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Content

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Financial Inclusion of Urban Poor in India and the Role of Urban Cooperative Banks: Evidence from Sub-national Data

Mini P Thomas[1], Radhika Gupta[2]

Abstract

This study attempts to examine the prevalence of financial inclusion among the urban poor of Telangana state in India and the role that Urban Cooperative Banks (UCBs) played in achieving this goal. More studies need to be conducted to look at supply-side indicators of financial inclusion of urban poor in India, specifically pertaining to cooperative banks, and the current study aims to fill this research gap. Secondary data extracted from the All India Debt and Investment Survey and RBI is initially analyzed descriptively. Primary data on financial inclusion, based on a field survey carried out among Telangana UCBs, is also analyzed. A Probit model is then estimated using the primary supply-side financial inclusion indicators data. This study found the prevalence of bank account ownership to be highest among males and OBCs (Other Backward Castes) in urban Telangana. Indebtedness among Telangana urban households is much higher than the All-India level, with a greater reliance on non-institutional lenders. Telangana UCBs with assets of higher value are more likely to have more than one branch. The majority of the UCBs are found to be meeting priority sector lending targets set by the Reserve Bank of India but lagged in terms of asset holding and bringing women into the banking fold.

Keywords: financial inclusion, urban poor, urban cooperative banks

[1] Associate Professor, Department of Economics & Finance, BITS Pilani Hyderabad Campus
[2] Doctoral Candidate in Economics, Indian Institute of Foreign Trade, New Delhi

Corresponding Author

Mini P Thomas, BITS Pilani Hyderabad Campus, Jawahar Nagar, Kapra Mandal, Medchal - 500078. Telangana.

Email: mini@hyderabad.bits-pilani.ac.in, radhika_phd2020@iift.edu

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1. Introduction

Financial inclusion of the urban poor is a major concern for policymakers in developing countries, and cooperative banks can play an important role in achieving this goal, given their proximity to the urban poor. According to the Global Findex Database 2021, 71 per cent of the adult population in developing countries now holds a bank account, and the gender gap in bank account ownership has also improved to 6 per cent (Demirgüç-Kunt *et al.*, 2022). World Bank (2018) defines the term financial inclusion as "individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way". Financial inclusion has been identified as a major enabler in achieving eight of the seventeen United Nations Sustainable Development Goals and it has assumed policy priority with governments across the world. Fostering financial inclusion is even more crucial for developing countries like India, where a sizeable chunk of the population still lacks access to basic banking services. This is the reason it has been firmly placed as a policy imperative in India by regulators and policymakers, especially by the Government of India (GOI) and the Reserve Bank of India (RBI). The RBI and GOI have accorded utmost importance to financial inclusion and have been making concerted efforts to extend the reach of the formal banking sector. Some of the measures include the simplification of Know Your Customer (KYC) norms, the opening of Basic Savings Bank Deposit Accounts, the issuance of Kisan Credit Cards and General Credit Cards, Pradhan Mantri Jan Dhan Yojana (PMJDY), and Financial Inclusion Plans (FIPs) for banks, to name a few. Moreover, PMJDY, which was launched in 2014, is considered one of the biggest financial inclusion initiatives in the world.

Urban Cooperative Banks (UCBs), being ingrained within the local community, play a significant role in increasing the outreach of banking services in urban and semi-urban areas. Unorganised sector workers, senior

citizens, disabled persons, women, small vendors, industrial labourers, and slum dwellers form a major chunk of the financially excluded groups in Indian cities and towns. UCBs have the upper hand over commercial banks in reaching out to the financially excluded because of lower establishment and operational costs, strong relationships with customers, flexibility, and shareholders also doubling up as stakeholders. They are based on the principles of cooperation, namely mutual help, democratic decision making and open membership and since inception, they have been promoting the interests of low-income people located in these areas by making affordable financial products and services available to them. UCBs have been marred with problems relating to dual regulation, with banking-related functions such as branch licensing and exposure norms being monitored by RBI, whereas the State and Central Governments govern the registration, management, audit, and liquidation of UCBs. However, in September 2020, the Central Government amended the Banking Regulation Act 1949 and brought UCBs under the direct supervision of RBI. The majority of the UCBs in India are single-branch banks and are faced with restrictions pertaining to the issue of fresh equity to raise growth capital, which increases their asset risk (Rajauria, 2022). Telangana is one of the major states located in South India. The urban population is estimated to be 46.1% of the total population of Telangana in 2021, with the Hyderabad metropolitan area occupying the lion's share (Government of Telangana, 2021). There are multi-faceted supply-side constraints to financial inclusion, such as huge distance from the bank, absence of flexible working hours for banks, time-consuming documentation procedures, minimum balance requirement, lack of customized products for the poor clients, language barriers, unfriendly staff, hidden charges, information asymmetry, lack of customer awareness programmes, the financial viability of a bank which holds a big number of small accounts etc. The present study attempts to understand the prevalence of financial inclusion among the urban poor of Telangana state and the role played by UCBs in achieving this goal by focusing on the supply-side indicators of financial inclusion.

The rest of the paper is organized as follows. Section 2 reviews the literature on financial inclusion, and Section 3 elaborates on the methodology and data sources. Section 4 gives the empirical analysis, Section 4.1 provides the findings based on secondary data analysis, and Section 4.2 reveals the findings

based on primary data analysis. Section 5 gives the major conclusions and policy implications emanating from this study.

2. Review of Literature

Ardic *et al.* (2011) compared banks to non-banking financial institutions in terms of deposit and loan penetration using the Financial Access Database. They found that 91 per cent of the total deposit volume across the world was held by commercial banks. Among NBFIs, cooperatives accounted for at least half of the credit volume in countries such as Spain and France. Girardin and Ping (1997) studied the operations, institutional context, and role of urban credit cooperatives in China within the savings and credit system. A primary survey of 57 cooperatives in 8 eight Chinese towns was carried out. The most profitable urban credit cooperatives were found to be located in the fast-growing coastal regions, but a major large proportion of their funds were being disbursed as loans to the government, rather than to the cooperative sector. Demirgüç-Kunt and Klapper (2013) measured financial inclusion by studying the variation in the use of financial services for savings, borrowing, payments and risk management, both within and across 148 countries. With the help of the Global Findex database for the year 2011, they found that 50 per cent of adults worldwide were "unbanked". Barriers to bank account usage include factors such as cost, distance, documentation requirements and distrust in formal financial institutions. Demirgüç-Kunt *et al.* (2018) found that the number of bank account holders rose from 53 per cent to 80 per cent in India between 2014 and 2017. They underlined the usefulness of digital technology in enhancing bank account usage since more than 50 per cent of adults with inactive accounts and even unbanked adults owned mobile phones in India.

Datta and Singh (2019) undertook a cross-country study of developing a financial inclusion index. Determinants of the financial inclusion index were estimated with the help of Pooled OLS and clustered standard error regression model. Per capita gross national income, population, life expectancy, and education were found to have a significant impact on FII. Sarma (2008) constructed a multi-dimensional financial inclusion index comparable across countries. Banking penetration, availability of banking services, and usage of banking systems are the three dimensions covered by the index. India occupied the 29th rank among 55 countries for its financial inclusion performance. Tulasi *et al.* (2017) examined the demand-side constraints of financial

inclusion in India. A primary survey was conducted in 25 slum areas of India's capital city, New Delhi, covering 600 slum dwellers. Their study found that the slum dwellers exhibited a low propensity to save and borrow, had low insurance coverage and were indifferent between formal and informal financial institutions.

Iqbal and Sami (2017) examined the role of banks in achieving financial inclusion in India for the time period from 2007-08 to 2013-14. They found that the number of bank branches and credit deposit ratio have a positive and statistically significant impact on India's GDP. Bapat and Bhattacharya (2016) studied the major demand-side determinants of financial inclusion of the urban poor in India based on a household survey conducted in the Ramtekdi slum of Pune City. They found that nuclear families with a number of members in the range of 2 to 4, respondents in the age group of 20-35 years, and those with moderate to high savings exhibited higher adult bank ratios. Ananth and Oncu (2013) focused on the institutional challenges to financial inclusion in Andhra Pradesh in India by focusing on public sector banks. They argued that banks should look at financial inclusion initiatives as long-term investments rather than capital costs or charitable expenses. Sahoo et al. (2017) studied the determinants of financial inclusion in two tribal districts of Orissa based on a primary survey conducted among 300 households. It was found that more than 70 per cent of the households did not possess savings bank accounts and were not taking part in self-help group activities. Educational attainment of the household head, private land ownership, annual household income and MGNREGS participation were found to be significant determinants of financial inclusion for tribal households.

Chakravarty and Pal (2013) analyzed the repercussions of policy changes in India's banking sector on financial inclusion at the state level with the help of panel data econometric techniques. They found that the social banking policy pursued between 1977- 1990 had helped in fostering financial inclusion across Indian states. Post 1991, the move towards pro-market financial reforms adversely affected the pace of financial inclusion. Nayak (2012) analyzed whether cooperative banks are a viable option for achieving financial inclusion in India. By analyzing secondary data for the time period from 1981-2011, he concludes that cooperative banks have a clear advantage over commercial banks in this regard due to their local involvement and lower labour costs.

Singh et al. (2014) examined the progress of financial inclusion in India over the years and also assessed the effectiveness of various efforts undertaken by the government to reduce low credit penetration in the country. By undertaking field research in Karnataka, they found out that there had been massive exclusion of people from the formal banking system, despite concerted efforts by the Government of India, RBI and NABARD.

Lal (2018) studied the impact of financial inclusion on poverty alleviation by conducting a primary survey among beneficiaries of cooperative banks operating in three northern states of India: J&K, Himachal Pradesh, and Punjab. Using factor analysis and ANOVA, he found that financial inclusion through cooperative banks directly and significantly impacted poverty alleviation via access to basic financial services such as savings, loans, insurance, and credit. Thomas and Gupta (2021) provided insights into the financial inclusion and fintech performance of Urban Cooperative Banks located in Telangana state in India, based on a primary survey carried out among bank officials. They found that more than 60 per cent of the surveyed UCBs catered to slum dwellers, daily wage labourers, MSMEs and SHGs. However, most of the UCBs were found to lag behind in terms of providing internet banking and mobile banking services and enabling direct benefit transfers. Barik and Lenka (2023) found that literacy rate and per capita state GDP had a positive impact on financial inclusion in Indian states. They also found that during the post-reform period, road length, electricity supply, social sector expenditure and capital receipts also had a positive and significant impact on financial inclusion at the sub-national level.

Based on the above review of the literature, it is found that most of the existing studies have focused on the role of commercial banks in financial inclusion in India. Few studies which have looked at the role of cooperative banks laid emphasis on financial inclusion through rural cooperatives (such as Nayak, 2012; Lal, 2018). There is a dearth of studies which have explored the role of UCBs in financial inclusion. Moreover, all the existing studies on the urban poor in India have looked at the demand-side barriers to financial inclusion (such as Bhattacharya, 2016; Sahoo et al., 2017; Singh et al., 2014) and neglected the supply-side indicators of financial inclusion. Our study bridges this research gap in the Indian context by examining the role of urban cooperative banks in financial inclusion for India in general and Telangana

state in particular. The focus of our study is on the supply-side indicators of financial inclusion, specific to banking.

3. Methodology and Data Sources

Erstwhile Andhra Pradesh was one of the forerunner states in India in implementing financial inclusion initiatives and has had some measure of success. Since more than 50 per cent of the Urban Cooperate Banks of erstwhile Andhra Pradesh are in Telangana after state bifurcation, it is chosen as the area of this study. Descriptive analysis using graphs and percentage shares is initially carried out with the help of secondary data extracted from the All-India Debt and Investment Survey (AIDIS) 2019 published by the Government of India, and the Database on Indian Economy (DBIE) 2021 published by the Reserve Bank of India. Data on financial inclusion and indebtedness of urban households in Telangana and at the All-India level are extracted from AIDIS 2019 and analyzed. UCB data pertaining to deposits, advances, credit-deposit ratios, and the number of ATMs in Telangana are extracted from DBIE 2021 and analyzed.

The secondary data analysis is complemented with primary data collected through a field survey covering all UCBs operating in Telangana to understand the ground-level realities of supply-side indicators of financial inclusion. There are 50 non-scheduled UCBs and one scheduled UCB in Telangana. In addition to the one scheduled UCB (A.P. Mahesh Cooperative Urban Bank), the names of the 44 non-scheduled UCBs in Telangana who took part in the primary survey can be found in the list published by RBI (2022). These UCBs have a network of 210 branches across Telangana (RBI, 2021). The primary survey was carried out by sending field investigators to each head office of these 51 UCBs to conduct in-person interviews. The head offices gave data on supply side indicators of financial inclusion for the UCB in question, including the branches. Out of the 50 non-scheduled UCBs in Telangana, 38 UCB head offices fall within the limits of Hyderabad and Ranga Reddy districts. The remaining 12 UCB head offices are spread across Khammam, Adilabad, Nalgonda, Mahabubnagar, Warangal and Karimnagar districts. The fieldwork for this study was carried out in the second half of 2019 and early 2021, and the data was successfully collected from 45 UCBs during this time frame. The remaining six UCBs refused to divulge information despite repeated visits. Fieldwork could not be carried out in 2020 due to the lockdown and social

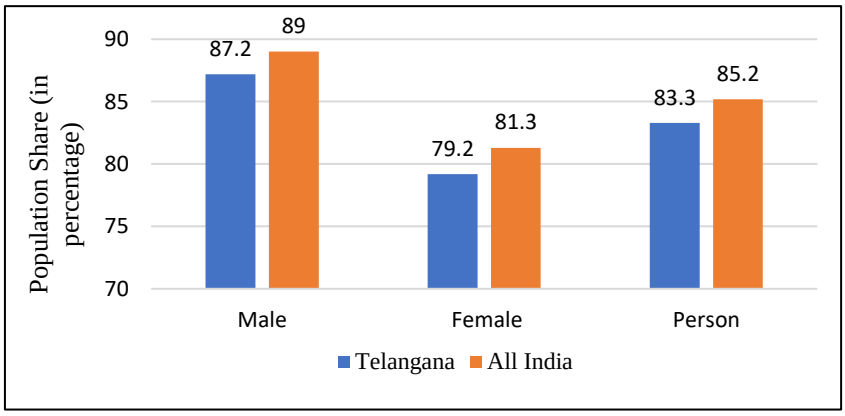
distancing rules put in place to counter the COVID-19 pandemic. The interview schedule was drafted to measure the progress in financial inclusion achieved by UCBs, by analyzing various supply-side indicators. It was designed concerning the RBI guidelines and other financial inclusion indicators published by the World Bank. Members of senior management of UCBs, such as CEOs, General Managers and Managing Directors, were the respondents of this survey. A Probit regression model is estimated, and the financial inclusion index is constructed using the primary data collected on supply-side indicators. Primary data collected is also used to examine the gender gap in account ownership and access to credit, priority sector lending and asset holding of the UCBs.

4. Empirical Analysis

4.1. Financial Inclusion in Urban Telangana and UCBs: Findings from Secondary Data

The All-India Debt and Investment Survey (2019) throws light on some important information about the urban population of Telangana. In urban Telangana, 83.3 per cent of the adult population (18 years and above) owned a deposit account in a bank, as against 85.2 per cent in urban areas at the all-India level. "Banks" as defined in Figure 1 and Table 1, based on data extracted from AIDIS, includes Scheduled Commercial Banks, Regional Rural Banks, and Co-operative Banks. Figure 1 reveals a clear gender gap in bank account ownership between men and women in urban areas, both in Telangana and at the national level.

Figure 1: Share of the adult population owning deposit accounts in banks in Urban Areas



Source: Authors' compilation from AIDIS 2019

When the deposit account ownership in Banks for the adult population across various social groups in urban Telangana is compared, the share is found to be highest among people belonging to Other Backward Castes (OBC), as evident from Table 1. 86.9% of OBCs and 83.6% of Scheduled Caste (SC) population were found to own bank accounts. However, the share of the adult population owning bank accounts among the Scheduled Tribes (ST) and "Others (Forward Caste)" category was found to be lower, at 48.3 per cent and 82.4 per cent, respectively. Historically, sections of society belonging to ST, SC, and OBC are also the economically backward classes of India. Therefore, it is striking that financial inclusion based on the indicator of bank account ownership is lesser among people belonging to Forward Castes compared to SCs and OBCs in urban Telangana. The picture at the All-India level is in line with apriori expectation, with bank account ownership among the Forward Caste population much higher than that of OBCs, SCs and STs.

Table 1: Share of the adult population owning deposit account in Bank by social group

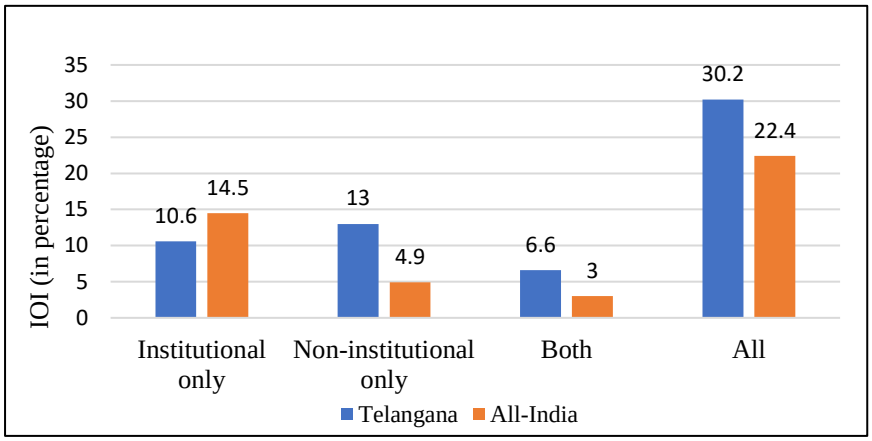
Social Groups	**Telangana (Urban) (in %)**	**All India (Urban) (in %)**
ST	48.3	80.4
SC	83.6	83.6
OBC	86.9	84.9
OTHERS (Forward Caste)	82.4	86.7

Source: Authors' compilation from AIDIS 2019

The incidence of indebtedness (IOI) among the urban population of Telangana, depicted in Figure 2, points towards a greater reliance on non-institutional lenders for their credit requirements. This trend was found to hold, irrespective of whether the households in urban Telangana fell into the occupational category of "self-employed" or "others". AIDIS's "Others" category includes households with regular wage or salary-earning members

and casual labourers. 10.6 per cent of the households in urban Telangana relied on institutional credit agencies, 13 per cent of the households relied on non-institutional credit agencies, and 6.6 per cent of the households relied on both types of lenders. This is in contrast to the All-India situation, which indicates a greater reliance by urban households on institutional lenders. 14.5 per cent of the households resorted to institutional credit agencies, 4.9 per cent of households resorted to non-institutional credit agencies, and 3 per cent of the households resorted to both types of lenders at the national level. It is also evident from Figure 2 that the overall incidence of indebtedness in households of urban Telangana, at 30.2 per cent, is much higher than that of urban India, at 22.4 per cent.

Figure 2: Incidence of indebtedness by type of credit agency in urban areas



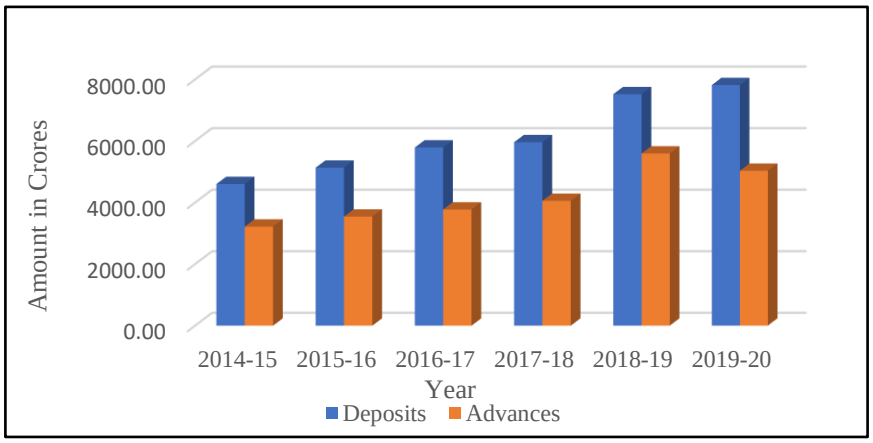
Source: Authors' compilation from AIDIS 2019

AIDIS 2019 also reveals further insights about the financial precarity of urban households in Telangana. The debt The Debt-to-asset ratio for urban households in Telangana stood at 7.6 per cent, compared to the DAR of 4.4 for urban India. 91 per cent of the households in urban Telangana reported asset holding in the form of bank deposits, whereas the comparable figure reported for Urban India is 94.7 per cent. 57.6 per cent, 51.7 per cent, and 46.4 per cent of Telangana urban households reported assets in transport equipment, land, and buildings, respectively. Households investing in financial market assets such as shares are found to be negligible both in urban Telangana and urban India.

Figure 3 gives the absolute number of total deposits and total advances of all 51 UCBs operating in Telangana. It is clear from the figure that total deposits

have outpaced total advances in absolute terms in the past few years. Total deposits in Telangana UCBs have grown from Rs.4598.81 crores in 2014-15 to Rs.7816.17 crores in 2019-20. It is also clear from Figure 3 that total advances given by Telangana UCBs declined from Rs.5592.6 crores in 2018-19 to Rs.5031.19 crores in 2019-20, which can be explained as more of a demand-side phenomenon since the private investment was not forthcoming during the pandemic.

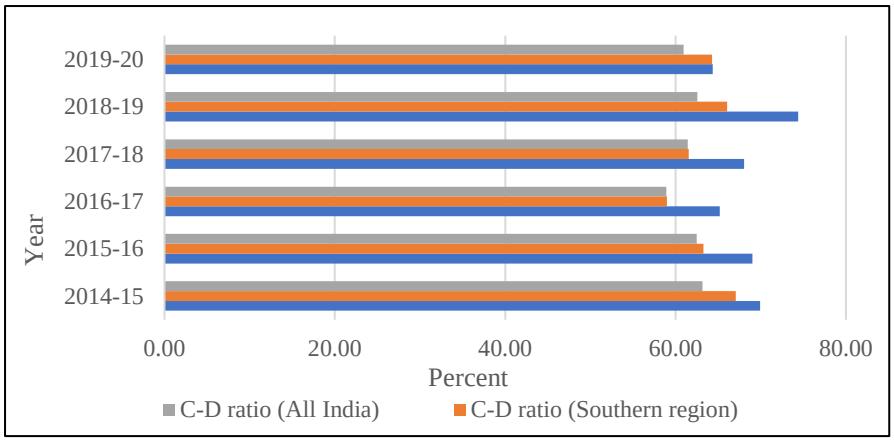
Figure 3: Total Deposits and Advances of Telangana UCBs



Source: Authors' compilation based on DBIE, RBI 2021

The Credit Deposit (C-D) ratio is defined as the ratio of total advances to total deposits for the same time period. The C-D ratio for UCBs in Telangana has been consistently higher than the average for southern region UCBs as well as at all India levels over the past few years, as is evident from Figure 4. Due to demonetization and the resultant increase in deposits and a decline in the number of advances for Telangana UCBs, their C-D ratio was lowest in 2016-17, at 65%. Eventually, with the slowdown in deposits, the C-D ratio began rising again and recorded its highest value of 74% in 2018-19. In 2019-20, the C-D ratio of Telangana UCBs fell drastically to 64%. Reserve Bank of India (2021) also reveals that the number of ATMs operated by UCBs in Telangana rose steadily from 37 in 2014-15 to 154 in 2018-19. However, some of the ATMs shut down in the following year, and the number of ATMs in Telangana UCBs declined to 150 in 2019-20.

