Master's thesis

Econometric analysis of competing theories of inflation in Sri Lanka— Money supply or exchange rate?

by

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Abstract

Sri Lanka underwent a severe balance-of-payments crisis coupled with high inflation in 2022, brought about by high foreign debt, poor trade balance, and multiple quarters of slow growth following COVID and other shocks. Historically, two prominent schools of thought in economics have explained inflation through radically different mechanisms—the monetarists believe that high inflation is always caused by excessive money supply; the post-Keynesians instead blame distributional conflicts and currency devaluation in open economies. While the Sri Lankan crisis was well-documented, causal analyses of the inflation are lacking. Further, most of the discourse is centred around the monetarist view, blaming fiscal deficit spending as the trigger of inflation. In general, literature on alternative theories of inflation is sparse in the case of South Asian countries. The present study developed two competing models to explain the 2022 inflation in Sri Lanka based on quantitative data and qualitative secondary sources — a monetarist model with money supply expansion as the cause and a post-Keynesian conflicting claims model with exchange rate fluctuation as the cause. A first econometric evaluation was conducted using autoregressive distributed lag time-series models. The econometric analysis was limited by constraints on the availability and nature of the data, and strategies are proposed to overcome these limitations in future work. In conclusion, this thesis proposes empirically founded competing models of inflation rooted in the political economy context of Sri Lanka and provides the first steps towards an econometric evaluation of the models.

Dedicated to my mother, who I hope is inspired to continue breaking barriers

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Table of contents

List of tables

List of figures

1. Introduction

The small and usually obscure island country of Sri Lanka made international headlines in 2022 as it went through its worst economic crisis in decades. Crippled by high foreign debt and faced with a dwindling trade balance and slowing growth amid multiple shocks including COVID, Sri Lanka essentially ran out of money to import essential goods and fund basic services. For its 22 million inhabitants, the crisis manifested in the form of high inflation, which peaked in September when the year-over-year inflation touched 70%, fuelling violent protests that plunged the country into political chaos (Central Bank of Sri Lanka, 2022a; Mashal, 2022).

Historically, two prominent schools of thought in economics have explained inflation through radically different mechanisms—monetarists believes that high inflation is always the result of excessive money supply; post-Keynesians believe that inflation is the result of distributional conflict compounded by currency devaluation in an open economy. Since the 1970s, the monetarist school has been dominant in academics and policy discourses (Vernengo, 2007).

Unsurprisingly, in the case of the Sri Lankan crisis, most of the public discourse has centred around the monetarist logic, with fiscal deficit spending by the government being blamed as the primary cause of inflation (De Silva et al., 2022; Mashal, 2022). Adhering to the same line of thought, the Central Bank explicitly geared its interest rate policy in 2022 with the aim of reducing the money in circulation to control inflation (Central Bank of Sri Lanka, 2022b).

While a rich body of literature on post-Keynesian theories of inflation exists in certain contexts such, as that of Latin American economies (Câmara & Vernengo, 2000), there are relatively few studies on South Asian countries from this perspective. Given the lack of discussion on competing explanations of inflation in the context of the Sri Lanka experience, it becomes important to evaluate the crisis from multiple theoretical viewpoints to foster a pluralist understanding of the Sri Lankan economy in particular and South Asian economies in general.

Further, while the events of the crisis are well documented (Asian Development Bank, 2023), no causal analysis of the inflation has been published till date to my knowledge. This study aims to fill this gap by (i) proposing distinct models of inflation based on competing theories and empirically rooted in the political economy of Sri Lanka and (ii) evaluating the models through econometric analysis. In the wider South Asian context, the recent political crises in Pakistan, Bangladesh, and Afghanistan have made it crucial and timely to analyze debt and inflation in this part of the world, which is at high risk of financial fragility (World Bank, 2023).

Specifically, this study aims to answer the following research question: **Did money supply expansion or exchange rate variation cause high inflation in Sri Lanka during 2022?** To answer this, two competing models of inflation are first formulated based on data analysis of multiple financial and macroeconomic indicators. Then, the models are evaluated using time-series econometrics. For the time-series analysis, the study employed the *autoregressive distributed lag* models, which are frequently used in inflation studies as they can handle the challenges posed by the specific nature of monetary time series data (Charles & Marie, 2020).

The rest of the thesis is organized as follows: Chapter 2 outlines the theoretical background on the two theories of inflation and provides a brief literature survey; Chapter 3 develops the two models for Sri Lanka based on quantitative analysis aided by secondary sources; Chapter 4 explains the econometric strategy and results; and Chapter 5 provides concluding remarks.

2. Theoretical background and literature review

Historically, two major schools of thought in economics have explained inflation in radically different ways: the monetarist school believes that the root of inflation is always in excessive money supply, while the post-Keynesians believe that distributional conflict compounded by exchange rate depreciation leads to inflation. This chapter presents an overview of the two competing theories and a brief literature review of empirical studies based on them.

2.1. Monetarist inflation theory

The monetarists follow in the line of Milton Friedman, according to whom 'every major inflation has been produced by monetary expansion' (Friedman, 1968: pp. 12). The quantity theory of money (QTM), which broadly encapsulates the idea that prices are influenced by the amount of money in circulation (at least in the short run), go back to sixteenth-century attempts to explain price revolutions and inflations by classical economists such as David Ricardo. QTM-based theories emphasize *demand-pull inflation*, i.e., rising demand due to monetary expansion puts pressure on prices (Vernengo, 2007).

In macroeconomic terms, demand-pull inflation may be explained through the aggregate market equilibrium (Fig. 2.1). As the money supply increases, whether through credit expansion or fiscal deficit spending by governments or some other mechanism, the aggregate demand curve shifts to the right. As the short-run aggregate supply curve is upward sloping, this leads to a new market equilibrium with higher prices than in the previous equilibrium.

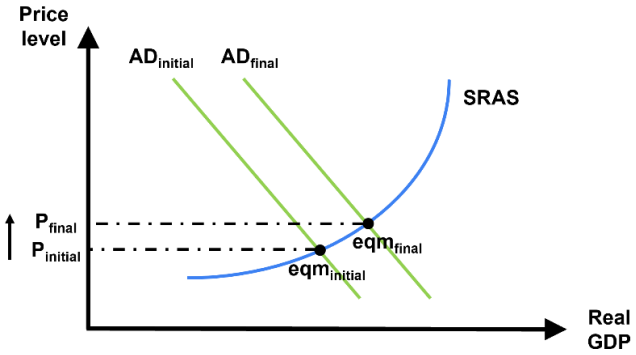

Fig. 2.1. Monetarist explanation of inflation using aggregate demand–supply equilibrium. AD: aggregate demand, SRAS: short-run aggregate supply, P: price level, eqm: equilibrium.

Own illustration.

Importantly, in the QTM, money supply is *exogenous*; therefore, it can be controlled through monetary policy. While exchange rate fluctuations play into monetarist explanations of inflation and hyperinflation, they are the *effect* rather than cause of inflation. For example, monetarist explanations of the hyperinflation in the Weimar Republic identify central bank-funded government expenditure towards war reparations and reconstruction efforts as the primary cause of hyperinflation. Moreover, the deprecation of the mark is explained as the effect and not the cause of domestic price rises. Thus, the chain of causality is as follows (ibid.):

Fiscal deficit spending → Monetary expansion → Hyperinflation→ Currency depreciation

Further, monetarist theory relies on *future expectations* of inflation by agents, i.e., actors in an economy expect price rises even before they happen, causing them to raise prices, resulting in a self-fulfilling prophecy of inflation (ibid.).

2.1.1. The Cagan model

The Cagan model was proposed by Chicago economist Phillip Cagan in 1956 to explain hyperinflation. In monetarist terms, 'hyperinflation' is defined simply as a situation in which monthly inflation exceeds 50%. It is thus not different from regular inflation in any structural sense. Although monthly inflation in Sri Lanka during the period under consideration was only around 10% per month at its peak, the same concepts may be used (Edmond, 2017).

Unlike in previous formulations of monetarist inflation theory, Cagan did not assume that the velocity of money in circulation in the economy is constant. Instead, he assumed that the velocity of money follows a power law in the nominal interest rate because the opportunity cost of holding onto money increases with increase in the nominal interest rate:

$$v \propto i^{\alpha} \qquad \text{Eq. 2.1.}$$

$$\Longrightarrow \log(v) \propto \alpha i, \qquad \text{Eq. 2.2.}$$

where v is the velocity of money, i is the nominal interest rate, and $\alpha > 0$ is a constant.

Using the exchange equation of money,

$$mv = py, \qquad \text{Eq. 2.3.}$$

where m is the money supply, p is the general level of prices, and y is the real GDP, we can write by log-transforming both sides:

$$\log(m) + \log(v) = \log(p) + \log(y) \qquad \text{Eq. 2.4.}$$

Using Eq. 2.2, we get,

$$\log(m) + \alpha i = \log(p) + \log(y) \qquad \text{Eq. 2.5.}$$

Cagan incorporated inflation expectations in his model by using the *Fischer identity* that connects the real interest rate r_t to the nominal interest i_t as follows:

$$i_t = r_t + \pi_t^e \qquad \text{Eq. 2.6.}$$

Here, the subscript t denotes values at time t.

Combining Eqs. 2.5 and 2.6, we can write:

$$\log(m_t) - \log(p_t) = y_t - \alpha r_t - \alpha \pi_t^e \qquad \text{Eq. 2.7.}$$

During hyperinflationary periods, Cagan assumed that the real variables y_t and r_t change much more slowly than the nominal variables. Using these assumptions, simplifying Eq. 2.7 yields the following:

$$\log(m_t) - \log(p_t) = -\alpha \pi_t^e \qquad \text{Eq. 2.8.}$$

Finally, Cagan assumed *adaptive expectations*, i.e., expected inflation is a weighted sum of current inflation ($p_t - p_{t-1}$) and past inflation expectations:

$$\pi_t^e = \lambda\pi_{t-1}^e + (1-\lambda)(\log(p_t) - \log(p_{t-1})), \qquad \text{Eq. 2.9.}$$

where $0 < \lambda < 1$.

Solving Eqs. 2.8 and 2.9 yields an equation of the following form:

$$\log(p_t) = \beta_1 \log(p_{t-1}) + \beta_2 \log(m_t) + \beta_3 \log(m_{t-1}), \qquad \text{Eq. 2.10.}$$

where $\beta_1 = \frac{\lambda - \alpha(1-\lambda)}{1-\alpha(1-\lambda)}$, $\beta_2 = \frac{1}{1-\alpha(1-\lambda)}$, and $\beta_3 = -\frac{\lambda}{1-\alpha(1-\lambda)}$.

Thus, according to the Cagan model, the general level of prices in an economy are *linear in the first lag of itself and of money supply*, i.e., price levels at a given time are influenced by (i) the price levels in the previous time period, (ii) the money supply in the current time period, and (iii) the money supply in the previous time period (Edmond, 2017).

2.2. Post-Keynesian inflation theory

In contrast to monetarists, post-Keynesian believe that money supply is *endogenous*, i.e., money is an outcome of economic processes and cannot be controlled exogenously by monetary authorities. If economic activities expand, money supply follows and not the other way round. Thus, when explaining inflation, post-Keynesians treat money supply as the outcome and not the cause of price increases (Lavoie, 2022: Chapter 8).

Instead of money supply, post-Keynesian theory identifies *distributional conflict* between different groups in society as the driver of inflation. The two groups—workers and capitalists (firm owners)—each fight over a bigger share of the economy's total income. In monetarist theory, such conflicts equilibrate through market forces; in post-Keynesian theory, the profit and wage shares of income are determined by institutional factors with market forces playing only 'frictional' roles (ibid.: 599). Depending on workers' bargaining power and firms' market power, the two groups strive to increase wages and prices, respectively. This leads to what is called the *wage–price spiral*, which explains rising prices. Therefore, *prices and wages are the exogenous factors* in post-Keynesian theory.

