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Cogency of Twin and Triple Deficit in India

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Abstract

The emergence of the current account deficit (CAD) based on the gross fiscal deficit (GFD) has been the focus of attention in the Indian economy. The theoretical underpinnings of Ricardian and Keynesian were different from their explanations, so the researchers sought to choose to be independent of their views. Along with Feldstein-Horioka puzzle which examined the twin deficit hypothesis (TWH) researcher also look for the role of saving-investment gap (S-IGap) which gave emergence of triple deficit hypothesis for a time spanning from1990-91 to 2019-20. Granger Causality under VAR environment was used to analyze the association and provide evidence on the TWH and TDH for India. The main contribution of this study is to propose an idea regarding the direction of the validity of the TWH and TDH in India. The FD, CAD, and S-Igap reflect government expenses, providing insights into the financial conditions and spending patterns of the government.

Keywords: Current Account (CA), TWH, TDH, Granger Causality (GC) Test

1. Introduction

The term 'twin deficit' is commonly used to refer to the association between CAD and GFD of a country (Karras, 2019; Dey and Tareque, 2022). This occurs when a country has both CAD and GFD. This indicates that the country's imports exceed exports and that the government expenditure of the country is greater than its revenue. This situation makes a country debtor to the overall world. Further, it claims that there is a strong cause-and-effect association between a nation's GFD and CAD, and that the GFD and CAD move positively in the long run (Xie and Chen, 2014; Ajilore and Usman, 2021).

The association of both deficits led India to experience economic and financial crises, except in the year 2003-04 (Economic Survey 2005-06) and recently in the last quarter of 2019-20 due to pandemic-induced import demand (Chakrabarty et al., 2021). This proves the validity of TDH in the Indian context (Mallick et al., 2021). Some researchers (Milesi-Ferretti and Razin, 1996; Badian,1997; Higgins and Klitgaard, 1998; Cooper, 2001; Gale and Orszag, 2003; Freund, 2005; Hubbard, 2006; Kuijs, 2006; Gruber and Kamin, 2007; Akinci et al., 2012; Tang,2014; Tareque,

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2022) cast doubt on the validity of both the Keynesian and Ricardian Equivalence hypothesis (REH). They observed that the S-I gap also plays a crucial role in the emergence of CAD and defined this situation as TDH. Triple deficit describes the co-occurrence of budget deficit, CAD, and private savings deficits (called the S–I gap). The supporters of this thought state that countries do not always observe a fiscal deficit; some developed countries have also experienced fiscal surplus. Hence, we cannot claim that only a fiscal deficit caused a trade deficit or that a trade deficit caused a fiscal deficit. The twin deficit hypothesis, which is the result of mounting fiscal and current account deficits, has been theoretically and empirically validated by many researchers as a researchable problem (Miller & Russek, 1989; Cavallo, 2005). The argument of twin deficits emerged in the 1980s, with a significant deterioration in the trade deficit in association with an increase in the US fiscal deficit. This relation is technically understood with the help of the following equations with the model presented by Keynes (NI), which discloses the identities of national income (NI) and explains the essential relationship between TWH and TDH in a better way. For an open economy, GDP for time "t" is expressed as

$$NI = C + I + G + (EX - IM) \quad (1)$$

Where NI indicates national income, C is consumption, I is investment, G indicates government spending, and (EX – IM) represents net exports (NX). Eq1 expresses the relationship between GDP and its components, according to the total expenditure approach of national income.

After making the necessary arrangements in eq (1), we obtain Eq (2) and (3) as the final outcome.

$$(T - G) + (GDP - C - G) - I = NX \quad (2)$$

$$(T - G) + (Sp - I) = NX \quad 3)$$

The trade balance (NX) is the addition of government budget balance (T - G) plus the gap between Sp – I as indicated in equation (3). In this equation, if savings (S) roughly equals investment (Sp = I), then an economy's budget balance is equal to its trade balance. This implies that budget and trade balances have a direct relationship (positive or negative) by nearly the same amount (at least arithmetically), implying that the two balances are directly correlated.