Figure 4: Credit-Deposit Ratio for UCBs - A Comparison



Source: Authors' compilation based on DBIE, RBI 2021

4.2. Financial Inclusion through UCBs: Findings from Primary Survey in Telangana

Table 2 reveals a great disparity in asset holding among the UCBs in Telangana. Most of the surveyed UCBs (54%) had an asset holding of less than Rs.50 crores, implying that their client base mostly comprises small borrowers and urban poor. 17% of the UCBs had an asset holding of Rs.100 to 200 crores. At the upper end of the spectrum, close to 15% of Telangana UCBs had an asset holding greater than Rs.500 crores.

Table 2: Telangana UCBs in various asset ranges

Assets (in Crores)	**% of UCBs across multiple asset ranges**
<50	53.7
50-100	4.9
100-200	17.1
200-300	0.0
300-400	4.9
400-500	4.9
>500	14.6

Source: Authors' calculations based on primary survey data

Reserve Bank of India revised the priority lending targets for Urban Cooperative Banks in September 2020. As per the revised guidelines, UCBs

should reach the following milestones concerning priority sector lending expressed as a percentage of adjusted net bank credit, as per the given timeline: 45% by March 31st, 2021, 50% by March 31st, 2022, 60% by March 31st, 2023, and 75% by March 31st, 2024. The categories which qualify as "priority sector", as per RBI definition, comprise agriculture (including credit to small and marginal farmers and farm infrastructure), MSMEs (including khadi and village industries), export credit, education, housing, social infrastructure, renewable energy, start-ups and self-help groups and other weaker sections. Table 3 reveals that more than 80 per cent of the UCBs in Telangana are on track to fulfilling the above-mentioned priority sector lending targets set by RBI. 36 per cent of Telangana UCBs were giving out priority sector advances as a share of net bank credit, in the interval of 61 to 80 per cent. One UCB even reported that 95 per cent of their net bank credit was being disbursed to the priority sector.

Table 3: Telangana UCBs in various ranges of Priority Sector Lending

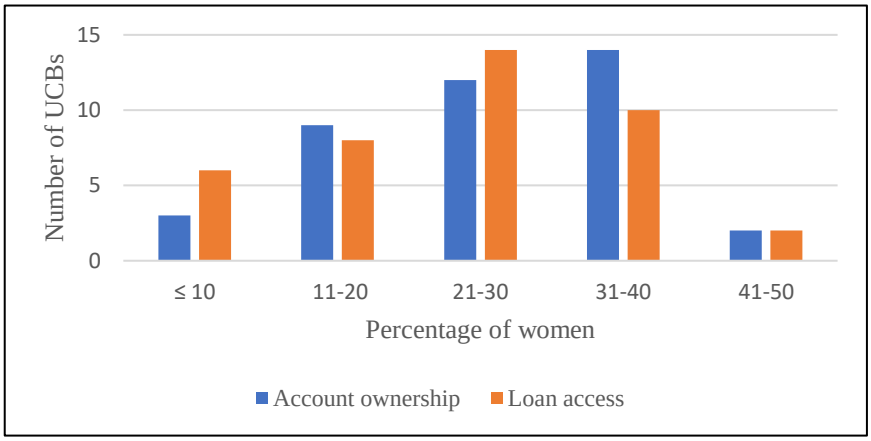
Percentage of Priority Sector Advances to Net Bank Credit	**Share of UCBs in Telangana (in %)**
40	7.7
41-50	10.3
51-60	30.8
61-70	17.9
71-80	17.9
81-90	12.8
91-95	2.6

Source: Authors' calculations based on primary survey data

Among the 45 UCBs who took part in the primary survey, 2 were full-fledged Mahila UCBs, with women forming their major clientele. Women constituted 75 per cent of the customers possessing bank accounts in A.P. Raja Rajeswari Mahila Cooperative Urban Bank and 60 per cent in Vardhaman Mahila Cooperative Urban Bank. A similar trend is also observed with regard to access to credit in the case of these two Mahila UCBs. Women formed 80 per cent of the customers taking loans from A.P. Raja Rajeswari Mahila Cooperative Urban Bank and 70 per cent from Vardhaman Mahila Cooperative Urban Bank. Excluding the Mahila UCBs will give a better picture of the gender gap in financial inclusion of Telangana UCBs, as is

evident from Figure 5. Only 2 UCBs in Telangana had a ratio of women to men customers in terms of account ownership as well as credit intake greater than 40 per cent.

Figure 5: Gender Gap in Bank Account Ownership and Loan Access among Telangana UCBs (excluding Mahila UCBs)



Source: Authors' calculations based on primary survey data

A Probit model has been used to examine whether the number of bank accounts and total assets with a UCB contribute to its likelihood of having more branches since a number of bank branches is also an indicator of financial inclusion. The dependent variable for the proposed Probit model is of a binary nature, taking a value of one (1) if a UCB has more than one branch and taking a value of zero (0) if a UCB has only one branch, which is also the head office. It is regressed on two supply-side variables of the respective UCB, namely, the total number of bank accounts and the total value of bank assets.

Table 4 reports the results of the omnibus test. It is a likelihood-ratio chi-square test of the fitted model versus the null model (i.e., the intercept-only model, without any other explanatory variables). Table 4 indicates that the chi-square test statistic is statistically significant at the 1 per cent level, implying that the fitted model is better than the intercept-only model. Table 4 also reports the Probit model regression estimation results. The regression coefficient for the total number of UCB accounts is negative and statistically insignificant. The regression coefficient pertaining to total assets of UCBs is found to be positive and statistically significant. The econometric results can be interpreted as follows: the number of accounts with a UCB does not

contribute to its likelihood of having more than one branch. However, UCBs with higher-value assets are more likely (greater probability) to have more than a single branch compared to those banks with fewer assets. Table 4 also gives the estimated model's goodness of fit and model selection criteria test statistics. Model specification with the smallest information criteria value is chosen for estimation purposes.

Table 4: Probit Model estimation results

Variable	B	SE	95% Wald Confidence Interval		Hypothesis Test			Exp (B)	95% Wald Confidence Interval	
			Lower	Upper	Wald Chi-Square	df	p-value		Lower	Upper
(Intercept)	-1.395	0.491	-2.358	-0.432	8.065	1	0.005	0.248	0.095	0.649
TotalBAccounts	-0.023	0.030	-0.082	0.036	0.564	1	0.453	0.978	0.921	1.037
TotalBAssets	0.087	0.315	0.026	0.149	7.701	1	0.006	1.091	1.026	1.161
(Scale)	1 [a]									

Omnibus Test		
Likelihood Ratio Chi-Square	**df**	**p value**
15.39	2	0.000

Goodness of Fit and Model Selection Criteria[b]	**Statistic value**
Deviance	42.832
Scaled Deviance	42.832
Pearson Chi-Square	48.506
Scaled Pearson Chi-Square	48.506
Log Likelihood	-21.416
Akaike's Information Criterion (AIC)	48.832
Finite Sample Corrected AIC (AICC)	49.463
Bayesian Information Criterion (BIC)	54.045

Source: Authors' estimation based on primary survey data

Notes: Dependent variable (binary): Likelihood of a UCB having more than one branch

Note: [a] Fixed at the displayed value
[b] Full likelihood function is used for computing information Criteria

5. Conclusion and Policy Implications

This study attempted to understand the prevalence of financial inclusion among the urban poor of Telangana state in India and the role played by Urban Cooperative Banks in achieving this goal by focusing on the supply-side indicators of financial inclusion. The prevalence of bank account ownership is highest among males and OBCs in urban Telangana. Indebtedness among urban households in Telangana is much higher than the All-India level, with a greater reliance on non-institutional lenders. Based on Probit Model estimation results, Telangana UCBs with higher value assets had a greater likelihood of having more than one branch. Most of the UCBs were meeting priority sector lending targets set by RBI but needed to catch up in terms of asset holding and bringing women into the banking fold. Priority sector lending as a share of net bank credit was more than 50% for most surveyed UCBs. It was found that more than 50 per cent of the surveyed UCBs had a small asset base of less than Rs. 50 crores, implying that their clientele and shareholders were mostly from the economically backward sections of society. The findings of our study are mostly in consonance with other studies on financial inclusion in the Indian context in terms of the widespread financial exclusion prevalent among the urban poor, even after close to twenty-five years of economic reforms implemented in the country. Our study contributes to the extant literature by showcasing the performance of UCBs concerning various banking-specific supply-side financial inclusion indicators. Our study also gives both a national as well as sub-national picture concerning the plight of the urban poor, the targeted clientele of UCBs.

The following policy implications can be derived from the study findings. The gender gap in account ownership and credit uptake of UCBs should be bridged by educating and incentivizing women to avail more financial services. Most of the UCBs in Telangana still have a long way to go before they can attain the revised priority sector lending target of 75 per cent recently set by the RBI. Giving loans and advances to women entrepreneurs, irrespective of which socio-economic strata they belong to, should be given extra weightage under the priority sector targets set for UCBs. Mahila UCBs, in particular, should be encouraged to focus solely on the financial inclusion needs of women customers and offer attractive deposit schemes for girl children. Since a number of bank branches is a supply-side indicator of financial inclusion,

banking penetration in terms of opening more branches should be permitted only for UCBs with high-value assets and not based on the criteria of a number of bank accounts. A government scheme similar to the National Rural Employment Guarantee Scheme should be implemented for the urban areas. UCBs can play a key role in facilitating the payment of wages from the government to the beneficiaries of such a scheme, which would encourage the urban poor to open bank accounts with UCBs. UCBs should focus on achieving targets and offering products tailored to customer needs. UCBs can also hold training programmes and credit counselling among the urban poor, especially slum dwellers, with the help of audio-visual aids to enhance their financial literacy. Policymakers should clearly distinguish between social development and social protection of the urban poor while formulating and implementing an antipoverty policy (Loughhead and Mittal, 2000). UCBs, by entering into partnerships with various stakeholders, can play an important role in facilitating both these dimensions for urban poverty alleviation. The supply-side barrier of distance from financial institutions is still cited as one of the major reasons for inactive bank accounts among adults in India (Demirgüç-Kunt *et al.*, 2022). Hence, policymakers should undertake concerted efforts through urban cooperative banks to circumvent this barrier to financial inclusion and thus progress towards inclusive growth in the country.

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The Impact of Uncertainty on the Cryptocurrency Prices

JMVM Jayasundara[1], PDCS Dharmadasa[2]

Abstract

This research aims to investigate the impact of uncertainty on virtual currency prices, focusing on Bitcoin prices. Bitcoin usage rapidly increases worldwide, making it cheaper and faster to conduct monetary transactions. Bitcoin trading is continuously at the top of the chart among the many varieties of cryptocurrencies. It is said that Bitcoin can act as a hedge against macroeconomic uncertainty. However, evidence has shown that its dominance lowered during the COVID-19 pandemic, emphasizing that uncertainty affects its market positions. The impact of economic uncertainties could be considerable, & it should be assessed to avoid unnecessary losses from investing in such currencies. The analysis is carried out using a quarterly time series of data collected from secondary sources for the variables bitcoin prices (BTC), US dollars (USD), and world uncertainty (UI). The period was from 2012 to 2022, covering of three identified global events, i.e., the COVID-19 pandemic, the Russian-Ukraine conflict, and the international growth slowdown. The analysis consists of several steps. First, the stationarity of variables was tested using the Augmented Dickey-Fuller (ADF) test. Second, the autoregressive distributed lag (ARDL) method was utilized to identify the impact of uncertainty on BTC prices. The ARDL method best suits the analysis as the unit root test results identified that the variables have different orders of integration. Third, an error correction version of ARDL was conducted as the bound testing results indicated the presence of a co-integration to check the speed of adjustment. Results revealed a long-run relationship between variables, i.e., uncertainty and Bitcoin prices. Further, the results indicated a

[1] Graduate student, Department of Economics, University of Kelaniya
[2] Senior Lecturer, Department of Economics, University of Kelaniya

Corresponding Author

P.D.C.S. Dharmadasa, Department of Economics, University of Kelaniya

Email: champias@kln.ac.lk

negative link between uncertainty and Bitcoin prices. The error correction results suggested that the speed of adjustment is slow (30%). Based on the findings, the paper concluded that global economic uncertainty hurts Bitcoin prices. Since the nature of the cryptocurrency market is explosive and unregulated, uncertainties suddenly affect the value and the volume of trading volatilities within a very short period. Therefore, it suggests that policymakers should enhance information dissemination, engage in international cooperation, and conduct further research to refine implications based on their cryptocurrency market characteristics to cope with occasionally emerging economic uncertainties. The findings of this research will contribute to a deeper understanding of the impact of economic uncertainty on the cryptocurrency market.

Key Words: Uncertainty, Cryptocurrency, Bitcoin, Autoregressive Distributed Lag (ARDL) model

JEL Classification Codes: C32, E3, E44

1. Introduction

Uncertainty generally refers to a lack of predictability or clarity about future economic conditions, outcomes, or policies with some degree of risk. It is characterized by a high level of ambiguity in the market environment, which makes it difficult for individuals, business entities, and policymakers to make informed decisions. Global uncertainty arose after the global financial crisis in 2008. However, it accelerated afterwards following a series of events happening worldwide, i.e., Brexit – 2016, the US presidential election, US-China trade sanctions, the Covid-19 pandemic, and then the war between Ukraine and Russia, emphasizing the fact that uncertainty arises due to changes in various entities such as economic, political, ethnic, and sociocultural front (Ahir et al., 2023).

Uncertainty arises from both the economic and political fronts. Economic uncertainty is first defined by Knight (1921) as "peoples' inability to forecast the likelihood of events happening". Recently, Jurado, K. et al. (2015) defined economic uncertainty as the "conditional volatility of a disturbance that is unforecastable from the perspective of future government actions, having three components: (i) Uncertainty about who will be making the policy decisions that have economic consequences, (ii) Uncertainty about what

policy decisions the people who end up in charge will make, (iii) Uncertainty about how particular policy decisions will affect the economy.

Considering the economic front, uncertainty can arise from fluctuations in key macroeconomic indicators such as GDP growth, inflation rates, interest rates, and exchange rates. Changes in these variables can have significant implications for business profitability, investment decisions, and consumer behaviour. Uncertainty surrounding inflation rates can impact business planning and consumer behaviour (Basu & Bundick, 2017; Christiano et al., 2014; Gilchrist et al., 2014). High inflation rates erode purchasing power, reducing consumer spending and increasing business costs. Conversely, deflation (falling prices) can create uncertainty by signaling weak demand and potential economic contraction. Interest rate changes can significantly impact borrowing costs, investment decisions, and consumer spending. Uncertainty about future interest rate movements can make it challenging for businesses and individuals to plan investments, make borrowing decisions, or determine the affordability of loans (Bobasu et al., 2020). Fluctuations in exchange rates can introduce uncertainty, particularly for businesses engaged in international trade. Exchange rate volatility can affect import/export costs, competitiveness, and profitability. For individuals, exchange rate fluctuations can impact the value of foreign currencies, travel costs, and the affordability of imported goods.

However, the impact of uncertainty on the political front is much larger compared to the direct economic effect. The uncertainty associated with an unstable political environment may reduce investment and the pace of economic development (Hussain, 2014). Bhattacharya et al. (2017) have emphasized that while political compromise encourages innovation, policy uncertainty hinders innovation. The view is also supported by Abdelkader (2017), stressing that investors are reluctant to invest in politically unstable countries. As emphasized, uncertainty created through government decision-making procedures and actions affects every segment of the economy; thus, it directly reduces investors' confidence, ultimately hindering the sustainability of innovative products and services.

Despite its negative influence, uncertainty can also have a "positive" effect on economic activity under certain conditions. This is discussed under the 'Oi-Hartman-Abel effect[1], which postulates that if a firm's profits are convex in

[1] (Oi 1961; Hartman 1976; Abel 1983)

demand or costs, then shocks to uncertainty about demand or cost increase expected benefits. This depends on firms' ability to expand to exploit good outcomes and their ability to contract to insure against bad outcomes (Baker & Bloom, 2013).

Against this backdrop, the main objective of this paper is to investigate the impact of uncertainty on cryptocurrency prices. Cryptocurrency is a newly innovated virtual currency that has recently changed the direction of investment among the masses. The popularity of cryptocurrency is accelerating due to its low transaction cost and unregulated trading system, which made it popular among interest parties (Blau, 2017; Kristoufek, 2015). However, they seem vulnerable as they are associated with certain risks, including security vulnerabilities, hacking incidents, fraud, market manipulation, and regulatory uncertainties. Besides, the speculative nature of cryptocurrency investments can lead to bubbles and overvaluation of currencies. When prices are driven primarily by speculation rather than underlying fundamentals, it increases the risk of market crashes and financial instability (Kindleberger, 2016; Bouri et al., 2019). Furthermore, with a lack of consumer protection mechanisms and irreversible cryptocurrency transactions, consumers incur losses due to irreversibility in case of fraudulent transactions. On the other hand, cryptocurrency has limited acceptability. Thus, it cannot be used as a medium of exchange. This hinders their ability to function as an alternative to traditional currencies.

Nonetheless, investors are deeply engaged in cryptocurrency trading due to its underlying blockchain technology having the potential to revolutionize various industries, including finance, supply chain management, voting systems, and more. Therefore, it is worthwhile to investigate how the uncertainty factor affects cryptocurrency prices and what is the nature of the relationship between uncertainty and cryptocurrency (Bitcoin) prices.

The remainder of the paper consists of three sections. The next section provides a comprehensive review of both theoretical and empirical literature related to cryptocurrency trading, price fluctuations and its impact on the cryptocurrency market. Section three discusses the methodology, including data and analytical methods. Section four discusses the results compared to the existing literature, and section five provides plausible conclusions and policy implications.

2. Literature Review

Theories on the impact of uncertainty on prices go far back to the Keynesian era. Keynesian view of uncertainty linked with money and how it is attached to the individual decision-making process. In uncertain conditions, money provides a sense of security, which forces individuals to determine specific behaviour to cope with uncertainties created by market dynamics. Thus, Keynes argued that in an environment dominated by uncertainty, people try to increase their liquidity preferences and increase the demand for money. The precautionary motive of money holding is one of the main motives in the Keynesian theory of money demand. Generally, uncertainty incorporates both 'risk' and 'Knightian uncertainty'. In the former, the risk emphasizes that the probabilities of potential outcomes are known, but which outcome will occur is not. In the latter, neither the probabilities of outcomes nor the eventual result is known (Knight, 1921; Cagliarini & Heath, 2000).

Potential channels that transfer the effect of uncertainty into the real economy are well documented in the theoretical literature. The real options channel emphasized that firms postpone investments and hiring of labour due to uncertainties (Bernanke, 1983; Pindyck, 1993; Bertola & Caballero, 1994). Similarly, the "cost financing" channel emphasized the reduction of investment due to raising the risk premium and increasing the cost of borrowing (Christiano et al., 2014; Arellano et al., 2010). Besides, the precautionary motive channel at the household level emphasizes that people voluntarily delay their consumption of durable goods during uncertainties (Kimball, 1990; Eberly, 1994). As previously emphasized in the paper, the 'Oi-Hartman-Abel effect' notion emphasized the positive real effect of uncertainty, while other theories mostly emphasized negative effects.

Owing to the increase in popularity of cryptocurrency trading, empirical investigation on this product and its market behaviour is also expanding at an alarming rate. A recent study by Fang et al. (2020) has analyzed the impact of the News-based Implied Volatility index (NVIX) on cryptocurrency returns. Results indicate that cryptocurrency market volatility might be more susceptible to price uncertainty and investors' perceptions than policy uncertainty. On the other hand, the study by Wang (2021) investigated the impact of cryptocurrency environmental attention on financial and economic variables. It employs econometric methodologies such as the Vector Error

Correction Model (VECM) and the Structural Vector Error Correction Model (SVECM) to assess the relationships between the ICEA and various variables, including cryptocurrency prices, policy uncertainty, crude oil markets, climate change, and real production output. The findings suggest that attention to environmental issues concerning cryptocurrencies significantly impacts cryptocurrency price fluctuations.

An interesting study on the effects of hacking events on price volatility conducted by Izwan (2020) found that hacking events significantly impact the targeted cryptocurrency. These events led to an increase in the hacked cryptocurrency's price volatility and cross-cryptocurrency correlations. Further, the research examined the abnormal returns in the hours leading up to a cybercrime event and highlighted that they result in abnormal returns that revert to zero upon public announcement. This is interesting as it deviates from mainstream research and emphasizes a different type of uncertain event that can come across to investors in the cryptocurrency market.

Besides, Lennart et al. (2021) investigated the impact of stablecoin issuances on the returns of major cryptocurrencies. Using an event study methodology, they investigate the behaviour of cryptocurrency markets before and after stablecoin issuances. The results revealed that there were cryptocurrency market downturns in the week leading up to a stablecoin issuance, and stablecoin issuances contributed to price discovery and efficiency in the cryptocurrency market. Leonardo (2020) analyzed the impact of network effects on competition by observing the changes in exchange rate data among cryptocurrencies over time. It consists of two main aspects, i.e. competition among different cryptocurrencies and competition among exchanges where these currencies are traded. Employing a VAR analysis, the study found that lagged exchange rates granger causes chosen cryptocurrencies.

Another study investigated the interrelationships between cryptocurrency liquidity and volatility during the COVID-19 pandemic, highlighting that Bitcoin, Litecoin, Ethereum, and Cardano were the most stable cryptocurrencies in terms of liquidity reliance, while Bitcoin Cash and Bitcoin SV were vulnerable to liquidity shocks (Shaen et al., 2022). Covering the same Covid-19 era, Huynh et al. (2021) investigated the prediction power of economic policy uncertainty on Bitcoin trading (return, volume, and volatility)

from 2013 to 2019 using the Transfer Entropy model. It has been revealed that economic policy uncertainty negatively causes Bitcoin volumes and volatilities.

Further, Wang et al. (2020) point out that economic uncertainty fundamentals lead to a rise in Bitcoin prices. Demir et al. (2018) analyze the impact of monetary policy uncertainty on Bitcoin earnings and find that the GEPU leads Bitcoin prices. Besides, Mokni (2021) investigates the causality between economic policy uncertainty and Bitcoin returns and volatility in 10 countries running Bitcoin nodes under different market conditions. Employing both symmetric and asymmetric causality in-quantiles tests, the study found that policy uncertainty improves the bitcoin returns of countries with extreme market conditions. However, uncertainty caused bitcoin volatilities in medium and high quantiles. Another study carried out by Matkovskyy et al. (2020) on the effects of economic policy uncertainty (hereafter, EPU) on the relationship between Bitcoin and traditional financial markets during the period 27/04/2015 to 25/10/2018 in the USA asserted that the investment attractiveness of Bitcoin as a hedging tool against shocks in uncertainty in the USA economic policy.

Nguyen & Nguyen (2023) have investigated the short-term and long-term impact of general economic policy uncertainty and crypto-specific policy uncertainty on Bitcoin's exchange inflows. The analysis used the ARDL Bound testing approach and found that monetary policy uncertainty affects Bitcoin only in the short run, while exchange inflows of Bitcoin "Granger" cause its price volatility. Further, they have found that the influence of exchange inflows of Bitcoin is persistent compared to the impact of economic policy uncertainty.