Most post-Keynesian inflation theories propose a *cost-push* explanation of inflation by focusing on distributional conflict. Thus, post-Keynesian theories assume a demand-constrained rather than supply-constrained view of the economy, in contrast to demand-pull monetarist theories (Vernengo, 2003).

In an open economy, post-Keynesian theories further emphasize the role of currency exchange rates as a proximal cause of inflation. A depreciation of the local currency makes imports more expensive, which puts further pressure on actors in the domestic economy, exacerbating the wage–price spiral and contributing to inflation. As money supply is endogenous, monetary policy cannot control the exchange rate in the long run. Instead, the real exchange rate is determined by factors such as trade deficits (ibid.).

The role of exchange rates was explored extensively in analyses of the Weimar hyperinflation that presented an alternative to the conventional quantity theory explanation. This came to be known as the *balance-of-payments theory* and was championed by Joan Robinson. According to the balance-of-payments school, the causality of hyperinflation is as follows (ibid.):

Trade deficit → Currency depreciation → Hyperinflation → Monetary expansion

Thus, the chain of causality between currency depreciation, hyperinflation, and monetary expansion is reversed as compared to that in the monetarist explanation.

2.2.1. The conflicting-claims model

The cost-push interpretation of inflation is formalized by the following identity, known as the *wage–cost markup* equation:

$$p = \kappa \frac{w}{y}, \qquad \text{Eq. 2.11.}$$

where p is the general level of prices, κ is a constant, w is average (nominal) wage per worker, and y is the real output per worker, i.e., unit labour productivity. This identity is the counterpart of the monetarist exchange identity ($mv = py$) and is similarly accepted as an identity or a statement that is always true; it is not a statement of causality between the different variables.

Taking the first difference of Eq. 2.11, we get the following[1]:

$$\Delta p = \Delta\kappa + \Delta w - \Delta y \qquad \text{Eq. 2.12.}$$

Keynes believed that in the long run, the rise in prices is determined only by ($\Delta w - \Delta y$) because κ, which represents the rise in the profit share of income, cannot increase or decrease indefinitely. Thus, post-Keynesian theories posit changes in wages over and above that in labour productivity to be the proximate cause of inflation (Lavoie, 2022: Chapter 7).

The model presented here is adopted from Lavoie (ibid.) and is based on the ideas of Kalecki and Rowthorn (Kalecki, 1971: Chapter 14; Rowthorn, 1977). In this model, inflation is the result of conflict between two groups of actors in the economy: trade unions, who want to negotiate increases in nominal wages to keep up with increasing prices, and firms, who want to raise prices to achieve a higher profit share of income. We formalize the markup targets in terms of the *wage rate* ω, which is defined as follows:

$$\omega = \frac{w}{p}, \qquad \text{Eq. 2.13.}$$

where w is the average nominal wage per worker in the economy, and p represents the general level of prices.

Let us first consider a closed economy and look at the firms' side of the bargaining process. Let the target wage rate of firms be ω_f. It is assumed that the rate of price increases desired by firms depend on the discrepancy between their desired target ω_f and the actual wage rate in

[1] Δ represents the first difference of the variable everywhere.

the previous period, ω_{-1}. Thus, in its simplest form the growth rate of prices is given by the following markup equation:

$$\Delta p = \Psi_1(\omega_{-1} - \omega_f), \quad \text{Eq. 2.14.}$$

where the constant Ψ_1 represents how well firms are able to achieve their target wage rate in reality. Ψ_1 is indicative of the market power of firms in an economy.

Similarly, the complementary equation for wage bargaining is given as follows:

$$\Delta w = \Omega_1(\omega_w - \omega_{-1}), \quad \text{Eq. 2.15.}$$

where $\omega_w$is the target wage rate of workers, and the constant $\Omega_1$is indicative of the bargaining power of workers in the economy.

Conflicting-claims model in the open economy

In an open economy, the real exchange rate is directly related to the price of imports, both finished products and raw materials. As the currency devalues, imports become more expensive. Hence, it is assumed that with an increase in the exchange rate, firms target a lower wage rate. Let the closed-economy firm target wage rate be ω_{f0}. Then, the open-economy firm target wage rate becomes

$$\omega_f = \omega_{f0} - \Psi_2 e_R, \quad \text{Eq. 2.16.}$$

where e_R is the exchange rate, and the constant Ψ_2 represents the pass-through rate of exchange rate fluctuations onto domestic prices.

Modifying Eq. 2.14, the final price inflation equation is as follows:

$$\Delta p = \Psi_1(\omega_{-1} - \omega_{f0} + \Psi_2 e_R) \quad \text{Eq. 2.17.}$$

A note on typology and future expectations

Note that the conflicting-claims model does not assume that agents' anticipation of future prices plays any role in the process. In fact, in post-Keynesian structuralist typology, 'hyperinflation' is specifically defined as a situation in which agents start indexing on future price expectations and not current prices (Charles et al., 2021). Thus, unlike monetarist theory, post-Keynesian theories distinguish hyperinflation as a qualitatively different phenomenon from high inflation. However, the analysis of the Sri Lankan economy in this work is limited to the high-inflation case; hence, future expectations are not factored in.

Table 2.1 summarizes the major conceptual differences between the Cagan model and conflicting-claims model of inflation in an open economy.

Table 2.1. Comparison of competing models of inflation.

Cagan model	Conflicting-claims model
1. Money supply expansion as proximate cause of price increases.	1. Wage–price spiral as proximate cause of price increases.
2. Money supply exogenous; wage–price structure endogenous.	2. Money supply endogenous; wage–price structure exogenous and historically given.
3. Market forces equilibrate distributional conflicts.	3. Distributional conflicts drive price changes and generation of (endogenous) money.
4. Prices indexed on future price expectations.	4. Future expectations play no role.
5. Hyperinflation: $> 50\%$ monthly inflation; structurally same as regular inflation.	5. Hyperinflation: indexing on future expectations; structurally different from regular inflation.
6. Chain of causality (open economy): Monetary expansion → Inflation → Currency depreciation.	6. Chain of causality (open economy): Currency depreciation → Inflation → Monetary expansion.
7. Supply-constrained economy.	7. Demand-constrained economy.

2.3. Literature review

The monetarist view of inflation has been dominant in economic literature since the 1970s. In the last three decades, a large number of empirical studies have been conducted based on the monetarist hypothesis in a variety of contexts. Regarding hyperinflation, the transition period in post-Soviet economies provide interesting case studies. For example, Petrović et al. (1999) conclude that monetary expansion was the cause of inflation using Granger causality tests. For recent inflation, Živkov et al. (2020) suggest that money supply expansion has little effect on inflation in Eastern European countries using Bayesian methods. Further, Asandului et al. (2021) conclude that fiscal policy expansion has an inflationary effect in post-Communist European countries using nonlinear autoregressive distributed lag (ARDL) models.

In the case of Greece, Karfakis (2002) suggests that there is a causal relationship between money supply and inflation using ARDL models with cointegration approaches. Using panel data on 160 countries, De Grauwe and Polan (2005) conclude that there is evidence for the causal link between money supply and price levels. For developing countries, Ojede (2015) provides evidence of money growth as the cause of inflation using data from 54 countries.

Relatively few empirical studies exist on the balance-of-payments school focusing on exchange rates as determinants of inflation as compared to the large number of monetarist studies of high inflation. A prominent body of literature based on the closely related structuralist and neo-structuralist schools have analysed hyperinflation in Latin American economies during the 1970s as being primarily the result of high foreign debt (Câmara & Vernengo, 2000). For example, Pastor (1991) conclude that the parallel exchange rate was a significant determinant of inflation in Bolivia during 1982–1985.

Burdekin & Burkett (1996) revisit the roots of the debate by analysing the role of currency depreciation in the German hyperinflation. They conclude using econometric models that currency depreciation had a strong role to play. For post-Soviet transition economies, Charles and Marie (2020) provide evidence that exchange rates, and not money supply expansion, played the causal role in driving the Bulgarian hyperinflation of 1977.

In the case of developing countries, Maswana (2005) finds evidence supporting the causal links of both exchange rates and money supply to inflation in the Democratic Republic of Congo. Further, Jalil et al. (2014) find that exchange rates play a significant role in determining inflation using data from Pakistan.

2.3.1. Studies of inflation in Sri Lanka

Relatively few studies exist on Sri Lanka's monetary dynamics. Among these, empirical studies of inflation have mainly focused on the period until the 2008 financial crisis. For example, Bandara (2011) conclude that both money supply and exchange rates were significant in determining inflation during the period of 1993 to 2008 using vector autoregression (VAR) models with Granger causality tests. Kulatunge (2017) also finds both exchange rates and domestic money supply to significantly influence inflation during 2000 to 2013.

For the post-liberalization period of 1978–1992, Weerasekara (1992) concludes that money supply was the most important determinant of inflation and also the cause for exchange rate changes. Duma (2008) finds a partial pass-through effect of exchange rate on inflation for the period of 2003–2007, thus attributing inflation mainly to domestic factors. Post-2008, Shifaniya et al. (2022) conclude the existence of a unidirectional causation from government spending to inflation for the period of 1977 to 2019.

In the context of Sri Lanka, as for other regions, most empirical studies on inflation focus on money supply as the causal factor, reporting mixed results on the causal role and importance of the real exchange rate. Some interesting recent studies challenging the monetarist perspective include Thenuwara and Morgan (2017), who empirically evaluate the question of endogeneity of money in the case of Sri Lanka, and Pathirana & Aluthge (2020), who present a Marxist critique to monetarist theories of inflation.

However, systemic quantitative evaluations of monetarist versus post-Keynesian explanations of inflation are lacking. Further, while the high-inflation episode of 2022 has been well-documented (ADB, 2023), the discourse has focused primarily on budget deficits (De Silva et al., 2022; Mashal, 2022). Little to no discussion has considered the possibility of exchange rate fluctuation as the primary causal mechanism even though the country went through drastic exchange rate policy shifts during the period. Moreover, as of writing, no causal analysis of the crisis has been published to the best of my knowledge. Thus, this study aims to close this gap in the literature and provide a pluralist understanding of potential causes of inflation in the context of the Sri Lanka's little-studied economy.

3. Data analysis and model specification

Sri Lanka's financial crisis was the result of multiple factors and shocks accumulating over many years. This chapter first provides a brief economic history of the country since independence and places the current crisis in this historical context. Next, it presents the exploratory data analysis and formulation of the two competing models of inflation—monetarist and post-Keynesian—in the case of the Sri Lankan crisis.

3.1. Context: The Sri Lankan economy

Sri Lanka is an island nation located in the Indian Ocean just off the southern coast of India. With approximately 22 million inhabitants, it hosts the second smallest population of all South Asian countries after Bhutan. Despite its relatively small size, Sri Lanka has almost consistently enjoyed higher per capita incomes and human welfare indicators compared to its South Asian neighbours since its independence in 1948 (Athukorala & Jayasuriya, 2013).

Until the 1970s, Sri Lanka's economic landscape was dominated by heavily inward-facing import-substitution-industrialization policies, a large public sector, and large social welfare programmes that persisted despite slowing growth. However, systemic oppression of the minority Tamil community and frustration with stagnating employment opportunities spawned many radical political movements, culminating in a violent civil war in the 1990s that lasted till 2009 (ibid.; Abeyratne, 2004).

From the middle of the 1990s, successive governments adopted policies moving the country away from protectionism to liberalization, trade openness, and privatization as it maintained an impressive growth record even through the war years and 2008 financial crisis, averaging at over 5% during the entire period. This was largely driven by the growth in the export-oriented manufacturing sector (Athukorala & Jayasuriya, 2013: 11–12).

President Mahinda Rajapaksa was elected in a decisive election victory in 2005. In the decades since, the Rajapaksa family and those close to them have progressively taken control of the country's governance bodies and businesses, turning Sri Lanka into a virtually one-family administration. Following the end of the war in 2009, the government reversed the liberalization trend through various measures such as high non-tariff duties and import taxes and aggressively promoted state-owned enterprises. This was coupled with a stated exchange rate policy of maintaining the 'dollar value of the rupee' (ibid.: 20).

