# Growth, and Private Sector Credit in Trinidad and Tobago: Evidence from an ARDL-Bounds Testing Approach

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**Draft Paper to be presented at the 54th Annual Monetary Studies Conference
Bank of Jamaica**

*November 2023*

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## Abstract

With the post-pandemic resurgence of growth in private sector credit, this paper explores the short-run and long-run effects of economic growth on private sector credit in Trinidad and Tobago from 1995-2021, along with control variables such as inflation, interest rate and unemployment. Our study employs an Autoregressive Distributed Lag (ARDL) model and the estimated results found that economic growth and inflation were statistically significant in the long run, but the interest rate and unemployment were not statistically significant. In the short run, economic growth remained statistically significant, along with the interest rate. However, unemployment and inflation did not impact private sector credit. In both the short-run and long-run, the relationship between private sector credit and economic growth rate appears to be consistent with a demand-following relationship, which can have serious implications for financial (in)stability.

## I.    Introduction

Private sector credit (PSC) is seen as a leading indicator of financial (in)stability (Kelly et al., 2013) and it serves as an important link in money transmission which can ultimately impact economic activity and growth especially in developing countries. In Trinidad and Tobago, PSC is an important indirect contributor to GDP, with the ratio of PSC-to-GDP at an annual average of 35.8% between 1995 and 2021. From 2022, the year-on-year growth in PSC accelerated and peaked at 7.1% in the third quarter of 2022 and remained elevated at 6.4% in the first quarter of 2023.

This post-pandemic recovery of PSC reignited interest in the direction or causal relationship between PSC and the macroeconomy. The supply-leading hypothesis states that an increase in PSC will lead to improved performance in the macroeconomy by stimulating economic growth and activity. If this holds true for Trinidad and Tobago, the monetary transmission mechanism can play a significant role in expanding PSC and consequently economic growth. The demand-following hypothesis states that an increase in economic growth will result in an increase demand for PSC to invest in consumer durables and new business projects. This captures a broader view of the accelerator principle.

Given the rebound in economic activity and the base effect recovery of GDP from the pandemic contractions that coincided with the accelerated growth in PSC, this paper aims to investigate the relationship between PSC and economic growth and other macroeconomic (control) variables by examining the demand-following relationship in both the short- and long-run. The remainder of the paper is structured as follows: Section II captures an empirical literature review, and this is followed by some stylized facts in Section III. Section IV highlights the methodology and estimated results along with an alternative specification and robustness checks. The paper concludes in Section V.

## II.    Literature Review

The relationship between bank credit, economic growth and other macroeconomic variables can be examined through two schools of thought, namely demand-following and supply-leading. The demand-following school of thought purports that economic growth creates an increase in inflation and demand for credit, and this translates into a greater supply of credit. Conversely, the supply-leading school of thought proposes that an increase in the availability and accessibility of credit will lead to higher inflation as well as higher economic growth.

Branch et al. (2015) investigate the relationship between private sector credit and economic growth in the Bahamas to determine if the relationship is demand-following or supply-leading since credit cycles mirror economic cycles for the Bahamian economy. Using annual data between 1989 and 2014, the authors employ the Ordinary Least Squares (OLS) method, the Johansen co-integration test, and the Granger Causality test to examine the relationship between economic growth, government expenditure, and private sector credit. The authors concluded that *"economic growth leads to improved labour market conditions, which then positively impacts credit expansion, thereby encouraging more buoyant economic growth— reflective of a "demand following" relationship."* As such, they propose that the government should continue to promote tourism and attract foreign direct investment to create greater movement in the credit-growth nexus.

Tinoco-Zermeno et al. (2014) undertake a similar study for Mexico using an ARDL model to estimate the long-run relationship between inflation, private sector credit and economic growth. Using annual data from 1969 to 2011, they estimate the impact of inflation, private sector credit and an interaction between both variables on GDP. The estimates reveal that private sector credit positively impacts GDP, which suggests that the relationship is supply-leading in Mexico. The results shed light on the issue of private sector credit remaining stagnant in Mexico over the past few decades which resulted in constraints in the volume and value of investment. Furthermore, the authors find that inflation diminishes growth by reducing private sector credit. This further confirms that the supply-leading school of thought exists in Mexico. As such, Tinoco-Zermeno et al. (2014) recommends that policymakers should intensively promote the development of the financial system through reforms and policies, so a stronger transmission mechanism exists between private sector credit and economic growth.

