

Digital Currency Impact on the Energy Market – With Reference to India

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Abstract:

The Indian economy has been highly subjected to the fluctuation of the global oil prices and the fluctuation of the exchange rate as of the recent past that directly translates into an increased energy import bill of the Indian economy as well. In the given study, it is an attempt to discuss one of the strategic solutions, i.e., the integrated adoption of the Central Bank Digital Currency (CBDC), i.e., the digital rupee, and the Local Currency Settlement (LCS) arrangements of India. To estimate a Structural Vector Autoregression (SVAR) model with a monthly dataset between January 2015 and October 2025 and take into consideration the key variables of interest, including the INR/USD Exchange rate Volatility, the Energy Import Bill, the policy dummies indicating the introduction of the Digital Rupee and LCS system in Russia and the UAE, respectively. It is performed through the strong analysis with the help of Foreign Exchange Reserves, Global Crude Oil Prices, IIP(Manufacturing) proxy of industrial production, Domestic Fuel Subsidy, INR/USD Exchange Rate, Trade weight NEER, and the USD-DXY Index as control variables. The article defines concrete facts that the fluctuation of the rate of INR/USD is among the drivers of the simultaneous launch of Digital Rupee and LCS models. It should be noted that these policies are complementary. The Digital Rupee is the digital infrastructure of the locations, and the LCS with Russia and the UAE is the legal way of trading without dollar. The key findings are that the policy variable shock will result in the energy import bill reduction that will be significant. It provides substantial reasons to show that the complex system of policies offered by India may be perceived as an empirically-abandoned, but practical method of energy security improvement and establishment of the macroeconomic stability.

Keywords: Digital Rupee, Bilateral Agreements, Crude Oil Imports, Exchange rate Volatility, Economic Stability.

I. Introduction:

The next-generation digital currencies that are commonly referred to as the CBDCs will have a paradigm shift in the international financial arena. Currently, there are more than CBDCs, which is a shift in the world monetary system, and over 130 countries-98% of the world GDP-are undertaking research and development of the matter (Atlantic Council Annual Report, 2024). The general motivation of this broad discovery lies in some fundamental policy concerns: enhancing financial inclusion through greater access to digital payment systems, enhancing efficiency and cutting down on the cost of cross-border settlements, and enabling central banks to execute monetary policy with greater precision in an extremely digitalized

economy(World Bank Report, 2023). First, it launched a pilot project of the Digital Rupee or e-Rupee, which is an RBI direct liability (Reserve Bank of India Bulletin, 2023). Second, in order to reduce its reliance on the US dollar and reduce geopolitical risks, India has developed the Local Currency Settlement (LCS) mechanism with major trading partners, such as Russia and the UAE (Economic Survey 2024-25). Such mechanisms can also charge and settle international trade using rupees and the local partners currencies without utilizing the US dollar. Such studies as (Prasad, 2022) indicate that digital currencies can make transactions across borders. Nevertheless, the literature gap is great. First, there is no empirical study work that quantifies the actual economic merits of an operating CBDC. Most of the literature

focuses on the technical problems related to the digital currencies or their impact on the stability of the domestic financial system. As a matter of fact, only a limited number of them explore the possibility of a CBDC being an effective instrument to control external sector risk particularly in the context of enhancing energy security. Such an essential connection between a CBDC and bilateral trade agreements such as LCS has not been paid much attention to in the past. In this case, the paper constructs a niche around a simple empirical question: How does the CBDC in India impact the economy of the country with respect to its energy importation, and how are the implications of these effects compounded with the strategic Local Currency Settlement accords? To analyze this, we have now employed the Structural Vector Autoregression (SVAR) model that is one of the effective and consistent econometric models. This approach can also be used to discover the dynamic relations between numerous economic factors through time. This study will look at the data of 2015 to 2025 which is the time frame of implementing such crucial regulations. Therefore, this research aims to provide empirical confirmation of the first collaborative policy framework. We look at the hypothesis that the Local Currency Settlement and the Digital Rupee are both mutual shock absorbers, as opposed to independent entities. The project will provide valuable evidence to the policymakers by following up on the ways in which the fluctuations in the exchange rate between the INR and the USD trigger policies and the end result of these policies on the price of imported energy. In this case, we attempt to show how such a combination as strategic financial digitalization and diplomatic trade activities can become an effective tool of maintaining financial sustainability and safeguarding domestic energy security.

II. Review of Literature:

Finance is a fast-changing environment. The development of Central Bank Digital Currency or CBDCs is also an important phenomenon. In simple words, a CBDC is a digital currency which is issued by a Central Bank of a country and is no safer than cash (Chohan, 2022). This development is occurring because of a number of reasons. To begin with, the

recent popularity of the private cryptocurrencies such as Bitcoin demonstrated the potential of the digital currency, but has also introduced a massive volatility and regulatory issues. Second, the market of digital payments is now controlled by large privately owned companies. Later, governments expect CBDCs to serve as a means of improved control over the economy and become more accessible to the banking system by more citizens, and make the payments faster (Bapat & Sharma, 2025; Jiang & Lucero, 2021). Scholars and Policy-makers are taking the potential impacts of such developments on industries such as the energy markets very seriously because many nations such as China and India are developing their individual digital currencies (Savelli et al., 2024). Technological studies are also frequently used by researchers to explore the possibility of people starting to use these new digital currencies. As an example, the Task-Technology-Fit (TTF) theory and the Pull-Push-Mooring (PPM) have been applied to the study of the digital currency in China (DCEP). Based on these findings, individuals will be more willing to use digital currency provided they perceive that its privacy is preserved and provided that the technology meets their needs. However, the process of adoption may be interrupted by the inconvenience and cost of altering payment mechanisms (Xia et al., 2023, 2025). The connection between CBDCs and the energy sector is an unexplored and important research area. A properly planned electronic currency can help to create a more modern and environmentally friendly energy system. An illustration is that a plan to completely integrate CBDCs with energy networks has been suggested. Such integration could enhance the energy projects that are run by communities, decrease transaction costs, and enhance transparency (Savelli et al., 2024). Based on this plan, a CBDC would simplify the process of monitoring and trading carbon credits and funding renewable power programs. It aligns with the broader concept of the so-called green fintech, which puts an emphasis on technology as a tool of improving data and transparency to facilitate investment in environmentally friendly initiatives (Murphy, 2024). The possibility of blockchain technology, which drives most of the CBDCs, to