If private domestic savings are not equal to gross domestic investment (gross domestic capital formation), that is, ($Sp \neq I$), and fiscal balance is negative ($T < G$), it will be equal to trade deficit ($X < M$), meaning that there exists a situation of triple deficits. In other words, the sum of the two domestic deficits equals the trade deficit from a policy standpoint, which implies that if there are budget deficits and an S-I imbalance, TDH is unavoidable, as expressed by Equation (3).

2. FinTech and Triple Deficit Hypothesis

Fintech, which involves using digital technology in the realm of financial services, is transforming the financial landscape. The COVID-19 pandemic played an important role in accelerating this transformation. The ongoing shift toward digital financial services and currencies paves the way for creating more inclusive and efficient financial systems, ultimately fostering economic growth. To contribute to a country's economic development, it is imperative to address the deficit arising from the disparity between savings and investment. A more effective solution emerges when we establish robust cross-border coordination and facilitate the sharing of information and best practices in a clear and essential manner, emphasizing the critical role of Financial Technology (FinTech).

Fintech also has significant implications that ultimately enhance coordination to bridge the gap between savings and investments. To begin with, it encourages innovation, promotes new ideas, manages risks, and, in doing so, broadens the scope of monitoring and necessitates a revaluation of regulatory frameworks. The integration of financial services blurs lines within the financial sector. Additionally, Fintech ensures the suitability of public funds for the digital world and expedites the resolution of related issues. Moreover, Fintech has the potential to stimulate job creation, competition, and innovation, which are generally beneficial in reducing the triple deficit hypothesis and fostering economic development in an economy.

Since 2018, policymakers have consistently been grappled with questions concerning inclusive economic expansion, financial stability, and regulatory measures. The recent G20 summit underscored the significance of inclusive growth and the need for an adaptable and proportionate legal and regulatory framework for maintaining the integrity of digital finance. As a recommendation, policymakers are urged to strike a delicate equilibrium between fostering financial innovation and addressing associated challenges and risks, particularly those related to financial integrity, consumer protection, and financial stability. Additionally, efforts should be directed towards enhancing financial and digital literacy, which is currently in short supply within the nation, ultimately contributing to the reduction of economic deficits.

3. Theoretical Supposition and Review of Literature

Recently, several researchers have investigated this problem (Mallick et al., 2021; Dey and Tareque, 2022; Nautiyal et al., 2023). In the present study, a brief and systematic approach, both worldwide and in the Indian context, is presented. The studies about twin deficits relationship are mainly based on two major macroeconomic theories given by J. M. Keynes (known as Keynesian approach) and Ricardo known as Ricardian Equivalence Hypothesis (REH). The Keynesian approach, associated with model (1962-63) argues that an increase in GFD will affect the interest rate (increase) in comparison to the world rate, which outcomes as capital inflows in a country and appreciation in domestic currency. The rise in the value of currency causes imports to be cheaper and exports costlier resulting into increase in imports, decrease in exports, loss of competitiveness in the international market, and the CAD (Leachman and Francis, 2002; Salvatore, 2006). The Keynesian approach is discussed in detail by Zietz and Pemberton (1990), Tallman and Rosensweig (1991), Bahmani-Oskooee (1992), Rosensweig and Tallman (1993), Dibooglu (1997), Darrat (1998), Khalid and Guan (1999), Fidrmuc (2002), Salvatore (2006), Mukhtar et al. (2007), Lau and Tang (2009), Ganchev (2010), Holmes (2011), Kulkarni and Erickson (2011), Trachanas and Katrakilidis (2013), and Banday and Aneja (2016). The crux of this approach is that there is a direct association between the GFD, which causes an increase in CAD.

The Keynesian strategy is opposed by the REH. It claims that there is no correlation between CAD and the GFD in an open economy and that the GFD does not lead to CAD. Private families modify their savings to counteract the anticipated future tax bills brought about by deficits. As a result, interest rates are unaffected and the GFD has no negative effects on the economy. This theory also shows that the real interest rate, investment volume, and trade balance are unaffected by changes in taxes and budget deficits (Barro, 1989; Neaime, 2008).

