

MODELLING THE CONSUMER PRICE AND PRODUCER PRICE INDICES WITH RELATED ECONOMIC VARIABLES

Abstract— This research intends to assess the relationship between Consumer Price Index (CPI) and Producer Price Index (PPI) in Sri Lanka with the related macroeconomic variables such as Broad Money Supply, Imports, and Exchange Rate for the period of January 2014 to June 2021. The multivariate time series analysis methods and stochastic forecasting methods based on the Root Mean Square Error (RMSE) are engaged in the analysis. The log transformation is used to stabilize the variation of data in each variable. The Johansen co-integration test results confirmed that the Consumer Price Index, Producer Price Index, Imports and Broad Money Supply have a significant long run equilibrium relationship. In the long run, the Producer Price Index and the Broad Money Supply both have a positive effect on the Colombo Consumer Price Index, while Imports have a negative effect. The Vector Error Correction (VEC) model's short run estimation results show that the Producer Price Index, Imports and Broad Money Supply are weakly exogenous to the Consumer Price Index. The Akaike Information Criteria (AIC), Schwarz Criteria (SC) and F-statistics indicated a fairly good fit of the VEC model. The diagnostic tests of the VEC model proved that the residual assumptions of no serial correlation, no heteroskedasticity and multivariate normally distributed are satisfied. The RMSE evaluated by the stochastic forecast under the dynamic method revealed that the fitted model is validated to the test data set showing the actual CPI figures from July 2021 to December 2021 are in both the forecast upper and lower bounds.

Keywords— *Consumer Price Index, Producer Price Index, Broad Money Supply, Johansen co-integration, VEC model*

I. INTRODUCTION

This study is aimed at examining the relationship between consumer and producer price indices in Sri Lanka. In addition to theoretical interest in the topic the study also has high degree of policy relevance as it deals with both short-term and long-term issues relating to Consumer Price Index (CPI) and Producer Price Index (PPI) with other related economic variables such as Money supply, Exports & Imports, Gross Domestic Product (GDP) and Exchange Rate, Interest Rate and Rice Price Index.

The Department of Census and Statistics (DCS), Sri Lanka compiles two consumer price indices on a monthly basis namely, National Consumer Price Index (NCPI) (Base 2013=100) and Colombo Consumer Price Index (CCPI) (Base 2013=100). The average change in the prices of consumer goods and services purchased by households for day-to-day living over specific time period is measured by a Consumer Price Index (CPI). The geographical coverage of the NCPI is the entire country, while that of the CCPI is urban areas in the Colombo district. The NCPI is compiled on a monthly basis with a time lag of 21 days and the CCPI is compiled last working day of each month by the DCS with an internationally accepted guideline.

The both weighting structures of NCPI and CCPI were developed using data from the Household Income and Expenditure Survey conducted by the DCS [1]. The NCPI expenditure value is divided into 12 categories, namely "Food and Non-Alcoholic Beverages", "Alcoholic beverages, Tobacco and Narcotics", "Clothing and Footwear", "Housing, Water, Electricity, Gas and Other fuels", "Furnishings, Household equipment and Routing household maintenance", "Health", "Transport", "Communication", "Recreation and Culture", "Education", "Restaurant and Hotels", "Miscellaneous Goods and Services". The Modified or Two-Stage, Laspeyres formula is used to calculate the Consumer Price Index [2]. Using the both NCPI and CCPI monthly percentage changes and annual percentage changes are calculated. The year-over-year increase in the general price level of goods and services is termed "Inflation", and it expresses itself as a percentage value. When the general price level rises, money becomes scarce and cannot be used to buy goods and services as easily as it could previously.

As continued practice, from 1953 the Central Bank of Sri Lanka (CBSL) uses CCPI for the monetary policy purposes for the country even though the NCPI was introduced from January 2014 [3]. Especially in Sri Lanka, most of the monetary variables depend on the CCPI. So, in this study, CCPI is considered instead of the NCPI as a proxy measure for country inflation.

