How does the Adoption of CBDCs impact a country's Banking stability?

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May 20, 2025

Abstract:

This study examines the impact of Central Bank Digital Currency (CBDC) adoption on bank stability, with a focus on how this effect varies by economic development. Using central bank data from 2010 to 2021 and bank liquidity ratios as the primary measure of stability, the results show that CBDC adoption generally enhances banking stability in low-income countries but has diminishing benefits as GDP per capita increases. These findings suggest that while CBDCs can support financial resilience in emerging economies, their effect is less pronounced in advanced economies. Robustness checks using Bank Z-score yield mixed results, underscoring the need for further analysis of CBDC design and long-term impacts.

1. Introduction:

There is a growing interest in adopting Central Bank Digital Currencies with more and more countries researching CBDCs, adopting pilot programs and even some officially launching CBDCs. With growing interest in CBDC adoption it is important to understand the effects that CBDCs could potentially have on the financial and banking stability of countries and whether certain countries could benefit more than others from CBDC adoption. CBDCs are a newer technology and so research on their potential impact remains limited. Most existing studies analyze commercial bank data to assess the potential impacts of CBDCs on the banking system. However, by focusing on central banks we can get a broad understanding of how CBDCs can affect financial stability at the country level and also analyze the effects on bank liquidity. Bank liquidity is a critical component of financial stability. It represents a bank's ability to meet its short-term obligations and withstand unexpected financial shocks. A more liquid banking sector is generally seen as more stable since it is better equipped to handle withdrawals and credit demands during economic downturns. This research measures bank stability through the Bank Liquid Reserves to Bank Assets Ratio, which is the proportion of bank assets that are held in cash or easily liquidated funds. The higher the ratio, the more the liquidity and hence the greater the stability. An important aspect to explore is whether the effect of CBDC adoption differs depending on a country's income level or economic development classification. It is possible that lower-income or developing countries may experience stronger benefits to banking stability from adopting CBDCs, while higher-income or developed countries may see more limited gains. This paper explores this question and provides insight into how CBDCs impact banking stability across different levels of economic development among other things.

2. Literature Review:

Previous research on CBDCs and financial stability has revealed varied impacts based on economic conditions and specific stability indicators. Hiep Ngoc Luu, Canh Phuc Nguyen, and Muhammad Ali Nasir (2023) analyzed commercial banks' data for 86 countries and 1,176 banks over the period from 2010 to 2021. Bank stability was primarily measured using the Bank Z-score, which detects insolvency risk. The researchers found that the use of CBDC enhances financial stability, with larger banks reaping more advantages than smaller banks. Interestingly, findings indicated there existed a divergence between developing and advanced countries. In advanced economies, the use of CBDC did not achieve statistically significant improvements in financial stability, whereas for developing economies, it was positive and significant. This means that the developing economies reap more stability advantages from the utilization of CBDCs compared to their developed counterparts.

Nguyen, Nguyen, and Duong (2023) also conducted the research by examining the impact of CBDC adoption on bank liquidity risk using a sample of 804 listed commercial banks in 47 countries over the same period. They applied the Financial Gap Ratio in their research to measure liquidity risk and discovered that CBDC adoption increases bank liquidity risk. The reason for this increased risk is that banks' core deposits reduce as their customers shift their funds into CBDC holdings. This finding refutes the assumption that CBDCs in all situations are preferable for financial stability, unveiling that the form and operation of CBDCs can be destabilizing influences on traditional deposit bases

Furthermore, the study conducted robustness tests with alternative measures of liquidity risk, including the Bank Liquidity Creation measure, and consistently found that CBDC adoption exacerbates liquidity strains. They also noted that the effect is economically significant;

transitioning to the next level of CBDC adoption is associated with a 1.4% increase in the bank financing gap on average.

While the previous studies focused primarily on liquidity and stability metrics, the current research extends this analysis by incorporating central bank data and specifically targeting bank liquidity as a measure of stability. The current study also aims to cut deeper into economic development's role, addressing how CBDC adoption interfaces with banking stability under varying phases of the economy. he inclusion of data at the central bank level allows for more precise examination of liquidity variations and provides a broader perspective of systemic risk beyond the commercial banking system.