enhance the trust and consensus in the carbon markets and other services related to climate is also being taken into account (Chen & Siklos, 2022). Thus, CBDCs are becoming viewed in the literature as a possible foundation of a more efficient and less harmful digital economy instead of the new money in and of itself. Nevertheless, there exists a complicated connection between the price of imported energy and digital money. They would have a profound influence over the purchase and payment of energy in the main developing economies such as India that is majorly an importer of energy. India is highly affected by world crude oil prices which count almost solely in US dollars. Whenever the value of that dollar changes or the oil prices increase, the impact is destructive to expanding the trade deficit in India, which increases inflation (Kim, 2023). This creates ongoing risk. It is proposed that CBDCs may have a role to play in resolving this. Among them is the sectoral fixed exchange rate model: a digital currency has the potential to generate a more reliable payment means, simply to those necessities like oil, thereby minimizing the use of the US dollar (Kim, 2023). Considering the modern tendencies on the global level, the RBI launched its own project of digital currency, which is a Digital Rupee, and launched wholesale transactions in November 2022. Although some studies have already been initiated, which investigate the economic impact of CBDCs, such as how they can strengthen economic interrelations in a specific region, such as that in China (Lei & Wang, 2024), they are still missing. There is not yet any critical, data-driven studies which establish the actual effect of a live CBDC on the energy imports of the major economies. The majority of studies in place are theoretical or individual effects. As an example, whilst a conceptual model may indicate that CBDCs are capable of lowering the cost and enhancing the level of transparency within the energy system (Savelli et al., 2024), it has not been confirmed using real data of a nation that has truly implemented a digital currency. Besides, the possibility of a CBDC along with bilateral trade agreements on local currencies has been mostly ignored.

Research Gap: Although the literature available provides a theoretical possibility of CBDCs modernizing finance and thus revolutionizing energy import systems, there is an existing gap in the research. The evidence on the effect of a fully operational CBDC on the dynamics of the energy import bill in a major economy, such as India, is in acute shortage, and based on models. The majority of the research conducted so far is based on the conceptual designs or the impacts separately. None of them tested the joint impact of digital currency and local-currency trade agreement policies on a particular macroeconomic variable, e.g. national energy import bill. The given paper is an attempt to bridge this gap as it considers this strategic interaction in the specific context of India through the data.

III. Research Methodology:

The paper discusses the real effect on the cost of importing energy of India of its digital currency and local currency trade agreements. As opposed to relying on theory alone, the research applied the empirical research method which utilized valid data. The data that was put under study consisted of monthly data between January 2015 and October 2025. This is because this period is regarded as the time that encompassed a vast majority of economic scenarios, immediately after the very introduction of the CBDC in India in November 2022. This enables new policy effects to be watched over time. There are a few important data variables that were examined in this study. The volatility variables of Indian Rupee against US dollar and the total bill of importing energy were examined. Special dummy variables were developed to indicate the declaration of the Digital Rupee - CBDC - and the initiation of the Local Currency Settlement (LCS) systems with Russia and the UAE to directly test the policy impact. The other causes that might have contributed to the results that have been taken into account in this study are the foreign exchange reserves in India, the price of crude oil in the world market and the level of production of manufacturing, which is represented in IIP-Manufacturing. The econometric method is a particular method that is conducted by the Structural Vector Autoregression (SVAR) method of analysis.

The application of this model in the study was chosen due to the fact that it is one of the methods that establish cause-and-effect relationships among numerous economic variables affecting one another over time. That is, it follows the effect of a shock or change in one region, like a sharp fall of the value of currency, on other variables, like the import bill. The results of the model are reliable as a number of econometric methods were applied. We relied on the Structural Vector Autoregression (SVAR) model so as to establish underlying economic shocks and to go beyond mere correlation. This provides us with more information on reliable policy analysis as it allows us to follow the dynamic causal dependencies of significant variables. In addition, to establish the model, a Cholesky - a typical econometric device of identifying specific economic shocks - was applied. To select the model, the model was decided to be two period lag form as it is the best model because it depicts the economy without leaving any patterns in the error terms. There were also several diagnostic tests that were used to assess the strength of the model. These tests confirmed the model to be stable and that issues such as heteroscedasticity are not affecting the findings. In the analysis of the data with the help of the EViews software version 12, the Maximum Likelihood (ML) Method has been employed.

