Financial Inclusion and Central Bank Digital Currency in The Bahamas

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1 Introduction

The global payments landscape continues to evolve as advancements in the field are being made through globalization and digitization. These developments have resulted in increased interest in the implementation of central bank digital currencies, hereafter CBDC, among policy makers and other interest groups. The Bahamas is considered a global leader in CBDC development following the launch of its CBDC, Sand Dollar, in October 2020. It is the first country in the region and among the few globally, to launch a central bank digital currency.

The use of a CBDC would offer another method of payment as not all consumers have credit or debit cards. Providing a safe and liquid government-backed means of completing payments without the necessity of getting or

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maintaining a bank account. The goal of Sand Dollar is to advance more inclusive access to regulated payments and other financial services for underserviced communities and socio-economic groups, as well as reduce service delivery costs and increase transactional efficiency for financial services across The Bahamas (Central Bank of The Bahamas, 2020). The purpose of this research memo is to assess the extent to which the Sand Dollar is capable of achieving these goals.

The purpose of this paper is to develop a dynamic, stochastic general equilibrium (DSGE) model of CBDC adoption in The Bahamas. The model allows us to assess how CBDC adoption will impact monetary and fiscal policy and is a Two-Agent, New Keynesian (TANK) Model first developed by Bilbiie (2008) with open-economy features, critical for the assessment in countries like The Bahamas. The TANK framework has become a standard model for assessing monetary policy when households are unbanked. We interpret Non-Savers as those who gain access to financial services through CBDC. Thus, our analysis focuses on a careful calibration of this important parameter. We discuss the model in detail below. To highlight a few important results: If the adoption rate of CBDC is sufficiently high, then

1. the volatility pass-through of monetary policy shocks falls substantially.

2. variance decompositions show that technology shocks account for the lion's share of volatility in the model.

3. negative monetary policy feedback effects are mitigated.

4. recessionary shocks are less likely.

5. Welfare of households, especially the constrained households, improves.

Our analysis depends critically on the fraction of households who do not have access to financial services that would gain access over the course of the next several years. Our estimate of 70k persons or 17.9% of population (IMF, 2019) that remains unbanked is discussed in detail below. The primary goal of the Sand Dollar project is to provide financial services to

those not currently integrated in the Bahamian banking system. If the Sand Dollar cuts the number of unbanked in half, the economic benefits discussed above come to fruition. The intuition of these results comes from the interest rate channel of monetary policy. If the population is 100% banked, then monetary policy can fully control inflation. The volatility of monetary policy pass-through is tied specifically to the number of unbanked. As this number increases, monetary policy loses control of inflation dynamics. This main mechanism spills over into the impact of monetary policy on the real economy. If there is a substantial number of unbanked, variance decompositions show that monetary policy has a much more significant impact on the volatility of GDP. As the number of unbanked falls, technology shocks account for the lion's share of volatility in the model. Thus, policy mistakes are amplified as the number of unbanked increases.

1.1 Stylized Facts on CBDC Adoption

The success of any CBDC and its potential impact on economic growth are dependent upon the rate of adoption by consumers and businesses. Therefore, the Bank conducted a survey on business and consumer payment practices in 2020 to assess the current environment and the potential for the future (Central Bank of The Bahamas, 2021). Two-thirds of consumers signaled that they have heard about or are aware of Sand Dollar. Moreover, most respondents indicated that they were most comfortable using cash and debit/credit cards, and in a positive sign of the CBDC's prospective usage, 31.5% of respondents said they were likely to use less cash in the future. For businesses, 76.6% of respondents confirmed business chequing accounts as their most utilized form of payment. In order to see a shift in the growth of CBDC adoption, both businesses and consumers will have to shift payment habits.