The dynamics between private sector credit, inflation and economic growth in India and Pakistan are investigated by Pradhan et al. (2017) between 1988 and 2011. They employ ARDL and VECM to investigate the long-run relationship between proxies of financial depth such as private sector credit and broad money supply on macroeconomic variables such as inflation and GDP. The estimates find that Granger causality exists between the variables, and all variables are cointegrated implying a long-run relationship. They also find a feedback relationship between financial depth as measured by private sector credit, inflation, and economic growth. That is, private sector credit causes inflation and economic growth, and the converse holds true. The authors also find that this relationship is stronger in India relative to Pakistan given the greater degree of development of the infrastructure and human capital in India than Pakistan. Pradhan et al. (2017) recommends that the Governments of India and Pakistan need to focus on inflation targeting and financial sector development in the long run to maintain sustainable growth and economic stability.

Building on the work of Levine et al. (2001), Favara (2003) aims to reassess the relationship between financial development and economic growth using an unbalanced panel of 85 countries between 1960 and 1998. Using liquidity in the banking system and private sector credit as the main measures of financial development, the author estimates Generalized Methods of Moments (GMM) and OLS models and find that there was, at best, a weak relationship between the measures of financial development and economic growth. This suggests that the supply-leading relationship does not hold across the panel. Furthermore, Favara (2003) finds evidence of non-linearity within the dataset, and it implies that the measures of financial development only impact economic growth at intermediate levels but not at lower or higher levels of financial development. The author continues by using an ARDL model to estimate the long-run relationship between financial development and economic growth. However, the results find no distinct relationship that bank liquidity and the availability of private sector credit spurs economic growth.

### III. Data Description

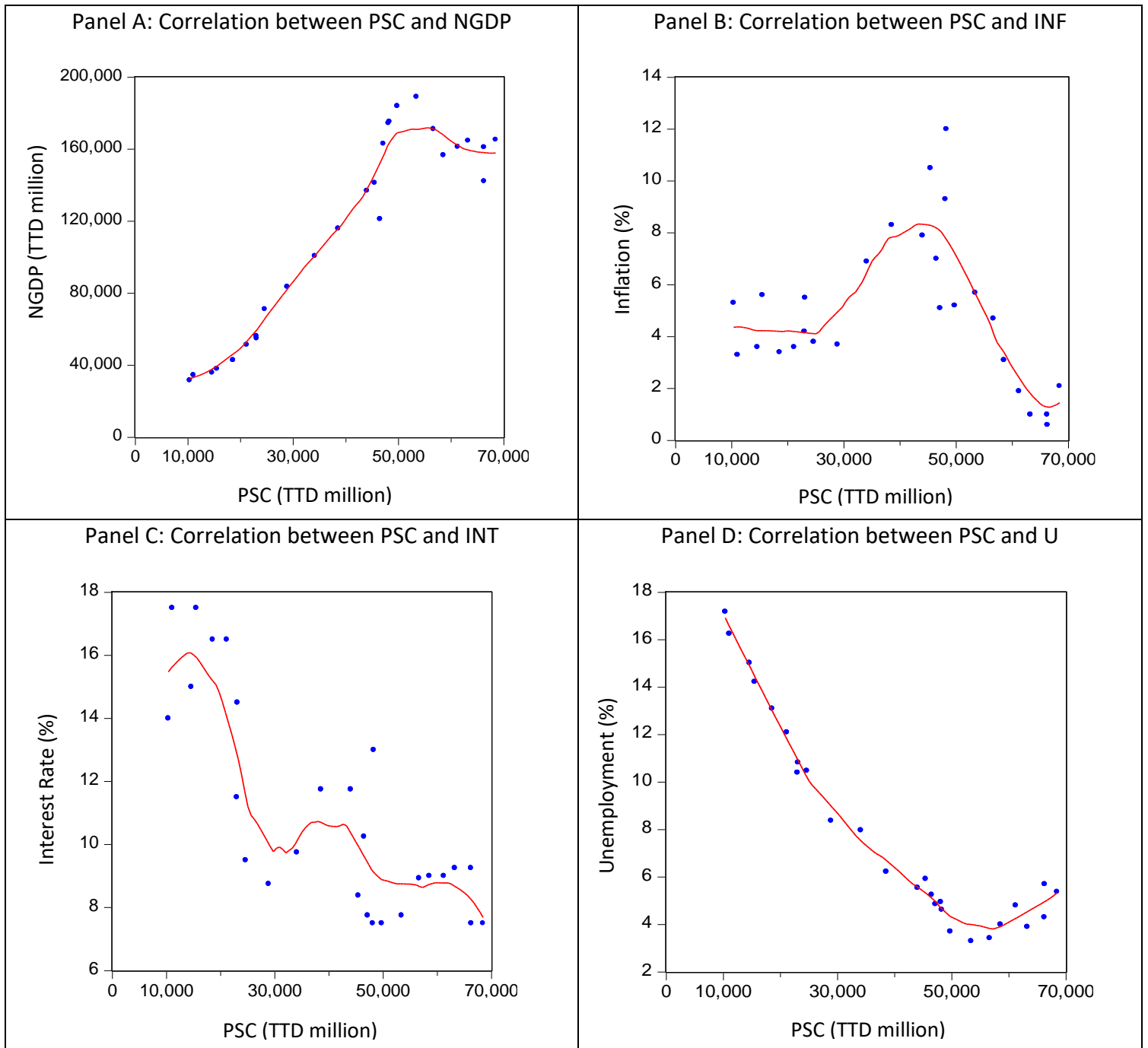The dataset comprises of annual data from 1995 to 2021. The sample period was largely based on data availability.