Since 2010, the public economics of Sri Lanka has been characterized by large public infrastructure projects funded through massive foreign debt. Further, growth in export sectors has been mostly stagnant. The resulting decline in trade balance and increasing debt-to-GDP ratio set the stage for the ensuing currency and balance-of-payments crises, as discussed in the rest of this chapter (ibid.; De Silva et al., 2022).

3.1.1. Timeline of the crisis

In the decade and half since the election of Mahinda Rajapaksa, Sri Lanka's economy accumulated many systemic fragilities that came to head with the COVID-led shock of 2019–2020. First, commentators have focused on the steady rise in the country's external public debt. Figure 3.1 shows the country's national debt-to-GDP ratio over the decade preceding the 2022 financial crisis. Between 2012 and 2022, the debt-to-GDP ratio nearly doubled to more than 115% of the GDP. While such high rates of debt are common in developed economies, they can be unsustainable for developing countries. For comparison, neighbouring Bangladesh's debt-to-GDP ratio stands at around 40% (International Monetary Fund (IMF), 2024). The resulting credit repayments may have put pressure on Sri Lanka's monetary system through multiple mechanisms.

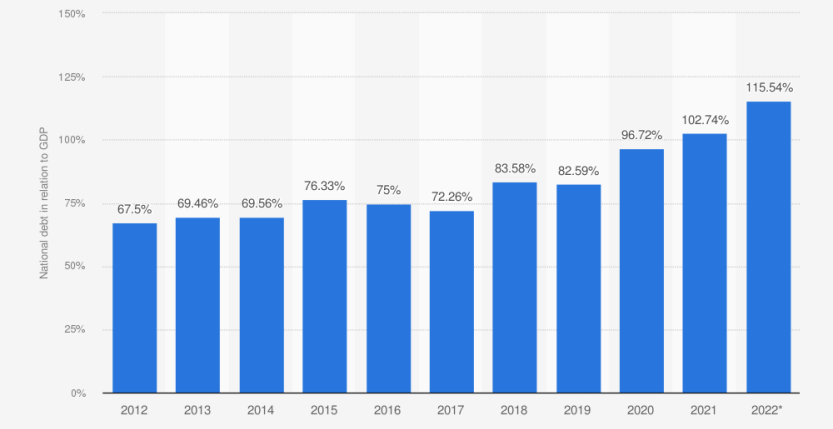

Fig. 3.1. Sri Lanka's national debt-to-GDP ratio over 10 years.

Data: International Monetary Fund. Visualization: Statista. © Statista 2024.

In 2019, Sri Lanka's economy faced major shocks, first with the Easter Sunday church bombings in Colombo and then the COVID pandemic, both of which greatly affected the tourism sector, which accounts for a significant portion of the country's revenues. Further, a temporary ban on the import and use of chemical fertilisers, effective between April and October 2021, may have had long-term effects by sharply reducing agricultural productivity and hitting tea and rubber exports (De Silva et al., 2022; Mashal, 2022).

Table 3.1. provides the sector-wise breakdown of GDP growth between 2019 and 2022. While the overall economy showed a recovery in 2021, the agricultural sector recorded negligible growth, which may have contributed to inflationary pressures. In February 2022, the recouping but fragile economy was once again hit by the global effect of the start of the war in Ukraine. As the country spiralled into a multifaceted economic and political crisis from the first quarter of 2022, consumption and investments took a sharp hit, with the GDP contracting by 7.8% by the end of the year (Asian Development Bank (ADB), 2023).

Table 3.2 summarizes the demand-side contributors to GDP growth between 2019 and 2022.

Table 3.1. Sectoral contributions to GDP growth.

	2019	2020	2021	2022
GDP growth rate (%)	−0.22	−4.62	3.51	−7.82
Sectoral growth rate (%)				
Agriculture	0.45	−0.89	0.94	−4.57
Industry	2.92	−1.92	3.45	−2.01
Services	−4.09	−5.32	5.73	−15.95

Data: Central Bank of Sri Lanka (CBSL).

Table 3.2. Demand-side contributions to GDP growth.

	2019	2020	2021	2022
GDP growth rate (%)	−0.23	−4.43	3.51	−7.82
Growth rate (%)				
Consumption	3.82	−5.76	2.64	−9.00
Government expenditure	6.56	0.01	−2.81	1.39
Investment	−12.07	0.16	4.47	−24.90
Net exports	18.85	−15.35	−9.27	101.14

Data: CBSL.

The negative net exports growth in 2020 and 2021 reflect the declining trade balance in these years as Sri Lanka's exports were hit due to the various factors described previously. Figure 3.2 shows the sharp reduction in current account balance between 2020 and the end of 2021, just before the start of the inflationary peak. The declining trade balance contributed to the drain on foreign currency reserves, which compounded the inflation crisis.

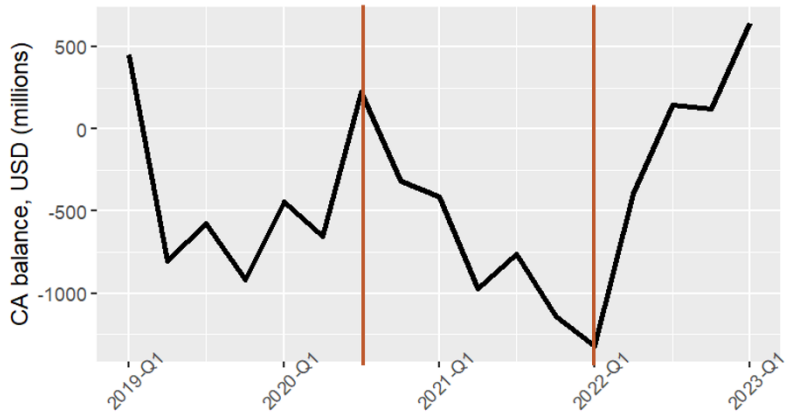

Fig. 3.2. Sri Lanka's current account balance between 2019 and 2023. The red bars demarcate period of high contraction resulting from multiple shocks.

Data: CBSL.

Inflationary pressures began to be felt from the last quarter of 2021. Figure 3.3 shows the monthly percentage national consumer price index (NCPI) inflation. Monthly inflation surged to 3.7% in December 2021 but receded to 1.1% in February 2022. Presumably following the shock from the Ukraine war, inflation began to mount again in March, exceeding 10% in June. The inflation rate stayed close to 10% for the next three months before beginning to decline from April. The peak year-over-year inflation was recorded in September at over 70%.

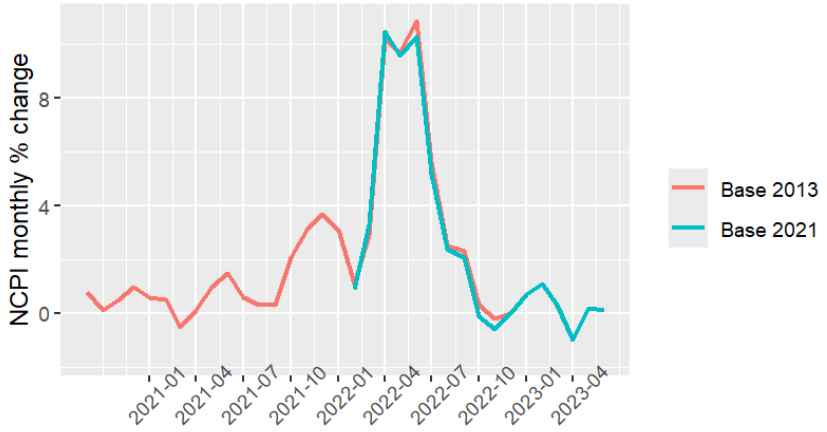

Fig. 3.3. Monthly inflation. NCPI: National consumer price index.

Data: CBSL. Note: CBSL changed base years from 2013 to 2021 and stopped reporting base-2013 data from 2023 onwards.

The period of rising inflation in the first two quarters of 2022 plunged Sri Lanka into violent political crisis. As power cuts loomed and fuel and food were rationed, riots erupted in Colombo. In April, Sri Lanka officially defaulted on its external debt. Talks for a debt restructuring agreement with the International Monetary Fund (IMF) were initiated in July (Mashal, 2022). As the external trade balance improved, inflation eased, declining to near-zero levels in October. Figure 3.4 provides a brief timeline of the crisis.

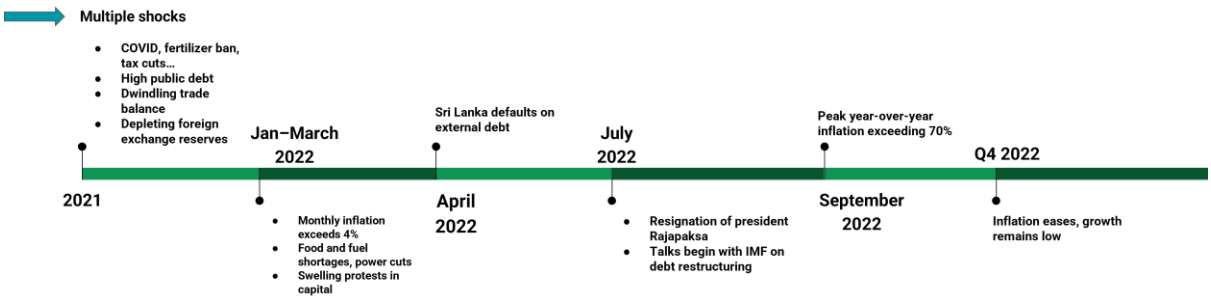

Fig. 3.4. Timeline of the Sri Lankan financial crisis.

The following sections explore the data on various indicators separately from the perspective of the monetarist and post-Keynesian balance-of-payments views on inflation. Then, two models are formulated based on the competing theories to be used for quantitative evaluation.

3.2. Theoretical models

3.2.1. The monetarist explanation

The discourse around the Sri Lankan financial crisis has been largely dominated by the monetarist view that identifies money supply expansion as the primary driver of inflation (ADB, 2023; De Silva et al., 2022; Mashal, 2022). Thus, the monetarist explanation of the inflationary period begins by identifying the drivers of an increase in money supply. Sri Lanka has a large public sector and has the reputation of sustaining robust social security programs

even in periods of low growth and high fiscal deficits (Athukorala & Jayasuriya, 2013; De Silva et al., 2022). Thus, scrutinizing government finances provides a good starting point for identifying changes in money supply.

Figure 3.5 shows the trajectory of the public accounts balance normalized to national GDP in the years preceding the crisis. It is clear that the changes in the fiscal deficit are largely driven by shifts in government expenditure as the revenue-to-GDP ratio remains roughly stable until 2021. The first three quarters of 2021 in particular show a sharply increasing fiscal deficit. However, by the last quarter of 2020, Sri Lanka's international credit ratings had deteriorated to the extent that it was virtually cut out from foreign credit markets (ADB, 2023: 178). Thus, the deficit was funded through Central Bank borrowing, i.e., Sri Lanka started 'printing money' to finance its deficit from the end of 2020.

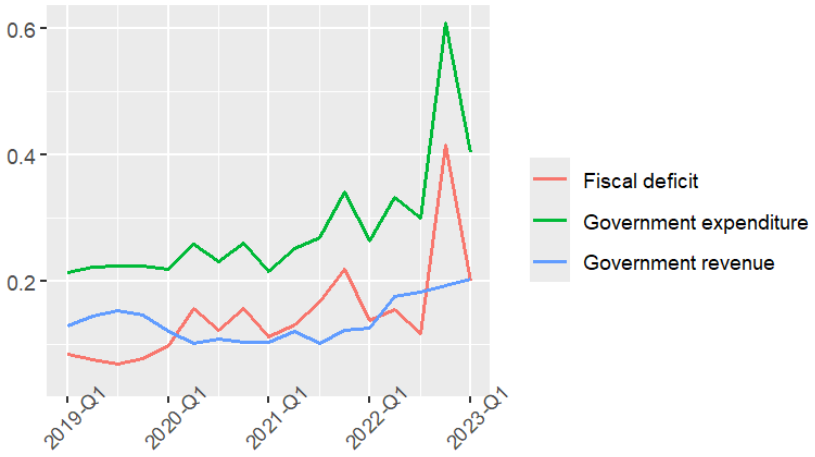

Fig. 3.5. Ratio of government financial statistics to real GDP.

