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## What is the macroeconomic impact of changing money market conditions?

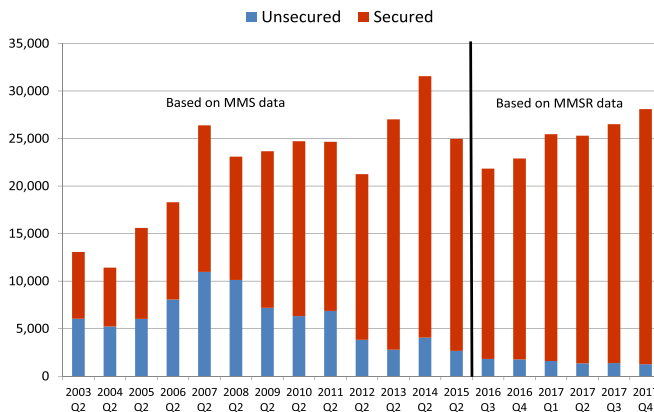
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*Money markets are an important source of short-term funding for banks, which rely heavily on them to cover their liquidity needs. But when money markets do not function smoothly, banks may have to de-leverage or increase their holdings of liquid assets, leading to a decline in lending and output. This decline can be mitigated by central banks if they increase the size of their balance sheets.*

Banks rely on money markets to cover their liquidity needs arising, for example, from inflows and outflows of deposits. Money markets have undergone substantial changes since the onset of the global financial crisis. Perhaps the most striking change has been the declining importance of the unsecured money market, in which borrowing is uncollateralised, relative to the secured money market, in which borrowing is collateralised. While the total turnover in the money markets doubled between 2003 and 2017 (see Figure 1), the share of the unsecured transactions in total declined from about 45% in 2003 to 5% in 2017. Importantly, unsecured market activity is likely to remain at low levels going forward. One reason is that unsecured funding has become more costly due to new Basel III liquidity regulations, in particular the Liquidity Coverage Ratio, which requires banks to hold large buffers of liquid assets against unsecured short-term money market funding. In sum, banks increasingly need collateral to borrow in money markets.

**Figure 1: Turnover in unsecured and secured euro area money markets**



Notes: Cumulative quarterly turnover in the euro area unsecured and secured money market segments (EUR billions). Source: Euro Area Money Market Survey (MMS) until Q2 2015, Money Market Statistical

Reporting (MMSR) data thereafter (based on data for 38 banks that participated in both data collections).

A second key development in euro area money markets involves the collateral assets of banks. In particular, both the value of banks' collateral assets and the availability of high-quality collateral assets have fluctuated significantly in recent years. Take the initial margin or "haircut" for instance – the amount trimmed off the face value of an asset when calculating how much cash can be lent against it. During the euro area sovereign debt crisis, haircuts on the government debt of some countries increased substantially, reaching 80% or more for some peripheral countries. The haircuts applied by the ECB on the same collateral were much lower and remained largely stable (see Table 1). Moreover, the overall amount of safe (AAA-rated) government debt, which commands the lowest haircuts, fell from 60% of total debt in 2003 to 20% in 2017. This was because several euro area sovereigns saw their debt repeatedly downgraded. Simply put, the value of bank collateral assets decreased substantially, and high-quality collateral became scarce.

Table 1: ECB vs private haircuts on government bonds (in %)

	ECB		Private	
	CQS1-2	CQS3	Germany/France/NL	Portugal
2010	2.8	7.8	2.8	7.9
2013	2.7	8.2	3.4	80.0
2017	2.2	9.4	2.8	28.4

Notes: ECB haircuts: CQS1-2 refers to sovereign bonds with credit quality 1 and 2, corresponding to a rating from AAA to A-; CQS3 refers to bonds with credit quality 3, corresponding to a rating from BBB+ to BBB-. Private haircuts: the column "Germany/France/NL" refers to an average haircut on bonds from Germany, France, and the Netherlands. Sources: ECB and LCH Clearnet.

How have these developments affected the macroeconomy? That is, how have they affected such things as lending and output?

