SUERF
The European Money and Finance Forum

SUERF Policy Brief
No 646, July 2023

CBDC and business cycle dynamics in a New Monetarist New Keynesian model*

By Katrin Assenmacher, Lea Bitter and Annukka Ristiniemi
European Central Bank

Keywords: Central bank digital currency, monetary policy, DSGE, search and matching.
JEL codes: E58, E41, E42, E51, E52.

To study implications of an interest-bearing central bank digital currency (CBDC) on the economy, we integrate a New Monetarist-type decentralised market that explicitly accounts for the means-of-exchange function of bank deposits and CBDC into a New Keynesian model with financial frictions. The central bank influences the store-of-value function of money through a conventional Taylor rule while it affects the means-of-exchange function of money through CBDC operations. We find that peak responses to monetary policy shocks remain similar in the presence of an interest-bearing CBDC, implying that monetary transmission is not impaired. At the same time, the provision of CBDC helps smooth responses to macroeconomic shocks.

*This Policy Brief provides a summary of Assenmacher, Bitter, and Ristiniemi (2023). The views are the personal views of the authors and should not be reported as representing the views of the European Central Bank (ECB) or the Eurosystem. The authors are not part of the ECB's digital euro project team.

Analysing CBDC in a centralised and a decentralised market

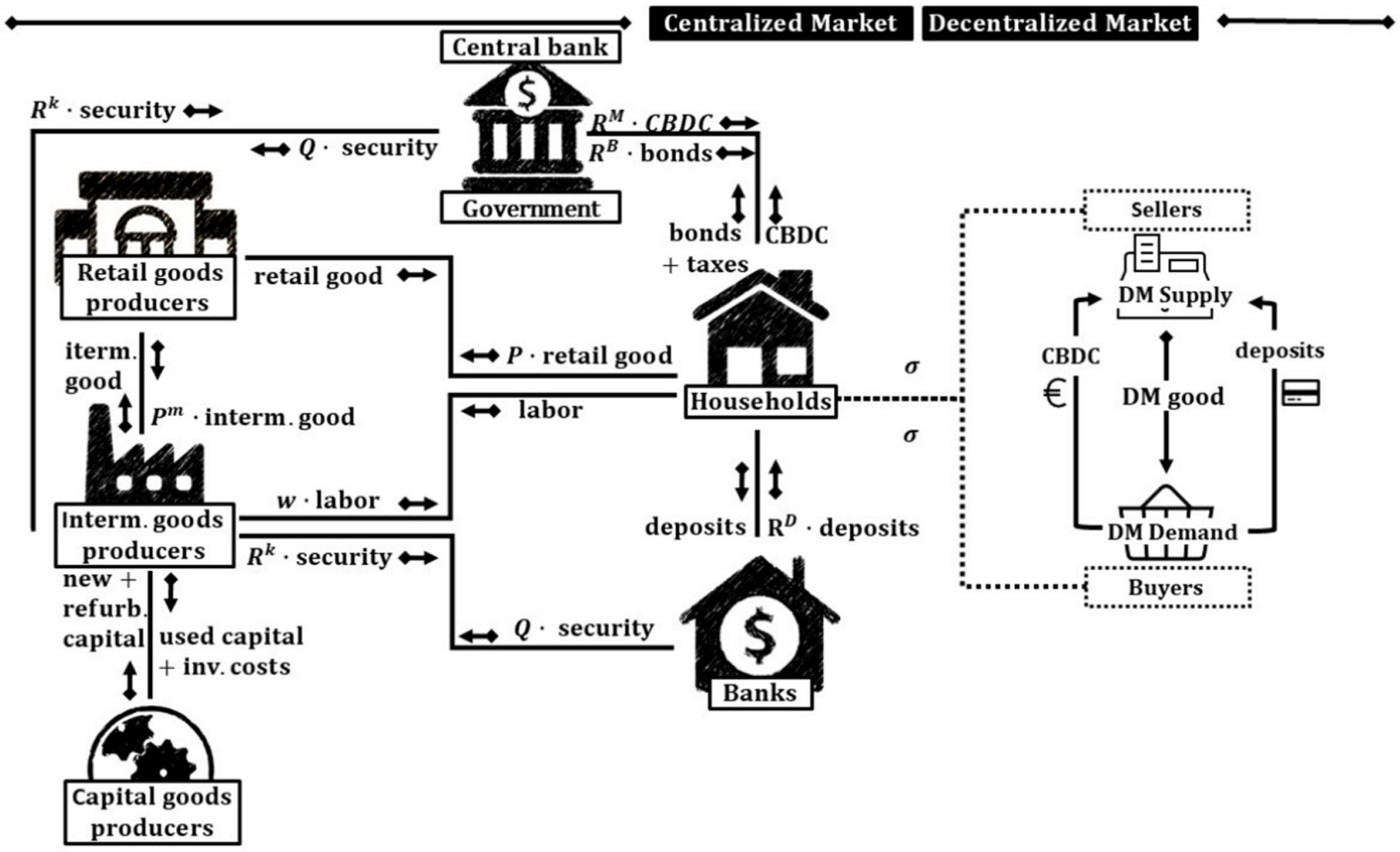
In the past few years, an increasing number of central banks have started to consider the possible provision of a central bank digital currency (CBDC) to the general public for payment purposes. Such provision could have implications for monetary policy transmission and financial stability, especially if households were to replace bank deposits with CBDC on a larger scale. Policy makers therefore need to be mindful of "doing no harm" to public policy objectives when considering a potential CBDC issuance (see Group of Central Banks, 2020).