IV. Data Analysis & Discussion:

The coefficients $C(10)$ to $C(13)$ are the main exogenous factors that manipulate the strategy policy framework of India. As it can be seen in the preceding studies, the tightening of the US dollar is also playing a big role in the situation, as shown by the US-DXY Index. Since the positive and very important coefficient $C(10)=0.011$ ($\rho=0.000$) suggests, the increase of the dollar directly contributes to the volatility in the market of INR/USD. The value of imports such as oil which are in rupee is raised by the strong dollar, therefore creating immediate turmoil. This kind of fluctuation in the exchange rates is a good indicator of policy intervention. The coefficients $C(11)$, $C(12)$, and $C(13)$ are the responsiveness of three policy variables to the shocks in the INR/USD exchange rate volatility (D-INR/USD-Volatility). $C(11)=1.226$ ($\rho=0.013$) is used to gauge the impact of

volatility on the CDBC Dummy. One unit increase in the INR/USD volatility leads to a 1.226 unit increase in switch-on of the Digital Rupee (CBDC). This is a very strong indication that a volatile currency market is a direct catalyst to the on-work switch on of the sovereign digital currency. $C(12)=1.259$ ($\rho=0.011$) is the result of the same volatility on the Russian LCS Dummy. It is the identical volatility shock that causes the CBDC, which causes a 1.259 unit increase in the switch-on of the Local Currency Settlement system with Russia. This is an indication that India reacts against forex risks by lobbying on Rupee-Ruble trade agreements in energy imports. $C(13)=1.435$ ($\rho=0.004$) is the effect of volatility on UAE LCS Dummy. Domestic currency uncertainty is causing an increase in the switch-on of the LCS framework with the UAE in 1.435 units. This would imply a collaboration towards establishing a non-dollar trade route with another key energy ally. The values of all three coefficients are positive and statistically significant that confirms the fact that the volatility of the INR/USD is the shared stimulus that triggers the desire to have the government resort to the joint defense strategy, which implies the domestic digital currency (CBDC) and bilateral trade agreements (LCS) with other states to minimize dependence on the dollar by the economy. The previous hypothesis that a stronger US dollar $C(10)$ will cause the volatility of the exchange rate between INR and the US dollar is a direct early warning of the policies maker. Evidence confirms this hypothesis - the currency volatility is related to highly significant and statistically significant switch-on of the CBDC and LCS policy with Russia and UAE. However, does this act of defense actually work? The facts speak it all: the implementation of these policies brings a significant decrease in the energy import bill. The effect of a shock on the CBDC policy dummy is very negative: $C(44)=-2.598$, ($\rho=0.000$). The impacts are nearly the same in Russia LCS: $C(45)=-2.602$, $\rho=0.000$, and UAE LCS: $C(46)=-2.439$, $\rho=0.000$. In the case of Russia LCS ($C(45)=-2.602$, $\rho=0.000$) and the UAE LCS ($C(46)=-2.439$, $\rho=0.000$) the resulting effects are almost the same. It is curious how the statistical findings are consistent. It is noted that such attempts are not individual but they are a concerted effort. The LCS



agreements provide the legal framework, and the CBDC provides the digital instruments on how to carry out on-dollar trade. This fact validates that the

responsive step that India takes is a thought-out data-driven strategy to the sustainability of the economy.

Table No.1: Structural VAR Estimates													
Sample (adjusted): 2015M04 2025M10 Included observations: 127 after adjustments													
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives) Convergence achieved after 64 iterations													
Structural VAR is just-identified													
Model: $e = \Phi_i F_i$ where $E(u_i u_i') = I$													
	DER_Volatility	DLN_COBE_VIX	DLN_Domestic_Fuel_Subsidy	DLN_Energy_import_bill	DLN_Er	DLN_Foreign_Exchange_Reserves	DLN_Global_Crude_Oil_Prices	DLN_IIP_Manufacturing	DLN_Trade_Weight_NEER	DLN_USD_Index_DXY	CBDC_DUMMY	POST_LCS_POLICY_DUMMY_RUSSIA	POST_LCS_POLICY_DUMMY_UAE
DER Volatility	C(1)	0	0	0	0	0	0	0	0	0	0	0	0
DLN COBE VIX	C(2)	C(14)	0	0	0	0	0	0	0	0	0	0	0
DLN Domestic Fuel Subsidy	C(3)	C(15)	C(26)	0	0	0	0	0	0	0	0	0	0
DLN Energy import bill	C(4)	C(16)	C(27)	C(37)	0	0	0	0	0	0	0	0	0
DLN Er	C(5)	C(17)	C(28)	C(38)	C(47)	0	0	0	0	0	0	0	0
DLN Foreign Exchange Reserves	C(6)	C(18)	C(29)	C(39)	C(48)	C(56)	0	0	0	0	0	0	0
DLN Global Crude Oil Prices	C(7)	C(19)	C(30)	C(40)	C(49)	C(57)	C(64)	0	0	0	0	0	0
DLN IIP Manufacturing	C(8)	C(20)	C(31)	C(41)	C(50)	C(58)	C(71)	0	0	0	0	0	0
DLN Trade Weight NEER	C(9)	C(21)	C(32)	C(42)	C(51)	C(59)	C(66)	C(72)	C(77)	0	0	0	0
DLN USD Index DXY	C(10)	C(22)	C(33)	C(43)	C(52)	C(60)	C(67)	C(73)	C(78)	C(82)	0	0	0
CBDC DUMMY	C(11)	C(23)	C(34)	C(44)	C(53)	C(61)	C(68)	C(74)	C(79)	C(83)	C(86)	0	0
POST LCS POLICY DUMMY RUSSIA	C(12)	C(24)	C(35)	C(45)	C(54)	C(62)	C(69)	C(75)	C(80)	C(84)	C(87)	C(89)	0
POST LCS POLICY DUMMY UAE	C(13)	C(25)	C(36)	C(46)	C(55)	C(63)	C(70)	C(76)	C(81)	C(85)	C(88)	C(90)	C(91)

