How does the industrial sector respond to the performance of the capital market? Econometric evidence from quarterly data for Peninsular India.

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Abstract

This research empirically investigates the relationship between the capital market and industrial development in peninsular India. To reach the target, quarterly time-series data sources from globally renowned domains, including total income for 17514 companies from CMIE, exchange rates and interest rates from the Economic Data published by the Federal Reserve Bank, and the Globalisation Index from the KOF Swiss Economic Institute, for the period from 2008Q1 to 2025Q1. The autoregressive distributed lag (ARDL) model employed on the time-series variables yielded some interesting insights. The empirical results confirmed the existence of a nexus between the capital market and industrial development. The result's magnitude indicates that a 1 per cent increase in market capitalisation augmented industrial development by 0.4 per cent per quarter. Hence, the computed results supported the proposed hypothesis that *market capitalisation has a positive and significant impact on India's industrial economy*. It validates the notion that Tobin's Q ratio is greater than one. However, the feeble coefficient implies it marginally exceeds the pivotal value of one warranted by Tobin. Hence, it requires disembodied technology and the shape-shifting of industrial R&D to augment Tobin's Q. Further, both globalisation and interest rates have positively influenced India's industrial economy. It shows how globalisation steers a seismic technology shift, promoting productivity growth, and how interest rate policy serves as an oracle guided by the spirit of business optimism.

Keywords: Tobin's Q, Business optimism, Capital market, Productivity shift, ARDL Bounds

Introduction

Finance has played a catalytic role in socioeconomic development for many decades. Hence, many view it as an essential driver of achieving the targeted growth level within the stipulated period. Schumpeter (1912) rightly pointed out that Finance is a critical input for growth. To substantiate Schumpeter's view, Levine (1991), Obstfeld (1994), and Devereux and Smith (1994) argue that a globally integrated and strengthened financial system may promote productivity growth and enhance economic status. It is also evident from the ground reality that many countries have registered significant growth in productivity/GDP with the support of robust financial intermediaries. The nexus between financial integration and economic growth has been extensively examined and scholarly discussed in both empirical and theoretical literature (Schumpeter, 1912; Patrick, 1966; Goldsmith, 1969; Shaw, 1973; McKinnon, 1973). Economic growth is positively affected by the expansion of the financial sector, which increases returns on investment by boosting savings and enhancing human capital (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991). It is imperative, and would constitute academic negligence, if we fail to note and adequately mention Tobin's Q, developed by James Tobin. Tobin

(1969) suggests that a ratio of the market value of installed capital to the replacement cost of capital should exceed 1 to stimulate reinvestment. The covert theoretical imprint is that such a value greater than one camouflages a positive marginal productivity of the factor. Hence, it infers that a well-flourished financial system will yield a multiplicative output for a given amount of input due to increasing returns to scale (Murthy & Samantaraya, 2014). Significant developments have occurred in the Indian financial sector, particularly in the capital market, in terms of size, function, and their forward and backward linkages with other sub-sectors, particularly after the 1991 unleashed developmental policy.

The industrial sector is generally vibrant in any nation, particularly in emerging economies, boosting growth. Though development theories recognised industrial development as a key factor in socio-economic progress, the *Nobel Laureate Simon Kuznets* (1966) argued that industrial development is synonymous with development. In their influential works, Hoffmann (1958), Kaldor (1966) and Chenery (1980) described the unique significance of the industrial sector in the paramount development of a nation. In seminal studies, scholars such as Rangarajan (1994), Ahluwalia (1985), Golder (2004), Chandrasekher (1988), Nagaraj (1980), and Balakrishnan and Babu (2003) have documented the contribution of the industrial sector in tapping the untapped potential resources, achieving export earnings, generating employment opportunities and enhancing the economic status of a nation. In all these research works, capital played a leading role.

