Public investment and growth in case of Madagascar

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Public Iinvestment and growth

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Abstract

This paper explores the role of public investment in the process of economic growth, in the context of Madagascar's economy, using the vector autoregressive approach (VAR). The model also includes monetary supply and exportation. The result show that public investment has positive effect on growth in short term especially in the second quarter but the effect slowly goes down in the next quarter. This is due to the impact of investment on monetary supply which can lead to potential rise of prices. The effect of investment on growth reaches his highest in the fifth quarter after that its return to his stationary state.

Keywords: Madagascar, VAR, Public investment, money, exportation, GDP.

1 Introduction

Madagascar is a developing country that faces numerous challenges in achieving sustained economic growth and development. Despite having vast natural resources, a diverse range of ecosystems, and a rich cultural heritage, Madagascar remains one of the poorest countries in the world. The country's economy has been plagued by political instability, weak infrastructure, and inadequate investment in key sectors such as agriculture, tourism, and manufacturing.

Public investment has long been recognized as a crucial driver of economic growth in developing countries. Public investment refers to government spending on infrastructure, social services, and other public goods that are essential for economic development. Public investment has the potential to catalyze private sector investment, create jobs, and improve the productivity of the economy.

In Madagascar, public investment has played a significant role in the country's economic development. The government has made substantial investments in infrastructure, including roads, ports, and airports, which have improved the country's connectivity and facilitated trade. The government has also invested in social services, such as health and education, which are crucial for human development and poverty reduction.

However, the effectiveness of public investment in Madagascar remains a topic of debate. Some argue that public investment has not yielded the expected returns, as evidenced by the slow pace of economic growth in recent years. Others argue that the problem lies not with public investment per se, but with the quality of investment, as well as issues related to corruption and weak governance.

The COVID-19 pandemic has further highlighted the importance of public investment in driving economic recovery. Madagascar, like many other countries, has been hit hard by the pandemic, which has disrupted supply chains, reduced demand, and led to a decline in economic activity. In response, the government has ramped up public investment in key sectors such as health, agriculture, and infrastructure to support the recovery effort.

Therefore, it is essential to understand the link between public investment and economic growth in Madagascar. This paper aims to contribute to this understanding by examining the impact of public investment on key economic indicators such as GDP growth, employment, and productivity. By analyzing existing literature and empirical data, we aim to shed light on the role that government investment can play in promoting sustainable economic growth in Madagascar. The findings of this study will be useful for policymakers and development practitioners in designing effective public investment strategies to support economic development in Madagascar.

2 Literature revew

2.1 Theorical approach

Numerous authors have investigated the relationship between public investments and economic growth. According to Keynes (1936), public investment is a determining factor and even a key element in short-term production trends. Post-Keynesian economists also place public investment at the heart of the economic growth process. They argue that investment influences growth through production techniques, the nature and composition of production goods, and capital goods Davenport (1976).

In the view of Harod (1939), a well-adjusted global demand is crucial for public investment to have a positive impact on economic growth. However, in the case of significant fluctuations, public investment may destabilize the economy. Moreover, Cornwall (1974) claims that the greater the proportion of production allocated to investment, the more the growth process will develop.

The endogenous growth model by Barro (1991) highlights the positive externalities generated by public services through public spending on infrastructure. Therefore, infrastructure spending plays an essential role in the growth process. However, the complementarity between private investment and public investment is necessary because it contributes to the improvement of the productivity of private factors Barro et al. (1995).

However, other authors such as Solow (1956) and Burmeister et al (1970) do not share the same view and have demonstrated that public investments have no place in the analysis of growth.

2.2 Empirical approach

Empirical studies on the relationship between public investment and economic growth can be classified into two distinct categories.

2.2.1 Public expenditure has an effect on economic growth

In his research, oriented towards the impact of public investment on the economic growth of the United States for the period 1949 to 1985, Aschauer (1989) opted for an aggregate production function composed of three factors: labor (L), capital (K), and the stock of non-military public infrastructure (S). The results of the analysis led the author to conclude that the productivity of an economy is influenced by investments, particularly in public infrastructure. Thus, a 1% increase in public capital leads to a 0.4% increase in productivity. Additionally, the author found that the decrease in economic growth is influenced by the decline in investment spending in infrastructure.