Data: CBSL. Accounting relation: Fiscal deficit = Government expenditure – Government revenue.

Figure 3.6 shows the ratio of broad money (M2) circulating in the Sri Lankan economy to real GDP during the same period. Indeed, there is a clear and steady increase in average money supply during this period despite fluctuations.

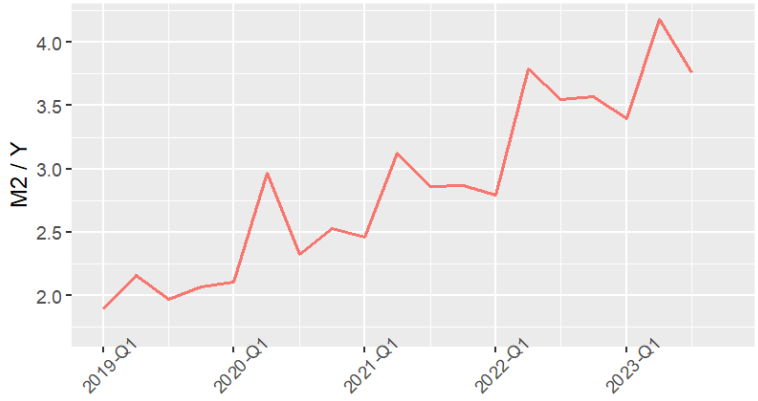

Fig. 3.6. Ratio of broad money supply (M2) to real GDP (Y).

Data: CBSL.

The Central Bank of Sri Lanka (CBSL) took cognizance of rising inflationary pressures much before the peak period starting in March 2022. In their Annual Report of 2022, the CBSL notes that 'tight monetary policy stance that commenced in August 2021 through 2022 in view of arresting inflationary pressures and possible de-anchoring of inflation expectations' was continued in 2022 (Central Bank of Sri Lanka (CBSL), 2022a: pp. 141). Thus, the Central Bank explicitly made policy decisions with a monetarist view in mind, where interest rates can be increased to act as an exogenous lever to control the money supply.

Recovery from high inflation

Figure 3.7 shows the changes in the average weighted lending rate versus monthly NCPI inflation from 2019. Following the inflationary surge in April 2022, the Central Bank sharply hiked interest rates hoping to control money supply and thereby, rising prices. They believe that this 'helped arrest the build-up of demand driven inflationary pressures and preempt the escalation of adverse inflationary expectations' (CBSL, 2022b: pp. 220), although the high inflation continued for another three months before abating.

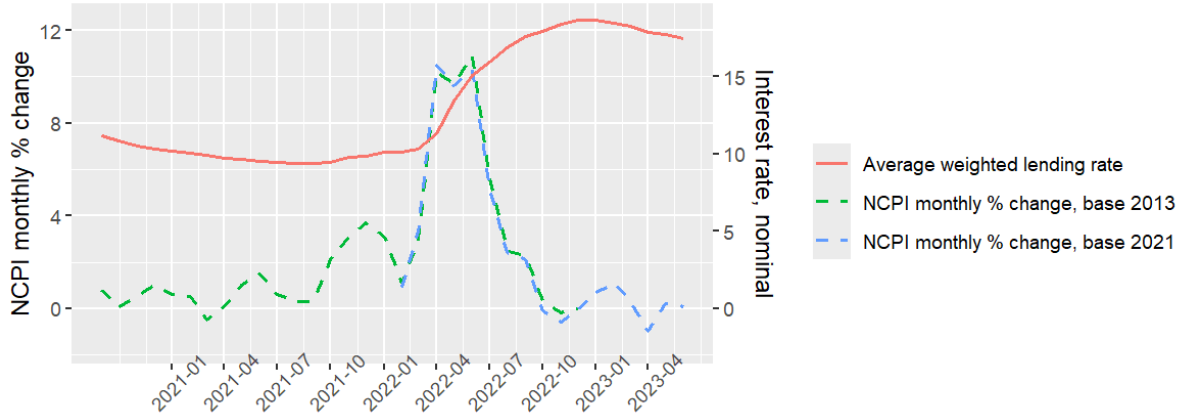

Fig. 3.7. Market interest rate and monthly inflation.

Data: CBSL.

Note that according to Cagan's assumption, the velocity of money follows a power law in the nominal interest rate (Section 2.1.1):

$$v \propto i^{\alpha} \qquad \text{Eq. 3.1}$$

$$\Longrightarrow \log(v) \propto \alpha i \qquad \text{Eq. 3.2}$$

Thus, increasing interest rates can have antagonistic effects on inflation: on the one hand, it can control money supply; on the other, it can exponentially increase the velocity of money, fuelling inflation further. In the monetarist view, it is thus hypothesized that initially, the hike in interest rates fails to arrest inflation because it increases the velocity of money. However, as the market adjusts, the money supply factor overtakes the effect of the velocity of money, thus leading to the decline in inflation.

Therefore, the chain of causality in the monetarist hypothesis is as follows: a high fiscal deficit financed by Central Bank credit leads to increasing money supply that triggers high inflation. This is reversed by increasing policy rates, which initially may have contributed to a brief spurt in inflation rates by increasing the velocity of money but eventually reins in the inflation.

3.2.2. The post-Keynesian explanation

According to open-economy post-Keynesian conflicting-claims theory, the primary driver of inflationary surges is distributional conflict between firms and workers, which is exacerbated by fluctuations in the real exchange rate of the currency. While the CBSL acknowledges the role of exchange rates in driving inflation ('The unprecedented acceleration of headline inflation was mainly due to… the sharp depreciation of the Sri Lanka rupee against the US dollar … *[among other reasons]*' (CBSL, 2022b: pp. 224–225)), they do not consider it to be the first driver preceding money supply. In contrast, post-Keynesian theory considers money supply to be exogenous, while the wage–price spiral and exchange rate variations are the primary causes of inflationary surges.

On the workers' side of the distributional conflict, Sri Lanka has a long history of labour movements, which played an important role in the anti-colonial movement. Post-independence, they were mainly integrated into major political parties as labour wings, as is common in South Asian countries and play an important role in national politics at the local levels irrespective of political orientation on other political issues (Biyanwila, 2011).

Thus, labour unions, whose membership covers around 10% of Sri Lanka's workforce, are significant players in the national economy (International Labour Organization, 2024). During the 2022 financial crisis, they were instrumental in mobilizing mass dissent and also took a stance against the subsequent IMF debt restructuring programme (Jayasinghe et al., 2022; Progressive International, 2023). Thus, in a post-Keynesian framework, labour bargaining is expected to have a strong impact on prices in this context.

Figure 3.8 shows the monthly change in the price index in the informal private sector against the monthly price inflation trend. The informal sector employs nearly 70% of the workforce. For simplicity, only this sector is considered for wage dynamics in this study. From Fig. 3.8, spikes in price inflation tend to follow spikes in the wage index change; hence, wage negotiations may play a major role in determining prices.

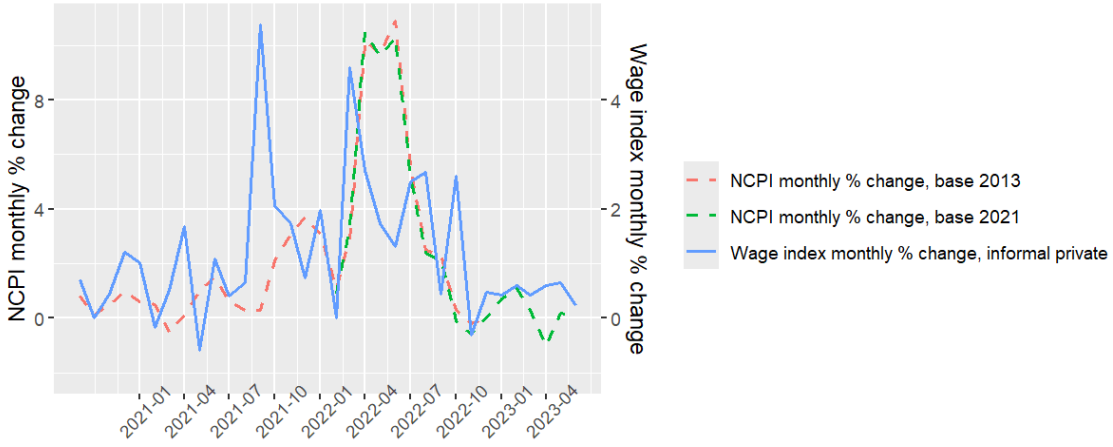

Fig. 3.8. Monthly variation of informal private sector wage index and NCPI.

Data: CBSL.

On the other side of the distributional conflict, Sri Lanka's market structure is dominated by, on the one hand, monopolistic state-owned enterprises (SOEs) in sectors such as electricity and transport and on the other hand, informal small markets in food and other everyday amenities (Athukorala & Jayasuriya, 2013; De Silva et al., 2022). While SOEs generally have a stable price policy, they were forced by external constraints to drastically increase prices in 2022. This manifested in the markups for non-food commodities and services, including fuel and transport, being much higher than those for food items in 2022 (CBSL, 2022a).

As a net importer of food and fuel (Institute of Policy Studies of Sri Lanka, 2022), prices in Sri Lankan markets are highly interlinked with external factors and exchange rate volatility. Figure 3.9 shows the variations in the real exchange rate along with monthly inflation between 2019 and early 2023. The real exchange rate and not the nominal exchange rate is used here because the former is calculated based on the actual prices of imports. It thus reflects the impact of currency devaluation on domestic prices better than the nominal exchange rate.

Fig. 3.9. Monthly variation of real exchange rate and NCPI.

Data: CBSL.

The beginning of the inflationary upsurge in March 2022 coincides with a sharp dip in the real exchange rate immediately after the start of the Russia–Ukraine war. In addition to experiencing the global economic shock in oil prices, Sri Lanka's food imports suffered as Russia and Ukraine are major exporters of food to the country. For example, wheat imported from these two countries constituted 45% of wheat consumed in Sri Lanka in 2022 (Institute of Policy Studies of Sri Lanka, 2022). Thus, it is highly likely that the start of the war played a major role in triggering the real exchange rate dip in March 2022.

However, the steady depreciation of the Lankan rupee had begun much before 2022. This may be linked to the gradual decline in the foreign exchange reserves. Sri Lanka continued repaying its mounting foreign debt even through the economic shocks of 2019–2021. A Central Bank announcement declares that the country maintained its 'unblemished record of debt service payments' even through the pandemic and that '[as] the government could not raise adequate liquidity…, the Central Bank continued to provide liquidity from the foreign reserves… during the period of 08 April to 22 June 2020… *utilising the Central Bank's foreign reserves* [emphasis added]' (CBSL, n.d.). Thus, they followed an explicit policy of drawing down foreign reserves to repay debt in foreign currencies.

Figure 3.10 shows the trajectories of the external public debt of Sri Lanka and the Central Bank's official foreign reserves from 2019. The drain on foreign reserves continued until the second quarter of 2022, when improving trade balance brought bolstered Sri Lanka's foreign exchange reserves.