Generally, the literature indicates that CBDC implementation has various impacts on banking stability. In developing economies it appears to favor stability measures such as the Z-score, while in developed economies its impact is weaker in general. Conversely, the increase in bank liquidity risk documented by Nguyen, Nguyen, and Duong (2023) is enough to raise questions about the ability of the traditional banking model to hold deposits within a CBDC-based financial system. The conflicting findings highlight the importance of economic context and the specific design of CBDC implementations in determining their influence on financial stability.

3. Data:

Most of the data for this study will be coming from the World Bank, coming from multiple databases such as World Development Indicators, International Financial Statistics from 2010-2021 with some variables up to 2023. This includes GDP per capita, Internet Use %, Deposit Money Banks' Assts to GDP % Unemployment % and other control variables. Information on the adoption level of central bank digital currencies across countries was manually derived from the CBDC Tracker by the Atlantic council.

The main variable of interest CBDC Adoption categorizes the current level of CBDC adoption of a country.

Cancelled: Countries who have abandoned/cancelled a CDC project

Research: Countries who have released formal reports and studied CBDCs

Development: Countries that have advanced research and small-scale pilot developments

Pilot: for countries piloting CBDCs in small initiatives for domestic or cross-border usage

Launched: Countries who have officially launched a CBDC.

These categories will be represented as in index (0-4) representing the level of CBDC adoption. 0 will be cancelled/no adoption, 1 represents research level, 2 represents development, 3 represents CBDC pilot programs, 4 represents a fully launched CBDC.

The CBDC Adoption variable was made to be time varying from 2010 to 2021 based on the announcement year of the CBDC project. Before the announcement year, countries are classified as “No Adoption” and after the announcement they transition into their respective stage of adoption.

Bank stability is measured through Bank Liquidity (%), specifically the Bank Liquid Reserves to Bank Assets Ratio. This ratio indicates the proportion of a bank's assets in liquid form, such as cash or assets that are easily liquefied. It is a key indicator of the ability of a bank to survive financial stress, meet withdrawal requirements, and hold up against an economic downturn. In essence, strong liquidity indicates stronger financial stability since banks with more liquid buffers are better positioned to be capable of withstanding shocks and preventing contagion in the financial system.

For added Robustness Bank Z-Score is used as an additional measure of stability. Bank Z-score measures the banks distance to insolvency combining profitability, leverage and volatility to

valuate risk of failure. Bank Z-score is calculated as Return on Assets + Equity/Assets all over the standard deviation of return on assets.

To account for other factors that could affect bank stability and to reduce omitted variable bias, several control variables are included.

GDP per Capita: represents the economic development of a country and is measured in 2015 USD.

Internet Use (%): Measures the proportion of the population connected to the internet, can be used as a proxy for digital infrastructure.

Unemployment Rate: Shows the labor market conditions measuring the level of unemployment in a country.

Bank Deposits to GDP (%): This represents the total value of demand, time and saving deposits at domestic deposit money banks as a share of GDP. It indicated how much of the economy's financial resources are held in bank deposits. A higher value could potentially suggest a deeper financial intermediation.

Deposit Money Banks' Assets to GDP (%): This measures the total assets held by deposit money banks as a percentage of GDP. Unlike the Deposit to GDP ratio this includes not just deposits but also loans and investments held by banks. It reflects the overall size and reach of the banking sector thus it can be used as a proxy for size of a country's banking sector.

Central Bank Assets to GDP (%): This ratio measures the total assets held by central banks as a share of GDP, which includes claims on the nonfinancial domestic sector. It essentially measures the extent of central bank influence in the economy.

4. Descriptive Statistics:

Table 1: Summary Statistics

Summary Statistics					
Statistic	N	Mean	St. Dev.	Min	Max
Bank Liquidity %	836	20.73	18.25	0.20	162.23
Unemployment %	836	7.05	4.92	0.10	28.14
Internet Users %	836	52.67	28.59	1.28	100.00
GDP Per Capita	836	14,663.39	19,535.68	422.92	98,998.26
Deposit Money Bank Assets to GDP %	836	57.65	51.85	11.30	415.75
Deposit to GDP %	836	68.21	48.35	7.77	283.91
Bank Zscore	836	18.08	9.95	1.11	56.05
Central Bank Assets to GDP %	779	5.55	9.96	0.0000	92.24
Announcement Year	836	2,020.38	2.03	2,014	2,024