The stock market contributes significantly to a country's economic growth through industrial development. The triangular relationship among capital market development, industrial development, and economic progress is cited below. The process of financial deepening and an increase in the volume of savings boost the level of investment even in the industrial sectors, which in turn generates a spillover effect on the economic status of a nation through technological upgradation, R&D, skilled human resources, modernisation and human capital accumulation in the industrial sector (Kabango & Paloni, 2011). However, in the recently emerged body of literature, researchers (Pagano et al., 1998; Hertzel and Li, 2010; Makan and Demos, 2012; Alden, 2014; & Fan, 2020) argue that industrial units are utilizing the fund (which is observed from the capital market) to alter their liabilities, change their debt maturity, enhance financial assets, replace more expensive financing with cheaper funding etc. In a recent study, the World Bank researchers Didier et al. (2021) unveil that firms raise capital market funds to enhance their tangible and intangible capital, boost their productive capacity, and increase their skilled workforce. These activities have a direct bearing on a nation's economic progress.

Following the pioneer work of McKinnon (1973) and Shaw (1973), several theoretical and empirical studies have demonstrated the interlinkage between the capital market and economic progress. However, little research has examined the nexus between capital market performance and industrial development. Further, as per the researchers' knowledge, no research has been conducted on the Indian premises (over the recent decade) on the above-mentioned research issue. Therefore, the current study is a scientific academic effort to address the gap. Counterpoised to that, the key objective of the present study is to evaluate whether or not the capital market's performance favours this nation's industrial development over the period from 2008Q1 to 2025Q1. Using the ARDL bounds test on time-series data from CMIE for 17514 companies, the study finds that India's industrial economy was positively affected by the capital market's performance (at the 5% significance level). Hence, the computed result verifies the proposed hypothesis that market capitalisation has a *positive and*

substantial impact on India's industrial economy. Therefore, the current study contributes to the growing body of literature/existing knowledge in the following ways: previous research has primarily focused on how capital market performance affects macroeconomic growth. However, this is one of the pioneering studies that estimated the impact of capital market performance exclusively on the nation's industrial sector, premised on Tobin's Q theorem, which explains how the capital market assesses a firm's viability.

The rest of this study is organised as follows. *Section* 2 critically examines the existing studies in two parts: (a) the finance-growth nexus and (b) empirical evidence for the finance-industrial growth relationship. *Section* 3 articulates data, study period, variables, and the model specification. *Section* 4 contains econometric results, interpretation, and discussion. Moreover, *Section* 5 concludes the research work and offers policy propositions.

Theory and Empirical Literature

(a). Finance-growth nexus

The neo-classical growth model, commonly known as exogenous growth theory, pioneered by Solow (1956 & 1957), proposed that economic growth can be driven by exogenous variables, primarily capital and labour. In association with the exogenous growth model, to examine economic growth, Cobb-Douglas (1928) developed the manufacturing function, modelling against capital input (both local and international), workforce accumulation, and the extent of technological advancement (subject to temporal variation). The theoretical frameworks of these globally renowned experts indicate that substantial capital accumulation has meaningfully contributed to a nation's economic growth, in proportion to its share of capital. In addition, both labour force augmentation and technological progress influence economic growth. Hence, these theories directly and indirectly illuminate the existence of the capital accumulation-economic growth nexus.

However, in the new growth model put forward by Romer (1986, 1990, and 1994) and Lucas (1988), it is advocated that two primary inputs, such as the stock of human resources and technical innovation, are required (Romer, 1986, 1990, and 1994; Lucas, 1988). The endogenous growth model assumes that long-run growth is a function of technological progress, achieved through capital accumulation, which enhances technological status and enriches human capital. A substantial number of empirical studies have investigated the relationship between financial sector development and economic progress using appropriate econometric models. Among the available pieces of literature, studies by Rajan and Zingales (1998); Demirguc-Kunt and Maksimovic (1998); and Levine and Zervos (1998) observed a positive inter-relationship between the performance of the capital market and economic growth, the latter the research finding of Henry, (2000); Beck and Levine, (2004) and Bekaert et al., (2005) endorsed the same.

(b). Finance-industrial development nexus

The theatrical contributions of Schumpeter (1912), Shaw (1973), and McKinnon (1973) identified the functional association between the financial categories and economic growth. More specifically, they argue that financial deepening and savings enhance investment across economic sub-sectors and improve economic progress. The industrial sector is one among them, which receives periodic support from the financial sector and contributes substantially to a nation's overall economic growth.