Tables 1-2 and Figures 1-5 provide stylized facts on the rollout of CBDC in The Bahamas. Highlights include

- Sand Dollar in Circulation now stands at $303,785.
- The current adoption rate is roughly 7.9%.
- 32,736 wallets in use with sovereign wallets equal to 1,340

- The pandemic reduced transactions but not substantially (Figure 5).
- Circulation has increased by a factor of three since inception in Q4-2019.
- Transaction values have fallen primarily due to the pandemic (Figure 4) while transaction volume has remained roughly constant (Figure 5).

2 Model

We employ a dynamic, stochastic general equilibrium model that contains the following crucial features—two agent types (savers and non-savers); a small open-economy; a non-competitive banking sector; and sticky prices and wages (New Keynesian); fiscal policy with debt accumulation. The non-savers work and consume all income contemporaneously. They do not have access to financial institutions. The small open-economy allows for trade shocks and external interest rate pressures. The banking sector controls capital flows within the economy and maximizes a non-zero profit function that introduces dead-weight loss. All of these features are important when assessing the impact of CBDC on a smaller economy like the Bahamas.

Parameters are calibrated to The Bahamian economy. We focus on monetary policy impacts but also note the importance of rising public debt. The key parameters of our model are the fraction of unbanked (η) and the debt-to-gdp ratio in steady state (initially set at 0.75). Results will be presented assuming low CBDC adoption (low, $\eta = 17.6$) and high adoption (high, $\eta = 16$). The model features four exogenous shocks: monetary policy, terms-of-trade, government spending and technology. The model is solved using Dynare Version 5.0, see Landi (2020) for a complete derivation of equilibrium dynamics and Dynare code.

The model is calibrated to standard values with the exception of the share of rule-of-thumbers. We set this value equal to 17.9% to represent the number of unbanked in The Bahamas. This is the standard calibration. Results presented will assume this value is cut in half to 8.9% (high adoption) and reduces less dramatically to 15% (low adoption).

2.1 Results Figures 6-10 present the results of our analysis. Figure 6 is a variance decomposition of all shocks (technology, government spending, monetary policy) under a low adoption rate and Figure 7 is the same decomposition under a high adoption rate. Recall that variance decompositions show what percentage of the variance of endogenous variables is attributable to the three shocks in the model (government spending, technology and monetary policy). The standard result in the NK model is for the technology shock to account for the overwhelming majority of the variation in macro aggregates. Thus, policy mistakes are not detrimental. This is true for Figure 7; that is, if adoption rates cut the number of unbanked in half, the volatility attributable to policy shocks (government spending and monetary policy) would be reduced substantially. However, with a significant fraction of non-savers (low adoption rate), government spending and monetary policy have significant impacts on macro aggregates. For inflation, the wage rate and consumption, monetary policy shocks are the dominant shock responsible for the most volatility.

The intuition for this result is that if households cannot save, they rely more heavily on policy to make "correct" economic decisions. If policy makers introduce significant shocks into the economy, the Volatility Pass-Through is substantial. More so than if adoption rates are low. Intertemporal substitution is critical for households to make optimal consumption/savings decisions. As more people are introduced to financial services, they can save optimally and will not react adversely to a shock. For example, suppose non-savers are hit with a monetary policy shock (increase in the interest rate). Normally, one would allocate consumption into the future as rates rise. This puts downward pressure on aggregate demand and prices—a positive monetary policy shock reduces inflation. However, non-savers are not able to reduce consumption so the central bank's control of inflation is mitigated. If the number of non-savers is substantial—-as in The Bahamas—the control of inflation is reduced significantly. Therefore, CBDC could foster an environment conducive to improved monetary policy outcomes.

The intuition for fiscal policy is similar. A shock to government spend-

ing has a much more powerful effect when non-savers are influential because they act as non-Ricardian households. They cannot offset changes in government spending with an increase in savings or an anticipated increase in tax rates. Thus, a positive government spending shock causes an increase in consumption, and the volatilities of g and c are strongly correlated.