5. Methodology:

To analyze the effect CBDC adoption has on bank liquidity the following baseline regression is used:

- $Bank\ Liquidity\ \%_{it} = \beta_0 + \beta_1 CBDC\ Adoption_{it} + \beta_x Control\ Variables_{it} + \alpha_i + \lambda_t + u_{it}$

Bank Liquidity will be the main measurement of bank stability and CBDC adoption is the main categorial level measuring the level of CBDC adoption in a country. Control variables include various banking and macroeconomic factors. i represents the country, and t represents the year. Both entity and time fixed effects will be used, for both models and robust standard errors are used accounting for heteroskedasticity.

6. Empirical Results:

6.1: Time and Country Fixed Effect Results

To analyze the effect of CBDC adoption on bank stability while controlling for both country-specific and global time-specific shocks, a fixed-effects regression model with time and country fixed effects is employed with robust standard errors. The results are shown in Table 2 for

four specifications, each adding more control variables progressively and including an interaction term in the fourth regression.

Table 2: Fixed-Effects Regression Results with Robust Standard Errors

Fixed-Effects Regression Results with Robust Standard Errors

	Dependent variable:			
	Bank Liquidity (%)			
	(1)	(2)	(3)	(4)
CBDC Adoption	1.688**	1.380**	0.657	2.080**
	(0.671)	(0.693)	(0.634)	(0.860)
GDP Per Capita	0.0001*	-0.0003	-0.001***	-0.001***
	(0.0001)	(0.0004)	(0.0004)	(0.0004)
CBDC Adoption:GDP Per Capita				-0.0001**
				(0.00003)
Deposit Money Bank Assets to GDP %		-0.166***	-0.468***	-0.468***
		(0.049)	(0.110)	(0.109)
Central Bank Assets to GDP %		0.248	-0.0004	-0.008
		(0.196)	(0.187)	(0.185)
Bank Deposit to GDP %			0.581***	0.600***
			(0.180)	(0.184)
Unemployment %			-0.484	-0.508
			(0.585)	(0.586)
Internet Users %			-0.181*	-0.219**
			(0.101)	(0.110)
Observations	836	779	779	779
R^2	0.014	0.067	0.196	0.205
Adjusted R^2	-0.100	-0.047	0.093	0.103
F Statistic	5.470*** (df = 2; 748)	12.457*** (df = 4; 693)	24.029*** (df = 7; 690)	22.264*** (df = 8; 689)
Note:				*p**p***p<0.01

Robust standard errors in parentheses. *p<0.01.

The first two regressions include CBDC Adoption as the main independent variable along with initial control variables. The results indicate that CBDC adoption is positive and statistically significant in both models, suggesting that greater CBDC development is associated with stronger bank liquidity. As expected, the introduction of Deposit Money Bank Assets to GDP (%) and Central Bank Assets to GDP (%) reveals interesting patterns. Deposit Money Bank Assets to GDP (%) is negative and significant, indicating that as the size of deposit money banks relative to GDP grows, liquidity in the banking sector declines. This could be explained by riskier lending or weaker buffers of liquidity for bigger banking sectors. Central Bank Assets to GDP (%) is positive but not significant, meaning higher central bank holdings are not being significantly contributing to bank liquidity in the short term.

The third regression incorporates broader macroeconomic controls, like Internet Users (%), Unemployment Rate (%), and GDP per Capita. Here, adoption of CBDC is rendered insignificant upon the introduction of these introduced macroeconomic variables. This change in meaning suggests that the relationship between CBDC adoption and bank liquidity can be explained to some extent by more general economic conditions which were not captured in earlier models. The contrasting signs between Deposit Money Bank Assets to GDP (%) and Bank Deposit to GDP (%) are particularly noteworthy, Deposit Money Bank Assets to GDP (%) remains negative and significant, implying that as the size of the banking sector increases relative to GDP, bank liquidity diminishes. This may be due to a higher proportion of lending or riskier investments that draw down liquidity reserves. Bank Deposit to GDP (%) is positive and significant, indicating that deposits specifically contribute positively to bank liquidity. This is expected, as deposits are liquid liabilities that banks can readily access, in contrast to broader bank assets that may be tied up in

long-term loans or investments. This divergence highlights the difference between total banking sector assets, which may be illiquid, and accessible deposits that contribute directly to liquidity.

