Forecasting the Economic Crisis of Sri Lanka *vis-à-vis* Time Series of its Inflation Rate

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**Abstract:** An economic system is a region where products and services are manufactured, distributed, traded, and consumed. It is generally understood to be a social realm that places an emphasis on the behaviors, philosophies, and material manifestations connected to the creation, utilization, and strategic planning of exhaustible resources. One's civilization, principles, professional training, technological progress, heritage, social hierarchies, polity, judicial framework, and environmental assets are all major determinants of an economy's processes. These elements establish the parameters and circumstances under which a financial system operates in addition to providing context and content. In other phrases, the financial realm is a collective domain made up of connected human behaviors and exchanges that cannot exist independently. Sri Lanka’s Island nation is experiencing a continuing financial downturn that began in 2019. Since independence in 1948, this nation has endured its worst economic meltdown. Unexpected levels of inflation, a close to complete exhaustion of foreign currency reserves, a shortage of medical aid, and a rising price of basic commodities are the results. The emergency has been reported to have originated because of numerous com-pounding factors such as tax reductions, printing money, a countywide regulation to switch to natural or biological agriculture, the 2019 Sri Lanka Easter bombings, and the implications of the COVID-19 pandemic in Sri Lanka. The resulting financial difficulties contributed as in 2022 Sri Lankan demonstrations. In this article we would investigate the Inflation Rates of Lankan Economy from 2021 till date. The time series data have been used to predict the Inflation Rate of Sri Lanka for the coming 6 months (till September 2023). We made use of N-BEATS (Neural Basis Expansion Analysis for interpretable Time Series forecasting) for this multi-step ahead forecast. The authors hope to schlep the Lankan Administrators to take governance from the predictions made in this paper that might help them in sense to improve the situation.

**Keywords:** Lankan Administrators; Inflation Rate; Artificial Intelligence; Time Series Forecast; Economy

1. Introduction

Economy is a portion where things are manufactured, distributed, traded, and consumed. Individuals, companies, institutions, or governments all qualify as economic agents. When two or more parties or groups agree on the price or worth of the item or service that is being exchanged, which is generally measured in a given asset, a financial transaction takes place. However, only a limited amount of economic activity is represented by financial exchanges. Manufacturing, where it makes use of labor, financing, and environmental assets, tends to stimulate economic activity. It has altered over a period of time because of advanced technologies, innovation, new services, workflows, smaller businesses, and revenue-generating capabilities like those that create intellectual property, changes in employment relationships, and broadening and diversifying global market. Recently news covered the decline of Sri Lankan Economy with a huge dip in GDP and surge in Inflation Rate. In 2019, Sri Lanka's capitalistic society had a nominal GDP of $84 billion and a purchasing power parity GDP of $296.959 billion (PPP). From 2003 to 2012, the nation had grown by 6.4 percent each year, significantly more than its contemporaries in the region. The expansion of quasi trade sectors, that the World Bank alerted would be neither viable nor fair and equal, was the main driver of this economic expansion. Since that time, expansion has slowed. The World Bank downgraded Sri Lanka from upper middle-income prestige to lower middle income in 2019 with an annual household income of 13,620 PPP dollars or 3,852 nominal US dollars as per 2021 population estimate. Significantly outperforming several other South Asian nations, Sri Lanka had achieved the Millennium Development Goal (MDG) objective of cutting severe poverty while remaining on track to accomplish the majority of the remaining MDGs. By 2016, Sri Lanka's national poverty score stood at 4.1%. Following the conclusion of its three-decade-long civil war, Sri Lanka has started to concentrate on long-term strategically important and structural development issues. It aspires to become an upper middle-income nation. In 2019, facilities made up 58.2% of Lankan financial system, slightly higher compared from 54.6% in 2010, market made up 27.4%, up from 26.4% then and agricultural production made up 7.4%. Despite the existence of a competitive agricultural export sector, technological advancements have been slow to reach the domestic sector that is protected. Sri Lanka is the world's largest producer of solid and industrial tires, and its apparel industry is rising through the value chain. However, the recent ten-year increase in trade protection has also raised worries about the resurgence of policies that are inward-looking. Due to the nation's newly acquired standing as a shipment and aerospace hub, docks and airport terminals generate revenue in the industrial sector. The world's biggest trans - shipment center in Southern Asia is the Port of Colombo. The communication technological and software industries are expanding, able to compete, and expose to international competition. The tourism industry is rapidly growing. Travel & Leisure decided to name Sri Lanka the ideal island and Lonely Planet the best country to attend in 2019. India, the United States, and the United Kingdom are Sri Lanka's main export markets. The primary vendors for imports are China, India, and the UAE. A number of self-governing rating downgrades have occurred as a result of ongoing worries about Sri Lanka's economic weakness, money creation, and government borrowing since the COVID-19 pandemic's start. Following a rise in monetary destabilization brought on by debt revenues, import bans and import - substituting have become more severe. One of the top ten nations in the world for how it has handled the COVID-19 pandemic is Sri Lanka. The very worst financial disaster to hit Sri Lanka in 73 years was formally announced by the administration in 2021. After 2 years of cash printing to endorse tax breaks, Sri Lanka reported that the majority of international loan repayments had been delayed as of April 12. This marked the end of an impeccable existing debt track record.

