

University of Wollongong Research Online

Faculty of Commerce - Papers (Archive)

Faculty of Business

2008

A model of inflation for Sri Lanka

Arusha V. Cooray University of Tasmania, arusha@uow.edu.au

Publication Details

This article was originally published as Cooray, AV, A model of inflation for Sri Lanka. Review of Applied Economics, 4(1-2), 2008, 35-44.

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au



A model of inflation for Sri Lanka

Abstract

This paper uses two models: an open economy model and a closed economy model to estimate a price equation for Sri Lanka. The results suggest greater support for the open economy model. Consistent with previous studies for Sri Lanka, supply side factors appear to be important in influencing the general price level in Sri Lanka.

Keywords

Sri Lanka, inflation, cointegration, non-nested models

Disciplines

Business | Macroeconomics | Social and Behavioral Sciences

Publication Details

This article was originally published as Cooray, AV, A model of inflation for Sri Lanka. Review of Applied Economics, 4(1-2), 2008, 35-44.

A MODEL OF INFLATION FOR SRI LANKA

Arusha Cooray School of Economics

University of Tasmania Private Bag 85

Hobart 7001

Tasmania

Australia

Email: Arusha.Cooray@utas.edu.au

Abstract: This paper uses two models: an open economy model and a closed economy

model to estimate a price equation for Sri Lanka. The results suggest greater support for

the open economy model. Consistent with previous studies for Sri Lanka, supply side

factors appear to be important in influencing the general price level in Sri Lanka.

Keywords: Sri Lanka, inflation, cointegration, non-nested models

1

1 Introduction

This study develops a model of inflation for Sri Lanka in order to see what factors influence the general price in Sri Lanka. One of the many explanations for the continuing increase in price level, is the monetarist theory of the excessive growth in money supply. A consequence of financial deregulation in Sri Lanka has been the growth in all monetary aggregates. Money supply as defined by M2, which rose threefold during the 1965-1977 period, rose 23 fold during the 1978-1996 period. The lack of fiscal restraint has been a prime factor underlying this monetary expansion. The adoption of liberalized trade and payment policies together with the introduction of a floating exchange rate system added further pressure on prices. With the removal of import and exchange controls during the post liberalization period, imports began to gain greater significance in affecting prices. By 1987, external trade accounted for 57% of the GDP the difference between the 1950's and post liberalization period being that imports had come to account for a larger share of the GDP than exports. With imports beginning to gain greater importance in price determination, the impact of exchange rate movements on the rate of inflation has also come to acquire greater significance and is therefore included as a likely explanatory variable in the empirical study that follows.

Studies on inflation in Sri Lanka include those by Nicholas (1990), Nicholas and Yatawara (1991), Weerasekera (1992), Rupananda (1994). These studies suggest the importance of supply side factors as affecting the general level of prices. Hence in estimating a price equation for Sri Lanka, two models are examined;

- 1) a closed economy model based on the monetarist explanation of inflation modified to incorporate the time lags in the adjustment of prices to changes in money supply ¹, and
- 2) an open economy model which incorporates in addition to the variables in (1), the import price index and foreign exchange rate².

The rest of the paper is structured as follows. Section 2 examines the data. Section 3 estimates two price equations for Sri Lanka for the closed and open economy models. Section 4 summarizes the conclusions.

2 Data

All data has been obtained from the annual reports and monthly bulletins of the Central Bank of Sri Lanka and the International Financial Statistics. The empirical analysis makes use of annual, quarterly and monthly data. The annual data covers the period 1978-2006, comprising in sum a total of 29 observations. The sample size is clearly very small, however, this is the longest time period for which data is available given that exchange rates are floating. Due to the limited number of annual observations, quarterly and monthly data for the period 1978-2006 is also used. This test involves estimating the effects of money supply, real GNP,

_

¹ Monetarist models of inflation for less developed countries can be found in the works of Harberger(1963), Vogel (1974), Bomberger and Makin (1979), Saini (1982, 1984), and Rao, Fahimuddin and Bajpai (1996), Masih and Masih (1998).

