

Box 8

Model simulations of the impact of a central bank digital currency on the international role of a currency

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The economic mechanisms through which a central bank digital currency (CBDC) could impact the international role of the currency in which it is denominated can be illustrated through the lens of a structural macroeconomic model. We use an extension of the three-country model of Eichenbaum et al. (2020) based on international trade in goods and assets, nominal and financial rigidities.¹⁰⁰ There are three countries (country 1, country 2 and country 3), each of which issue a currency (currency 1, currency 2 and currency 3). The model is extended in three directions.

- It includes different pricing strategies for exporters who choose between setting their prices in their currency (producer currency pricing, or PCP), in the currency of destination markets (local currency pricing, or LCP) or that of a third currency (dominant currency pricing, or DCP). The pricing paradigm matters for exchange rate pass-through and therefore for the simulation results of the model. PCP, LCP and DCP shares are typically calibrated to match observed patterns in data on invoicing currency. In the model, however, exporters choose the optimal invoicing currency to maximise expected profits.¹⁰¹

¹⁰⁰ See Eichenbaum, M., Johannsen, B. and Rebelo, S., "Monetary policy and the predictability of nominal exchange rates", *Review of Economic Studies*, Vol. 88(1), 2020, pp. 192-228.

¹⁰¹ This is another extension of the model. Profits are defined as the unconditional mean of the profits of firms computed using a second-order approximation of the model with pruning. The unconditional mean might differ from the deterministic steady state of the model owing to uncertainty.

- Moreover, the model includes cash-in-advance constraints. In the model, agents need means of payment to purchase final goods. They use domestic cash to pay for domestic goods in all three countries. By contrast, internationally traded goods are paid for with short-term debt securities denominated in either currency. However, only currency 1 and currency 2 (the two international vehicle currencies of the model) can be used in transactions not involving their country of issuance, unlike currency 3. The presence of cash-in-advance constraints implies that agents need to save in short-term debt securities to pay exporters for future purchases of internationally traded goods. This enables the model to capture complementarities between the store of value and medium of exchange functions of international currencies, which is reminiscent of the mechanism developed by Gopinath and Stein (2020) leading to the dominant currency paradigm.¹⁰² Moreover, short-term debt securities need to be liquidated before payment by paying a cost, which captures standard frictions in cross-border payments in terms of, for example, speed, cost and opaqueness.¹⁰³ Finally, short-term debt securities are remunerated at an interest rate that comprises a stochastic risk premium, which enables differences in safety between the alternative means of payment of the model to be introduced.
- Lastly, we add a CBDC to the model. The CBDC is issued by country 1. The CBDC can be used to pay for domestic goods in country 1, in the same way as cash. It can be used to pay for imports from any of the three countries, like short-term debt securities denominated in currency 1 or currency 2. There is a trade-off between using a CBDC or short-term debt securities in international payments. On the one hand, the CBDC is fully liquid: it can be used to pay for imports without paying liquidation costs ex ante, unlike short-term debt securities. Moreover, it is safe – it carries no risk premium. On the other hand, the remuneration rate on short-term debt securities is systematically higher than on the CBDC, which, in the baseline simulations, is set to zero to compensate for risk and liquidity frictions.

Simulations from the model illustrate the importance of the stability of economic fundamentals and size for international currency status. Global exports tend to be invoiced in the currency of the economy with the most stable economic fundamentals, as shown in the simulations shown in the left panel of **Chart A**. The simulations assume absence of capital controls, a 1% liquidation cost for debt securities and that each of the three countries accounts for one-third of global trade. The volatility of the economic shocks in each country is used to measure the stability of economic fundamentals.¹⁰⁴ The effect of stable economic fundamentals is significant – if the instability of economic fundamentals in countries 2 and 3 increases by one-third relative to country 1, the share of currency 1 in global export payments increases by 50%, to almost 90%. Economic size matters, too, as the simulations in the right panel of **Chart A** show. If country 1 is smaller, which is modelled by reducing its share of global trade from 33% to 20% and 10%, the share of currency 1 in global export payments decreases by almost 20 and 30 percentage points respectively. Economic scale therefore bolsters the use of an international currency in global trade.

¹⁰² Gopinath, G. and Stein, J.C., “Banking, trade, and the making of a dominant currency”, *The Quarterly Journal of Economics*.

¹⁰³ For a discussion of frictions to cross-border payments, see, for example, Financial Stability Board, *Enhancing cross-border payments – Stage 3 roadmap*, 13 October 2020.

