Changes in POS Fees and Consumer Payment Behaviour: A Difference-in-Differences Analysis Between Jamaica and Trinidad & Tobago

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Abstract:
This study examines the impact of point of sale (POS) fee changes on consumer payment behaviour in Jamaica and Trinidad & Tobago, focussing on the shift in the cash-to-card ratio. While existing research has explored the impact of interchange fees on consumer payment behaviour, the impact of end-user fees is underexplored. Employing a difference-in-differences (DiD) approach, this study leverages the contrasting trends in POS fees between Jamaica, where fees have fluctuated, and Trinidad & Tobago, where fees have remained constant. The results indicate that relative cash usage declines in Jamaica regardless of a fee increase or fee decrease but there is a larger decline after a fee decrease. This offers practical insight for Caribbean policymakers seeking to drive financial inclusion or reduce the reliance on cash.

Keywords: Point of Sale (POS) Fees, Cash-to-Card ratio, Difference-in-Differences (DiD), Consumer Payment Behaviour

JEL classification: E42**,** G21, G40, O33

INTRODUCTION

In recent years, the global diffusion of technology has resulted in the development of numerous electronic payment instruments (EPIs). Such EPIs have transformed the payments and financial landscapes, altering consumer payment behaviours. An EPI refers to any means of payment that allows for a customer to transfer payment to a merchant via their respective banks without the use of cash, and mostly in real time (Koul, Jasrotia and Mishra 2021, 201-213). EPIs include debit cards, credit cards, and numerous mobile applications and e-wallets. The prevalence of these EPIs has been impactful for the retail payments system, a component of the national payment system which captures a high volume of small value payments between non-financial parties (Cirasino and Garcia 2008).

Particularly, point-of-sale (POS) systems have become essential in facilitating electronic transactions for consumers and merchants. Just the availability of POS systems has impacted consumers' and merchants' willingness to use and adopt electronic payments instead of cash. Notwithstanding, changes in POS fees can influence the consumer's decision to utilise cash or card at the checkout point. Debit cards are one of the EPIs that is widely used as a substitute for cash at a POS and the existing literature, based on payment survey data or payment diaries, concludes that the relative cost effectiveness of debit cards is a major determinant of consumers decision to use debit cards (Stavins 2012; Salandy 2021, 47-57; Hoang & Vu, 159-183). Based on the core law of demand, if something becomes more expensive then the consumer will demand less of it and vice versa. In the scope of this study, this law of demand can be adopted to establish that if it becomes more expensive (cheaper) to use EPIs at a POS then consumers are likely to use EPIs less (more) and instead use cash more (less), increasing (decreasing) the relative usage of cash in the economy.

In the Caribbean, monetary authorities have played a vital role in regulating bank fees, yet a lack of published bank fee data has hindered extensive research on this topic. The Central Bank of Trinidad & Tobago (CBTT) and Bank of Jamaica (BOJ) have both published comprehensive payment datasets. This study uses data from 2018 to 2023. The average POS fee in Jamaica fluctuated during this time period, while the average POS fee in Trinidad & Tobago has remained unchanged at TT $0.67 up until May 2023, providing an ideal setting for Difference in Differences (DiD) analysis.

This study aims to answer the question: "What is the impact of POS fee changes in Jamaica on relative cash usage, versus in Trinidad & Tobago where POS fees have remained constant?". This research will employ the DiD approach to provide evidence on how consumer payment behaviour changes in response to changes in POS fees. A key assumption of the DiD methodology is the parallel trends assumption that posits that the differences in the relevant cash usage between Jamaica and Trinidad & Tobago would follow a similar trend over time if there were no POS fee changes. This underlying assumption is crucial as it allows for the results to be attributed to POS fee changes rather than other external factors.

Understanding such dynamics in the payment market is crucial for financial inclusion, payments efficiency and proper market conduct in the financial system. This paper makes a two-fold contribution. First, it provides first-time evidence for Caribbean economies with regards to how consumers respond to changes in bank fees. Secondly, while the existing international literature on countries such as Canada and the US focus on interchange fees between merchants and banks, this study examines the impact of end-user fees, paid directly by the consumer. Ultimately, by leveraging data on POS fees, relative cash usage and other control variables, this research will provide valuable insights on payment system dynamics and can inform policy decisions on driving financial inclusion and electronic payment acceptance.

In the next section, I will review the existing literature surrounding measuring relative cash usage, consumers' payment substitution patterns; and methodologies utilised by current studies to assess the

impact of bank fees. This will be followed by the Methodology and Data section which presents a description of the dataset and the DiD methodology, as well as a preliminary data analysis of key payment indicators for Jamaica and Trinidad & Tobago. The presentation and discussion of results will follow and lastly, a conclusion will be provided.

LITERATURE REVIEW

Cost Efficiency of Payment Systems

There are costs attached to payment systems and the cost efficiency of alternative payment instruments can cause them to be more or less attractive than cash, influencing whether consumers sustain their cash habit (Brits and Winder 2005). With this in mind, this study seeks to add to the literature, determining through empirical investigation, the impact of POS fees on relative cash usage as measured by the cash-to-card ratio (see Ardizzi 2013). Research to date has investigated the impact of interchange fees, paid by the merchant, on consumers' payment choice but has not yet determined the impact of fees paid directly by consumers (end-user fees) on their choice of cash or card at POS terminals (McGinnis 2013) (Ardizzi 2013). It is important to understand how consumer payment behaviour changes in response to fees as it has direct implications for financial inclusion, EPI acceptance and ultimately payment systems efficiency.

Despite the narrow scope, existing studies provide foundational evidence that an increase in the cost of using debit cards or credit cards tends to negatively affect consumer usage. Stavins (2011) analyses payment survey data to gauge how higher interchange fees would impact consumer payment behaviour. The author clearly presents her methdology on how consumers' survey responses were adjusted to estimate the impact on debit card usage. The results of the study suggest that the impact of an increase in the cost of using debit cards could be four-fold. Consumer adoption of debit cards, debit cards in circulation and the number of debit card transactions could all potentially decline while adoption of credit cards may increase. These results confirm that consumer payment behavior is responsive to changes in the cost of using a debit card with greater impact in the case of direct costs compared to one-time costs such as setting up a debit card (Stavins 2011).