Simran & Sharma (2023) studied the relationship between the cryptocurrency market and economic policy uncertainty, concentrating on the top five cryptocurrencies assessed by market capitalization. The analysis revealed that all currencies display a positive relation in the short run, which became negative in the long run except for Tether. Besides, the study found that in advanced economies (US), economic policy uncertainties have a negative effect on the Bitcoin market, whereas in emerging economies (India & China), a significant influence cannot be found. Even though the study asserted that

cryptocurrencies exhibit asymmetries in the short run, it did not clearly explain the asymmetries present.

Wu et al. (2019) analyzed whether Bitcoin can play as a hedge against economic policy risk in the United States by employing GARCH and Quantile Model with dummy variables. The study discovered that Bitcoin does not provide a safe haven to hedge the economic policy risk of the USA. Moreover, the study revealed that in extreme market conditions, whether higher or lower or extreme bullish and bearish trends, the ability of Bitcoin to act as a hedger or safe haven is weak. However, the study asserted that it can be used for diversification or risk mitigation intent. In contrast, Shaikh (2020) found that Bitcoin can perform as a safe haven and hedge against market uncertainty in the United States, Japan, and China. Employing quantile regression and the ordinary least square method, the study confirmed that the returns of Bitcoin are more reactive to the economic policy uncertainty of those countries. There is a contradiction in the findings of these two studies. When observing the facts, it is clear that the time frame of these two studies is slightly different. Therefore, time-varying features may influence the findings to be different. Besides, analytical methods may also affect the issue.

Khan et al. (2021) have investigated the global economic uncertainty on bitcoin prices using the rolling window method from 2011Q4 to 2020Q3 and have found both positive and negative bi-directional causalities between uncertainty and Bitcoin prices. This study used various sub-samples covering different uncertainty events in the analysis. Even though it is theoretically and empirically acceptable that economic policy uncertainty negatively influences Bitcoin prices, the causality from Bitcoin prices to uncertainty is doubtful.

Similarly, Qin et al. (2021) have investigated the role of Bitcoin in diversifying investment risks during periods of high global economic policy uncertainty using the same methodology as Khan et al. (2021). They also emphasized both positive and negative causal impacts on Bitcoin returns. However, they have asserted that Bitcoin cannot always be a hedge against policy uncertainty. They have further stressed that Bitcoin returns indicate useful information on forecasting global economic policy uncertainty emphasizing the presence of bi-directional causality between global economic policy uncertainty and Bitcoin returns as in the previous study.

The review of empirical studies revealed that research on the impact of various uncertainties on cryptocurrencies and the cryptocurrency market has been conducted worldwide, and most of the studies found the negative influence of uncertainty on cryptocurrency prices and trading. Besides, several studies have emphasized the positive uncertainty effect as well. Some empirical studies concerning causality links have also found some doubtful areas. This may happen due to measurement errors. Therefore, further studies are needed to confirm the findings. This study aims to recheck the validity of previous findings by investigating the impact of uncertainty on cryptocurrency prices using a new estimation method not previously utilized to analyze the uncertainty impacts on cryptocurrency. The paper provides insightful policy implications to prevent the adverse effects of uncertainties in the Bitcoin market.

3. Methodology

3.1. Variable Selection

The study has identified three main variables of interest: The Bitcoin price index (as the dependent variable), the USD price index (as an independent variable), and the global economic uncertainty index (as an independent variable). The Bitcoin price index represents the fluctuations in the price of Bitcoin, the most widely recognized and traded cryptocurrency. The USD price index, on the other hand, reflects the value of the US dollar relative to other currencies. As cryptocurrencies are often traded against major fiat currencies like the US dollar, changes in the USD price index can provide indications of how fiat currency fluctuations impact cryptocurrency prices. global economic uncertainty, economic policy uncertainty indices, or other indicators that capture uncertainty in the international financial landscape. The rationale behind the choice of USD here is that the dollar has been considered a strong currency due to its usage as the World's reserve currency. Besides, it has been used as a base currency for foreign exchange transactions since the interwar period, and dollar-denominated debt accounts for 60 per cent of global debt (Shaban, 2022; Chitu, 2012). Recently, it became further stronger against the British Pound, benefiting Americans with cheaper imports (Shaban, 2022). Therefore, fluctuation in the dollar creates uncertainties worldwide, not only in trading goods and services but also in currency

exchange. Thus, the paper assumed that utilizing the dollar price index is ideal to achieve the paper's desired objective.

3.2. Data & the Time Frame

Quarterly time series data was collected from secondary sources i.e., www.coindesk.com and www.Coinmarketcap.com, from 2012Q1 to 2023Q2. The significance of this time frame is that it covers the three identified global economic uncertainty events, i.e., the era of the COVID–19 pandemic, the era of the Russian-Ukraine conflict, and the era of global growth slowdown, which are known to affect serious commodity price fluctuations worldwide. Besides, Bitcoin became popular after 2011, and the data on Bitcoin prices and trading also became available; the time frame is assumed to be ideal in this setting.

3.3. Analytical Methods

The analysis consists of several steps. First, a unit root test is conducted using the Augmented Dickey-Fuller (ADF) test to check the stationarity, a common practice when analyzing time series data. It is said that using non-stationary data for analysis provides spurious results. After identifying the variables with different orders of integration, an Autoregressive Distributed Lag (ARDL) bound test introduced by Pesaran & Shin (1999) is conducted to check whether variables have long-run relationships. It is widely recognized that the ARDL bound test is the best method for testing co-integration when the variables have different orders of integration, or it can be utilized for analysis irrespective of the order of integration, such that *I*(0) or *I*(1) of variables (Pesaran et al., 2001). Since the results confirmed that the variables were co-integrated, the Error Correction form of the ARDL test was conducted. Finally, the Wald Coefficient test is conducted to determine the influence of independent variables on the dependent variable.

3.4. The Model

$$Y_t = a_0 + a_1 t + \sum_{i=1}^{p} \phi Y_{t-i} + \beta' X_t + \sum_{i=0}^{q-1} \beta_1^* \Delta X_{t-i} + u_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\Delta X_t = P_1 \Delta X_{t-1} + P_2 \Delta X_{t-2} + \ldots\ldots + P_s \Delta X_{t-s} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where Y is the dependent variable, and X_t is the k-dimensional *I*(1) variables that are not co-integrated. *u* and *e* are serially uncorrelated disturbances.

This study uses the Autoregressive distributed lag (ARDL) approach to examine the impact of global economic uncertainty on cryptocurrency prices. The following model is specified:

$$\Delta BTC_t = \alpha_{10} + \alpha_{11} BTC_{t-1} + \alpha_{12} UI_{t-1} + \alpha_{13} USD_{t-1} + \varepsilon_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The decision is made based on the following specification: the null hypothesis of no long-run effect is inferred by the coefficients represented by the term alpha placed near the variables assumed to be affected on Bitcoin prices. The null hypothesis ($H_0: \alpha_{11} = \alpha_{12} = \alpha_{13} = 0$), which states that co-integration does not exist among the variables tested against the alternative hypotheses of ($H_1: \alpha_{11} \neq \alpha_{12} \neq \alpha_{13} \neq 0$), that indicates the presence of co-integration between the utilized variables.

The following specification can explain the short-run dynamics in the above equation:

$$\Delta BTC_t = \beta_{10} + \beta_{11} \sum_{i=1}^{p} \Delta BTC_{t-i}\, \beta_{12} \sum_{i=o}^{p} \Delta UI_{t-i} + \beta_{13} \sum_{i=0}^{p} \Delta\, USD_{t-i} + \mu_{11} ECM_{t-1} + \eta_1 \ldots\ldots (4)$$

ARDL bound test is conducted to achieve desired objectives.

4. Results and Discussion

4.1. Unit Root Test

One of the problems associated with time series data is that they could incorporate time trends, which could give spurious results when estimating parameters (means that they may underrepresent or overrepresent the influence of utilized independent variables on the dependent variables, ultimately leading to false conclusions. Therefore, it is a common practice to conduct a unit root test on variables before going to the main analysis. Following that practice, the Augmented Dickey-Fuller test (ADF) was performed on variables to check their level of stationarity. Results are given in Table 1.

Table 1 - Unit Root Test Results

Variables	Level Test	First Difference
BTC	-1.886714 (0.3356)	-3.788000 (0.0057)***
UI	-2.808404 (0.0646)**	-6.127214 (0.0000)***
USD	-1.310882 (0.6174)	-4.705695 (0.0004)***

Source: Statistical output Results

, * shows the level of significance of 5% and 1%, respectively. Probability values are in parenthesis.

ADF test results have shown that except UI (uncertainty index), all other variables show unit roots and became stationary at their first difference. Thus, the variables utilized consist of both stationary and non-stationary data. It is said that variables with unit roots may have an integration in the long run (). Therefore, the study realized that a co-integration test is necessary to check whether variables indicate a long-run relationship. However, it is obvious that a general co-integration test cannot be utilized here as variables have different levels of integration. Therefore, as discussed in the methodology section, ARDL bound test is utilized to check the long-run relationship of variables.

4.2. ARDL Bound Test Results

As previously emphasized in the paper, ARDL-bound testing is carried out to identify whether variables have a long-run relationship. The test results have shown the presence of a co-integration in the estimated data, which are presented in Table 2.

Table 2: ARDL Long Run Form & Bounds Test

ARDL Long Run Form and Bounds Test Dependent Variable: D(BTC) Selected Model: ARDL(3, 4, 0) Case 2: Restricted Constant and No Trend Date: 09/09/23 Time: 20:31 Sample: 2012Q1 2023Q1 Included observations: 41				
Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-22196.36	10205.18	-2.175010	0.0374
BTC(-1)*	-0.306065	0.055710	-5.493895	0.0000
UI(-1)	10.3546	7.149031	5.737726	0.0000
USD**	10.6768	8.605894	0.954760	0.3471
D(BTC(-1))	-0.159642	0.123706	-1.290498	0.2064
D(BTC(-2))	0.157951	0.123870	1.275134	0.2117
D(UI)	-8.755283	0.20500	-0.857941	0.3975
D(UI(-1))	-11.4304	7.72565	-6.448541	0.0000
D(UI(-2))	-7.11958	7.06986	-4.170849	0.0002
D(UI(-3))	-4.49917	2.29045	-3.660708	0.0009
* p-value incompatible with t-Bounds distribution.				

** Variable interpreted as Z = Z(-1) + D(Z).				
Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
UI	327.8868	58.92899	5.564100	0.0000
USD	338.7414	338.4025	1.001001	0.3246
C	-72521.79	30214.38	-2.400240	0.0226
EC = BTC - (327.8868*UI + 338.7414*USD -72521.7851)				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.66662	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5
Actual Sample Size	41		Finite Sample: n=45	
		10%	2.788	3.54
		5%	3.368	4.203
		1%	4.8	5.725
			Finite Sample: n=40	
		10%	2.835	3.585
		5%	3.435	4.26
		1%	4.77	5.855

Source: Statistical Output

In the bound test, the F statistic is the main concern and indicator of whether the variables have a long-run relationship (Pesaran et al., 2001). As shown in the above table, the F statistic (10.66662) indicates a significantly higher value than both the lower and upper bound of the critical values of both 1 per cent and 5 per cent. According to the theory, this emphasizes a long-run relationship among variables in the model. It also revealed that the long-run

link between uncertainty (UI) and bitcoin prices (BTC) in US dollars (USD) was not significant.

Since the test confirms at least one co-integration link, an error correction version of the ARDL test was conducted to identify the time that it takes for that imbalance/ fluctuation to settle. The results are shown in Table 3.

Table 3: ARDL Error Correction Regression

ARDL Error Correction Regression				
Dependent Variable: D(BTC) Selected Model: ARDL (3, 4, 0) Case 2: Restricted Constant and No Trend Date: 09/09/23 Time: 20:34 Sample: 2012Q1 2023Q1 Included observations: 41				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BTC(-1))	-0.159642	0.109559	-1.457136	0.1551
D(BTC(-2))	0.157951	0.112521	1.403748	0.1703
D(UI)	-8.755283	8.905825	-0.983096	0.3332
D(UI(-1))	-11.43046	16.39482	-6.971995	0.0000
D(UI(-2))	-71.19581	16.06860	-4.430742	0.0001
D(UI(-3))	-44.99176	11.66838	-3.855871	0.0005
CointEq(-1)*	**-0.306065**	**0.044742**	**-6.840725**	**0.0000**
R-squared	0.684778	Mean dependent var		563.6976
Adjusted R-squared	0.629151	S.D. dependent var		6225.931
S.E. of regression	3791.428	Akaike info criterion		19.47312
Sum squared resid	4.89E+08	Schwarz criterion		19.76569
Log likelihood	-392.1991	Hannan-Quinn criter.		19.57966
Durbin-Watson stat	2.118579			

Source: Statistical Output

The coefficient of the error correction term is significant with the correct sign and magnitude. Theoretically, it says that the coefficient of the error correction term should lie between -1 and 0 ($-1<\beta< 0$). The result of this estimation is consistent with the theory as it shows that one period lagged value of the co-integration equation is negative and significant with (-0.306065) of coefficient value. This can be interpreted as a 30 per cent downward adjustment of prices needed to correct the error or to reach equilibrium. Considering the magnitude

of the coefficient (30%), the speed of adjustment seems somewhat slow. The findings are similar to those of the study of Glouderman (2014), which emphasized that government intervention in the cryptocurrency market may cause downward pressure on cryptocurrency prices. Nonetheless, the obtained result through this analysis somewhat contradicts the findings of Bouri et al. (2020) and Khan et al. (2021). However, these studies found a positive (upward pressure) price effect due to uncertainty by analyzing the sub-samples taken from the main sample. Those sub-samples covered the periods with low levels of uncertainty, especially the period between 2017:12–2018:04 and between 2015:05–2015:08. These periods indicate less volatility in the global economy. Hence, their findings concerning those periods can be accepted. However, this analysis used the whole sample and wasn't divided into sub-samples. Therefore, the overall results obtained here are quite clear.

The VEC analysis's Short-run test results have shown that uncertainty's lagged effect on bitcoin prices is negative. The quarter-lagged effect is stronger than one and three, emphasizing that uncertainty affects future bitcoin prices. Hence, the value of Bitcoin in the future, following any uncertain condition, will be lowered. Coefficient values emphasized that uncertainty caused the reduction of bitcoin prices by more than 100 per cent.

However, the reliability and validity of the obtained results depend on several other specific factors. Among them, the value of R square, coefficient diagnostics, model stability, absence of autocorrelation, and normalcy of the residuals are important. Therefore, the analysis extended to test for those specifics as well.

The adjusted R-square value of the estimated error correction output has been indicated as 0.629151. This implies that around 63 per cent of variations in independent variables can be explained by the independent variables utilized in the model. Therefore, the variables are reliable and fit the model best.

4.3. Wald Coefficient Diagnostic Test

Wald test is a parametric statistical measure used in analysis to confirm whether a set of independent variables are collectively 'significant' for the model. It is also used to check whether each independent variable present in the model is significant (refer to Table 4).

Table 4: Wald Test

Test Statistic	Value	df	Probability
F-statistic	52.76513	(3, 31)	0.0000

Chi-square	158.2954	3	0.0000
Null Hypothesis: C(1)=C(2)=C(3)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(1)		0.534293	0.135533
C(2)		0.317593	0.161021
C(3)		-0.157951	0.123870
Restrictions are linear in coefficients.			

Source: Statistical Output

The probability value of both the F statistic and Chi-square value is significant at the 1 per cent level, confirming that the variables add some incremental value to the model. In addition, a higher Chi-square value emphasizes that variables have more predictive power. Therefore, it can be said that variables best fit the model.

4.4. Test for Autocorrelation

Another problem of concern in time series analysis is the autocorrelation of residuals. Autocorrelation emphasizes model-drawing conclusions or sub-optimal estimates of model parameters. Therefore, an autocorrelation LM test is conducted, and the results are shown in Table 5.

Table 5: Autocorrelation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 4 lags			
F-statistic	0.822223	Prob. F(4,13)	0.5338
Obs*R-squared	7.672582	Prob. Chi-Square(4)	0.1043

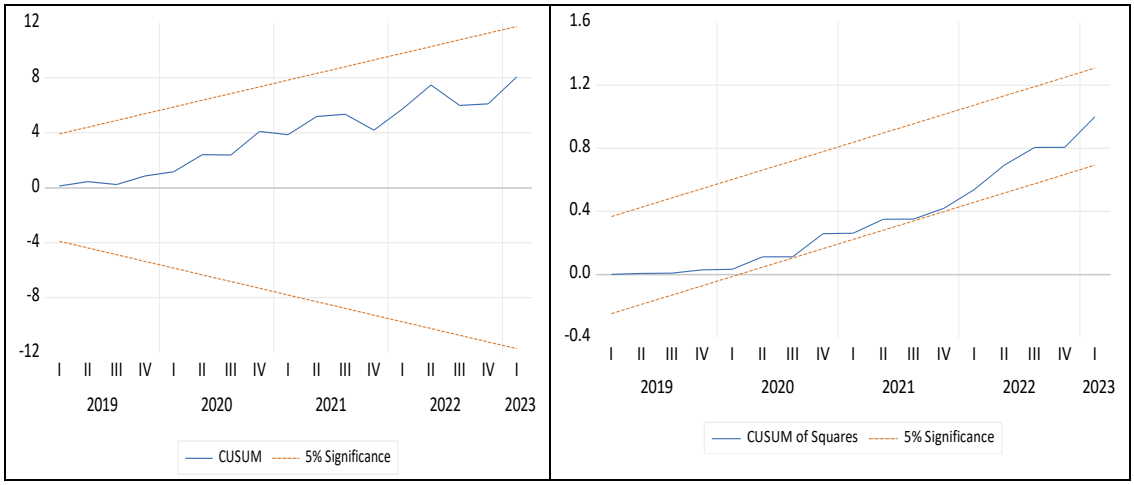
Source: Statistical Output

As shown in the results, F statistics are not significant and, therefore, cannot reject the null hypothesis, and it can be concluded that residuals are not serially correlated.

4.5. Model Stability Tests

CUSUM and CUSUM of Square tests are conducted to test whether the utilized parameters are stable. Both tests have shown that regression coefficients fall within the 5% level of significance range and don't indicate deviations, emphasizing the stability of the model.

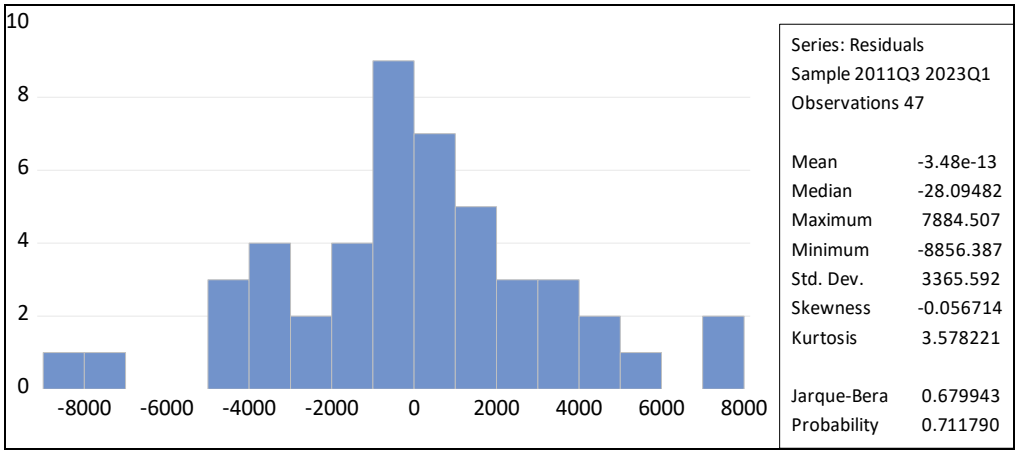
Figure 1: CUSUM & CUSUM of Square Test



Source: Statistical Output

4.6. Residual normality test

Figure 2: Residual Normality Test



Source: Statistical Output

Residual normality test results also emphasized the normal or near-normal distribution. As shown in Figure 2, insignificant Jarque-Bera test statistics show a low value, and the normal distribution's spread and height, shown by Skewness and Kurtosis, respectively, also don't show much of an issue. Therefore, the overall distribution of data is normal.

5. Conclusion and Policy Implications

This paper investigated the effect of global economic uncertainty on Bitcoin prices using the autoregressive distributed lag (ARDL) method. Data on the

Global economic uncertainty index, Bitcoin prices, and United States dollar prices have been utilized for the analysis from the first quarter of 2012 to the first quarter of 2023. The period covered here included all serious socio-economic events that positively and negatively affected the world market. The analysis revealed the presence of a co-integration relationship among variables in the model, and therefore, an error correction version of ARDL analysis is conducted. Findings revealed that global economic uncertainty negatively affects Bitcoin prices and puts downward pressure on prices. Error correction coefficient shows a low-speed downward adjustment towards the equilibrium. Based on the findings, the paper concluded that global economic uncertainty has a negative effect on Bitcoin prices. This may be due to various government policy interventions of respective countries to prevent the manipulative buying & selling behaviour of investors in the Bitcoin market. Since the nature of the cryptocurrency market is explosive and unregulated, uncertainties suddenly affect the value and the volume of trading volatilities within a very short period. Therefore, authorities or policy-making bodies should take action to establish a perfect information flow for investors to minimize the volatility in cryptocurrency trading and stabilize the market. Otherwise, unnecessary volatilities enhance speculative market activities, hindering the world's financial system's stability and creating greater income inequality among individual and institutional investors.

Taking sub-samples that consider various socio-economic events for analyses will also be helpful in identifying the individual effects of various events that cause price fluctuations, which is a limitation of this study. Besides, the volume of trade, demand for Bitcoin, prices, and trading of other cryptocurrencies are significant factors affecting Bitcoin prices. Incorporating such information would also help obtain more accurate results. Such analysis would be an avenue for future research.

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Exploring Barriers to Women's Participation in University-Level Sports

W.T.C Kurera[1], P.D.V.C Wickramaratne[2], W.G.D.S.Wehigaldeniya[3]

Abstract

This study aims to discern the barriers affecting women's engagement in sports. Drawing upon an extensive review of relevant literature, a conceptual framework was developed to guide the investigation. The research adopted a quantitative methodology, utilizing primary sources for data collection. The sample, chosen through the stratified random sampling technique, comprised Kelaniya University athletic team athletes. A self-administered survey questionnaire was employed to gather information from 55 University of Kelaniya, Sri Lanka athletes. Data analysis involved the application of SPSS and AMOS Factor Analysis, revealing cultural, religious, and familial barriers to women's sports participation. In conclusion, the study highlights the significant impact of culture, religion, and family dynamics on women's participation in sports.

Keywords: women's Sports, university-level participation, barriers, culture, religion

1. Introduction

In contemporary society, sports capture a widespread interest and offer myriad benefits, yet the definition of sports varies among individuals. Steffen Borge (2020) describes sports as an extraordinary, unnecessary, rule-based, competitive, skill-based physical activity involving cooperation to fulfil a goal through a competition, with participants adhering to the sport's constitutive rules. Alternatively, (Sport, 2021) characterizes sports similarly, emphasizing

[1] Graduate Student, Department of Sport Science and Physical Education, Faculty of Social Sciences, University of Kelaniya
[2] Senior Lecturer, Department of Sport Science and Physical Education, Faculty of Social Sciences, University of Kelaniya
[3] Lecturer, Department of Sport Science and Physical Education, Faculty of Social Sciences, University of Kelaniya

the rule-based, competitive, and skill-based nature of physical activities with the goal of competition.

Participation in sports activities is widely encouraged among adolescents due to its numerous psychosocial health benefits. Physical activity helps to relieve mental and physical stress. (Nawarathna et. al 2021) At the same time physically active students improve their brain capacity (Wickramaratne et.al, 2020). Defining sports participation is nuanced and subjective, generally referring to individuals engaging in sporting activities, whether formally or informally. Fowlie (2021) categorizes sports participation in various ways, including participation by women, men, and transgender individuals.