Barro (1991) studied the contribution of public investments (consisting of education and defense) on economic growth, covering 98 countries from 1980 to 1985. The study found a positive impact, but statistically insignificant. The author estimates that a 1% increase in the public investment-to-GDP ratio stimulates a 0.1% increase in the average growth rate of income per capita.

Numerous empirical studies have proposed the existence of a positive relationship between economic growth and investments in road infrastructure in developing countries.

For example, Canning et al. (1999) devoted their studies to analyzing the impact of paved roads and electricity on growth. They used two production functions, one of the Cobb-Douglas type and the other of the translog type.

Using cross-sectional and panel data, **?** concluded that transport capital has a positive and significant effect on the economic growth of Sub-Saharan countries.

Based on the Ordinary Least Squares method, Bosede et al. (2013) deduced that the improvement of transport infrastructure has a positive and significant impact on the economy of Nigeria for the period 1981 to 2011.

Morley et al. (2000) affirmed the long-term positive impact of total public spending on Egyptian growth. Analyzing the impact of public infrastructure on competitiveness and economic growth in Senegal, Dumont et al. (2000) found that an increase in public spending on infrastructure promotes economic growth and improves commercial performance.

Veganzones (2001) revealed a positive link between public investments in infrastructure and growth in a sample of 87 countries and demonstrated the complementarity of public and private investments. To do this, he tested 25 Sub-Saharan African countries based on the Triple Least Squares method.

In an empirical study using time-series data conducted in Uganda, Reinikka et al. (2004) also found that economic growth was significantly justified by public expenditures.

According to a study by Banque mondiale (2005) conducted in Senegal for the period 1966-2000, the effect of public investment is delayed over time and its positive impact, estimated at 2.47 points, appears after two years. One of the few contributions to our knowledge on the impact of public spending on growth in Benin was carried out by CAPOD in 2011 using a Sequential Dynamic Computable General Equilibrium Model (MEGC) that takes into account the externalities of social infrastructure spending and is based on the Social Accounting Matrix (MCS) of Benin built for the year 2007: Do infrastructure expenditures stimulate growth and productivity in Benin? The simulations performed show that the effects of public spending on macroeconomic and sectoral variables, as well as on poverty, can vary significantly depending on the direction given to these expenditures. Thus, the report suggests directing investments towards sectors that have a higher potential for productivity gains, such as infrastructure and education. It also emphasizes the importance of proper allocation of public funds in order to achieve optimal economic growth and poverty reduction.

2.2.2 Public spending does not have an effect on economic growth

On the other hand, some empirical studies have suggested that public spending does not have a significant effect on economic growth. For instance, Dhanasekaran (2001) and Martinez-Lopez (2005)found no significant evidence to support the idea that public investment in infrastructure affects the growth rate of the South African economy.

Similarly, Zahira et al. (2015) investigated the impact of public investment in infrastructure on economic growth in India over the period 1951-2010. The study used a vector autoregression (VAR) model and found that public investment in infrastructure did not have a statistically significant impact on economic growth.

Koffi Yovo (2017) also investigated the relationship between public investment and economic growth in Latin America and the Caribbean using panel data from 1980 to 2010. The results of the study suggest that public investment does not have a significant effect on economic growth in the region.

In summary, while some empirical studies have suggested a positive relationship between public investment and economic growth, other studies have found no significant evidence to support this idea. The findings of these studies highlight the need for more research in this area to better understand the relationship between public investment and economic growth.

3 Madagascar's investment public

The Malagasy economy is generally disjointed. Economic growth has been on a roller-coaster path punctuated by cyclic crises occurring almost every five years (1991, 2002, 2009, and recently the Covid-19 crisis in 2020).