Figures 8-10 plot impulse responses under three scenarios—low adoption of CBDC, high adoption, and low adoption with high debt-to-GDP ratio. The debt-GDP ratio is calibrated to 175% and increased to over 200% in the high scenario. As in the volatility results, the "High Adoption" case represents the standard impulse response to a monetary policy shock—inflation and output fall in response to a positive monetary policy shock and return to steady state within two years. This is our baseline case. With a higher number of non-savers (Figure 9), there are negative feedback effects—all macro aggregates overshoot targets. This overshooting is made substantially worse with high levels of debt (Figure 10). The intuition for this result is as follows: As the fraction of non-savers increases, the initial impact of monetary policy is muted (i.e., non-savers do not respond to changes in the interest rate). The impact on firms is muted as well. Wages begin to increase after two quarters leading non-savers to have more disposable income, causing the overshooting.

2.2 Welfare analysis Compared with baseline TANK model, a monopolistic banking sector decreases the deposit rate and discourages saving, the steady state capital stock is lower and the social welfare is lower for both constrained and unconstrained household. Dollarization benefits directly constrained household since it provides an additional way of transaction and saving, but it generates negative externality to unconstrained household mainly by lowering the terms of trade. Both results are apparent in the welfare calculations in the table below.

CBDC does not affect baseline model, since all the agents are unconstrained and they will always choose to hold deposit as long as the deposit rate is higher than CBDC return. CBDC benefits manly the constrained household, the welfare of the constrained household will be lowered because

Table 1: Welfare change by adding different frictions

Welfare change	Unconstrained	Constrained	Social
Bank	-0.0058	-0.0143	-0.0082
Dollarization	-0.0577	0.9438	0.0986

of central bank's cost to run CBDC (interest rate payment) and lower labor supply of constrained household.

Table 2: Welfare change by introducing CBDC

Welfare change	Unconstrained	Constrained	Social
Baseline	0	0	0
TANK	-0.0419	1.0064	0.1196
TANK with bank	-0.0421	1.0081	0.1207
TANK with dollarization	0.0064	0.0123	0.0073

The upshot of our analysis is that if the CBDC leads to improved financial inclusion, the volatility of all macro aggregates can be dampened substantially and the efficacy of monetary policy enhanced with an increase in CBDC adoption rates.

3 Conclusion

The results of this paper determined that there is a positive correlation between CBDC and financial inclusion. To this end, several initiatives have been implemented as a means of increasing financial inclusion. The Central Bank of The Bahamas relaunched its financial literacy program in April 2019. Subsequently, the Bank hosted its financial literacy video essay competition for students in 2020 and 2021. In addition, the Bank also launched its Sand Dollar website on 4 January, 2021. This website allows the public to not only get a better understanding of Sand Dollar but connects consumers with all Authorized Financial Institutions (AFIs). Further, the Bank has commenced efforts to require all AFIs to offer interoperable Sand Dollar services. This would allow enrolled merchants and individuals to send and receive funds from any other digital wallet holders, once transacting in Sand

Dollars.

Moreover, commercial banks and electronic money service providers are encouraged to conduct educational campaigns to increase adoption efforts. Also, town hall meetings and virtual seminars and workshops should be pursued as a means of reaching the public. Through multilateral partnerships, consumers and merchants should be engaged in a manner to ensure financial instruments are easily accessible, reliable and available for use.

As it relates to further areas of study, the authors expect the current initiatives being employed, coupled with these recommendations, to result in a significant increase in adoption. As The Bahamas prepares for the elimination of domestic cheque cashing by December 2022 and the full elimination of cheques by December 2024, it is also expected that merchants and consumers will pursue more digital payment options. As the adoption rate of CBDC increases, it may be worthwhile to measure the impact of macro aggregates to note any improvements.

