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Impact of Non-Cash Payments on the Economic Growth of Sri Lanka

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Abstract

There has been extensive discourse on the topic of cashless payments, and their global adoption has witnessed exponential growth in recent years. Cash transactions pose certain challenges, notably the impracticality of managing physical currency and the restricted accessibility of financial institutions to withdraw cash. Multiple research studies have affirmed the positive influence of cashless payments on economic growth, thus highlighting their crucial significance. The present study aims to examine the effects of cashless payments on the economy of Sri Lanka. In particular, the investigation focuses on the measurement of economic growth using the real Gross Domestic Product (GDP), and the analysis of cashless payment systems through the employment of Real-time Gross Settlement System (RTGS), Cheque (CHE), Sri Lanka Interbank Payment System (SLIPS), and Internet Banking (IB), Mobile Banking (MB), Credit Card (CC), Debit Card (DC) transactions as representative indicators. The data utilized in this study is based on secondary sources in the form of time series data, spanning from quarter 01 of 2015 to quarter 3 of 2022. The AutoRegressive Distributed Lag (ARDL) model is then employed for the purpose of data analysis. Upon conducting an analysis of the long-term impact of various payment methods on economic growth, it is determined that RTGS (94% of total digital transaction) and SLIPS have a statistically significant positive relationship with economic growth. Conversely, IB exhibits a significant negative relationship which requires targeted improvements. Notably, there is no significant impact on economic growth observed with respect to the CHE, CC, DC, and MB indicating the need for technological advancements and integration. In the short run, it can be inferred that there is a significant positive correlation between RTGS, CHE, IB, and MB. Conversely, the analysis indicates a significant negative relationship between the SLIPS and DC payment methods. It is worth noting that the analysis does not reveal any significant association between the CC payment method and economic growth. Hence, this study conclude that digital currencies have on overall positive impact on short and long run in Sri Lankan economic growth and highlights the importance of prioritizing efficient payment systems that foster the economic growth while addressing the challenges with less effective methods. Policy makers and financial institutions can enhance the efficiency of payment ecosystems, ultimately driving sustainable economic growth.

Keywords*: Auto Regressive Distributed Lag (ARDL), Cointegration, Error Correction Models, Cashless Payments, Economic Growth, Unit root Test.*

1. Introduction

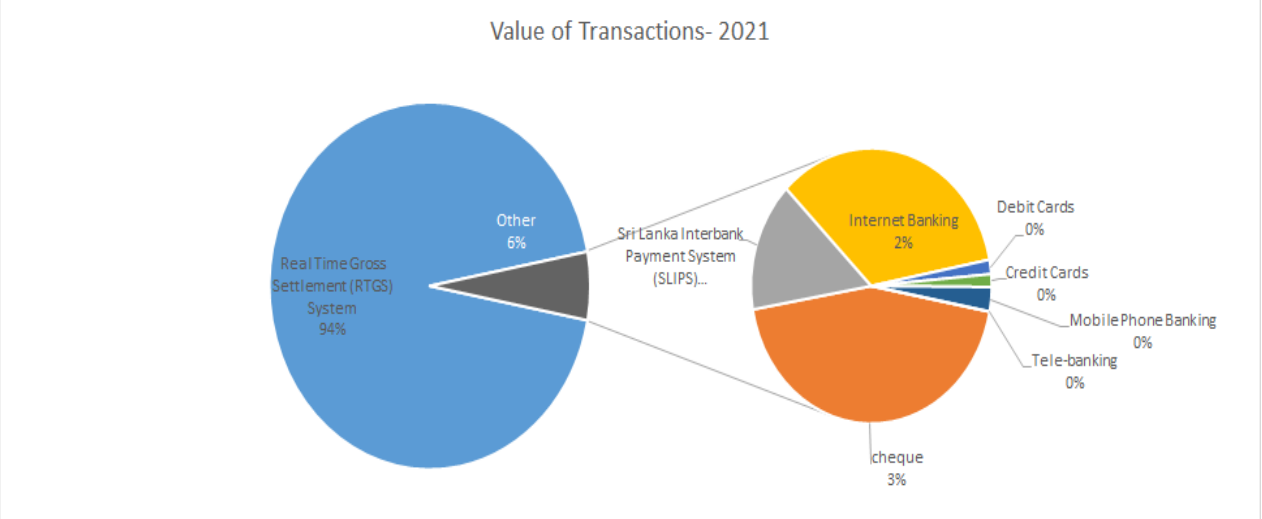
Transactions can be made via cash and non-cash payment mechanisms. Non-cash payments penetrated globally at an exponential growth rate in recent years due to the increasing adoption of smartphones and the widespread availability of internet access (Bagale et al., 2021). Cashless payments refer to transactions that do not consist of physical/hard cash and are made mainly through electronic methods such as mobile wallets, credit and debit cards, and online payment systems (Suhaimi et al., 2022).

Diffusion of innovation theory facilitates understanding the shift from cash to the non-cash payment due to the benefits it brought to society (Krivosheya, 2020). Some of the benefits of cashless payments are reducing transaction costs, increasing efficiency, and promoting financial inclusion. Further, this way of transaction improves the hygiene among food sellers than using physical cash. Physical cash system needs more paper costs, printing, and handling costs while possible theft is high. Further, Jebarajakirthy and Shankar (2021) proved that customers mainly use cashless payments due to convenience which stimulates consumer spending and eventually contributes to economic growth. According to Wong et al. (2020), growth of a country is measured by GDP which is a combination of consumption, private investment, and government expenditure. Through cashless payment, all three transition channels will contribute to the growth of the country.