The fourth regression introduces an interaction term between CBDC adoption and GDP per Capita to investigate whether the effects of CBDC adoption on bank liquidity differ based on a country's economic development. The findings show CBDC Adoption regains positive and statistical significance, reinforcing the notion that CBDC development is associated with stronger bank liquidity, particularly in lower-income settings. The interaction term is negative and significant, indicating that the liquidity benefits of CBDC adoption diminish as GDP per capita increases. This supports the hypothesis that CBDC benefits are more pronounced in lower-income economies and tend to taper off in wealthier nations.

These findings are in line with previous research that found emerging economies benefit more from CBDC adoption, though they did so without testing an interaction term and instead split the sample by development level. This analysis confirms that the positive effects of CBDC adoption are conditional on a country's economic status, providing a more nuanced understanding than past literature. While the fixed-effects models in time and country do provide very robust evidence regarding the relationship between liquidity in banks and CBDC adoption, there are some drawbacks. All sorts of differences among digital infrastructure and regulation in different countries aren't fully taken in by this model. the Adjusted R squared is low with poor explanatory power. This might be either due to issues in sample sizes or heterogeneity that's not observed.
Overall, these results emphasize the conditional impact of bank liquidity's dependence on CBDC adoption, which is motivated by a country's income level. This relationship, as investigated through the interaction term, suggests that CBDC policies may require varying strategic considerations depending on national income levels.

Robustness Checks and Additional Analysis

6.2 Splitting Data into Emerging and Advanced Economies

In order to gain a better understanding of the impact of CBDC adoption on banking stability, the sample was split into two groups: Advanced Economies and Emerging/Developing Economies, based on the IMF classification in the World Economic Outlook database. This approach aims to capture potential differences in how CBDC adoption influences banking stability across varying stages of economic development. The models were estimated both with and without an interaction term between CBDC adoption and GDP per capita.

6.2.1 Without Interaction Term (Table 6.2: 1)

The first analysis runs separate fixed-effects regressions for advanced and emerging economies without the interaction term. The results reveal distinct differences: In Advanced Economies, CBDC adoption is negative and statistically significant, which suggests that CBDC adoption might be associated with reduced bank liquidity. The finding is contrary to the baseline model where CBDC adoption was always positive, meaning for the more developed banking systems, digital currencies may introduce inefficiencies or liquidity stresses. In Emerging/Developing Economies, CBDC adoption is positive, though not statistically significant at conventional levels. This is surprising given previous research (e.g., Luu et al., 2023) which found significant improvements in bank stability for emerging markets. One possible explanation is that the liquidity boost in these economies is not as immediate or is offset by macroeconomic instability not captured in the model.

Deposit Money Bank Assets to GDP (%) is negative and significant in emerging economies, consistent with previous findings that as banking sectors grow, liquidity buffers shrink. Bank Deposit to GDP (%) remains positive and significant in emerging markets, reinforcing the

idea that deposits are critical to bank liquidity in these economies. Interestingly, Unemployment Rate (%) is significant and negative only in advanced economies, suggesting that labor market health might influence banking liquidity differently depending on the stage of economic development.

6.2.2 With Interaction Term (Table 6.2: 2)

The second analysis introduces an interaction term between CBDC Adoption and GDP per Capita to test if the effect of CBDC adoption on bank liquidity is conditioned by economic development. In Advanced Economies, the effect of CBDC adoption turns insignificant, while the interaction term is also insignificant. This suggests that the liquidity drawbacks seen previously may be conditional on factors other than GDP per capita. In Emerging/Developing Economies, the story shifts: CBDC Adoption is positive and highly significant, while the interaction term is negative and significant. This reinforces findings from the previous regressions in section 6.1, indicating that CBDC adoption boosts liquidity in lower-income settings, but this benefit diminishes as income levels rise. These results align with previous studies (e.g., Luu et al., 2023), which reached the conclusion that emerging markets benefit more from the adoption of CBDC, although their specification did not include interaction terms. This study follows on from those findings by illustrating how the interaction with GDP per capita provides a richer description of CBDC's conditional benefits according to economic development