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5 Figures & Tables

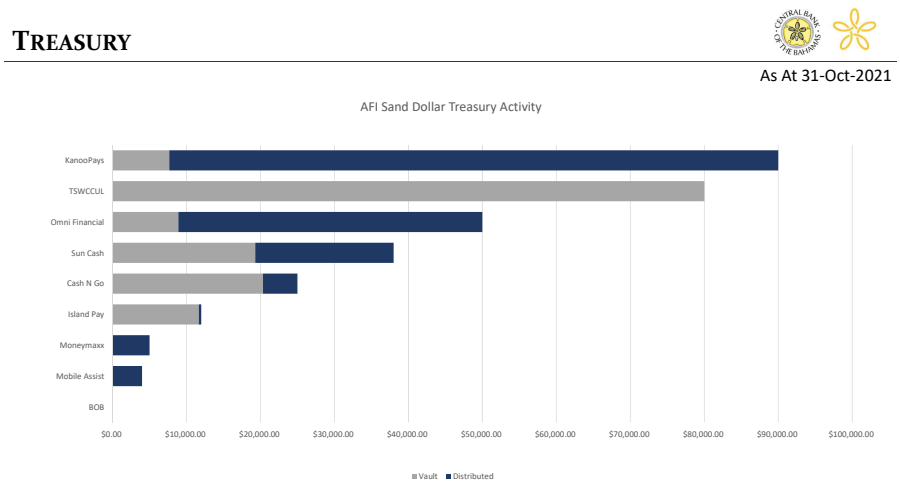

Figure 1: Treasury Activity

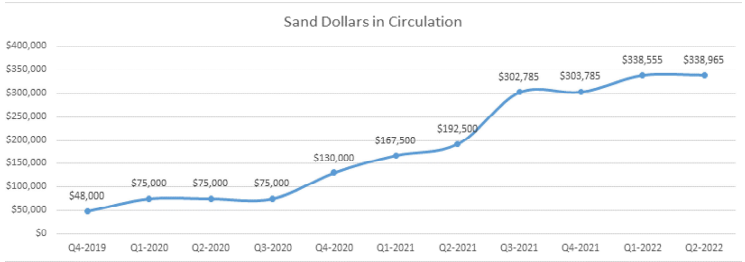

Figure 2: Wallets

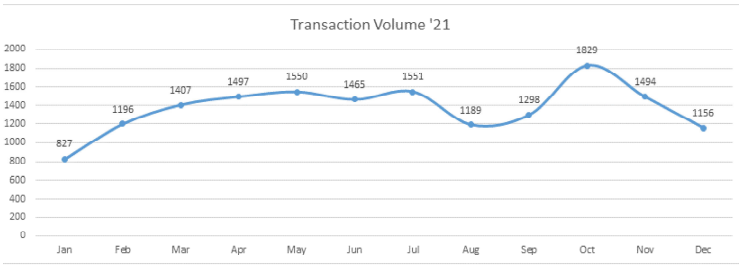

Figure 3: Circulation

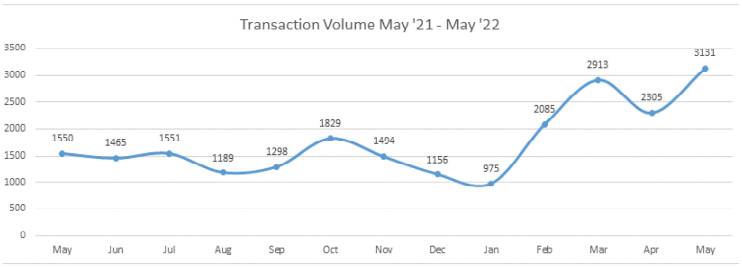

Figure 4: Transaction Value