We investigate how the potential existence of an interest-bearing CBDC affects the transmission of macroeconomic shocks to the economy in a model that combines New-Monetarist-type decentralised transactions with New Keynesian business cycle dynamics. We find that peak responses to monetary policy shocks remain similar in the presence of an interest-bearing CBDC, implying that monetary transmission is not impaired. At the same time, the provision of CBDC helps smooth responses to macroeconomic shocks.

An explicit role for CBDC and deposits as media of exchange

Our model consists of a centralised market (CM) and a decentralised market (DM). The CM is a standard New Keynesian model with financial frictions to study the impact of monetary policy, as well as various shocks to the economy (based on Gertler and Karadi, 2011). The DM is a monetary search model (in the spirit of Lagos and Wright, 2005), providing microfoundations for the role of CBDC and deposits as means of exchange. The two markets take place sequentially in each period, i.e. a period starts with the CM, after which the DM opens. Figure 1 presents the model structure.

Figure 1: Model structure



The real sector in the CM features the usual New-Keynesian frictions that produce sticky prices and allow monetary policy to have real effects. As in Gertler and Karadi (2011), banks face an agency problem that introduces a leverage constraint and can lead to an insufficiently low provision of credit and deposits. This financial friction amplifies the effects of shocks on the real economy, credit flows and deposits, thereby spilling over to transactions in the DM.

Households' financial assets consist of bank deposits, CBDC and bonds but only deposits and CBDC qualify as money and can be used to carry out transactions in the DM. Households receive a preference shock at the beginning of the DM that determines whether they become sellers or buyers, creating a double-coincidence-of-wants problem. In the DM, households are anonymous and can either pay with deposits or CBDC.

While money is modeled as a store of value in the CM, i.e. it can be used for savings, the DM provides a role for money as a means of exchange. The central bank may issue CBDC, which is a perfect substitute for deposits as a means of exchange. As CBDC and deposits are equally useful for transactions in the DM, their interest rates are identical and only their relative quantities adjust to shocks hitting the economy. Conventional monetary policy is modelled by a Taylor rule that sets the interest rate on bonds as a function of inflation and the output gap, and thereby affects the attractiveness of money as a store of value. The central bank issues CBDC according to a rule that targets the liquidity premium, which we define as the spread between the interest rate on bonds relative to the rate on CBDC and deposits. By setting the supply of CBDC, the central bank influences the economy through stabilising the value of money as means-of-exchange.

In our model, CBDC issuance increases the central bank's balance sheet as we abstract from cash, reserves and other central bank liabilities. To counterbalance CBDC issuance, we assume that the central bank purchases an equivalent amount of capital securities.