A consideration in interpreting these findings is the use of Deposit Money Bank Assets to GDP (%) as a measure of banking sector size. Here, it is consistently negative and significant in emerging and developed economies, indicating that as the banking sector expands in proportion to GDP, system liquidity decreases. This means that larger banking industries would engage in more substantial lending or riskier investments that charge liquidity reserves. These results differ

considerably from Luu et al. (2023), whose conclusion was that larger commercial banks were assisted more by the implementation of CBDC. One of the key differences is in data type used: Luu et al. worked with commercial bank data, which captures liquidity at the institutional level, whereas the present study employs macroeconomic-level central bank data. This broader scale may account for the observed liquidity stress since banking sectors grow as it captures the overall effects of sector-level lending practices and market exposures, as well as individual institutional activity. The discrepancy in findings signals the need to consider the level of analysis in gauging CBDC impacts. While as much as one commercial bank can utilize CBDCs to realize efficiency and liquidity gains, the overall banking system could experience reduced liquidity cushions as a consequence of higher lending and risk diversification across a larger economic base. This perspective casts more insight on the interaction of CBDC adoption with financial systems in emerging and advanced economies.

The split-sample regression implies that economic conditions do matter when interpreting CBDC effects: in advanced economies, liquidity risks could emerge even after CBDC introduction perhaps due to a shift in the deposit structure or digital payment preference. In developing economies, CBDCs appear to increase liquidity, yet this impact is diminished when incomes are higher.

6.3 Regressions with Bank Zscore as measurement of Bank Stability

To further confirm the strength of the key findings, the models were re-estimated with Bank Z-Score as the financial stability measure. The Z-Score is a common measure of a bank's insolvency risk, with higher Z-Score indicating higher stability. The analysis is conducted both for the full sample and by splitting the data into Advanced Economies and Emerging/Developing Economies.

The results of the full sample analysis (Table 6.3: 1) reveal that CBDC Adoption is statistically insignificant in all of them. This is opposite to the positive and significant results using Bank Liquidity (%). The insignificance shows that while CBDC adoption may have an impact on liquidity buffers, it does not appear to have an impact on the risk of insolvency in general as captured by the Z-Score. One possible reason is that liquidity improvements initiated by CBDCs may or may not affect capital adequacy and default risk, two key components of the Z-Score. Additionally, the adjusted R-squared values are negative across all regressions, indicating weak explanatory power. This can perhaps be due to the level of analysis difference—commercial bank data in past work (e.g., Luu et al., 2023) were significant, but macroeconomic central bank data here was not. This suggests that reforms at an institutional level can possibly be more closely captured through commercial bank data as opposed to macro-level indicators.

When splitting the data into Advanced Economies and Emerging/Developing Economies (Table 6.3: 2), the results diverge: For Advanced Economies, CBDC Adoption is statistically significant and positive, meaning greater stability. This is opposite to the liquidity analysis that found CBDC adoption led to liquidity decreases. This may be explained by greater digital transaction efficiency or better liquidity management in more developed economies. In Emerging/Developing Economies, CBDC Adoption remains insignificant, diverging from previous studies such as Luu et al. (2023), which found that CBDCs boosted stability. This difference could be due to the use of macroeconomic central bank data in this study versus commercial bank data in previous research. Central bank data may capture broader systemic effects that dampen observable stability improvements.

The findings show that CBDC adoption influences liquidity and solvency in a way that positive liquidity impacts are not necessarily accompanied by lower insolvency risk. This deviation

from previous research emphasizes the merit of understanding CBDC effects at different levels of the banking system. While commercial bank data offers institution-level benefits, central bank data shows macroeconomic forces, which may dampen observed stability impacts in emerging markets.

6.4 Regressions with CBDC as Dummy Variable

To further validate the robustness of the main findings, CBDC adoption was re-estimated using dummy variables to represent its stages instead of the index used in previous regressions. That is, Early Stage captures countries at the Research or Development stages of CBDC adoption, while Advanced Stage captures countries with Pilot or Launched CBDCs. The base category for reference is countries with No Adoption or Abandoned CBDC projects.