Measurement of Relative Cash Usage

Adequately measuring the relative cash usage is critical to this study. The cash-to-card ratio is described by Ardizzi (2013) as the ratio of cash withdrawals at the automated teller machine (ATM) to the sum of the value of ATM withdrawals and debit card transactions at the POS. However, as noted later on in that study, this measure is narrow as it does not account for substitution effects between debit cards and credit cards. This substitution effect was also found by Stavins (2011) underscoring the need for it to be captured. Recent evidence from during the pandemic, suggest that a little more than half of the population in Latin America and the Caribbean owned and used a debit or credit card (Ozili 2023). Based on this finding, it is imperative that I account for credit card transactions in the calculation of relative cash usage for this study. Without incorporating credit card transactions, the cash-to-card ratio would falsely inflate if there was a substantial shift from debit cards to credit cards. The increased ratio would suggest cash usage has risen, when in fact consumers switched to credit cards. The literature posits that the substitution pattern between debit cards and credit cards is dependent upon current and expected financial conditions and behavioural motives in the form of spending restraints and expenditure tracking (Borzekowski, Kiser and Ahmed 2006). Based on the findings of Abdul-Muhmin 2010, the substitution of cash for debit cards is prevalent at lower transaction values. Therefore, this study will include credit card transactions in the calculation of relative cash usage to capture these substitution effects.

Methodological Approaches

Existing studies employ various methodologies to assess the impact of fees on payment behaviour. Koulayev (2016) and Stavins (2018) employ two-stage models whereby in the first stage the consumer makes the decision to adopt the payment instrument and in the second stage the consumer decides to use the payment instrument. Both studies consider a wider range of payment options and also multiple payment contexts (e.g. online purchases or essential retail). However, given that this study focuses on consumer use at the POS, there is no need for a two-stage model. Instead, a simple linear model such as that adopted by Ardizzi (2013) is relevant to this study. Ardizzi (2013) studied the impact of interchange fees by utilising final information from the card-issuing bank. There was no need to build a simultaneous equation to capture any interaction between merchants and consumers. Moreover, Borzekowski, Kiser and Ahmed (2006) used a survey and identified respondents whose bank charges and those whose bank does not charge debit card transaction fees from survey responses. The authors then determine the proportion from each of those groups that use their debit card for payment. The survey results indicate that debit card usage is more likely in users of banks who do not charge a debit card transaction fee. However, these results are insufficient to draw conclusions on whether card transaction fees paid by consumers influence their card usage, as it does not account for the influence of other control variables.

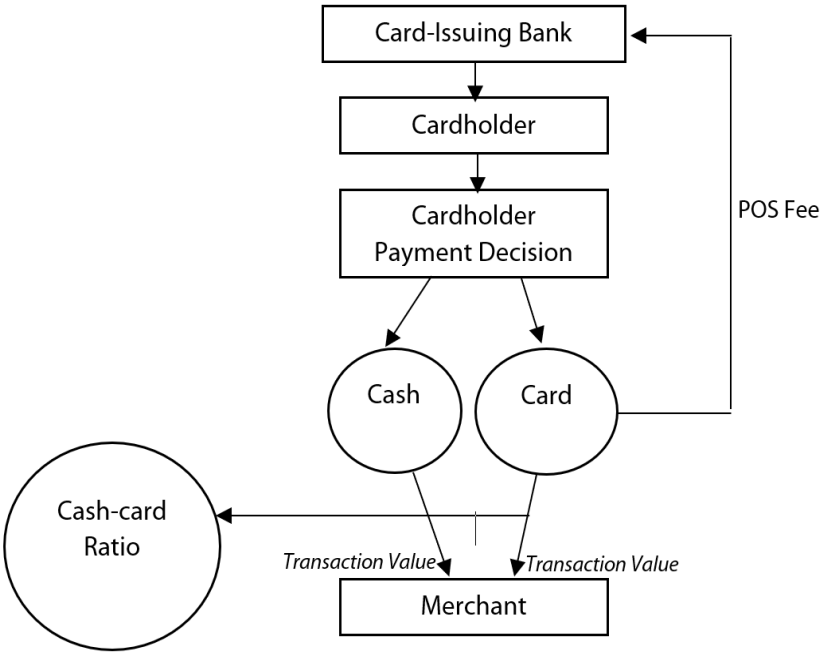
The DiD approach, though has not been applied in current studies on consumer payment behaviour, has become a prominent methodology for comparing the changes in an outcome variable between a group exposed to a policy change and a control group. DiD analysis is vastly applied in policy evaluation. For instance, McKinnon, et al. (2014) examines the impact of policies that removed user fees for facility-based maternity delivery services on three binary dependent variables. By comparing regions where fees were eliminated to other regions where they were not, the study provided evidence that facility-based deliveries increased after a fee exemption policy. While the study by McKinnon, et al. (2014) is of a different discipline compared to this study, the research objectives are similar as this study also seeks to determine the impact of a fee change. Moreover, the validity of DiD results is hinged upon the parallel trends assumption which states that in the absence of policy change, or fee change in this instance, the average outcome in the treatment and control group would evolve in a parallel manner if no treatment occurred (Roth, Sant'Anna and Poe 2023).

Given the established usefulness of the DiD methodology in evaluating how an outcome variable changes after a policy intervention, this study adopts this methodology to assess the effect of changes in POS fees on consumer payment behaviour in Jamaica and Trinidad & Tobago. Leveraging the fact that POS fees have been constant in Trinidad & Tobago for a long time while fluctuating in Jamaica, this study aims to estimate the impact of fee changes on relative cash usage. One limitation of results provided by DiD analysis is that the findings are specific to the groups and the time period studied, limiting the generalisation of results to other countries. The findings will be compared to existing literature to ensure that results are consistent.

Model of Analysis

In this study, both debit card and credit transactions are accounted for in order to capture any substitution between debit card and credit card usage. Debit cards and credit cards are issued to customers by their bank. Debit cards provide access to funds stored in bank accounts while credit cards provide access to borrowed money. Both payment cards, however, can be used to facilitate payment at a POS, ATM withdrawals (cash advances for credit cards) or payments for an online transaction. The cardholder's decision to use a debit card or credit card at a POS instead or cash will influence the cash-to-card ratio. If a card is used, then the cardholder pays the value of the transaction to the merchant and any POS fees imposed to the card-issuing bank. If cash is used, only the transaction value is paid to the merchant. The POS fee can be incurred per transaction or based on the value of the transaction.

Figure 1: Model of the Cash or Card Decision at the POS



As iterated in the literature review, this research is concerned with the POS fee paid by the cardholder. Thus, similar to the work of Ardizzi (2013), there is no need to incorporate merchant-side factors such as interchange fees and merchants' willingness to accept card or cash payments in the analysis. Instead, the model is simple, not requiring a two-stage or simultaneous equation to be estimated.