Parmar (2018) stated that electronic transactions act as audit trails and taxes on transactions can be easily collected as all the transactions are recorded digitally. Maurya (2019) mentioned that besides economic growth, cashless payment contributes to the growth of other sectors such as telecom and e-commerce industries. Further, cashless payment allows an increase the industry productivity and drives toward the sustainability of economic activities (Givelyn et al., 2022). However, there are limitations as well. Losing personal information such as PIN number, passwords, and other sensitive information is one of the major drawbacks of the cashless payment method. Further, the community which has less about the digital platform refuses to use, and limited technological facilities may also deter the usage of cashless payment (Parmar, 2018).

In Sri Lanka, the usage of non-cash payments increased in recent periods (Central Bank of Sri Lanka, 2021). Non-cash payments are supported by large and retail value payment systems. Real Time Gross Settlement system (RTGS) is the only payment system that exists under large value payments system while main cheques clearing system, Sri Lanka Interbank Payment System (SLIPS), Internet Banking, Credit card, Debit card, ATM terminals, POS terminals, Mobile phone banking and Tele banking represent the retail value payments systems. In 2021, out of total value transaction of LKR 302 trillion, 94% was produced from RTGS while remaining was produced from retail value payments systems as shown below in the figure 01. (Central Bank of Sri Lanka, 2021).

Figure 1: Value of Transactions (2021)



Source: Central Bank, Sri Lanka.

Research on digitalized finance and its impact on economic growth has gained momentum in recent years. The emergence of cashless payment systems in Sri Lanka has shown rapid growth, making it an interesting area for empirical study to measure the impact of such systems on economic growth. The objective of this study is to identify the impact of cashless payments on the economic growth of Sri Lanka.

To measure the non-cash payment mechanism, the value of transactions of the Real Time Gross Settlement System (RTGS), Cheque, Sri Lanka Interbank Payment System (SLIPS), Internet Banking (IB), Mobile Banking (MB), Credit Card (CC), and Debit Card (DC) are considered. To measure economic growth, Gross Domestic Product (GDP) of Sri Lanka is considered.

The study samples are taken on a quarterly basis from the 1Q 2015- 3Q of 2022. This paper intends to contribute to the understanding of the impact of cashless payments on economic growth in Sri Lanka, providing insights into how these payment systems can support economic development in the country. The significance of the study is as stated above, non-cash payments are essential to enhance the economic growth in a theoretical point of view (Noman et al., 2023; Agustiawati et al., 2023; Grzelczak & Soliwoda, 2023; Givelyn et al., 2022; Wong et al., 2020; Zandi et al., 2013; Hasan et al., 2012). However, this must be proven empirically in Sri Lanka to enhance the validity of the statement. Hence this study focuses on finding what type of digital payments significantly supports to growth of economy. Therefore, the findings of this paper can be used by Central bank of Sri Lanka, government, businessmen, economists and other researchers for the growth of country and to bring new knowledge on this topic area.

The following section provides a comprehensive review of both theoretical and empirical literature, followed by a detailed exposition of the methodology, including model specification and data

collection. The subsequent section presents the results and subsequent discussion, culminating in concluding remarks that provide limitations of the study and scope for future research.

2. Literature Review

Many researchers studied the impact of cashless payments on economic growth. This paper focuses on the impact of cashless payment on economic growth of Sri Lanka. Theoretically many theories support this concept. The payments systems theory suggests that payments systems play an essential role to carry out the economic transaction which eventually enhances economic growth of the country by reducing the transaction costs, increase the security and speed of transactions. Another theory which is the technology adoption theory indicates that implementing new technology increases productivity and efficiency which therefore reduces the costs of carrying out business activities and ensures economic growth. Further, financial inclusion theory suggests that to stimulate economic growth and reduce the poverty level, access to financial services is a key requirement. Further network externalities theory suggests that when many people use, there will be an increase in the value of technology and services which contributes to economic expansion. Diffusion of Innovation theory explains how new ideas, products, and technologies spread through society. This theory is particularly relevant in the context of non-cash payment systems, where the adoption of new payment technologies and practices is essential for the growth and development of the financial sector. On top of these theories, the endogenous growth theory indicates that technological advancement is a crucial component of the economic growth process, resulting in amplified returns to scale.

The diffusion of Innovation theory introduced by Roger in 1995 was referred to study the link between electronic payments and economic expansion (Grzelczak & Pastusiak, 2020). In this study, Western, Central and Eastern European countries were taken for the analysis from 2005 to 2018 and found that there is a positive link between cashless payment and economic growth in Western European regions while due to lack of penetration, in Central and Eastern European, only card payments indicated a positive relationship.

Based on empirical literature review, contradicting views were obtained. However, most researchers support the positive relationship between cash-less payments and the economic growth of the countries in the long run. (Wong et al., 2020; Zandi et al., 2013; Givelyn et al., 2022; Hasan et al., 2012). Conversely, Ravikumar et al., (2019) confirmed insignificant relationship in long run in between cashless payments and economic growth. Others confirmed that only in long run the relationship was existed (Tee and Ong, 2016; Narayan, 2019).