| Variable | Description |
|---|---|
| PSC | Loans and credit to the private sector. Measured in TTD Millions |
| NGDP | The value of final goods and services produced for a given year measured at current or market prices with a base year 2000 (TTD millions) |
| INF | The year-on-year percentage change in the index of consumer prices which measures changes in the prices of goods and services bought for household consumption, with a base year 2015= 100. |
| INT | Commercial Banks Median Basic Prime Lending Rate (end of period; %) |
| U | The unemployment rate is the ratio of unemployed person to the total labour force (%) |

*Source: Central Bank of Trinidad and Tobago*

To begin our analysis, we assess the correlation between the variables. There is a high positive correlation of 92% between PSC and NGDP (panel A). This is consistent with Katusiime (2018) who finds that an increase in GDP growth and its transmission through private consumption and investment leads to an increase in the demand for credit. Furthermore, the correlation between PSC and the INF is marginally negative at -14% (panel B). This is consistent with the findings of Tinoco-Zermeño et al. (2014) where inflation rates contribute negatively to the growth in private sector credit. However, negative relationships may be non-linear and the marginal impact of inflation on private sector credit can decay rapidly (Boyd et al.,2001).

Another control variable we include in the model is the median prime lending rate (INT) to capture the average cost of borrowing. There is a high negative correlation of approximately -80% and this conforms to our a priori expectations (panel C). There is a strong negative correlation of -91.5% between PSC and U (panel D). This is intuitively correct as an increase in unemployment can reduce demand for PSC. This is consistent with the findings of Shijaku and Kalluci (2013) in their investigation of Albania.

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Figure 1: Correlation Analysis



Source: Authors' calculation and Central Bank of Trinidad and Tobago

The Pairwise Granger Causality test reveal that the inflation rate, unemployment, and GDP does not Granger cause private sector credit. However, the interest rate Granger causes private sector credit. Both the correlation and Granger causality tests hint to the absence of the demand-following relationship between private sector credit and GDP in Trinidad and Tobago.

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| Pairwise Granger Causality Tests | | | |
|---|---|---|---|
| Lags: 2 | | | |
| Null Hypothesis: | Obs | F-Statistic | Prob. |
| NGDP does not Granger Cause PSC | 25 | 0.04564 | 0.9555 |
| INT does not Granger Cause PSC | 25 | 6.53571 | 0.0065 |
| INF does not Granger Cause PSC | 25 | 0.49544 | 0.6166 |
| U does not Granger Cause PSC | 25 | 0.06357 | 0.9386 |

*Source: Authors' estimation.*

## IV.    Methodology and Estimation

Throughout the literature, there are several approaches and variables used to examine the relationship between indicators of financial development such as private sector credit and macroeconomic variables. However, the ARDL methodology remains largely consistent as the most appropriate approach for assessing this relationship. This methodology allows for the estimation of both short-run and long-run relationships among the variables. The ARDL model is proven to be more efficient and superior in small samples and it eliminates spurious results while identifying short-run and long-run elasticities (Adabor, 2023). The ARDL model also allows for the interaction between stationary and non-stationary variables, and this highlights a key advantage over VAR/VECM estimation.