² Several studies on inflation have incorporated exchange rates and foreign prices as additional variables - Diz (1970), Lowinger (1978), Nugent and Glezakos (1979), Sheehey (1979), Saini (1984), Moser (1995) - in some cases primary explanatory variables. See Otani (1975), Aigbokhan (1991), Gali and Monacelli (2005).

import prices and exchange rate on the Colombo Consumer Price Index (CCPI). Data on the CCPI, money supply, real GNP and import price index have been used for this purpose. Real GNP figures were available only for the 1982-2006 period with 1982 as the base year. For the period before 1982 these figures were approximated by deflating nominal GNP by the CCPI. Due to the lack of quarterly and monthly data on real GNP, quarterly and monthly series have been constructed subject to the constraint that real GNP grew at a constant rate each quarter/month throughout the year. A similar procedure has been used for the construction of quarterly and monthly series for import prices.

3 The Estimation of a Suitable Price Equation for Sri Lanka

A Preliminary Test

This section attempts to analyse the main factors influencing the rate of inflation in Sri Lanka. As mentioned in section 1, two models are estimated. A closed economy model and an open economy model.

The closed economy price equation is given by³,

$$P_{t} = a_{1} + a_{2} M_{t} + a_{3} M_{t-1} + a_{4} P_{t-1} + a_{5} GNP_{t} + u_{t}$$
 (1)

the open economy price equation is given by;

$$P_t = a_1 + a_2 M_t + a_3 M_{t-1} + a_4 P_{t-1} + a_5 GNP_t + a_6 IMP_t + a_7 ER_t + u_t$$
 (2)

where,

P_t = Colombo Consumer Price Index

 M_t = Money supply (M_2)

_

³ The effects of changes in money supply are not instantaneously reflected in prices. Therefore M $_{t-1}$ is designed to capture the lagged response of prices to money supply. P $_{t-1}$ is incorporated to capture the lagged effects of prices on current prices. The limited number of observations precludes the use of too many lagged variables. Theoretical justification for the inclusion of lagged variables of money supply can be found in the works of Harberger (1963), Diz(1970), Saini(1982, 1984), Bomberger and Makin (1979).

 P_{t-1} = Colombo Consumer Price Index lagged by one period

GNP_t = Real Gross National Product

 IMP_t = Import price index

ER_t = Official exchange rate Rupee/US Dollar

 u_t = random error term

All variables are expressed in terms of their logarithms.

(Table 1, about here)

A number of alternative specifications of equations (1) and (2) were estimated in arriving at the final model. Two alternative specifications appeared promising for Sri Lanka. Panel 1 reports the estimated regression coefficients based on the variable deletion tests carried out on equation (1), and panel 2 reports the estimated regression coefficients based on the variable deletion tests carried out on equation (2). The t statistics are reported within parentheses. In order to determine the best specification, diagnostic tests have been carried out. The models appear to be well specified on the basis of these tests. The J test from Davidson and MacKinnon (1981) and JA test from Fisher and McAleer have been used to compare the alternative specifications. The non nested hypothesis tests are reported below. The results reported in Table 2 suggest that the open economy price equation performs better for all three data sets.

(Table 2, about here)

The ADF test for unit roots has been employed to detect the presence of unit roots. Table 3 reports results of unit root tests. All variables exhibit the presence of a unit root at the 10%, 5% and 1% levels. Inspection of the results for the first differences indicate that with the exception of the import price index for the monthly data, that all variables

are I(1) series at the 1%, 5% or 10% levels of significance. Further differencing shows import prices to be a I(2) series.