However, historical patterns reveal a consistently lower rate of sports participation among women. In the early Olympic Games, women were excluded, with the competition viewed as a display exclusively for men (Olympic history, n.d.). This exclusion persisted into the first modern Olympics in 1896, reflecting the prevailing mindset of that era. Limited opportunities for women outside their homes and families during the early 20th century resulted in a scarcity of dedicated female athletes. Although the concept of "Sports for all" emerged in the mid-1970s, aiming to promote equal opportunities, achieving gender equality in sports has been proven to be challenging.

The "Sports for All" movement, initiated in the mid-1970s, aimed to motivate people to be more active and establish sports as a fundamental human right in an egalitarian society. Despite the ideal of equal opportunities for all, realistically achieving this goal, especially for women, has been challenging (Joshua, 2013). Women have encountered obstacles, with historical male dominance in sports shaping it to suit their preferences and skills, ultimately contributing to lower rates of women's sports participation (Amuche, 2004; Joshua, 2013).

Moreover, there is a noticeable decline in physical exercise participation during young adulthood, often attributed to factors such as time constraints and financial limitations among university students. Social support or the lack of support from family and friends is another common obstacle. Burton's research (2021) highlights barriers to women's sports engagement, including

limited family support, domestic obligations, busy academic schedules, inadequate facilities, and environmental factors like hot weather.

Sociocultural influences also play a significant role in women's sports participation. A study by the University of Ilorin reveals that cultural and social forces, encompassing religion, parenting, culture, peers, gender roles and mass media, act as barriers to women's sports participation (Ikulayo, 1998). Yan and Thomas (2005) further note that cultural expectations influence children's physical activity patterns (Joshua, 2013). In conclusion, while sports are a universal interest, historical and contemporary barriers persist, particularly impacting women's participation. Understanding these barriers is crucial for fostering inclusive and equitable sports environments.

2. Literature Review

This section focuses on the Findings of past studies about the impediments to women's sports participation. According to Ashraf (2018), women are more likely to experience different kinds of impediments when participating in sports than men. Gender is the most obvious source of inequality in sports, according to Paaij, Farquharson, and Marjoribanks (2015, 400). Women are underrepresented in professional roles, the media, and sports as female coaches and players due to gender inequality and gender imbalance, claim Algarve (2018), Burton (2015), Pletzer (2015), and Byron (2015). While males have historically dominated sports involvement, Fowlie (2021) also found that there have also been some traditionally male-dominated sports in which women were previously largely prohibited from participating. The majority of men and a minority of women who participate in sports are influenced by culture, 26 religions, racism, class, and socioeconomic resources, according to Strandbu, 2019. The study also demonstrates how low socioeconomic resource levels in families are a barrier to both boys' and girls' engagement in sports. (Strandbu, 2019) Sports maintained a far greater place among guys than among girls in terms of peer culture and youth, according to Shakib's 2011 survey, an American study of high school students. (Strandbu, 2019) Joseph (2015) identified three main categories of impediments that prevent women from participating in sports: as follows.

- Intrapersonal – Research indicates a lack of drive, a lack of understanding, tiredness, and concern for appearance.

- Interpersonal - insufficient social support, insufficient partners for activities, limited time for housework.
- Environmental barriers - a lack of practical master plans, safety concerns in the area and the community, absence of sidewalks, lack of facilities for activities, and the weather (high temperatures, wind, and rain) (Joseph, 2015).

Socio-cultural barriers are one of the biggest obstacles when it comes to participating in sports, and they are particularly prominent among female participants, according to a study on university students in Pakistan (Turkmen, 2018). According to Fowile's (2021) research, teenage girls who play sports are looking for themselves and other girls who do the same sport. The study also demonstrates that they are connected to the game because of this (Fowlie, 2021). According to a Morton 2018 study, there is a widespread issue with the underrepresentation of women in the adventure sports sector. This investigation shows that women participate in adventure sports less frequently than men because of the expensive sports equipment and a lack of support from friends and family, among other factors (Morton, 2018). In contrast to their male counterparts, female adolescents are more likely than their male counterparts to imitate their older siblings' active lifestyles, according to a study by Casey et al. (2009) and Craike, Symons, and Zimmermann (2009), shows the requirement of Joshua-inspired rewards further. (Fowlie J. R., 2021). Because of this, the study supports the idea that women should follow their family's traditions and that sports are not necessary for them (Strandbu, 2019). According to the study by Strandbu 2019, the countries of origin of the parents have a significant impact on disparities in sports involvement. According to the report, Muslim nations like Pakistan and Turkey are more likely to experience the problem (Strandbu, 2019). Women from migrant origins are strongly encouraged to participate in sports and religion is a component of the society. According to the Pfister 2000 study, Muslim principles of gender discrimination are a significant barrier preventing young Muslim women from participating in athletics (De Knop et al. 1996, Strandbu, 2019). Marwat (2021) states that religious considerations impact women's sports engagement. (Marwat, 2021). According to the International Olympic Committee's 2019 report, statistics on Olympic Games participation paint a dismal picture of women in Muslim-majority nations. In accordance with

Rizvi and Rio (2016), Iranian women competed for their country in gymnastics and athletics in the 1964 Tokyo Olympics. Only 2% (98) of the female competitors in the 2008 Beijing Olympic Games represented Muslim countries, even though over 20% of the world's population is Muslim (Marwat, 2021). When focusing on the religious perspective in sports, Marwat 2021 noted that there are some impediments for women to participate in sports based on their religion in the Muslim community (Marwat, 2021). According to the report, women should have religious practices that shield them from seeing their male counterparts (Marwat, 2021). Marwat's study from 2021 also revealed that the main obstacles preventing women from participating in sports include a lack of sports infrastructure, family obligations, time limits, and financial issues. According to Kara and Demircial, there is no issue with women from affluent families participating in sports. According to Muthuri, Wachira, Onywera, and Tremblay (2019), women's engagement in sports is impacted by personal safety concerns, gender discrimination, and expensive facility costs (Marwat, 2021). According to a study by Strandbu (2019), a minority of females were less likely to participate in sports if they were identified as Muslims (Strandbu, 2019).

Research in various European nations has shown that discrimination against racial and ethnic minorities is an issue. According to the 2014 research paper by Massao and Fasting, this causes disparities in how men and women experience things (Strandbu, 2019).

Following an extensive review of existing literature, the researchers formulated the conceptual framework for this study. The investigation identified five independent variables based on the literature related to barriers to women's sports participation. These variables encompass Friends, Family, Economy, Culture, and Religion. The dependent variable in this study is Women's sports participation among university athletes.

3. Method

3.1. Study Design

This research adopts a quantitative approach to investigate the impediments to women's participation in sports at the university level. A cross-sectional design is employed to collect data at a specific point in time, providing a snapshot of the current perceptions and experiences of female athletes.

3.2. Sampling

The study focuses on the athletics team of the University of Kelaniya as the target population. A stratified random sampling technique is employed to ensure representation across different strata within the athletic team, such as various sports disciplines and academic years. A sample size of 55 athletes is determined for this study.

3.3. Data Collection Instrument:

To gather data, a Google Form questionnaire is utilized. Google Forms offer a convenient and widely accessible platform for data collection, allowing respondents to provide timely and efficient responses. The questionnaire is designed to elicit information regarding barriers to women's sports participation, with a specific focus on cultural, religious, and familial factors. The inclusion of Likert scale questions facilitates the quantification of responses, providing a structured framework for analysis.

3.4. Variables and Questionnaire Construction:

The questionnaire comprises both closed-ended and Likert scale questions. Closed-ended questions capture demographic information, including age, academic year, and gender. Likert scale questions assess the perceived barriers to women's sports participation, with items related to cultural, religious, and familial influences. Careful consideration is given to constructing unbiased and comprehensive questions to ensure the reliability and validity of the collected data.

3.5. Data Analysis:

The collected data is subjected to statistical analysis using the Statistical Package for the Social Sciences (SPSS) and AMOS Factor Analysis. Descriptive statistics provide an overview of the respondents' demographics, while factor analysis helps identify underlying factors contributing to women's sports participation barriers.

This methodology aims to provide a robust framework for investigating the impediments to women's sports participation, ensuring the collection of reliable and meaningful data to address the research question.

4. Data Analysis

The questionnaire aims to identify the factors that have an impact on the Impediments to Women's Sports Participation. The results are analyzed by "SPSS AMOS Factor analysis" for further analysis using descriptive statistics, KMO and Bartlett's Test, scree plot, Component Transformation Matrix, and One- Way ANOVA tests. Analyze using significance value, eigenvalue as well as the maximum value and minimum value of results and discuss the overall results. The chapter concludes by pointing out the limitations of data analysis.

Table 1: Descriptive statistics

	N	Mean	Std. Deviation
Religion	55	19.60	5.69
Culture	55	18.58	4.69
Family	55	19.05	3.84
Friends	55	19.16	3.66
Economy	55	14.52	2.78

Source: Research 2023

The detailed descriptive statistics provide information about the variables in the datasets and highlight the potential relationships between the variables. It also gives an idea of how many of these factors affect the analysis of the facts.

The mean of the variables used for factor analysis shows that the challenges of Religion and Friends are most influential, showing a mean between 19.6000 and 19.1636, depending on the sample size used in focusing on the highest value and the lowest value. Also, according to the above results, the Economy has a minimum mean of 14. 5273, has a minimal effect on the Women's Sports Participation.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.717
Bartlett's Test of Sphericity	Approx. Chi-Square	1526.184
	df	435
	Sig.	.000

Source: Research 2023

Table 2 shows the table containing the KMO value obtained from the factor loading to proceed with the factor based on the results obtained from the data analysis. The KMO measures the sampling adequacy, which should be greater than 0.5 (>0.5) for a satisfactory factor analysis to proceed. If any pair of variables has a value less than this, consider dropping one from the analysis. Kaisen (1974) recommends 0.5 as the minimum value for adequacy, and values between 0.7 and 0.8 are acceptable; also, values above 0.9 are superb for suitability to proceed. Looking at the table above, the KMO measure is 0.825. Therefore, it is more appropriate to proceed with this analysis (Kaisen, 1974).

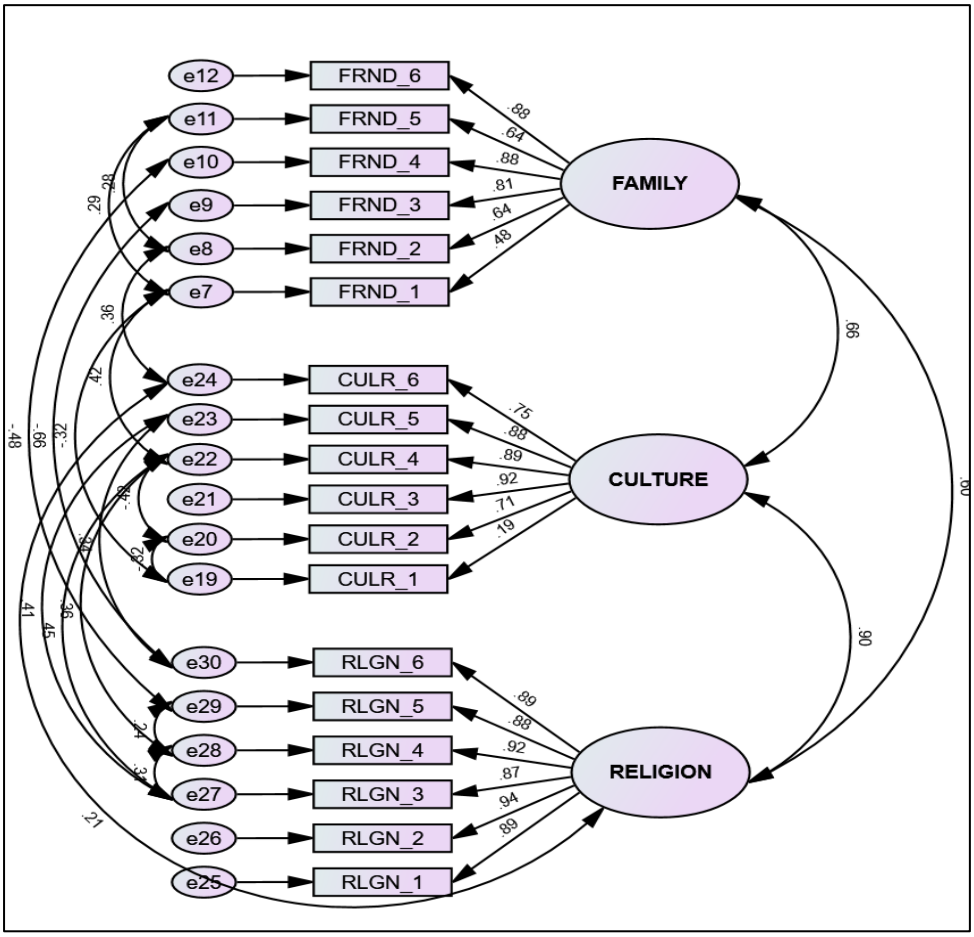
Table 3: Component Transformation Matrix

Component	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	0.660	0.542	0.467	0.105	0.172	0.111	0.014
2	0.543	-0.387	-0.511	0.481	0.202	0.060	-0.136
3	-0.471	0.023	0.234	0.465	0.660	0.254	-0.085
4	0.115	-0.653	0.677	0.149	-0.153	-0.237	-0.034
5	0.187	-0.337	0.012	-0.670	0.546	0.246	0.211
6	-0.009	0.032	-0.062	0.228	0.095	-0.319	0.912
7	-0.009	-0.125	0.069	0.136	-0.405	0.837	0.310

Source: Research 2023

The next item shows in Table (3), of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors.

Figure 1: Confirmatory Factor Analysis – CFA



Explaining the Amos output Figure 1, the first analysis table removes the standardized regression weight from less than 0.5 in the Friends and Economy factors of reduce. The output obtained by the analysis is displayed at the top. The maximum standardized regression weight is 0.94, which can be seen in the Culture factor, and the lowest is 0.19. It is represented by the cultural factor. However, this analysis is acceptable as all the values here are greater than 0.5.

5. Conclusion

The analysis was done based on the data obtained from the questionnaire provided through a Google form. The research objectives were based on

Descriptive statistics, KMO and Bartlett's Test, Component Transformation Matrix Scree Plot SPSS analysis, and SPSS AMOS Confirmatory Factor Analysis – CFA. The median, eigenvalue, and significant values confirmed the factors that impede women's sports participation.

SPSS AMOS factor analysis confirmed that the factors of Family, Culture, and religion are more affected, and the factors of Friends and Economy are less affected by women's sports participation. Looking at the overall study, it can be concluded that the study successfully identified the barriers affecting women's sports participation, the Barriers that have the most and least impact.

6. Limitations and Suggestions for Future Research

The present study utilized quantitative methods to investigate impediments to women's participation in sports at the university level. However, certain limitations should be acknowledged to guide future research endeavors.

6.1. Limitations

Scope of Participants: The current study focused exclusively on track and field athletes at the University of Kelaniya. This limited scope may not capture the diverse experiences and challenges women face participating in other sports.

Generalization: Findings from this study may need to be more generalizable to the wider population of female athletes, as the research centered on a specific athletic group within a single university.

Quantitative Approach: While the quantitative approach provides valuable numerical insights, it may need to fully capture the nuanced and qualitative aspects of the challenges faced by women in sports. Future research could benefit from a mixed methods approach to offer a more comprehensive understanding.

6.2. Suggestions for Future Research:

Exploring Varied Sports Disciplines: Future studies should consider widening the scope to encompass various sports disciplines. This would enable a more comprehensive examination of the unique challenges faced by women across different athletic activities.

Qualitative Investigations: Complementing quantitative methods with qualitative approaches, such as interviews or focus group discussions, can provide deeper insights into the live experiences and perspectives of female athletes. This qualitative dimension could enrich the understanding of the multifaceted challenges encountered.

Comparative Analysis: Investigating and comparing the impact of Friends, Family, Economy, Culture, and Religion on athletes could offer a nuanced understanding of how these factors intersect and influence sports participation differently. This comparative approach could lead to targeted interventions and support mechanisms.

Longitudinal Studies: Conducting longitudinal studies would allow researchers to track changes and developments in women's sports participation. This longitudinal perspective could unveil trends and patterns that may not be apparent in a cross-sectional study.

Community Impact Analysis: Future research could delve into the broader societal impact of women's sports participation. Understanding how challenges in sports involvement affect communities can underscore the importance of fostering an inclusive sporting environment.

In conclusion, while the current study provides valuable insights, addressing these limitations and pursuing suggested avenues for future research will contribute to a more holistic comprehension of impediments to women's sports participation and facilitate the development of targeted interventions.

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Investigating Factors Affecting Job Performance of Married Women in the Banking Sector of Sri Lanka: A Case Study

B. E. de Alwis Seneviratne[1], H. P. T. N. Silva[2]

Abstract

Married women, particularly in Asian nations, manage many roles as wives, mothers, daughters-in-law, sisters-in-law, and employers, facing everyday problems that affect their professional performance. For many women, balancing the demands of their work while maintaining family integrity is a huge challenge. This research aims to identify and examine the important elements impacting the work performance of married female employees in Sri Lanka's banking sector. Primary data were acquired using a questionnaire from a sample of 274 married female workers in a private bank using a simple random sampling approach. The findings of a Structural Equation Model (SEM) revealed that the number of working hours and prior experience substantially impacted the job performance of married female employees, with prior experience having the most profound effect. There were also notable connections between factors such as the employee's highest educational level and designation, years of service and designation, monthly compensation and working hours per day, and designation and the ages of the oldest and youngest children. As a result, this study renders several actionable recommendations, including adjusting monthly remuneration to account for the cost of living, closing promotion gaps, investing in training and development programs, establishing daycare centers for breastfeeding mothers, and implementing user-friendly systems to promote a paperless work environment. The findings of this study are expected to help corporate organizations, researchers, educators, legislators, and other stakeholders

[1] Student, Department of Social Statistics, University of Sri Jayewardenepura, Email: erandiseneviratne@gmail.com

[2] Senior Lecturer, Department of Social Statistics, University of Sri Jayawardenapura, Email: thanuja@sjp.ac.lk

create and develop efforts to increase resource availability and promote a growth and accomplishment attitude among women.

Keywords: Job performance, married female employees, banking sector, structural equation modeling, The role of women

1. Introduction

The role of women in maintaining the stability of the household unit and their contribution to the economy is often neglected in society. Historically, women were predominantly relegated to the role of housewives, with only a limited few venturing into the workforce. However, in the twenty-first century, with the rapid development of economies, more women were inspired to receive education, and they tended to open their minds to modern society (Anita et al., 2020). Notably, in Sri Lanka, statistics from the Statista Research Department (2021) reveal a noteworthy gender distribution in tertiary education enrollment, with approximately 1.38 females for every male. This indicates that nearly 60% of those engaged in tertiary education in the country are females. However, a woman's participation in the labor market varies from country to country, depending on the country's level of education, economic development, norms, and values. The labor force participation rate of women in Sri Lanka is recorded to be only 33.55% out of the whole women population, as stated by the World Bank report (2021). Job performance emerges as a critical variable, garnering attention from businesses, educators, society, and government bodies (Rotundo, 2002; Arifin et al., 2019). Campbell's definition characterizes job performance as "activities or actions relevant to the organization's goals" (Kohli, 2017). Berghe (2011) adds that job performance encompasses the effort exerted by individuals in executing their tasks. In the context of this study, job performance refers to an individual's ability to fulfill their tasks in alignment with the organization's objectives (Jankingthong & Rurkkhum, 2012). The contribution of female workers to the Sri Lankan economy is undeniable, with a reported labor force participation rate of 33.65% in 2021 World Bank collection of development indicators (Trading Economics, 2022). Kamaruddin et al. (2021) identify factors like organizational environment, culture, motivation, and time management as significant influencers on the job performance of female employees. Moreover, personality has been recognized as a key factor

impacting employee performance (Allahmeh et al., 2012; Askarian, 2013; Halim et al., 2011).

This study addresses the gap in research concerning factors influencing the job performance of married women in the Sri Lankan context. While several studies have explored work-life balance among married women in countries like India and Indonesia, limited research has been conducted on the factors affecting the job performance of married women in Sri Lanka. Thus, this study centers on investigating the existence of significant relationships among seven hypothesized key independent factors: domestic factors, demographic factors, work environment, working hours, employee benefits, employee well-being, and work experience. The private banking industry serves as the focal point due to its diverse hierarchical levels, varied age groups of female employees, and the substantial impact of their work on family life.

The primary objective is to identify factors influencing the job performance of married women in Sri Lanka, with four sub-objectives: identifying challenges negatively impacting job performance, determining motivational factors for improved performance, suggesting solutions to enhance women's labor force participation, and understanding women's involvement in the banking sector.

2. Literature Review

Job performance is a significant factor in both business and psychology. According to Campbell, job performance is defined as “activities or actions that are relevant to the goals of the organization” (Arifin et al., 2019; Rotundo, 2002). In Sri Lanka, female workers have made significant economic contributions. According to various studies (Jankingthong & Rurkkhum, 2012; Kamaruddin et al., 2021; Allahmeh et al., 2012; Askarian, 2013; Halim et al., 2011; Yusaf & Hasnida, 2020; Moeheriono, 2020), factors like organizational environment, culture, motivation, time management, and personality can affect job performance. According to Yusaf and Hasnida (2020), performance measuring indicators can be divided into six categories: effective, efficient, quality, timely, productive, and safe. Research in management, workplace dangers, and organizational consciousness all affect job performance (Kohli, 2017). A single approach does not track employee activities and behaviors that have an impact on performance. Individual work

performance evaluation has traditionally been based on objective measurements of job productivity (Kohli, 2017). Although job performance cannot be directly quantified, its modules and magnitudes can (Kohli, 2017). The two most significant facets of a person's life are their personal and professional lives, and conflicts between them have an impact on people as individuals, families, and organizations (Andrews & Withey, cited in Kohli, 2017). Even though they are busy with their professional careers, women are expected to care for their families (Burke, cited in Kohli, 2017). To identify the factors influencing married female employees' success on the job in the private banking industry, this study focuses on their job performance (Kohli, 2017).

Pleck (1977) stated that there was a general agreement that work life and family life positively impact one another. Various extraneous factors such as time, attitudes, tasks, stress, emotions, and behavior are said to have an influence over the imbalance of work life and family life. Gutek (1991) indicated that despite working roughly the same number of hours as men, women reported more work interference in the family than men. However, women reported the same level of family involvement in their work, even though they are recorded to spend more hours in family work than men (Hamilton, 2006). Numerous factors that affect the degree of family work and work-family are the size of the family, the age of the children, the number of hours worked, and the degree of social support (Reddy et al., 2010).

3. Materials and Methods

This study aims to explore the factors that positively or negatively affect the job performance of married female employees in the private banking sector of Sri Lanka. The target population considered for the study is all married female employees working at Seylan Bank PLC during the data collection stage. The study uses simple random sampling as the population can be explicitly identified. A quantitative approach was applied to this study using a standardized questionnaire. Accordingly, out of a total of 785 married female staff members, a minimum of 265 respondents were needed for the survey according to the Taro Yamane formula with a 95% confidence level. However, 274 responses were collected. Hence, the analysis was approached using all 274 responses.