Source: Author's calculations using Eviews@13

A deeper analysis brings out their individual impacts on the financial defenses of India although the results demonstrate that these policies lower the energy import bill, which gives an overview. The specifics of the findings are that the shock to trigger the CBDC policy (CDBD-Dummy) also destroys the foreign exchange reserves seriously with a coefficient of $C(61) = -1.370$, ($\rho=0.000$). This probably means that certain initial expenses and liquidity some adjustments might be necessary in the early days of the digital currency introduction and penetration of the financial system and may temporarily consume the reserves. However, when we look at the results of the LCS policies, we notice more interesting things that are revealed. Another shock to Russia LCS Policy (Post-LCS-Policy-Dummy-Russia) at $C(62) = -1.634$, ($\rho=0.000$), also exhibits a negative relationship with reserves. This could be unexpected but it is favoring rupee settlement of the cheaper oil prices. Although this policy might require a temporary rebalancing of the reserves structure, which might be rather expensive, the primary objectives of the policy are to secure energy security and save money on import bills. It is worth noting that the UAE LCS Policy is not that significant at $C(63) = 1.434$ ($\rho=0.000$) yet significant. These three findings bring out a vivid image. The close usage of the CBDC and LCS policy regulations implies complex relations with

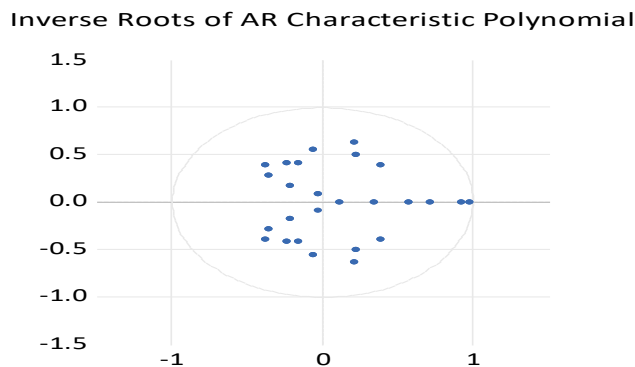
the country currency reserves. The first cost of the change of the reserves, as the serious adverse effects on the dollar-denominated energy trade have shown, are the empirical price that has to be paid to establish a more sustainable system, which reduces the dependence on dollar-denominated energy trade. This analysis clearly demonstrates the great impacts of these policies on the actual economic growth. A shock to the CBDC, or $C(74) = 1.936$ ($\rho=0.000$) is significant to improve manufacturing output. This would mean that the efficiency benefits of the digital currency go beyond a source of energy and improve trade financing overall. The difference between the two policies of LCS is very high. Although the Russia LCS or $C(75) = 1.977$, $r = 0.000$ also strengthens the manufacturing, the prior discovery of its opposite effect introduces a short-run trade-off between energy security and supply chain stability. In that regard, the UAE LCS appears to demonstrate a great positive effect: $C(76): 2.010$, $\rho=0.000$. This is therefore one of the reasons why it should be considered as a holistic alliance that supplements industrial output by ensuring the diversification of trade and investments flows, which also substantiates its growth orientation. These findings are symptomatic of the impact of the Indian strategic policies on the overall competitiveness of the rupee in the global trade as reflected in the Nominal Effective Exchange Rate (NEER). The negative shock of CBDC indicated by $C(79) = -1.990$,

$\rho=0.000$ indicates that the effect on the trade weighted exchange rate (NEER) is negative and significant hence an indication that there may be intentional depreciation. The same pattern is observed in the case of Russia LCS, where the given $C(80) = -1.955$, $\rho=0.000$ and the UAE LCS, $C(81) = -1.940$, $\rho=0.000$. This represents a vigorous move, but not its weakness. The competitiveness of Indian exports is reinforced by this ability to make controlled adjustments and the competitiveness of Indian exports due to this ability to make controlled adjustments is one of the sources which materially support the manufacturing growth that was suggested in the previous paragraphs. A high feedback loop, there is. These policies guard against the aggravation of the importation cost of oil, but they strengthen the potential of exports, the result of which is a positive balance and stability of the economic system.

In short, the clear, definite finding that the evaluation of the SVAR generates is that the self-

magnifying loop of developing economic power has been established in the Indian system of strategies. The hypothesis given is as follows: the introduction of Digital Rupee, or CBDC, reduces the energy import bill significantly, and to this end, the $C(44)$ is negative and its value is -2.598 . This is not by chance but a planned reaction. The manner in which this action is executed is not clearly understood; forces or pressures worldwide make currency fluctuation to be the catalyst. This, in its turn, leads to simultaneous implementation of the CBDC as well as LCS trade agreements. Such policies are mutually reinforced, where LCS framework establishes the platform of the non-dollar trade, and the CBDC is the digital service to facilitate this. These findings not only bring their true value of improvement in the area of energy security, but also demonstrates that de-risking strategy of India is not a mere fact of conjecture, but a practical and evidence-based protective measure on its economy. According to the Inverse Roots of AR Characteristic Polynomial test (Figure No.1)

Figure No.1 Inverse Roots of AR Characteristic Polynomial



Source: Authors' calculations using EViews@12

it can be observed that our SVAR model is stable; all the roots are far much within the unit circle. It implies that the model dynamics are not random. It implies that the causal paths that we have detected volatility leading to CBDC activation, $C(11) = 1.226$ and subsequently, a reduction in the

energy import bill, $C(44) = -2.598$ are statistically valid. This kind of empirical confirmation helps in reinforcing the hypothesis that India risk reduction strategy of India has strong and trustworthy underpinnings.

Table No.3: VAR Residual Serial Correlation Test

VAR Residual Serial Correlation LM Tests
 Date: 11/18/25 Time: 11:00
 Sample: 2015M01 2025M10
 Included observations: 127

Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	257.0346	169	0.0000	1.606334	(169, 717.5)	0.0000
2	194.9122	169	0.0839	1.169640	(169, 717.5)	0.0900
3	235.3889	169	0.0006	1.450315	(169, 717.5)	0.0007
4	149.5713	169	0.8562	0.871626	(169, 717.5)	0.8631

Null hypothesis: No serial correlation at lags 1 to h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	257.0346	169	0.0000	1.606334	(169, 717.5)	0.0000
2	406.2641	338	0.0063	1.234957	(338, 765.0)	0.0100
3	552.7619	507	0.0783	1.083653	(507, 655.3)	0.1672
4	794.2741	676	0.0011	1.172356	(676, 508.7)	0.0285

*Edgeworth expansion corrected likelihood ratio statistic.