The overall results are shown in Regression 4 (Table 6.4), which includes an interaction term between the phases of CBDC adoption and GDP per capita to examine if the effect on bank liquidity varies with economic development. The results are more or less as consistent as with those in index-based regressions. Advanced Stage CBDC Adoption still remains positive and highly significant, indicating that countries initiating pilot or fully launching CBDC projects experience improved bank liquidity compared to non-adopting countries. This is consistent with the preliminary results in Section 6.2 and 6.1 where increased values of CBDC adoption provided more stability for banks. The Advanced Stage-GDP per Capita interaction term is negative and significant, indicating that the positive effect on bank liquidity falls with increased income levels for a particular country. This finding is consistent with earlier models, which again validate that low income countries benefit more from the application of CBDCs in terms of liquidity. For the Early Stage of adoption of CBDCs, the coefficients remain insignificant for all the regressions, indicating that early research and development phases do not yet emerge into detectable liquidity effects.

The similarity between the results using dummy variables and the index-based measure of CBDC adoption underscores the robustness of the findings. Regardless of the measurement of CBDC adoption, its positive effect on bank liquidity in remains evident, particularly for low-income nations. This strengthens the argument that the mechanism by which CBDCs enhance liquidity is consistent across different measurement methods.

7. Conclusion:

To conclude, this study finds that the economic development level of a nation is most crucial in determining whether central bank digital currency (CBDC) implementation bolsters or undermines financial stability. Based on the findings, the initial benefit of CBDC implementation is revealed to decrease with the increase in the GDP per capita of a nation. This supports the idea that CBDCs may be more beneficial to financial stability in developing and emerging economies than in advanced ones. This pattern aligns with earlier studies that found greater banking sector stability among developing economies that adopted CBDCs, while changes in bank stability among advanced economies could not be attributed to CBDC adoption.

One potential economic rationale for this finding is that emerging markets often have less mature financial infrastructures and less diversified banking sectors, making liquidity constraints more binding. In these settings, the liquidity buffer that CBDCs provide can add stability by reducing dependence on volatile short-term funding as well as by enhancing payment efficiencies. In contrast, advanced economies have more developed capital markets and diversified funding channels, making the liquidity gains from the implementation of CBDCs relatively marginal. In fact, the introduction of CBDCs in advanced markets might disrupt traditional deposit channels, generating liquidity risk instead of mitigating it.

However, this study departs from previous findings in several key ways. Earlier research often showed that larger commercial banks benefited more from CBDC implementation than smaller ones. In contrast, this paper finds that a larger banking sector, when measured at the macro level, is negatively associated with bank liquidity, suggesting that financial depth does not necessarily translate to higher stability. This difference could stem from the use of central bank data rather than commercial bank data, which may capture broader systemic effects rather than institution-specific outcomes. The other important characteristic of this study is the robustness of the results. By using both an index measure and dummy variables for CBDC adoption, the study consistently finds that greater levels of CBDC adoption are associated with improved bank liquidity in lower-income countries. Such similarity in findings with different measurement methods strengthens the case that the favorable effect of CBDCs on bank stability is particularly relevant to emerging markets. Furthermore, adding an interaction term between GDP per capita and the adoption of CBDCs—a factor not controlled for in previous studies—reveals that the favorable effect of CBDCs on liquidity is conditional on the country's income level.

The policy implications of these findings are significant. For developing and emerging economies, the results suggest that CBDCs would be an effective means to boost financial stability, where banking infrastructure is weak. Policymakers in these economies should include CBDC adoption in the overall financial inclusion and stability plan, while monitoring possible liquidity risks as the economy evolves. For advanced economies, the results highlight the need for caution. While CBDCs in their advanced stages may offer some stability benefits, the decline in return with rising income levels implies that the impact of CBDC adoption on liquidity will not be uniformly positive. Policymakers should exercise special vigilance in analyzing possible liquidity risks in large, advanced banking sectors before scaling up CBDC adoption.

Future studies could further investigate the mechanisms by which CBDCs influence bank liquidity and stability. One potential avenue is exploring the differences between wholesale and retail CBDC models, as the specific design choices may have varied effects on financial stability. Comparing commercial bank performance data with central bank data could shed light on the CBDCs' behavior across various parts of the financial system. Longitudinal studies that track CBDC effects over extended periods would also be valuable to understand the long-term impacts of digital currency adoption on banking stability. Furthermore, case studies focusing on countries that have recently launched or piloted CBDCs would help contextualize the quantitative findings with qualitative insights into policy implementation and regulatory responses.