In the existing empirical literature, only a limited number of studies have examined the capital market's influence on industrial development in the short and long run. For instance, studies by Okoye et al. (2013), Dagogo (2014), Ibi et al. (2015), and Didier et al. (2021) observed a positive relationship between the development of the capital market and industrial development worldwide. At the same time, the academic exercise of Josiah et al. (2012) and Kwode (2015) concluded that industrial development goes beyond the influence of capital market performance. Hence, it is evident that the knowledge emanated from these research studies is mixed and inconclusive.

Date, Methods, and Model Specification

The key objective of the current study is to examine the nexus between the capital market performance and industrial development in the Indian context. In our regression equation, the total income of the manufacturing sector (*TIM*) is the dependent variable (a proxy for industrial development). Besides this, market capitalisation (*MCAP*), exchange rate (*EXCH*), interest rate (*INTER*), and globalisation index (*GI*) are the regressors. The central focus is on assessing the magnitude of the transformation in the dynamic relationship between TIM and MCAP from the short run to the long run. The famous Tobin's Q theory is the theoretical lens that we borrowed to observe the behaviour among the variables. The theory explicitly stipulates that the ratio of capital employed to the replacement cost of capital should be above 1 to facilitate reinvestment. The covert theoretical implication is that positive marginal productivity of capital is associated with Tobin's Q value greater than one.

The further globalisation index is a vehicle for the transfer of foreign technology through trade and FDI. This is expected to drive a desirable shift in productivity in industrial production functions. Interest is taken as a measure of economic optimism and business cycle upswing, as interest rate hikes in India are generally part of a counter-cyclical macroeconomic policy set. The exchange rate is the channel through which international macroeconomic shocks are transmitted. The quarterly time-series data on the variables mentioned above have been sourced from globally renowned data sources from 2008Q1 to 2025Q1. The dataset includes income data for 17514 manufacturing industries. The industrial bouquet of India comprises industries producing textiles, food processing, chemicals, wood and wooden products, plastics, and other products. The total income of the manufacturing sector and market capitalisation have been extracted from the **CMIE** subscribed database. Both exchange rates and interest rates have been collected from online economic data published by the **Federal Reserve Bank of St. Louis.** At the same time, the globalisation index has been sourced from the **KOF Swiss Economic Institute**. For this academic exercise, time-series data on these exogenous and endogenous variables have been collected, as time-series data can provide better insights into the factors driving the dependent variable (Wang, 2022). The magnitudes of these time-series variables are as follows: quarterly data on market capitalisation are reported in absolute terms (in million Rupees). While the exchange rate is a quarterly nominal rate, the interest rate is the lending rate. We have transformed the annual globalisation index data into quarterly data using Eviews in linear mode. The availability of data in terms of duration varies widely. Hence, to maintain uniformity in our data set, we have included the time-series variables only up to 2025Q1.

All these variables are converted into a log form and the question form of the time-series variables as follows:

$$\ln TIM_t = 1 + 2\ln MCAP_t + 4\ln INTER_t + 5\ln GI_t + 5\ln EXCH_t + t \dots (1)$$

As per the procedure, before estimating the functional relationship among the exogenous and endogenous variables, the time-series variables' orders of integration are to be checked. Hence, following previous works, we have employed both the Augmented Dickey-Fuller test (1979) and the Phillips and Perron (1988) examinations. As a few variables are *I(0)* and the remaining variables are *I(1)*, we have applied the dynamic ARDL model. Our lag selection criteria have directed us to impose two lags. We conducted a cointegration test to examine the long-run associations among the variables (before estimating the ARDL model). To examine the long-run and short-run functional relationship among the time series variables in the industrial economy of India, the following ARDL model has been used:

$$\Delta \ln TIM_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta \ln TIM_{t-i} + \sum_{i=0}^{n} \alpha_2 \Delta \ln MCAP_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta \ln INTER_{t-i}$$
$$+ \sum_{i=0}^{n} \alpha_4 \Delta \ln GI_{t-i} + \sum_{i=0}^{n} \alpha_5 \Delta \ln EXCH_{t-i} + \beta_1 \ln TIM_{t-i} + \beta_2 \ln MCAPI_{t-i}$$
$$+ \beta_3 \ln INTER_{t-i} + \beta_4 \ln GI_{t-i} + \beta_5 \ln EXCH_{t-i} + \mu_t$$

In addition to the ARDL model, the stability, normality and serial correlation of the model are to be scanned. Hence, we have performed some post-estimation checks: the Ramsey test, the Breusch-Godfrey LM test, the Breusch-Pagan-Godfrey test, the Heteroscedasticity test, the Histogram, and the CUSUM and CUSUM of squares charts to assess the stability, normality, and the presence of serial correlation in our model.