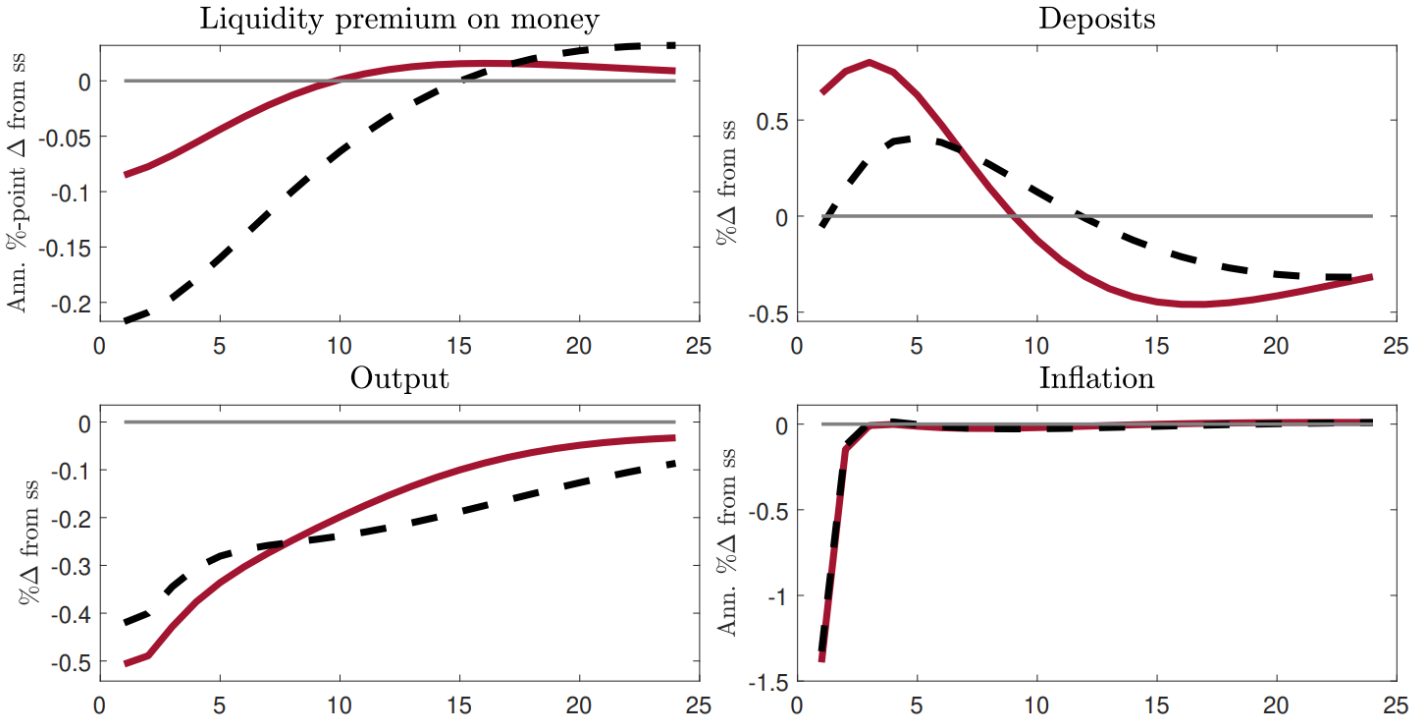
CBDC and the transmission of macroeconomic shocks

We proceed by comparing responses of macroeconomic variables to four different types of shocks – monetary policy shocks, business cycle shocks, financial shocks and shocks to the liquidity premium – with and without a CBDC. In this way, we can analyse the transmission channels and the role of a CBDC as an additional monetary policy tool. Generally, we find that the presence of a CBDC does not significantly alter the properties of the model's peak responses to the standard macroeconomic shocks and tends to smooth their transmission to core variables such as output and inflation. The exception is a shock to the liquidity premium that affects money demand, in which case the responses of output and inflation are amplified.

In the discussion of our results, we focus on the additional transmission channels that arise through the presence of a CBDC. When adjusting the supply of the CBDC, the central bank can smooth the reactions of core economic variables to shocks by stabilising fluctuations in the liquidity premium. An increase in the supply of the CBDC decreases the liquidity premium and boosts consumption, output, and inflation. The liquidity premium affects the economy through two main channels: A larger supply of CBDC directly increases consumption in the DM as more money is available. It also improves bank funding conditions and thereby increases the profitability of investments.