Overall, the findings of this research highlight the importance of considering the economic progress of a nation while analyzing the potential benefits of CBDC adoption. As central banks and policymakers further explore digital money, being aware of the intricate effects on financial stability across different economic settings will be essential in making informed and effective policy design.

References:

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8. Appendix:

Table 6.1: Country Fixed effect model of section 6.1 regressions

Country Fixed-Effects Regression Results with Robust Standard Errors

	Dependent variable:			
	Bank Liquidity (%)			
	(1)	(2)	(3)	(4)
CBDC Adoption	1.946***	2.184***	1.538**	2.645***
	(0.484)	(0.478)	(0.644)	(0.975)
GDP Per Capita	0.0001	-0.0002	-0.001**	-0.001**
	(0.0001)	(0.0004)	(0.0004)	(0.0004)
CBDC Adoption:GDP Per Capita				-0.0001*
				(0.00003)
Deposit Money Bank Assets to GDP %		-0.139***	-0.462***	-0.461***
		(0.037)	(0.114)	(0.114)
Central Bank Assets to GDP %		0.256	0.001	-0.004
		(0.195)	(0.191)	(0.190)
Bank Deposit to GDP %			0.619***	0.636***
			(0.188)	(0.193)
Unemployment %			-0.420	-0.440
			(0.554)	(0.556)
Internet Users %			-0.037	-0.051
			(0.067)	(0.070)
Observations	836	779	779	779
R^2	0.024	0.071	0.187	0.193
Adjusted R^2	-0.074	-0.027	0.098	0.103
F Statistic	9.141*** (df = 2; 759)	13.387*** (df = 4; 704)	23.101*** (df = 7; 701)	20.880*** (df = 8; 700)
Note:				*p**p***p<0.01

Robust standard errors in parentheses. *p<0.01.

Table 6.2: 1

Fixed Effects Results by Economic Level No Interaction

	Dependent variable:	
	Bank Liquidity (%)	
	Advanced	Emerging/Developing
	(1)	(2)
CBDC Adoption	-2.793**	1.217
	(1.231)	(0.747)
GDP Per Capita	-0.003	-0.001***
	(0.002)	(0.0004)
Deposit Money Bank Assets to GDP %	-0.111	-0.541***
	(0.116)	(0.162)
Bank deposit to GDP %	0.184	0.764***
	(0.134)	(0.247)
Central Bank Assets to GDP %	0.110	-0.091
	(0.146)	(0.330)
Unemployment %	-3.999**	-0.197
	(1.846)	(0.538)
Internet Users %	-0.030	-0.200
	(0.126)	(0.122)
Observations	120	659
R^2	0.572	0.173
Adjusted R^2	0.440	0.063
F Statistic	17.366*** (df = 7; 91)	17.304*** (df = 7; 581)
Note:		*p**p***p<0.01
	Robust standard errors in parentheses. *p<0.01.	

Table 6.2: 2

Fixed Effects Results by Economic Level With Interaction

	Dependent variable:	
	Bank Liquidity (%)	
	Advanced	Emerging/Developing
	(1)	(2)
CBDC Adoption	-3.218	3.083***
	(2.710)	(1.178)
GDP Per Capita	-0.003	-0.001***
	(0.002)	(0.0004)
CBDC Adoption:GDP Per Capita	0.00001	-0.0001**
	(0.00004)	(0.0001)
Deposit Money Bank Assets to GDP %	-0.112	-0.552***
	(0.115)	(0.164)
Bank Deposit to GDP %	0.188	0.792***
	(0.137)	(0.252)
Central Bank Assets to GDP %	0.110	-0.105
	(0.147)	(0.325)
Unemployment %	-4.024**	-0.260
	(1.928)	(0.546)
Internet Users %	-0.021	-0.207*
	(0.136)	(0.121)
Observations	120	659
R^2	0.572	0.182
Adjusted R^2	0.434	0.072
F Statistic	15.039*** (df = 8; 90)	16.091*** (df = 8; 580)
Note:		*p**p***p<0.01
	Robust standard errors in parentheses. *p<0.01.	