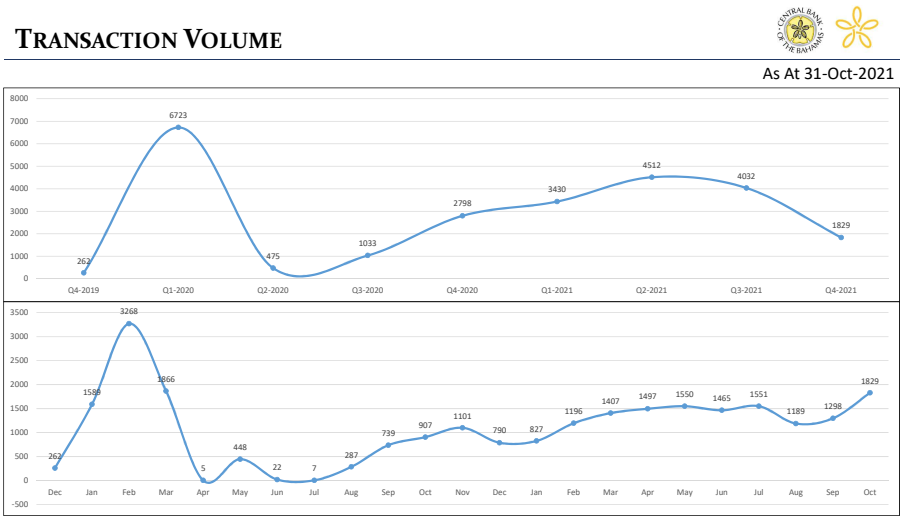

Figure 5: Transaction Volume

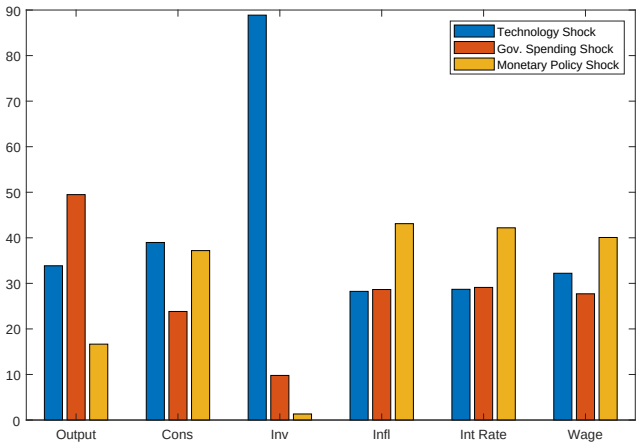

Figure 6: Variance Decomposition (Low Adoption Rate)

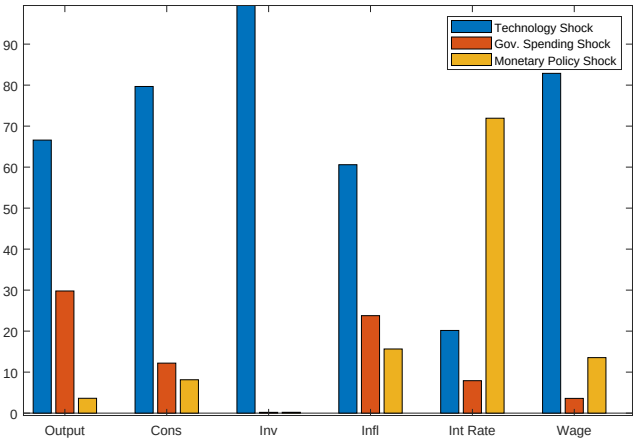

Figure 7: Variance Decomposition (High Adoption Rate)

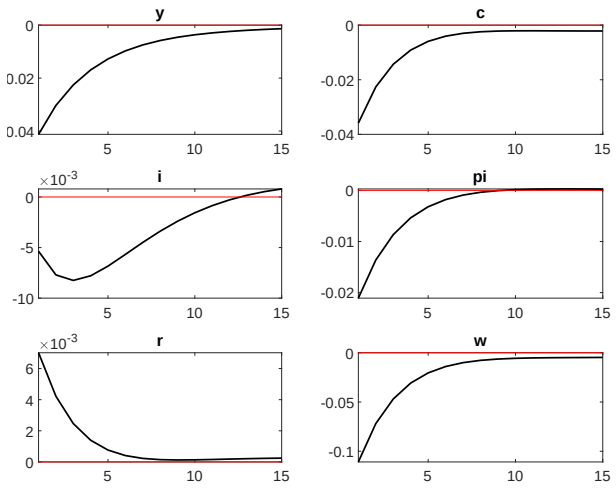

Figure 8: IRF: Monetary Policy Shock (High Adoption of CBDC)