Results and Discussion

Initially, the study employed the Variance Inflation Factor (VIF) test to assess the collinearity among time-series variables and to evaluate the relationship between capital market performance and industrial development. The variance inflation factor (presented in Appendix 3) indicates that any possibility of multicollinear relationships among the variables is overcome by a piece of evidence against the establishment of the variables, as the centred VIF exhibits the fact that none of the centred VIF exceeds the lethal limit of 10. Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests for unit root test (appendix 4) bespeak non-stationary behaviour, a precondition to establishing a cointegration relationship among any set of variables. The ARDL bounds approach to cointegration, an umbrella model encompassing both short- and long-run relationship coefficients, reveals a dynamic association among the variables, with metamorphosis in the relationship over time accounted for.

Short-run association

In the first step, let us examine the short-run association. The industrial sector's total income is the dependent variable. Total income has a one-year lagged impact on itself. It suggests that any effect in the past is likely to carry over into the next period, especially adverse effects with a more persistent memory. The dependent variable is positively affected by a one-year lag in market capitalisation. Higher market capitalisation reflects a favourable business environment, suggesting higher demand, profits, and income.

Table 1: Short-run model

Variables	Coefficient	Std. Error	t-Statistic	Prob.
LnTIM(-1)	-0.7	0.1	-5.7	0.0
D(LnMCAP)	0.0	0.1	0.3	0.8
LnMCAP(-1)	0.3	0.1	4.2	0.0
D(LnINTERE)	0.8	0.2	4.2	0.0
LnINTERE(-1)	0.3	0.1	3.0	0.0

LnEXCH	-0.2	0.1	-1.2	0.2
GI(-1)	4.4	1.4	3.2	0.0
D(LnGI)	11.3	5.8	2.0	0.1
D(LnGI(-1))	-15.9	5.6	-2.8	0.0
C	-5.2	2.0	-2.6	0.0

***, ** and * are, the 1%, 5%, and 10% significant levels respectively

In theory, the dependent variable is positively affected by the previous year's interest rate hike. A rise in interest rates is mostly a counter-*cyclical process* to ease inflation when the economy enters a boom period. Hence, the interest rate is also an indicator of economy-wide optimism as the RBI undertakes it as a counter-cyclical measure. Hence, a 1% increase in interest rates in the current year has a positive, one-year-lagged effect on the manufacturing sector's earnings.

The globalisation index also elicits a highly positive impact. A 1 per cent change in the regressor has a 4.4 per cent positive impact on the regressand, which bears testimony to the international macroeconomic dynamics Adam Smith pinpointed, explaining how market expansion increases sales and how the division of labour facilitates specialisation. Further, the interest rate has an immediate positive impact on manufacturing income, which suggests a pessimistic outlook for the economy. The lagged negative implications of the globalisation index point to international macroeconomic hazards that have negative repercussions, including falling global demand for domestic manufacturing commodities. The impact of the exchange rate is negative, as the Marshall-Lerner condition is not satisfied in the short run, and the J-curve effect takes longer to realise.

Long-run association

The long-run relationship maintains a pattern similar to that in the short run. Market capitalisation has a 0.4 per cent impact on the regressand for a one per cent increase. Market capitalisation is driven by brand creation, reputation, and sales volume. However, in the short run, it is volatile mainly due to rapidly changing global and national macroeconomic scenarios, both pessimistic and optimistic. Hence, a market capitalisation fall also reflects the systemic risks the industry is prone to, including demand for the underlying commodities, sales turnover, and industry profits. Hence, the impact of market capitalisation is not linear, and the positive effect outstrips the negative dissonance. *Tobin's Q hypothesis* suggests that higher long-term interest rates are a catalyst for reversing the business cycle and deflecting international and national market trends of market optimism. Hence, the interest rate has a 0.4 per cent affirmative imprint on the dependent variable. The globalisation index shows a significant positive response, which is paramount, reflecting that international division and specialisation of labour provoke macroeconomic economies of scale in terms of an extensive market, higher marginal productivity of fixed factors, productivity shifts via technological change, and shifts in human skills. Further, globalisation facilitates greater technology transfer through trade and FDI. This has favourable outcomes in the domestic and foreign markets, provided favourable and enlightened macroeconomic policies coexist. The exchange rate has still negatively impacted income outcomes, but the effect is insignificant. Due to exchange rate depreciation, we could not demonstrate any desirable long-run outcomes, such as the Marshall-Lerner condition or the J-curve effect.