According to the REH, Modigliani, and Ando's (1957) life cycle model serves as the foundation for human consumption habits. As opposed to the Keynesian model, this model contends that present consumption is dependent on the predicted lifetime income. The permanent income hypothesis, advanced by Ricardo, was supported by Friedman (1957), who claimed that private consumption only increases with an increase in permanent income, meaning that a temporary increase in income brought on by tax cuts or government spending financed by deficits will only cause private savings to rise rather than spending (Barro, 1989; Hashemzadeh and Wilson, 2006). Additionally, when domestic savings increase, less foreign capital is required and there is less risk of CAD (Khalid and Guan, 1999). Modigliani and Sterling (1986), Abell (1990), Enders and Lee (1990), Boucher (1991), Feldstein (1992), Kim (1995), Khalid and Guan (1996, 1999) and Kaufmann et al. (2002), Kim and Roubini (2008), Rafiq (2010), Nazier and Essam (2012), Algieri (2013), and others all support the REH. Banday and Aneja (2019) used the Autoregressive Distributed Lag (ARDL) Zivot and Andrew (ZA) structural break model to evaluate the causal relationship between GFD and CAD in China from 1985 to 2016. The Keynesian hypothesis is supported by the ARDL cointegration model, which also validates long-term integration between the selected variables. Furthermore, the GC test demonstrated the validity of TWD theory in China and concluded that CAD and GFD are correlated in the opposite direction.

Sakyi and Opoku (2016) examined the issue of relationship between GFD and CAD and Ricardian equivalence (REH) in Ghana for a time spanning from 1960-2012 by applying co-integration methodology with allowance of structural swifts. They concluded that both deficits hold a relationship meaning that CAD is the result of GFD. But they further added that validity of TWH is not overall valid over the acceptability REH. Considering the constant co-movement between the GFD and CAD for the period 1980–2014, Senadza and Aloryito (2016) analyse the TWH for Ghana. The Johansen co-integration test results showed that the selected variables were co-integrated, and the error correction model indicates both a long run and short run association of CAD and the GFD. Further GC test supports the reverse causality between the selected variables. A few studies (Magoti et.al, 2020; Yeniwati, 2019; Tang, 2014; Bolata et.al, 2014; Sen et al., 2014; Surekcı, 2011; Akbas and Lebe, 2016; and Shruti et al., 2017) tested the validity of TDH in different economic settings and reported that the hypothesis holds true. However, some researchers (Winner, 1993; Chawdhary and Saleh, 2007; and Sen and Kaya, 2018) refute the validity of TDH. Bolata et.al, (2014) applied Hacker and Hatemi-j (2006) bootstrap causality test for examine the TWH and TDH for different EU countries from $2002Q_1$-$2013Q_3$. As a result, they have provided evidence on the existence of TWH and TDH for different EU countries. Magoti et.al, (2020) aimed at examining the relevance of TDH for East African countries for the time period from 2004-2018 by adopting ARDL and Dumitrescu-Hurlin panel granger causality analysis which helpful to capturing the effect of slope of heterogeneity. They found that GFD and S-I gap to have a positive impact on CAD. But in short run causality is not moved from fiscal balance and S-I gap to CAD. Further, Dumitrescu – Hurlin granger causality results conclude that TDH is invalid in east African countries. Yeniwati (2019) to analyse the causal relationship between BD, CAD and S-Igap on quarterly data for the period of 2003Q -2016Q in Indonesia. With the help of vector autoregressive (VAR) method BD and CAD have unidirectional relationship, BD and S-Igap have one way relationship whereas CAD and S-Igap does not cause each other. Tang (2014) examined the validity of TDH on US data for a period from $1960Q_1$ to $2013Q_1$. He verified the existence of a direct relationship between GFD, CAD and S-IGap. He also showed that this relationship is valid as statistically it showing a significantly causal association between CAD and GFD as well as the financial situation of the US.

