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The Causality between Economic Growth, Public Debt and Government Spending of Lao PDR

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Abstract

This paper examines the causality between economic growth, government debt and government spending. For this study, the time series data from 1995-2021 were used and implied with a VAR model and a Granger causality test. In addition, the statistics for unit root, cointegration, Lagrange multiplier and Jarque-Bera test were used. The empirical analysis using the VAR model revealed that government debt and economic growth have no effect on government spending. However, government spending affects government debt in the same direction with a statistical significance level of 0.1, which means that only government spending affects government debt, while government debt does not affect government spending. Government spending and government debt influence economic growth in the same direction with a statistical significance level of 0.01. In the Granger causality test, there is a unidirectional relationship, which means that only government spending and government debt influence economic growth, while economic growth does not influence government spending and government debt.

Keywords

Government spending, economic growth, public debt

1. Introduction

Government spending and public debt can indeed impact economic growth in Laos, as they do in many other countries. Government spending can stimulate economic growth by directly injecting funds into the economy through infrastructure projects, social programs, and other initiatives. In Laos, where there may be a need for infrastructure development and improvements in healthcare and education, targeted government spending can be particularly effective in driving growth. Keynes (1936) argued that government spending is crucial for economic growth, acting as a monetary policy tool for short-term stability and long-term growth. He suggested government intervention through budgets and borrowing from the private sector. Benos (2009) advocates for the positive effects budget deficits have on economic growth, suggesting that budget deficits characterized by public investment spending, such as infrastructural development projects, play a vital role in the growth of the country's economy. Otherwise, Valentino (2001) &

Philasouk (2020) points out that public spending is the value of goods and services purchased by the state and its obligations. He stressed that, in terms of democracy, public expenditure is a manifestation of the people's desire and the way of management by political parties and institutions, especially the lack of empathy and high dependence on the law, to meet the needs of the majority of people today. It has been observed that there is a correlation between government expenditure and government debt in the economy, and the increase in government spending deficit also increases the amount of debt. Government borrowing reduces accessible funds and increases the cost of capital, thus causing businesses to abandon investment projects in the economy.

However, most studies have considered that the crowding-out effect of budget deficits due to excessive government spending without proper fiscal management can lead to inflationary pressures and crowd out private investment, potentially hindering economic growth in the long run (Luzuko, 2013; Snyder, 2003).

Public debt refers to the total amount of money that a government owes to its creditors. High levels of public debt can be detrimental to economic growth if they lead to higher interest payments, which can crowd out other government spending on productive investments. For Laos, where the economy may be relatively small and less diversified, high levels of public debt could pose significant risks, especially if the debt is denominated in foreign currencies and subject to exchange rate fluctuations. Since the year 2000, the PDR has been one of the fastest-growing economies in the world, with an average annual growth rate of about 7 percent, mostly from the capital resource sector (mining and hydropower) and supported by infrastructure development. However, the growth factor is not enough. The rapid economic growth did not create jobs as expected; poverty fell, but at a slower pace than other fast-growing economies in the region. Moreover, this growth is not sustainable from an environmental perspective. Public debt has risen to critical levels, rising to nearly 20% of GDP since 2010 due to low revenue collection rates and debt-fueled investments in the electricity sector. From 1984 to 2016, the average value of Lao government spending was equal to 10.15% of GDP; the lowest was 6.46% of GDP in 2000, and the highest was 17.07% in 2013. 2016 is 13.97%. High levels of public debt can also undermine investor confidence and lead to higher borrowing costs for the government and the private sector, further dampening economic growth prospects in Sri Lanka (Jeevakumar, 2023).

Overall, while government spending can be an important driver of economic growth in Laos, policymakers need to strike a balance between stimulating growth and maintaining fiscal sustainability to avoid the adverse effects of excessive public debt. Effective fiscal management, along with policies aimed at enhancing productivity, promoting private sector development, and improving governance, will be crucial for sustaining long-term economic growth in Laos. The project examines the causality between economic growth, public debt, and government spending in Lao PDR, where the cause is partly responsible for the effect and the effect is partly dependent on the cause.

Several empirical studies have focused on the connection between output and government expenditure.