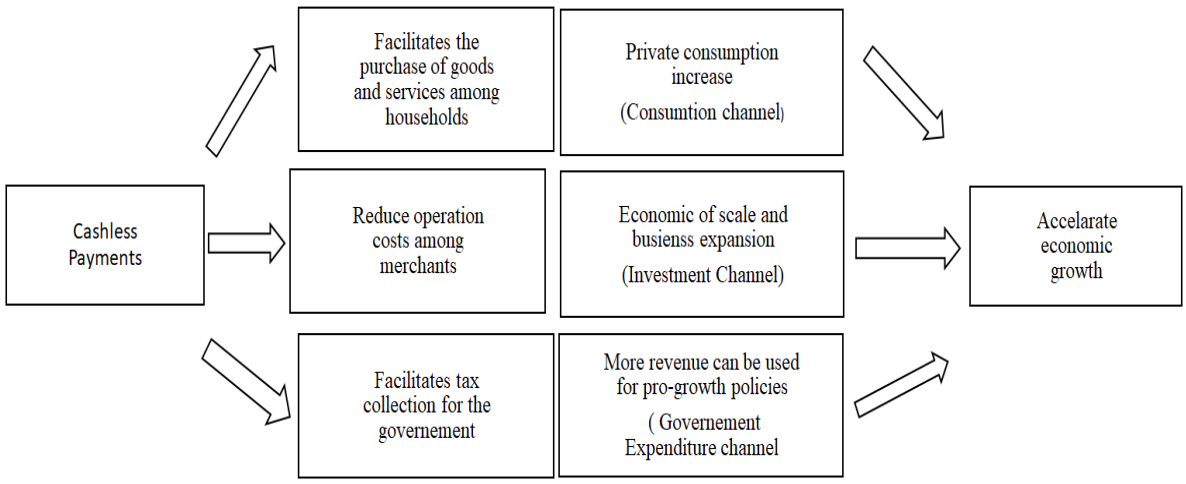
Wong et al., (2020) found a statistically significant strong positive relationship in between cashless payments and the economic growth of OECD countries by using Generalized Method of Moments (GMM). Further this study revealed countries which generate higher level of income, have more

developed information and communication technologies, and have a higher levels of financial development possess a stronger relationship between these variables. Another study carried out by Givelyn et al., (2022), also supported the positive relationship in Indonesia market. By using data from the period of January 2018 to December 2022, Auto Regressive Distributed Lag (ARDL), researchers confirmed before and during the COVID-19 pandemic, a strong relationship was found and during the pandemic the relationship was bigger. Further, another study carried out based on 56 countries confirmed that move towards electronic payment methods increases the economic growth through rapid growth in consumption (Zandi et al., 2013).

In another study, researchers investigate the relationship between economic growth and electronic retail payments in 27 European countries from 1995 to 2009. The authors discover a positive correlation between real economic indicators and digital retail payment technology. The empirical finding demonstrates that electronic retail payments can boost economic productivity, consumption, and trade while also accelerating trade and economic growth. Additionally, the same study comes to the realization that card payments have the most favourable effects on economic growth (Hasan et al., 2012).

According to Wong et al., (2020), economic growth can be stimulated by cashless payments as through three channels of consumption, investment and government expenditures as follows.

Figure 2: Cashless Payments' Impact On Economic Growth Channels



Source: Wong et al., (2020).

In this chart, cashless payments allow customers to possess instant cash, thereby accelerating consumption. The resultant effect of this would be a stimulation of household consumption, thereby fostering economic growth (Zandi et al., 2013). Brzoska and Hjelm (2020) conducted a study on the influence of cashless payment systems on consumption patterns and found that there exists a strong correlation between on-the-go personal consumption and cashless transactions within the Swedish

market. Furthermore, the adoption of cashless transactions has the potential to reduce the costs associated with paper-based transactions, resulting in lower operational expenses and increased efficiency, which in turn facilitates business expansion and investments, and contributes to overall economic growth (Hasan et al., 2012). Another study revealed that the cost of digital payments is lower than non-digital payments by 53% for small and medium enterprises in 2018 and increased revenue by 8% after having digital operations in the USA (Visa, 2018). There is evidence that cashless transactions make it easier to collect value-added taxes which can be used to balance the budget and spend more, thereby fostering the growth of the economy (Kearney A.T & Schneider F., 2013).

On the other hand, Tee and Ong (2016) investigated the connection between the cashless payment and economic growth by using Pedroni residual cointegration and Panel Vector Error Correction Model (VECM) for the period of 2000-2012 in five selected European countries. The Study discovered that adoption of one method of cashless payment affects other one in short run and impact on economic growth can be witnessed in the long time period only. Narayan (2019) reconfirmed this by investigating the connection between financial technology and Indonesia's economic growth between 1998 and 2018. This study demonstrates that fintech has a delayed positive impact on economic growth, with less impact in the first year but large economic contributions starting in the second. However, contradicting result found by Ravikumar et al., (2019). According to the study's findings, short-term economic growth is greatly impacted by digital payments. But, in the long run, digital payments have insignificant impact on economic growth. The research was conducted for the periods of 2011 to 2019 in India by using Ordinary Least Square regression, auto regressive distributed lag, co-integrated approach, and ARDL bound tests.

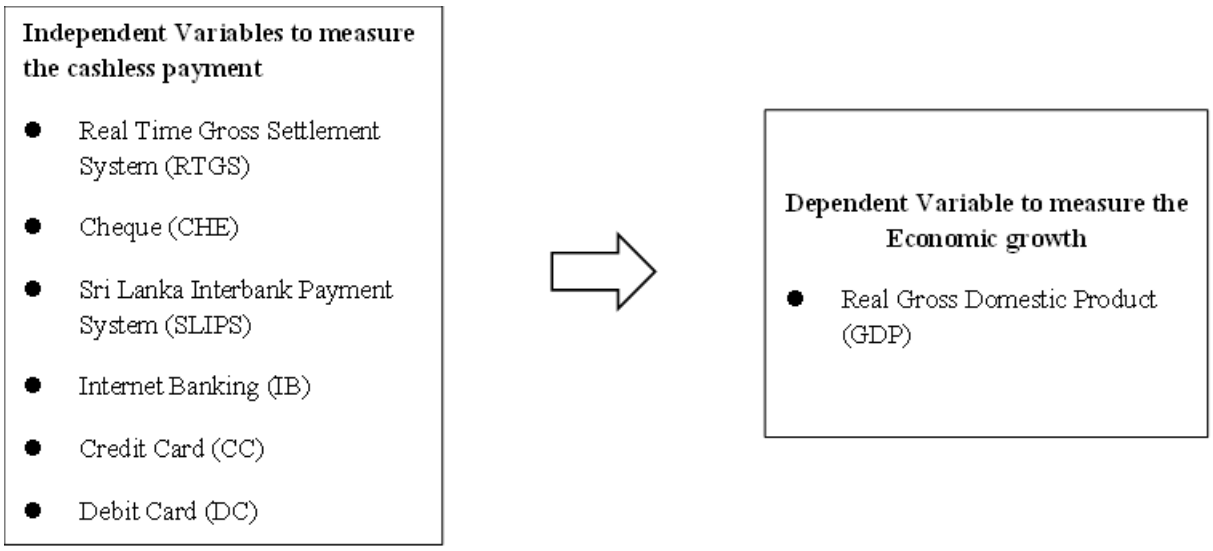
According to Aldaas (2020), when an economy shifts from developing stage to developed stage, usage of cashless transactions will also grow. The researcher found that relationship between electronic payments and economic growth varied by country. While Australia and Cananda showed a negative correlation, the UK and Saudi Arabia showed a positive one. In Saudi Arabia, the impact is strong in long run, but it weakens short term in Jordan. Hence, there is a need to do the analysis country wise before bringing a policy change rather than just following the global trends.

