71	0.095	-0.0055	0.0654
Government Spending Growth(%)	0.0079	0.0092	0.87	0.391	0.0105	0.0264
cons	1.86135	0.1641	11.35	0.000	1.5308	2.1979

As depicted in Table 4, there are 49 samples in the entire OLS model. F (4, 44) statistic is 40.93 with p value of 0.0000, demonstrating that the entire model is statistically significant, suggesting that at least one explanatory variable exerts a significant influence on the explained variable in the model. R^2 and adjusted R^2 are 0.7882 and 0.7689 respectively, which indicates that the model can account for 78.82% of the variability in GDP growth rate without considering the number of independent variables, and 76.89% of the GDP growth rate when the number of independent variables is considered. The root mean square error is 0.74087, which means that when the model predicts the GDP growth rate, there will be an average error of 0.74087% with the actual GDP growth rate. As for the constant term and regression coefficient, the intercept term is 1.86135, signifying that when all independent variables are zero, the estimated GDP growth rate is 1.86135, and the p value is 0.000, indicating that the intercept term is statistically significant. The regression coefficient for consumer expenditure is 0.2953934. This indicate that with each unit increase in consumer expenditure, the expected increase in GDP growth rate is 0.2953934 units. p value associated with this coefficient is 0.000, indicating statistically significant. Furthermore, the 95% confidence interval does not encompass 0, providing additional evidence of the coefficients significance. The regression coefficient for the export growth rate is 0.1880651, indicating that a one-unit increase in the export growth rat is associated with an expected increase of 0.1880651 unit in the GDP growth rate. Its p value is 0.000, indicating that the coefficient is significant, and the 95% confidence interval does not include 0, which also verifies that the coefficient is significant. The regression coefficient for investment is 0.0299693, implying that a one-unit increase in fixed investment is expected to lead to a 0.0299693 unit increase in the growth rate of GDP. Its p value is 0.095, indicating that the coefficient is not significant, and the 95% confidence interval includes 0, which also verifies that the coefficient is not significant. The regression coefficient of government expenditure is 0.0079277, indicating that a one-unit increase in government expenditure, is expected to result in a 0.0079277 unit increase in the GDP growth rate. Its p value is 0.391, indicating that the coefficient is not statistically significant, and the 95% confidence interval includes 0, which also verifies that the coefficient is not significant. In general, among the factors affecting China's GDP growth rate, consumer expenditure and export growth rate are significant positive factors, while investment and government expenditure do not show significance in this model.

Table 5. Multicollinearity test.

Variable	VIF
Investment Growth	1.14
Government Spending Growth	1.11
Export Growth	1.10
Consumption Growth	1.10
Mean	1.11

To validate the robustness of the model, this paper conducted multiple tests. First, in order to prevent the correlation between independent variables from affecting the results, this paper calculated the variance inflation factor (VIF) used to assess multicollinearity among independent variables. The results are shown in Table 5.

The VIF of all variables is between 1.10 and 1.14, and all are less than 5, which indicates that there is no serious collinearity problem between these variables.

In order to test the normality of the residuals, this paper uses the Shapiro-Wilk W test, histogram and Q-Q plot method through Stata software, and the results are shown in Table 6.

Table 6. Shapiro-Wilk W Test.

Variable	Obs	W	V	z	Prob>z
residuals	49	0.98984	0.470	-1.608	0.94604

As shown in Table 6, the W value is 0.98984, which is close to 1, indicating that the residual is close to normal distribution. And Prob > z is 0.94604, exceeding the typical significance level, indicating that there is insufficient evidence to reject the null hypothesis of normal distribution of residue.

Most of the residual points are distributed along the diagonal, which indicates that the residuals are close to normal distribution. This further supports the results of the Shapiro-Wilk test, indicating that the model residuals meet the normality assumption. The residuals are roughly normally distributed, which is consistent with the results of the Q-Q plot and the Shapiro-Wilk test, indicating that the residuals are close to normal distribution. To examine constancy of residue variance, this paper employs the Breusch-Pagan test, and the results are shown in Table 7.

Table 7. Breusch-Pagan Test.

H0	Constant Variance
Chi2(1)	0.00
Prob>chi2	0.9932

As indicated in Table 7, the p value is 0.9932, significantly exceeding 0.05, thus it is failed to reject the null hypothesis (the variance of the residual is constant). This means that the model satisfies the homoscedasticity assumption and the variance of the residual is constant. The study also calculated Cook distance. Cook distance of these data points is between 0 and 0.6, and only one data point exceeds 0.5. Generally speaking, a data point with a Cook distance greater than 1 is considered to have a significant impact on the model, and most of the data points are concentrated between 0 and 0.1. Therefore, the author believes that the model is robust as a whole.

4 Conclusion

After using multiple test methods to test the OLS model, the author believes that the model is relatively robust and its regression results are reliable. From the first quarter of 2011 to the first quarter of 2024, an increase of one-unit in China's consumer ex-

penditure is expected to correspond with a 0.2953934 unit increase in the growth rate of GDP. Additionally, a one-unit increase in China's export growth rate is anticipated to result in a 0.1880651 unit increase in GDP growth rate. From this result, it is evidence that in the past thirteen years, GDP growth rate has relied more on consumption than exports in China. This also means that China's previous export-led economic growth model should gradually be replaced by a domestic consumption-led economic growth model. Therefore, this paper puts forward two suggestions:

Further establish and improve social security systems such as medical care and pension. For a long time, the high savings rate in China is closely related to the imperfect social security system such as medical care and pension. Especially for migrant workers who work from rural areas to urban areas, due to the restrictions of the household registration system, it is difficult to obtain the same social security conditions as urban residents, which suppresses their consumption willingness and demand.

Reduce the urban-rural income gap and change the current situation of too low a proportion of rural consumption. Although the added value induced by rural consumption per unit is higher than that of urban and government consumption, the proportion of rural consumption in the three continues to decline, which has a consequence on the consumption-driven economic growth effect. Therefore, it is necessary to increase government financial support for rural areas, establish a long-term mechanism for rural residents' income growth, and increase the disposable income level of rural residents.

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