The positive relationship between economic growth and government expenditure: Damian (2018) examines a cointegration relationship between economic growth and government s expenditure

between 1970 and 2016. Using modern cointegration techniques, the Granger causality test, error correction modeling, and variance decomposition analysis, he found both short-run and long-run bidirectional relationships between the variables. The causality was stronger from economic growth to government expenditure than in the opposite direction, as confirmed by the variance decomposition analysis. Srinivasan's (2013) study on the causal relationship between public expenditure and economic growth in India, conducted from 1973 to 2012, found a long-run relationship between public expenditure and economic growth. The error correction model found a unidirectional causality between economic growth and public expenditure in both the short and long run, supporting Wagner's law of public expenditure. Arestis et al. (2021) conducted a study on the relationship between government expenditure and economic performance using Turkey as a case study. They used disaggregated data and applied linear and nonlinear Granger causality tests to understand the causal relationship. The results showed that government spending on defense, economy, education, health, housing and social protection positively influence output through the fiscal multiplier and investment accelerator mechanism proposed by John Maynard Keynes. The study by Odhiambo (2021) examined the causal relationship between health spending and economic growth in Sub-Saharan African countries from 2008-2017. Using panel data, the study found that public spending leads to unidirectional causality from health spending to economic growth in low-income countries, while private health spending leads to short-term causality from economic growth to health spending in middle-income countries. No causality was found in low-income countries.

There are conflicting results in the previous studies that is currently available on external debt and economic growth. There is a lack of agreement in the previous study, with some empirical research reporting a positive association between the two variables and many others reporting a negative relationship between economic growth and external debt. For example, Hutaria et al. (2019) used a two-stage least squares model to examine the effect of government debt on GDP from 1981 to 2017. They discovered that while employee spending remained unaffected, government debt had a major effect on capital and regional spending. Nonetheless, regional spending had the largest multiplier effect on GDP, although capital expenditure had a considerable impact as well. According to Mohanty (2017) and Chindengwike (2021), Ethiopia's and Tanzania's economic growth are positively impacted by external debt. According to Grob'ety (2012), the positive liquidity effect of public debt originates from domestic debt, and growth is stronger in nations with higher levels of government debt and industries with larger liquidity demands.

Numerous studies have shown a negative correlation between external debt and economic growth: Al-Tamimi & Jaradat (2019) used data from 2010-2017 to analyze the impact of external debt on GDP growth. They found a significant negative impact on economic growth. Senadza et al. (2017) also found a negative impact of external debt on economic growth in 39 Sub-Saharan African countries. Nevertheless, there was no non-linear link between external debt and economic development, and classification based on per capita income had no effect on the external debt-growth relationship. Research on the connection between the public debt-to-GDP ratio and growth in developed and developing nations was done

by Reinhart and Rogoff (2010) & Krugman (2013). It was discovered that the correlation is weak for ratios under 90% and negative for ratios greater than 90%. Data for 44 nations from 1946 to 2009 were sourced by the study from the IMF, World Bank, and OECD. Results indicated that countries with high debt-to-GDP ratios grew at a slower rate than less indebted groupings, with mean growth about 3% lower and median growth of 1.5% lower. High levels of governmental debt appear to have a negative. On the other hand, Mumba and Li (2020) used panel data for 28 rising Asian nations, using panel fixed and random effects through panel integration, to investigate the relationship between external debt and economic growth over the research period of 1995–2019. The results demonstrate that the impact of debt varies according to the time frame over which the policy was put into place. As a result, their research revealed that, although having a negative effect over time, external debt had a short-term favorable affect on economic growth.

The previous studies mentioned above indicates that conflicting outcomes are still being reported. Since there is currently disagreement in the literature regarding the relationship between external debt and government expenditure on economic growth in Laos, this article adds to the body of knowledge already available on the subject.

2. Materials and Methods

Economic vector autoregressive (VAR) models developed by Sims are a powerful tool for forecasting and characterizing the dynamic behavior of financial and economic time series. When compared to complex theory-based simultaneous equation models and univariate time series models, they provide better forecasts. Additionally, flexible projections based on possible future pathways for the variables are offered by VAR models.