After conducting a literature review, it has been confirmed that there are conflicting results among different researchers. As a result, the following conceptualization has been developed with the support of the review.

2.1 Conceptualization

Following chart illustrates the conceptual framework of the study after studying the literature review.

Figure 3: Conceptual Framework



2.2 Operationalization

Table 1: Summary Statistics of the variables

Variables	Indicators	Measurement	Sources
Dependent Variable			
Real Gross Domestic Product (GDP)	Real Gross Domestic Production value	Log of Real Gross Domestic Production value	Ahmad et al., 2021; Lee et al., 2022
Independent Variables			
Real Time Gross Settlement System (RTGS)	Total Value Transactions	Log of Real Time Gross Settlement total transaction value	Aldaas, 2021; Central Bank of Sri Lanka, 2021; Agustiawati et al., 2023)
Cheque (CHE)	Total Value Transactions	Log of Credit Card transaction value	Aldaas, 2021; Central Bank of Sri Lanka, 2021; Noman et al., 2023

Sri Lanka Interbank Payment System (SLIPS)	Total Value Transactions	Log of Sri Lanka Interbank Payment System	Aldaas, 2021; Central Bank of Sri Lanka, 2021; Agustiawati et al., 2023
Internet Banking (IB)	Total Value Transactions	Log of Internet banking transaction value	Aldaas, 2021; Central Bank of Sri Lanka, 2021
Mobile Banking (MB)	Total Value Transactions	Log of Mobile banking transaction value	Aldaas, 2021; Central Bank of Sri Lanka, 2021
Credit Card (CC)	Total Value Transactions	Log of Credit Card transaction value	Lee et al., 2022
Debit Card (DC)	Total Value Transactions	Log of Debit Card transaction value	Lee et al., 2022

2.3 Research Hypotheses

The following hypotheses are formulated by the researcher to test the objective of the research based on the previous literature and theoretical understanding.

H1: There is a short run causal impact of cashless payments on economic growth.

H2: There is a long run impact of cashless payments on economic growth.

3. Methodology

The philosophical assumptions underpinning this research can be analysed in terms of their ontological, epistemological, and axiological dimensions. The ontological stance taken in this study is one of objectivism, which assumes that there is a universal truth regarding the impact of cashless payments on economic growth. The knowledge produced in this study is gathered through the application of the Autoregressive Distributed Lag (ARDL) method using Stata to understand the relationship. In addition, the research approach adopted in this study is one of detachment, wherein the researchers dissociate themselves from the research process. This study adheres to the value-free axiological assumptions, which entail a commitment to neutrality and objectivity.

Considering the philosophical assumptions outlined above, this research aligns with the positivist research paradigm and adopts a deductive research approach. Accordingly, the methodology employed in this study is quantitative in nature, which is well-suited to examining the impact of cashless payments on the economic growth of Sri Lanka. The secondary data was acquired from reputable source, the

Central Bank of Sri Lanka statistic data which is widely recognized for its accuracy, reliability, and comprehensiveness for the periods of Quarter 01 2015 to Quarter 03 2022.

The analytical approach adopted in this study is the Autoregressive Distributed Lag (ARDL) method, which is a popular econometric technique used to estimate the long-run relationships among variables. ARDL is particularly useful in situations where the variables under analysis may be non-stationary, meaning that they may exhibit trends, cycles, or other forms of systematic variation over time. ARDL is also capable of modelling the short-run dynamics between variables, which can provide valuable insights into the causal relationships among them.

Non-cash payments are facilitated by two distinct payment systems in Sri Lanka, namely large and retail value payments systems. Within the large value payments system, the Real Time Gross Settlement system (RTGS) remains the sole payment system in operation. Meanwhile, the Sri Lanka Interbank Payment System (SLIPS), Cheque, Internet Banking, Credit card, Debit card, ATM terminals, POS terminals, Mobile phone banking, and Telebanking represent the retail value payments systems. According to recent data from the Central Bank of Sri Lanka (2021), in 2021, the RTGS system accounted for 93% of the total value transactions, while the remaining 7% was facilitated by the retail value payments systems. This amounts to a total value transaction of LKR 302 trillion, highlighting the significant contribution of the RTGS system to the non-cash payments ecosystem.

3.1 Model Specifications The present study centres on a thorough examination of the effect of cashless payment systems on the economic growth of Sri Lanka. The investigation is based on a time series analysis spanning from the first quarter of 2015 to the third quarter of 2022 to determine the extent of the impact.