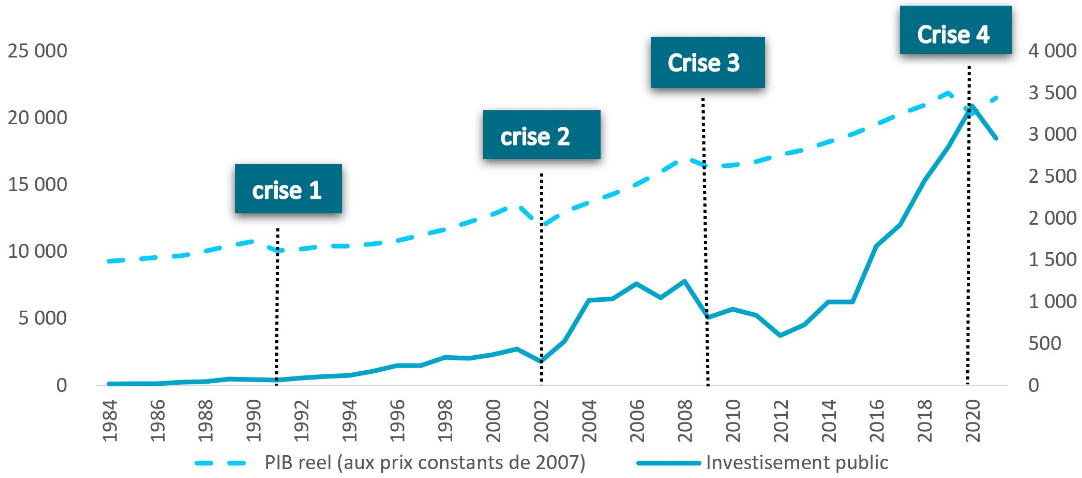

Figure 1 – Evolution of real GDP and public investment in Madagascar in billions of Ariary

Public investment has also seen a similar trend in Madagascar. According to the World Bank, budget allocations in Madagascar were among the lowest compared to other sub-Saharan African countries in 1984.

However, from 2006 to 2008, there was an upward trend in public investment, surpassing that of other African countries. State spending increased from 531.5 billion Ariary in 2006 to 1244 billion Ariary in 2008. This trend was also observed in the country's Gross Domestic Product (GDP).

In 2009, there was a sudden halt in public investment due to a coup d'état that led to a new crisis. All external financing, including budgetary aid and project financing, was suspended. This was due to a disagreement between the government and international donors. As a result, a significant amount of financing intended for public investment was canceled.

From 2012, public investment began to increase exponentially, reaching a peak of 3,300 billion Ariary in 2019. This was a result of a democratic transition that led to good conditions for the economy to recover, particularly through the return of confidence from economic and financial partners. This recovery was reflected in the upward trend in investment during this period.

In recent years, Madagascar has been working to improve its investment climate, implementing reforms and initiatives to attract more foreign direct investment (FDI) into the country. According to the United Nations Conference on Trade and Development (UNCTAD), FDI inflows into Madagascar reached a record high of 464 million USD in 2019, up from 365 million USD in 2018.

However, the COVID-19 pandemic has had a significant impact on global investment flows, and Madagascar has not been immune to this. According to the International Monetary Fund (IMF), FDI inflows into Madagascar declined to 316 million USD in 2020, a drop of around 32% from the previous year.

Overall, Madagascar's investment climate has seen some improvement in recent years, but there are still challenges that need to be addressed, such as corruption, weak infrastructure, and a lack of skilled labor. The government has taken steps to address these issues, and it remains to be seen how the investment landscape in Madagascar will develop in the coming years.

4 Methodology

We used quarterly data from the Ministry of Economy and Finance, particularly from the General Directorate of the Economy and Planning (DGEP), as well as data from the National Institute of Statistics (INSTAT). The study period spans from the first quarter of 2009 to the last quarters of 2020.

4.1 Basic Model and Variables Used

In order to establish the relationship between public investment and economic growth, the following variables were chosen: real GDP, public investment, exports, and money supply. Thus, the equation of our model can be written as follows:

$$GDP_t = f(PubInv, Exp, M3)$$

where:
— GDP: Real Gross Domestic Product or proxy for economic growth
— PubInv: Public investment
— Exp: Exports
— M3: Money supply (M3)

Exports were included because Madagascar is a country that is more outward-oriented. Thus, the integration of this variable is necessary in the context of this analysis. Money supply was taken into account in the sense that public investment leads to a massive injection of money that will undoubtedly lead to an increase in the money supply, which could result in a generalized price increase.