A time series as mathematical concept is a collection of information points that have been outlined, plotted, or numbered according to time. A data series is most frequently a pattern captured at a series of spaced evenly moments in time. As a result, it is a collection of discrete values in time. A run chart, a type of temporal line chart, is regularly used to plot a time - series data. Time series are employed in numerous fields related to applied sciences and engineering that use temporal measurement results, including statistical data, information theory, information processing, quantitative methods, arithmetical financial services, meteorology, seismic prognostication, electroencephalography, control theory, astrophysics, and telecommunications equipment. Time series evaluation refers to techniques for deriving useful statistics and other aspects of time series data through analysis. Time series forecasting refers to the technique of using a mathematical model to foresee possible trends based on values that have already been observed. Although regression analysis is frequently used to test associations among one or even more distinct time-series, this kind of evaluation is not typically referred to as "time series analysis," which specifically refers to associations among different times periods within a short series.

To investigate the recent economic crisis in Sri Lanka, we have collected Economical Data directly from the Lankan Officials. We have taken Inflation rate as the principal component for our Research. In the economics literature, inflation means a rise in the overall price of commodities and services in a country. For every unit of currency can purchase a smaller number of products and services as the overall price index increases, so inflation is associated with a decline in the money's value as a currency. Deflation, which is a drop in the broader level of the cost of products and services, is the contrary of inflation. The annualized rate percentage growth in a price index in general, or inflation rate, is the most widely used indicator of inflation.  Consumer Price Index (CPI) is frequently employed for this reason because prices that households experience do not rise uniformly. In the United States, wages are also calculated using the employment cost index. For multi-step ahead future forecast, we have employed Neural Basis Expansion Analysis for interpretable Time Series forecasting (N-BEATS). The same have been compared with several other Time Series Forecasters, like Bidirectional LSTM, Reservoir Computing, etc.

2. Historical Lankan Economy

It is recognized from ancient writings that have survived on the archipelago and from records of foreign travelers that Sri Lanka has a longstanding experience as a trading center due to its location at the center of east-west commerce and intensive agriculture in the hinterland. After the *Indo-Aryan* migration, ancient monarchs constructed irrigation reservoirs, and numerous them still exist today.  They are connected to more contemporary structures through an irrigation system. Around 400 BC, a Chinese mystic *Fa Hsien* visited India as well as Sri Lanka. In his writings, he describes local myths about traders from other nations doing business with island's original primitive inhabitants until Indo-Aryans arrived. *Faxian* described the region in "A Record of Buddhistic Kingdoms" as "the nation that initially had little or no sentient residents but then was inhabited by spirits and serpent worshipers with whom vendors of different nations conducted on a commerce." He describes precious stone and pearl fisheries that are subject to a 30% king-imposed tax. To get to the island, the monk had left India "in a large merchant vessel." The fact that he "took passage in a large merchantman on board which were more than 200 men" to return to China and then showed up in Indonesia after the vendors were compelled to abandon some of their cargo because of a hurricane demonstrates Sri Lanka's engaged coastline and long-distance seaborne trading relationships. *Cosmas Indicopleustes*, an Egyptian vendor and hermit who traveled to the Indian subcontinent in the sixth century, wrote extensively about Sri Lanka as a commercial hub and referred to the archipelago as *Taprobane* as well as *Sieladiba*.