For data description, forecasting, structural inference, and policy analysis, the VAR model is employed. It makes the assumption that the data under study has a causal structure and uses impulse response functions and forecast error variance decompositions to characterize the causal effects of unforeseen shocks or innovations on model variables.

The time series data from 1995–2021 (27 observations) was used, and GDP per capita and economic growth are taken from the website of the Asian Development Bank (www.adb.org). While public debt and government spending were retired from the report of the Bank of the Lao PDR (www.bol.gov.la), Then implied is the vector autoregressive (VAR) model, which is written as below:

$$Y_t = A_i X_t + \varepsilon_t \qquad (1)$$

Where A is the matrix coefficient and ε_t is an error term

From equation (1) we can write in matrix form as follows:

$$\begin{bmatrix} LnGSP_t \\ LnDebt_t \\ LnPerC_t \end{bmatrix} = \begin{bmatrix} \alpha_0 \\ \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} b_{11}\ b_{12}\ b_{13} \\ b_{21}\ b_{22}\ b_{23} \\ b_{31}\ b_{32}\ b_{33} \end{bmatrix} \begin{bmatrix} LnGSP_{t-i} \\ LnDebt_{t-i} \\ LnPerC_{t-i} \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \\ z_t \end{bmatrix} \qquad (2)$$

$LnGSP_t$: The logarithm of the government spending in period t.

$LnDebt_t$: The logarithm of the public debt in period t.

$LnPerC_t$: The logarithm of GDP per capita in period t.

α_0, α_1, α_2: Constants.

b_{ij} : The coefficients of independent variables such as government spending, public debt and GDP per capita.

u_t, v_t, z_t: error terms metric.

The study involved six procedures: assessing the uniform time series for each vital sign, testing long-run or short-run relationships, determining appropriate lag, assessing residual autocorrelation using Lagrange Multiplier and Jarque-Bera tests, evaluating granger causality, and checking the stability of the VAR system in the final stable model.

2.1 Unit Root Test

The augment Dickey Fuller test (Dickey, D. A., & Fuller, W. A. (1981)) is used to test the stationarity of time series data due to the conditional nature of VECM analysis, which has to be stationary at first order and written as:

- For none intercept and trend: $\Delta y_t = \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (3)
- For Intercept: $\Delta y_t = \alpha + \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (4)
- For Intercept and Trend: $\Delta y_t = \alpha + \beta t + \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (5)

Where, y_t: the series at t period, t–i: the lag length reduced by 1,

$\alpha, \beta, \theta, \emptyset$: the coefficients, t: trend, u_i: error term

2.2 Cointegration Test

The Johansen cointegration test (Johansen, 1988) is used to determine the short-run and long-run relationships between the variables.

$$Y_t = \alpha_1 Y_{t-1} + \cdots + \alpha_p Y_{t-p} + \beta X_t + \varepsilon_t \quad (6)$$

Where Y_t : vector of endogenous variables.

α_p are the autoregressive matrices

$X_t$is the deterministic vector

β are the parameter matrices

p is the lag order

ε_t : vector of innovation

Hypothesis: H_0: There is no cointegration means that construct only the short-run causality.

H_1: There is cointegration, construct both short-run and long-run causality.

If the result rejects the null hypothesis, the model should include residuals from the vectors, which means that it has long-run causality, and we should run the Vector Error Correcting Model (VECM).

2.3 Lagrange Multiplier Test

The Lagrange Multiplier Test (LM test) is used to evaluate autocorrelation using the following formula (Johansen, S. 1995):

$$\Delta y_t = \alpha \hat{E}_t + \sum_{i=1}^{p-1} \tau_i \Delta y_{t-i} + \epsilon_t \quad (7)$$

Where τ_i : the coefficients

$p-1$: a VAR lags where the endogenous variables have been first-differenced

$\widehat{E_t}$: augmented with the exogenous variables

Hypothesis: H_0: there is no auto correlation at lags order

H_1: there is auto correlation at lags order

2.4 Jarque-Bera Test

The Jarque-Bera test (Jarque, C.M & Bera, A.K. 1987) is used for testing the autocorrelation of the model and can be defined as:

$$JB = \frac{n}{6}(S^2 + \frac{1}{4}(K-3)^2) \quad (8)$$

Where n is the number of observations, S is the sample of Skewness and K is the sample of Kurtosis.