The validity of TDH was further examined by Akbas and Lebe (2016) using a sample of G7 nations from 1994 to 2011. They discovered bidirectional causation between the S-Igap proxy with CAD and GFD, as well as between the CAD and S-Igap. Savings gap has a significant impact on CAD and the GFD. Sen et al. (2014) and Surekci (2011) independently examine the effects of TDH on the Turkish economy. Using quarterly data spanning 1987 to 2007 and stipulating a causal relationship between the GFD and CAD, Surekci (2011) found no causal association between the S-I rate and CAD, demonstrating the nonexistence of the TDH. Sen et al. (2014) examine the causes and effects of trade, fiscal, and savings deficits from 1980 to 2010. Their findings support the validity of TDH by showing a causal relationship between CAD and GFD and the S-I deficit. Akbas and Lebe (2016) confirmed TDH in Turkey between 1960 and 2012 by observing a bidirectional correlation between CAD and GFD, and CAD and S-Igap, in line with Sen et al. (2014). Similarly, S-I and budget deficits affect CAD according to Akbas and Lebe (2016). Their findings demonstrated the validity of the TDH for Turkey for 1975–2010 by showing that both deficits have a favorable impact on CAD in the short and long terms.

In contrast to what was stated above, Winner (1993) investigated how the GFD, CAD, and S-I gap related to the Australian economy. This study supported the REH by demonstrating that the GFD, as opposed to the S-I gap, was caused by various macroeconomic factors. The fact that CAD were a result of GFD and S-I gap was also emphasised, indicating that Australia's TDH theory was not applicable throughout the study period. Like Chowdhury and Saleh (2007), who examined the TDH for Sri Lanka using the Autoregressive Distributed Lag (ARDL) technique, TDH were not present in Sri Lanka between 1970 and 2005. Sen and Kaya (2018) argued that six post-communist nations between 1994 and 2012 did not support the TWD and TDH. The researchers rejected the usual techniques but supported the REH, indicating that the TDH was not present. In India, choosing a course of action requires knowledge of the TWH and TDH hypotheses' viability. Policymakers will be better able to create the most effective fiscal policies and control the fiscal deficit, Debt to GDP ratio, and Tax to GDP ratio if they have knowledge of the validity of the hypothesis.

4. Data and Methodology

The annual data of fiscal deficit, CAD, and S-I imbalance were extracted from the official websites of the Reserve Bank of India (RBI) and Economic Survey (2019-20) covering the period from 1990-91 to 2019-20. This particular time period is taken into consideration because the economy becomes open or the policy of liberalization, privatization, and globalization was introduced; in particular, saving and investment started their role, which is one of the crucial components of the triple deficit hypothesis. To test the validity of TWH and TDH in India, Granger causality under the VAR/VECM environment was applied in the present study.

First, to describe the characteristics of selected variables, descriptive statistics such as Mean, Median, Standard Deviation, Skewness, Kurtosis, Jarque-Bera value, and its associated probability are calculated, which are presented in Table 1 in the Appendix.

The outcome of descriptive statistics depict that selected variables are asymmetrically distributed or there is presence of skewness and kurtosis in the selected variables. As basic assumption before applying an econometric test is that data should be stationary; hence, to make the datasets stationary and relevant for study, the researcher has converted all datasets into a natural logarithm form.

4.1 Stationarity Test

The Augmented Dickey-Fuller (ADF) unit root test was used to test the stationarity of the log-transformed value of selected variables with the null hypothesis that all variables have the presence of a unit root. The results of the ADF unit root test presented in Table 2 indicate that all the selected variables are non-stationary at level I (0), but stationary at the first difference I (1).

4.2 Testing Twin Deficit Hypothesis (TWH)

Before examining the validity of the TDH in the Indian context, it is necessary to examine the TWH case in India. As GFD and CAD are stationary at the first difference, the validity of TWH is checked by examining causality between GFD and CAD through the Granger causality test. The results indicate unidirectional causality between CAD and GFD, meaning that CAD causes GFD but GFD does not cause CAD. It shows that TWH is not true in Indian context during the period of study.

4.3 Testing Triple Deficit Hypothesis (TDH)

The TDH describes a situation in an economy where GFD, S-I deficit, and the CAD occur at the same time. So, the researcher feels it necessary to check the long-run and short-run dynamics among Gross GFD, SI Gap, and CAD.