(Table 3, about here)

Having established the time series properties of the variables, cointegration tests have been carried out to examine the existence of a long run relationship between the variables. The cointegrating regression equations take the following form;

Annual data,

$$P_{t} = \beta_{0} + \beta_{1} M_{t} + \beta_{2} IMP_{t} + \beta_{3} ER_{t}$$
 (3)

quarterly data,

$$P_{t} = \delta_0 + \delta_1 GNP_{t} + \delta_2 IMP_{t} + \delta_3 ER_{t}$$
 (4)

monthly data,

$$P_{t=} \eta_0 + \eta_1 E R_t \tag{5}$$

(Table 4, about here)

The unit root tests for the residuals reported in Table 4 indicate the existence of a long run relationship between the variables. The existence of a long run relationship between the variables calls for the use of an error correction model to correct for the likely disequilibrium that could arise between the variables in the short run. Hendry's (1986) general to specific modeling method has been employed to model the short run adjustment associated with the cointegrating relationships. The results for the optimal error correction models are reported below where EC_{t-1} is the error correction term.

Annual data;

$$\Delta P_t = .004 + .56\Delta M_t - .12 \Delta IMP_t + .13 \Delta ER_t - 1.31 ECt$$
 (6)
(0.16) (3.99) (1.26) (0.86) (-5.30)

$$\chi^2_{sc} = 2.04$$
 $\chi^2_{ff} = .79$ $\chi^2_{n} = 2.86$ $\chi^2_{hs} = .00$

Quarterly data;

$$\Delta P_{t} = 0.02 - .78\Delta RGNP_{t-1} - .40 \Delta P_{t-2} + .05 \Delta ER_{t} - .11\Delta IMP_{t-} .52EC_{t}$$
(7)
(3.05) (-1.96) (4.39) (-0.39) (0.83) (-5.98)
$$\chi^{2}_{sc} = 5.96 \quad \chi^{2}_{ff} = 0.17 \quad \chi^{2}_{n} = 7.2 \quad \chi^{2}_{hs} = 1.09$$

Monthly data;

$$\Delta P_t = 0.01 + .41\Delta P_{t-1} - .24 \Delta P_{t-2} + .23 \Delta ER_t - .11\Delta ER_{t-1} - .14EC_t$$
 (8)
(2.68) (3.94) (-2.15) (0.65) (-0.33) (-2.38)
 $\chi^2_{sc} = 18.54 \quad \chi^2_{ff} = .79 \quad \chi^2_{n} = 10.30 \quad \chi^2_{hs} = 0.56$

The annual data indicates that money supply is important in affecting prices in the long run while the monthly data shows that the lagged rates of inflation are more important in affecting prices in the short run. The error correction terms in all three equations are significant implying that approximately the entire disequilibrium in price level is corrected by the end of the first year, and 13% by the end of each month. Except the χ^2 statistic for normality in equation (8), the χ^2 statistics for serial correlation, functional form, normality and heteroscedasticity are insignificant at the 5% level implying that the models are correctly specified.

For purposes of comparison, Johansen's(1988) technique has also been applied to the quarterly and monthly data. The lack of sufficient observations precludes the use of this method for the annual data. Table 5 displays the test statistics and the estimated cointegrating vectors from the Johansen procedure for the quarterly data. Panel 3 presents the estimated cointegrating vector. The coefficients in parenthesis are

normalized on the CCPI. The coefficients of real GNP, exchange rate and import price index have the expected sign and is of reasonable magnitude, providing evidence in support of a long run relationship between real GNP, exchange rates and import prices.

(Table 5, about here)

Table 6 presents the computed test statistics for the monthly data. The estimated coefficient exchange rate is correctly signed and is of reasonable magnitude. The results are therefore consistent with those obtained under the Engel Granger (1987) technique. The results point to the importance of supply side factors in price level movements in Sri Lanka.