In our recent paper (De Fiore, Hoerova and Uhlig, 2019), we address these questions through the lens of a general equilibrium model with secured and unsecured money markets, a diverse array of small banks, and a central bank (CB). A central feature of the model is that banks financing themselves through deposits face the risk of temporary deposit outflows, for instance, when depositors transfer their funds to other banks while paying for goods and services using their checking accounts (similar to Bianchi and Bigio (2014)). Moreover, some banks face a liquidity constraint: they cannot manage their deposit outflows by borrowing in the unsecured money market but, instead, they must resort to collateralised borrowing in the secured market or from the central bank, and/or hold precautionary buffers of reserves. We call banks without access to the unsecured money market "Unconnected", while the other banks are "Connected" and not subject to these liquidity constraints. In addition to these constraints, all banks face a leverage constraint (similar to Gertler and Kiyotaki (2011)) that limits how much they can borrow. This constraint arises because depositors recognise that excessive leverage provides incentives for bankers to misbehave.

We calibrate the model to the pre-crisis euro area data and compare macroeconomic outcomes under three alternative central bank balance sheet policies: 1) maintaining a constant balance sheet; 2) standing ready to provide credit to banks at a fixed rate, against collateral in the form of government bonds, so that the size of the balance sheet is determined by banks' demand for central bank funding (akin to a fixed-rate full-allotment policy); and 3) conducting outright purchases of government bonds, with the central bank buying bonds at market price to achieve a certain inflation goal (akin to quantitative easing).<sup>[2]</sup>

The interactions between bank leverage and liquidity constraints turn out to be key for determining macroeconomic outcomes as money market conditions change. We should note that, in our analysis, changes in money market conditions (like the increase in haircuts or the reduction in unsecured lending) are treated as exogenous parameters. This is not to deny that there likely were endogenous reasons for these developments, such as sovereign default fears or a general weakening of bank balance sheets. Our analysis is therefore silent on the optimality of various central bank policies. Nevertheless, it is important to understand the quantitative response of the banking system and the economy to these policies, and this is our aim.

## What is the impact of an increase in secured market haircuts?

If haircuts in the private market increase, banks face tighter liquidity constraints. Unless the central bank intervenes, banks may have to de-leverage by reducing both their deposits and their lending, in turn triggering a fall in output. The left panel of Figure 2 compares the output effects (as % deviations from the calibrated pre-crisis steady state) of an increase in the secured market haircuts (from 0.03, or 3%, to 0.70,

or 70%) under the three central bank balance sheet policies outlined above. Under the constant balance sheet policy, as haircuts increase, the collateral value of bonds in the secured market decreases. Reserves become increasingly scarce as Unconnected banks increase their demand but the central bank keeps its balance sheet constant. Unconnected banks become so severely liquidity-constrained that they de-leverage sharply, both by accepting fewer deposits and by reducing their lending to firms. Output declines significantly (for haircut levels above 25%). Under our benchmark calibration, steady-state output is 7% lower under 70% haircuts than it is under 3% haircuts.

The key to mitigating the reduction in lending and output is to expand the central bank balance sheet to prevent sharp de-leveraging. This can be achieved both through collateralised credit operations, which allow Unconnected banks to top up their deposit funding with central bank funding, and through outright bond purchases, which replace bonds with low collateral value in the private market with reserves so that banks can self-insure against deposit outflows. Both policies reduce output losses. The difference in output between a steady-state with 3% haircuts and one with 70% haircuts is just 0.6% under a policy of credit operations, and even lower – a mere 0.06% – under outright purchases. The reason why credit operations are somewhat less effective than outright purchases at mitigating output losses is that, under the former, banks must hold collateral to obtain central bank funding and this crowds out their lending to firms, though only marginally so.

### What is the impact of reduced activity in the unsecured market?

Now consider a situation in which the secured market functions smoothly but fewer banks can borrow in the unsecured market. In this case, banks anticipate that they will need to rely on collateralised money market transactions and they increase their demand for liquid assets accordingly. As banks shift the composition of their assets away from lending, there is a decline in output.

How much does central bank balance sheet policy matter? The right panel of Figure 2 compares the output effects (as % deviations from the calibrated pre-crisis steady state) of an increase in the share of Unconnected banks in the economy under the three balance sheet policies outlined above. Outright purchases expand the central bank balance sheet and mitigate the scarcity of reserves. By contrast, the central bank balance sheet remains constant under both the constant balance sheet policy and under the credit operations, as there is no advantage in borrowing from the central bank as long as the secured market functions smoothly. The difference in output between a steady-state in which 0.58 of banks are Unconnected and one in which 0.95 of banks are Unconnected (average pre-2008 versus 2017 share of secured market turnover in total turnover) is around 1.5% under the constant balance sheet/credit operations and about 1% under outright purchases.