4.3.1 Lag Selection

Lag length selection is one of the criteria decided prior to run a dynamic model such as the Johansen Cointegration test and Granger Causality test. In econometrics, there are several criteria for determining the optimal lag length in time series modelling. The prominent among them are: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQIC). To decide lag length for LNGFD, LNCAD, LNSIGAP all these criteria are used; the results presented in Table 4 indicate optimum leg length is four for the selected variables. According to the calculated result lag four is selected because on that point the residual sum of square is minimal and model predictive power is highest as highlighted by *.

4.3.2 Johansen Co-integration Test

The Johansen co integration test is used to examine the co integrating relationships between several non-stationary time series data at level. As selected variables under study are non-stationary at level I (0), but stationary at first difference I (1), the researcher has used Johansen's co integration model. The test results presented in Table 5 indicate that the p-value of trace statistics and maximum Eigen value are significant at 5 percent level of significance, meaning that there exists a cointegrating relationship among the selected variables, and the null hypothesis that there is no cointegration relationship among the selected variable is rejected. The results thus prove the validity of TDH in India.

4.3.3 Vector Error-Correction Model (VECM)

The econometrics theory suggests that when variables in VAR framework are cointegrated, VECM is used to examine whether variables have long-run or short run properties in the cointegrated series. In case no cointegration is observed, VECM is no longer required, and we directly proceed to granger causality test to find causal association among variables. In VECM, cointegration rank shows the number of cointegrating vectors and a negative and significant coefficient of ECM indicates the long-run causality running from independent variables to dependent variables. If coefficient of cointegrated model or error term is found non-negative and insignificant, then we apply Wald test for testing the short-run properties of independent and dependent variables.

Since selected variables (LNGFD, LNSIGAP and LNCAD) are found cointegrated, the researcher has used vector error-correction model (VECM). The VECM model result presented in Table 6 where coefficient of cointegrated model value is found non- negative and insignificant reveals that there is no long run causality running from LNSIGAP and LNCAD to LNGFD. In order to know the validity, accuracy and significance of the VECM model, VECM is applied through OLS for getting p value by which we can accept or reject our null hypothesis. The results presented in Table 7 indicate value of r^2 equal to 0.86 and F statistics 0.004. The results of residual testing show non-presence of serial correlation, heteroscedasticity, and normally distributed residuals meaning that model is valid for the study.

Although, results depict that there is no long-run causality running from LNSIGAP and LNCAD to LNGFD, but in order to know short-run causality, the researcher applied Wald test. The test results shown in Table 8 indicate p-value less than 0.05, meaning that there is short-term causality among selected variables, LNGFD, LNCAD, and LNSIGAP.

4.4 Granger Causality Test

As per results described above, all the variables are found cointegrated, and since Johansen's cointegration test is not capable to give the degree and direction of the relationship, the researcher applied Granger causality test in VECM environment.

To test causality among selected variables, the VECM bivariate Granger causality test is performed on LNGFD, LNCAD, and LNSIGAP. The result presented in Table 9 indicate bi-directional causality running from LNGFD to LNCAD, and from LNGFD to LNSIGAP and vice versa. It means GFD (LNGFD) causes CAD (LNCAD) and S-I gap (LNSIGAP). Further, CAD (LNCAD) and S-Igap (LNSIGAP) causes GFD (LNGFD). It proves the existence of the TDH in India during the period of study. Moreover, there is unidirectional causality between CAD (LNCAD) and SIgap (LNSIGAP), meaning that CAD does not cause SIGAP, but SIGAP causes CAD.

5. Discussion and Findings

Fiscal policy is an arrangement for expenditure and investment in an economy which includes tax policy, expenditure policy, investment or disinvestment strategies, and debt and surplus management. It is an important constituent of government policy as it affects overall health of an economy. The TWH is considered as one of the crucial components for fiscal deficit therefore to test this and make the association with financial technology is also essential. The TWH establishes the association between GFD and CAD, and the TDH describes a situation in an economy where

GFD, SIGap, and the CAD occur at the same time. Knowing the validity of TWH and TDH the researcher tried to test the validity of both deficit in Indian context by using different econometrics methodology over a period from 1990-91 to 2019-20. The result of Granger causality test conducted to assess the validity of TDH indicate the unidirectional causality running between GFD and CAD which means GFD cause CAD, but CAD does not granger cause GFD. To determine the validity of India's TDH, the researcher employed Johansen's methodology and GC test. The Johansen's cointegration test confirms the cointegration between the selected variables. To learn more about long-term and short-term cointegration, the researcher further used VEC model. The results indicate that GFD, CAD, and SIGAP have short-term relationships verified through the VEC model and Wald test. The Granger causality tests revealed bidirectional causality running from GFD to CAD and SIGAP, and from CAD and SIGAP to GFD. All this proves validity of TDH in Indian context during the period of study.