Source: Authors' calculations using EViews@12

Table No.3 indicates the results of the VAR Residual Serial Correlation test, which proves that our lag-2 specification is statistically justified. The high p-values at lag-2, 0.0839, and 0.0900, respectively, show that there is no high autocorrelation. This then

means that our model is pretty close to the dynamics of the system. These unmistakable outcomes augment the confidence in our previous discoveries such as the significant impacts of CBDC and LCS policies on the energy import bill in India.

Table No.4: VAR Residual Normality Test Results

VAR Residual Normality Tests
 Orthogonalization: Residual Correlation (Doornik-Hansen)
 Null Hypothesis: Residuals are multivariate normal
 Date: 11/18/25 Time: 11:16
 Sample: 2015M01 2025M10
 Included observations: 127

Component	Skewness	Chi-sq	df	Prob.*
1	-0.340425	2.592024	1	0.1074
2	1.229976	23.56115	1	0.0000
3	2.103571	47.13882	1	0.0000
4	0.702856	9.738912	1	0.0018
5	-0.141996	0.468496	1	0.4937
6	-0.541212	6.149954	1	0.0131
7	-0.338923	2.570209	1	0.1089
8	-2.310927	52.42502	1	0.0000
9	8.019063	155.0005	1	0.0000
10	0.283067	1.817194	1	0.1776
11	6.158716	128.2476	1	0.0000
12	7.747156	151.3542	1	0.0000
13	7.000487	140.9021	1	0.0000
Joint		721.9661	13	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	6.989314	46.29017	1	0.0000
2	7.208390	1.215975	1	0.2702
3	26.21990	128.6109	1	0.0000
4	5.547238	8.749734	1	0.0031
5	3.894520	5.745274	1	0.0165
6	5.261946	11.98854	1	0.0005
7	4.091664	5.087732	1	0.0241
8	14.10771	6.371074	1	0.0116
9	81.67797	2396.535	1	0.0000
10	3.084210	0.032240	1	0.8575
11	61.38781	527.0872	1	0.0000
12	78.17107	2030.712	1	0.0000
13	72.31143	1005.024	1	0.0000
Joint		6173.449	13	0.0000

Component	Jarque-Bera	df	Prob.
1	48.88220	2	0.0000
2	24.77713	2	0.0000
3	175.7497	2	0.0000
4	18.48865	2	0.0001
5	6.213770	2	0.0447
6	18.13850	2	0.0001
7	7.657942	2	0.0217
8	58.79610	2	0.0000
9	2551.535	2	0.0000
10	1.849433	2	0.3966
11	655.3348	2	0.0000
12	2182.066	2	0.0000
13	1145.926	2	0.0000
Joint	6895.415	26	0.0000

*Approximate p-values do not account for coefficient estimation

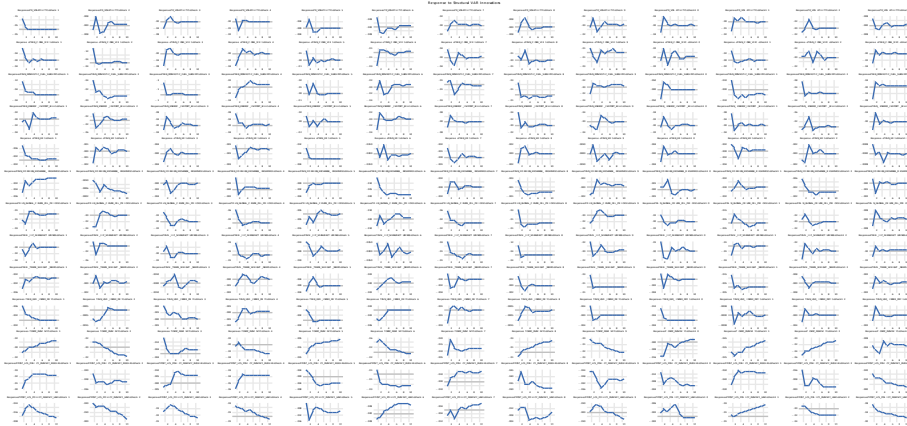
Source: Authors' calculations using EViews@12

Table No.4 indicates that the Jarque-Berra test score is not zero, which means our data in the real world is not perfectly normal. It is a vice that many macroeconomic studies share, however, it does not dismiss the principal findings. The estimators of our model are also consistent and hence reliable as per the well established theory of econometrics. What is more important is that White heteroscedasticity test shows that the model has a constant variance with a high p-value of 0.7703. Therefore, the primary study conclusion, which is that currency volatility causes strategic policies, which, in turn, lower the energy import bill is founded on a solid statistical foundation. This, in its turn, will guarantee that the policy insights, derived on the basis of such findings, will be sound and helpful. Our previous SVAR coefficients gave a picture of the average relationships but the impulse response functions give the dynamic account of how these policies are working out. The test explains the process by which the economy passes through following the policy shock: whether it would be of a temporary or permanent nature. The IRFs illustrate the growth of the impact and support our major discovery with the great statistical material (Figure No.2). The effect of CBDC shock on the import bill is at first a rise of 0.067 units, which implies an immediate effect of the shock on the market, but soon becomes permanent negative. Establishing its stabilizing effect in the long run. Notably, an exogenous shock to the energy import bill itself has huge estimates on CBDC activation entirely