The average change in prices received by domestic producers for goods and services over a specific period of time is measured by PPI. The PPI was introduced in 2015 for the first time in Sri Lanka with index reference of 2013Q4 (fourth quarter) and published series from January 2014. The DCS changed the index reference of the PPI to 2018Q4 (fourth quarter) in 2021 and disseminated the monthly indices with effect from the month of November 2021 with a time lag of 40 days. The index covered Agriculture, Manufacturing and Utility (Electricity and Water) sectors. Agriculture and Utility sector covered the entire country. Even though manufacturing sector covered six provinces, it represents the main geographical coverage of the industry sector of the country. The reference period for the current PPI is considered from the Annual Survey of Industries, 2016 [4]. PPI is considered as an important macro-economic indicator. The PPI is used as an indicator to measure future inflation movements for the short-term and as a deflator of national accounts which is used for the compilation of productivity processes in the country. To compile the PPI the Modified, or Two-Stage, Laspeyres formula is also used by the DCS [5].

Even though the same mathematical formula is used for compiling both the CPI and the PPI, the concepts of calculating the two indices are different. The CPI measures

changes of prices paid by consumers for the goods and services (That is based on market retail prices) and PPI measures changes of prices received by domestic producers. The PPI is a leading indicator for the retail price change for the country so that it is the leading indicator for the CPI. The relationship between CPI and PPI cannot be studied directly since macro-economic variables such as Exchange Rate, Money Supply, Treasury Bill Interest Rate, Exports and Imports, GDP, Rice Price Index ~~that~~ are linked with these two indicators.

The CPI and PPI are the main macroeconomic variables in an economy and are published on a monthly basis. Study the relationship between CPI and PPI with related economic variables for the short run and long run and its degree of significance is very important in achieving price stability goal of Sri Lanka's economic policy it affects to control inflation and producer price increase for of the country as well. In addition, forecasting of CPI for the specific time period ~~are~~ is very essential to develop and implement effective economic policies of the country. In addition it is very useful to formulate government budget constraints as well.

It has been noted that the lack of investigation of relationship between CPI and PPI in Sri Lanka since the series of PPI was initiated from January 2014 by the DCS. Therefore, this study tries to assess the short run or long run relationship between CPI and PPI in Sri Lanka with the related macroeconomic variables.

II. LITERATURE REVIEW

The following describes the past studies related to the relationship between the CPI and PPI and the CPI with the other related economic variables.

A study done in China from 2008 to 2018 revealed that there is a co-integration association and short run and long run significant impact between CPI and PPI [6]. Further the study discovered VEC model that has a negative effect of the preceding month's CPI and a positive effect of the preceding month's PPI on the current CPI. Another study done in 2003 discovered that there is no short-run relationship between CPI and PPI using Granger causality test [7]. In 2015 a study done in Indonesia showed that there is a long-run relationship between the variables CPI and Wholesale Price Index (WPI) during the period from December 1984 to December 2012 and one-to-one short-term relationship between the variables [8].

The similar investigation done in Sri Lanka revealed the existence of a positive association between CPI and the money supply using the Error Correction Model (ECM) [9]. In this study the variables considered for the CPI were money supply, exchange rate, gold prices, oil prices, treasury bill interest rates and gross domestic production. It also discovered that the effects of oil prices and gross domestic product on inflation are lower, the effect of the Treasury bill on inflation is mild, and exchange rate and treasury bill Interest rate) are less significant on Inflation. It was concluded that long run equilibrium exists among the variables.

III. THEORY AND METHODOLOGY

A. Methodology

- Check the stationarity condition and remove multicollinearity [10].
- Discuss the VAR model, Co-integration and VEC model as well as model adequacy measures.
- Further discuss the special features pertaining to the selected model and check the appropriateness of the model using the concept of Root Mean Square Error.

B. Theory

A VECM is a restricted VAR that consists of co-integration restrictions. VECM can be fitted with either stationary or non-stationary series, which must be co-integrated [11]. A vector matrix notation of VECM is:

$$y_t = \mu + \pi y_{t-1} + \sum_{i=1}^p \tau_i^* \Delta y_{t-1} + \epsilon_t \quad (1)$$

where,

y_t - $m \times 1$ vector: variables,

Δy_t - $m \times 1$ vector: first differences of variables in y_t ,

μ - $m \times 1$ vector: intercept coefficients,

π and the τ_i^* 's - $m \times m$ matrices,

ϵ_t - $m \times 1$ vector: error with contemporaneous correlations but no autocorrelation.

C. Limitation/Delimitations and Data Sources

Since the introduction of the PPI was started in January 2014 and the economic crisis in Sri Lanka was also started in January 2022, the time-period of this study is limited to January 2014 to December 2021. The main sources of data for this study are the monthly web releases and bulletins of the DCS and the CBSL. Imports & Exports data are obtained from the Sri Lanka Customs.