The following time series regression model is specified for this paper.

$$LnGDP = f(LnRTGS, LnCHE, LnSLIPS, LnCC, LnDC, LnIB, LnMB) \quad (1)$$

Where,

LnGDP = natural logarithm of real Gross Domestic Product

LnRTGS = natural logarithm of Real Time Gross Settlement value

LnCHE = natural logarithm of Cheque transaction value

LnSLIPS = natural logarithm of Sri Lanka Interbank Payment System

LnCC = natural logarithm of Credit Card transaction value

LnDC = natural logarithm of Debit Card transaction value

LnIB = natural logarithm of Internet banking transaction value

LnMB = natural logarithm of Mobile banking transaction value

As per the equations below, the estimation of the ARDL-Unrestricted Error Correction Model (ECM) for long run and short run are carried out.

$$\text{LnGDP} = \varphi 0 + \beta 1 \cdot Ln\text{GDP}._{t\text{-}1} + \beta 2 \cdot Ln\text{RTGS} \cdot_{t\text{-}1} + \beta 3 \cdot Ln\text{CHE} \cdot_{t\text{-}1} + \beta 3 \cdot Ln\text{SLIPS} \cdot_{t\text{-}1} + \beta 4 \cdot Ln\text{CC} \cdot_{t\text{-}1} + \beta 5 \cdot Ln\text{DC} \cdot_{t\text{-}1} + + \beta 6 \cdot Ln\text{IB} \cdot_{t\text{-}1} + \beta 7 \cdot Ln\text{MB} \cdot_{t\text{-}1} + \mu t$$

$$\Delta \cdot \text{Ln.GDP} \cdot t = \varphi 0 + \Sigma^{p}_{n=1}\ \varphi 1 \cdot \Delta \cdot Ln\text{GDP} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 2 \cdot \Delta \cdot Ln\text{RTGS} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 3 \cdot \Delta \cdot Ln\text{CHE} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 4 \cdot \Delta \cdot Ln\text{SLIPS} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 5 \cdot \Delta \cdot Ln\text{CC} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 6 \cdot \Delta \cdot Ln\text{DC} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 7 \cdot \Delta \cdot Ln\text{IB} \cdot_{t-i} + \Sigma^{q}_{n=0}\ \varphi 8 \cdot \Delta \cdot Ln\text{MB} \cdot_{t-i} + + \delta ecm \cdot_{t-1} + \mu t$$

Where,

$\varphi 0$ - constant

β1-β7 - coefficients of independent variables (long-run)

μt - white noise

φ 1- φ 7 - coefficients of first differentiated both exogenous and endogenous variables (short run)

δ - adjustment speed

ecm·t-1- one-period lagged error correction term

Δ - delta operator

4. Findings and Discussion

4.1 Unit root tests

In this study, time series analysis has been implemented, commencing with the initial step of testing the variables to ensure stationary behaviour at either levels or differences. Non-stationary data, possessing unit roots, are considered irrelevant in time series analysis since such data might contain non-constant means, non-constant variances, or seasonal effects. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests have been utilized to examine the stationary nature of the variables. The outputs from these tests provide insights into the levels of stationery, thereby facilitating the identification of a suitable econometric time series model.

The following table 2 shows the results of augmented dickey fuller and Phillips perron unit roots tests

Table 2: Time Series Stationarity Testing

Variable	Testing method	At Levels		First differences		Stationary (Absolute test statistic should be higher than 5% critical value)
		Constant (-1.950)	Trend (-3.600)	Constant (-1.950)	Trend (-3.600)	
GDP	ADF	0.670	-3.568	-4.975 *	-5.196*	Stationary at first difference constant and trend
	PP	0.666	-3.520	-7.474*	-8.386*	Stationary at first difference constant and trend
RTGS	ADF	1.527	-0.607	-2.260 *	-3.310 *	Stationary at first difference constant and trend
	PP	2.360	-0.125	-3.573 *	-4.735*	Stationary at first difference constant and trend
Cheque	ADF	0.287	-2.383	-4.596*	-4.436*	Stationary at first difference constant and trend
	PP	0.256	-3.037	-7.835*	-7.591*	Stationary at first difference constant and trend
SLIPS	ADF	3.004*	-2.595	-2.824*	-4.768*	Stationary at level constant and first difference constant and trend
	PP	4.392*	-2.795	-3.520*	-5.025 *	Stationary at level constant and first difference constant and trend
IB	ADF	2.439*	-3.409	-3.866 *	-5.027 *	Stationary at level constant and first difference constant and trend
	PP	2.375*	-4.109*	-6.279*		Stationary at level and first difference constant and trend

					-7.266*	
MB	ADF	2.009*	-1.248	-2.247	-4.254*	Stationary at level constant and first difference constant and trend
	PP	3.133*	-1.234	-2.603*	-4.225*	Stationary at level constant and first difference constant and trend
CC	ADF	-0.756	-1.460	-3.736*	-3.810*	Stationary at first difference constant and trend
	PP	-1.584	-2.498	-7.737*	-7.685*	Stationary at first difference constant and trend
DC	ADF	2.875*	-1.874	-3.396*	-4.875*	Stationary at level constant and first difference constant and trend
	PP	2.998*	-2.628	-5.608*	-6.951*	Stationary at level constant and first difference constant and trend

Source: Authors calculation

According to the aforementioned analysis, it is ascertained through both the augmented Dickey-Fuller and Phillips-Perron unit root tests that the time series is not susceptible to spurious regression since certain variables are stationary at levels and others at first differences. As the stationary levels of variables are present in both levels and first differences, it is not viable to utilize the Johansen cointegration test. Further, the absence of I(2) among the variables was verified, and an assessment of the cointegration relationship between the variables was conducted using the ARDL model. The rationale for utilizing the Autoregressive Distributed Lag (ARDL) approach resides in its capability to scrutinize the influence and impact of both dependent (y) and independent (x) variables over time while distinguishing between short-run and long-run responses. Additionally, the ARDL method allows for the assessment of the influence of past values of y on the present y, thus contributing to a more thorough understanding of the dynamic relationships among variables. Furthermore, the ARDL approach enables researchers to test or analyses cointegration, which is a necessary condition for establishing long-term relationships among variables.

