การวิเคราะห์ความสัมพันธ์ระหว่างรายได้ รายจ่าย และผลิตภัณฑ์มวลรวมของรัฐบาล: หลักฐานเชิงประจักษ์จาก สาธารณรัฐประชาธิปไตยประชาชนลาว

Analysis the Relationship Between Government's Revenue, Expenditure and Gross Domestic Product: Evidence of Lao PDR

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ผลการดำเนินงานรายรับ-รายจ่ายของรัฐบาลบ่งชี้ถึงฐานะทางการเงินของรัฐบาล และเป็นตัวบ่งชี้ที่สำคัญสำหรับการวางแผนพัฒนาเศรษฐกิจมหภาค ดังนั้น ผู้วิจัย จึงมีวัตถุประสงค์เพื่อทดสอบความสัมพันธ์ระหว่างรายรับ รายจ่าย และผลิตภัณฑ์มวลรวมภายในประเทศ ของรัฐบาลลาว โดยใช้แบบจำลองทางเศรษฐมิติโครอินทิเกรชัน และ แบบจำลองเอเรอร์คอร์เรคชัน กับข้อมูลอนุกรมเวลาตั้งแต่ปี 1990-2019

ผลการศึกษาพบ ความสัมพันธ์ทั้งในระยะสั้นและระยะยาว ในระยะยาวพบว่ามีความสัมพันธ์ของรายได้และ ผลิตภัณฑ์มวลรวมภายในประเทศ มีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญกับรายจ่ายโดยมีระดับนัยสำคัญที่ 0.01 และ 0.1 ตามลำดับ สำหรับระยะสั้น พบว่ารายได้ของรัฐบาลเท่านั้นที่มีความสัมพันธ์กับการใช้จ่ายของรัฐบาลอย่างมีนัยสำคัญทางสถิติที่ระดับนัยสำคัญที่ 0.01 โดยมีค่าสัมประสิทธิ์ของ เงื่อนไขการแก้ไขข้อผิดพลาด (ECT) เท่ากับ -0.781 ในการทดสอบ การกระจายค่าปกติที่เหลือ และ สหสัมพันธ์เชิงอนุกรมบ่งชี้ว่าเราไม่สามารถปฏิเสธสมมติฐานว่างได้ หมายความว่าแบบจำลองที่ใช้ในการศึกษานี้เหมาะสำหรับการทดสอบความสัมพันธ์ระหว่างรายรับ รายจ่าย และ ผลิตภัณฑ์รวมในประเทศ ของ สปป.ลาว นอกจากนี้ ผู้วิจัยยังเสนอว่ารัฐบาลควรตัดสินใจ ด้านรายจ่ายและรายรับควบคู่กันไปโดยเพิ่มรายได้และลดรายจ่ายไปพร้อมกันเพื่อบริหารการขาดดุลงบประมาณเนื่องจากการใช้จ่ายภาครัฐที่เพิ่มขึ้นจะช่วยกระตุ้นกิจกรรมทางเศรษฐกิจซึ่งจะส่งผลให้รายได้ของรัฐบาลเพิ่มขึ้น

ข้อจำกัด การศึกษานี้ใช้กลุ่มตัวอย่างขนาดเล็ก และเป็นการศึกษาเพียงประเทศเดียว ดังนั้น นักวิจัยที่จะศึกษาเพิ่มเติมควรพิจารณาข้อมูลแบบกลุ่มและใช้ตัวแปรอิสระมากขึ้นเพื่อให้สามารถทำนายได้แม่นยำยิ่งขึ้น

คำสำคัญ: รายรับ รายจ่าย ผลิตภัณฑ์รวมในประเทศ รูปแบบการแก้ไขข้อผิดพลาด

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ABSTRACT

The government's income-expenditure performance indicates the government's financial position and is an important indicator for macroeconomic development planning. Therefore, the researcher aims to test the relationship between Lao government's revenue, expenditure and gross domestic product (GDP) by using the Cointegration and Error Correction model with the time series data from 1990-2019. The results of the study found that there is a relationship in both the short-run and long-run. In the long-run, both revenue and GDP have a positive significant relationship on expenditure with a significance level of 0.01 and 0.1 respectively. For short-run, only government's revenue has a statistically significant relationship with government spending at a significance level of 0.01, with the coefficient of ECT equal to -0.781. In the test of residual normality distributed and serial correlation indicates we cannot reject null hypothesis, meaning that the model used in this study is suitable for testing the relationship between revenue, expenditure and GDP of Lao PDR. The researchers also suggest that the government should decide on expenditure and revenue side by side by increasing revenue and reducing expenditure simultaneously to manage the budget deficit because the increase in public spending helps to stimulate economic activities which will result in an increase in government revenue.