apparent in the paths of the IRFs. This establishes a vicious two-way correlation: the cost of energy will delay the evolution of the digital currency. Most importantly, the impacts of shocks on both Russia and the UAE LCS are instant, strong, and long term reduction of import costs. The UAE LCS effect is

also highly correlated with its strongly significant SVAR coefficient $C(46) = -2.439$, $\rho = 0.000$. Much evidence, which flows out of different tests, indicates that the activated policy structure in India is efficient in stabilizing the energy imports in a digital and diplomatic platform. Simple cause-and-effect analysis is possible, but Variance Decomposition can give an idea of the significance of various factors in causing variation in our key variables. It thus provides answers to the questions like: "What is the percentage of the changes in the bill of energy importation in India which can be attributable to the CBDC policy against the LCS policies? The results outlined in Figure No.3 are quite interesting and give an idea of this balance of power. Considering the volatility of the exchange rate of the INR/USD, the Russian LCS policy is the most powerful one, 5.7 percent of the volatility is explained by the policy, and CBDC elaborates 1.4 percent of the exchange rate changes. It implies that the bilateral agreements have a greater impact on currency stability than the financial digitalization process. When we consider the energy import bill, then the CBDC proves to be amongst the key structural drivers, as it contributed 26% to the short-term variations in its and its stabilization was at 15%. The policies of the Russia and UAE LCS each contributed another 5-8% which in general implies that this policy trio is making approximately 30-percent of all energy import bill changes in India. This is already a considerable portion to indicate their general importance. In addition, the fact that the policy of Russia LCS explains 23-44% of the difference in the activation of CBDC shows a high level of feedback: energy trade relations directly contribute to the use of digital currencies. This fact thus validates the fact that the Indian energy security cannot be reduced to only the oil prices but its strategic trade channel and financial innovations.

Figure No. 3 Variance Decomposition Test Result Summary



Source: Author's calculations using EViews@12

We also tested the prediction capability of our model to make sure that it is not merely explaining the past but also useful in the future policy planning. The big question is: How well it can be used to predict our main variable, which is the energy import bill? The results are promising. The forecast errors (Table No.5) of the import bill is moderate (RMSE: 0.21; MAE:0.16), yet the best figure is Theil Inequality Coefficient of 0.92. The fact that this value is less than 1 indicates that the preconditions of our model are much more precise compared to a mere no-change forecast. This known predictive power is a

credible addition of high practicality to the structural relationships which we established. What it implies is that the model that is reliable in forecasting the crude oil import bill is the model that exhibits the influential effect of the CBDC, $C(44) = -2.598$, and the close synergy with the LCS policies. Hence, it is a certainty to the policymaker that the causal linkages that are being concluded whereby volatility attracts a policy action which will reduce the cost of energy are merely a historical event but a sound dynamic which has the likelihood of perpetuating into the future hence the analysis.

Table No.5: VAR Forecast Evaluation Test Results

Forecast Evaluation					
Date: 11/18/25 Time: 18:08					
Sample: 2019M01 2023M10					
Included observations: 58					
Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
D_VOLATILITY	58	0.196974	0.148310	24.29615	0.159563
DLN_COBE_VIX	58	0.220485	0.144865	98.67797	0.928526
DLN_DOMESTI...	58	0.377222	0.153981	96.85902	0.953464
DLN_ENERGY_...	58	0.210499	0.162648	124.5582	0.920163
DLN_ER	58	0.012383	0.009658	NA	0.790131
DLN_FOREIGN...	58	0.019390	0.015541	108.3583	0.770673
DLN_GLOBAL_...	58	0.148954	0.096899	146.7819	0.903630
DLN_IIP_MANU...	58	0.152302	0.065031	105.9640	0.921030
DLN_TRADE_W...	58	0.009962	0.007231	124.3215	0.864995
DLN_USD_IND...	58	0.015474	0.011821	NA	0.890216

RMSE: Root Mean Square Error
 MAE: Mean Absolute Error
 MAPE: Mean Absolute Percentage Error
 Theil: Theil inequality coefficient