4.2 Model Determination

In order to study the relationship between public investment and GDP in Madagascar, it is necessary to determine the model to be used in order to conduct the analysis properly. This process is done through a stationarity test on each variable and a cointegration test on the entire series. If the results show that the variables are integrated of the same order and that there is a cointegration relationship between them, we use the Vector Error Correction Model (VECM). However, we use the Vector Autoregressive Model (VAR) if these variables are integrated of the same order, but there is no cointegration relationship between them. Finally, we use the Autoregressive Distributed Lag Model (ARDL) if the variables are all integrated at different orders.

In this work, the stationarity tests (Philip-Perron and Augmented Dickey-Fuller) and cointegration test showed that the variables GDP, public investment, money supply, and exports are all stationary at the first difference. Therefore, we deduce that we will use the Vector Autoregressive Model (VAR) to study the relationship between public investment and economic growth in Madagascar

5 Results and Discussions

The variables are expressed in logarithm and then differenced to have data in growth rates. The result of the lag selection (AIC and SBIC test) displays an optimal lag equal to 3.

The impulse response function or IRF (figure 2) shows the effects of a standard shock of endogenous variables on GDP. In the case of public investment, the response of the economy varies over time. Indeed, its impact on GDP is positive during the second period, namely the second quarter, which reflects a good performance of the recovery plan. However, it is worth noting that the trend shows a decline in the third period. This situation is relative to the backlash from the increase in the money supply generated by the massive injection of money from the investment, which could lead to a generalized price increase slowing down the economy but also have effects on exports. This would then require the intervention of the Central Bank in the regulation of the economy to cushion the shock of inflation on investment. In the longer term, the effects reach their maximum in the fifth period, or the fifth quarter, to gradually fade away and return to the stationary state.

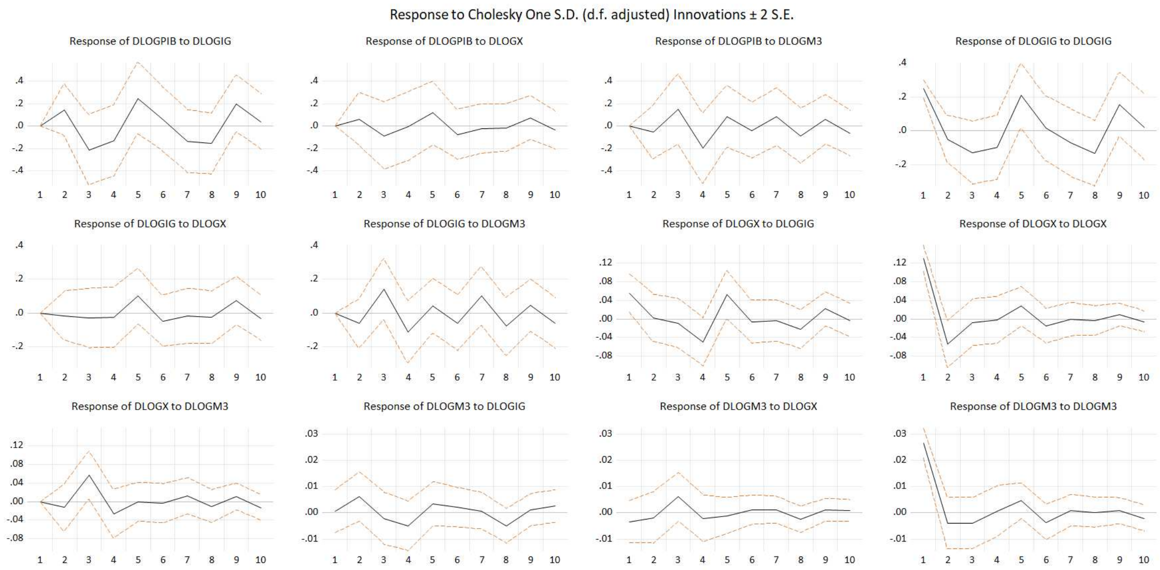

Figure 2 – Résult of the IRF

6 Conclusion

The relationship between public investment and economic growth has been extensively studied by various economists such as Keynes (1936) and Barro (1991). These scholars attest that public investment has a positive influence on the economy. However, some empirical studies have concluded in some cases a negative correlation between these two aggregates.