For that firstly, Bound test from the Auto Regressive Distributed Lag (ARDL) model will be utilized to examine both the long-run and short-run relationships among the variables.

Prior to conducting the bound test, it is essential to determine the maximum lags that will be included in the analysis.

4.2 Lag length determination

In this step, the optimal lag of the variables is determined since time series data is influenced by prior data. The VAR lag order selection technique is employed to generate the following results. Stata software produces Akaike's Information Criterion (AIC), Hannan and Quinn Information Criterion (HQIC), and Schwarz's Bayesian Information Criterion (SBIC) as mentioned below.

Table 3:Vector Autoregression Lag Length

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	113.947	-	5.40E-14	-7.84795	-7.73378	-7.464
1	285.864	343.83	2.30E-17	-15.8418	-14.8143	-12.3862
2	459.501	347.27	2.e-109*	-477.653*	-474.571*	-467.286*
3	3424.89	5930.8	3.20E-20	-238.881	-236.026	-229.282
4	6664.32	6478.9*	-	-23.963	-22.0221	-17.4358

Source: Authors calculation

* indicates lag order selection by the criterion

Based on the table above, the Akaike Information Criterion (AIC), Hannan and Quinn Information Criterion (HQIC), and Schwarz's Bayesian Information Criterion (SBIC), indicate that this study should incorporate a maximum of 2 lags.

4.3 Autoregressive distributed lag bounds tests

As previously mentioned, certain variables exhibit stationary behaviour at levels, while others are stationary at first differences. Consequently, to determine the long-term cointegrating relationship, the Auto Regressive Distributed Lag (ARDL) Bound test is employed rather than the Johansen Cointegration test, which is appropriate only when all variables exhibit stationary behaviours at levels or first differences

Table 4: Long Run Bound Test

F = 129.924		
Significance level (%)	Lower Bound I(0)	Upper Bound I(1)
10	2.03	3.13
5	2.32	3.50
2.5	2.60	3.84
1	2.96	4.26

Source: Authors calculation

In the context of conducting a bound test for cointegration, if the computed F-statistic surpasses the upper bounds value, it provides evidence in support of the existence of cointegration. Conversely, if the F-statistic falls below the lower bounds value, it indicates that there is no cointegration. It is important to note, however, that if the computed F-statistic falls between the upper bounds value and the lower bounds value, the results are deemed inconclusive.

As illustrated in the table above, the F statistic exceeds the upper bound for all levels of significance. Thus, the null hypothesis of no long-run cointegration is rejected, confirming the presence of long-run cointegration among the variables of economic growth and cashless payment methods investigated in this study

4.4 Autoregressive Distributed Lag Model

The impact of cashless payment methods on the economic growth of Sri Lanka is tested using the ARDL model and the following outcome is produced as mentioned in the below table 5.

Table 5: ARDL Lag Estimates (2,2,2,1,2,2,2,2)

Variables	**Regression Coefficient**	**Standard error**	**t value**	**Probability value**	**Interpretation**
GDP(-1)	-0.5563915	0.0518775	-10.73	0.000	Significant and Positively related
GDP(-2)	-0.0730917	0.0448092	-1.63	0.154	Insignificant
RTGS	0.0555465	0.0185869	2.99	0.024	Significant and Positively related

RTGS(-1)	-0.3722979	0.0246534	-15.1	0.000	Significant and Negatively related
RTGS(-2)	0.0330609	0.0231159	1.43	0.203	Insignificant
CHE	1.055012	0.0806864	13.08	0.000	Significant and Positively related
CHE (-1)	-0.3354862	0.0891375	-3.76	0.009	Significant and Negatively related
CHE (-2)	-0.5086367	0.0958389	-5.31	0.002	Significant and Negatively related
SLIPS	-0.5241945	0.1406356	-3.73	0.010	Significant and Negatively related
SLIPS(-1)	1.413454	0.176826	7.99	0.000	Significant and Positively related
CC	-0.2217831	0.0755972	-2.93	0.026	Significant and Negatively related
CC(-1)	0.2932802	0.0607159	4.83	0.003	Significant and Positively related
CC(-2)	-0.1606049	0.0760819	-2.11	0.079	Insignificant
DC	-0.0783475	0.0867389	-0.9	0.401	Insignificant
DC(-1)	-0.1877782	0.0641317	-2.93	0.026	Significant and Negatively related
DC(-2)	0.4526947	0.087192	5.19	0.002	Significant and Positively related
IB	-0.1776002	0.0239168	-7.43	0.000	Significant and Negatively related
IB(-1)	-0.0236701	0.0172822	-1.37	0.220	Insignificant
IB(-2)	-0.0745405	0.0180447	-4.13	0.006	Significant and Negatively related

MB	0.1464597	0.0242942	6.03	0.001	Significant and Positively related
MB(-1)	-0.037596	0.0262819	-1.43	0.203	Insignificant
MB(-2)	-0.0752787	0.024661	-3.05	0.022	Significant and Negatively related
Cons	10.36005	0.7339098	14.12	0.000	Significant and Positively related

R-squared	0.9972	F-statistic	98.87
Adjusted R-squared	0.9872	Prob(F-statistic)	0.0000
Log likelihood	114.40543	Durbin-Watson	2.22302

Diagnostic test:		
Breusch-Godfrey LM test for autocorrelation	chi2 0.986	(p value 0.544)

Source: Authors Calculation

Based on the data presented in the above table 5, it can be observed that the F statistic is 98.87 and significant at 0.05 level. These values indicate that the model is statistically significant. Furthermore, the results suggest that RTGS and CHE exhibit a significant positive relationship with economic growth in Sri Lanka. On the other hand, SLIPS, CC, and IB exhibit a significant negative relationship with economic growth in the country. Interestingly, DC and MB do not demonstrate any significant relationship with economic growth in Sri Lanka in the short term. Further, diagnostic test of the autoregressive distributed lag (ARDL) model was performed through an examination of Breusch-Godfrey LM test autocorrelation test. The chi square value is significant at 0.05 level which reveals that no auto correlation in the ARDL model. The Durbin-Watson test is utilized as a means to detect the presence of autocorrelation. Statistically, the dataset is considered normal when the value is between 1.7 to 2.3.