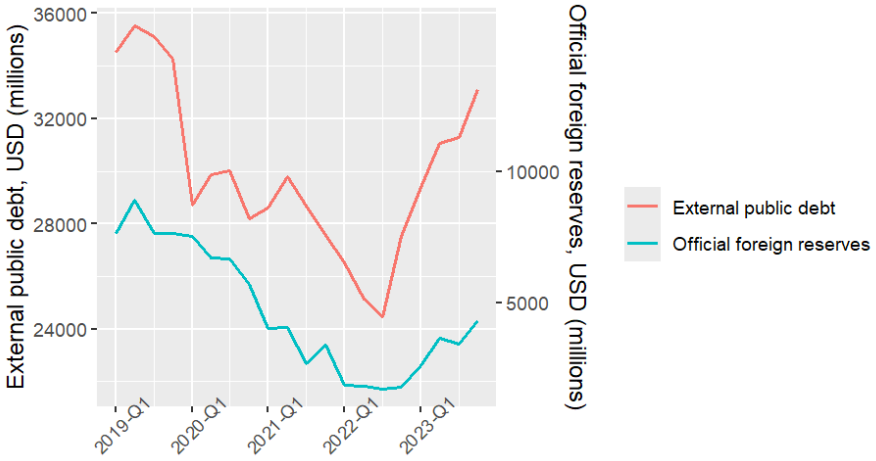

Fig. 3.10. External public debt and official foreign reserves.

Data: CBSL, International Reserves and Foreign Currency Liquidity Database (IMF).

Figure 3.11 shows the trajectories of foreign reserves and real exchange rate in the same time period. The decline in foreign reserves is accompanied by an overall depreciation of the Lankan rupee even before 2022. As inflation rates were relatively high even in 2021, the Central Bank adopted a pegged exchange rate policy in April 2021 as a measure to avoid further inflation through exchange rate volatility (CBSL, 2021).

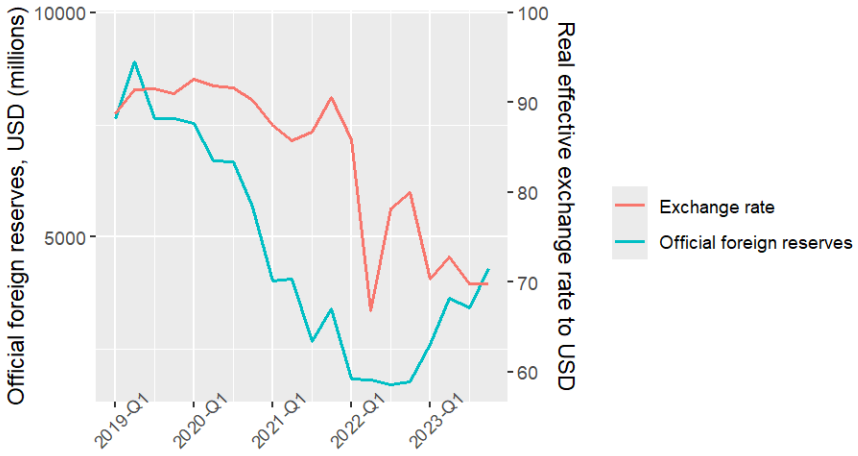

Fig. 3.11. Real effective exchange rate and foreign reserves.

Data: CBSL.

From March 2022, they started gradually moving away from the peg, first allowing measured adjustments and then moving to a floating rate in March 2023. This was done presumably to encourage remittances (Jayasinghe, 2022) but compounded the effect of the Ukraine war, leading to the observed decline of nearly 20% in the effective real exchange rate between February and March (Fig. 3.7).

Recovery from high inflation

In response to the currency depreciation and balance-of-payments crisis, Sri Lanka imposed import restrictions in 2022. Further, the devalued currency and recovery of global demand post-COVID had a positive effect on net exports (ADB, 2023), which contributed positively to aggregate demand in 2022 as it improved towards the end of the year (Table 3.1). As seen in Fig. 3.2, Sri Lanka's current account balance showed an upward trajectory from the first quarter of 2022 after an overall decline in the previous seven quarters.

The improving trade balance brought in foreign cash that bolstered Sri Lanka's foreign reserves in the last two quarters of 2022 (Fig. 3.3). This not only aided recovery from high inflation but also helped the economy withstand the second sharp dip in real exchange rate that occurred in February–March 2023 (Fig. 3.9).

Further, Sri Lanka reached a debt restructuring agreement with the IMF in March 2023 that approved funds of about USD 3 billion to be provided over the next 48 months (IMF, 2023). Agreements were also reached with major donors such as China and India in the latter half of 2023, thus opening up Sri Lanka to the inflow of foreign exchange after being cut off from international credit markets for most of 2022 (Gamage & Ul Haque, 2024).

Thus, according to the post-Keynesian model, the chain of causality is as follows: Sri Lanka's foreign exchange reserves are drawn down to finance foreign debt repayment over many years. This leads to a gradual depreciation of the currency. This is compounded by the effect of the Ukraine war and relaxation of the exchange rate peg in March 2022, causing a sharp decline in the real exchange rate. The increasing price of imports exacerbates the wage–price spiral in the domestic economy, leading to high inflation. Inflation eases in the last two quarters of 2022 as improving trade balance brings in foreign exchange, aided further by the influx of foreign credit in the latter half of the next year as debt restructuring agreements are reached with donors.

Figure 3.12 shows a visual representation of the two proposed explanations of the inflation. The next chapter explains the model evaluation strategy and the results obtained.

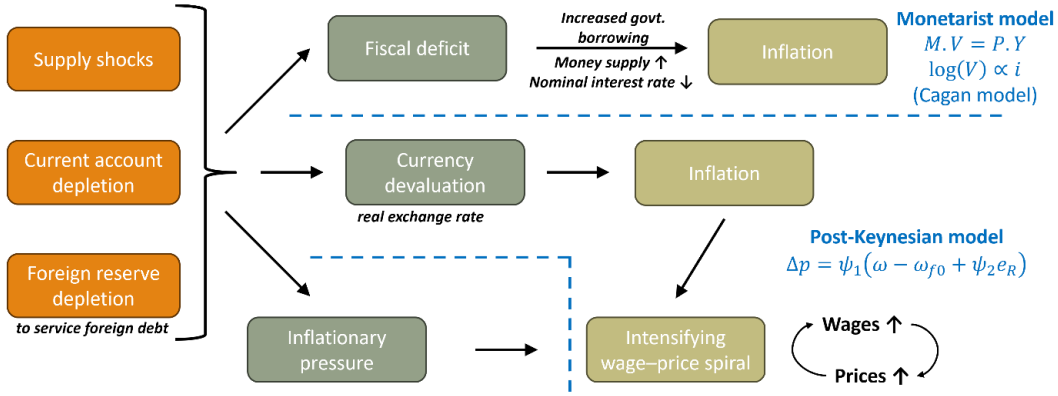

Fig. 3.12. Competing explanations of inflation in Sri Lanka.

References: Cagan model—Edmond (2017); Conflicting-claims model—Lavoie (2022), Chapter 8: pp. 622

4. Model evaluation and econometric analysis

This chapter describes in detail the data and strategy used for model evaluation. The steps for data processing, choices made, and challenges faces are outlined. The results obtained and directions for future work are described in detail.

4.1. The data

Data on macroeconomic indicators is available from the Central Bank of Sri Lanka (CBSL); some data were obtained from aggregated databases such as the International Monetary Fund's International Financial Statistics. The main variables used for the analysis are as follows:

1. National consumer price index (NCPI) and first difference of NCPI (inflation): dependent variables
2. Broad money $M2$: independent variable for monetarist model
3. Real exchange rate e_R: independent variable for conflicting-claims model
4. Control variables for monetarist model: real GDP, nominal interest rate (i)
5. Wage rate, defined as the ratio of the wage index (w) and price index (NCPI): control variable for conflicting-claims model

Descriptive statistics of the variables used for the analysis are given in Table 4.1. For brevity, the statistics for only the raw data are presented; statistics for transformed data such as log-transforms and first differences are omitted from the table and are available in Appendix 1.

Table 4.1. Descriptive statistics.

Variable	N	Mean	Median	Std. dev.	Min.	Max.
NCPI, adjusted to base 2013[1]	120	148.70	126.90	54.05	103.00	281.70
Broad money $M2$ (LKR[2], millions)	120	6747223	6423232	2586522	3094570	11485069
Real exchange rate e_R (w.r.t USD)	120	94.04	92.83	12.85	61.74	112.67
Wage rate $(\frac{w}{p})$[3]	106	1.26	1.26	0.11	1.06	1.44
Real GDP[4] (LKR, millions)	120	4132291	3865245	1328739	2483977	7339004
Nominal interest rate i	120	13.23	13.46	2.27	9.37	18.70

[1]Adjustment discussed in Section 4.1.1; [2]LKR: Lankan rupees; [3]Wage index data unavailable after October 2022; [4]Quarterly GDP triplicated to generate monthly data

4.1.1. CPI base year conversion

The first problem encountered is in the reporting of the data: the Central Bank changed its base year for CPI calculation from 2013 to 2021 in 2022. Further, it stopped reporting values in base year 2013 from 2023. Hence, the NCPI monthly inflation plots in Fig. 3.2 show two trendlines. As the CPI is calculated as a *weighted average* of relative prices of different commodities in the basket of goods, changing base years implies not only a change in the reference year for price calculation, but also the relative weight of different commodities. Hence, it is not possible to do a simple base year conversion using just the ratio of the general level of prices.

However, given the limitations of data availability, I attempted a crude conversion using GDP deflator data for Sri Lanka. The GDP deflator is defined as the general level of prices in a year compared to a given base year (data: World Bank, n.d.). Prices are converted from base year 2021 to base year 2013 using the following relation:

$$p_{y,2013} = p_{y,2021} \times \frac{p_{2021}}{p_{2013}}, \qquad \text{Eq. 4.1.}$$

where $p_{y,b}$ is the price in year y in terms of base year b, and p_r is the GDP deflator of year r.

The conversion results are calibrated on the data points for the year 2022, during which period official CPI estimates are available in both base years. The conversion reduces the average discrepancy between the 2013 and 2021 base year values from $\sim$20% to 6% (Appendix 2). Hence, even if the conversion does not account for changes in weights of different commodities in the basket of goods, it is a good approximation for the purpose of this analysis.

Fig. 4.1 shows the adjusted inflation trend.

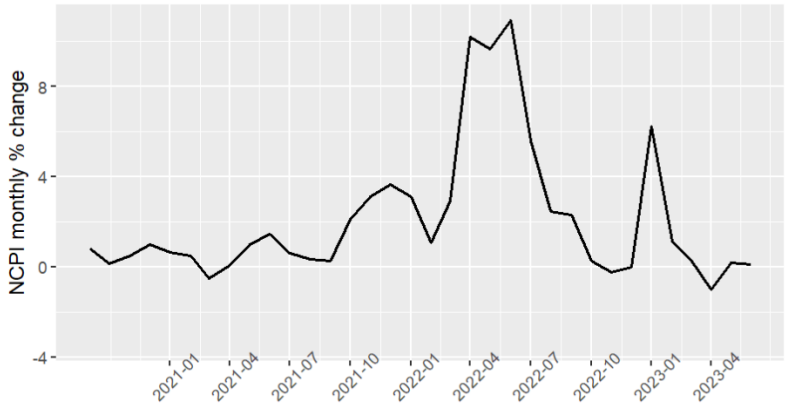

Fig. 4.1. Monthly inflation adjusted to base year 2013. Compared to the base-2021 series (see Fig. 3.2), the peak at February 2023 has disappeared, and a new peak has appeared at January 2023. The data point at the transition of 2022 and 2023 is spurious as it is the point of shift in data series.

4.2. Stationarity tests

Before conducting econometric analyses on time series data, it is essential to perform stationarity tests to aid the choice of the appropriate method. A time series is said to be stationary if the process generating it possesses both of the following properties (Hamilton, 1994: Chapter 3):

i. The mean is independent of time.
ii. The covariance between the time series and a lagged version of itself depends only on the duration of the lag.

First, consider the independent variables: broad money M2 and real exchange rate e_R. To empirically determine whether a time series is generated by a stationary process or not, different statistical tests may be used. I employed the following three standard stationarity tests that are based on the presence or absence of unit roots:

1. Augmented Dickey–Fuller (ADF) test
2. Phillips–Perron (PP) test
3. Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test

For the ADF and PP tests, the null hypothesis is that the series is non-stationary; hence, a p-value less than the critical level provides evidence that the series is stationary. For the KPSS test, the null hypothesis is that the series is stationary; hence, a p-value higher than the critical level indicates that the series is likely to be stationary.