Once Sri Lanka won its independence in 1948, it was ahead of several Asian countries and had financial and societal indicators pretty similar to Japan. The social indicators in Sri Lanka have always been rated as being extraordinarily high.  Even by final decade of the nineteenth century, 21.7% of the population was literate. A 1946 policy to eradicate malaria reduced the mortality rate from 20 per 1000 in 1946 to 14 per 1000 in 1947. A Lankan child's average lifespan in 1948 was 54 years, merely a little less than Japan's 57.5 years. 1950 saw a mortality rate for infants of 82 per 1,000 live births in Sri Lanka, 91 in Malaysia, and 102 in the Philippines. Sri Lanka emerged as successful new international location, with its prime point in the Indian Ocean anticipated to afford it a good opportunity compared to its majority Asian neighbors to enroll a rapid economic growth take-off. However, the enthusiasm of 1948 had faded by 1960 as a result of poor economic policy and management decisions. East Asia was catching up to Sri Lanka. In 1950, Sri Lanka had a seasonally adjusted primary school enrolment proportion of 54%, followed by India with 19%, Korea with 43%, and the Philippines with 59% of the population aged 5 to 19. Sri Lanka's primary school enrollment percentage was only 74% in 1979, while it was 85% in the Philippines and 94% in Korea. When Sri Lanka won independence, it had a sound macroeconomic system. On August 29, 1950, Sri Lanka established a central financial institution and joined the IMF, joining the *Bretton Woods framework* of fixed exchange rates. By 1953, a new law had stiffened trade restrictions. *Ceylon* had a per capita GDP of $152 in 1960, compared to $153 in Korea, $280 in Malaysia, $95 in Thailand, $62 in Indonesia, $254 in the Philippines, and $149 in Taiwan. However, in 1978, Malaysia's GDP per capita was $588, Indonesia's was $370, and Taiwan's was $505. *The Janatha Vimukthi Peramuna Rebellion* in the Countryside and the beginnings of a civil chaos between the North and East were also witnessed in the 1970s.

Colombo gave up its shipping industrialization strategy and socialistic fiscal plans in favor of market- and export-oriented barter in 1977. Afterwards, Sri Lanka would be recognized for managing dynamic sectors of the economy like food preparation, clothing and textiles, beverages and food production, information technology, healthcare, and financial services. The proportion of individuals from the middle class enhanced in the 1970s. Under the rule of Prez *J.R. Jayawardana*, Sri Lanka started steering away out of a social democrat alignment in 1977, and the UNP ruled the nation from 1977 to 1994. Since that time, the administration has started to privatize, deregulate, and expose the economy to foreign competitors in the market.  In 2001, Sri Lanka was on the verge of bankruptcy due to debt that was 101% of Gross Domestic Product. Following that,  the nation hastily agreed to a cessation of hostilities with *Liberation Tigers of Tamil Eelam* and arranged sizeable foreign loans, the approaching financial crisis was avoided. Following 2004, the UPFA congress focused on producing goods in large quantities for household use, such as rice, grains, and certain other agricultural commodities. Steadily increasing deregulation, financial change, and a focus on export-oriented expansion all contributed to strengthening the economy's effectiveness after the *Janatha Vimukthi Peramuna* uprising was put down, pushing Gross Domestic Product to 7% in 1993. Cultivation harvests only compensated for 20% of exports in 1996 down from 93% throughout 70s, whilst still textile industries and apparel completely fabricated 63%. All throughout 1990s, Gross Domestic Product increased at an average yearly percentage of 5.5%, but in 1996, a dry spell and a worsening terror threat caused growth to fall to 3.8%. Between 1997 & 1998, the economy was recovering with economic expansion of 6.4% and 4.7%, respectively, although in 1999, the growth decelerated to 3.7%. The monetary authority of Sri Lanka advises Sri Lanka to break up the administration's stranglehold on agricultural imports, broaden economic incentives in nonplantation agricultural production, and foster more rivalry in the banking segment for the upcoming round of legislative changes. In the subsequent decades, the financial system faced numerous domestic and international economic and political obstacles, resulting in imbalanced productivity expansion. Over the years 1991 to 2000, the mean yearly increase in GDP was 5.2%. However, Economic growth in 2001 was hostile 1.4%, marking the very first decline since self-government. Numerous worldwide and domestic financial issues as well as the terrorist attacks in the US and Sri Lanka had an effect on economic performance. The catastrophes also made it clear that initiatives were required in order to address the nation's economic inequities and fundamental legal flaws. Parliament elections in December brought an end to the year, with the *United National Party* winning seats in the House whereas the *Sri Lanka Freedom Party* kept the presidency. The economy benefitted immensely from reduced interest rates, a rehabilitation in household consumption, an enhance in international tourism, a renaissance of the stock market, and an enhance in outside investment in during short-lived peace negotiations between 2002 as well as 2004. The financial system began to slowly improve in 2002. Sri Lanka has already been able to cut back on defense spending throughout this time and start concentrating on managing its significant public enterprise liabilities. Powerful service industry growth helped the economy grow by 4% in 2002. The economy's agricultural industry made some progress toward rehabilitation. Inflows of FDI totaled about $246 million in 2002. The *Mahinda Rajapakse* administration stalled the privatization, established a number of new businesses, and re-nationalized former state-owned businesses, including one for which the courts ruled that the deregulation was illegal. Numerous frauds were exposed in some state-owned conglomerates, which led to people making enormous losses and an increase in paternalism. They also became understaffed and overworked and less effective. Because of purported human rights abuses throughout this time, the EU terminated Sri Lanka's GSP and furthermore preferential market access, costing the country about US$500 million annually. In 2005, when the military conflict flared up again, federal spending skyrocketed. A few donor nations reduced their aid to the nation because of the country's rising conflict and gangsterism. Inflation reached its peak at 20% as a result of the pointed rise in global oil price, coupled with the financial impact of the civil conflict.