Payment surveys indicate that consumers' preference for debit cards is hinged upon its cost effectiveness (Stavins 2012; Hoang & Vu 2020, 159-183). Hence, increases in the costs involved in using a debit card are likely to result in consumers using their card less at the POS. The literature unanimously finds that a negative relationship exists between debit card fees and debit card usage. As it becomes more expensive to use a debit card, consumers tend to use the debit card less. This is evidenced by the results of Borzekowski, Kiser and Ahmed (2006) which show that when there are no fees attached to a debit card, a higher proportion of consumers use the card. Debit card fees are found to have a substantial impact on the frequency of use and the magnitude of impact is greater with per transaction fees (Dave & Paatel 2021, 20-34; Stavins 2011).

Consumer Fee Sensitivity

The literature goes on further to investigate consumers' fee sensitivity. Consumers' sensitivity to fee changes may also differ across fee increases and fee reductions. In the credit card market, consumer sensitivity is greater for fee increases than fee decreases (Srinivas, Goradia and Fromhart 2016). If this is the same in the debit card market, it means that lowering debit card fees to motivate debit card use will only have a limited impact but increased fees can have a large detrimental impact on consumer usage. In accordance with this, Ligon et al. (2019) find that lower debit card fees will have only a small impact on consumer usage. Nonetheless, the magnitude of consumers' response to debit card fees differs across the literature. Studies based on consumers in the US and Canada estimate relatively higher elasticities than studies based on consumers in emerging economies such as India. This could be attributed to demographic variables (Fusaro 2013, 1986-2001; Borzekowski, Kiser and Ahmed 2006) and other financial variables that influence consumers' sensitivity towards debit card fees (Stavins 2012). Given data availability constraints and the annual frequency of key demographic and financial variables, I am not able to include them into the DiD model. However, I will utilise the data available to contextualise results.

As highlighted in the introduction of this research, the availability of payments infrastructure is necessary to facilitate electronic payments. In fact, the extensiveness of infrastructure availability is considered when assessing national payments system development (Cirasino and Garcia 2008). To capture this, the relative size of the ATM network is included in the study as a control variable. With this, if the ATM network is more widely distributed than the POS network, customers will have greater access to ATMs, resulting in a likely increase in relative cash usage. Evidence from Trinidad & Tobago suggest that infrastructure availability is statistically significant (Salandy 2021). Specifically, greater availability of the infrastructure is associated with greater e-payments. Salandy (2021) captures infrastructure availability through financial depth which is measured as the "share of domestic credit provided by the financial sector as a ratio of GDP".

Overall, the existing literature highlights the significance of payment costs, especially relevant bank fees, in influencing consumers' payment behaviour. Existing research has vastly explored the impact of interchange fees paid by merchants on consumer payment behaviour, leaving a critical gap in understanding how end-user fees impact consumers' payment behaviour. This study seeks to fill this gap in the literature, examining the impact of POS fees paid by the consumer on their payment behaviour and providing first-time evidence for Jamaica, and the Caribbean.

Moreover, by focussing on POS fees, the model of analysis is simple, not requiring simultaneous or two-stage models to capture interactions between consumers and merchants. However, the lack of variability in POS fees make it difficult to apply tradition OLS regression models. The DiD methodology presents a relevant manner to estimate the impact of fee changes on consumer payment choices, particularly relative cash usage. Relative cash usage is measured based on both debit card and credit card transactions as a means of accounting for substitution patterns between the two cards. The two-group, two-period setting of DiD analysis allows for the examination of changes in relative cash usage after an increase or decrease in POS fees, provided that the parallel trends assumption is met.

This research not only adds to academic literature but provides practical insights for relevant stakeholders such as policymakers and financial institutions that are concerned with improving payment system efficiency. The insights can serve as key inputs for guidelines on regulating bank fees, financial inclusion policies and electronic payment acceptance initiatives.

METHODOLOGY AND DATA

This study applies payments data from January 2018 to May 2023 for Jamaica and Trinidad & Tobago. The datasets were sourced from publicly available payments datasets on CBTT's and BOJ's websites (Bank of Jamaica 2024; Central Bank of Trinidad & Tobago 2024). Both CBTT and BOJ publish commercial banks' fees and charges annually. To derive the monthly frequency for this analysis, the researcher assumed that the POS fees for approved local transactions remain constant for the subsequent 12-month period. This assumption is rooted in the fact that POS fees change infrequently and this is evident by the fact that the POS fees at commercial banks in Trinidad & Tobago remained constant from June 2017 to May 2023. Moreover, further scouting of fee change notices on the websites of commercial banks confirmed the infrequency of POS fee changes.

Additionally, both jurisdictions consistently compile monthly data on the volume and value of debit card and credit card transactions at ATMs and POS terminals (Central Bank of Trinidad & Tobago 2024; Bank of Jamaica 2024). This data was utilised to compute the relative cash usage. As posited in the literature, cash-to-card ratio can be computed based on the volume or the value of transactions. Given that the POS fees in Jamaica and Trinidad & Tobago are charged per transaction and not based on value, it is most appropriate to compute the cash-to-card ratio based on the volume of transactions and it was computed as follows:

$$Cash - to - Card\ Card\ ratio = \frac{\#\ of\ Debit\ Card\ Transactions\ at\ the\ ATM\ +\ \#\ of\ Credit\ Card\ Transactions\ at\ the\ ATM}{\#\ of\ Debit\ Card\ Transactions\ at\ the\ ATM\ and\ POS\ +\ \#\ of\ Credit\ Card\ Transactions\ at\ the\ ATM\ and\ POS}$$

As noted in the literature review, unlike Ardizzi (2013), credit card transactions are included to capture the substitution between debit cards and credit cards which was found by existing literature (Stavins 2011).