### *Stationarity Testing*

The first step in the analysis is to test the variables for stationarity. Any combination of I(0) and I(1) variables can be used. However, the model cannot be estimated with I(2) variables. Additionally, the dependent variable (PSC) must be I(1).

Testing for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) resulted in the following:

| Variable | ADF (level) | PP (level) | ADF (First Difference) | PP (First Difference) | Inference |
|----------|-------------|------------|------------------------|-----------------------|-----------|
| PSC | -2.7774 | -2.0650 | -3.3830* | -3.4412* | I(1) in level and I(0) in first difference |
| GDP | -1.5405 | -1.5012 | -5.5639* | -5.6015* | I(1) in level and I(0) in first difference |
| INF | -0.9071 | -2.2922 | -10.4688* | -9.6080 | I(1) in level and I(0) in first difference |
| INT | -1.8247 | -1.2504 | -5.6200* | -5.5090* | I(1) in level and I(0) in first difference |

*Source: Authors' estimation.*

The results from both the ADF and PP tests for stationarity confirm that the variables have unit roots in levels but are stationary when first differenced. With all I(1) variables, a Vector Error Correction Model can be used. However, given the small sample size, an ARDL model may provide more robust results.

### *ARDL Specification*

Ramlogan and Mitchell-Ryan (2010) investigate the long-run relationship between PSC and economic growth in Trinidad and Tobago using a Vector Error Correction Model between 1970 and 2008 and find the demand following relationship exists for the aggregate economy. To test if this demand following hypothesis still holds in Trinidad and Tobago, we adopt the approach of Pradhan et al. (2017) and specify the following equation:

$$\Delta lnPSC_t = \alpha_0 + \sum_{t=1}^{p} \pi_{1i} \Delta lnPSC_{t-i} + \sum_{t=1}^{p} \pi_{2i} \Delta lnGDP_{t-i} + \sum_{t=1}^{p} \pi_{3i} \Delta lnUnemp_{t-i} +$$

$$\sum_{t=1}^{p} \pi_{4i} \Delta lnINT_{t-i} + \sum_{t=1}^{p} \pi_{5i} \Delta lnINF_{t-i} + \delta_1 lnPSC_{t-1} + \delta_2 lnGDP_{t-1} +$$

$$\delta_3 lnUnemp_{t-1} + \delta_4 lnINT_{t-1} + \delta_5 lnINF_{t-1} + \varepsilon_t$$

Where $\Delta$ is the first difference operator, $\pi$ denotes the short-run dynamics, $\rho$ represents the number of lags, $\varepsilon$ is the error term and $\delta$ are the long-run multipliers.

Following the estimation of the ARDL model, the Pesaran Shin and Smith (1995) ARDL bounds test procedure can be used to investigate long-run relationships by testing the coefficients of the long-run multipliers for joint significance and comparing this F-statistic to the Kripfganz and Schneider (2020) critical bound values. As such, the hypothesis is given as:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0 \text{ (no cointegration)}$$

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0 \text{ (cointegration)}$$

|  | Critical Values – Lower Bound | | |
|---|---|---|---|
|  | **10%** | **5%** | **1%** |
| **F-statistic: 13.66** | 2.90 | 3.65 | 5.63 |
| **T-statistic: -5.18** | -2.54 | -2.95 | -3.83 |

*Source: Authors' estimation.*

The null hypothesis of no level relationship or no cointegration is rejected at all significant levels and we can conclude that a long-run relationship exists among the variables. As a measure of robustness, the Johansen cointegration test was applied and confirm the presence of long-run relationships.

### Long Run Estimation

| Variables | Coefficient |
|---|---|
| GDP | 0.9532* |
| Unemployment | 0.3096 |
| Interest Rate | -0.0482 |
| Inflation | -0.1490* |
| EC Adjustment = - 0.3701* | |

where * denotes statistical significance at 1% significance level.