Further, data were collected from the above-mentioned sources on a monthly basis from January 2014 to December 2021. The time-period from January 2014 to June 2021 is considered as the training data set and from July 2021 to 2021 December is considered as the test data set.

IV. RESULTS AND DISCUSSIONS

Stationary in the log transformed original variables and in the first difference log transformed variables (LCCPI, LPPI, LIMP, LM2, LM1, LER, LRICE, and LGDP) was checked using Augmented Dickey Fuller (ADF) unit root test and presented in Table I and Table II.

TABLE I. THE ADF TEST RESULTS (AT LEVEL)

Variable	Level				Results
	With Constant		With Trend and Constant		
	Stat	Prob.	Stat	Prob.	
LCCPI	1.058	0.997	-2.526	0.315	-
LPPI	0.113	0.965	-2.503	0.326	-
LIMP	-2.096	0.247	-2.926	0.160	-
LEXP	-4.491	0.000	-6.236	0.000	I(0)
LM2	-0.349	0.912	-2.160	0.505	-
LM1	0.553	0.988	-1.366	0.863	-
LER	0.041	0.959	-3.225	0.087	-
LRICE	0.306	0.977	-1.584	0.791	-
LGDP	-2.021	0.277	-1.227	0.898	-

TABLE II. THE ADF TEST RESULTS (AT FIRST DIFFERENCE)

Variable	First Difference				Results
	With Constant		With Trend and Constant		
	Stat	Prob.	Stat	Prob.	
LCCPI	-10.127	0.000	-10.203	0.000	I(1)
LPPI	-9.808	0.000	-9.812	0.000	I(1)
LIMP	-14.769	0.000	-14.685	0.000	I(1)
LEXP					
LM2	-3.251	0.020	-7.862	0.000	I(1)
LM1	-1.172	0.683	-1.376	0.860	-
LER	-6.647	0.000	-6.649	0.000	I(1)
LRICE	-5.623	0.000	-5.542	0.000	I(1)
LGDP	-5.014	0.000	-11.615	0.000	I(1)

According to the Tables I and II, the ADF test indicated that at the 5% significance level for with constant and with trend & constant categories, the variables LCCPI, LPPI, LIMP, LM2, LM1, LER, LRICE, and LGDP are non-stationary. However, the ADF test suggests at the 5% significance level for with a constant and with trend & constant, the variable LEXP is stationary. That is, LEXP is I(0). Furthermore, the first difference of the other log transformed variables is used to determine the stationary condition.

The ADF test suggests that all the LCCPI, LPPI, LIMP, LM2, LER, LRICE and LGDP series are stationary at first difference. At the 5% significance level, the series are referred to as integrated to order one, I(1). Therefore, with the ADF (with constant and with trend and constant) test, it can be concluded that the LCCPI, LPPI, LIMP, LM2, LER, LRICE, and LGDP are non-stationary at the 5% significance level, and the first difference of the same series are stationary at the 5% significance level.

Next, to study the co-integration, all the variables' order of integration must be the same. So, the EXP and M1 were dropped since they have different orders of integration.

TABLE III. CORRELATION MATRIX OF THE FIRST DIFFERENCE OF THE LOG VARIABLES

	DLPP1	DLIMP	DLM2	DLER	DLRICE	DLGDP
DLCCPI	0.477 ^{cc}	0.033	-0.197	0.001	0.349 ^c	-0.075
DLPP1		0.009	0.063	0.099	0.209 ^c	-0.045
DLIMP			0.018	0.129	-0.043	0.567 ^{cc}
DLM2				0.044	-0.090	0.066
DLER					0.001	0.022
DLRICE						-0.090
DLGDP						

^{cc} Correlation, 1% sig. level (2-tailed).

^c Correlation, 5% sig. level (2-tailed).

The Table III shows the existence of a significant correlation between first difference log transformed RICE and first difference log transformed PPI. The variable RICE can be dropped since it has a lower correlation with the response CCPI when compared with the PPI. There is a significant correlation between DLGDP and DLIMP. Again, the variable GDP can be dropped ~~that~~ since it has a lower correlation with the response CCPI when compared with the IMP.