(Table 6, about here)

4 Conclusions

This study suggests the importance of supply side factors as affecting the general level of prices in Sri Lanka. A long run relationship is found between the price level, real GNP, the exchange rate and import prices. With the opening up of the economy, import prices and exchange rate movements appear to have a significant impact on the general level of prices. Alexius (1997) studying the case of Sweden, finds that in a small open economy such as Sweden that the nominal exchange rate and import prices are central factors in influencing the level of prices. The effects of exchange rate movements on import prices appear to be influenced by country size according to Alexius. The country size argument could also perhaps be applied to Sri Lanka. The results are consistent with the studies of Nicholas (1990), Nicholas and Yatawara (1991), Weerasekera (1992), Rupananda

(1994) who also find supply side factors as important determinants of the general price level in Sri Lanka.

References

- Aigbokhan B E (1991) "The Naira Exchange Rate Depreciation and Domestic Inflation," *Indian Journal of Economics* 71(283), 507–517
- Alexius A (1997) "Import Prices and Nominal Exchange Rates in Sweden" *Finnish Economic Papers*, 10(2), 99-107
- Bomberger W A and Makinen G E (1979) "Some Further Tests of the Harberger Inflation Model Using Quarterly Data," *Economic Development and Cultural Change* 27(4), 629–644
- Central Bank of Sri Lanka Annual Report: Various Issues, Central Bank of Sri Lanka,
 Colombo
- Davidson R and MacKinnon J G (1993) Estimation and Inference in Econometrics,
 Oxford University Press, Oxford
- Diz A C (1970), "Money and Prices in Argentina 1935–1962," in Meiselman D, ed; Varieties of Monetary Experience, University of Chicago Press, Chicago
- Engle R F and Granger C W C (1987) "Co-integration and Error Correction:

 Representation, Estimation and Testing," *Econometrica* 55(2), 251–276
- Gali J and Monacelli T (2005) "Monetary Policy and Exchange Rate Volatility in a Small Open Economy" *Review of Economic Studies*, 72 (3) 707-34
- Harberger A C (1963) "The Dynamics of Inflation in Chile," in: Christ C et al eds.,

 Measurement in Economics: Studies in Mathematical Economics and Econometrics
 in Memory of Yehuda Grunfeld, Stanford University Press, CA
- International Monetary Fund *International Financial Statistics*, IMF, Washington D.C Johansen S (1988) "Statistical Analysis of Cointegration Vectors," *Journal of*

- Economic Dynamics and Control 12(2/3), 231–254
- Johansen S and Juselius K (1990) "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money" *Oxford Bulletin of Economics and Statistics* 52(2), 169–210
- Lowinger T C (1978) "Domestic Inflation and Exchange Rate Changes: The Less-Developed Countries' Case," *Weltwirtschaftliches Archiv* 114(1), 85–99
- Masih A M and Masih R (1998) "Does Money Cause Prices, or the Other Way Around? Multi-country Econometric Evidence Including Error-Correction Modelling from South-East Asia" *Journal of Economic Studies*, 25 (2-3) 138-60
- Moser G G (1995) "The Main Determinants of Inflation in Nigeria," *IMF Staff Papers* 42(2), 270–289
- Nicholas H V B (1990) "Inflation in Sri Lanka 1971–87: A Preliminary Study," *Macroeconomic Series* No.3, Institute of Policy Studies, Colombo
- Nicholas H V B and Yatawara R A (1991) "Inflation in Sri Lanka in 1990" *Institute of Policy Studies Working Paper* No.2, Institute of Policy Studies, Colombo
- Nugent J B and Glezakos C (1979) "A Model of Inflation and Expectations in Latin America," *Journal of Development Economics* 6(3), 431–446
- Otani I (1975) "Inflation in an Open Economy: A Case Study of the Philippines," *IMF*Staff Papers 22(3), 750–774
- Rao B B, Fahimuddin and Bajpai D K (1997) "The Relationship Between the Price Level, Money and Output in India," Unpublished Manuscript
- Rupananda W (1994) "Econometric Model for Inflation in Sri Lanka," *Economic Review* Sri Lanka 20(7), 25–28, Colombo, Sri Lanka