The error-correction term is negative and highly significant at the 1% level. The long-run coefficients from the ARDL estimation suggests that a 1.0% increase in GDP leads to a 0.95% increase in PSC as long-term growth stimulates increased business and consumer spending. Additionally, the results reveal that a 1.0% increase in the inflation rate leads to a 0.15% fall in PSC as consumers and business become more cautious about incurring debt as the value

of money declines. Long-term inflation is usually met by contractionary monetary policy which results in rising interest rate that can curb the growth of PSC. Furthermore, higher inflation is associated with greater uncertainty and lower investment by consumers and businesses. The results are consistent with a priori expectations as well as other studies including Tinoco-Zermeno et al. (2014), Katusiime (2018) and Branch et al. (2015). However, unemployment and the interest rate did not have a long-run impact on PSC. Using the AIC, an estimated ARDL (1,0,2,1,0) computed the following short-run coefficient.

### *Short Run Estimation*

| Variable | Coefficient |
|---|---|
| $PSC_{t-1}$ | 0.6299* |
| | (8.81) |
| $GDP_t$ | 0.3527* |
| | (4.66) |
| $UNEMP_t$ | 0.1146 |
| | (1.74) |
| $INT_t$ | 0.0527 |
| | (0.72) |
| $INT_{t-1}$ | 0.1882 |
| | (1.65) |
| $INT_{t-2}$ | -0.2487* |
| | (-3.60) |
| $INF_t$ | -0.0241 |
| | (-1.48) |
| $INF_{t-1}$ | -0.0310 |
| | (-1.66) |
| $Constant$ | -0.2193 |
| | (-0.27) |

Where * denotes statistical significance at 1%. T-statistics are in parentheses.
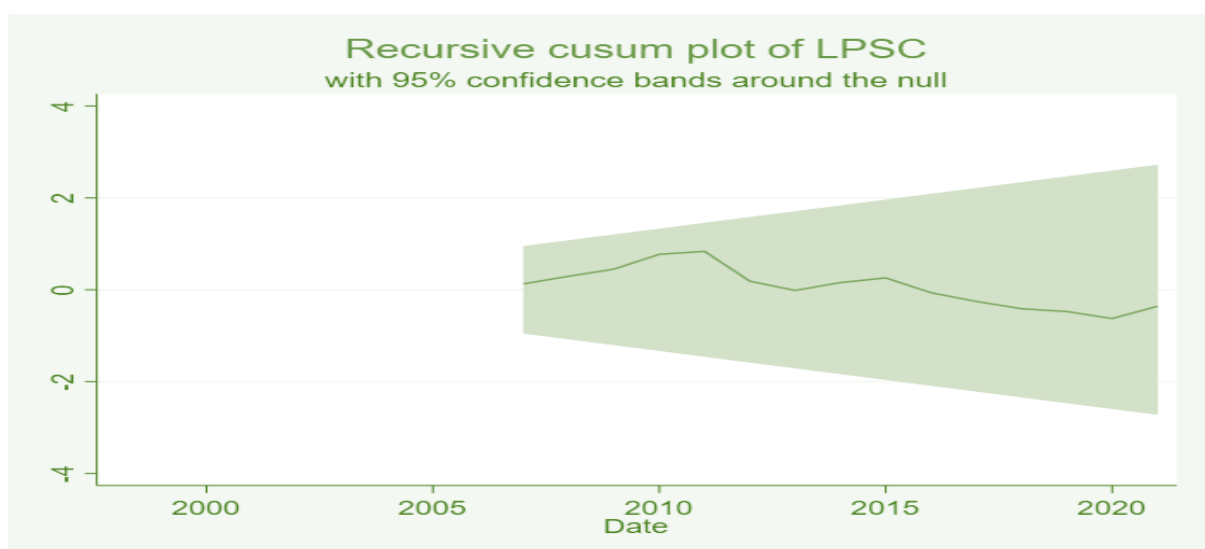
As expected, PSC exhibits high levels of inertia where the coefficient of the one period lag is statistically significant at 0.63. In the short-run, a 1% increase in GDP can result in PSC increasing by 0.35% and this is consistent with the long-run results as well. Surprisingly, the impact of unemployment on PSC is positive but not statistically significant. While an increase in unemployment should reduce the demand for new loans (Moinescu, 2008), it can result in a small increase in PSC as consumers and business try to preserve assets and consolidate. The immediate impact of the interest rate on PSC is statistically insignificant in the short run. However, an increase in the interest rate by 1% will result in a fall in PSC by 0.25% two periods later. A similar relationship was found between PSC and inflation, but it was statistically insignificant.