In this study, the VAR approach was used to model this relationship for the case of Madagascar. The results show that in the short term, public investment has a positive effect on economic growth. The effects of public investment are mainly seen in the long term, after five quarters. However, these effects fluctuate in an undulatory manner, as an increase in public investment has consequences on other aggregates. Therefore, public investment is a good tool for stimulating economic growth in Madagascar, but it must be accompanied by sound monetary policy to limit its effects.

In conclusion, this study provides evidence that public investment can have a positive impact on economic growth in Madagascar, but policymakers need to carefully consider its effects and ensure that it is accompanied by effective monetary policies. Future research can explore the dynamic relationship between public investment and other economic variables in Madagascar to better inform policy decisions.

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7 Annexes

Null Hypothesis: DLOGIG has a unit root
Exogenous: None
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.78505	0.0000
Test critical values:	1% level	-2.616203	
	5% level	-1.948140	
	10% level	-1.612320	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.423903
HAC corrected variance (Bartlett kernel)	0.103347

Phillips-Perron Test Equation
Dependent Variable: D(DLOGIG)
Method: Least Squares
Date: 03/26/23 Time: 19:04
Sample (adjusted): 2009Q3 2020Q4
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOGIG(-1)	-1.384960	0.142119	-9.745059	0.0000

R-squared	0.678319	Mean dependent var	0.026765
Adjusted R-squared	0.678319	S.D. dependent var	1.160629
S.E. of regression	0.658273	Akaike info criterion	2.023105
Sum squared resid	19.49955	Schwarz criterion	2.062859
Log likelihood	-45.53143	Hannan-Quinn criter.	2.037997
Durbin-Watson stat	2.144082		

Null Hypothesis: DLOGIG has a unit root
Exogenous: None
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.78505	0.0000
Test critical values:	1% level	-2.616203	
	5% level	-1.948140	
	10% level	-1.612320	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.423903
HAC corrected variance (Bartlett kernel)	0.103347

Phillips-Perron Test Equation
Dependent Variable: D(DLOGIG)
Method: Least Squares
Date: 03/26/23 Time: 19:04
Sample (adjusted): 2009Q3 2020Q4
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOGIG(-1)	-1.384960	0.142119	-9.745059	0.0000

R-squared	0.678319	Mean dependent var	0.026765
Adjusted R-squared	0.678319	S.D. dependent var	1.160629
S.E. of regression	0.658273	Akaike info criterion	2.023105
Sum squared resid	19.49955	Schwarz criterion	2.062859
Log likelihood	-45.53143	Hannan-Quinn criter.	2.037997
Durbin-Watson stat	2.144082		

Null Hypothesis: DLOGM3 has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.148989	0.0001
Test critical values:	1% level	-2.616203	
	5% level	-1.948140	
	10% level	-1.612320	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.001464
HAC corrected variance (Bartlett kernel)	0.001353

Phillips-Perron Test Equation
Dependent Variable: D(DLOGM3)
Method: Least Squares
Date: 03/26/23 Time: 19:04
Sample (adjusted): 2009Q3 2020Q4
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOGM3(-1)	-0.597741	0.141233	-4.232299	0.0001

R-squared	0.283980	Mean dependent var	0.001454
Adjusted R-squared	0.283980	S.D. dependent var	0.045724
S.E. of regression	0.038690	Akaike info criterion	-3.644947
Sum squared resid	0.067363	Schwarz criterion	-3.605194
Log likelihood	84.83378	Hannan-Quinn criter.	-3.630055
Durbin-Watson stat	2.066219		

Null Hypothesis: STATIONNDLOGXPP has a unit root
Exogenous: None
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.839735	0.0000
Test critical values:	1% level	-2.616203	
	5% level	-1.948140	
	10% level	-1.612320	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.024648
HAC corrected variance (Bartlett kernel)	0.026721

Phillips-Perron Test Equation
Dependent Variable: D(STATIONNDLOGXPP)
Method: Least Squares
Date: 03/26/23 Time: 19:05
Sample (adjusted): 2009Q3 2020Q4
Included observations: 46 after adjustments