$K = \frac{1}{N}\sum_{i=1}^{N}(\frac{y_i-\bar{y}}{\hat{\sigma}})^4$ (9)

$\hat{\sigma}$: the biased estimator for the variance

Hypothesis: H_0: Residual are normally distributed or P-value > 0.05

H_1: Residual are not normally distributed or P-value < 0.05

2.5 Granger Causality Test

The Granger test method (Engle & Granger, 1987) was employed by the researcher to determine the direction of the link between the variables.

$Y_t = \beta_1 + \sum_{j=1}^{n}\theta_i X_{t-1} + \sum_{j=1}^{m}\gamma_j Y_{t-j} + e_t$ (10)

where β is the constant coefficient, γ is the lag coefficient of the dependent variable, and θ is the coefficient of the independent variable.

Hypothesis: H_0: $\theta_i = 0$ X and Y are related

H_1: $\theta_i \neq 0$ X and Y are not related

2.6 Stability of the VAR system

The stability of a VAR system is determined by assessing its ability to accurately represent the evolution of the time series over the sampling window period, which is typically determined by the roots of the characteristic polynomial of the coefficient matrix, which are less than 0.

3. Results

According to the augment Dickey Fuller test, it is seen that the MacKinnon value after the first differences of all the variables is smaller than the critical values of 0.05 and 0.01, which indicates that each variable is stationary at I(1) and results (Table 1). The results of the long-term correlation test using Johansen's method show that at the rank (0) level, the trace statistic value is greater than the critical value of 5%, indicating that we reject the null hypothesis that the models do not have a long-term relationship. Therefore, the VAR model was used in the study to test the relationship between the variables (Table 2). The test results from the table above found that the statistical values of FPE, AIC, HQIC, and SBIC indicators are all at lag level 1. Therefore, it can be concluded that the most appropriate amount of lag in this test is at level 1 (Table 3). The results of the VAR model (Table 4) show that model 1 has a positive effect with a statistical significance level of 0.01 and is in accordance with the set hypothesis. It means that if government spending in the past year increases or decreases by 1%, it will result in current government spending increasing or decreasing by 1.105%. Public debt and GDP per capita have no effect on government spending. However, this model indicates that the independent variables can explain the dependent variable up to 97%.

For model 2, both $LnGSP_{t-1}$ and $LnDebt_{t-1}$ in the past year have a positive effect on current with a statistical significance level of 0.1 and 0.01, respectively. In which the government spending is according to the set hypothesis, it means that if other factors are constant and the government spending last year increases by 1%, it will result in the public debt increasing by 0.288% and vice versa. If government spending in the last year decreases by 1%, it will result in the public debt decreasing by 0.288%. $LnDebt_{t-1}$ also affects the public debt in the current year in the same direction with a statistical significance level of 0.01, which means that if the public debt in the past year increases by 1%, it will result in the public debt in the current year increasing by 0.937% in the same direction. $LnPerC_{t-1}$ has no effect on the public debt. The model also found that the constant value has a statistical significance level of 0.01, which means that there are other factors that affect the current public debt.

However, this model indicates that the most important variable is public debt in the past year, followed by other factors and government spending, respectively, and this model can explain about 98%.

For the model 3, $LnPerC_{t-1}$ has no effect on $LnPerC_t$, but $LnGSP_{t-1}$ and $LnDebt_{t-1}$ are significant. $LnGSP_{t-1}$ has a positive effect on $LnPerC_t$ with a statistical significance level of 0.01 and does not align with the hypothesis. The result indicates that in the case of the Lao People's Democratic Republic, public debt has a positive effect on economic growth, which may be due to the fact that such debt is used for the development of infrastructure that is necessary for development, such as roads, irrigation, power grids, etc. Based on this result, if other factors are constant, when government spending in the past year increases by 1%, it will push economic growth by 0.453% in the same direction. $LnDebt_{t-1}$also has positive effect on $LnPerC_t$ with a significance level of 0.01 and is according to the hypothesis. It means that if other factors are constant, when the amount of public debt in the past year increases by 1%, it will cause economic growth to increase by 0.276% in the same direction. However, it can be seen that government spending is the main factor affecting economic growth, followed by public debt. R^2 is quite high, meaning that the independent variables used in this model can explain the dependent variable by 98%.