6. Managerial Implication

The main contribution of this study is to propose an idea for the direction of the validity of the TWH and TDH of India. This will enable the government to take corrective qualitative and quantitative measures to maintain economic sustainability. In prior studies, the authors have investigated the validity of the TWH; however, the validity of the TDH has not been tested by the author in reference to India. Additionally, this study seeks to investigate this by applying Johansen Cointegration methodology. By integrating the gap and approach together, the research framework provides a more comprehensive understanding, proposes an idea about the validity of TDH in an economy, and provides insights into the positioning of an economy in terms of deficit. Therefore, this study was designed to fill this gap in literature.

The results of this investigation have significant implications for various institutions and individuals. For instance, the GFD, CAD, and S-I gap reflect government expenses, which can provide insights into the financial condition of the government and the spending patterns of the ruling party. It is also often used as a critical indicator for determining the overall health of the economy. In addition, these findings can be valuable for government bodies, policy-making organizations, and lenders in devising macroeconomic policies and strategies to regulate and manage India's fiscal deficit. Moreover, this study can provide new perspectives and opportunities for researchers, academics, and students who are currently pursuing or planning to pursue research on related topics.

7. Limitation and Future Research

In conclusion, we believe that this study has enhanced our understanding of the relationship between GFD, CAD, and S-I gap, providing empirical evidence in support of this association. We hope that this research will inspire further theoretical refinement and empirical examination of this important area of research. Based on the statistical findings, we recommend that governments focus on reinforcing their innovative efforts, which can lead to filling the S-I gap by adopting sustainable practices. This includes introducing new laws, constructing or adopting sustainable measures, and enhancing existing ones to enhance economic growth in the economy. Consequently, the practical implications of this research are to provide insights for policymakers, entrepreneurs, and practitioners to invest in a country to improve sustainability performance.

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APPENDIX

Table 1: Basic Descriptive:					No. of Observation: 32			
S. No.	Variables	Mean	Median	Std. Dev.	Skew-ness	Kurtosis	Jaque Bera	Prob*
1	GFD	255582.0	141746.0	224223.0	0.67	1.97	3.56	0.1600
2	CAD	99580.9	44060.0	131855.0	1.14	4.02	11.32	0.0034
3	SIGAP	102483.0	38216.9	145266.0	1.20	3.11	7.28	0.0260

Note: P-value is at 5% level of significance

Here, GFD = Gross Fiscal Deficit, CAD = Current Account Deficit, and SIGap = Saving-Investment Gap.

Source: **Author's Elaboration**

Table2: Results of ADF Unit Root Test

S. No	Variables (Integrated at 1st difference)	't' Value	Critical Value	P-value
1	LNGFD	5.17	2.986	0.0002
2	LNCAD	4.63	2.986	0.0012
3	LNSIGAP	6.62	2.986	0.0000

Here, GFD is Gross Fiscal Deficit, CAD is Current Account Deficit, and SI Gap is Saving-Investment Gap.