However, this study uses a small sampling and is a study of only one country. Therefore, further researchers should consider panel data and use more independent variables in order to more accurate predict.

Keywords: Revenue, Expenditure, Gross Domestic Product, Error Correction Model

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1. Introduction

The global financial or economic crisis has resulted in many governments facing huge public debt and budget deficits (Presbitero, 2010). According to the sustainable budget policy, the problem of public debt and budget deficit is still a problem that both developed, developing and underdeveloped countries are facing. Cottarelli and Schaechte (2010) have argued that the short-term budget deficit results in increased unemployment leading to the problem of continuous accumulation of public debt and exceeding the level that is said to be sustainable, causing difficulties in adjusting policies or macro variables, especially affecting the gross domestic product (GDP). To solve this problem, the government should reduce expenses or increase income sources and income sources that have a balanced budget or a low dividend. However, if the country's economy is tied to foreign economies too much, when external factors or the global economy change, it will result in changes in revenue and expenditure, especially when the price of fuel. In order to understand those problem, we must understand the relationship between the revenue and expenditure of the government first, which has some research indicated that the increase in revenue or decrease in expenditure affects the related variables and makes the policy ineffective. Therefore, before increasing revenue or reducing expenditure, it is important to know the extent of the influence of those variables that affect government expenditure. Although Lao PDR's economy has been growing fast with an average of 7% per year, according to the collected data and the annual report of the Ministry of Finance, it is found that the Lao government is experiencing continuous and chronic budget deficit problems. In other words, the budget deficit is a characteristic of the Lao government, and the government of each term tries to find a way to solve it, but disable due to many factors. Sometimes reducing the problem of unemployment needs to use the budget deficit policy. Especially during the Covid-19 pandemic, has affected the economic system of Laos in a wide range and caused the government unable collecting revenue as the target, but on the other hand, there is overspending which in 2020, the revenue performance is reduced to 13.8% compared to 2019, but the expenditure performance increased by 0.8% compared to 2019 and the budget deficit is equal to 5.2% of GDP (Souvannachoumkham, 2020). However, the Government of Laos as well as the Ministry of Finance have paid attention to the implementation of various financial measures to enforce the implementation of the state budget plan to follow the National Assembly's plan to ensure that the economy is stimulated to grow and people have jobs.

From the mentioned problems, the researchers interested to test the relationship between income, government expenditure and gross domestic product using the Cointegration and Error Correction (ECM) model because: first, it is a convenient model measuring the correction from disequilibrium of the previous period, which has a very good economic implication. Second, if we have cointegration, ECMs are formulated in terms of first differences, which typically eliminate trends from the variables involved, and they resolve the

problem of spurious regressions, A third, very important, advantage of ECMs is the ease with which they can fit into the general to specific approach to econometric modelling, which is in fact a search for the most parsimonious ECM model that best fits the given data sets. Finally, the fourth and most important feature of the ECM comes from the fact that the disequilibrium error term is a stationary variable.

Objective of the Study

This study aims to test the relationship between government's revenue, expenditure and the gross domestic product of the Lao PDR by using the error correction model.