After removing the multicollinearity, the variables remaining for the further analysis are LCCPI, LM2, LER, LPPI, and LIMP. The unit root test results disclose that all

LCCPI, LM2, LER, LPPI, and LIMP variables are integrated into order 1.

A. Co-integration Relations

A co-integration test is applied to the non-stationary variables that are at the first order of integration. The Johansen co-integration test can be used to demonstrate the existence of a co-integration relationship between the LCCPI and other related variables, assuming a linear deterministic trend.

TABLE IV. CO-INTEGRATION TEST RESULTS: TRACE TEST (LCCPI, LPPI, LM2, LIMP)

Hypothesized No. of co-integrations	Eigenvalue	^a Trace Statistics		
		Value	5% CV	Prob.
None	0.302	55.269	47.856	0.009
At most 1	0.182	24.331	29.797	0.187
At most 2	0.077	7.006	15.495	0.577
At most 3	0.001	0.125	3.841	0.724

TABLE V. CO-INTEGRATION TEST RESULTS: MAX-EIGENVALUE TEST (LCCPI, LPPI, LM2, LIMP)

Hypothesized No. of co-integrations	Eigenvalue	^b Maximum-Eigen Statistics		
		Value	5% CV	Prob.
None	0.302	30.938	27.584	0.018
At most 1	0.182	17.326	21.132	0.157
At most 2	0.077	6.881	14.265	0.503
At most 3	0.001	0.125	3.841	0.724

^a Trace test: one co-integration equation, 5% sig. level, CV as Critical Value

^b Max-eigenvalue test: one co-integration equation, 5% sig. level, CV as Critical Value

According to the Trace statistic and Maximum-Eigen statistic, "co-integration relation does not exist" is rejected at the 5% level of significance. Therefore, it can be claimed that a co-integration relationship does exist among the variables with 95 percent confidence. Trace and Maximum-Eigen statistics revealed that the no. of possible co-integrations that can exist is one.

TABLE VI. CO-INTEGRATION RELATIONSHIP (LCCPI, LPPI, LM2, LIMP) RESPONSE VARIABLE: LCCPI

Determinant	Coefficient	Std.Error	T-ratio
LPPI	0.245	-0.075	[-3.241] ^c
LIMP	-0.116	-0.020	[5.844] ^c
LM2	0.233	-0.034	[-6.762] ^c
Constant	1.512		

^c Significance at 5 % level

B. Long run relationship (Response variable CCPI)

The co-integration test revealed the existence of a significant long-run relationship between CCPI and PPI, IMP, M2. From the co-integration relationship, it can be observed that, when other variables remain fixed, each percentage point increase in PPI will cause an increase of 0.24 percentage points in CCPI. Also, each percentage point increase in M2 will cause an increase of 0.23 percentage points in the CCPI. However, results revealed that each percentage point increase

in IMP will cause a decrease of 0.12 percentage points in CCPI.

C. Vector Error Correction Model (VECM)

The unit root test results disclosed that all LCCPI, LM2, LPPI, and LIMP variables are integrated into order 1. Since the co-integration test revealed the existence of a significant long-run relationship between LCCPI and LPPI, LIMP, LM2, VECM model is fitted instead of Vector Autoregressive (VAR). Table VII shows the model summary statistics given by the VEC (DLCCPI, DLM2, DLPPI, DLIMP) model.

TABLE VII. VECM (DLCCPI, DLM2, DLPPI, DLIMP) SUMMARY STATISTICS

	D(LCCPI)	D(LM2)	D(LPPI)	D(LIMP)
Error Correction term:	-0.0834	0.065	0.325	-3.378
Std. Error	-0.066	-0.066	-0.164	-0.986
t statistics	[-1.260]	[0.973]	[1.987]	[-3.425]
AIC Statistic	-7.093	-7.087	-5.283	-1.691
SC Statistic	-6.694	-6.687	-4.884	-1.291
F-statistic	4.251	2.435	2.441	3.858

The model statistics in Table VII indicate that AIC and SC statistics represent smaller values and F-statistics are significant at the 5% significance level. Therefore, the VECM (DLCCPI, DLM2, DLPPI, DLIMP) model indicates a fairly good fit. The LCCPI, speed of adjustment term (Table VII) sign is negative (in between 0 and -1) but not significant, which indicates that it will be adjusted to the equilibrium level (converge to the equilibrium level) of the LCCPI at a fairly low rate.