Source: Author's Elaboration

Table 3: Results of the Granger Causality Test VECM Framework

S. No.	Null Hypothesis	P-Value (Sign. 0.05)	Conclusion
1.	LNGFD does not granger cause LNCAD	0.0968	Accept
2.	LNCAD does not granger cause LNGFD	0.0174	Reject

Source: Author's Elaboration

Table 4: VAR Lag Order Selection Criteria

Endogenous Variable: LNGFD LNCAD and LNSIGAP

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1016.159	NA	2.24e+30	78.39683	78.54200	78.43863
1	-968.9381	79.91203	1.19e+29	75.45677	76.03743	75.62398
2	-951.1524	25.99449	6.27e+28	74.78095	75.79711	75.07357
3	-939.2024	14.70764	5.44e+28	74.55403	76.00568	74.97205
4	-915.7152	23.48716*	2.12e+28*	73.43963*	75.32678*	73.98306*

Note: * Lag length selected by the criterion (each test at 5% level of significance)

Source: Author's Elaboration

Table 5: Results of Johansen Cointegration test

Optimum Lag: 4

S. No.	Null Hypothesis (Ho)	Trace statistics	Max Eigenvalue	Decision	Conclusion
1	No cointegration	51.99	41.68	Reject	Cointegrated
2	At most, one cointegration	10.34	8.84	Accept	Cointegrated
3	At most, two cointegration	1.468	1.468	Accept	Cointegrated

Note: Critical value of trace statistics and maximum eigenvalue at 5% level of significance are 15.4947 and 14.2646, respectively.

Source: Author's Elaboration

Table 6: Results of VEC estimates for long-term cointegration among selected variables

Error Correction:	D(GFD)	D(CAD)	D(SIGAP)
Coint. Eq. 1	0.379634	-0.111805	0.120542
	(0.05782)	(0.08405)	(0.05881)
	[6.56552]	**[-1.33019]**	**[2.04968]**
D(GFD(-1))	-0.367295	0.884960	-0.082470
	(0.15429)	(0.22427)	(0.15692)
	[-2.38062]	**[3.94589]**	**[-0.52555]**
D(GFD(-2))	-0.614920	0.211065	0.514565
	(0.16408)	(0.23851)	(0.16688)
	[-3.74769]	**[0.88493]**	**[3.08340]**
D(GFD(-3))	0.419139	1.579451	0.721643
	(0.21736)	(0.31597)	(0.22108)
	[1.92828]	**[4.99879]**	**[3.26421]**
D(GFD(-4))	-0.428634	-0.010299	0.548620
	(0.31047)	(0.45131)	(0.31577)
	[-1.38060]	**[-0.02282]**	**[1.73739]**
D(CAD(-1))	0.811647	0.022642	-0.320486
	(0.12702)	(0.18464)	(0.12919)
	[6.38988]	**[0.12263]**	**[-2.48072]**
D(CAD(-2))	-0.143343	-1.076369	-0.114904
	(0.16547)	(0.24053)	(0.16829)
	[-0.86629]	**[-4.47500]**	**[-0.68276]**
D(CAD(-3))	0.965445	-0.215702	-0.084248
	(0.26475)	(0.38484)	(0.26927)
	[3.64669]	**[-0.56050]**	**[-0.31288]**
D(CAD(-4))	0.513606	-0.971073	-0.032194
	(0.16600)	(0.24130)	(0.16883)
	[3.09403]	**[-4.02433]**	**[-0.19068]**
D(SIGAP(-1))	-1.872325	-0.057417	-0.510287
	(0.32242)	(0.46868)	(0.32793)
	[-5.80711]	**[-0.12251]**	**[-1.55610]**
D(SIGAP(-2))	-1.176462	0.512005	-1.158029
	(0.32615)	(0.47410)	(0.33172)
	[-3.60714]	**[1.07996]**	**[-3.49099]**
D(SIGAP(-3))	-2.027561	-0.159241	-0.791030

	(0.37663)	(0.54748)	(0.38306)
	[-5.38345]	**[-0.29086]**	**[-2.06501]**
D(SIGAP(-4))	-1.948710	0.228314	-0.580592
	(0.38871)	(0.56504)	(0.39535)
	[-5.01331]	**[0.40407]**	**[-1.46856]**
C	139795.4	-40906.66	33222.72
	(19228.0)	(27950.3)	(19556.4)
	[7.27042]	**[-1.46355]**	**[1.69881]**
R – Squared	0.863181	0.907695	0.909967
Adj. R – Squared	0.701485	0.798607	0.803565