Sample size calculation:

$$n = \frac{N}{1 + N(e^2)} = \frac{785}{1 + 785(0.05^2)} \approx 265$$

The study utilized descriptive statistics to illuminate the fundamental characteristics of the data, serving as the basis for quantitative analysis. In examining single demographic variables among married women, the study employs tables, pie charts, and bar charts as graphical tools. The chi-square test was applied to determine the association between socio-demographic characteristics of married women. Reliability and validity of the data are ensured through tests Cronbach's alpha, KMO measure and Bartlet's test of sphericity. Factor analysis was carried out to identify an arrangement among the variables based on the covariance structure of the variables.

Structural equation modeling (SEM) is employed for a more comprehensive exploration of structural relationships between the factors and the job performance of married women. SEM is a collection of statistical techniques that examine the relationships between one or more independent variables and one or more dependent variables that are either continuous or discrete. The sample size should be large (greater than 150) to carry out an SEM analysis. This allows researchers to set up and reliably test hypothetical relationships that could possibly exist among theoretical constructs as well as between constructs and their observed indicators. The distribution of variables and the data used in the analysis meet the requirements and assumptions of SEM, making it feasible to do further analysis using the same. The SEM analysis approach applied in the study is the Covariance-based SEM (CB-SEM), conducted using the AMOS software package, as the variables in the study satisfied all the assumptions of the Covariance-based SEM.

4. Results and Discussion

The age range of respondents varies from 22 to 58 years, with a majority (31 respondents) falling in the 50-52 age category. The distribution is negatively skewed, indicating that over 50% of respondents are in older age categories compared to younger ones (Figure 1).

Figure 1: Ages of Employees

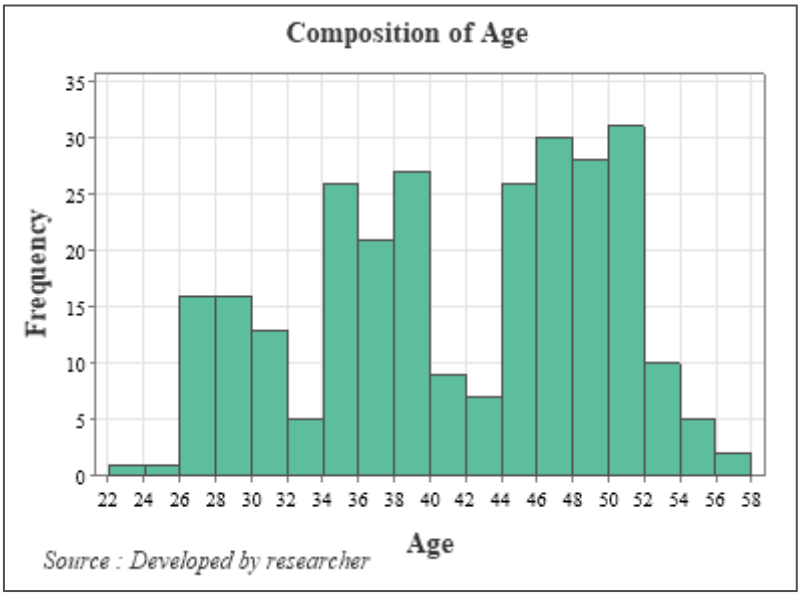


Table 1 below shows that a majority of 150 respondents have been recorded as graduates with a Bachelor's Degree (or have completed Banking Exams). Following up on this, it was found that the employees have completed their Banking exams for two main reasons: one - because they are hoping to pursue their career in the banking field itself, and two - to be able to move higher in their career ladder. Further, out of the majority of 112 Executive officers (41%), approximately 54% have a Bachelor's Degree/ Professional Qualification. Further, a considerable proportion of approximately 71%, 55%, 65%, 39%, and 63% of Banking Assistants, Banking Officers, Assistant Managers, Managers, and Senior Managers have recorded their highest educational qualification as Bachelor's/Professional Qualification. Furthermore, only 1 respondent is an Assistant General Manager, and a single executive has recorded her highest educational qualification as the Ordinary Level examination.

Table 4: Cross Tabulation of Designation and Highest Educational Qualification

		Highest Educational Qualification				
		O/L	A/L	Bachelors/Banking	Masters	Total
Designation	Banking Assistant (Trainee/I/II)	0	5	12	0	17
	Banking Officer	0	26	41	7	74
	Executive Officer (I or II)	1	35	60	16	112
	Assistant Manager	0	8	20	3	31
	Manager	0	7	11	10	28
	Senior Manager	0	0	5	3	8
	Chief Manager	0	0	0	3	3
	Assistant General Manager	0	0	1	0	1
Total		1	81	150	42	274

Source: Survey Data

Evaluating the number of years of service at Seylan Bank PLC, it was found that the minimum number of years of service recorded by the respondents is 3 years, while the highest number of years of service is given by an employee who has 33 years of work experience at Seylan Bank PLC. The mean number of years of service is 19, whereas 26 respondents have provided a 15-year service to the bank, being the modal number of years. Further, the negative skewness coefficient of -0.23 implies that more than 50% of the employees have been employed by the bank-for over 18 years. The most common reason the respondents gave for being employed at the bank for such a number of years was that they were happy about the incentives and facilities provided to them by the bank. However, 9 respondents mentioned they were employed at Seylan Bank PLC because the family's monthly income would need to be increased.

A cross-tabulation was carried out to determine if an association exists between the employee's designation and their number of service years. Table 2 below depicts its results.

Table 5: Number of service years and Designation

		Number of Service Years				
		0-9	10-19	20-29	30-39	Total
Designation	Banking Assistant (Trainee/I/II)	17	0	0	0	17
	Banking Officer	25	43	6	0	74
	Executive Officer (I or II)	2	49	56	5	112
	Manager	3	1	15	9	28
	Senior Manager	0	0	3	5	8
	Chief Manager	0	0	1	2	3
	Assistant General Manager	0	0	0	1	1
	Total	47	95	102	30	274

Source: Survey Data

It is notable that all the employees in the most junior positions have served the bank for less than 10 years. The highest-ranked employee (Assistant General Manager) has served the bank for 33 years, and this is the highest number of service years out of all the respondents. However, the Managerial position is questionable, as the distribution of the number of service years varies from 0-9 years to 30-39 years. Further, an analysis was done to find out if a relationship exists between the variable monthly income and the average number of working hours per day. Table 3 below shows the descriptive summary of the results.

Table 6: Average monthly income and Number of working hours per day

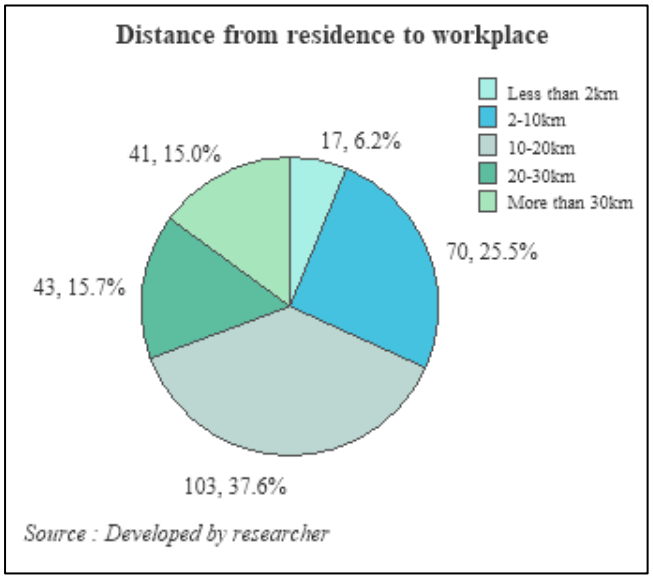
		Average number of working hours per day					
		Less than 8	8 - 9	9 - 10	10 – 11	Greater than 11	Total
Average Monthly	Less than Rs 75,000	1	22	11	2	0	36
	Rs.75,000 - 150,000	1	104	45	11	1	162

	Rs.150,000 - 225,000	0	18	19	9	2	48
	Rs.225,000 - 300,000	0	12	5	3	0	20
	Over Rs.300,000	0	3	2	3	0	8
	Total	2	159	82	28	3	274

Source: Survey Data

Accordingly, most employees (65%) that work between 8-9 hours receive a monthly salary between Rs.75,000-150,000, whereas a handful of 3 employees (1.9%) receive an average monthly income greater than Rs.300,000. Further, out of the 162 employees that receive an average monthly income between Rs.75,000-150,000, one employee works for more than 11 hours, whereas one employee works for less than 8 years in contradiction.

Figure 2: Composition of distance from residence to workplace

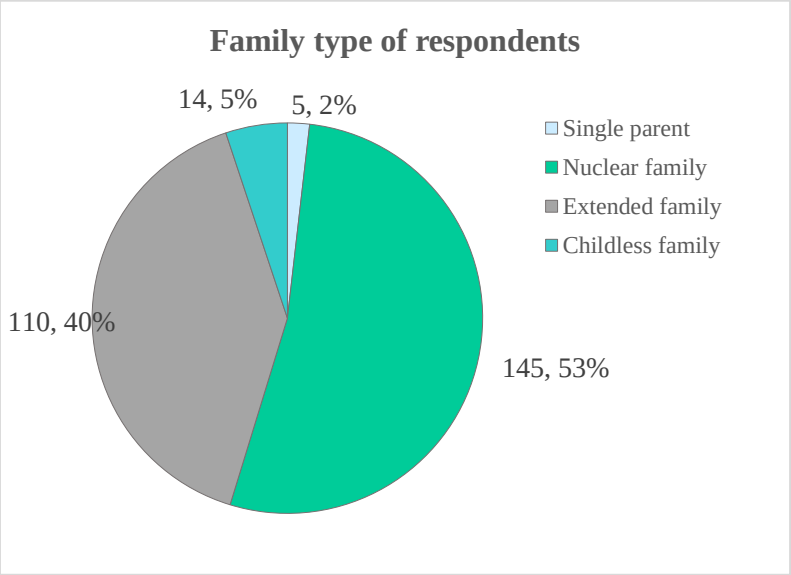


Further, an analysis of the distance traveled by the sample of married female employees currently working at Seylan Bank PLC was made and illustrated in Figure 2.

Accordingly, a majority of 37.6% travel 10-20km daily to get to the workplace, while only a minority of 6.2% live within 2km of the workplace. Further, approximately equal numbers of respondents reside between 20-30km and more than 30km.

A further analysis was made on the nature of the family type of the respondents. The following chart represents a visual summary of the nature of the family as mentioned by the respondents.

Figure 3: Composition of family type



Source: Survey Data

Accordingly, most respondents reside in a nuclear family, taking up 53% of the entire sample of married female employees. Only a handful of 2% of the employees (5) are single parents, while 40% and 5% reside as extended families and childless families, respectively.

Table 7: Statistics of number of children and number of working hours

		Number of children					Total
		0	1	2	3	5	
No. of working hours	10 - 11	2	6	16	3	1	28
	8 - 9	31	52	60	16	0	159
	9 - 10	14	27	31	10	0	82
	Less than 8	1	1	0	0	0	2
	More than 11	1	1	1	0	0	3
Total		49	87	108	29	1	274

Source: Survey Data

A cross tabulation was constructed to analyze if an association exists between the number of children and the number of working hours of the respondents.

Approximately 18% of the respondents have no children. Further, 32%, 39% and 11% have one child, two children and three children respectively. It is a notable characteristic that a single respondent has five children; the maximum count of children recorded. Further, out of the majority of employees who have two children, approximately 56% work between 8-9 hours daily, on average. Further, it is notable that out of the 159 employees who work for 8-9 hours, the majority of them have two children.

4.1 Association between socio-demographic characteristics

The Chi-Square test for independence was employed to examine associations between various variables, particularly focusing on demographic factors. Table 5 summarizes the outcomes of the Chi-Square test:

Table 8: Summary Chi-square test statistics for assessing the association between variables

Variables	Test Statistic	Contingency coefficient	p-value	Decision
Education & Designation	40.241	0.358	0.007	**Significant**
Number of years of Experience & Designation	765.573	0.858	0.000	**Significant**
Salary & Number of working hours per day	27.327	0.301	0.038	**Significant**

Distance & Number of working hours per day	22.611	0.276	0.125	Not Significant
Designation & Age of youngest child	480.514	0.798	0.000	**Significant**
Designation & Age of oldest child	570.178	0.822	0.000	**Significant**
Number of working hours per day & Number of children	17.629	0.246	0.346	Not Significant

Source: Survey Data

According to Table 5, 'Highest educational level of the employee and Designation,' 'Number of years of service and Designation,' 'Monthly salary and Number of working hours per day,' 'Designation and Age of the eldest child', and 'Designation and age of the youngest child' have p-values less than 0.05. Hence, it can be concluded with 95% confidence that the aforementioned factors have a significant association among them. However, since the p-values of the combinations 'distance from residence to workplace and number of working hours per day' and 'Number of children and the number of working hours per day' yield p-values greater than 0.05, it can be concluded with 95% confidence that the distance from residence to workplace and the number of children do not have significant impacts on the number of working hours per day.

4.2 Reliability Analysis

The Cronbach's alpha coefficients were calculated to assess the internal consistency of various variables. Cronbach's alpha, according to (Sekaran, 2003), indicates the degree to which the items in a variable are positively connected as a group. The higher the internal consistency, the closer Cronbach's alpha is to one. All variables demonstrated good internal consistency, with alpha values surpassing the threshold of 0.6. Some items were removed to enhance reliability, leading to improved alpha values.

Table 9: Reliability Analysis

Variable	Cronbach's Alpha	Number of items
Domestic Factors	0.800	7

Work Environment	0.846	5
Working Hours	0.601	4
Employee Benefits	0.822	4
Employee Wellbeing	0.832	7
Working Experience	0.672	4
Job Performance	0.910	6

Source: Survey Data

Accordingly, all variables surpassed the threshold of 0.6 without the removal of any items hence demonstrating a good internal consistency/ reliability. Further, Cronbach's Alpha reliability was measured to be higher with the absence of a single factor from the factors 'working hours' and 'employee benefits' and two items from the variable 'job performance', hence the items that caused the lower level of inter-item correlation were excluded, and the reliability analysis was rerun thus increasing the reliability of the measurement items. After excluding these items, four variables were found to contain alpha values between 0.7 and 0.9, while the job performance variable indicated an optimum internal consistency with a coefficient surpassing 0.9.

4.3 Hidden Factors Identifications

A factor analysis was conducted to identify an arrangement among variables. Results of the factor analysis, including the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity, carried out to test the validity of the Likert scale statements of each variable, are illustrated below.

Table 10: KMO and Bartlett's Test Coefficients

Variable	**KMO Measure of Sampling Adequacy**	**Bartlett's Test of Sphericity**	
		Chi-Square	**P-value**
Domestic Factors	0.795	566.767	0.000
Work Environment	0.826	536.446	0.000

Working Hours	0.609	342.328	0.000
Employee Benefits	0.784	391.594	0.000
Employee Wellbeing	0.842	671.752	0.000
Working Experience	0.701	170.259	0.000
Job Performance	0.897	1103.102	0.000

Source: Survey Data

Based on the factor analysis, it is observed that all variables cohered to the Kaiser-Meyer-Olkin (KMO) threshold of 0.6, thus indicating that the sample is adequate (Tabachnick & Fidell, 2007). While obtaining statistically significant values of ($p = 0.000$) for each variable, Bartlett's test of sphericity confirms that the data set is suitable for a data reduction technique and that correlations between items were sufficiently large for Principal Component Analysis.

Table 11: Total Variation of Factor Analysis

Variable	**Component**	**Extraction Sums of Squared Loadings**		
		Total	**Percentage of Variance**	**Cumulative Percentage**
Domestic Factors	1	3.251	46.442	46.442
Work Environment	1	3.104	62.075	62.075
Working Hours	1	1.869	46.735	46.735
Employee Benefits	1	2.611	65.266	65.266
Employee Wellbeing	1	3.517	50.249	50.249
Working Experience	1	2.037	50.925	50.925
Job Performance	1	4.171	69.525	69.525

Source: Survey Data

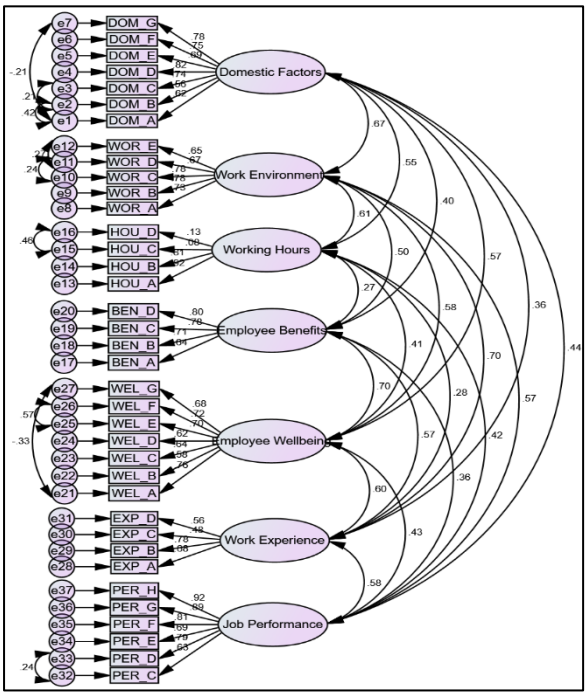
The total Extraction Sums of Squared Loadings depict the amount of variance in the original variables accounted for by each component. The percentage of variance denotes the ratio expressed as a percentage of variance accounted for by each component to the total variance in all the variables, while the cumulative percentage column gives the percentage of variance accounted for by the first component. According to Table 8, the first component effectively represents all components highlighted by the variables. The extracted sum of squared loadings percentage of variance depicts that the variance explained ranges from approximately 46% to 70%, indicating the total variability that can be accounted for by each factor. Finally, all measurement items were extracted into a single component and the loaded items were considered for further analysis.

4.4 Structural Equation Modelling

Structural Equation Modelling (SEM) analysis was used to identify the direct and indirect effects of factors on the job performance of married women in the banking sector. A confirmatory factor analysis was first conducted to build up a measurement model, and the estimated measurement model developed is illustrated in Figure 6. Standardized estimates and correlations were calculated considering the modification indices to build the best-estimated model.

4.5 Confirmatory factor analysis

Figure 4: Measurement Model



Source: Survey Data

Table 12: Model Fit Indices of the Measurement Model

Category	Goodness of Fit Index	Observed value	Threshold	Comment
Absolute fit indices	CMIN/DF	1.897	< 3 good	Satisfied
	GFI	0.822	Closer to 1 - good	Satisfied
	AGFI	0.791	Closer to 1 - good	Satisfied
	RMR	0.062	< 0.1	Satisfied
	RMSEA	0.057	< 0.1	Satisfied
	TLI	0.889	Closer to 1 - good	Satisfied

Incremental fit Indices	CFI	0.900	Closer to 1 - good	Satisfied
	RFI	0.792	Closer to 1 - good	Satisfied
	NFI	0.813	Closer to 1 - good	Satisfied
Parsimony fit indices	PGFI	0.701	Closer to 1 - good	Satisfied
	PRATIO	0.899	Closer to 1 - good	Satisfied
	PNFI	0.731	Closer to 1 - good	Satisfied
	PCFI	0.810	Closer to 1 - good	Satisfied

Source: Survey Data

The CMIN/DF of 1.897, below the threshold of 3, indicates an acceptable measurement model. The RMSEA (0.057) and RMR (0.062) are under 0.1, reinforcing the model's appropriateness. Additionally, GFI, CFI, NFI, and other indices meet the criteria for a well-fitting model.

Further, the Goodness of Fit Index (GFI) that represents the overall amount of covariation among the observed variables that can be accounted for by the model is 0.822, and the Comparative fit index (CFI) value for the model is very close to 1 (CFI = 0.900) indicating a good overall fit of the measurement model. The Normed Fit Index (NFI) value was 0.813, too is close to one. The Tucker-Lewis Index (TLI) and Relative Fit Index (RFI) values for the model are 0.889 and 0.792, respectively, indicating a good incremental fit. Moreover, Parsimony-Adjusted Measures are also close to one (PGFI = 0.701, PRATIO = 0.899, PNFI = 0.731, PCFI = 0.810). Accordingly, all the model fit indices meet the requirements for a good-fitting measurement model.

4.6 Validation of the Measurement Model

Tests involving convergent and discriminant validity measures were carried out to evaluate the validity of the measurement model. Convergent validity was assessed using three criteria: individual standardized factor loadings,

Average Variance Extracted (AVE), and Composite Reliabilities. Table 10 below represents the results of testing the convergent validity of the measurement model.

Table 13: Convergent Validity Measures

Construct	No. of items	Standardized factor loadings Min – Max	Average Variance Exacted	Composite Reliability
BEN	4	0.638 – 0.800	0.502	0.722
DOM	7	0.628 – 0.824	0.510	0.878
WOR	5	0.686 – 0.810	0.527	0.847
HOU	4	0.508 – 0.921	0.581	0.702
WEL	7	0.519 – 0.832	0.539	0.823
EXP	4	0.561 – 0.774	0.553	0.852
PER	6	0.653 – 0.918	0.634	0.911

Source: Survey Data

Accordingly, the minimum accepted level of standardized factor loadings for reflective indicators is 0.5. The above table indicates that all standardized factor loadings are greater than the threshold value of 0.5, and they are significant at a 5% level of significance. Furthermore, all the AVE values are above the cut-off value of 0.6, and all the composite reliability measures are above the cut-off value of 0.7 (Hair et al., 2010). Hence, Table 10 provides evidence for a satisfactory level of convergent validity for the measurement model. The inter-construct correlation estimates between each construct were compared with the square root of AVE of each construct to assess the discriminant validity. The square root of AVE of all constructs was recorded to be higher than the inter-construct correlations estimate between that construct and all other constructs, satisfying the condition for discriminant validity.

Table 14: Inter-construct correlations and square root of AVE (Discriminant validity)

	EXP	DOM	WOR	HOU	BEN	WEL	PER

EXP	**0.634**						
DOM	0.357	**0.714**					
WOR	0.626	0.666	**0.726**				
HOU	0.279	0.546	0.609	**0.617**			
BEN	0.571	0.401	0.496	0.274	**0.734**		
WEL	0.595	0.569	0.576	0.410	0.695	**0.673**	
PER	0.577	0.445	0.567	0.420	0.364	0.429	**0.796**

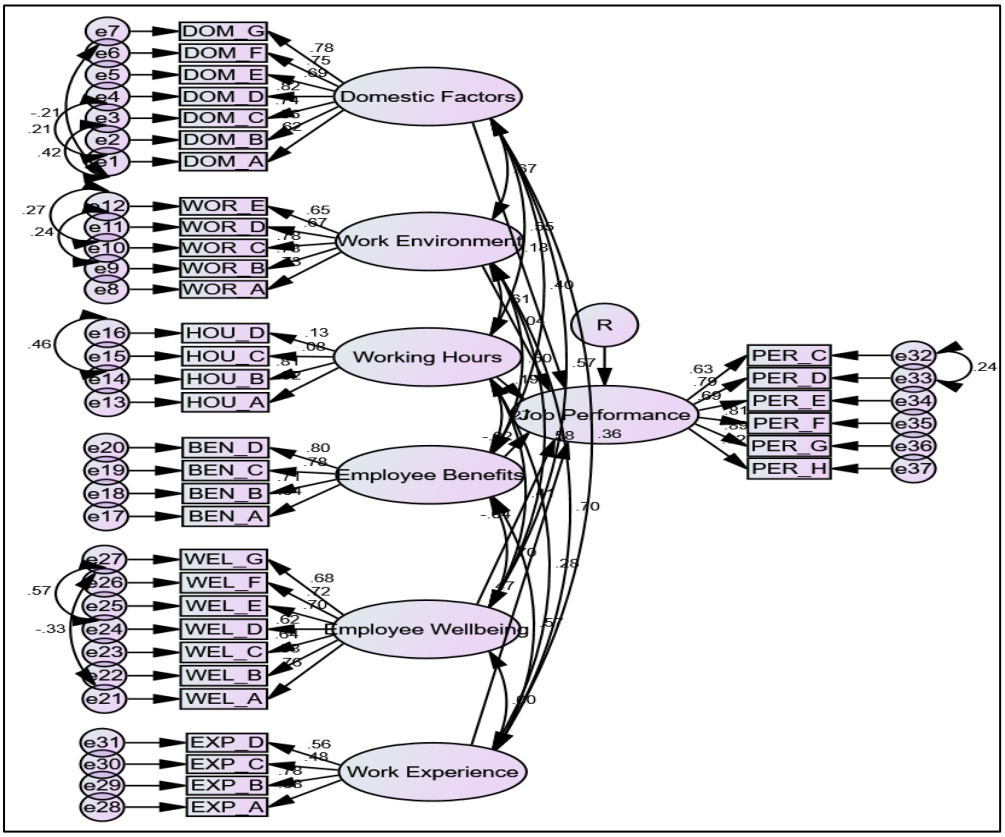
Source: Survey Data

Table 11 depicts and compares the inter-construct correlation estimates with the square root of AVE for all constructs. Diagonal entries (in bold) are the square root values of AVE for all constructs, and sub-diagonal entries are the inter-construct correlation estimates among constructs. The table indicates that the square root of AVE for each construct is higher than the correlations between that construct and other constructs. This confirms the discriminant validity of the model.