2. Literature Reviews

Wagner and Weber (1977) said that changes in government spending would be more effective in the long term than in the short term due to operational reasons (defense), wide administrative scope, and economic development planning. In addition, the increase in government spending depends on the government economic activities. When the government devolves power to the local government, local government spending must go through the political process, so it is seen that there are many factors that determine government spending. On the other hand, the problems and obstacles of managing the government's expenditure budget are caused by the lack of knowledge and understanding of the budget, the lack of knowledge and methods of budget estimation, resulting in the inability to predict accurately and precisely how much the budget will increase or decrease in the next year. In addition, the tax collection system is not as efficient as it should be, causing the budget to leak both at the local government level and at the national level, some governments still lack of loan experience and budgets arrangement, resulting in extravagant and inefficient budget spending. tested Wagner's law which found that the growth of government spending has uneven patterns and jumps during major social changes such as war. The people who have the right to vote are the reason for the expansion of government services, but at the same time they do not want to pay taxes, which is a self-contradiction that is hidden in themselves, and at that time, government expenditures will increase. Samuelson (1954) gave the concept of public expenditure in the perspective of microeconomics, which is the best allocation of resources in the event that the goods are public goods which is at a level where the additional cost of producing goods is equal to the sum of the vertical lines of individual demand because the private economic system cannot allocate public goods effectively. So, there are many theories said that government has an important role to solve those problems.

Friedman (1978) developed the hypothesis that when government revenue increases, it will result in an increase in government expenditures. This positive relationship when tax revenue increases will lead to budget deficits. Therefore, the appropriate policy is to reduce taxes to decrease spending and lead to a reduced budget deficit. On the other hand, the

budget deficit cannot be done by the government's revenue growth policy and Buchanan and Wagner (1977) said that under this hypothesis, government revenue and expenditure will have a negative relationship because the increase in government revenue may make taxpayers unhappy because they think they will have to bear the increased burden. Peacock and Wiseman (1979) and Barro (1974) developed the hypothesis of a relationship between taxes and government expenditure or revenue and government expenditure in which they assumed that changes in expenditure would lead to changes in revenue. which they said in a crisis situation will lead to what is called the displacement effect, for example: increasing government spending in current will lead to increased revenue and at the same time, increasing government spending will lead to increased taxes because when the government spends, they replace it by taxes. which may be detrimental to the shareholders (investors) and cause them to move the production base to other countries because they expected that taxes will increase in the future.

Gülşen (2022) pointed out tax revenues, non-tax ordinary incomes, factor incomes, and social funds affects economic growth and he also suggest that public investment expenditures have long term effect on economic growth. Pak (2007) found that government expenditure effect the growth rate of real GDP through 3 channels-total factor productivity, investment and aggregate demand. The study of Cyrus Muriithi (2013) identifies the connection between government income and Kenyan economic expansion. A descriptive research design was included in this study. Since only Kenya was engaged, this study was a case study of a single country. Secondary data was used to compile the tax revenue, which included import duty, customs taxes, income tax, and Value Added Tax (VAT). In addition, the research gathered information on non-tax revenue. Tables and figures were also used to illustrate the recorded information. The result revealed that economic growth and import taxes have an unfavorable connection. As import tariffs rise, so does economic growth, and vice versa. In the case of excise duty, the study shows that if the pace of increase in excise tax slows, the rate of economic growth lowers as well. In terms of income tax, the study suggests that a well-established income tax leads to steady growth in government revenue. The study also suggests that income tax has a direct association with economic growth. According to the findings, raising the VAT has a favorable impact on the rate of economic growth. Nguyen (2022) expressed that government revenue decreases while governance increases economic growth but their interaction reduces it. Besides, trade openness and inflation are significant determinants of economic growth in these countries. In addition, Roşoiu (2015) found there is also important to remember that between government revenues and government expenditure there is a bidirectional relation. Ofoegbu and Akwu (2016) examine the effect of tax revenue on the economic development of Nigerian. By using the annual time series data in the period 2005 - 2014 to estimate the linear income model and the human development index with Ordinary Least Square (OLS), the research has been shown. The positive relationship

between tax revenue and economic development. This study has shown the importance of tax revenue for Nigeria's economic development and it can be the instrument for Nigeria's economic. So, it is necessary to take measures to encourage people to pay taxes and use this revenue carefully.

3. Materials and Methods

Because Laos is still in the early stage of developing countries. Therefore, most of the information remains recording in the traditional way so that some information is damaged and cannot be disclosed, only some information can be uploaded on the website of the government or international organizations, resulting can only summarize information from 1990 onwards. Therefore, in this study, we used the time series data from 1990-2019, was collected from the website of the Bank of Lao PDR and the Asian Development Bank.