A DiD model is applied in the literature to capture a two-period and two-group setting. One period when there is no policy change and a post-treatment period which also includes the time of the policy change. The two groups would be a treatment group that is exposed to the change being studied and a control group which does not face any change. Following the typical DiD specification, the DiD model used in this study is as follows:

$$CASHCARD_{i,t} = \beta_0 + \beta_1 JAM_i + \beta_2 TIME_t + \beta_3 (JAM_i TIME_t) + \beta_4 ATMPOS + \varepsilon_{it}$$

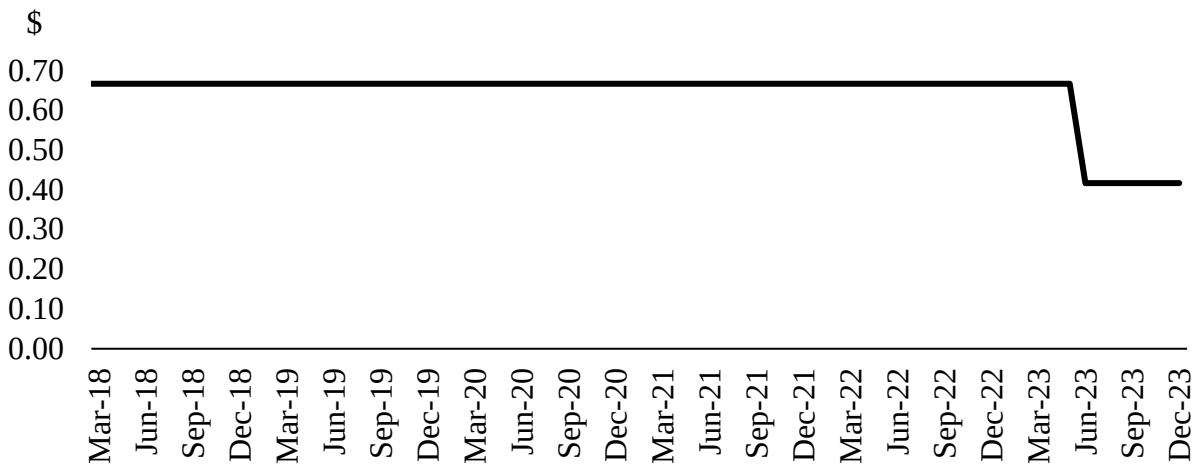
CASHCARD represents the cash-to-card ratio computed for Jamaica and Trinidad & Tobago. JAM reflects the two-group setting of DiD analysis. In this study, Jamaica is classified as the treatment group as its POS fee has fluctuated over the period of analysis, rising in December 2019 and then falling significantly in November 2022. Hence, observations for Jamaica are codified as 1 for the JAM variable. On the other hand, the average POS fee has remained constant in Trinidad & Tobago up to June 2023 facilitating its role as the control group in this study. Observations relating to Trinidad & Tobago are codified as 0 for the JAM variable.

The variable TIME reflects the two-period setting of DiD analysis. The variable will be encoded as 1 in periods when there is a notable change in the POS fees in Jamaica. Studies on consumer fee sensitivity suggests that the response of consumer payment behaviour differs across fee increases and fee decreases, positing that there may be a larger change in payment behaviour for fee increases relative to fee

decreases. To expand on the literature and add new evidence for the Caribbean, I will perform DiD analysis for a fee increase and a fee decrease. The coefficient on this variable is the most important in this analysis as it signifies whether the POS fee adjustments had a negative or positive impact on relative cash usage in Jamaica.

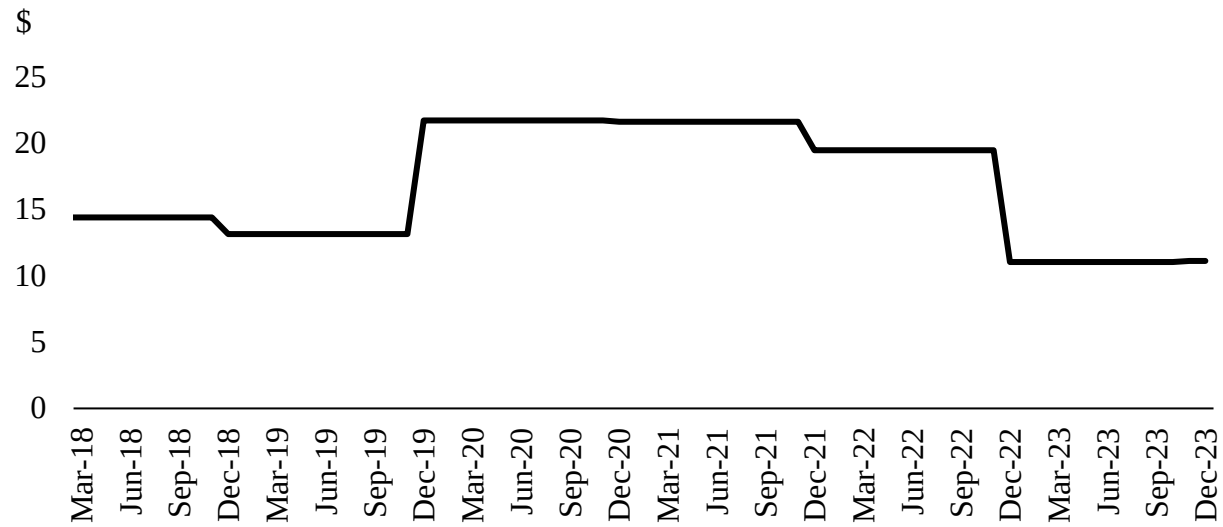
For the fee increase, I will utilise the period January 2018 to November 2022. While fees remained the same in Trinidad & Tobago during that time period, there was a notable increase in fees in Jamaica in December 2019 and the fee remained higher than pre-2019 up until November 2022. This period of increase is also codified as the post-treatment period. With regards to the fee decrease, the time period of December 2019 to May 2023 will be utilised. The time period was not extended to December 2023 as the average POS fee ratio in Trinidad and Tobago fell from June 2023 making it inapplicable for a control group then. During the selected time period, fees fell notably in Jamaica from December 2022 up until May 2023 and hence this time period is codified as the post-treatment period.

Figure 2: Average POS Fee for Trinidad & Tobago (TTD $)



Source: CBTT

Figure 3: Average POS fee for Jamaica (JMD $)