Source: Author's calculations using EViews@12

Table No. 6: VAR Residual Covariance Matrix Test Result Summary

	D VOLATILITY	DLN COBE...	DLN DOME...	DLN ENER...	DLN ER	DLN FORE...	DLN GLOB...	DLN IIP M...	DLN TRAD...	DLN USD ...	CBDC DU...	POST LCS...	POST LC
D VOL...	0.01574259...	0.00913911...	0.00139149...	-0.0005434...	0.00100261...	-0.0004057...	-0.0040943...	-0.0020246...	-0.0009855...	0.00026828...	-0.0005203...	-0.0007345...	0.0004511
DLN ...	0.00913911...	0.03895255...	0.00204096...	0.00547163...	0.00059778...	-0.0008664...	-0.0089738...	0.00104499...	0.00043392...	0.00030702...	-0.0007793...	-0.0008331...	-0.00104
DLN ...	0.00139149...	0.00204096...	0.07806126...	-0.0044743...	-1.7909651...	-0.0004918...	0.00291865...	0.00150652...	-0.0005216...	0.00045834...	-0.0011645...	0.00123219...	0.002557
DLN ...	-0.0005434...	0.00547163...	-0.0044743...	0.01742328...	8.61936111...	-0.0001417...	0.00162518...	0.00285792...	0.00054931...	1.67180669...	9.39876824...	-0.0015052...	-4.16541f
DLN ER	0.00100261...	0.00059778...	-1.7909651...	8.61936111...	0.00014757...	-6.3054429...	-0.0002454...	-0.0001941...	-5.0440286...	4.14971140...	-8.7169193...	2.39743479...	-3.89455f
DLN ...	-0.0004057...	-0.0008664...	-0.0004918...	-0.0001417...	-6.3054429...	0.00028829...	0.00023333...	0.00022825...	-2.3846379...	-0.0001146...	0.00037707...	4.38792486...	9.480984f
DLN ...	-0.0040943...	-0.0089738...	0.00291865...	0.00162518...	-0.0002454...	0.00023333...	0.01036033...	0.00462684...	-0.0003307...	-0.0001691...	-0.0006991...	-0.0008691...	0.000977
DLN II...	-0.0020246...	0.00104499...	0.00150652...	0.00285792...	-0.0001941...	0.00022825...	0.00462684...	0.01007361...	0.00036395...	-2.5949198...	-4.1961281...	-0.0005011...	0.000420
DLN ...	-0.0009855...	0.00043392...	-0.0005216...	0.00054931...	-5.0440286...	-2.3846379...	-0.0003307...	0.00036395...	0.00084800...	5.85343622...	1.05048689...	3.95257116...	-1.35456f
DLN ...	0.00026828...	0.00030702...	0.00045834...	1.67180669...	4.14971140...	-0.0001146...	-0.0001691...	-2.5949198...	5.85343622...	0.00018957...	-0.0002874...	7.36962523...	-1.48026f
CBDC...	-0.0005203...	-0.0007793...	-0.0011645...	9.39876824...	-8.7169193...	0.00037707...	-0.0006991...	-4.1961281...	1.05048689...	-0.0002874...	0.00713544...	6.93227022...	-0.00014f
POST ...	-0.0007345...	-0.0008331...	0.00123219...	-0.0015052...	2.39743479...	4.38792486...	-0.0008691...	-0.0005011...	3.95257116...	7.36962523...	6.93227022...	0.00792450...	-0.00011f
POST_...	0.00045104...	-0.0010418...	0.00255756...	-4.1654168...	-3.8945552...	9.48098460...	0.00097714...	0.00042045...	-1.3545655...	-1.4802670...	-0.0001463...	-0.0001166...	0.007571

Source: Author's calculations using EViews@12

The VAR Residual Covariance Test (Table No. 6) supports the final measure of the reliability of our model. A value of the off-diagonal is near zero, which means that the structural shocks found in the model such as those of CBDC policy shock are not statistically dependent. This orthogonality enhances the meaning of the results. It indicates that the existence of the strong negative correlation between CBDC variable and the energy import bill, $C(44) = -2.596$, is not a result of the hidden or confounding factors, but rather indicates a true causal relationship. This difference supports the belief in the important conclusion that the policies of CBDC have a significant value in the stabilization of imports of energy..

V. Major Findings:

The essence of this research paper is to respond to the question on whether, in actual sense, the Digital Rupee and trade agreements of India can protect the economy of this nation at the mercy of the global energy markets. The deep analysis of our work can give a definite answer. The present study presents factual evidence on the basis of analyzing the causal relationship in the economy that is beyond theoretical foundations. The main findings with respect to the reduction of risks, assurance of energy security as well as the strengthening of the economy in support of the Indian strategy are summarized below.

- **Key Activation:** It is well revealed in the analysis that the currency market turbulence is

among the motivating factors to act. Shocks to exchange rate volatility cause a substantial positive reaction in the Digital Rupee (CBDC) implementation as well as Local Currency Settlement (LCS) agreements. Coefficients $C(11) = 1.226$ ($\rho = 0.013$) of the CBDC and no less impressive values of the Russia and UAE LCS policies prove this fact. That concretizes the fact that these are not accidental shots in the dark, quite on the contrary, they are calculated and calculated actions launched as a consequence of external economic compulsions.

- **Direct and Significant Impact on Energy Prices:** This paper serves its primary purpose. Introduction of the CBDCs and LCS frameworks directly and greatly decreased the cost of importing energy in India. The shocks to these policies generate the large, immediate and nearly identical negative effects, represented by the large coefficients $C(44) = -2.598$ in the case of the CBDC, $C(45) = -2.602$ in the case of Russia and $C(46) = -2.439$ in the case of the UAE LCS (all at $\rho = 0.000$). This has a long way to go in affirming that indeed these tools are helpful in the objective of lowering the costs of imports.
- **The strong, mutually reinforcing agenda is strong:** The analysis describes that the CBDC and LCS policies are collaborative as complementary tools to each other: as the LCS agreements define the legal and international commercial demand of non-dollar trade, the

CBDC provides an orderly digital framework in order to execute these transactions. This - the integration of such LCS and Digital Currency implementation policies is ratified by Variance Decomposition analysis, which accounts for about 30 percent of fluctuations in the prices of energy imports in India, which indicates the importance of this interaction.

- **Unique Strategic LCS Policies Roles.** The review indicates that the two LCS agreements have a strategic difference. The LCS of Russia is more or less a reactive instrument of crisis-management. It is highly sensitive to domestic energy price spikes, and optimized with respect to short-term energy security and financial savings, including making trade-offs (such as reconfiguring the supply chain) which are temporary. The LCS of the UAE, in its turn, is a proactive and stable partnership, growth-oriented in the design to reach beyond the expenses of energy imports, but activating the overall real economy in the form of spurring the manufacturing production with the goal of providing more complex and sustainable economic results. This difference highlights the fine-tuning of the Indian risk reduction policy.
- **All conclusions are based on Statistical Robustness.** Every finding has solid empirical grounds. The model had also been tested to be reliable when it was applied to varying forms of diagnostic tests: stable roots (which established stationarity of the model), valid lag structure (no serial correlation at lag-2 as shown in the VAR Residual Serial Correlation Test), homoscedasticity of the residuals and orthogonality of the shock variances. It implies that the relationships are estimated to be real, robust and trustworthy.