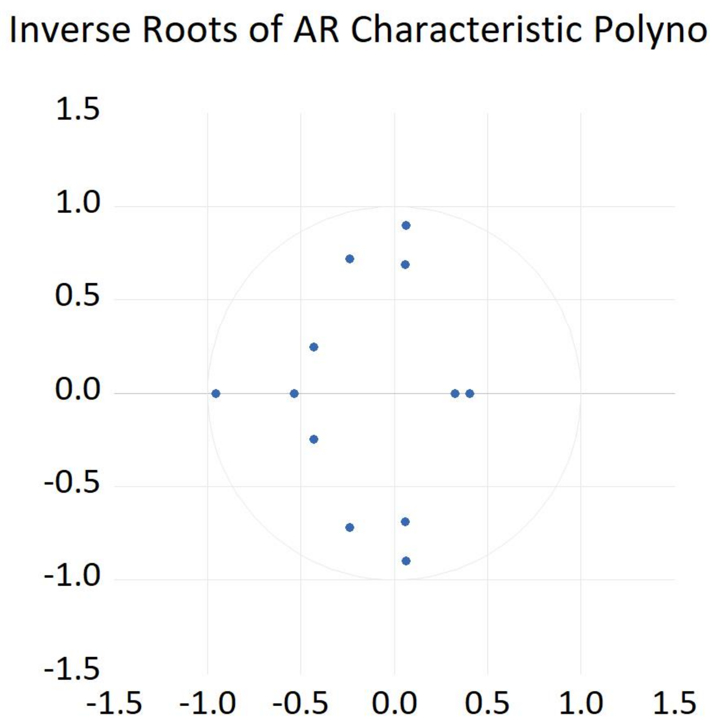
Variable	Coefficient	Std. Error	t-Statistic	Prob.
STATIONNDLOGXPP(-1)	-1.274806	0.142742	-8.930819	0.0000

R-squared	0.639306	Mean dependent var	-0.000293
Adjusted R-squared	0.639306	S.D. dependent var	0.264301
S.E. of regression	0.158733	Akaike info criterion	-0.821684
Sum squared resid	1.133831	Schwarz criterion	-0.781931
Log likelihood	19.89873	Hannan-Quinn criter.	-0.806792
Durbin-Watson stat	2.076369		

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	51.84791	NA	1.27e-06	-2.225484	-2.061652*	-2.165068
1	71.80004	35.26422	1.06e-06	-2.409304	-1.590141	-2.107222
2	86.79584	23.71428	1.13e-06	-2.362597	-0.888104	-1.818850
3	117.2754	42.52963*	6.10e-07*	-3.036065*	-0.906242	-2.250652*
4	125.0803	9.438431	9.91e-07	-2.654896	0.130258	-1.627817

* indicates lag order selected by the criterion
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



VAR Residual Serial Correlation LM Tests

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	22.58444	16	0.1253	1.487299	(16, 74.0)	0.1277
2	9.361777	16	0.8978	0.566652	(16, 74.0)	0.8988
3	25.66317	16	0.0590	1.724116	(16, 74.0)	0.0605
4	14.79802	16	0.5395	0.927054	(16, 74.0)	0.5427

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	22.58444	16	0.1253	1.487299	(16, 74.0)	0.1277
2	33.38540	32	0.3998	1.052612	(32, 75.4)	0.4161
3	48.53371	48	0.4513	0.995697	(48, 63.7)	0.5013
4	63.73095	64	0.4860	0.933119	(64, 49.3)	0.6061

*Edgeworth expansion corrected likelihood ratio statistic.

VAR Residual Heteroskedasticity Tests (Levels and Squares)

Joint test:

Chi-sq	df	Prob.
262.4321	240	0.1530

Individual components:

Dependent	R-squared	F(24,19)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.745980	2.324890	0.0324	32.82314	0.1079
res2*res2	0.724949	2.086591	0.0530	31.89777	0.1295
res3*res3	0.768301	2.625117	0.0178	33.80523	0.0882
res4*res4	0.450308	0.648534	0.8430	19.81356	0.7073
res2*res1	0.753147	2.415376	0.0269	33.13849	0.1012
res3*res1	0.637576	1.392701	0.2325	28.05336	0.2578
res3*res2	0.544599	0.946727	0.5563	23.96235	0.4638
res4*res1	0.707159	1.911734	0.0767	31.11500	0.1505
res4*res2	0.651575	1.480463	0.1931	28.66930	0.2328
res4*res3	0.563687	1.022778	0.4863	24.80221	0.4166