Below Table 6 shows the long-term parameters and short run dynamic relationship of the ARDL Error Correction model.

Table 6: ARDL short run estimate and Error Correction Model

Variables	Regression Coefficient	Standard error	t value	Probability value	Interpretation
ECM	-0.629483	0.0681913	-23.9	0.000	Significant
DLnGDP(-1)	0.0730917	0.0448092	1.63	0.154	Insignificant
DLnRTGS	0.339237	0.0250979	13.52	0.000	Significant and Positively related
DLnRTGS(-1)	-0.0330609	0.0231159	-1.43	0.203	Insignificant
DLnCHE	0.8441229	0.153308	5.51	0.002	Significant and Positively related
DLnCHE (-1)	0.5086367	0.0958389	5.31	0.002	Significant and Positively related
DLnSLIPS	-1.413454	0.176826	-7.99	0.000	Significant and Negatively related
DLnCC	-0.1326753	0.0844917	-1.57	0.167	Insignificant
DLnCC(-1)	0.1606049	0.0760819	2.11	0.079	Insignificant
DLnDC	-0.2649165	0.0731846	-3.62	0.011	Significant and Negatively related
DLnDC(-1)	-0.4526947	0.087192	-5.19	0.002	Significant and Negatively related
DLnIB	0.0982106	0.0243056	4.04	0.007	Significant and Positively related
DLnIB(-1)	0.0745405	0.0180447	4.13	0.006	Significant and Positively related
DLnMB	0.1128747	0.034038	3.32	0.016	Significant and Positively related
DLnMB(-1)	0.0752787	0.024661	3.05	0.022	Significant and Positively related
Constant	10.36005	0.7339098	14.12	0.000	Significant and Positively related
R-squared	0.9984		Adjusted R-squared		0.9924

Source: Authors Calculations

Table 7 displays the outcome of the autoregressive distributed lag (ARDL) error correction model (ECM), revealing an error correction term or speed of adjustment coefficient of -0.629 with a p-value

of 0.0000. This suggests that there is a 62% rate of adjustment in the event of any disequilibrium observed within this model from the short run back to the long run on a quarterly basis. Based on the analysis conducted, it can be concluded that in the short run, RTGS, CHE, IB, and MB exhibit a significant positive relationship. This may reflect immediate boosts to economic activity resulting from increased transaction volumes and liquidity injections. Conversely, the analysis revealed that the SLIPS and the DC payment methods display a significant negative relationship. This could be from the factors such as liquidity constraints and inefficiencies within specific payment networks. Notably, the analysis did not reveal any significant relationship between the payment method CC and the economic growth. This may be due to the factors such as consumer debt levels, merchant acceptance and preference for alternative payment methods.

Table 7: ARDL Estimates of The Long Run Relationship

Variables	Regression Coefficient	Standard error	t value	Probability value	Interpretation
LnRTGS	0.1740984	0.01208	14.41	0.000	Significant and Positively related
LnCHE	0.1294209	0.0890843	1.45	0.196	Insignificant
LnSLIPS	0.5457312	0.072202	7.56	0.000	Significant and Positively related
LnCC	-0.0546847	0.0792933	-0.69	0.516	Insignificant
LnDC	0.1144958	0.0664976	1.72	0.136	Insignificant
LNIB	-0.1692628	0.018899	-8.96	0.000	Significant and Negatively related
LnMB	0.0206109	0.0091247	2.26	0.065	Insignificant

Source: Authors calculation

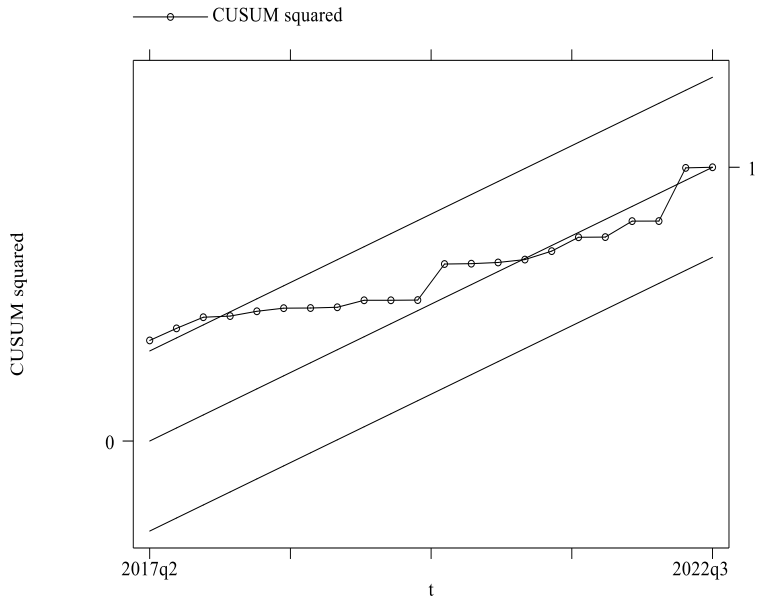
In the long run, RTGS and SLIPS have a significant positive relationship with economic growth due to their efficiency in facilitating large-scale transactions between financial institutions and businesses. These systems streamline the payment processes, reduce transaction times, and improve liquidity management thereby improving the economic activities and growth of the economy. Further, IB has a significant negative relationship due to the potential barriers to access and usage, particularly segments of the population with limited interment connectivity or digital literacy. Moreover, concerns about the cyber security and data privacy associated with online banking may deter the widespread adoption, limiting its contribution to economic expansion. In addition, CHE, CC, DC MB do not have any

significant impact on the economic growth. While these payment methods offer convenience and accessibility for customers, their overall contribution to economic growth may be limited by factors such as transactions fees, regulatory constraints and preferences for cash transactions for certain sectors of the economy.