Source: BOJ

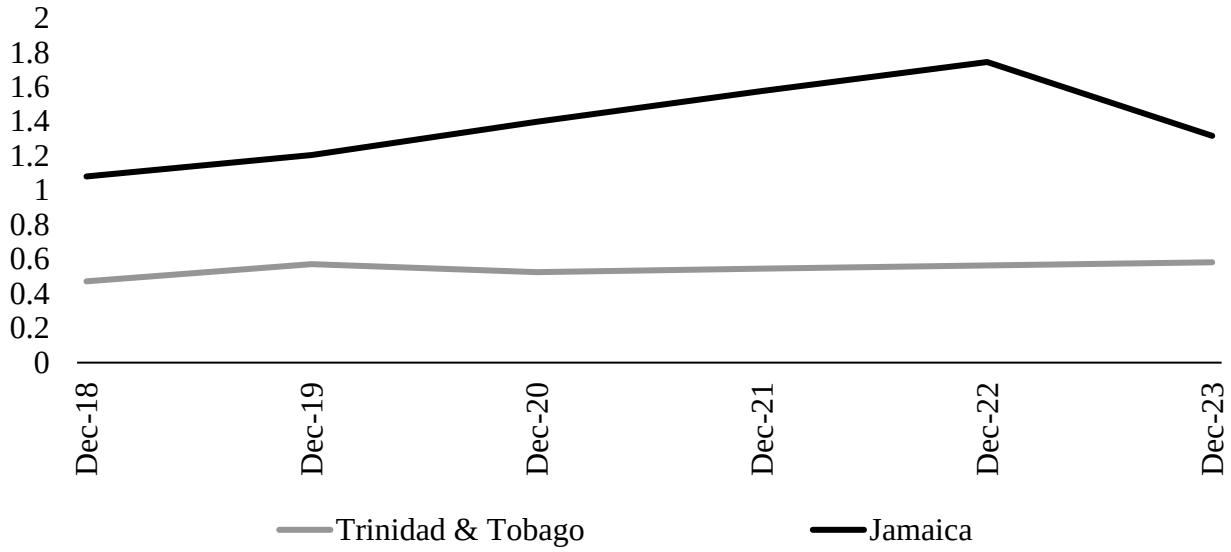
The remaining variables in the DiD model can be described as follows. JAMTIME is an interaction variable capturing the difference in the effect of POS fee adjustments on relative cash usage in Jamaica versus Trinidad &Tobago. ATMPOS is an independent variable reflecting the relative size od the ATM network. Finally, the subscripts *i* and *t* capture the countries and the time period, respectively while ε is the residual error term.

PRELIMINARY DATA ANALYSIS

The commercial banking sector is the primary player in the financial sectors of both Jamaica and Trinidad and Tobago, owning at least 40% of financial sector assets (Central Bank of Trinidad & Tobago 2023; Bank of Jamaica 2024). Financial inclusion appears be similar across the two jurisdictions with the unbanked population standing at nearly 23% in Jamaica at the end of 2023 and 21% in Trinidad and Tobago at the end of 2021 (Miles 2024; Kowlessar-Alonzo 2021). These proportions are similar to India and China where 20% of the population is unbanked but much higher than other European countries such as Spain and France which have an unbanked population of 6% (Statista 2021).

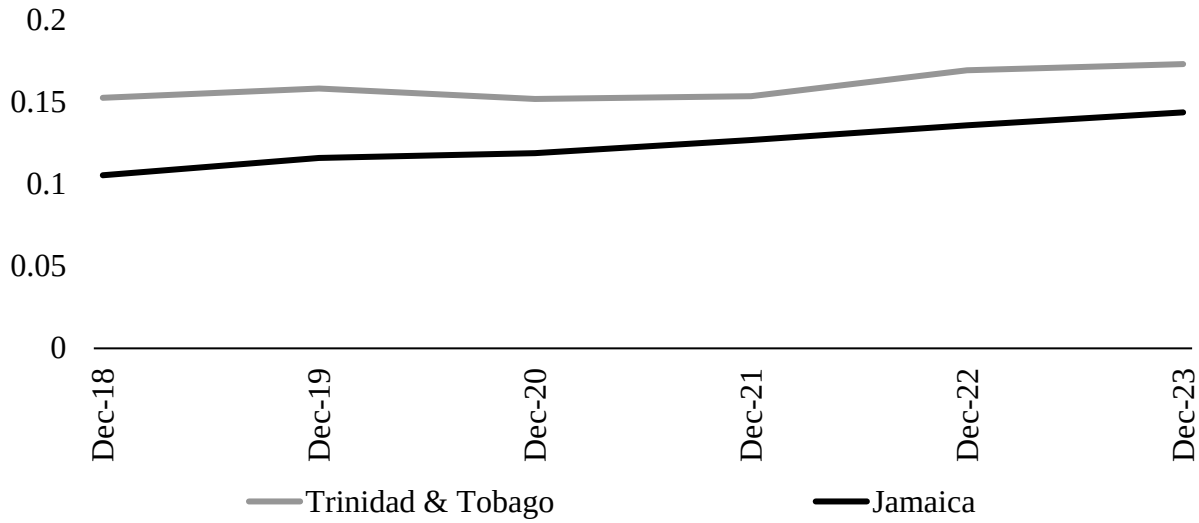
As noted in the literature, debit cards have emerged as a primary substitute for cash payments. On average, there is approximately one local debit card in circulation for every two persons in Trinidad and Tobago. This ratio is much higher in Jamaica, where the number of debit cards in circulation exceeds the population size. During the previous five years, there have been 1-1.5 debit cards per person in Jamaica. This wide circulation of debit cards suggest that the Jamaican population has access to an alternative form of payment which is necessary to build cash-lite societies. The prevalence of credit cards is less in both countries and also similar across the countries.

Figure 4: No. of Debit Cards Per Person (Annual)



Sources: BOJ, CBTT, World Bank

Figure 5: No. of Credit Cards Per Person (Annual)