The rebellion and constantly battling between Lankan Government and the LTTE continued to cast a shadow over the financial system prior to 2009, but the conflict reached its conclusion on May 19, 2009, with a decisive win for the Sri Lankan Government with the complete annihilation of the LTTE. Due primarily to the surge in non-tradable industries, the financial system started expanding more quickly after the conflict ended in May 2009, reaching 8.0% in 2010 and 9.1% in 2012. Nevertheless, the surge did doesn't last longer, and GDP growth for 2013 started falling to 3.4% in 2013, but only mildly rebounded to 4.5% in 2014. The Western Region Megapolis will be built in the contemporary region of the island nation of Sri Lanka, as according administration policies as well as economic initiatives announced by the head of state and chief of nationwide policies and financial relationships *Ranil Wickremesinghe*. Travel locations in addition to the establishment of numerous entrepreneurial and technological project areas with a variety of industry-specific specializations have also been considered. Due to rising public debt and a constitutional turmoil that caused the nation's debt assessment to be lowered, Sri Lanka was in threat of experiencing economic ruin in the middle to late 2010s. The administration was successful in getting the EU to end its prohibition on Sri Lankan fishery products in 2016, which caused a 200% increase in fish shipments to the EU. In 2017, as human rights symptoms worsen, the European Commission proposed to reinstate the GSP plus institution for Sri Lanka. Additionally, Sri Lanka's government revenues as a percentage of GDP expanded from 10% in 2014—the lowest level in nearly 20 years—to 12.3% in 2015. Despite reforms, *Bloomberg* ranked Sri Lanka as one of the countries that posed the greatest risk for shareholders. Additionally, growth rate dropped even more, to 3.3% in 2018 as well as 2.3% in 2019. Between 2015 as well as 2019, the rupee dropped from 131 to 182 against the US dollar, increasing external debt and putting an end to a span of largely stable household consumption. Over the past ten years, China has surpassed both Japan as well as the World Bank as Sri Lanka's top debt collector. Tourist industry, tea exports, clothing, textiles, crop yield, and other farm commodities are the nation's primary sector of the economy. In particular with respect to these aspects of the economy, employment abroad makes a significant contribution to foreign exchange. From the beginning of the 2020s, the heavily indebted nation is going through a financial downturn that has resulted in months of nutrition, energy, and power shortfalls for the populace. Per the government statistics, inflation has reached a high of 57%. *Ranil Wickremesinghe*, Sri Lanka's Prime Minister, announced in front of the legislature in June 2022 that the country's economy had collapsed and it was no longer able to pay for necessities.

3. Data and Methods

3.1 Data Description

Not much data is made opensource by the Lankan Authorities. Following necessary protocols and confidentiality, we managed to gather respective Inflation Rates for the time period January’21 to March’23. The authors of this article, believe in *Sharing is Caring*. We made the data openly and freely available for all at