In this study, the researcher used the Cointegration and Error Correction model of Engle and Granger (1987) to analyze the long-term equilibrium relationship between government revenue and expenditure with the GDP variable as a control variable. Since economic variables are often non-stationary, the application of such techniques to the analysis will make the estimated coefficients more efficient and reliable. In addition to not causing problems of spurious relationship. This method also able to analyze the effects both in the short-run and long-run which the model could be written as following:

- Cointegration Regression

$$LnS_t = \beta_0 + \beta_1 LnR_t + \beta_2 LnGDP_t + \varepsilon_t \quad (1)$$

$$\varepsilon_t = LnS_t - \beta_0 - \beta_1 LnR_t - \beta_2 LnGDP_t \quad (2)$$

where $\varepsilon_t = I(0)$

β_0: constant

β_i: the coefficients of independent variables.

LnS_t: logarithms of government's spending in period t

LnR_t: logarithms of government's revenue in period t

$LnGDP_t$: logarithms of GDP in period t

ε_t: error term$\sim N(0, \sigma^2)$

If the ADF test of residuals found that test statistic of residual is greater than the critical value for regression residual based cointegration tests indicates that we reject null hypothesis or accept alternative hypothesis, meaning that there are long-run relationships (Engle and Granger 1987)

Hypothesis: H_0: there is not Cointegrated)

H_1: there is Cointegrated

- Error Correction Model

$$\Delta LnS_t = \beta_0 + \beta_1 \Delta LnR_t + \beta_2 \Delta GDP_t + \beta_3 \varepsilon_{t-1} + v_t \quad (3)$$

which

$$\varepsilon_{t-1} = LnS_t - \beta_0 - \beta_1 LnR_{t-1} - \beta_2 LnGDP_{t-1} \quad (4)$$

If plug (4) in (3) we get:

$$\Delta LnS_t = \beta_0 + \beta_1 \Delta LnR_t + \beta_2 \Delta GDP_t + \beta_3 (LnS_t - \beta_0 - \beta_1 LnR_{t-1} - \beta_2 LnGDP_{t-1}) + v_t \quad (5)$$

v_t: error term$\sim N(0, \sigma^2)$

And Error Correction Model can be written as

$$\Delta LnS_t = \beta_0 + \beta_1 \Delta LnR_t + \beta_2 \Delta GDP_t + \beta_3 ECT + v_t \quad (6)$$

ECT: Error Correction Term

β_3: the coefficient of error correction term or the speed of adjustment toward the long-run equilibrium which $-1 < \beta_3 < 0$

3.1 Unit Root Tests

The augment Dickey Fuller test (Dickey and Fuller, 1979) is used testing the stationary of time series data due to the conditional of VECM analysis have to stationary at first order and written as:

- For none intercept and trend: $\Delta y_t = \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (7)

- For Intercept: $\Delta y_t = \alpha + \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (8)

- For Intercept and Trend: $\Delta y_t = \alpha + \beta t + \theta y_{t-1} + \sum_{t=1}^{p} \emptyset_i \Delta y_{t-i} + u_i$ (9)

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

3.2 Cointegration Test

For test cointegration, the researchers used Two-steps ECM of Engle and Granger procedure (1987) to determine the short-run and long-run relationships between the variables.

First step: Consider a simple model, where Y_t and $X_t$are both I(1)

$$Y_t = \beta_1 + \beta_2 X_t + u_t \quad (10)$$

If there is a linear combination of $Y_t$and X_t that is stationary (that is I(0)), thenY_t and $X_t$are cointegrated. This implies that the estimated residuals are stationary, so that

$$\widehat{u_t} = Y_t - \widehat{\beta_1} - \widehat{\beta_2} X_t \quad (11)$$

Where $\widehat{\beta_2}$ is the long-run coefficient

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 reject null hypothesis, the model should include residuals from the vectors mean that it has long-run causality and we should run Vector Error Correcting Model (VECM).