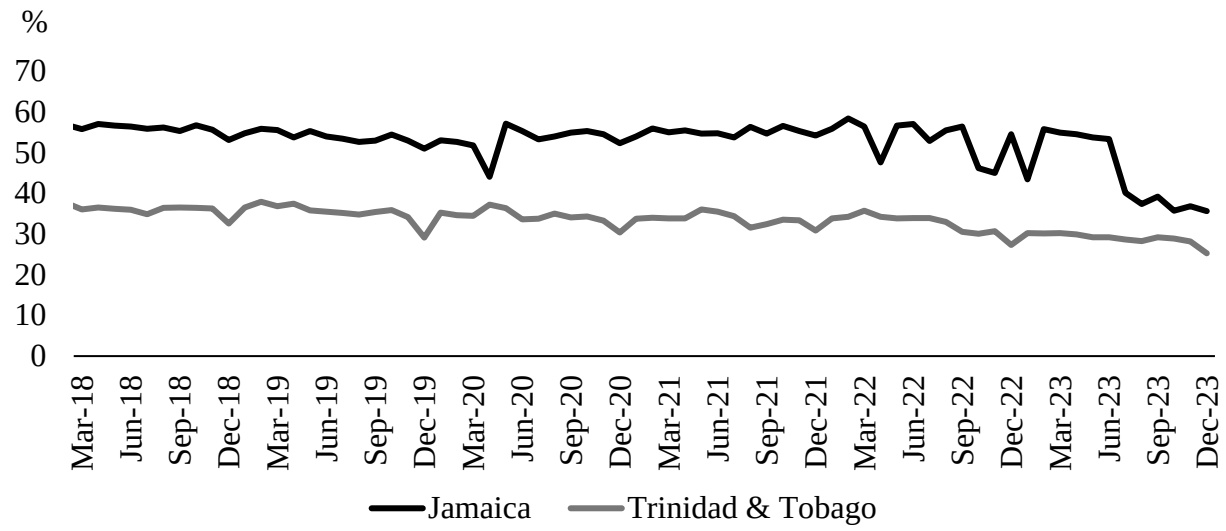


Sources: BOJ, CBTT, World Bank

The data indicates a very modest and gradual decline in relative cash usage across both jurisdictions, but surprisingly the cash-to-card ratio is higher for Jamaica. Despite having a higher prevalence of debit cards, relative cash usage is higher in Jamaica suggesting that there may be issues regarding the willingness and/or ability of consumers to use the debit card instead of cash. The cash-to-card ratio has been gradually declining in Trinidad & Tobago falling from near 40% to just over 25% by the end of 2023 (figure 6). Steeper declines began mid-year of 2023, coinciding with the decline in the average POS fee showcased in figure 2. The effect of POS fees on relative cash usage remains inconclusive from this preliminary analysis as relative cash usage declined gradually as POS fees remained unchanged. Between 2018 and March 2022, relative cash usage was steadier in Jamaica reflecting the persistence of

cash (figure 6). However, a more noticeable declining trend emanated during the first half of 2023, potentially representing lagged effects from the decline in the POS fee in December 2022. Similar to Trinidad & Tobago the cash-to-card ratio has also improved considerably, falling from near 60% to approximately 36% at the end of 2023.

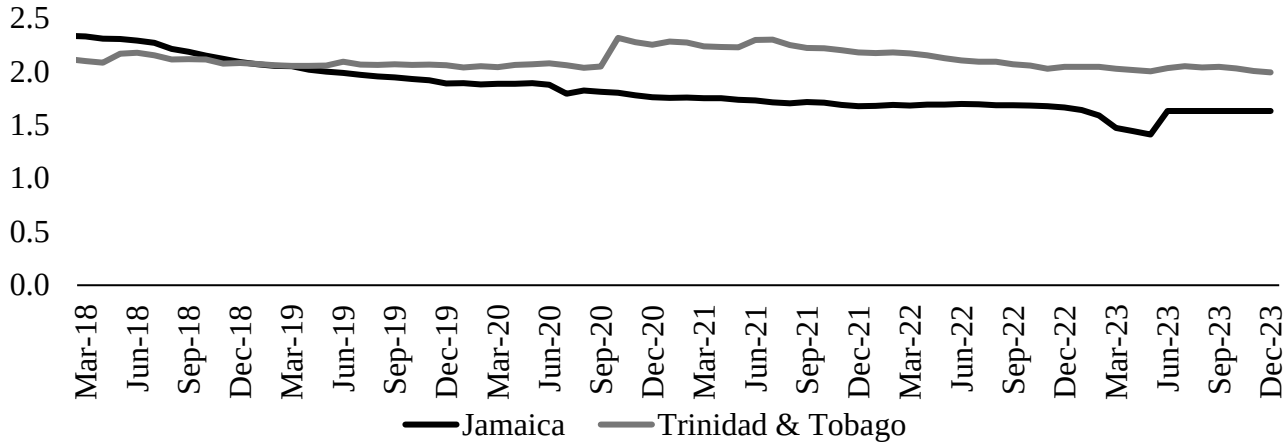
Figure 6: Cash-to-Card Ratio



Source: Author's calculations based on data from CBTT.

As noted in the literature, the availability of payments infrastructure is necessary for consumer's adoption of non-cash payment methods. The ratio of ATMs to POS terminals is analysed to examine the availability of ATMS relative to POS terminals. Interestingly, the ratio increased Trinidad & Tobago near the end of 2020 due to reductions in available POS machines which persisted throughout the pandemic period and recovered in the last quarter of 2022. In the case of Jamaica, the ratio of ATMs to POS terminals has been gradually declining during the period due to rising availability of POS terminals. Comparing figure 6 and figure 7, there is no apparent correlation between the cash-to-card ratio and the relative size of the ATM network.

Figure 7: Relative Size of the ATM Network (Ratio of ATMs to POS Terminals)



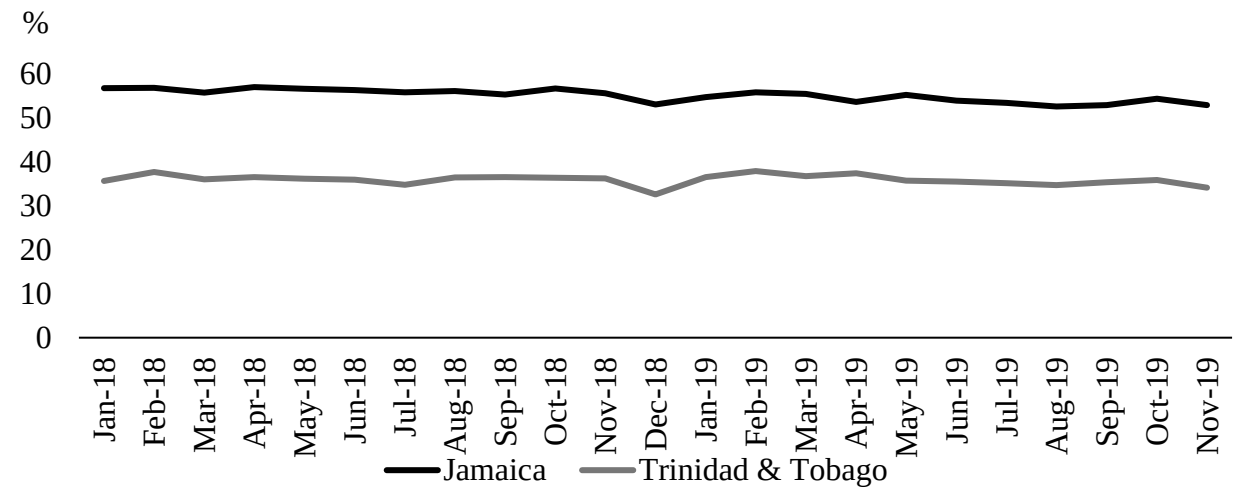
Source: Author's Calculations based on data from BOJ and CBTT.