In Table VII, VECM -0.0834 is an error correction term of the CCPI, which indicates that deviation from long-run equilibrium is corrected monthly at a fairly low rate of 8.34 percent. The error correction term is known as the co-integration term or the speed of adjustment term because it measures the stepwise adjustment of a deviation from long-run equilibrium to equilibrium level through a partial short-run dynamics.

D. VEC model, Short run estimates- Response Variable D(LCCPI)

$$\begin{aligned}
D(LCCPI) = & -0.083 \times (LCCPI(-1) - 0.2326 \times LM2(-1) \\
& - 0.2445 \times LPPI(-1) + 0.1158 \\
& \times LIMP(-1) - 1.5123) + C_1 \\
& \times D(LCCPI(-1)) + C_2 \times D(LCCPI(-2)) \\
& + C_3 \times D(LCCPI(-3)) + C_4 \\
& \times D(LM2(-1)) + C_5 \times D(LM2(-2)) \\
& + C_6 \times D(LM2(-3)) + C_7 \\
& \times D(LPPI(-1)) + C_8 \times D(LPPI(-2)) \\
& + C_9 \times D(LPPI(-3)) + C_{10} \\
& \times D(LIMP(-1)) + C_{11} \times D(LIMP(-2)) \\
& + C_{12} \times D(LIMP(-3)) + C_{13}
\end{aligned}$$

(2)

TABLE VIII. VECM, RESPONSE VARIABLE D(LCCPI)- COEFFICIENT ESTIMATES

Determinant	Coefficient Value notation	Std.Error	t-Statistic	Probability
D(LCCPI(-1))	C ₁ 0.091	0.113	0.804	0.422
D(LCCPI(-2))	C ₂ -0.294	0.114	-2.578	0.010 ^c
D(LCCPI(-3))	C ₃ -0.648	0.127	-5.092	0.000 ^c
D(LM2(-1))	C ₄ 0.039	0.116	0.335	0.738
D(LM2(-2))	C ₅ -0.239	0.111	-2.161	0.032 ^c
D(LM2(-3))	C ₆ 0.015	0.120	0.122	0.903
D(LPPI(-1))	C ₇ -0.041	0.053	-0.767	0.444
D(LPPI(-2))	C ₈ 0.039	0.051	0.772	0.441
D(LPPI(-3))	C ₉ 0.135	0.050	2.713	0.007 ^c
D(LIMP(-1))	C ₁₀ 0.019	0.008	2.278	0.024 ^c
D(LIMP(-2))	C ₁₁ 0.005	0.008	0.553	0.580
D(LIMP(-3))	C ₁₂ -0.002	0.008	-0.287	0.774
Constant	C ₁₃ 0.008	0.002	3.279	0.001

D(Variable(lag))-First difference of log of Variable lag

^c Significance at 5% level

It can be seen from the equation that the lag 2 and 3 of CCPI are significant to the CCPI. Also, lag 3 of PPI is significant to the CCPI. The lag 2 of Broad Money Supply (M2) and lag 1 of Imports are significant to the CCPI. PPI, M2, and IMP have the significant long-run effects on the CCPI and all three variables are weakly exogenous (even one lag of each independent variable is significant to the CCPI) in the short run. Therefore, it can be concluded that in the long run and short run, the main determinants of CCPI are the PPI, M2 and IMP.

E. Model Diagnostics of fitted VEC model

Model diagnostics statistics are shown in Table IX.

TABLE IX. MODEL DIAGNOSTICS OF FITTED VEC MODEL

Serial Correlation LM test			
Lags	LM-Stat.	Probability	
1	25.836	0.056	
2	22.386	0.131	
3	17.115	0.378	
Heteroskedasticity test			
	Chi-squared	DF	Probability
	283.235	260	0.154
Normality test			
Data series	Jarque-Bera	DF	Probability
LCCPI	3.118	02	0.210
LM2	4.678	02	0.096
LPPI	0.875	02	0.646
LIMP	0.272	02	0.873
Joint	8.942	08	0.347

DF-Degrees of Freedom

In the Table IX, serial correlation-LM test confirms that serial correlation does not exist among the model's residuals at the 5 % significance level. Also, heteroskedasticity-White test confirms that heteroskedasticity does not exist among the model's residuals at the 5% significance level and the normality-Jarque-Bera test confirms that the model's residuals are multivariate normally distributed at the 5% significance level. It can be claimed that all three model diagnostics tests are satisfied with a 95% level of confidence, so the VECM model is well fitted and can be used to evaluate forecasting purposes etc.