Table 4.2 provides the test statistics along with their significance levels obtained by performing the tests on the listed variables.

Table 4.2. Stationarity test results on independent variables.

	ADF	PP	KPSS
Broad money M2			
Level	-1.99	-4.47	2.47^{***}
First difference	-7.39^{***}	-100.77^{***}	0.66^{**}
Log level	-0.57	-1.52	2.48^{***}
First difference (log)	-6.91^{***}	-104.54^{***}	0.35
Real exchange rate			
Level	-3.88^{**}	-21.98^{**}	2.19^{***}
First difference	-7.38^{***}	-96.64^{***}	0.10
Log level	-3.92^{**}	-23.58^{**}	2.15^{***}
First difference (log)	-7.50^{***}	-99.92^{***}	0.09

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

From the test results, it is clear that $\log(M2)$ is non-stationary at level but stationary in first differences. Thus, the variable is clearly $I(1)$. For $M2$, the KPSS result at the first difference indicates that it may not be stationary; hence, the $M2$ series is potentially $I(2)$.

For the real exchange rate e_R, there is some ambiguity in the test results at level. For e_R, the ADF and PP tests indicate stationarity at the critical 5% level, whereas the KPSS test rejects stationarity at the critical 1% level. The $\log(e_R)$ time series presents similarly conflicting results. However, the tests clearly indicate that the first differences of both are stationary; hence, the time series is at least $I(1)$.

For the dependent variable, I considered the first difference of NCPI, i.e., the inflation. Note that as the data series changes from December 2022 to January 2023 due to the change in base year and subsequent adjustment done in Section 4.1.1, the differenced value for January 2023 is spurious. However, I first ignored this and conducted the stationarity tests for the entire time series ($N = 120$) for both linear and log values of inflation[2].

Table 4.3. Stationarity test results for inflation (first difference of NCPI) for entire data series ($N = 120$).

	ADF	PP	KPSS
Level	-4.75***	-40.21***	0.58**
First difference	-8.48***	-107.91***	0.02
Log level	-5.40***	-97.86***	0.24
First difference (log)	-12.53***	-139.53***	0.08

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

Thus, there is some ambiguity in whether inflation is stationary at level due to conflicting results from the ADF and PP tests on the one hand, which indicate stationarity, and the KPSS test on the other hand, which indicates non-stationarity. However, the first difference is unambiguously stationary; therefore, the maximum order of integration of inflation is 1. As defined here, the $\log(inflation)$ time series is clearly $I(0)$.

To further confirm that the January 2023 data point does not affect the results, I performed the tests on the data series up to December 2022 ($N = 108$). Results are presented in Table 4.4.

Table 4.4. Stationarity test results for inflation on truncated data series ($N = 108$).

	ADF	PP	KPSS
Level	-4.38***	-26.76**	0.59**
First difference	-7.11***	-79.41***	0.34
Log level	-5.00***	-88.82***	0.32
First difference (log)	-12.55***	-125.44***	0.06

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

[2] Inflation can take both positive, negative, and zero values; hence, a simple log operator cannot be applied. Instead, I have used the log of the absolute value multiplied by the sign of the value, i.e., the logarithm of x is calculated as $\frac{x}{|x|} \times \log(|x|)$ for $x \neq 0$ and as 0 for $x = 0$.

The results are fairly close to those for the tests conducted on the full adjusted data series. There is no change in significance levels. Hence, I proceeded with the full series for further analysis.

The orders of integration of the three model variables as determined from the stationarity tests are summarized in Table 4.5. Due to the ambiguity in the orders of integration of the variables, they cannot all be assumed to be of the same order of integration. In this situation, typical vector autoregression (VAR) models cannot be used. Instead, financial analysis for mixed order-of-integration data typically uses autoregressive distributed lag (ARDL) models, which offer several advantages as discussed in the next section (Charles & Marie, 2017, 2020).

Table 4.5. Orders of integration of main model variables.

Variable	Order of integration
Inflation (dependent)	
Linear	$I(1)$ or $I(0)$
Log-transformed[2]	$I(0)$
Broad money $M2$ (independent)	
Linear	$I(1)$ or $I(2)$
Log-transformed	$I(1)$
Real exchange rate e_R (independent)	
Linear	$I(1)$ or $I(0)$
Log-transformed	$I(1)$ or $I(0)$

4.3. Methodology: Autoregressive distributed lag model

Autoregressive distributed lag (ARDL) models are ordinary least squares (OLS)-based models that can be used to estimate relationships between variables that may not have the same order of integration. The dependent variable can depend on lagged values of itself (the "AR" part) as well current and lagged values of the independent variables (the "DL" part). Unlike VAR, ARDL does not require all the variables to have the same order of integration, thus allowing the user to incorporate a vast range of variables. Moreover, ARDL can incorporate endogenous variables (Natsiopoulos & Tzeremes, 2022; Nkoro & Uko, 2016; Shin & Pesaran, 1999).

Further, ARDL models can be used to estimate whether a *stable long-run relationship* exists between the dependent and independent variables despite short-term deviations. Mathematically, two variables are said to have a long-run relationship, or are *cointegrated*, if there exists a linear combination of them that generates a stationary, i.e., $I(0)$, process. In other words, x_t and y_t are said to be cointegrated if there exists α such that

$$z_t = y_t - \alpha x_t \qquad \text{Eq. 4.2.}$$

is an $I(0)$ process. ARDL models can estimate the presence or absence of a long-run relationship exists between the variables by using error-correction models (ECMs), which include an error term to correct for the deviation from the long-run equilibrium relationship in the short-run (Jordan & Philips, 2019; Pesaran et al., 2001).

4.3.1. ARDL assumptions

As the ARDL is an OLS-based method, the following assumptions need to be satisfied by the data for the model to be applicable (Jordan & Philips, 2019):

i. No autocorrelation: If autocorrelation exists, further lags of the regressors may be added to eliminate it.
ii. Errors should be distributed normally.
iii. There should be no heteroskedasticity.

4.3.2. ARDL implementation

To implement an ARDL model, the following steps are employed (Jordan & Philips, 2019; Natsiopoulos & Tzeremes, 2022).

1. Model specification:
    a. Specify lags of all regressors.
    b. Specify orders of integration of all variables.
2. Diagnostic tests for testing model assumptions.

The next step would be to run cointegration tests for determining long-run equilibrium relationships between variables with appropriate critical values for small samples (Narayan, 2005; Pesaran et al., 2001). However, this was out of the scope of the current project and should be addressed in future work.

For this study, the ARDL models were implemented using the `dynamac` package in the software R (Jordan & Philips, 2019).

4.4. Modelling strategy and results

I employed three different strategies for model estimation, each with their advantages and disadvantages as discussed in the rest of the chapter. The aim was to obtain an evidence base to come to a conclusion regarding the determinants of inflation:

1. Strategy 1: Monetarist model.
2. Strategy 2: Conflicting-claims model.
3. Strategy 3: 'Heuristic' model combining both theories.

4.4.1. Strategy 1: Monetarist model

Based on the discussion in Section 2.1.1, the regression equation for the monetarist model may be written as follows:

$$\log(p) \sim \log(p_{-1}) + \log(M2) + \log(M2_{-1}), \qquad \text{Eq. 4.3.}$$

where p is the price index (adjusted NCPI in our data), and the subscript -1 represents a time lag of 1 unit.

The relationship between the variables is specified in terms of their log-transformed values. Thus, we cannot use the logarithm of inflation (first difference of adjusted NCPI) as our dependent variable because $\Delta \log(p) \neq \log \Delta p$, where Δp gives the inflation.

Thus, it is necessary to first check for the stationarity of $\log(p)$ time series. Table 4.6 gives the results of the stationarity tests for the log $(NCPI)$ time series.

Table 4.6. Stationarity test results for log-transform of NCPI.

	ADF	PP	KPSS
Level	-1.15	-1.53	1.96^{***}
First difference	-4.98^{***}	-34.17^{***}	0.57^{**}
Second difference	-7.99^{***}	-82.37^{***}	0.04

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

The results are ambiguous at the first difference; hence, the NCPI series could potentially be $I(2)$. Thus, unfortunately, the assumptions for ARDL models may not be satisfied. In the following, I run different models to test out different possibilities.

To check whether the ambiguous stationarity results may be occurring because of the discontinuity in the data series at January 2023, I also estimated the results for the truncated series up to December 2022 ($N = 108$). The results are shown in Table 4.7.

Table 4.7. Stationarity test results for log-transform of NCPI up to December 2022.

	ADF	PP	KPSS
Level	-0.93	2.25	1.71^{***}
First difference	-4.98^{***}	-34.17^{***}	0.57^{**}
Second difference	-7.99^{***}	-82.37^{***}	0.04

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

The results are similar to that for the full data series; hence, the length of the series does not make much difference.

In the following, I describe the models specified and results obtained.

Model M1: $\log(p) \sim \log(M2)$ Eq. 4.4.

Lags—log (p): 1, log $(M2)$: 1 according to Cagan's model[3]

[3] From here onwards, lagged terms are not written in regression equations for the rest of this chapter in the interest of brevity. The specifications, including lags, are described in the text.

Model M2: $I(1)$ variables.

This model used the differenced form of Eq. 4.3. This was done to eliminate potential problems resulting from the $I(2)$ nature of the NCPI series.

$$\Delta \log(p) \sim \Delta \log(M2) \qquad \text{Eq. 4.5.}$$

Lags—$\Delta\log(p)$: 1, $\Delta\log(M2)$: 1

Model M3: Omitted variables.

To eliminate the possibility of omitted variable bias, I included the quarterly real GDP and the nominal interest rate i as control variables.

Justification: The Cagan model is typically used for hyperinflationary periods with monthly inflation $> 50\%$, in which case the assumption that real GDP and real interest rates change slowly compared to price indices is a good one. This assumption may not hold in the Sri Lankan case, where the maximum monthly inflation was $\sim 10\%$.

$$\Delta \log(p) \sim \Delta \log(M2) + \Delta \log(rGDP) + \Delta\log(i) \qquad \text{Eq. 4.6.}$$

Lags—$\Delta\log(p)$: 1, $\Delta\log(M2)$: 1, $\Delta\log(GDP)$: 1, $\Delta\log(i)$: 1

Model M4: Seasonality.

To eliminate for possible seasonal trends in the data, I deseasonalized both the NCPI and $M2$ time series using the LOESS filter.

$$\Delta \log(p_{ds}) \sim \Delta \log(M2_{ds}) \qquad \text{Eq. 4.7.}$$

Lags—$\Delta\log(p_{ds})$: 1, $\Delta\log(M2_{ds})$: 1

After evaluating the models, it is necessary to test for the validity of the following ARDL assumptions: no autocorrelation, normal distribution of errors, and no heteroskedasticity, as discussed in Section 4.3.1. Here, I tested these assumptions with the following standard tests, respectively: the Breusch–Godfrey, Shapiro–Wilk, and White test.

Table 4.8 summarizes the regression results for models M1–M4.

Table 4.8. Summary of monetarist models and regression results. For each model, a lag of 1 is specified for both the dependent and independent variables.