Figure 2 shows that the responses of output and inflation to a monetary policy shock remain similar in the presence of a CBDC. In response to a contractionary shock to the Taylor rule, the interest rates on CBDC and deposits increase more than the government bond rate as transaction needs decline. By reducing the CBDC supply, the central bank mitigates the fall in the liquidity premium, inducing households to replace CBDC holdings partially with deposits, thereby easing bank funding conditions (upper panels of Figure 2). The responses of output and inflation remain mostly unaffected by the presence of a CBDC, suggesting that monetary policy retains its ability to influence output and inflation through a conventional Taylor rule.

Figure 2: Responses to a contractionary 50 bps monetary policy shock with and without CBDC



To better understand the implications of the CBDC rule specification for the outcomes of our model, we analyse different reaction parameters for the CBDC interest rate rule, which result in different degrees of stabilisation of the liquidity premium. The more the liquidity premium is stabilised, the more the responses of macroeconomic variables to shocks differ from those in a model version without a CBDC. In the limit, without any stabilisation of the liquidity premium, the presence of a CBDC has no impact on how the economy reacts to shocks. Moreover, we show that in a setup with a CBDC as the only liability of the central bank, the economic impact of a CBDC results from both, the liability and asset side of the central bank balance sheet. This underlines that it is necessary to be attentive to potential asset side implications of CBDC issuance.

Conclusions

To analyse the macroeconomic effects of a CBDC, we integrated a New-Monetarist-type decentralised market into a New Keynesian model with financial frictions. Overall, we find that a CBDC does not significantly alter the peak responses of the core economic variables to the standard macroeconomic shocks and tends to smooth transmission. In particular, monetary policy shocks to a conventional Taylor rule generate similar responses of output and inflation with and without a CBDC, suggesting that monetary policy transmission is not impaired in the presence of a CBDC.

As in George et al. (2020), the existence of a CBDC allows the central bank to target fluctuations in the liquidity premium, which helps to smooth and dampen consumption and investment responses to macroeconomic shocks. In this way, the central bank can affect the economy through two different channels: By setting the interest rate on government bonds via a Taylor rule, it determines the relative attractiveness of money as a store of value. By setting the interest rate on CBDC, it influences the means-of-exchange function of money in the DM.

References

Assenmacher, K., L. Bitter, and A. Ristiniemi (2023). CBDC and business cycle dynamics in a New Monetarist New Keynesian model. *ECB Working Paper No 2811*.

George, A., T. Xie, and J. D. A. Alba (2020). Central bank digital currency with adjustable interest rate in small open economies. Policy research paper series, Asia Competitiveness Institute.

Gertler, M. and P. Karadi (2011). A model of unconventional monetary policy. *Journal of Monetary Economics 58* (1), 17–34.

Group of Central Banks (2020). Central bank digital currencies: foundational principles and core features. Report 1, Series of collaborations from a group of central banks.

Lagos, R. and R. Wright (2005). A unified framework for monetary theory and policy analysis. *Journal of Political Economy 113*(3), 463–484.

About the authors

Katrin Assenmacher *is Head of the Monetary Policy Strategy Division at the European Central Bank (ECB) since November 2016. From 2010 to 2016 she led the Monetary Policy Analysis unit at the Swiss National Bank (SNB). Katrin was a visiting scholar at the Federal Reserve Banks of St. Louis and Atlanta, the Oesterreichische Nationalbank and the Universities of Copenhagen and Southern California. She holds a Doctorate and a Diploma in economics from the University of Bonn, where she also received her Habilitation.*

Lea Bitter *is an Economist at the ECB's Monetary Policy Strategy division and a PhD candidate at the Technische Universität Berlin and the Berlin School of Economics. Her research interests include monetary policy, macroeconomics, digital currencies and behavioral economics.*

Annukka Ristiniemi *is a Senior Economist at the ECB's Monetary Policy Strategy division working mainly on macro modelling. Prior to that she worked at the Modelling division at the Riksbank. Annukka completed her PhD at Paris School of Economics with Daniel Cohen and spent time at the Banque de France, ECB, and CEPREMAP among other places.*