Second Step: Express the relationship between Y_t and X_t with an ECM specification as

$$\Delta Y_t = \beta_3 + \beta_4 \Delta X_t - \pi_1 \hat{u}_{t-1} + \varepsilon_t \quad (12)$$

β_3 = constant term

β_4 = short-run coefficient, measure the immediate impact of a change in X_t will have on a change in Y_t

π_1 = coefficient of the estimated lagged residual of equation 10

ε_t = white noise error term

$\hat{u}_{t-1}$ = error correction term

Of course $\hat{u}_{t-1} = Y_{t-1} - \hat{\beta}_1 - \hat{\beta}_2 X_{t-1}$ (13)

In this case OLS perform well.

$$\Delta Y_t = \beta_3 + \beta_4 \Delta X_t - \pi_1 (Y_{t-1} - \hat{\beta}_1 - \hat{\beta}_2 X_{t-1}) + \varepsilon_t \quad (14)$$

3.3 Jarque-Bera Test

The Jarque-Bera test (Jarque and Bera, 1987) is used for testing the autocorrelation of the model and can be defined as:

$$JB = \frac{n}{6}(S^2 + \frac{1}{4}(K-3)^2) \quad (13)$$

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

$$K = \frac{1}{N}\sum_{i=1}^{N}(\frac{y_i - \bar{y}}{\hat{\sigma}})^4 \quad (14)$$

$\hat{\sigma}$: 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

3.4 Serial Correlation Testing

It is a test of autocorrelation of independent variable of time derivative. In this test, Portmanteau test will be used to check the problem of white noise and autocorrelation which has the formula as:

$$Q = n(n+2)\sum_{j=1}^{m}\frac{1}{n-j}\hat{\rho}^2(j) \rightarrow \chi^2_m$$

m: number of Autocorrelation

χ^2: Normal distribution with degrees of freedom m

$\hat{\rho}j$: Autocorrelation value calculated for lag j

Hypothesis: H_0: there is White noise

H_1: there is not White noise

4. Empirical Results

Based on the basic conditional of ECM, the series must be stationary. The first part of the table 1 below show the value of tested non-stationary and the second part of the table express the stationary of time series data at the 1st differences of the statistically 5% level.

Table 1: Unit Root Test Results

H_0: Non-stationary H_1:Stationary

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	MacKinnon (Sig. Level)
		Before difference			
		Interpolated Dickey-Fuller			
LnR	-2.089	-3.723	-2.989	-2.625	0.2491
LnS	-1.655	-3.723	-2.989	-2.625	0.4546
$LnGDP$	-0.903	-3.723	-2.989	-2.625	0.7869
		After 1st difference			
$D.LnR$	-3.012	-3.730	-2.992	-2.626	0.0338
$D.LnS$	-3.693	-3.730	-2.992	-2.626	0.0042
$D.LnGDP$	-5.428	-3.730	-2.992	-2.626	0.0000

Note: the value in parentheses is MacKinnon approximate p-value

According to the ADF test above seen that before diff, the revenue and spending variables of the Lao government are not stationary, but after 1st differences, we can reject the null hypothesis and accept the alternative hypothesis, means that the variable is statistically significant with a significance level of 0.05 and can be used to test the relationships and we get the long-run model as:

$$\widehat{LnS_t} = 0.3818 + 0.9138\widehat{LnR_t} + 0.0580\widehat{LnGDP_t}$$

(29.23)* (1.92)*** (5.19)*

$$R^2 = 0.9984, Adj\ R^2 = 0.9983, F = 8573.75, Prob = 0.000, Root\ MSE = 0.07777$$

Note: the value in parentheses "( )" is the t-test

*,**,*** Statistically significance at 0.01, 0.05 and 0.1 respectively.