	Model			
	M1	**M2**	**M3**	**M4**
Variables				
Dependent	$\log(p)$	$\Delta\log(p)$	$\Delta\log(p)$	$\Delta\log(p_{ds})$
Independent	$\log(M2)$	$\Delta\log(M2)$	$\Delta\log(M2)$, $\Delta\log(GDP)$, $\Delta\log(i)$	$\Delta\log(M2_{ds})$
Significant	$\Delta\log(M2)$*	$\Delta\log(p_{-1})$**	$\Delta\log(p_{-1})$*** $\Delta\Delta\log(i)$** $\Delta\log(i_{-1})$***	$\Delta\log(p_{ds,-1})$***
Diagnostic tests				
Breusch–Godfrey LM	44.22*** ×	0.63 ✓	1.43 ✓	0.46 ✓
Shapiro–Wilk	0.81*** ×	0.87*** ×	0.90*** ×	0.86*** ×
White	5.61** ×	1.46 ✓	2.09 ✓	1.46 ✓
Model statistics				
Adjusted R^2	0.11	0.18	0.30	0.14
F	5.642***	13.53***	11.11***	10.31***
N	120	120	120	120

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

Note that Table 4.8 (and subsequent regression tables in this chapter) should not be read as a typical regression table. For example, the adjusted R^2 values cannot be used for comparing models that have different dependent variables. Instead, the results presented here should be viewed as an attempt to gather a large evidence base for comparing the two theories of inflation.

Results

First, note in Table 4.8 that the results from models M2 and M4 are similar; hence, it can be assumed that deseasonalizing the data makes little difference. Thus, I ignore any seasonality concerns henceforth.

M1 concludes that $\log(M2)$ is a significant determinant of inflation at the 10% critical level. In contrast, the log–log model M2 concludes that money supply is not significant; the price level depends only on its own lagged value. As M1 is a level model, there are concerns regarding the potentially $I(2)$ nature of the NCPI data series. Hence, M2 should be preferred. Further, according to the Breusch–Godfrey LM test, M2 satisfies the condition of no autocorrelation; M1 does not.

Model M3, which includes the nominal interest rate and quarterly GDP as controls, also indicates that money supply is not significant. Before running the model, stationarity tests were conducted on the GDP and interest rate variables. $\Delta\log(GDP)$ appeared to be stationary according to the ADF, PP, and KPSS tests; however, $\Delta\log(i)$ was non-stationary according to

the PP and KPSS test (Appendix 3). Hence, the first difference of $\Delta \log(i)$ was added as a regressor in the model to account for non-stationarity. This variable was reported to be significant; however, the second difference of the logarithm of the interest rate is difficult to interpret. This model may be over-specified.

The results of the Breusch–Godfrey and White test indicate that all the models except M1 satisfy the assumptions of no autocorrelation and no heteroskedasticity, respectively.

The Shapiro–Wilk test results indicate that none of the models satisfy the condition of non-normality of residuals. It is known that normality tests, such as the Shapiro–Wilk test, are likely to falsely reject the null hypothesis of no normality in case of small samples. This issue is frequently encountered in time-series financial data (Razali & Wah, 2011). However, the regression results presented here must be treated with caution as the crucial assumption of non-normality could not be verified. Further tests are needed to confirm this.

In conclusion, none of the three models that satisfy at least two of the regression assumptions (no autocorrelation and no heteroskedasticity) indicate that there is any evidence that money supply is a significant determinant of inflation in the given dataset.

4.4.2. Strategy 2: Conflicting-claims model

Based on the discussion in Section 2.2.2, the regression equation for the conflicting-claims model in an open economy may be written as follows:

$$\Delta p \sim \frac{w}{p} + e_R \qquad \text{Eq. 4.8.}$$

$$\text{or, } inf \sim \frac{w}{p} + e_R, \qquad \text{Eq. 4.9.}$$

where inf is the monthly inflation (first difference of the price index). As the highest possible order of integration of inflation 1 (Table 4.5), the conflicting-claims specification does not run into issues of a potentially $I(2)$ series as encountered with the monetarist formulation.

As this study is concerned with determining the significance of exchange rates versus money supply, I started with the simplest model specification with e_R as the only explanatory variable.

Model CC1: Exchange rate only.

$$inf \sim e_R \qquad \text{Eq. 4.10.}$$

Lags: 1 for both variables.

Model CC2: Log specification; exchange rate only.

$$\log(inf) \sim \log(e_R) \qquad \text{Eq. 4.11.}$$

Lags: 1 for both variables.

Model CC3: Exchange rate and wage rate.

To improve the model and test the role of wage–price conflicts, I included the wage rate as a control variable in the specification. To recall, the wage rate is defined as the ratio of the wage index to the price index in the economy ($\frac{w}{p}$), i.e., it represents the wage share of national income.

For simplicity, I included only the informal sector wage index as the informal sector accounts for approximately 67% of all employment in Sri Lanka (IMF, 2022).

Data for wage indices are not available after October 2022; hence, the analysis had to be terminated at $N = 106$. Again, a lag of 1 is specified for all the variables.

$$\log\ (inf) \sim \log\ (e_R) + \log\ (\frac{w}{p}) \qquad \text{Eq. 4.12.}$$

Table 4.9 summarizes the conflicting-claims models and results.

Table 4.9. Summary of conflicting-claims models and regression results. For each model, a lag of 1 is specified for both the dependent and independent variables.

	Model		
	CC1	**CC2**	**CC3**
Variables			
Dependent	inf	$\log\ (inf)$	$\log\ (inf)$
Independent	e_R	$\log\ (e_R)$	$\log\ (e_R)$, $\log\ (\frac{w}{p})$
Significant	inf_{-1} *** e_R *	$\log\ (inf_{-1})$**	$\log\ (e_R)$* $\Delta\log\ (\frac{w}{p})$*** $\log\ (\frac{w}{p})$**
Diagnostic tests			
Breusch–Godfrey LM	0.22 ✓	0.87 ✓	0.82 ✓
Shapiro–Wilk	0.77*** ×	097*** ×	0.96 *** ×
White	16.03*** ×	7.42*** ×	1.90 ✓
Model statistics			
Adjusted R^2	0.18	0.09	0.39
F	9.43***	5.32***	14.26***
N	120	120	106

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

Results

Among all the conflicting-claims models, only CC3 (with wage rate as control variable) satisfies both the no autocorrelation and no heteroskedasticity assumptions according to the diagnostic tests. This model indicates that the exchange rate and wage rate are both significant

in determining inflation. However, it should be kept in mind that the log-transform of the wage rate may be $I(2)$ as the KPSS test does not confirm that the first difference of $\log(\frac{w}{p})$ is stationary (Appendix 3). In this case, the ARDL model is not valid.

As with the monetarist models, none of the CC models satisfy the assumption of normality of residuals.

In conclusion, there may be some limited evidence for the significance of distributional conflicts and exchange rates in determining inflation. However, this cannot be confirmed without further diagnostic and directional causality tests.

4.4.3. Strategy 3: 'Heuristic' models

To directly test the significance of money supply versus exchange rates in explaining inflation and to resolve the issues faced with the two previous modelling strategies, I implemented ARDL models that include explanatory variables from both theories. Note that for regular OLS, this strategy would run into endogeneity issues because for both models, one of the variables is endogenous—for the monetarist model, exchange rates are endogenous; for the conflicting-claims model, money supply is endogenous. However, ARDL is robust to endogeneity issues; hence, it is applicable for the present problem (Charles & Marie, 2020: pp. 4).

Model H1: $\log(inf) \sim \log(\mathrm{M2}) + \log(\mathrm{e_R})$ Eq. 4.13.

Lags: 1 for both variables.

Following Charles and Marie (2020), I also tried a dynamic model in the first difference of the log-transformed variables (model H2).

Model H2: $\Delta \log(inf) \sim \Delta \log(M2) + \Delta \log(e_R)$ Eq. 4.14.

Lags: 1 for both variables.

Model H3: Adding wage rate as control. Again, this is run on a truncated dataset ($N = 106$) as wage index is not available for the entire period.

$$\Delta \log(inf) \sim \Delta \log(M2) + \Delta \log(e_R) + \Delta \log(\frac{w}{p}) \quad \text{Eq. 4.14.}$$

Lags: 1 for all variables.

The results of models H1–H3 are summarized in Table 4.10.

Table 4.10. Summary of heuristic models and regression results. For each model, a lag of 1 is specified for both the dependent and independent variables.

	Model		
	H1	**H2**	**H3**
Variables			
Dependent	$\log(inf)$	$\Delta\log(inf)$	$\log(inf)$
Independent	$\log(M2)$, $\log(e_R)$	$\Delta\log(M2)$, $\Delta\log(e_R)$	$\Delta\log(M2)$, $\Delta\log(e_R)$, $\Delta\log(\frac{w}{p})$
Significant	$\log(inf_{-1})$*	$\Delta\log(inf_{-1})$***	$\Delta\log(inf_{-1})$*** $\Delta\Delta\log(\frac{w}{p})$** $\Delta\log\left(\frac{w}{p}\right)_{-1}$*
Diagnostic tests			
Breusch–Godfrey LM	0.034 ✓	11.28*** ×	21.41*** ×
Shapiro–Wilk	0.97*** ×	0.98* ×	0.98* ×
White	3.61* ×	2.78* ×	0.89 ✓
Model statistics			
Adjusted R^2	0.08	0.18	0.29
F	3.21***	6.11***	7.139***
N	120	120	106

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

Results

None of the models tested report either money supply or exchange rate to be a significant determinant of inflation. Model H3, with wage rate included as an independent variable, indicates that the wage rate as well as the lagged inflation are significant determinants of inflation. However, as discussed in Section 4.4.2, the wage rate time series may be $I(2)$, in which case the ARDL model is not valid.

As before, none of the models satisfy the normality condition for residuals (Shapiro–Wilk test). Moreover, none of the heuristic models satisfy both the other conditions either—H1 satisfies the no autocorrelation condition but shows heteroskedasticity; H3 does not show heteroskedasticity but has autocorrelation. The autocorrelation issue may be overcome by adding higher lags of the independent variables.

Thus, keeping in mind all the caveats regarding the non-satisfaction of regression assumptions, the heuristic models provide no evidence to support either monetarist or conflicting-claims theories of inflation for the given data set.

4.5. Discussion of results

Section 4.4 explored different regression formulations based on the two theories with the aim of collecting a variety of evidence to evaluate the two models of inflation under consideration in the Sri Lankan context. The results obtained indicate there is little support for either money supply or exchange rate as a significant determinant of inflation, with only one of the models (CC3) reporting that the exchange rate, in conjunction with the wage rate, is significant while satisfying at least two of the three model assumptions.

4.5.1. Small sample size

These problems are not unexpected given the small sample size available: $N = 120$ for the entire series, and an even smaller $N = 106$ for some models due to data availability constraints. This study was inspired by the work of Charles and Marie (2020), who conducted a similar analysis comparing money supply and exchange rate as determinants of inflation in the context of the Bulgarian hyperinflation of 1997 using ARDL models and the bounds-testing approach for evaluating long-run relationships. While their data set was even smaller ($N = 68$), the Bulgarian data displayed certain characteristics, such as unambiguous stationarity test results for the money supply time series, that made ARDL modelling meaningful.

In contrast, the nature of the data from Sri Lanka caused several difficulties in drawing meaningful conclusions from ARDL models. For example, the order of integration of the $M2$ money supply time series is unclear; it could be either $I(1)$ or $I(2)$. An $I(2)$ series cannot be used with ARDL models; hence, if $M2$ is $I(2)$, the model could give false results. Further, there were discontinuities in the available data, such as the change in CPI base year in 2022.

None of the models evaluated satisfied the condition of normal distribution of residuals. As the Shapiro–Wilk test for normality is known to have low power for small sample sizes (Razali & Wah, 2011), the test results may not be reliable. However, further tests should be conducted to ascertain normality before proceeding with the models as normality is a crucial condition for OLS-based econometric models.

4.5.2. Nature of underlying processes

For a structural understanding of an economy, it is vital to interpret statistical results, such as those of stationarity tests or regression models, in terms of real economic processes. Such underlying processes will naturally differ across countries and contexts. In particular, the discussion in Section 4.5.1 indicates that the underlying mechanisms of monetary systems may be different in Sri Lanka and in a post-Soviet transition economy like Bulgaria.

The Sri Lankan economy is characterized by a high import restriction at various times, a large state sector, high foreign debt, and dominant non-tradeable sectors (Athukorala & Jayasuriya, 2013). Regarding monetary policy, the Central Bank has consistently followed inflation targeting since the early 2000s (Weerasinghe, 2018). Regarding exchange rate policy, different degrees of free and floating rates have been in place at different times during the last two and a half decade in response to currency crises (ADB, 2023).