EMPIRICAL ANALYSIS

Parallel Trend Test

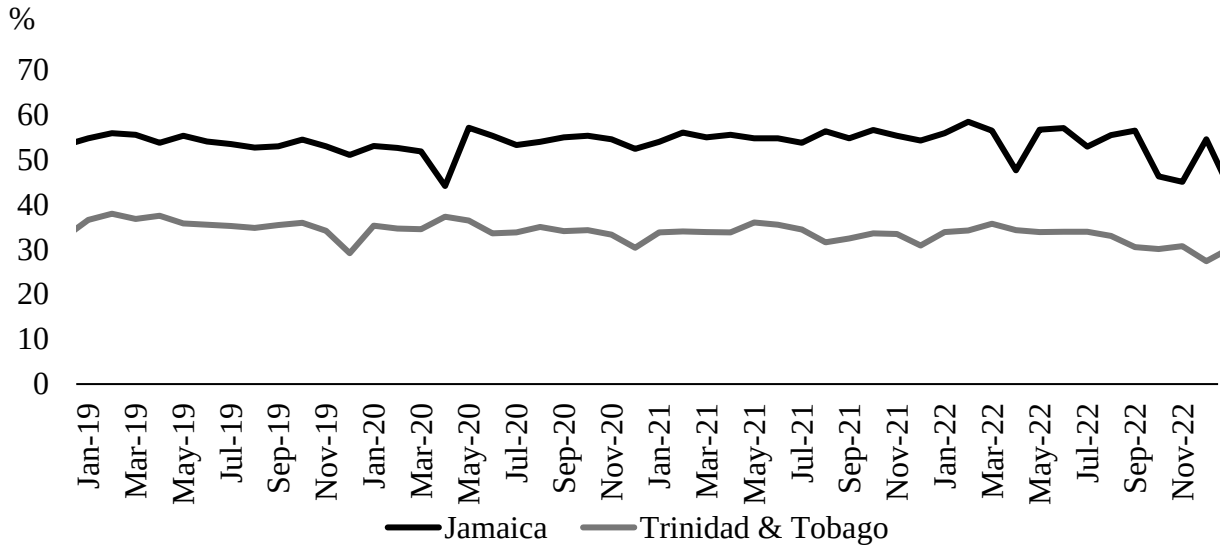
The parallel trends assumption is a core assumption of DiD analysis. This assumption states that the average outcome in the treatment and control groups would be parallel in the absence of a policy change (Roth, Sant'Anna and Poe 2023). A visual inspection of pre-treatment trends in the cash-to-card ratio for the fee increase and fee decrease periods generally reflect parallel movements.

Figure 8: Cash-to-Card Ratio during Pre-Treatment Period for Fee Increase



Source: Author's Calculations based on data from CBTT.

Figure 9: Cash-to-Card Ratio during Pre-Treatment Period for Fee Decrease



Source: Author's Calculations based on data from CBTT.

To further verify that the parallel trend assumption is met, I performed placebo tests. For the fee increase model, January 2018 to September 2018 is codified as if the treatment occurred then. In the fee decrease model, January 2020 to December 2020 is codified as if the treatment occurred then. In both models, the interaction variable is statistically insignificant (**Table 1**), suggesting that there was no effect during the treatment period and supporting the parallel trends assumption.

Table 1: Results of Placebo DiD Tests

	Coefficients	
Variables	**Fee Increase Model**	**Fee Decrease Model**
JAM	19.22	18.17
	pvalue = 0	pvalue=0.0
TIME	1.55	0.35
	pvalue =0.08	pvalue =0.70
JAMTIME	2.00	-1.48
	pvalue=0.17	pvalue =0.25
ATMPOS	-2.65	-4.4
	pvalue=0.05	pvalue =0.06

Source: Author's calculations produced by the Stata Software

Empirical Results

As a reminder, two DiD models were estimated to examine the impact of changes in POS fees on the cash-to-card ratio, one for a POS fee increase and another pertaining to a fee decrease. The DiD model for the fee increase is based on a dataset comprising observations from January 2018 to November 2022, while the DiD model for the fee decrease uses observations from January 2019 to May 2023. The models were estimated using Stata software and the results are presented below in Table 2.

Table 2: Empirical Results from DiD Model

	Coefficients	
Variables	**Fee Increase Model**	**Fee Decrease Model**
JAM	19.11***	18.75***
	0.67	1.6
TIME	-2.53***	-4.54***
	0.67	1.3
JAMTIME	2.22*	2.69
	1.28	1.66
ATMPOS	2.69	-3.8
	2.23	2.46
Adjusted R-Squared	95.14%	93.82%

Source: Author's calculations produced by the Stata Software
***, ** and * indicates significance at the 1%, 5% and 10% levels, respectively, while the standard errors are placed below.

The JAM variable, which captures the difference between Jamaica and Trinidad & Tobago prior to fee changes, reveals that Jamaica's cash-to-card ratio is approximately 19 units higher, ceteris paribus, in both models. The statistical significance of the JAM variable at the 1% level, suggest a strong distinction in payment behaviour between Jamaica and Trinidad & Tobago. This finding is consistent with **Figure 6** which shows that the cash-to-card ratio is consistently higher in Jamaica compared to Trinidad & Tobago.

The TIME variable, which captures the effect of POS fee changes on the cash-to-card ratio, indicates that the cash-to-card ratio decreases regardless of an increase or decrease in the POS fee. A decrease of 2.5 units is recorded after a fee increase, which is counterintuitive as one would expect cash usage to increase when POS fees rise. It is possible that consumers have already developed a habit of paying by card and hence, have become insensitive to POS fee changes. Additionally, consumers may be shifting towards EPIs due to its perceived convenience and other non-pecuniary benefits, despite higher fees. In the case of a fee decrease, the cash-to-card ratio is 4.5 units lower, suggesting that lower fees can encourage more consumers to pay via EPIs instead of cash. This larger decline after a fee decrease, highlights the sensitivity of consumer payment behaviour to POS fee adjustments. Based on the empirical results, fee reductions could be a strategic tool to reduce cash usage. This can be insightful for designing optimal fee structures, especially for more the most vulnerable population, which will drive financial inclusion.