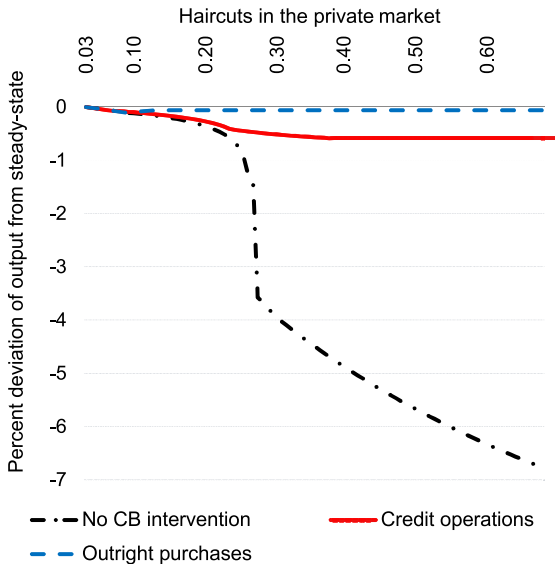
### Concluding remarks

To conclude, in our stylised model, changes in money market conditions affect the macroeconomy as they force banks to either divert resources into unproductive but liquid assets (bonds or reserves) or to de-leverage (raise fewer deposits, as it is deposit funding that exposes banks to deposit outflows). This leads to less lending and lower output in the economy.

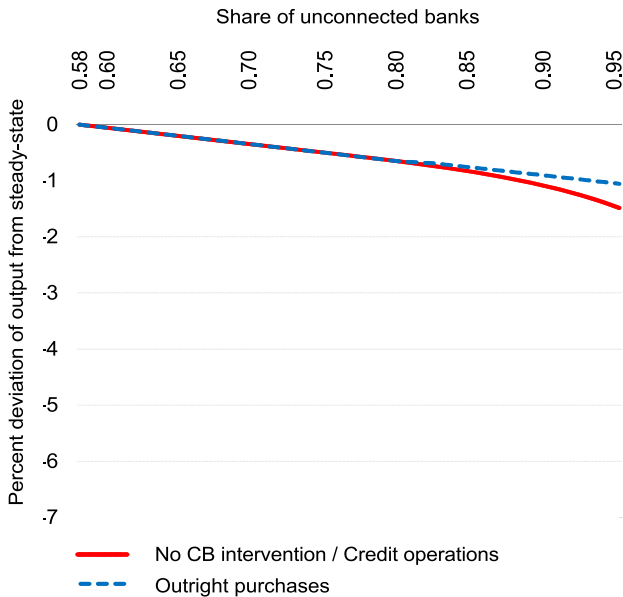
What are the effects of central bank policies? Quantitatively, we find that very tight liquidity constraints can lead to large declines in output (up to 5% in our calibrated example) in the absence of central bank intervention. Central bank policies that increase the size of the central bank balance sheet – via outright purchases or credit operations – can significantly mitigate the decline in lending and output, with the output decline being somewhat smaller under outright purchases compared to credit operations in our examples. While our analysis sheds some light on the effects of central bank balance sheet policies, normative conclusions as to whether or not these policies should be used lie outside the scope of our analysis.

**Figure 2: Impact of changing money market conditions on output**

Secured market



Unsecured market



## References

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[1] Disclaimer: This article was written by Fiorella De Fiore (Head of Monetary Policy, Bank for International Settlements), Marie Hoerova (Adviser, Directorate General Research, Monetary Policy Research Division) and Harald Uhlig (The Bruce Allen and Barbara Ritzenhaler Professor of Economics, University of Chicago). It is based on a paper entitled "Money Markets, Collateral and Monetary Policy". The authors gratefully acknowledge the comments of Paul Dudenhefer, Michael Ehrmann, Fabian Eser, Philipp Hartmann, Benjamin Hartung, Simone Manganelli, Silvia Margiocco, Alberto Martin and Zoë Sprokel. The views expressed here are those of the authors and do not necessarily represent the views of the European Central Bank, the Eurosystem or the Bank for International Settlements.

[2] Our model is related to two recent papers that also analyse money markets in a macroeconomic model, Bianchi and Bigio (2014) and Piazzesi and Schneider (2018). The distinguishing feature of our model is that we consider both secured and unsecured money markets, as well as a broader set of central bank policies. Moreover, our model is able to account for the key developments observed in euro area money markets.

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