Thus, it is necessary to interpret the stationarity of time series, particularly for money supply and exchange rates, in light of these policy shifts and the unique features of the Sri Lankan economy. For example, to a pegged exchange rate was adopted between April 2021 and March

2022 in response to currency devaluation pressures during the COVID crisis. This period may mark a structural break in exchange rate policy. Indeed, preliminary tests showed that the results of stationary tests are very sensitive to the data range selected when terminated in this period. Thus, a simple time-series model covering the entire period may not be able to capture these changes.

4.6. Next steps

Although the models presented in this chapter report conflicting results and did not satisfy all model assumptions, they are a first step in characterizing monetary dynamics in the Sri Lankan economy during the years under study. Based on the indications from the model results, I discuss here potential strategies to overcome the limitations so that meaningful conclusions may be reached.

4.6.1. Lags

A simple extension of the Cagan and conflicting-claims models evaluated here is to include higher lags in the dependent and independent variables. For example, it is possible that inflation is not an autoregressive (AR)-1 but an AR-2 process, i.e., inflation depends on its past values up to a lag of two time units. Inclusion of higher lag orders is one of the most common strategies to resolve issues of non-normal distribution of residuals (Jordan & Philips, 2019). Further, model H3, which indicates that neither money supply nor exchange rate are significant in determining inflation (but the wage rate is), does not satisfy the no autocorrelation condition. This problem may be resolved by adding higher order lags. Hence, this strategy may eliminate some of the problems in the models.

More rigorously, the appropriate number of lags can be determined through information criteria such as the Akaike information criterion. Further, simple autoregressive moving average (ARMA) models may first be tried out to determine the AR order of the dependent variable by using autocorrelation functions (Hamilton, 1994). When trying out higher lag orders, it has to be ensured that the chosen order is grounded in theoretical justification and the socioeconomic context of the country to avoid overspecification.

4.6.2. Structural breaks

As discussed in Section 4.5.2, there may be structural breaks in the data. For example, the period of the exchange rate peg between April 2021 and March 2022 may be a structurally different period where the relationship between the main variables—inflation, money supply, and exchange rate—are changed. One possible strategy would be to employ a dummy variable to capture such structural breaks.

However, the small sample size of the period under study is likely to again present problems for identifying structural breaks. It will be useful to study a longer data series going back at least one more decade. With regard to structural breaks, this approach may yield interesting results as Sri Lanka's exchange rate policy underwent several changes in the late 1990s and early 2000s with changing political leadership (Weerasinghe, 2018).

4.6.3. Non-parametric models

A purely statistical strategy to eliminate the problems associated with non-normality of residuals is to use non-parametric methods, i.e., models that do not rely on the assumption of the error distribution having a specific form. This includes methods such as Bayesian models and Markov chain-based models. Further, studies have combined such models with nonlinear ARDL models to capture the asymmetric response of systems to positive and negative changes in regressors, such as in Rushdi et al. (2012).

The caveat is that using complicated statistical methods risks making the model a black box with reduced interpretability in terms of the structural mechanisms of the system. Hence, in my opinion, such methods may be used as auxiliary tests but should not be treated as a substitute for a deep understanding of the structural dynamics of the economy.

4.6.4. Bounds testing

Finally, the aim of the modelling exercise should be to identify not just short-term relationships that may result from peculiarities of the short data set, but also stable long-term relationships between the variables, if any. In conjunction with ARDL models, several approaches have been proposed to test long-term relationships between variables. In particular, the bounds-testing methodology developed by Pesaran et al. (2001) has been shown to be robust for small samples.

However, the critical values specified for bounds-testing by Pesaran et al. (2001) are applicable on samples with 500 or more data points. These critical values may not be appropriate for smaller samples (Narayan, 2005). As the dataset for this study has only $N = 120$ data points, a different set of critical values as proposed by Narayan (2005) should be used, following the methodology of Charles and Marie (2020).

Before testing for long-term relationships, it has to be ensured that the ARDL models satisfy all assumptions by following the various strategies discussed before. In particular, the order of integration of all variables needs to be checked (particularly the wage rate variable) to ensure that none of them are of order $I(2)$ or higher as in this case, ARDL models are not applicable.

The next chapter summarizes the results and provides some concluding remarks.

5. Conclusion

This study analysed the high inflation episode during Sri Lanka's financial crisis of 2022 through two competing theoretical lenses—the monetarist view, which identifies money supply expansion as the root of inflation, and the post-Keynesian view, which believes that inflation is caused by distributional conflict compounded by currency devaluation. Two competing models based on these two theories were proposed for the Sri Lankan inflation by analysing financial and macroeconomic data and surveying secondary sources. Then, the models were evaluated using autoregressive distributed lag (ARDL) time-series models.

By proposing two competing models of inflation based on empirical data grounded in the political economy context of Sri Lanka, this study provides a pluralist understanding of the financial crisis in general and the inflation dynamics in particular. Given that the general discourse on the issue is dominated by the monetarist view and that empirical studies based on post-Keynesian inflation theory are rare for South Asian countries, the present study seeks to enrich the debate through empirically rooted analysis.

The econometric analysis found little evidence to support either theory, i.e., neither money supply nor exchange rate are found to be significant in all except one model, which identifies the exchange rate as a significant determinant of inflation. The econometric analysis was severely limited by the small sample size and several challenging features of the data, for example, unclear orders of integration of some variables. Further, the data suffered from discontinuities in reporting that hindered reliable analysis.

To overcome these limitations, future work can explore several possibilities. For example, expanding the scope of the models to include more time lags in the dependent variables may overcome some crucial limitations of the present models, such as the non-normal distribution of residuals. Further, structural breaks in the data, such as those that can result due to changes in exchange rate policy in the past two decades, should be considered and the underlying dynamics of the Sri Lankan economy investigated further to refine the model parameters or modelling strategies.

In addition, non-parametric models, such as Bayesian models, may be explored if ARDLs are found to be unsuitable for the given data set. However, as non-parametric methods can obscure the structural dynamics of the system under complicated statistical techniques, they should be treated as auxiliary models rather than a substitute for a thorough structural understanding of the data. Finally, cointegration tests need to be conducted to determine whether stable long-term relationships exist between the different variables.

In conclusion, the present study empirically developed two alternative models of inflation during the Sri Lankan financial crisis of 2022 based on competing monetarist and post-Keynesian theoretical frameworks. The econometric evaluation of the two models ran into several challenges due to limitations of available data. Possible avenues for future work were proposed to overcome these challenges and empirically establish whether money supply or exchange rate fluctuation was significant in causing the high-inflation episode.

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Economic Policies for the Global transition (EPOG+)
Plagiarism declaration

The following statutory declaration is a part of the thesis, and should be included in the bound work.

I, the undersigned,

Last name: Biswas

First name: Pranandita

Cohort: 2022–2024

Major/minor: Minor C3

One or two-year programme: Two-year programme

Title of Master's thesis: Econometric analysis of competing theories of inflation in Sri Lanka—Money supply or exchange rate?

Name of supervisor 1 (Paris): Jonathan Marie

Name of supervisor 2 (first year institution): Jonas Bunte

Name of additional supervisor: N/A

Hereby formally declare that I have written the submitted Master's thesis entirely by myself without anyone else's assistance. Where I have drawn on literature or other sources, either in direct quotes, or in paraphrasing such material, I have referenced the original author or authors and the source in which it appeared.

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Appendix 1: Descriptive statistics

Table A1.1. Descriptive statistics of all variables used in model.

Variable	N	Mean	Median	Std. dev.	Min.	Max.
NCPI, adjusted to base 2013[1]	120	148.70	126.90	54.05	103.00	281.70
log (NCPI)	120	4.95	4.84	0.30	4.63	5.64
Δlog (NCPI)	119	0.008	0.005	0.019	−0.035	0.103
Δlog (NCPI), deseasonalized	119	0.008	0.006	0.017	−0.019	0.090
Inflation (ΔNCPI)	119	1.50	0.80	3.82	−3.90	22.80
log (Inflation)	119	0.20	0.18	1.06	−2.30	3.13
Δlog (Inflation)	118	−0.008	0.02	1.24	−3.91	3.17
Broad money $M2$ (LKR[2], millions)	120	6747223	6423232	2586522	3094570	11485069
log ($M2$)	120	15.65	15.67	0.40	14.95	16.26
Δlog ($M2$)	119	0.01	0.01	0.007	−0.007	0.04
Δlog ($M2_{ds}$)	119	0.01	0.01	0.007	−0.007	0.04
Real exchange rate e_R (w.r.t USD)	120	94.04	92.83	12.85	61.74	112.67
log (e_R)	120	4.53	4.53	0.14	4.12	4.72
Δlog (e_R)	119	−0.003	0.0005	0.04	0.25	0.13
Wage rate $(\frac{w}{p})$[3]	106	1.26	1.26	0.11	1.06	1.44
log $(\frac{w}{p})$	105	0.23	0.23	0.09	0.06	0.37
Δlog $(\frac{w}{p})$	105	−0.0002	0.0001	0.02	−0.08	0.05
Real GDP[4] (LKR, millions)	120	4132291	3865245	1328739	2483977	7339004
$\Delta \log(GDP)$	119	0.009	0	0.06	−0.28	0.29
Nominal interest rate i	120	13.23	13.46	2.27	9.37	18.70
Δlog (i)	119	−0.0003	−0.004	0.03	−0.05	0.17

[1]Adjustment discussed in Section 4.1.1 of thesis; [2]LKR: Lankan rupees; [3]Wage index data unavailable after October 2022; [4]Quarterly GDP triplicated to generate monthly data

Appendix 2: CPI base year adjustment

Base year conversion is done using the following formula:

$$p_{y,2013} = p_{y,2021} \times \frac{p_{2021}}{p_{2013}}, \quad \text{Eq. 4.1.}$$

where $p_{y,b}$ is the price in year y in terms of base year b, and p_r is the GDP deflator of year r.

The conversion is calibrated on data for the year 2022. The data and relative errors are listed in Table A2.1.

Table A2.1. Base year conversion.

Month	NCPI, base 2013	NCPI, base 2021	NCPI, adjusted	% error between base 2013 and 2021	% error between base 2013 and adjusted
January	166	131.7	−20.7	177.7	7.0
February	167.8	132.9	−20.8	179.3	6.9
March	172.7	137.3	−20.5	185.2	7.3
April	190.3	151.7	−20.3	204.7	7.6
May	208.7	166.3	−20.3	224.4	7.5
June	231.5	183.5	−20.7	247.6	6.9
July	244.4	193.1	−21.0	260.5	6.6
August	250.4	197.7	−21.0	266.7	6.5
September	256.2	201.9	−21.2	272.4	6.3
October	256.9	201.6	−21.5	272.0	5.9
November	256.3	200.3	−21.8	270.2	5.4
December	256.3	200.4	−21.8	270.4	5.5
Mean % error			**−21.0**		**6.6**

Appendix 3: Stationarity tests for control variables

Table A3.1. Stationarity test results for log-transform of real GDP.

	ADF	PP	KPSS
Level	−3.16	−15.96	2.20***
First difference	−7.19***	−93.41***	0.08

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

$\log(GDP)$ is $I(1)$.

Table A3.2. Stationarity test results for log-transform of nominal interest rate.

	ADF	PP	KPSS
Level	−3.28*	−6.57	0.22***
First difference	−3.56**	−18.62	0.12***

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

$\log(i)$ may be $I(1)$ or $I(2)$.

Table A3.3. Stationarity test results for log-transform of wage rate up to October 2022.

	ADF	PP	KPSS
Level	−0.13	1.85	1.17***
First difference	−6.43***	−78.16***	0.47**

*Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01; ADF tests performed at lag = 1 in keeping with theoretical models*

$\log(wage\ rate)$ may be $I(1)$ or $I(2)$.