Table 2: Long-run model

Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LnMCAP	0.4	0.1	4.6	0.00***
LnINTERE	0.4	0.1	4.0	0.00***

LnGI	6.4	1.7	3.9	0.00***
LnEXCH	-0.2	0.2	-1.2	0.20
C	-7.6	2.6	-2.9	0.00***

***, ** and * are, the 1%, 5%, and 10% significant levels respectively

Diagnostic test

The diagnostic tests were undertaken to check for serial correlation, non-normality in the error term distribution, and heteroscedasticity. The respective tests for these problems are the LM test, Jarque-Berra, and ARCH test, with the results presented in Table 3, which failed to reject the respective null hypotheses that there is no serial correlation, no non-normality in the distribution of error terms, and no heteroscedasticity, indicating the model is free from any of the problems against which the test is undertaken.

Table 3: Results of Diagnostic Test:

| Ramsey RESET test	LM test	Jarque-Bera test	ARCH test
0.08(0.77)	0.34(0.70)	0.13(0.93)	0.14(0.17)

The value inside the parentheses is the p-value.

Stability Check

The results of the CUSUM and CUSUMSQ for the stability test indicate that the plots are well within the bandwidth, as shown by the blue plot's movement relative to the red line. This implies the models are stable and free from autoregressive structures.

Figure No. 1

Stability test result

Cusum test

Cusum square test
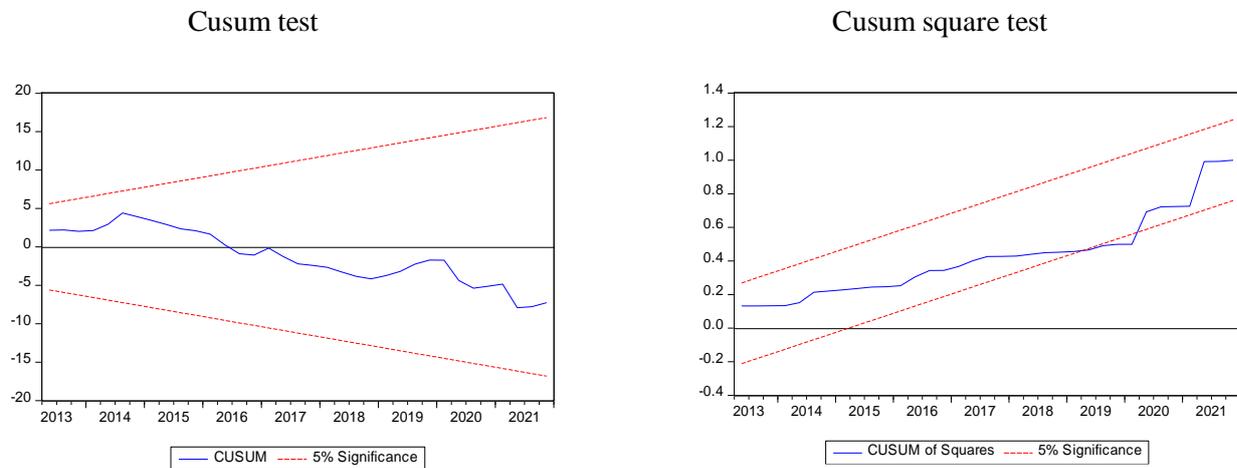
Significant at 5% level.