As the long-term effect model above, it is indicated that the independent variables can explain the dependent variable by 99.84% which the most influential factor being revenue. In the long term, income has a positive significant relationship with expenditure at a statistical level of 0.1, which means that if other factors are constant, when revenue increases by 1 % will result in an increase in Lao government spending by 0.9138 % and vice versa, if the government revenue decreases by 1 %, it will also reduce government spending by 0.9138 %. As for GDP, there is also a positive significant relationship with the government's spending

at the statistical level of 0.01, meaning that if other factors are constant, an increasing in the GDP of Laos by 1% will result the government's spending increased by 0.058% and on the contrary, if the GDP of Laos increased by 1% will cause the government's spending increased by 0.058%. However, an analysis was found that the constant coefficient has a statistically significance level of 0.01, means that even if the government does not have revenue and the GDP does not increase, the Lao government still spends.

According to the ECM condition, the researchers continue to conduct the cointegration by Engle-Granger test and expressed that the test statistic of residuals equal to -4.580 which greater than the table of critical value of Cointegration test at the confidence level of 90%, 95% and 99% respectively, meaning that the ε_t stationary at $I(0)$ indicated that the null hypothesis was rejected or accepted alternative hypothesis that there is error correction model and written as:

$$\widehat{\Delta LnS_t} = -0.0030 + 0.9261\widehat{\Delta LnS_t} + 0.0307\widehat{\Delta GDP_t} - 0.7810ECT$$
$$\text{(-0.17)} \qquad \text{(13.74)*} \qquad \text{(1.16)} \qquad \text{(-4.42)*}$$

For the short-run found that only revenue and ETC are statistically significant of 0.01 level. If we suppose other variables are constant, when the government's revenue increased by 1% will cause the government's spending increased by 0.9261 %. In contrast, the decreasing of 1% in the government's revenue will cause the government's spending decreased by 0.9261 % which is according to the theory of the government's revenue and expenditure of Freidman (1978).

For the speed of adjustment or coefficient of ECT stand between $-1 < ECT < 0$, based on the assumption set indicated that the deviations from the long-run equilibrium are often corrected by the speed of adjustment of the ECT through the data set which the coefficient of ECT equal to -0.781 meaning that the residuals of the government's revenue and spending derivation from the equilibrium point in the past year will adjusted to the long-run equilibrium by 78.1%.

To check whether the model used in this test is suitable or not. The researcher conducted a test of the distribution of volatility with the method of Sharpio-Wilk W test and results:

Table 2: Residuals Normality Test

Shapiro-Wilk W test for normal data					
Variable	**Observation**	**W**	**V**	**z**	**Prob>z**
Residual	29	0.98138	0.577	-1.134	0.87163

As the table 2 above we cannot reject null hypothesis at the statistical level of 0.05, shown that the residuals are normally distributed, then we conduct to test serial correlation by Portmanteau test and result in:

Table 3: Serial Correlation Test

Portmanteau test for white noise	
Portmanteau (Q) statistic	12.0097
Prob > chi2(12)	0.4449

For the table 3 above we also cannot reject null hypothesis meaning that residuals do not have serial correlation problem or there is white noise which indicated our model is goodness of fit and appropriate to predict.

5. Conclusion

5.1 Results Finding

For the analysis of the relationship between revenue, expenditure of the government and GDP of Lao PDR by using the Cointegration and Error Correction model, it is found that it is according to the hypothesis. It is also found to be related both in the short-run and in the long-run. In the long-run, both revenue and GDP have a positive significant relationship on expenditure with a significance level of 0.01 and 0.1 respectively. For short-run, only government's revenue has a statistically significant relationship with government spending at a significance level of 0.01, with the coefficient of ECT equal to -0.781, suggesting that almost 78% of the discrepancy between the long-run and the short-run is corrected within a series. In the test of residual normality distributed and serial correlation indicates we cannot reject null hypothesis, meaning that the model used in this study is suitable for testing the relationship between revenue, expenditure and GDP of Lao PDR.

5.2 Suggestions for Use in This Research

This study will provide some important information for related policymakers for implementation of short-run and long-run policies to meet the development goals. The relative departments could manage revenue and expenditure efficiently to push economic growth. Because the budget balance will give the government money to manage and develop the country continuously as well as maintain economic stability.

5.3 Further Research

However, this study uses a small sampling and is a study of only one country. Therefore, further researchers should consider panel data and use more independent variables in order to more accurate predict. In addition, other models should be used to analyze to compare with this method which method can provide more accurate prediction results.

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