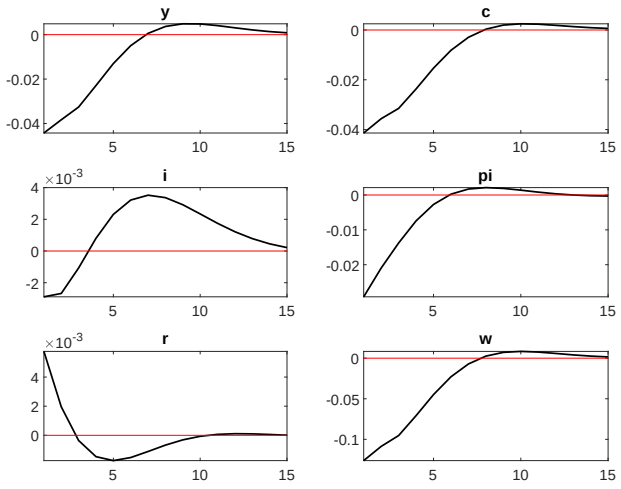

Figure 9: MP Shock (Low Adoption of CBDC)

National adoption rate	**No. wallets(% of pop)**	**20% of adult pop.**
Personal sovereign wallets (less CBOB staff)	1340	1340
Personal custodial wallets	31396	31396
Total personal wallets	32736	32736
* Estimated adult population (2020 aged 15+)	308300	61660
Estimated adoption rate -All Bahamas (%)	10.618	53.091

Table 3: Adoption Rates. Source https://www.statista.com/statistics/795139/population-total-age-bahamas/ Notes: Sovereign wallets represent those that are client owned and are visable in the Sand Dollar environment.

Currency in circulation	386,000,000
Sand Dollar in circulation	303,785.04
Estimated adoption rate - All Bahamas (%)	0.079

Table 4: Using the AFI methodology—cbdc in circulation vs fiat currency. Source: https://www.worldbank.org/en/topic/financialinclusion/brief/how-to-measure-financial-inclusion

beta=0.975;	discount factor
alpha=1/3;	capital share
delta=0.025;	depreciation rate
sigma=1;	relative risk aversion
phi=0.2;	inverse of Frisch elasticity
eta=0.179;	fraction of rule-of thumb
g=0.2;	public spending over GDP ratio
D=1.75;	public debt over GDP ratio
pi=1;	inflation targeting
y=1;	gdp
h=1/3;	hours of work

Table 5: Structural Parameters (quarterly calibration)

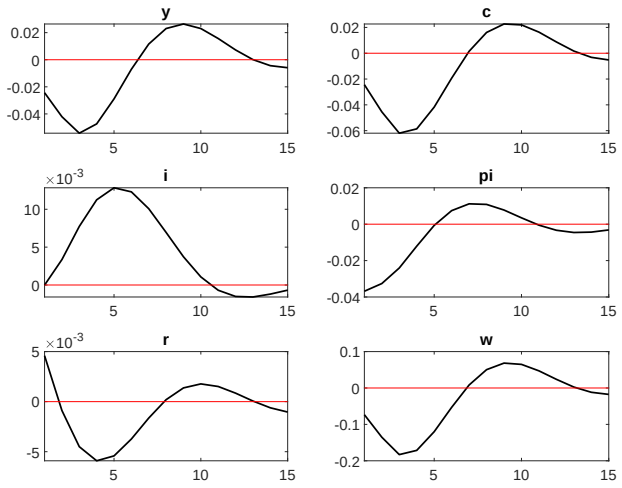

Figure 10: MP Shock (Low Adoption of CBDC & High Debt-GDP)