Source: Author's Elaboration

Table 7: Goodness of VECM through OLS model

Dependent Variable: D(GFD)
Model: D(GFD)=C(1)*(GFD(-1)-0.724492229299*CAD(-1)+ 1.94930847425 *SIGAP(-1) - 427625.065903) + C(2)*D(GFD(-1)) + C(3)*D(GFD(-2)) + C(4)*D(GFD(-3)) + C(5)*D(GFD(-4)) + C(6)*D(CAD(-1)) + C(7)*D(CAD(-2)) + C(8)*D(CAD(-3)) + C(9)*D(CAD(-4)) + C(10)*D(SIGAP(-1)) + C(11)*D(SIGAP(-2)) + C(12)*D(SIGAP(-3)) + C(13)*D(SIGAP(-4)) + C(14)

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	0.379634	0.057822	6.565518	0.0000
C(2)	-0.367295	0.154286	-2.380616	0.0365
C(3)	-0.614920	0.164080	-3.747691	0.0032
C(4)	0.419139	0.217364	1.928277	0.0800
C(5)	-0.428634	0.310469	-1.380598	0.1948
C(6)	0.811647	0.127021	6.389881	0.0001
C(7)	-0.143343	0.165468	-0.866286	0.4048
C(8)	0.965445	0.264745	3.646693	0.0038
C(9)	0.513606	0.165999	3.094026	0.0102
C(10)	-1.872325	0.322419	-5.807110	0.0001
C(11)	-1.176462	0.326148	-3.607144	0.0041
C(12)	-2.027561	0.376629	-5.383445	0.0002
C(13)	-1.948710	0.388707	-5.013309	0.0004
C(14)	139795.4	19227.97	7.270419	0.0000
R-squared	0.8632			
Adjusted R-squared	0.7014			
F-statistic	5.3383			
Prob (F-statistic)	0.0042			
Durbin-Watson stat.	1.4308			

Residual Testing (Diagnostic test)

S. No.	**Test**	**Null Hypothesis (H_O)**	**Prob. Value***	**Conclusion**
1.	Breusch-Godfrey LM test	No Serial Correlation	0.1713	H_O Accepted
2.	Breusch-Pagan-Godfrey	No Heteroscedasticity	0.9704	H_O Accepted
3.	Jarque-Bera test	Normally distributed	0.6902	H_O Accepted

Note: *** at 5% level of significance**
Source: Author's Elaboration

Table 8: Wald test for short-term causality of LNCAD and LNSIGAP

(A) CAD

H_0: C(6)=C(7)=C(8)=C(9)=0			
Test Statistic	**Value**	**D.F.**	**Probability**
F-statistic	10.38802	(4, 11)	0.0010
Chi-square	41.55209	4	0.0000
Normalized Restriction (= 0)		**Value**	**Std. Error**
C(6)		0.811647	0.127021
C(7)		-0.143343	0.165468
C(8)		0.965445	0.264745
C(9)		0.513606	0.165999

(B) S-I Gap

H_0: C(10)=C(11)=C(12)=C(13)=0			
Test Statistic	**Value**	**D.F.**	**Probability**
F-statistic	11.82299	(4, 11)	0.0006
Chi-square	47.29198	4	0.0000
Normalized Restriction (= 0)		**Value**	**Std. Error**
C(10)		-1.872325	0.322419
C(11)		-1.176462	0.326148
C(12)		-2.027561	0.376629
C(13)		-1.948710	0.388707

Here, C(6) = C(7) = C(8) = C(9) are coefficients of CAD, and C(10) = C(11) = C(12) = C(13) are coefficients of SIGAP

Source: Author's Elaboration

Table 9: Results of Granger causality test in VECM framework

S. No.	**Null Hypothesis**	**P-Value (Sign. 0.05)**	**Conclusion**
1.	LNGFD does not granger cause LNCAD	0.0000	Reject
2.	LNGFD does not granger cause LNSIGAP	0.0000	Reject
3.	LNCAD does not granger cause LNGFD	0.0000	Reject
4.	LNCAD does not granger cause LNSIGAP	0.7962	Do not Reject
5.	LNSIGAP does not granger cause LNGFD	0.0001	Reject
6.	LNSIGAP does not granger cause LNCAD	0.0237	Reject

Source: Author's Elaboration