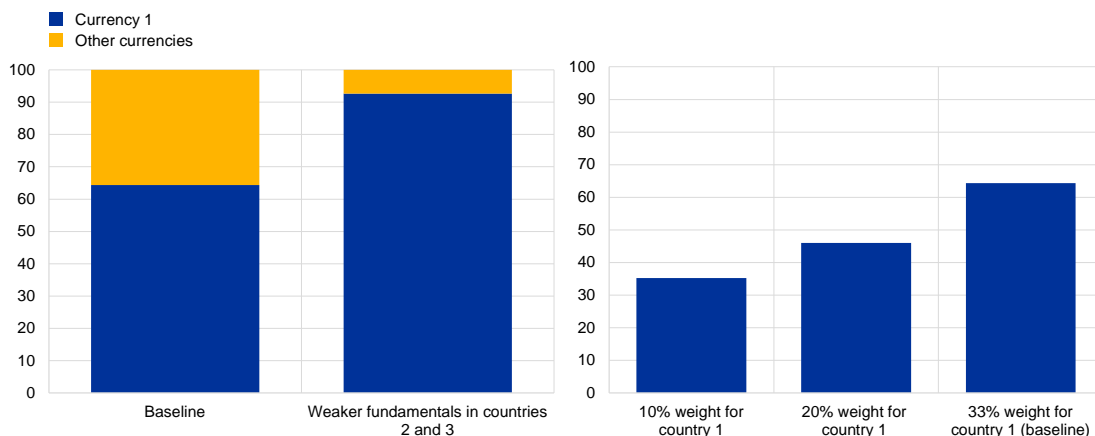
¹⁰⁴ The model includes five exogenous shocks to monetary policy, government spending, total factor productivity, consumer preferences (which acts as a risk premium shock) and a shock to the liquidation cost of debt securities.

Chart A

Model simulations on the importance of the stability of economic fundamentals and size for international currency use

Currency breakdown of global export payments (left panel) and share of currency 1 in global export payments (right panel)

(percentages)



Source: ECB calculations.

Notes: The left panel shows simulations based on a three-country DSGE model in the spirit of Eichenbaum et al. (2020), where it is assumed that there are no capital controls, a 1% liquidation cost for debt securities and symmetric 33% weights for each of the three countries. In the baseline simulation, the volatility of the shocks in countries 1, 2 and 3 are calibrated to 0.01, 0.015 and 0.015 respectively, against 0.01, 0.02 and 0.02 in the alternative simulation with weaker fundamentals in countries 2 and 3. The right panel shows simulations using the baseline assumptions (see the last bar) and simulations where country 1 is smaller (i.e. with weights of 10% and 20%).

The model simulations suggest that a CBDC supports the use of a currency in cross-border payments. However, it is not a game changer. The left panel of **Chart B** contrasts two model simulations – one without CBDC and the other simulation with a CBDC issued in country 1.¹⁰⁵ The CBDC visibly supports the use of currency 1 by reducing frictions and costs of cross-border payments relative to slower, costly and more opaque means of payments – the short-debt securities that need to be liquidated before payments in the model (see the increase in the blue bar in **Chart B**). However, the rise in the share of currency 1 in global export payments remains modest, at about 5 percentage points – less than a 10% increase relative to the baseline simulation without CBDC. The international role of currency 1 depends more importantly on fundamental forces discussed above, such as the stability of economic fundamentals and size.

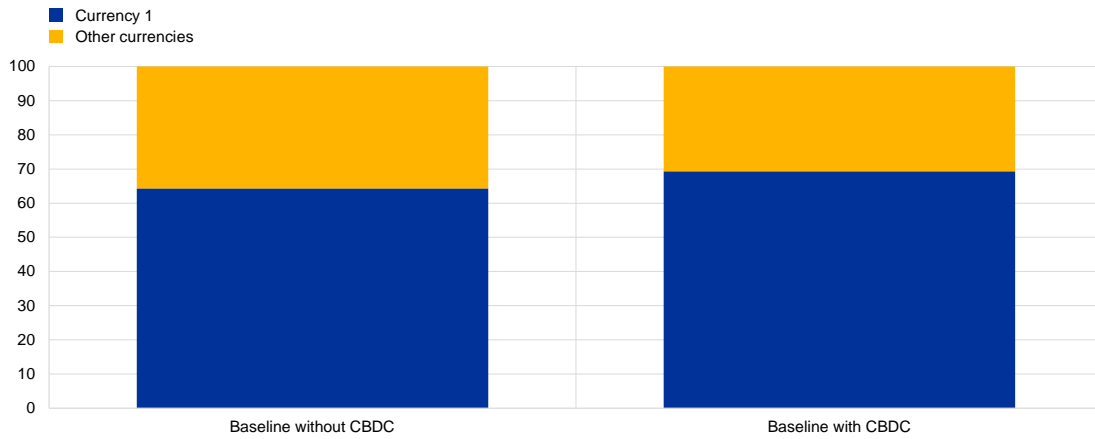
¹⁰⁵ The simulations use the baseline assumptions discussed above (i.e. no capital controls, a 1% liquidation cost for debt securities, symmetric 33% weights for all countries and the same volatility of the exogenous shocks).

Chart B

Model simulations on the impact of CBDC for international currency use

Currency breakdown of global export payments in alternative simulations

(percentages)



Source: ECB calculations.

Notes: The chart shows simulations based on a three-country DSGE model in the spirit of Eichenbaum et al. (2020) with the baseline assumptions (no capital controls, a 1% liquidation cost for debt securities, symmetric 33%-weights for all countries, and volatility of the shocks as discussed above).