The Granger causality test (Table 5) indicates that public debt and economic growth have no effect on government spending, as evidenced by Lao PDR. But government spending affects public debt with a statistical significance level of 0.1, which means that government spending and public debt have a unidirectional relationship; only government spending affects public debt, while public debt does not affect government spending. While government spending and public debt affect economic growth in the same direction with a statistical significance level of 0.01 and also have a unidirectional relationship, this means that only government spending and public debt affect economic growth, while economic growth does not affect government spending and public debt. The Lagrange-multiplier test (Table 6) shows that we cannot reject the main hypothesis that the model has no autocorrelation problem, meaning that the expected values of the random variables are not related to each other with a statistical significance level of 0.05, indicating that the VAR model is appropriate. The results of the root test of the companion matrix (Figure 1) found that the data values are in the circle, which means that the co-variance of the model is stable, so it can be said that the data are stable.

4. Discussion

The study found that government spending positively impacts economic growth, aligning with Robinson's (2014) findings that health spending has an inverse relationship with GDP growth, and education spending has no relationship with GDP growth. Government spending not only meets public sector needs but also helps manage the private sector (Arestis et al., 2021).

Public debt also has a positive effect or relationship with economic growth, which aligns with the research of Hutaria et al. (2019), who found that public debt, which is the government's debt that arises, especially domestic debt, has a positive effect on economic growth. While many researchers pointed out that public debt could potentially hinder economic growth, Kourtellos et al. (2013) found that higher public debt results in countries with low democratic governance and reduced growth. Furthermore, Al-Tamimi & Jaradat (2019) found that public debt

affects economic growth in the opposite direction, especially external debt or foreign debt. Therefore, the government should reduce public debt by using financial instruments to help solve it, especially by allowing foreign private companies to participate in the form of foreign direct investment. Senadza et al. (2017) found that public debt, especially foreign debt, has a negative effect on economic growth, but when analyzed through each item, it is found that there is a non-linear relationship, meaning that in the first stage it will have a positive effect on economic growth and when it reaches a certain point, it will have a negative effect on economic growth. Therefore, public debt owed to foreign countries should only be short-term debt to have a positive effect on economic growth. José Alves. (2015) also said that public debt has a negative effect on economic growth, reducing economic growth by 10 times. However, Grob'ety (2012) pointed out that high public debt can result in high-liquidity industries growing quickly, while foreign debt has no effect on the difference between the growth of various industries.

Furthermore, we found that economic growth does not affect government spending or public debt, which contradicts the research of Damian (2018) that there is a positive relationship between economic growth and government spending and that there is a two-way relationship in both the short and long term between the variables with stronger causality from economic growth to government spending than the opposite direction, as evidenced by variance analysis. Srinivasan (2013) studied the relationship between government expenditure and economic growth with the VECM model. Cointegration test results confirm the existence of a long-run equilibrium relationship between government spending and economic growth in India. The analytical results based on the prediction of the ECM model indicate one causality from economic growth to short-term and long-term government spending, which supports Wagner's rule or theory of government spending.

However, Arvin et al. (2021) argued that improving the efficiency of government spending plays a more important role in stimulating long-term economic growth in low-income countries than in high-income countries. Odhiambo (2021) found a significant effect of public health spending on economic growth in low-income countries in sub-Saharan Africa, but this effect was insignificant in middle-income countries in the region.

In this paper, the researcher used only one model, which makes it impossible to compare the results of the analysis because each model will give different results. In order to be able to find a unified conclusion about the relationship between variables for those who will study the topic next time, multiple models and panel data should be used, especially SVAR, ARDL, and ECM models.