4.7 Structural Model

The estimated structural model is illustrated in Figure 5 below, considering the dependent variable (Job Performance) and six independent variables: Domestic factors, Work environment, Working hours, Employee benefits, Employee well-being, and work experience.

Figure 5 : Estimated Structural Model



Source: Survey Data

Table 15: Model fit Indices of the Structural Model

Category	Goodness of fit Index	Observed value	Threshold	Comment
Absolute fit indices	CMIN/DF	1.897	< 3 good	Satisfied
	GFI	0.820	> 0.8 acceptable	Satisfied
	RMR	0.058	< 0.1	Satisfied
	RMESA	0.057	< 0.1	Satisfied
Incremental fit indices	TLI	0.889	Closer to 1 - good	Satisfied

	CFI	0.900	Closer to 1 - good	Satisfied
	RFI	0.792	Closer to 1 - good	Satisfied
	NFI	0.813	Closer to 1 - good	Satisfied
Parsimony fit indices	PRATIO	0.899	Closer to 1 - good	Satisfied
	PNFI	0.731	Closer to 1 - good	Satisfied
	PCFI	0.810	Closer to 1 - good	Satisfied

Source: Survey Data

Considering the overall model fit of the structural model in Table 12, the CMIN/DF value of 1.897 is below the threshold value of 3, indicating the acceptability of the structural model. As demonstrated in Table 12, the Root Mean Square Error of Approximation (RMSEA), assessing the fit of the hypothesized model with a population covariance matrix, is 0.057, well below the critical value of 0.1. The Goodness of Fit Index (GFI), representing the overall amount of covariation among the observed variables that can be accounted for by the model, is 0.820, close to the optimal value of 1. The Comparative Fit Index (CFI) for the fitted model is very close to 1 (CFI = 0.900), indicating a robust overall fit of the structural model. The Normed Fit Index (NFI) value in this study is 0.813, also in proximity to 1.

The Tucker-Lewis Index (TLI) and Relative Fit Index (RFI) values for the fitted model are 0.889 and 0.792, respectively, suggesting a strong incremental fit. Furthermore, Parsimony-Adjusted Measures, including PRATIO (0.899), PNFI (0.731), and PCFI (0.810), are all close to 1. Consequently, all model fit indices meet the criteria for a well-fitting structural model.

4.8 Path Coefficients (Direct Effects) of Structural Model

Table 16: Path Coefficients of the Structural Model

Path	Path coefficients	Standardized path coefficients	Standard error	P-value	Decision
DOM → PER	0.140	0.177	0.122	0.098	Not Significant
WOR → PER	0.026	0.039	0.217	0.837	Not Significant
HOU → PER	0.116	0.190	0.099	0.022	**Significant**
BEN → PER	-0.016	-0.019	0.118	0.865	Not Significant
WEL → PER	-0.024	-0.037	0.131	0.710	Not Significant
EXP → PER	0.374	0.467	0.185	0.004	**Significant**

Source: Survey Data

The standardized direct (unmediated) effects of Domestic factors (DOM), Work environment (WOR), Working hours (HOU), Employee benefits (BEN), Employee well-being (WEL), and Work experience (EXP) are 0.177, 0.039, 0.190, -0.019, -0.037, and 0.467, respectively, according to the path coefficients presented in Table 13 for the structural model. When the independent variables rise by one unit, Job Performance improves (if the standardized path coefficients are positive) or decreases (if the standardized route coefficients are negative) by the stated number of units. This is in addition to any indirect (mediated) impacts on work performance that the independent factors may have.

Notably, only two variables, Working Hours (p-value = 0.022) and Work Experience (p-value = 0.004), have p-values that are less than the alpha critical value of 0.05.

Table 17: Hypothesis testing Results

Hypothesis	Results
H_{0a}: There is no significant association between domestic factors and job performance of married female employees	Supported
H_{0b}: There is no significant association between work environment and the job performance of married female employees	Supported
H_{0c}: There is no significant relationship between the working hours and job performance of married female employees.	**Rejected**
H_{0d}: Employee benefits do not have a significant positive impact on the job performance of married female employees	Supported
H_{0e}: Employee wellbeing does not have a significant positive impact on the job performance of married female employees.	Supported
H_{0f}: There is no significant association between work experience and the job performance of married female employees.	**Rejected**

Source: Survey Data

According to Table 14, domestic factors have no significant impact on the job performance of married female employees (β = 0.177, P = 0.098). Therefore, it can be concluded with 95% confidence that domestic factors such as support system, household responsibilities, and childcare/dependencies have no significant impact on the job performance of married female employees in the Private Banking Sector of Sri Lanka. Work environment also has no significant impact on the job performance of married female employees (β = 0.039, P = 0.837). Therefore, it can be concluded with 95% confidence that work environment-related factors such as work stress and workplace support have no significant impact on the job performance of married female employees in this Sector. However, working hours have a significant impact on the job performance of married female employees (β = 0.190, P = 0.022). Therefore, it can be concluded with 95% confidence that working hours-related factors such as workload have a significant impact on the job performance of married female employees in the Private Banking Sector of Sri Lanka. Moreover, employee benefits and employee well-being do not have a significant impact on the job performance of married female employees.

Therefore, it can be concluded with 95% confidence that employee benefits such as incentives, financial support, and transport facilities do not have a significant impact on the job performance of married female employees, while employee benefits such as incentives, financial support, and transport facilities also do not have a significant impact on the job performance of married female employees in the Private Banking Sector of Sri Lanka. Based on the statistics provided by the above table, prior work experience has a significant impact on the job performance of married female employees ($\beta = 0.467$, $P = 0.004$).

5. Conclusion

The empirical evidence of this study found that prior working experience has the most significant influence on the job performance of married female employees in the private banking sector, followed by working hours which too demonstrated a significant influence on job performance. These results thus validate the findings of previous studies in terms of the significant relationship between job performance and the aforementioned antecedents. On the contrary, the study revealed that domestic factors, work environment, employee benefits, and well-being generate a non-significant impact on the job performance of married female employees in the private banking sector of Sri Lanka. Further, it was revealed through the chi-square tests at a 95% confidence level that 'Highest educational level of the employee and designation', 'Number of years of service and designation', 'Monthly salary and the number of working hours per day', 'Designation and age of the eldest child', and 'Designation and age of the youngest child' have significant associations among them.

The theoretical framework of this study proposed three domestic factors, i.e., support system, household responsibilities, and childcare/dependencies, as possible factors that may affect the job performance of married female employees in the private banking sector of Sri Lanka. The results of the data analysis revealed that the three sub-domestic factors considered do not have a significant association with an individual's job performance. Even though the model fit indices of the measurement model and structural model, as well as convergent and discriminant validity measures in the SEM analysis, provided satisfactory results, the path coefficients of the model depicted a non-significant association between domestic factors and job performance of married female employees in the private banking sector of Sri Lanka ($\beta = 0.177$, $P = 0.098$). Furthermore, it should be noted that a similar empirical

research conducted in an Indian context concerning job performance and the effect of domestic factors revealed that domestic factors such as marriage, child raising, and elderly caretaking at home have a significant effect on their performances in the job and family life balancing since they demand more family responsibilities (Delecta, 2011). It is believed that people who must care for children or the elderly may occasionally be forced to compromise their careers by cutting back on their working hours, which causes stress for them. While this poses a questionable argument regarding the consistency of the association between the variables in question, it can be rationalized that the difference in the population sampled (n=274) and the substandard sample size (n=152) of the research study in question may have affected the conflicting result. On that account, it can be stated that H_{0a} is supported. Likewise, the results of the data analysis showed that factors relating to the work environment, work stress, and workplace support too do not depict a significant association with the job performance of married female employees ($\beta = 0.039$, $P = 0.837$). Even though Balaji (2014) mentioned that researchers have found that the number of hours worked per week, the proportion of overtime required, the flexibility of work, the support given by the supervisors and line managers, and the nature of the organizational culture impact the performance of women employees in their work, the study under consideration proves the opposite. The discrepancy in the results could be rationalized as the population sampled is in the Sri Lankan banking context, whereas the substandard sample is from India's IT sector. Hence, *H0b* is supported. However, the results of the data analysis displayed a significant association between working hours and job performance ($\beta = 0.190$, $P = 0.022$). The sub-variable considered for the independent variable working hours is the average workload given to an individual by their workplace. This observation conforms to previous literature such as (Balaji, 2014; Zhenjing et al., 2022). Hence, H_{0c} is rejected. Moreover, the study revealed that employee benefits and employee well-being do not play a direct and prominent role in determining job performance levels, despite the theoretical significance in research done previously by Tsai et al. (2005) and Ahamed (2001); for employee benefits, and Kalleberg (1977), Lehmann (2016), Fisher (2003) and Ledford (1999) for employee wellbeing. The corresponding results for employee benefits such as incentives, transport facilities, and financial assistance, and employee well-being factors such as personal expectations and

satisfaction were β = -0.019, P = 0.865, and β = -0.037, P = 0.710, respectively, hence supporting H_{0d} and H_{0e}. Nonetheless, the SEM analysis indicated that prior working experience has a statistically significant positive influence on the job performance of married female employees in the private banking sector of Sri Lanka (β = 0.467, P = 0.004). Hence, complying with the previous theoretical literature by Njogu (2017) and Rynes (1997). Therefore, rejecting H_{0f}. Furthermore, Karl Pearson's chi-square tests for independence revealed at a 95% confidence level that the 'Highest educational level of the employee and designation', 'Number of years of service and designation', 'Monthly salary and the number of working hours per day', 'Designation and age of the eldest child', and 'Designation and age of the youngest child' have significant associations among them.

According to the research findings, the research's conclusions allow for the following recommendations;

(i) Monthly remuneration adjusted to the cost of living.
(ii) To appraise people who work hard.
(iii) To reduce promotion gaps
(iv) Provide a sufficient workforce with required competencies.
(v) More training and development
(vi) Day care center for breastfeeding moms, arranging transfers to the closest branch since we have only one hour to breastfeed the child.
(vii) Flexible working hours.
(viii) Implementing user friendly systems and having a paperless work environment.

As a suggestion for future research, researchers can try to identify other factors that affect the job performances of married female employees, perhaps in a larger context, by researching new possible areas for the study rather than limiting to the private banking system of Sri Lanka alone. They can gain further insight into this domain as well as understand the overall impact of factors that affect the job performance of married women.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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National Innovation System (NIS) for Sustain Economic Growth: Global South versus Global North

Udeshika Lakshinie Weerawansha[1], Sanika Sulochani Ramanayake[2]

Abstract

Existing literature emphasizes innovation, technological development, and knowledge (especially foreign technological knowledge) are critical economic growth and development factors. Most of the developed nations obtained economic transformation through knowledge-based innovations. The growth of East Asian tigers (Particularly in South Korea, Taiwan, and Singapore) is the best example. They have achieved rapid industrial and technological catch-up through the effectiveness of the National Innovation System (NIS). Therefore, this study investigates the NIS interrelated dimensions such as Patent applications, R&D expenditure, and High-Tech exports of three East Asian Tiger countries (South Korea, Singapore, and Taiwan) and compares them with Sri Lanka. Furthermore, this study investigates how these factors (Patent applications, R&D expenditure, and High-Tech exports) impacted growth for different income levels. For that, the study uses a quantitative methodology, depending on secondary data, relying on the data period from 2000- 2021; the study empirically estimated pooled OLS, panel Fixed effect, and Random Effects estimation using 20 Developed countries and 22 Developing countries. The key findings indicate that High-tech exports, the number of patent applications, and R&D expenditure on science and technology are significant measures of a country's growth.

Keywords: ***National Innovation System (NIS), Knowledge, Innovations, Sustain Growth, Global North, Global South, Sri Lanka***

[1] Production Officer, Ace Healthcare Pvt Ltd. Sri Lanka, & Junior Researcher (udeshikalakshinie@gmail.com)

[2] Senior Lecturer, Department of Social Statistics, University of Kelaniya, Sri Lanka (sulochani00@kln.ac.lk)

1. Introduction

Existing literature discussed the importance of technological development on growth through the National Innovation System (NIS) (Lundwal, 2007; Malerba, 2005; Lee, 2001, 2016, 2018; Joseph, 2021; Singh, 2010). Granting NIS is not only a pillar of innovation but also technological development for both parts of the innovation process and its result. Innovation involves much more than knowledge of the relevant science and technology. Schumpeter (2000) has accepted a distinction between the formulation of a working idea for a product or process (an invention) and the application of that idea to the economy (an innovation). The literature indicates that innovation as the improvement of existing or the creation of entirely new products, processes, services, and business or organization models, drives long-run economic growth and quality-of-life improvements (Becker & Knudsen, 2002).

The view is that innovation is a crucial sustainability driver, and many scholars have emphasized it. Hence, Sustainable development is a pressing issue that requires immediate action and changes from governments, industry, and society (Tirca & Silvestre, 2019). In the context of globalization, the marketplace is experiencing rapid changes in competition, technological advancement, and a shift to knowledge-based economies. Against this background, the importance of knowledge as a competitive weapon has increased dramatically (Dierdonck, Debackere, & Engelen, 1990). Furthermore, Mansell (2002) stated a more substantial knowledge base for knowledge-driven development. Research enables advancement in knowledge and technology and thereby creates an environment conducive to innovation which is considered the driving force behind economic development (Esham, 2008).

In the late 1980s, the systematic view of innovation at the national level attracted much attention. Freeman (1987) and Nelson (1993) are significant contributors to the perspective of the National Innovation System (NIS). The National Innovation System (NIS) is a concept aimed at interpreting the phenomena of current growth. The miraculous economic development experienced in the 1900s by East Asian countries (such as Japan, South Korea, and Taiwan) has been critical to many other developing countries. It has attracted much attention in development studies (Amsden, 1994).

However, many developing countries failed to reach knowledge-based development since most developing countries need proper NIS. Furthermore,

they need more technology, innovation, and knowledge, especially in high-tech industries. Instead of technological innovation-based industries, developing countries still have mostly labor-intensive sectors. At the same time, government spending on research and development (R&D) is a relatively low amount.

Therefore, the main research questions addressed in this study are why is it essential to have better NIS for developing countries? Moreover, what is the role of National Innovation Systems in Sustainable Growth in developing countries; what are the development indicators of NIS? Finally, how innovations and knowledge-based development could enhance growth, and what are the determinants of it?

As the methodology for answering for mentioned questions, first, this study conducted a comparative analysis of global South and global North countries. The study researched three East Asian countries, namely South Korea, Taiwan, and Singapore, and compared them with Sri Lanka in selected growth indicators. Furthermore, using the quantitative methodology, depending on secondary data, relying on the data period from 2000- 2021, the study conducted a pooled Ordinary Least Square (POLS), panel Fixed effect, and Random Effects estimation for global north countries (20 selected developed countries) and Global south countries (22 selected developing countries).

This paper has been organized as follows. Section two discusses related literature; Section three shows the methodology, data, sample, and empirical framework. Section four shows the comparative and empirical analysis with empirical results and Interpretations. Finally, section five concludes the study by providing policy suggestions.

2. Literature review

Concept of Innovation

Innovation is a significant business challenge, seen as increasingly essential for growth and viability (Tidd, 2001). However, it is challenging for companies to know what is necessary for successful innovation (Christensen, Raynor, & McDonald, 2013). Innovation adoption is 'the generation, development, and adaptation of novel ideas on the part of the firm' (Damanpour 1991; Higgins 1995). In the 1930s, an Austrian-American economist Schumpeter (1934), realizing the importance of innovation or

novelty in an economic system, defined innovation means the commercial or industrial application of something new such as goods, a new style of manufacturing, the opportunity for a new marketplace, detain of a new transport source, polishing off a new institute or the association of any industry (Usman, Liu, Hameed, Bi, & Wu, 2015). According to Lewis (2009), innovation has become the engine of the universal economy nowadays. It is widely discussed as the core driver of countries' competitiveness, trade, and industry growth.

National Innovation System (NIS)

National Innovation System (NIS), also called National System of Innovation (NSI). The innovation system was developed in Europe and the US in the 80s. However, the collaboration between Christopher Freeman and the IKE group in Aalborg at the beginning of the eighties was important in coining and shaping the earliest versions of the concept (Freeman 1982 and Lundvall 1985). The essential ingredients and inspiration may be found in the work of many other innovation scholars before that (Lundvall 2007). Freeman brought a deep understanding of innovation processes, historical insight, and wisdom to the collaboration. His reference to Friedrich List was crucial since it linked the concept to the state's role in catching-up processes. The IKE group, inspired by French structuralist Marxists and development economists, contributed ideas about 'national production systems' and 'industrial complexes' where vertical interaction was crucial for performance and outcome and linked this to the analysis of international specialization and international competitiveness (Lundvall, 2007). However, the NIS is a concept aimed at interpreting the phenomena of current growth and has primarily been analyzed in the literature of the 1990s.

Furthermore, NISs have become indispensable, both in academic circles as well as in international institutions. Moreover, the literature on 'regional systems of innovation' has proliferated since the middle of the nineties (Malmberg, 1997), while Franco Malerba and colleagues developed the concept of 'sectoral systems of innovation' (Breschi & Malerba, 1997). Some of the critical ideas inherent in the innovation system concept (vertical interaction and innovation as an interactive process) appear in Porter's industrial clusters and Etzkowitz & Leydesdorff's Triple Helix-concept (Etzkowitz & Leydesdorff, 2000).

NIS in Taiwan

Wong (1999) describes Taiwan's path and the NIS, which supported it as the Reverse Value Chain. In essence, this technological capability development strategy involves developing process capabilities, then extension into product design capabilities, and finally, new product creation/branding activities. This reverses the typical sequence of value chain activities pursued by large, established, high-tech firms in advanced countries. Most Taiwanese firms that pursued the reverse value chain strategy started as SMEs[1] engaging in labour-intensive manufacturing activities. Because of their limited resources, they could not invest much in R&D efforts. Hence, the state played an essential role in diffusing process technologies to the SMEs through public research institutes (PRIs) in the early stage and later by establishing various product technology consortia (Poh-Kam 1995). Shyu and Chiu discussed government innovation policies' role in advancing Taiwan's competitive advantage in more detail. The authors described how tools such as alleviating taxation, loan subsidies, technological assistance, government procurement, and workforce cultivation have increased incentives based on the supply, demand, and environmental sides (Shyu & Chiu, 2002; Ramanayake, 2022).

NIS in South Korea

In contrast to Taiwan, the Korean innovation system model is characterized by large conglomerates, the Chaebols. Their large size and ready access to finance give them an enormous opportunity to undertake the reverse product life cycle. This can be seen in the rapid technological catch-up of the large Korean chaebols in such sectors as automobile, steel, consumer electronics, semiconductors (especially DRAM[2]), and Active Matrix LCD[3]. In all these cases, the giant Korean chaebols have moved aggressively from late followers to fast followers. In the case of DRAM technology, to become the global technological leader overtaking the USA and Japan (Kayal, 2008). To achieve their rapid catch-up via this strategic route, Korean firms have resorted to aggressive capacity investment to accelerate the learning effect, accepting thin margin or loss bearing to build volume and gain market share, and deep investment in R&D (Wong, 1999). After huge state investments in education

[1] SMEs: Small and Medium Enterprises
[2] DRAM: Dynamic Random Access Memory
[3] LED: Light-Emitting Diode

and public Research and Technology Organizations (RTOs) during the 1960s and 1970s to increase the supply side of technology, the industrial sector needed more demand for R&D despite the government's strong encouragement and incentives. In other words, the supply of R&D and the linking mechanism were present, but the demand side was missing. Industries largely ignored the linking mechanisms due to the absence of a felt need to invest in R&D, given the relatively easy means of acquiring and assimilating foreign technologies available from many sources. It was only in the 1980s when technology was regarded as one of the essential underlying variables in market competition, that the situation changed. To fix this shortfall, the government introduced new policies designed to strengthen the industry's need for R&D. One of which was a list of import-substitution of major import items. The government designated specific target machinery, parts, and new materials to be localized for import substitution. It then offered tax incentives, preferential financing, and R&D subsidies to those who developed the designated items. Through 1987, the government has designated 1,555 such items (Kim & Dahlman, 1992)

NIS in Singapore

In contrast to Taiwan and Korea, Singapore adopted a model of a national innovation system that can be characterized as one emphasizing government facilitation of technological learning from Multi-National Corporations (MNC). Ever since the government embarked on a strategy of encouraging foreign investment to jump-start industrial development in the 1960s, the Singapore government has continued to encourage MNCs to upgrade their manufacturing processes and to bring in successive waves of new and more advanced products to be manufactured in Singapore. Research evidence has shown that these MNC operations have spawned a large supporting industry in Singapore and induced substantial technological capability development among many local subcontracting and contract assembly firms. This was also facilitated by the movement of experienced technical professionals and managers from the MNCs to start their contract manufacturing firms (Wong 1997). Although the Singapore government established PRIs to promote the diffusion of process technologies to local small and medium-sized enterprises (SMEs), it has probably done less in facilitating the diffusion of product design know-how than Taiwan and Korea (Kayal, 2008). To support a shift to another

route of technological development, the government has accelerated the establishment of funding for PRIs[1], and university R&D to encourage MNCs to start product R&D operations in Singapore and recently launched an ambitious Technopreneur ship Program to promote the growth of new technology start-ups. Besides promoting the development of new supporting infrastructure such as a venture capital industry and IPR support services, the government is reviewing changes to existing business regulations (e.g., stock exchange listing regulations, stock option rules, and tax incentives for business angel investment) to facilitate the growth of technopreneur-ship (Wong, 1999).

NIS in Sri Lanka

According to Wickremasinghe (2006), the NIS concept is novel for Sri Lanka, where interaction among various actors and institutions involved in technological innovation remains weak and emphasizes the importance of paying attention to how the government policy framework, R&D activities, education system, culture, history, traditions, etc., play their roles in this network system. Developing a robust innovation system in a country requires a robust network of government institutions, regulators, research institutes, universities, enterprises, consulting firms, and professional/ business groups. It is not just creating the right environment for this network to operate but also proving the right government interventions to ensure that a productive nexus develops from this (Wijesinha & Perera, 2012). However, NIS is weaker in Sri Lanka (Ramanayake 2022).