However, according to Agustiawati et al., (2023) , debit card, credit card and E money collectively influenced economic growth. However, individually, debit and credit card transactions significantly impacted growth, while E money transactions showed no significant effect. On the other hand, Pang et al., (2022) revealed that only E money payments were statistically significant in influencing growth while debit card and credit cards were insignificant. Noman et al., (2023) highlighted that cashless payment methods, including cards, E money, credit transfers and cheques positively influenced economic growth in the long run, with a strong correlation to real in GDP in G7 countries. In the short run, card, E money and cheque payments significantly impacted GDP, whereas credit transfers had no notable short-term effect.

To assess the stability of the autoregressive distributed lag (ARDL) model, the cumulative sum of recursive residual (CUSUM) test was conducted at a 95% confidence level. The findings of this test indicated that the model is appropriately specified, demonstrating its robustness and suitability for analysis.

Figure 4: Cumulative Sum of Recursive Residual (CUSUM) Test



Source: Survey Data

5. Conclusion

This research study aims to investigate the impact of cashless payment methods on the economic growth of Sri Lanka. Specifically, the study employs Real-time Gross Settlement System (RTGS), Cheque (CHE), Sri Lanka Interbank Payment System (SLIPS), Internet Banking (IB), Mobile Banking (MB), Credit Card (CC), and Debit Card (DC) as independent variables, while real Gross Domestic Product (GDP) serves as the dependent variable. The study covers a period from 1Q 2015 to 3Q 2022. To analyses the data, the Autoregressive Distributed Lag (ARDL) model is utilized, preceded by the application of the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests to establish the stationary relationship of variables at both levels and differences.

The RTGS system in Sri Lanka has demonstrated a significant positive correlation with the country's GDP in both the short and long term. The Central Bank of Sri Lanka has identified RTGS as the most significant contributor to non-cash payment systems. Consequently, it is crucial to eliminate the regulatory and infrastructure obstacles hindering the wider adoption of non-cash payment methods in Sri Lanka through the use of RTGS. Additionally, SLIPS has exhibited a favourable association in the long term despite exhibiting a negative relationship in the short term. Thus, it is imperative to implement sustainable systems in the long run to reap the long-term benefits. In the long term, IB demonstrated a negative correlation, despite indicating a positive association in the short term. On the other hand, both CHE and MB exhibited an insignificant relationship with GDP in the long term and a positive relationship in the short term. CC and DC did not demonstrate any significant correlation in the long term. However, DC revealed a negative relationship with GDP, while CC did not show a significant relationship in the short term.

Central banks, with the assistance of other institutions can promote the usage of cashless payments and conduct educational sessions and provide guidance to senior citizen to encourage them to use the technologies in their day-to-day transactions. Government can motivate businesses to utilize these cashless payment systems in their day-to-day operations. Further, government and other organizations can invest in expanding internet connectivity and digital infrastructure to ensure widespread of usage in online banking and digital transactions, particularly in rural and underserved areas in Sri Lanka. Further, implementation of digital literacy related educational programs to raise the awareness of the benefits of cashless payments are crucial. Another important consideration should be given to strengthen the cybersecurity measures and regulatory frameworks to safeguard against online fraud and data breaches. Further, encouraging businesses to accept and adapt to cashless payments is another important aspect by providing support for the adoption of point of sales (POS) terminals and other payment processing equipment. Further, transaction fee should be minimized to increase the usage of non-cash transactions, In Sri Lanka, collaboration between government agencies, financial institutions,

fin tech companies and businesses are important to improve the digital inclusion and growth in cashless payments.

Overall, the study provides valuable insights into the potential impact of non-cash payments on the economic growth of Sri Lanka. The findings can inform policymakers and stakeholders in the financial sector on the measures needed to promote the adoption of non-cash payment methods in Sri Lanka, which can lead to a more efficient, inclusive, and sustainable financial system in the country.

6. Limitations and Scope for Future Studies

This study offers significant insights into the relationship between cashless payments and economic growth in Sri Lanka. However, it is important to acknowledge the limitations of the study. One notable limitation is the restricted number of cashless payment methods considered, which excludes Tele Banking, and Postal Instruments due to their relatively insignificant contribution to the total cashless payments in Sri Lanka. As a result, the study may not fully capture the breadth and depth of the impact of cashless payments on the country's economy. Moreover, the study only focuses on the impact of cashless payments on economic growth, while there may be other important dimensions to consider, such as financial inclusion, consumer behaviour, and regulatory frameworks.

Future studies could address these limitations by expanding the number of cashless payment methods considered and investigating other dimensions of the impact of cashless payments. Additionally, further research could examine the potential trade-offs and complementarities between cashless payments and other forms of payment, such as cash, and investigate how the adoption of cashless payments may affect different stakeholders in the economy, including consumers, businesses, and the government. Furthermore, future studies could explore the role of digital infrastructure and financial literacy in driving the adoption and impact of cashless payments.

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