- Saini K G (1982) "The Monetarist Explanation of Inflation: The Experience of six Asian Countries," *World Development* 10(10), 871–884
- Saini K G (1984) "Can Monetary Growth Explain Inflation in India," *Indian Economic Journal* 32(1), 61–71
- Sheehey E J (1979) "On the Measurement of Imported Inflation in Developing Countries," *Weltwirtschaftliches Archiv* 115(1), 68–79
- Vogel R (1974) "The Dynamics of Inflation in Latin America 1950–1969," *American Economic Review* 64(1), 102–114
- Weeresekera (1992) "Inflation in Sri Lanka: A Causality Analysis," *South East Asian Central Banks Centre Staff Paper* No.46, South East Asian Central Banks Research and Training Centre, Kuala Lumpur

TABLE 1: FACTORS INFLUENCING THE RATE OF INFLATION IN SRI LANKA

Data Frequency	Dependent	constant			Independ	ent Variab	les		\mathbb{R}^2	Diagnostic Tests
	Variable									
Closed Economy			M _t	M _{t-1}	P _{t-1}	GNP _t	IMP _t	ER _t		
Model										
Annual	P _t	6.82	0.65		0.49	-0.90			.996	χ^2_{sc} =0.11 χ^2_{ff} =0.08
		(2.8)	(3.7)		(2.1)	(-2.5)				$\chi^2_{n}=1.12 \chi^2_{hc}=0.47$
Quarterly	P_t	-0.13	0.15		0.95				.998	χ^2_{sc} =16.3 χ^2_{ff} =0.32
		(-0.5)	(1.2)		(15.6)					χ^2_{n} =0.84 χ^2_{hc} =4.5
Monthly	P_t	0.18		0.17	0.87				.993	χ^2_{sc} =30.1 χ^2_{ff} =0.18
		(0.20)		(3.1)	(18.9)					χ^2_{n} =0.32 χ^2_{hc} =5.2
Open Economy										
Model										
Annual	P _t	-0.32	0.46				0.20	0.30	.987	$\chi^2_{\text{sc}}=1.47 \; \chi^2_{\text{ff}}=0.24$
		(-1.16)	(6.7)				(2.8)	(1.9)		$\chi^2_{n}=1.40 \chi^2_{hc}=2.58$
Quarterly	P_t	-1.99			0.60	0.29	0.23	0.19	.997	χ^2_{sc} =14.8 χ^2_{ff} =1.40
		(-2.2)			(6.0)	(2.6)	(4.3)	(2.4)		$\chi^2_{n}=2.85 \chi^2_{hc}=4.16$
Monthly	P_t	0.11			0.78		0.14	0.27	.994	χ^2_{sc} =419 χ^2_{ff} =0.01
		(1.4)			(11.7)		(2.5)	(2.8)		$\chi^2_{n}=0.16 \chi^2_{hc}=4.7$

 χ^2_{sc} =lagrange multiplier test of residual serial correlation; χ^2_{ff} =Ramsy's RESET test using the square of the fitted values; χ^2_{n} =test of skewness and kurtosis of residuals; χ^2_{hc} = based on the regression of squared residuals on squared fitted values

TABLE 2: NON NESTED HYPOTHESIS TESTS

Annual Data

Regressors for model M1: Constant M_t P_{t-1} RGNP_t

Regressors for model M2: Constant M_t IMP_t ER_t

 Test Statistic
 M1 against M2
 M2 against M1

 J-Test
 2.96(.002)
 0.716(.470)

 JA-Test
 2.95(.003)
 0.584(.540)

Quarterly Data

Regressors for model M1: Constant M_t P_{t-1}

Regressors for model M2: Constant P_{t-1} RGNP_t IMP_t ER_t

 Test Statistic
 M1 against M2
 M2 against M1

 J-Test
 4.67(.000)
 0.072(.955)