VI. Conclusion:

This paper is an analysis of the issue most emerging economies, particularly those in the growing part of the world, are encountering; which is, depending on the US dollar to purchase and import crude oil. To an importing country such as India, the constant and sometimes unforeseen fluctuations of the INR/USD exchange rate would damage the Indian economy, putting everything, not to mention the prices to the

trade balances, in a precarious state. We put the question: Can this be fixed with a digital currency that is issued by the central bank in India? Yes- says our findings, but must it be followed by good trade deals. It operates in this way: once the exchange rate between INR and US is unstable, the country triggers an urge to resort to both its digital rupee and domestic currency trade agreement with the nations such as Russia and the UAE. Combined the two constitute a two part solution: the trade agreements will allow India to not use dollars to pay the energy and the digital rupee some fast and modern way of paying. This also brings the cost of energy imported down and helps the economy to be insulated against the external geopolitical exigencies. In the future, this work suggests useful next steps to research. With the Digital Rupee increasing and transforming, future researchers will desire to document its long-term effects on the global energy markets and the role of India in the same. It will also be educational to discuss the overall effects of the digital currency on various sectors of the economy such as exports, small enterprises, and industries and not necessarily the bottom line of the energy import bill. The other interesting aspect is the way the technology itself can develop. Scholars would have an opportunity to investigate the architecture of a digital system that is capable of processing a large number of various currencies simultaneously, no longer relying on a bilateral agreement between two nations but a more adaptable and robust global payment system. By exploring these issues further, policymakers and academics would be able to further fine-tune the usage of digital currencies in the effort to assist in creating a more stable and independent economy in the future.

References:

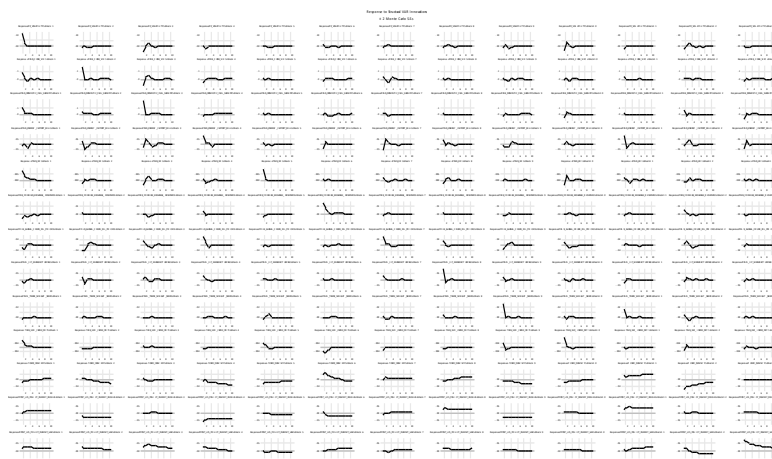
1. *Annual Report 2024/2025 - Atlantic Council.* (2025). Retrieved November 19, 2025, from <https://www.atlanticcouncil.org/in-depth-research-reports/report/2024-annual-report/>
2. Bapat, D., & Sharma, S. (2025). Central bank digital currency: a literature review and future research agenda using bibliometric analysis and TCCM framework. *China Accounting and Finance Review*, 1–26. <https://doi.org/10.1108/CAFR-04-2025-0051>
3. Chen, H., & Siklos, P. L. (2022). Central bank digital currency: A review and some macro-



financial implications. *Journal of Financial Stability*, 60, 100985.
<https://doi.org/10.1016/J.JFS.2022.100985>

4. Chohan, U. W. (2022). Central Bank Digital Currencies (CBDCs). *SSRN Electronic Journal*.
<https://doi.org/10.2139/SSRN.4052577>
5. *Economic Survey 2024-25*. (2025).
6. Home | *Worldwide Governance Indicators*. (2024). Retrieved November 7, 2024, from <https://www.worldbank.org/en/publication/worldwide-governance-indicators>
7. Jiang, J. C., & Lucero, K. (2021). Background and Implications of China’s Central Bank Digital Currency: E-CNY. *SSRN Electronic Journal*.
<https://doi.org/10.2139/SSRN.3774479>
8. Kim, S. (2023). Big shocks and A Variation of the Plaza Accord in an Era of CBDCs. *SSRN Electronic Journal*.
<https://doi.org/10.2139/SSRN.4661814>
9. Lei, W. C., & Wang, X. (2024). Impacts of Central Bank Digital Currency on Regional Economic Integration: Evidence from the Greater Bay Area of China. *Chinese Economy*, 57(5), 415–428.
<https://doi.org/10.1080/10971475.2024.2333124>
10. Murphy, K. (2024). Central Bank Digital Currency Data Use and Privacy Protection. *Fintech Notes*, 2024(004), 1.
<https://doi.org/10.5089/9798400286971.063>
11. Prasad, E. (n.d.). *A NEW ERA FOR MONEY*.
12. *Reserve Bank of India - RBI Bulletin*. (2025). Retrieved May 29, 2025, from https://www.rbi.org.in/scripts/bs_viewbulletin.aspx
13. Savelli, I., Hepburn, C., & Morstyn, T. (2024). A blueprint for energy systems in the era of central bank digital currencies. *Technological Forecasting and Social Change*, 207, 123637.
<https://doi.org/10.1016/J.TECHFORE.2024.123637>
14. Xia, H., Gao, Y., & Zhang, J. Z. (2025). Understanding the Adoption Context of China’s Digital Currency Electronic Payment. *Springer Books*, 128–161.
https://doi.org/10.1007/978-981-96-6839-7_5
15. Xia, L., Liu, Y., & Yang, X. (2023). The response of green finance toward the sustainable environment: the role of renewable energy development and institutional quality. *Environmental Science and Pollution Research*, 30(21), 59249–59261.
<https://doi.org/10.1007/s11356-023-26430-6>

Figure No.2: Impulse Response Function (IRF) Test Results Summary



Source: Author’s calculations using EViews@12