5. Conclusion

According to the results of the VAR model, public debt and economic growth have no effect on government spending. Government spending has positive effects on public debt with a statistical significance level of 0.01, and public debt also affects economic growth in the same direction with a statistical significance level of 0.01. For the Granger test results, it shows that public debt and economic growth have no effect on government spending. But public spending affects public debt with a statistical significance level of 0.1, which means that public spending and public debt have a unidirectional relationship with only public spending affecting public debt, while public

debt does not affect government spending. While government spending and public debt affect economic growth in the same direction with a statistical significance level of 0.01 and also a unidirectional relationship, which means that only government spending and public debt affect economic growth, economic growth does not affect government spending and public debt.

6. Conflict of Interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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Table 1: Unit Root Test

H_0: non-stationary or has unit root	H_1: stationary
Before first differences	
Interpolated Dickey-Fuller	

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	MacKinnon (Sig. Level)
$LnGSP_t$	-0.404	-3.743	-2.997	-2.629	0.9093
$LnDebt_t$	-0.640	-3.743	-2.997	-2.629	0.8616
$LnPerC_t$	0.231	-3.743	-2.997	-2.629	0.9740
		After first differences			
$D.LnGSP_t$	-3.329	-3.750	-3.000	-2.630	0.0136**
$D.LnDebt_t$	-4.437	-3.750	-3.000	-2.630	0.0003*
$D.LnPerC$	-3.222	-3.750	-3.000	-2.630	0.0188**

Note: *,**, ***Statistically significance at the level of 0.01, 0.05 and 0.1 respectively

Table 2: Cointegration Test

Rank	LL	Eigenvalue	Trace statistic	Critical Value 5%
0	64.623311		25.9986*	29.68
1	73.166885	0.49515	8.9115	15.41
2	76.6291	0.24193	1.9870	3.76
3	77.622618	0.07640		

Note: * selected rank

Table 3: optimal lag

Lag-order selection criteria				
Lag	FPE	AIC	HQIC	SBIC
0	0.000292	0.375573	0.414641	0.52283
1	1.5e-06*	-4.88862*	-4.73235*	-4.2996*
2	1.6e-06	-4.8857	-4.61223	-3.8549
3	2.7e-06	-4.48006	-4.08939	-3.00749

Note: * optimal lag

Table 4: Empirical Analysis by VAR

Independent variables	Models		
	$LnGSP_t$	$LnDebt_t$	$LnPerC_t$
$LnGSP_{t-1}$	1.105072	0.288653	0.4536455
	(3.65)***	(1.95)*	(2.61)**
$LnDebt_{t-1}$	0.1711718	0.9373081	0.2764645
	(1.05)	(11.78)***	(2.96)***
$LnPerC_{t-1}$	-0.3074955	-0.2936561	0.1930008
	(-0.67)	(-1.30)	(0.73)
$Cons$	0.0599138	0.5695711	0.1625004
	(0.14)	(2.75)**	(0.67)
$P > Chi2$	0.0000	0.0000	0.0000
R^2	0.9718	0.9897	0.9866
Log likelihood		73.76433	
FPE		1.75e-06	
Sigma		6.89e-07	

AIC	-4.751103
HQIC	-4.583894
SBIC	-4.170443
Number of obs	26

Note: ***,**, *Statistically significance at the level of 0.01, 0.05 and 0.1 respectively.

The values in "()" is z-statistics

Table 5: Granger Causality Test

Equation	Excluded	chi2	df	Prob > chi2
LnGSP	LnDebt	1.1066	1	0.293
	LnPerC	0.4426	1	0.506
	ALL	1.1202	2	0.571
LnDebt	LnGSP	3.8107	1	0.051***
	LnPerC	1.6887	1	0.194
	ALL	7.0491	2	0.029*
LnPerC	LnGSP	6.8118	1	0.009**
	LnDebt	8.74	1	0.003**
	ALL	10.64	2	0.005**

Note: *,**Statistically significance at the level of 0.05 and 0.01 respectively

Table 6. Lagrange-multiplier (LM) Test

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	6.2766	9	0.71195
2	6.1564	9	0.72417
3	5.8552	9	0.75431
4	16.2865	9	0.06113

H_0: no autocorrelation at lag order

Figure 1. Roots of the companion matrix