 JA-Test
 0.76(.435)
 0.071(.943)

Monthly Data

Regressors for model M1: Constant M_{t-1} P_{t-1}

Regressors for model M2: Constant P_{t-1} IMP_t ER_t

 Test Statistic
 M1 against M2
 M2 against M1

 J-Test
 2.18(.031)
 0.828(.408)

 JA-Test
 2.15(.031)
 0.826(.407)

TABLE 3: UNIT ROOT TESTS FOR THE SERIES

Data Frequency	Variable	k*	τ α1	Variable	k	τ α1
Annual	P1 _t	0	-2.30	ΔP1 _t	0	-3.44**
	M_{t}	2	-2.41	ΔM_{t}	0	-2.63*
	IMP_t	0	-1.42	ΔIMP_t	0	-3.16**
	ER_t	0	-2.25	ΔER_t	0	-5.57***
Quarterly Data	$P1_t$	2	-2.71	$\Delta P1_t$	1	-4.67***
	GNP_t	3	-2.21	$RGNP_t$	4	-2.78*
	IMP_t	1	-2.72	$\Delta IMP_t \\$	0	-3.01**
	ER_t	0	-2.14	ΔER_t	0	-8.80***
Monthly	$P1_t$	2	-3.16	$\Delta P1_t$	1	-7.48***
	IMP_t	1	-2.72	ΔIMP_t	1	-2.34
	ER_t	1	-2.17	ΔER_t	0	-6.41***

Note: significance levels: 1%, -4.07: 5%, -3.46: 10%, -3.16

Significance levels first differences: 1%, -3.51 : 5%, -2.90 : 10% -2.58 (Davidson and MacKinnon)

k* refers to the order of the autoregression used to calculate the ADF statistic

TABLE 4: TESTS FOR COINTEGRATION

7
5
)
3

Significance levels: 1%, -4.29 : 5%, -3.74 : 10%, -3.45 (Davidson and MacKinnon)

TABLE 5: COINTEGRATION TESTS FOR QUARTERLY DATA

A. Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

List of Variables included in the cointegrating vector:

$P_t \quad GNP_t \quad ER_t \quad IMP_t \quad Intercept$

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	
r = 0	r = 1	39.5098	28.2700	25.8000	
r <= 1	r = 2	17.2370	22.0400	19.8600	
r <= 1	r = 3	9.6131	15.8700	13.8100	
r <= 3	r = 4	7.1321	9.1600	7.5300	

B. Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	
r = 0	r = 1	73.4919	53.4800	49.9500	
r <= 1	r = 2	33.9821	34.8700	31.9300	
r <= 1	r = 3	16.7451	20.1800	17.8800	
r <= 3	r = 4	7.1321	9.1600	7.5300	

C Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)

List of Variables included in the cointegrating vector: P_t GNP_t ER_t IMP_t Intercept

Vector	P _t	GNP_t	ER_t	IMP_t	Intercept	_
1	-1.5039	37097	.74569	1.2958	6.6821	_
	(-1.0000)	(24668)	(.49585)	(.86167)	(4.4433)	

TABLE 6: COINTEGRATION TESTS FOR MONTHLY DATA

A. Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

List of Variables included in the cointegrating vector:

P_t	ER_t	Intercept
- ı		

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	
r = 0	r = 1	49.4800	15.8700	13.8100	
r <= 1	r = 2	10.5755	9.1600	7.5300	

B. Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	
r = 0	r = 1	60.0555	20.1800	17.8800	
r <= 1	r = 2	10.5755	9.1600	7.5300	

C Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)

List of Variables included in the cointegrating vector: P_t ER_t Intercept

Vector	P_t	ER_t	Intercept	
1	.40387	66173	26606	
	(-1.0000)	(1.6385)	(.65877)	
2	2.8906	-5.1597	-1.0680	
	(-1.0000)	(1.7850)	(.36947)	