3. Methodology

As a methodology, this study uses quantitative methodology using secondary data. First, the study conducted a comparative analysis of NIS and its global South and North trends. For the comparative analysis, the Global North is represented by South Korea, Taiwan, and Singapore; and Sri Lanka represents the Global South. For our interest, we have studied China as well. Patent applications, high-tech exports, and R&D expenditure, were compared as the measurements of NIS. As the secondary data sources, the study referred to World Bank online data, WIPO data, Country websites, and journal articles.

[1] PRI: Public Research Institutes

Data Analyzing Techniques

For analyzing data, we conducted an empirical analysis of panel data by Pooled OLS and Random Effect (RE) estimations with the Houseman test using STATA software. Further, some graphs and tables are drawn to identify data trends using MS Excel.

Empirical Framework and the Sample

This study conducted a panel data regression using 20 developed (North) and 22 developing (South) countries as the sample. The data period was taken from the annual data from 2000 to 2021, which included 11 years for each country. In this empirical analysis, we considered the key indicators of NIS and its impact on growth. Therefore, the effect of patent applications, R&D expenditure, high-tech exports, and foreign direct investments on the country's GDP growth was tested using Pooled Ordinary Least Square (POLS) estimation. Moreover, the fixed effect and random effect panels were also tested for robustness. Finally, the Housman Test was done to distinguish the difference between the fixed effect (FE) and the random effect (RE). Table 1 indicates the selected sample countries for North and South.

Table 1: Selected Sample List for Developed and Developing Countries

North Countries		**South Countries**	
Canada	Finland	Kenya	Indonesia
Germany	Austria	Jordan	Israel
Portugal	Norway	Singapore	Thailand
Belgium	Netherland	Hong Kong	Columbia
Italy	Poland	China	Saudi Arabia
Denmark	France	Pakistan	Brazil
United States	United Kingdom	Korea, rep	Sri Lanka
Japan	Switzerland	Argentina	Egypt
Spain	Luxemburg	Bangladesh	Mexico
Greece	Sweden	Malaysia	South Africa
		Vietnam	India

Source: Country Classification – World Economic Situation and Prospects, 2022

The growth equation for multiple regressions is used as follows.

$$\hat{y}_{it} = B_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + Ui$$

$\hat{y}_{it}$ = Gross Domestic Product (GDP)
x_1 = Total Patent Applications
x_2 = Research and Development Expenditure (R&D)
x_3 = High–Tech Exports
x_4 = Foreign Direct Investments (FDI)
Uit = Error term

4. Results and Interpretations

4.1 Comparative Analysis of North versus South in selected indicators of NIS

According to Carvalho, Carvalho, & Nunes (2015), the most significant measures for innovation performance in a country are the number of patents, private and public R&D, and the percentage of innovation firms. Furthermore, Sahin (2019) stated that high-technology exports with their high-added value are considered a determinant of economic growth. According to Kengatharan & Suganya (2022), foreign direct investments would also play an active role in economic growth, positively leading to the GDP. Therefore, the number of patents, R&D expenditure, and high technology exports are significant measures of the country's economic growth through innovation performance.

This section discusses the sleeted indicators necessary for innovation and growth through NIS.

Analysis of Global North: South Korea, Taiwan, China, and Singapore

This section discusses the R&D intensity (expenditure on GDP), Patents and patent applications, Trademark and Industrial design applications, and High-Tech exports in selected East Asian countries, namely South Korea, Taiwan, China, and Singapore. We included China because most of Taiwan's statistics are included under China.

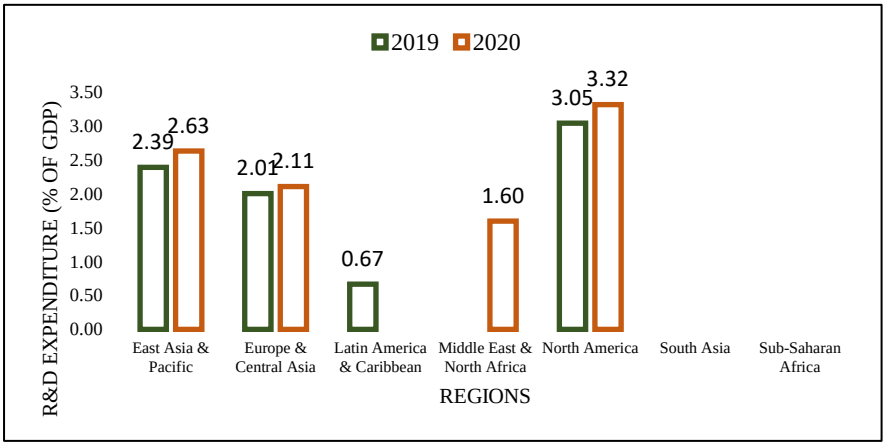
R & D Expenditure on GDP

Ildırar, Ozmen, and İşcan (2016) reported that R&D is an essential variable affecting the country's economic growth and development through increasing the technology capabilities, enlarging the resource base, and promoting the

capability of resource utilization. Countries that innovate by conducting R&D activities always have high economic growth. Since 2000, total global R&D expenditures have more than tripled in current dollars, from $676 billion to $2.0 trillion in 2018[1] (Global Research and Development: Fact sheet, 2020)

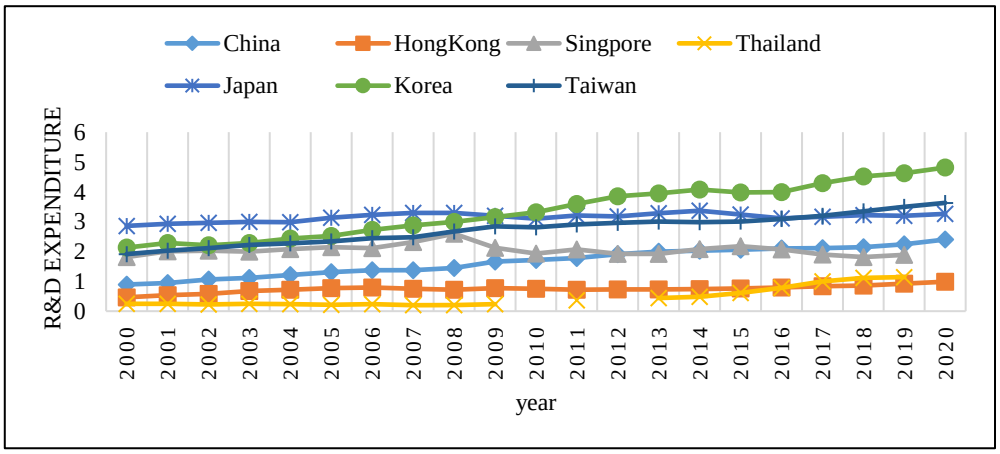
Figure 1 indicates that the most on R&D (% of GDP) in the past two years, 2019 and 2020, is the North American region, which is 3.05 per cent in 2019 and 3.32 per cent in 2020. The second highest is from East Asia, which was 2.39 per cent in 2019 and 2.63 per cent in 2020.

Figure 1: R & D Expenditure on GDP in regions -2018 and 2019



Source: World Bank Data (South Asia and Sub-Saharan Africa data is not available)

Figure 2: R & D Expenditure on GDP in East Asia (2000-2020)



[1] Global Research and Development: Fact sheet, 2020

Source: World Bank Data (Taiwan data is from OEDC and statista.com)

Figure 2 indicates R&D expenditure on GDP in selected East Asian countries. According to that, the highest from South Korea spent 4.63 per cent on R&D in 2019 and 4.81 per cent in 2020. According to the Federation of Korean Industries (FKI) descriptions, South Korea's R&D expenditures reached 93.1 trillion won ($75.4 billion) in 2020, up from roughly 89 trillion South Korean won in the previous year. Taiwan remains the second largest, spending 3.49 per cent and 3.63 per cent of R&D on GDP in 2019 and 2020, respectively. Japan also spent 3.26 per cent for R&D of its national GDP in 2020.

Moreover, China increased its R&D intensity by spending 2.24 per cent of GDP in 2019 and 2.4 per cent in 2020. According to the Chinese National Bureau of Statistics, the total public and private science and technology expenditures in 2019 rose 12.5 per cent over the previous year to 2.21 trillion Chinese yuan ($322 billion). Spending on basic research accounted for 6% of the total; applied research, 11.3%; and development, 82.7%. The spending amounted to 2.23 per cent of GDP, an increase of 0.09 percentage points from 2019. China's increasing trends in R&D investment have contributed to its growing innovation power, mainly focusing on high-tech areas such as artificial intelligence, quantum information, and semiconductor manufacturing. After China, Thailand also showed significant growth in expanding R&D on GDP, marking 1.14 per cent in 2019.

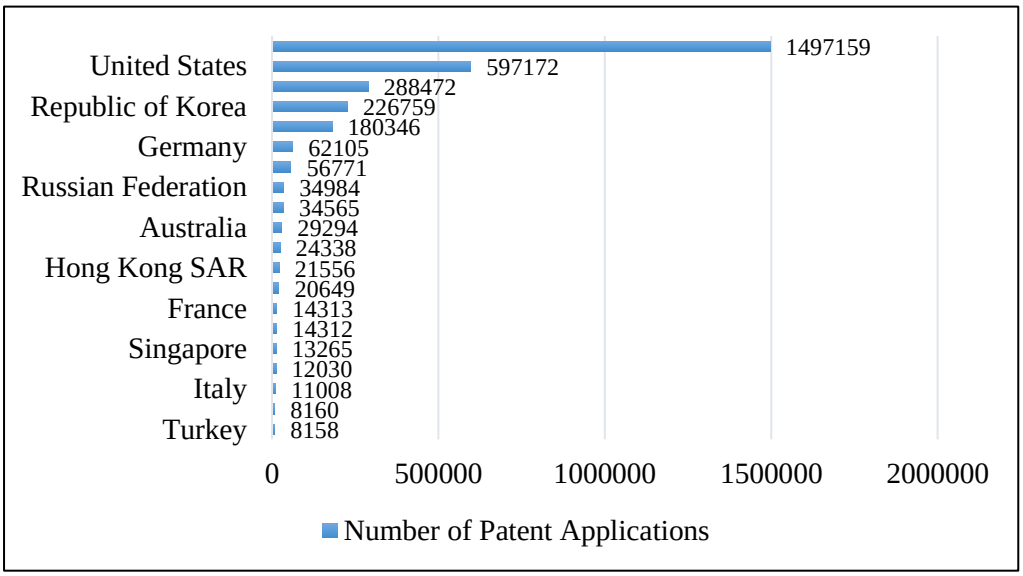
Number of Patent Applications

According to the WIPO (2023), in 2021, patent filings grew by 3.6 per cent in the world. Trademark and industrial design filing activity grew by 5.5 per cent and 9.2 per cent, respectively. Patent filings worldwide exceeded 3.4 million, trademark filing activity totalled 18.1 million, and industrial design filing activity amounted to 1.5 million. Furthermore, Applications for utility models, a particular form of a patent right, dropped by 2.5 per cent to 2.9 million applications (WIPO, 2023).

World Intellectual Property Office (WIPO) stated that patents are the engine of economic growth. Based on the WIPO reports, China's IP office received 1.5 million patent applications in 2020 of a total of 3.4 million filed worldwide in 2021; China was followed by the offices of the United States (597,172), Japan (288,472), the Republic of Korea (226,759) and the European Patent Office (180,346). Together, these five offices accounted for 85.1 per cent of

the world's total. Figure 3 shows the top 20 countries in Patent applications worldwide.

Figure 3: Patent Applications in the Top 20 Countries in 2020



Source: World Intellectual Property Indicators-2021

Furthermore, in 2021 Patents in force worldwide grew by 4.2 percent. China has become the top, followed by the US (3.3 million), Japan (2 million), the Republic of Korea (1.2 million), and Germany (877,763). China (+17.6%) saw the fastest growth in patents in force in 2021, followed by Germany (+5.2%) and the Republic of Korea (+5.2%).

Comparing the number of patent applications of South Korea, Singapore & China, China has been leading the number of patent applications compared with other countries (see Figure 4 and Table 2).

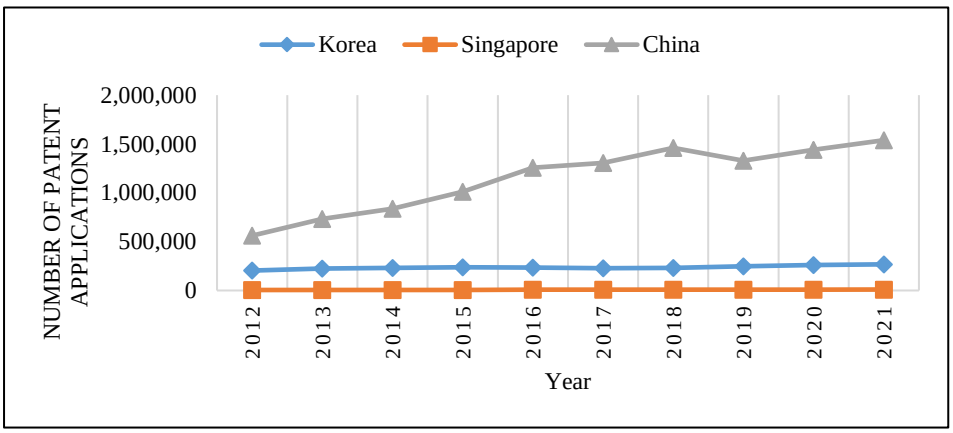
Table 2: Patent Applications

Year	Korea	Singapore	China
2012	203,880	4,905	561,472
2013	223,560	5,489	734,115
2014	230,583	5,937	837,857
2015	238,229	6,192	1,010,557
2016	233,834	6,745	1,257,466
2017	226,614	6,951	1,306,077
2018	232,022	7,414	1,460,243

2019	248,550	7,378	1,328,067
2020	260,614	7,946	1,441,086
2021	267,517	9,764	1,538,558

Source: (WIPO, 2021)- Taiwan data is not available

Figure 4: Patent Applications



Source: (WIPO, 2021)- Taiwan data is not available

However, TIPO[1] Statistics Report showed the patent and trademark applications in 2018. while Taiwan (ROC) is not a member of the United Nations, and the number of patents filed in Taiwan is not reported separately from China in the indicators. Therefore, the number of patent applications filed with the Taiwan Intellectual Property Office (TIPO) in 2018 was 73,4319, placing it in sixth place worldwide for that year, or second place per capita.

Number of Trademark Applications

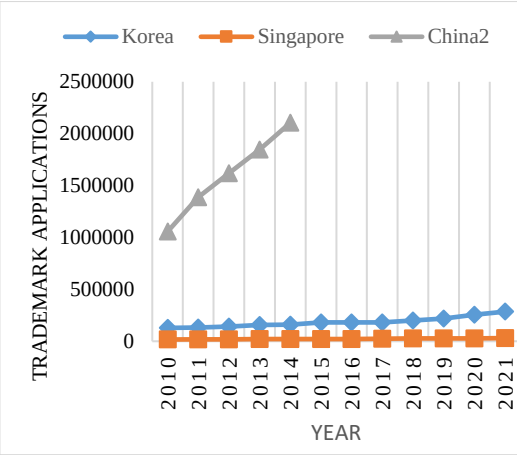
According to WIPO's Trademark Statistics Report 2021, an estimated 13.9 million trademark applications covering 18.1 million classes were filed worldwide in 2021. The number of classes specified in applications grew by a remarkable 5.5%. The trend of Trademark Applications worldwide from 2000 to 2021 is indicated in Figure 5. Trademark Applications increased from 2.6 million in 2000 to 13.9 million in 2021.

[1] TIPO: Taiwan Intellectual Property Office

Table 3: Trademark Applications

Year	Korea	Singapore	China
2010	128672	16929	1056563
2011	132506	18202	1386776
2012	141838	19265	1618432
2013	157139	20033	1847938
2014	160311	21297	2104414
2015	183005	21380	
2016	181889	22758	
2017	180427	24155	
2018	199518	25974	
2019	218591	26581	
2020	256834	26560	
2021	285274	30639	

Figure 5: Trademark Applications



Source: (WIPO, 2021) (Note: Taiwan data is not available)

China's IP office had the highest volume of filing activity of trademark applications with a class count of around 9.5 million, followed by the United States Patent and Trademark Office (USPTO) (899,678), the European Union Intellectual Property Office (EUIPO) (497,542), and the offices of India (488,526) and the UK (450,815). Table 3 and Figure 5 compare trademark applications of selected East Asian countries, such as Korea, Singapore, and China (as Taiwan data is not separated from China).

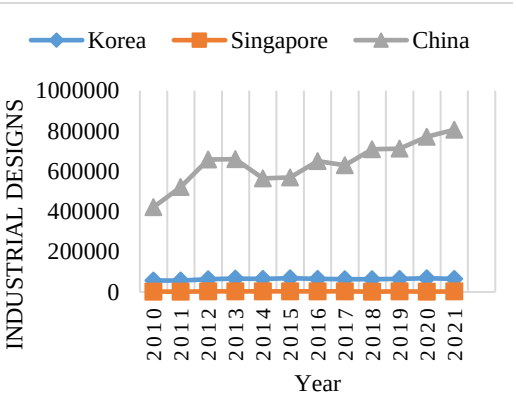
Number of Industrial Designs

An estimated 1.2 million industrial applications containing 1.5 million designs were filed worldwide in 2021. The number of designs grew by 9.2% in 2021. Table 4 and Figure 6 compare several industrial designs in Korea, Singapore, and China. China has been leading the number of industrial design applications for an extended period.

Table 4: Industrial Design Applications

Year	Korea	Singapore	China
2010	57187	1977	421273
2011	56524	2167	521468
2012	63135	2182	657582
2013	66940	2434	659563
2014	64620	2360	564555
2015	68236	2411	569059
2016	65656	2221	650344
2017	63425	2389	628658
2018	63797	2043	708799
2019	65311	2365	711617
2020	67381	2063	770362
2021	64925	2554	805710

Figure 6: Industrial Design Applications



Source: WIPO Online Database

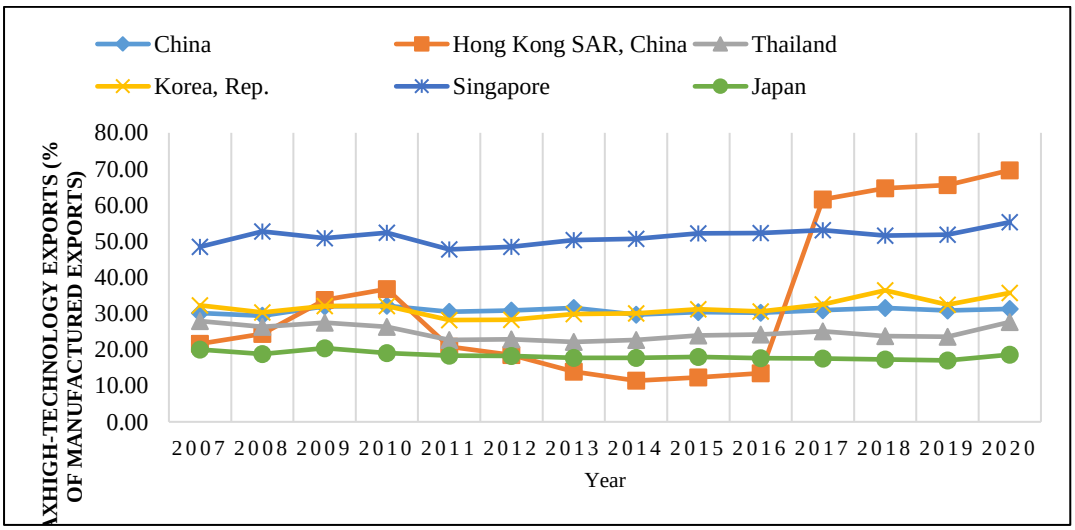
High-Technology Exports

High-technology exports are products with high R&D intensity, such as computers, scientific instruments, electrical machinery, pharmaceuticals, consumer electronics, and aerospace products. According to the OECD, High-technology goods have been among the most dynamic components of international trade over the last decade. Therefore, a country's ability to compete in high-technology markets is essential to its global economic competitiveness. Many developing countries need more R&D to reach this industry, which requires high technology and knowledge (Ramanayake 2022). High-tech exports positively impact economic growth, while low-tech exports negatively impact growth. However, high-technology product exports lead to increased productivity between domestic and foreign competition (Lee, 2020; Sofuoğlu, Kizilkaya, & Koçak, 2022).

Moreover, according to Sahin (2019), high-technology exports, with their high added value, are considered one of the determinants of growth in recent years. The increasing competitiveness of developing countries in international markets depends on the country's capacity to produce and export high-tech products. Therefore, exporting high-technology products is a vital engine of the country's economic growth and development.

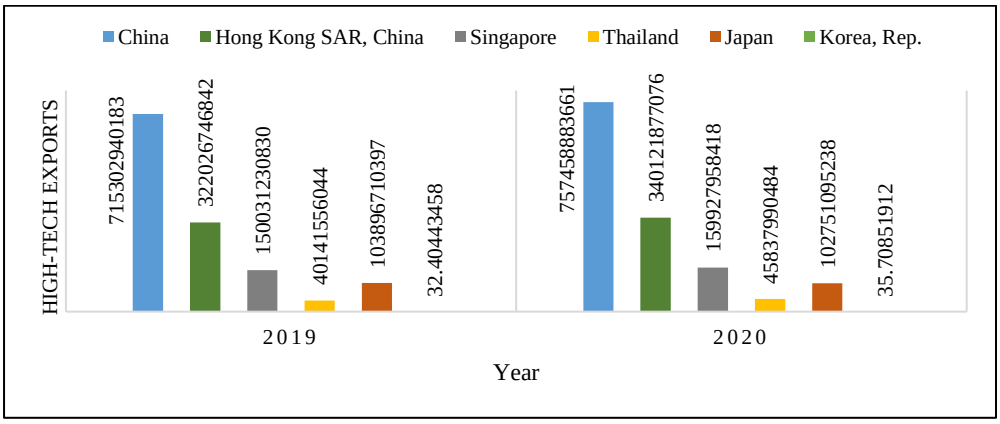
According to World Bank data, high-tech exports worldwide increased from 2.21 trillion in 2007 to 2.85 trillion in 2019. Figure 7 shows the trend in high-tech exports (share of manufactured exports) in selected East Asian countries. Hong Kong, China, Korea, and Singapore are at the top in East Asia and the world. This shows 2016 China's significant acceleration of high-tech exports, particularly with China's Belt and Road Initiatives (BRI) started in 2013 mainly.

Figure 7: High-technology exports (as a share of manufactured exports) of selected East Asian Countries



Source: Using World Bank Online Data created by the Authors

Figure 8: High-technology exports (current US$)) of selected East Asian Countries in 2019 & 2020



Source: Using World Bank Online Data created by the Authors

Figure 8 shows that China's high–tech exports (current US$) were highest in 2019, 2020, and 2021.

In Taiwan's case, according to Taiwan's Ministry of Economic Affairs, Taiwan-based makers received export orders for high-tech products worth US$400.47 billion in 2021, amounting to 59.41percent of the total value for all export orders and an increase of 22.9 per cent in the year. Moreover, Taiwan shipped $477.8 billion worth of export products around the World in 2022. That dollar reflects a 43 per cent gain compared to $334.2 billion in 2018. The biggest export of Taiwan is electronic integrated circuits and related micro assemblies, especially semiconductors. That represents almost four-fifths (38%) of total shipments. According to the data by Taipei-based research firm Trend Force, Taiwan dominates the foundry market or outsourcing of semiconductors manufacturing. That is 60 per cent of the total global foundry revenue.