### *Structural Breaks*

As a measure of model verification, the cumulative sum test for parameter stability was used to examine for structural breaks. The null hypothesis of no structural breaks present in the sample could not be rejected at all significance levels and the recursive cusum plot was well within the 95% confidence bands.

| | Critical Values | | |
|---|---|---|---|
| | **1%** | **5%** | **10%** |
| T-statistic: 0.5035 | 1.1430 | 0.9479 | 0.8499 |

*Source: Authors' estimation.*



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*Robustness*

As a measure of robustness, an alternative specification was estimated using the Quarterly Index of Economic Activity (QIEA) as a measure of economic activity. It is a volume index compiled using production indicators of economic activity. The Pesaran, Shin, and Smith (2001) bounds test conclude that cointegration exists among the variables resulting in the following long-run coefficients:

### Long Run Estimates

| Variables | Coefficient |
|---|---|
| QIEA | 2.0631* |
| Unemployment | 0.3875 |
| Interest Rate | 0.1223 |
| Inflation | -0.3060* |
| EC Adjustment = - 0.2987* | |

where * denotes statistical significance at 1% significance level.

The results were consistent with the baseline specification with the QIEA and inflation impacting PSC in the long run while unemployment and the interest rate were statistically insignificant. The EC term was also negative and statistically significant indicating that the system was converging to its long-run equilibrium. This is a necessary and sufficient condition of the cointegrating equation to be valid. Using the AIC, an estimated ARDL (2,1,2,1,1) computed the following short-run coefficient:

### Short Run Estimates

| Variable | Coefficient |
|---|---|
| $PSC_{t-1}$ | 0.2175 <br> (1.60) |
| $PSC_{t-2}$ | 0.4837* <br> (3.50) |
| $QIEA_t$ | -0.0761* <br> (-0.52) |
| $QIEA_{t-1}$ | 0.6924* <br> (3.50) |

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| | |
|---|---|
| $UNEMP_t$ | -0.0175 |
| | (-0.31) |
| $UNEMP_{t-1}$ | 0.1332** |
| | (2.79) |
| $INT_t$ | 0.2907* |
| | (3.63) |
| $INT_{t-1}$ | -0.0502 |
| | (-0.59) |
| $INT_{t-2}$ | -0.2039* |
| | (-3.68) |
| $INF_t$ | -0.0168 |
| | (-1.29) |
| $INF_{t-1}$ | -0.0746* |
| | (-4.72) |
| $Constant$ | 0.3618 |
| | (0.65) |

Where * and ** denotes statistical significance at 1% and 5% respectively. T-statistics are in parentheses.

PSC exhibits inertia at the second lag, and this is consistent with PSC as a stock rather than a flow variable. When the QIEA increases by 1%, PSC credit will increase by 0.70% in the following period. Additionally, PSC does not respond immediately to changes in the interest rate but an increase in the interest rate results in a fall in PSC two periods later. Lagged inflation has a negative impact on PSC in the short-run and this is consistent with the long-run relationship as an increase in inflation can lead to a fall in PSC through the interest rate transmission mechanism. This is consistent with the results Khamis (1996) in the empirical investigation of Mexico, Argentina, and Chile. The relationship between unemployment and PSC is consistent with the initial specification. Model diagnostic revealed no structural breaks were present at the 5% significance level.

## V.    Conclusion

In Trinidad and Tobago, credit plays an important role in financing consumer and business spending and averaged approximately 36% of GDP over the past three decades. Previous empirical studies for Trinidad and Tobago examined the supply-leading hypothesis through the monetary transmission mechanism with less focus on the demand-following hypothesis. As such, this study aimed to investigate the impact of economic activity and growth as well as other macroeconomic control variables on PSC. Given the short sample size, the study employs an ARDL model to assess the short-run and long-run relationships between PSC and the macroeconomic variables.

The study found that a stable long-run relationship exists among the variables using the Pesaran, Shin, and Smith (2001) bounds test, with economic activity and inflation having a long-run impact on PSC while unemployment and the interest rate were statistically insignificant. In the short-run, only economic activity and the interest rate impacted PSC. As a measure of robustness, an alternative specification was investigated with the QIEA as the key indicator of economic activity and similar results were found.

The implications of this study support the view of the demand-following hypothesis exists in Trinidad and Tobago and PSC is influenced by key macroeconomic variables. As economic growth continues, it can be expected that the growth in PSC will keep pace. However, rapid growth in PSC can pose risks to financial stability and eventual macroeconomic performance and as such, emerging PSC vulnerabilities should be guarded against and mitigated.

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