F. Forecast Evaluation of fitted VEC model

The test data set from July 2021 to December 2021 is used to forecast and validate the model. The compiled RMSE of the test data set is near zero, the fitted VECM model can be used to validate the test data set.

TABLE X. ACTUAL, MEAN FORECAST, UPPER BOUND FORECAST AND LOWER BOUND FORECAST FROM JULY 2021 TO DECEMBER 2021 FOR THE CCPI

Month	Actual	Mean Forecast	Upper bound forecast	Lower bound forecast
2021 July	143.1	143.7	145.8	141.9
2021 Aug.	143.5	142.6	145.0	140.1
2021 Sep.	144.1	143.8	144.5	139.0
2021 Oct.	146.9	145.1	147.1	141.1
2021 Nov.	150.7	148.4	151.5	145.3
2021 Dec.	154.7	151.6	154.8	148.4

Table X shows that the actual CCPI figures from July 2021 to December 2021 are in both the forecast upper and lower bounds.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

- The log transformation is used to stabilize the variation of data in each variable. At their first difference, the log transformed Consumer Price Index, Producer Price Index, Broad Money supply, Imports, and Exchange Rate series were formed stationary.
- The information criterion AIC, SC and F-statistic indicated a fairly good fit of the VEC model.
- For the fitted VEC model's, serial correlation-LM test confirmed that serial correlation does not exist among the model's residuals at the 5 % significance level. Also, the heteroskedasticity-White test confirmed that heteroskedasticity does not exist among the model's residuals and the normality-Jarque-Bera test confirmed that the model's residuals are multivariate normally distributed at the 5% significance level. It can be claimed that all three model's diagnostics tests were satisfied with a 95% level of confidence.
- The Johansen co-integration test results confirmed that the relationship between the CPI and PPI, Imports and Broad Money supply have a significant long run relationship.
- In the long run, the PPI and the Broad Money Supply both have a positive effect on the Colombo Consumer Price Index, while Imports has a negative effect.
- The LCCPI, speed of adjustment term sign is negative (in between 0 and -1), but not significant, which indicates that it will be adjusted to the equilibrium level (converge to the equilibrium level) of the LCCPI at a fairly low rate.
- The error correction term indicates that deviation from long-run equilibrium is corrected monthly at a fairly low rate of 8.34 percent.
- Since the information criterion AIC, SC and F-statistic indicated a well-fitting of the VEC model and all the assumptions of the model's diagnostics statistics were

satisfied, this model can be used to evaluate impulse response function, variance decomposition, forecasting, etc.

- Short-run estimation results from the VEC model revealed that the PPI, Imports, and Broad Money Supply are all weakly exogenous to the CPI. This study revealed that the PPI, Board Money Supply and Imports are the main determinants of the CPI in the long and short runs.
- This study is limited to January 2014–December 2021, since the introduction of the Producer Price Index started in January 2014 and the economic crisis in Sri Lanka also started in January 2022. During the economic crisis, economic variables affect ad hoc day-to-day policies, and the static economic policies violate the laws pertaining to each and every economic variable.
- The factors related to the CPI in the short and long runs are the PPI, Board Money Supply and Imports. The fitted model can also be used to forecast the CPI for a specific time period.

B. Recommendations

This study revealed that the CPI is mainly related to the PPI, Board Money Supply and Imports, its degree of significance was also proved in this study. To achieve the country's price stability goal in substantial level, policymakers can take decisions to control or expand the country's money supply and imports. Also, forecasting the CPI for a specific time period with related economic variables is important because the CPI is simultaneously related to the other economic variables that are directly related to the country's effective economic policies and plan implementation.

C. Further Studies

The CPI has 12 sub-indices and the PPI has 3 sub-indices. The first principal component that accounts for the maximum variance of the 12 sub-indices of the CPI was identified, which can be named the "Cost of Living Index," and the first principal component that accounts for the maximum variance of the 3 sub-indices of the PPI was identified, which can be named the "Cost of Production Index." A study can be conducted to determine the relationship between the Cost of Living Index and the Cost of Production Index with related economic variables to capture the living standard of the country based on government policies.

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