The interaction variable JAMTIME is marginally significant at the 10% level in the fee-increase model and at the 15% level in the fee-decrease model. The positive coefficient on the interaction variable in both models reflect the fact that relative cash usage is declining at a slower pace in Jamaica relative to Trinidad & Tobago. For the fee increase model, the JAMTIME coefficient suggests that decline in the cash-to-card ratio is less by 2.2 units in Jamaica relative to Trinidad & Tobago, all else constant. In the fee decrease model, the decrease in the cash-to-card ratio is smaller by 4.54 units in Jamaica. Although the significance of the interaction term is marginal, it highlights the importance of considering country-specific factors when assessing potential implications of fee changes.

The coefficient on ATMPOS which measures the relative size of the ATM network is not statistically significant in either model. This suggests that there is no strong relationship between the relative cash

usage and the relative availability of POS infrastructure. This is contrary to some literature which emphasise the importance of infrastructure availability in containing relative cash usage. This may perhaps be due to the fact that POS penetration has reached a point where its marginal availability no longer has a significant impact on consumer payment behaviour.

DISCUSSION OF RESULTS

The overarching aim of this research is to provide novel evidence for the Caribbean with regards to how consumer payment behaviour changes when there is an increase or decrease in bank fees. Unlike existing international literature which examine interchange fees that are paid by merchants, this study analyses POS fees, an end-user fee paid by consumers. This is particularly relevant for the Caribbean as regulating bank fees, especially fees relating to electronic transactions, has become a major challenge for monetary authorities. Concurring with international evidence from the literature, debit cards have become the primary substitute for cash across the region. In the case of Jamaica, the number of debit cards in circulation has even exceeded its population size. Given its prevalence and the fact that cost is deemed a critical determinant of debit card usage, it is important to consider the impact of fees associated with using cards on consumer payment behaviour.

Interestingly, despite a higher circulation of debit cards and a lower ratio of ATMS to POS terminals, relative cash usage is higher in Jamaica compared to Trinidad & Tobago. This goes against apriori assumptions in the literature. Based on the existing literature, relative cash usage should be comparatively lower in a country with greater access to electronic payment methods and greater availability of the relevant infrastructure (Salandy 2021; Cirasino and Garcia 2008). Nonetheless, the downward trend in the cash-to-card ratio irrespective of a fee increase or decrease is encouraging. With similar rates of an unbanked population, the higher relative cash usage in Jamaica appears to be related to differential socioeconomic conditions. Results from BOJ's National Financial Inclusion Survey for 2023 state that cash was selected for payment even when there was an option to pay using electronic methods and this was largely the case for low-income respondents (Bank of Jamaica 2023). The HDI and BNI per capita is lower in Jamaica compared to Trinidad & Tobago signalling lower income and education levels which both encourage consumer acceptance and usage of electronic payment methods (United Nations Development Programme 2024). The significance of the interaction variable JAMTIME reiterates the fact that country-specific factors are important when considering the implementation of a fee. The positive coefficients of the interaction variable signal that POS fees have less of an impact in Jamaica than Trinidad & Tobago. The prevailing higher relative cash in Jamaica could be a potential explanation for this as transaction fees may not be sufficient to break the cash habit of consumers.

Based on the finding in the literature which shows that consumer sensitivity to fee increases and fee decreases may differ, I performed DiD analysis for both a fee increase and a fee decrease (Srinivas, Goradia and Fromhart 2016). To gauge how consumer payment behaviour changes in response to POS fee changes, the TIME variable in the DiD model is most important. The TIME variable is highly significant in both models suggesting that there is a response in consumer payment behaviour when there is a change in POS fees. This signals to policymakers, that decisions on fee changes should be made in isolation or with a narrow scope but there must also be consideration of the impact on consumers' payment behaviour. What is interesting is that there is a reduction in relative cash usage after an increase or a decrease in POS fees. This suggests that the gradual downward trend in the cash-to-card ratio (**Figure 6**) is persistent and potentially signal a slowly but surely movement towards a cash lite society. The

persistent decline may also suggest that consumers have become inelastic to changes in the cost of using a card at the POS.

Notably, the size of the decline is larger when there is a POS fee reduction. This finding suggests that the reduction and or elimination of fees can accelerate the shift towards EPIs in the region. As such, it is critical for policy makers to design optimal fee structures to ensure that fees do not hinder the acceptance of EPIs. Targeted fee policies such as fee waivers and/or fee ceilings for low-income persons will also be a critical element for financial inclusion strategies. However, the literature cautions that the reduction of fees alone cannot provide all the motivation necessary (The World Bank Group 2020, Ligon, et al. 2019). It is important to collect and examine data relating to demographic and socio-economic factors which also influence consumers' adoption and usage of electronic payment methods. Hence, surveys such as BOJ's National Financial Inclusion Strategy can be beneficial to regional counterparts in order to gain a comprehensive understanding of the factors affecting consumer payment behaviour.

The statistical insignificance of the relative size of the ATM network goes against the apriori expectations of the literature. Intuitively, for there to be usage of any electronic payment method, the necessary infrastructure must be available. The statistical insignificance of the ATMPOS variable suggests that while the infrastructure is necessary, it can only have a limited impact of encouraging the use of alternative payment methods. Thus far the findings of the research have echoed that a combination of factors must be applied to spur the adoption of electronic payment methods. Solely reducing fees, increasing debit card circulation or providing the required payment infrastructure will not be sufficient.

CONCLUSION

Understanding how changes in POS fees, an end-user fee, affects consumer payment behaviour is a critical input for bank fee regulation, financial inclusion strategies and electronic payment acceptance initiatives. Thus, a review of changes in consumer payment behaviour post a fee increase or decrease is important. The infrequency of changes in POS fees make it difficult to model, but the fact that Trinidad & Tobago faced constant average POS fees for a substantial time while fees changed in Jamaica over that period, facilitated the application of the DiD analysis. Visual inspection of pre-treatment trends suggest that the key assumption of parallel trends analysis was met and thus ensuring the validity of results from the DiD analysis. Results from the DiD models confirmed that consumer payment changes after an increase or decrease in POS fees is statistically significant but the magnitude of the change is larger for fee decreases. This insinuates that fee decreases can be useful in spurring the use of electronic payments but empirical evidence from this study and the literature cautions against reliance on a single factor to drive drown relative cash usage. In the case of Jamaica, despite a greater ratio of debit cards per person and a lower ratio of ATMs to POS compared to Trinidad & Tobago, relative cash usage is still higher in Jamaica. It appears that a combination of socioeconomic and demographic factors is driving this trend and must be considered when designing payment systems policies. To fulfil this, the Caribbean policymakers must invest in designing relevant surveys to collect and examine such data. Furthermore, policymakers should consider these findings when designing policies aimed at fostering greater financial inclusion and payments efficiency.

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