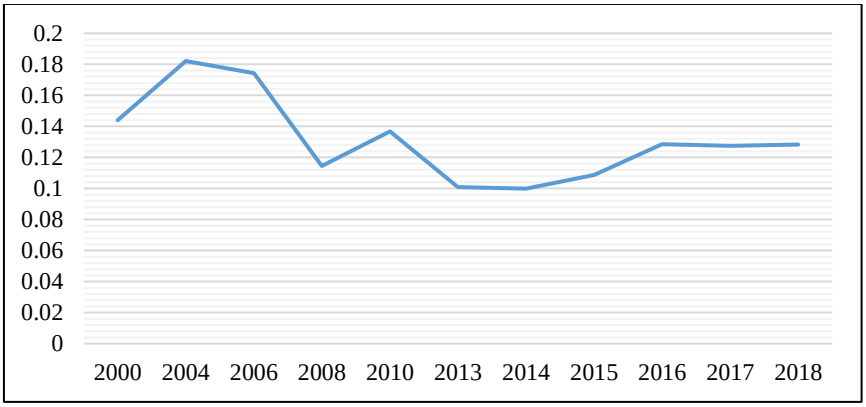
Analysis of Global South: Sri Lanka

To compare with the Global North, we took Sri Lanka as a country representing the Global South. One of the limitations of this study is that we only consider Sri Lanka as a South country to compare with the North. Thus, the empirical analysis included some other South countries. R&D intensity, Patents, Trademarks and Industrial design applications, and High-Tech exports are discussed in the context of Sri Lanka.

R&D Intensity in Sri Lanka

Sri Lanka's R&D Expenditure as a share of GDP was reported 0.144 percent in 2000 and increased to 0.182 percent in 2004. However, in 2013, it decreased to 0.10 per cent, and in 2020 it was 0.12 per cent (Rs. 18,174.60 million). Figure 9 indicates the R&D expenditure in Sri Lanka from 2000 to 2018.

Figure 9: R&D Expenditure share of GDP from 2000 to 2018



Source: World Bank Database

Sri Lanka spent the highest of Rs. 14854.59 million for re-current expenditure (81.62%) and Rs. 3320.01 million for capital expenditure (18.38%) on R&D in 2020. According to the R&D statistics of the National Research and Development Survey 2020 conducted by the National Science Foundation (NSF), Sri Lanka, the highest gross expenditure on R&D (GERD)[1] was acquired by Business Enterprises (37.94%), followed by Government Research Institutes (34.12%), Higher Education Sector (26.7%), and Private Non-Profit Organizations (1.25%).

The highest proportion of funds for R&D was devoted to applied research, 47.45 per cent of GERD, while basic and experimental developments accounted for 29.30 per cent and 23.25 per cent of GERD, respectively. At the same time, the top three fields of science that have the highest GERD are Engineering and Technology (27.65%), Agricultural sciences (24.20%), and Natural sciences (22.46%). The Social Sciences and Humanities field has a lower value of 12.18% when compared with other fields (See Table 5 & Figure 10). In Sri Lanka, 6,064 Researchers (Head Count) are employed in domestic R&D activities, and their Full-Time Equivalent value was 2267. The number of researchers per million of the population was 103.43 full-time, equaled (FTE).

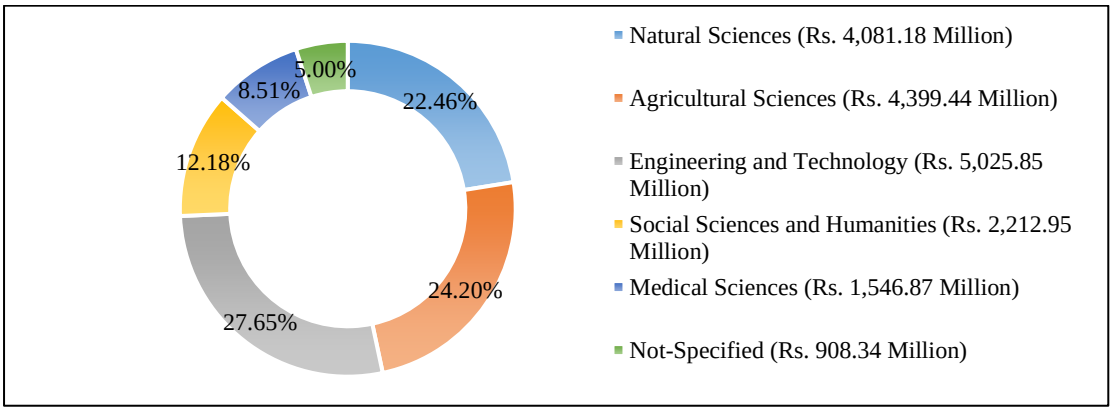
[1] Gross Domestic Expenditure on Research & Development

Table 5: Time Trend - GERD by Field of Science (Rs. Million)

Discipline	2014	2015	2016	2017	2018	2020
Natural Sciences	2,666.19	3,170.30	3,020.67	3,060.19	3,350.26	4,081.18
Engineering and Technology	2,447.55	2,991.80	4,913.90	3,432.84	5,986.74	5,025.85
Medical Sciences	371.85	1,019.10	930.77	1,588.50	1,558.03	1,546.87
Agricultural Sciences	4,077.77	3,746.10	4,349.42	6,080.86	4,372.72	4,399.44
Social Sciences and Humanities	603.85	647.8	1,390.84	1,561.81	2,654.95	2,212.95
Not Specified	182.87	329	813.7	1,279.14	421.23	908.34
Total	10,350.08	11,904.10	15,419.30	17,003.34	18,343.92	18,174.63

Source: National R&D Survey of Sri Lanka 2020 (NSF)

Figure 10: Gross Domestic Expenditure on R&D (GERD) by Field of Science 2020



Source: National R&D Survey of Sri Lanka 2020 (NSF)

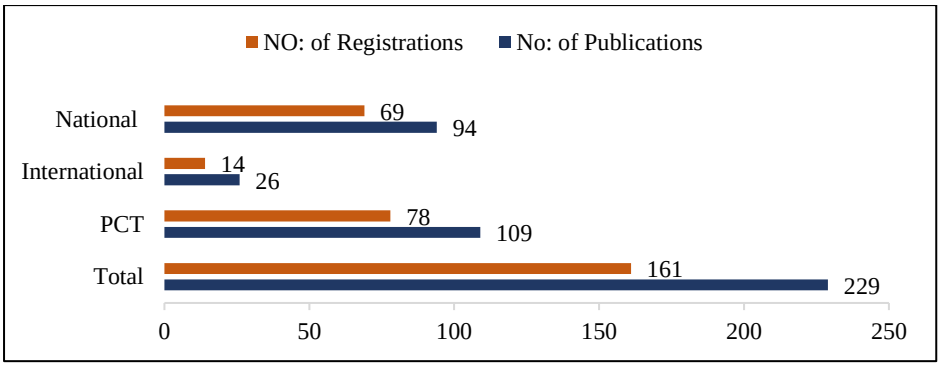
Moreover, Lee (2013) indicates that middle-income countries or developing countries generally present low ratios of R&D. That is true in the Sri Lankan context as the R&D expenditure on GDP in Sri Lanka has a relatively low value when compared with selected East Asian countries like Korea, Taiwan, and Singapore and in China and Japan. Korea is at the top by spending the highest GDP share in R&D, which is 4.81 per cent in 2020 (93.1 trillion), and

Taiwan remains the second largest by spending 3.63 per cent, Japan spends 3.26 per cent, China has 2.4 per cent, Singapore has1.9 per cent in 2019 respectively. Hence, Sri Lanka only spends 0.12 per cent of its GDP share on R&D.

Patent Applications in Sri Lanka

As stated by the National Intellectual Property Office (NIPO) in Sri Lanka, Patents protect inventions and ensure the inventors. The benefits resulting from the inventions thereby provide incentives for inventiveness, encouraging other inventions, and promoting investment. This will stimulate economic and technological development. According to the NIPO statistics, Sri Lanka had 161 registrations and 229 publications of total patents in 2020, including the registrations and publications of National, International, and PCT[1]. Figure 11 shows the patent applications in Sri Lanka in 2020.

Figure 11: Patent Applications of Sri Lanka in 2020



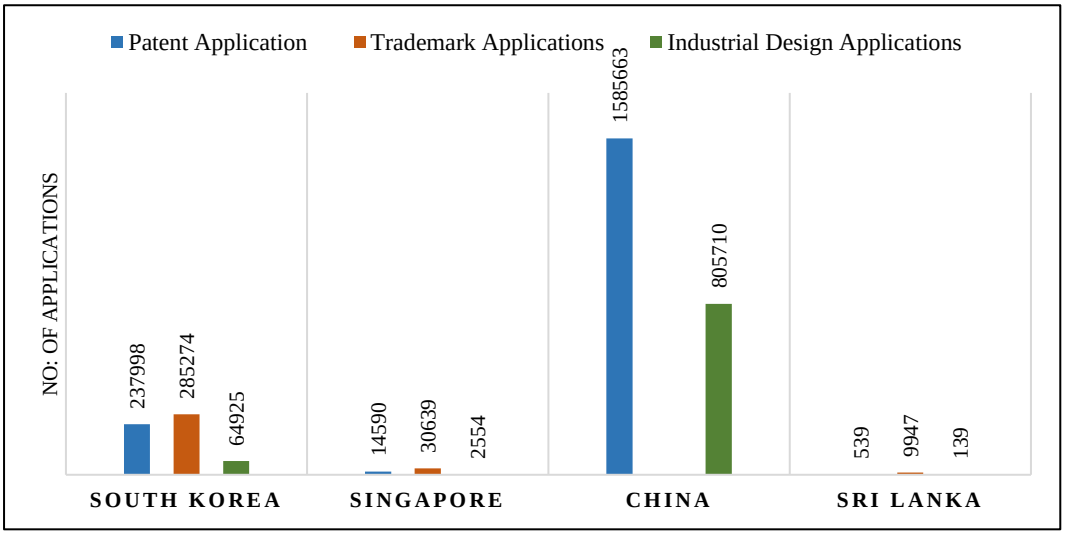
Source: Using NIPO Statistics created by the Authors

Figure 12 compares patents, trademarks & industrial design applications of selected East Asian countries, including Sri Lanka, in 2021. When comparing these factors in Sri Lanka, they have significantly low numbers. According to the WIPO statistics, the highest number of patent applications is from China at 1585663, South Korea accounted for 237998, and Singapore has 14590 patent applications. In comparison, Sri Lanka owned only 513 patent applications in 2021. Moreover, South Korea reported 285274 trademark

[1] Patent Cooperation Treaty (PCT) assists applicants in seeking patent protection internationally for their inventions.

applications, Singapore reported 30639 trademark applications, and Sri Lanka reported only 9947. Regarding industrial design applications, China has the highest, achieving 805710 applications, followed by South Korea with 64925, Singapore with 2554, and Sri Lanka with only 139 industrial design applications in 2021.

Figure 12: Comparison of Patent Applications, Trademark & Industrial Designs Applications in EA and Sri Lanka



Source: Using WIPO Data created by the authors

High-Technology Exports in Sri Lanka

High-Tech exports in Sri Lanka are relatively low compared to other East Asian countries. Sri Lankan exports are limited to a few labor-intensive primary export industries, such as textiles, garments, and agricultural products. Sri Lankan export basket is mainly filled with textiles and garments (52% of total exports) and tea (17%); others include spices, gems, coconut products, rubber, and fish since the 1980s till now (Marwah and Ramanayake 2021; Ramanayake & Wijetunga, 2018).

High-tech exports have declined in Sri Lanka since 2008. It was 103 million in 2008, declining to 63 million in 2015. However, in 2021 it shows an increment, and it was 94 million in 2021 in current US dollars. Furthermore, a high-tech export (as a share of manufactured exports) of Sri Lanka was also

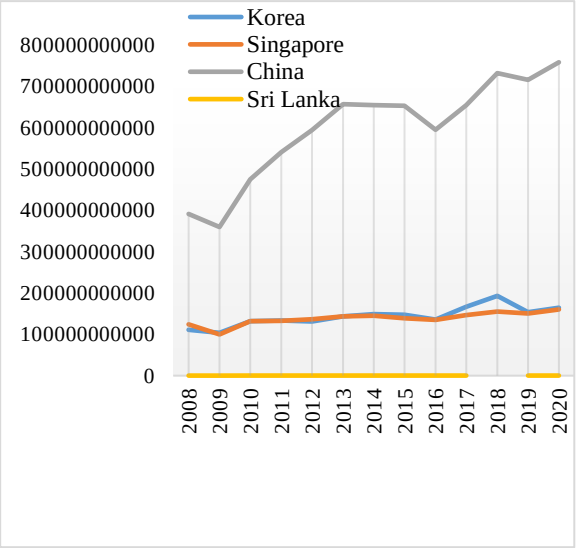
very low; it was 1.9 per cent in 2008, declined to 0.89 per cent in 2015 and 1.04 per cent in 2021.

When comparing the High-tech exports in Sri Lanka with selected East Asian countries South Korea, Singapore, and China (Taiwan data is unavailable), Sri Lanka is very low and it is in the initial stage (See Figure 13). China led the field by accounting for 757459 million, followed by South Korea and Singapore, having 163987 million and 159927 million, respectively, in 2020. While Sri Lanka only accounted for 83 million. Therefore, Sri Lanka is incapable of competing in the global market, which affects the country's economic growth as unable to sustain economic growth. According to these statistics and trends, the growth dream for Sri Lanka needs to catch up.

Table 6: High-technology exports (share of manufactured exports) of Korea, Singapore, China & Sri Lanka

Year	Korea	Singapore	China	Sri Lanka
2010	32.07	52.32	32.12	1.13
2011	28.18	47.72	30.48	1.04
2012	28.22	48.45	30.85	0.95
2013	29.82	50.32	31.57	1.04
2014	30.06	50.63	29.70	0.95
2015	31.21	52.21	30.42	0.89
2016	30.52	52.23	30.24	0.94
2017	32.55	53.07	30.91	1.02
2018	36.39	51.56	31.55	
2019	32.40	51.81	30.82	1.10
2020	35.71	55.26	31.28	1.26

Figure 13: High-technology exports (current US$) of Korea, Singapore, China & Sri Lanka



Source: Using World Bank data created by the authors

4.2 Empirical Analysis: Comparison of Global North versus Global South

This section discusses empirical analysis by comparing global south countries and north countries. Tables 7 and 8 show the descriptive statistics of two samples. The North sample (developed) included 20 countries, and the South sample (developing countries) included 22 countries.

Table 7: Descriptive Statistics - North Countries

Variable	Mean	Standard deviation	Minimum value	Maximum value	No: of Observations
GDP	1.89	3.48	2.12	2.14	420
Total Patents	52014.21	130328.8	24	621453	413
R&D expenditure	2.0566	0.83538	0.5273	3.8738	398
High-Tech exports	15.2994	6.55836	3.77465	29.87957	280
FDI	1.28	5.57	-3.45	2.18	411

Sources: Author's calculations

Table 8: Descriptive Statistics – South Countries

Variable	Mean	Standard deviation	Minimum value	Maximum value	No: of Observations
GDP	7.50	1.76	1.47	8.46	462
Total Patents	44069.33	176792.7	72	1542002	452
R&D expenditure	1.13466	1.200887	0.423	5.43562	326
High-Tech exports	16.79151	16.45854	0.194923	69.6469	284
FDI	-1.12	2.27	-2.32	4.17	462

Sources: Author's calculations

Empirical Results for South Countries

Table 9 indicates the results on POLS, FE, and RE for the sample for North countries.

Table 9: Effect of Patent applications, R&D, High-tech exports and FDI to the GDP of developed countries

Dependent Variable: GDP	Constant Variance	Total Patents	R&D Expenditure	High-Tech exports	FDI	R square value (R^2)	No: of observations
Pooled OLS	7.05** (0.043)	2.650*** (0.000)	2.11** (0.036)	-2.90** (0.005)	-1.266*** (0.002)	0.8708	269

Fixed Effect (FE)	6.60*** (0.010)	2.65*** (0.000)	2.62** (0.011)	-3.37*** (0.002)	-1.201*** (0.004)	0.8674	269
Random Effect (RE)	7.05*** (0.0043)	2.65*** (0.000)	2.11** (0.036)	-2.90*** (0.005)	-1.266*** (0.002)	0.8708	269

Sources: Author's calculations

Pooled OLS model:

$\hat{y} = 7.05 + 2.650\ x_1 + 2.11\ x_2 - 2.90\ x_3 - 1.266\ x_4 + Ui$

According to the POLS model, the R square value (R2) is 0.8708. That is, the independent variables cover 87% of the variation of the dependent variable. Thus, the constant coefficient is shown to be 7.05. When one unit of total patent applications is increased at the constant level of R&D expenditure, High-tech exports, and FDI, the GDP will increase by 2.650. At the same time, when the R&D expenditure is increased by one unit with the constant total patent applications, high-tech exports, and FDI, GDP will have increased by 2.11. Hence R&D expenditure is not significant for growth for developed countries.

Moreover, results indicate that, for developed countries, High-tech exports negatively impact growth. In other words, GDP will decrease by 2.90 when the one unit of High-tech exports increases while total patent applications, R&D expenditure, and the FDI are constant. FDI also shows negative impacts on growth for developed countries.

Fixed Effect (FE) & Random Effect (RE):

FE: $\hat{y} = 6.60 + 2.650\ x_1 + 2.62\ x_2 - 3.37\ x_3 - 1.201\ x_4 + Ui$

RE: $\hat{y} = 7.05 + 2.650\ x_1 + 2.11\ x_2 - 2.90\ x_3 - 1.266\ x_4 + Ui$

According to the fixed effect (FE), the R square value (R2) is 0.8674. That is, the independent variables cover 87% of the variation of the dependent variable. Thus, the constant coefficient is shown to be 6.60. At the same time, according to the RE estimation, the R square value (R2) is 0.8708. That is, the independent variables cover 87% of the variation of the dependent variable. In contrast, the constant coefficient is shown to be 7.05. Therefore, robustly POLS, FE, and RE results show the same significance.

Housman Test

The Housman test is carried out in panel data regression to distinguish the difference between the fixed effect (FE) and the random effect (RE). Here, random effects are applicable if the P value is more significant than 0.05, and if the P value is less than 0.05, the fixed effect is more significant. Therefore, Housman test results in P values displayed 0.00 for the developed sample, indicating that the fixed effect is more suitable.

Empirical Results for South Countries

Table 10 indicates the results on POLS, FE, and RE for the sample of developing countries. The results indicate that R&D expenditure and High-tech exports are insignificant for developing countries. This results in line with many existing pieces of literature. Many developing countries have very low R&D intensity and low High-Tech exports.

Table 10: Effect of Patent applications, R&D, High-tech exports, and FDI on the GDP of developing countries

Dependent Variable: GDP	Constant Variance	Total Patents	R&D Expenditure	High-Tech exports	FDI	R square value (R^2)	No: of observations
Pooled OLS	3.65*** (0.000)	824646*** (0.000)	6.73 (0.172)	-1.62 (0.491)	-8.665*** (0.000)	0.9549	207
Fixed Effect (FE)	2.56*** (0.004)	797502*** (0.000)	1.95*** (0.002)	-9.33 (0.702)	-7.423*** (0.000)	0.9310	207
Random Effect (RE)	3.65*** (0.000)	824646*** (0.000)	6.73 (0.172)	-1.62 (0.491)	-8.665*** (0.000)	0.9549	207

Sources: Author's calculations

5. Concussions & Policy Suggestions

With the continuous rapid technological change and the emergence of globalized markets, all the developed and developing countries are hurrying to become more innovative. The concept of National Innovation Systems plays a significant role in growing a country's economy.

According to the literature, Wong (1999) stated that among late industrializing economies in the world, Korea, Taiwan, and Singapore have achieved significantly faster high-tech industrial growth over the last three decades than all other developing countries. More interestingly, they have evolved distinctly different models of NISs. Furthermore, China is escaping the middle-income trap by following the same path through NIS. However, most low- and middle-income countries like Sri Lanka cannot sustain economic growth as they have paid little attention to the NIS. Moreover, they are weak in developing technology and innovation outputs. According to Lee (2016), and Ramanayake (2022), most middle-income and developing countries failed to sustain growth because they specialized in low-technological industries and the inability to upgrade their specialization to more advanced technologies.

High-tech exports, the number of patent applications, and R&D expenditure on science and technology are significant measures of a country's ability to innovate.

When comparing the NIS interrelated dimensions of Sri Lanka with selected East Asian countries with rapid technological catch-up, Sri Lanka is deficient and in its initial stage of NIS. In Sri Lanka, the number of patent applications, trademarks, industrial designs, and R&D expenditures on science and technology (S&T) is remarkably low compared with other Asian countries. Sri Lanka's weak performance on innovation is a symptom of the low priority given to S&T and R&D investments over the past several years. Compared to other developing and developed countries, the University-Industry collaboration is not substantially established in Sri Lanka. Very few industry-research linkages exist today. Furthermore, High-Tech exports in Sri Lanka are also comparatively low and limited to a few labor-intensive primary export industries.

Based on the results of the panel data regression, it is clearly stated that the NIS interrelated dimensions such as patent applications, Research & Development expenditure, High-Tech exports, and foreign direct investments (FDI) positively impact the GDP of developed countries but do not in developing countries. These indicators are relatively lower in developing countries than in developed countries.

According to the data collected in this study, the growth-driven NIS-associated indicators could perform better in Sri Lanka. Therefore, Sri Lanka must take an integrated approach to innovations or S&T to benefit from NIS. The government of Sri Lanka needs to act by developing new policies to expand and uplift NIS to sustain the country's economy.

Policy Suggestions for Sri Lanka

Based on the study's findings, the following suggestions can be made.

1. The government of Sri Lanka should prioritize Science and Technology in its path toward economic development and need to increase the country's technological development fund. Sri Lanka's GERD remained under 0.12 per cent of the GDP in 2020 compared with others – Korea (4.81%), Taiwan (3.63%), and China (2.24%). Therefore, increasing the GERD to at least 1 per cent is recommended.

2. Promoting university-industry R&D cooperation can be an excellent strengthening of the NIS. Unlike developing and developed countries, the University-Industry collaboration is not substantially established in Sri Lanka. Universities and higher education centres should increase their existing collaboration with industries. Moreover, that should include more than essential student internships but more research-oriented ones.

3. The Sri Lankan government should take the necessary steps to allow industries to do joint R&D with the academic sector.

4. The country's future is mostly based on the upcoming generation or youth; therefore, developing the country's educational system is necessary. We need to increase general science and technology literacy among every level of students to build up a critical mass of scientists, researchers, and people with innovative and critical thinking.
5. In Sri Lanka, Exports are mainly limited to a few labor-intensive primary export industries such as textiles, garments, and some agricultural products. Therefore, more expertise in these fields must be needed to compete in the global market. Moreover, economic activities

like high-tech exports in Sri Lanka need to be more knowledge-intensive to benefit from international trade.

6. Furthermore, in the export industry, Sri Lanka should introduce and develop new innovative industries other than textile and agriculture to gain higher profits. Moreover, relevant policies need to be taken from the government side to encourage the private sector to global market competition with higher profits.

7. Encouraging people towards innovations and entrepreneurs with appropriate policy support for "techno-entrepreneurship" is also significant in commercializing technical innovations.

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