Conclusion and Policy Implications

The relationship between market capitalisation and industrial development has been estimated using an ARDL model. The intention was to analyse quarterly data from 2008Q1 to 2025Q1 to identify short- and long-duration coefficients. The basic idea behind market capitalisation and its relationship with total income stems from Tobin's Q theory, which states that reinvesting in the company is preferable if installed capital's market value exceeds its replacement cost. Further, the higher the market capitalisation, the greater the business's viability and the greater the market optimism. Even when market capitalisation is negative, its ability to stimulate income is weak in the short and long term. Market capitalisation is one of the essential factors that influence and stimulate reinvestment,

sales turnover, and profits. Even though we have a Tobin's Q ratio greater than one, as indicated by the nexus between the two, we need a better prospect. The higher the Tobin's Q value, the higher the marginal productivity. Hence, apart from embodied capital, we need to procure disembodied technology and successfully apply it to get a better Tobin's Q ratio. Accordingly, the time demands greater investment in R&D, the creation of R&D centres, and the enrichment of physical infrastructure.

In Interest is a torchbearer of short- and long-term business optimism and the upswing of the business cycle. The globalisation index is proven to profoundly influence the dependent variable when we switch from short-duration to long-duration. International macroeconomics of scale operate through expanding market horizons and foreign technology penetration via FDI and trade. The exchange rate has an adverse effect in the short term. However, its long-term impact is insignificant, indicating *that the Marshall-Lerner* condition and *the J-curve effect* have not been recognised even in the long run.

Appendix:

Appendix 1: Data source and description of the variables:

Variables	Symbol	Unit	Data Source
Total income of the manufacturing sector	LnTIM	Absolute value in Million Rs	CMIE
Market Capitalization	LnMC	Absolute value in Million Rs	CMIE
Interest rate	LnINTER	Lending rate	FRED Bank
Globalization	LnGI	KOF Globalisation Index	Swiss Economic Institute
Exchange rate	LnEXCH	Nominal exchange rate (annual)	FRED Bank

Appendix: 2 Descriptive Statistics:

Variables	TIM	MCAP	INTERE	GI	EXCH
Mean	6.900583	7.954255	0.996856	1.790638	1.771031
Median	6.919324	7.973156	0.986342	1.790109	1.793221
Maximum	7.152261	8.421646	1.124260	1.807873	1.879957
Minimum	6.657845	7.461828	0.920820	1.772688	1.598745
Std. Dev.	0.115686	0.225002	0.042765	0.009052	0.080770
Skewness	-0.465330	-0.004411	1.270233	0.136684	-0.460827
Kurtosis	2.709228	2.487790	4.692512	2.504946	1.870061
Jarque-Bera	2.218249	0.612354	21.74331	0.746219	4.961152
Probability	0.329848	0.736256	0.000019	0.688590	0.083695
Sum Sq. Dev.	0.736079	2.784420	0.100587	0.004507	0.358812
Observations	65	65	65	65	65

Appendix: 3 Result of Variance Inflation Factors:

Variables	Coefficient Variance	Uncentered VIF	Centered VIF
LnMCAP	0.008659	7999.477	6.281567
LnINTER	0.093870	1363.385	2.459927
LnGI	2.924788	3.434088	3.434088

LnEXCH	0.041382	136825.0	3.868412
C	8.398693	122533.9	NA

Appendix: 4 Result of Unit root tests:

Model	ADF		ADF 1st diff		PP level		PP 1st diff	
	t-stat	*p*-value	*t*-stat	*p*-value	*t*-stat	*p*-value	*t*-stat	*p*-value
LnTIM	-1.402	0.574	-8.638	0.000***	-1.076	0.718	-8.839	0.000***
LnMCAP	0.076	0.961	-6.610	0.000***	-0.020	0.952	-6.604	0.000***
LnINTER	-3.820	0.004**	-	-	-3.489	0.003**	-	-
LnGI	-1.187	0.673	-4.790	0.003**	-1.06	0.723	-3.287	0.002**
LnEXCH	-1.847	0.354	-5.928	0.000***	-1.801	0.376	-5.811	0.000***

Appendix: 5 Lag selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	512.5669	NA	2.29e-15	-19.52180	-19.33418	-19.44987
1	791.6510	493.7642	1.31e-19	-29.29427	-28.16855	-28.86270
2	848.8037	90.12534	3.9e-20*	-30.53091	-28.4670*	-29.7969*
3	859.2105	14.40940	7.36e-20	-29.96963	-26.96772	-28.81877
4	899.0147	47.4588*	4.79e-20	-30.5390*	-26.59902	-29.02852

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

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