Table 6.3: 1

Bank Zscore Fixed-Effects Regression Results with RSE

	Dependent variable:			
	Bank Zscore			
	(1)	(2)	(3)	(4)
CBDC Adoption	0.070	0.048	0.060	-0.106
	(0.194)	(0.163)	(0.159)	(0.251)
GDP Per Capita	0.0001	0.0002	0.0002*	0.0002*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
CBDC Adoption:GDP Per Capita				0.00001
				(0.00001)
Deposit Money Bank Assets to GDP %		-0.016	-0.005	-0.005
		(0.011)	(0.017)	(0.017)
Central Bank Assets to GDP %		0.007	0.012	0.013
		(0.026)	(0.026)	(0.025)
Unemployment %			0.113**	0.116**
			(0.057)	(0.058)
Internet Users %			-0.023	-0.019
			(0.020)	(0.019)
Bank Deposit to GDP %			-0.022	-0.024
			(0.025)	(0.025)
Observations	836	779	779	779
R^2	0.011	0.032	0.046	0.048
Adjusted R^2	-0.104	-0.087	-0.076	-0.075
F Statistic	4.015** (df = 2; 748)	5.717*** (df = 4; 693)	4.731*** (df = 7; 690)	4.369*** (df = 8; 689)

Note: *p**p***p<0.01

Robust standard errors in parentheses. *p<0.01.

Table 6.3: 2

Bank Zscore Fixed Effects Results by Economic Level

	Dependent variable:	
	Bank Z-Score	
	Advanced	Emerging/Developing
	(1)	(2)
CBDC Adoption	0.809***	-0.055
	(0.267)	(0.162)
GDP Per Capita	0.0001	0.0002*
	(0.0004)	(0.0001)
Unemployment %	0.271	0.081
	(0.256)	(0.060)
Internet Users %	-0.147	-0.021
	(0.102)	(0.018)
Deposit Money Bank Assets to GDP %	-0.004	-0.015
	(0.037)	(0.016)
Bank Deposit to GDP %	-0.036	-0.013
	(0.037)	(0.030)
Central Bank Assets to GDP %	-0.006	0.039
	(0.033)	(0.035)
Observations	120	659
R^2	0.197	0.047
Adjusted R^2	-0.050	-0.080
F Statistic	3.192*** (df = 7; 91)	4.062*** (df = 7; 581)
Note:		*p**p***p<0.01
	Robust standard errors in parentheses. *p<0.01.	

Table 6.4: CBDC Adoption variable as Dummy

CBDC Dummy Variable Fixed-Effects Regression Results with RSE

	Dependent variable:			
	Bank Liquidity (%)			
	(1)	(2)	(3)	(4)
CBDC AdoptionAdvanced Stage	4.777**	4.470**	2.498	9.655***
	(2.265)	(2.002)	(2.116)	(3.369)
CBDC AdoptionEarly Stage	2.447	1.715	1.305	3.113
	(1.907)	(2.116)	(1.936)	(2.388)
CBDC AdoptionAdvanced Stage:GDP Per Capita				-0.001***
				(0.0002)
CBDC AdoptionEarly Stage:GDP Per Capita				-0.0001
				(0.0001)
GDP Per Capita	0.0001	-0.0003	-0.001***	-0.001***
	(0.0001)	(0.0004)	(0.0004)	(0.0004)
Deposit Money Bank Assets to GDP %		-0.168***	-0.470***	-0.476***
		(0.049)	(0.110)	(0.110)
Central Bank Assets to GDP %		0.253	0.001	-0.020
		(0.196)	(0.188)	(0.185)
Bank Deposit to GDP %			0.584***	0.619***
			(0.181)	(0.186)
Unemployment %			-0.486	-0.512
			(0.589)	(0.588)
Internet Users %			-0.180*	-0.211*
			(0.101)	(0.108)
Observations	836	779	779	779
R^2	0.012	0.066	0.197	0.208
Adjusted R^2	-0.104	-0.050	0.093	0.103
F Statistic	3.016** (df = 3; 747)	9.845*** (df = 5; 692)	21.099*** (df = 8; 689)	18.065*** (df = 10; 687)

Note: *p**p***p<0.01

Robust standard errors in parentheses. *p<0.01.