Box 3.4

MONETARY POLICY IMPLEMENTATION AFTER THE CRISIS: A COMPARISON OF THE CORRIDOR AND FLOOR SYSTEMS

As indicated in the main text, the expansion of the main central banks' balance sheets has prompted a *de facto* transition from an operational framework characterised by limited bank reserves (relative to minimum requirements) and by money market yields, which fluctuated within the corridor formed by the interest rates on the deposit and lending facilities, to a situation of ample reserves and yields close to their floor (the deposit facility rate). The prospect of a gradual normalisation of monetary policy confronts these central banks with the dilemma of whether to maintain the current floor system or revert to the previous corridor system. This box uses the macroeconomic model of Arce, Nuño, Thaler and Thomas (2018) to compare the stabilising properties of both systems where monetary policy is restricted by the lower bound of interest rates.[1]

Arce *et al.* propose a neo-Keynesian general equilibrium model with a detailed characterisation of the banking sector. Banks have heterogeneous investment opportunities in the model, which give rise to an interbank market where banks lend each other money. To capture this bilateralism in practice, the model assumes that in the interbank market banks which ask for and offer credit have to actively seek each other out. If they do not find a counterparty, they may use the central bank's deposit or lending facilities (as appropriate). Thus, the interbank rate always stands within the corridor formed by the interest rates on the two facilities. The exact position of the interbank rate within this corridor depends on the liquidity conditions of that market: the higher credit supply relative to demand, the closer the interbank rate will be to the floor set by the interest rate on the deposit facility. The other interest rates in the economy are linked to the interbank rate, with the result that fluctuations in this rate are passed through to the interest rates on households' deposits and firms' loans.

In the model the central bank has two ways of influencing market rates. On one hand, the central bank alters the rate on deposit and lending facilities through conventional monetary policy. Thus, for example, when it effects a downward shift in the corridor, it prompts the interbank rate to fall and, consequently, causes other market rates to decline. On the other, the central bank can have a bearing on liquidity conditions in the interbank market and, therefore, on the position of the interbank rate within the corridor through quantitative easing (asset purchase policies). For example, when the monetary authority buys sovereign bonds owned by the banks, those banks with poorer investment opportunities attempt to lend their newly obtained liquidity on the interbank market. The attendant increase in the supply of interbank credit has two consequences. First, the lending banks which manage to find counterparties are forced to accept lower interest rates. Second, the proportion of lender banks which *do not* find counterparties increases and, consequently, they are forced to deposit their funds at the central bank in the form of reserves. The model therefore explains how asset purchase programmes by the central bank push the volume of reserves higher and shift the interbank rate towards the floor, in line with the international experience described above. Chart 1 shows, for the euro area, the relationship between the amount of reserves (as a percentage of GDP) and the spread between the interbank rate (in particular, the Eurepo index of interbank yields) and the remuneration of reserves, together with the relationship as predicted by the model (the black line).

Next the model is used to compare the stabilising capacity of a floor system and a corridor system. Consider a situation in which the economy is in a steady or long-term state. In this situation, the interest rate on households' deposits and the interbank rate only depend on real factors – such as households' discount rate – and the level of the central bank's inflation target, but they *do not* depend on the monetary policy operating system (floor or corridor).[2] The interest rate on reserves in the long term does depend on this system. If the central bank uses the corridor system, the interbank rate is in the middle of the corridor and, consequently, the reserve rate is *below* the interbank rate. Conversely, if it uses a floor system, the interbank rate is the same as the reserve rate. Therefore, in the long term, the floor system means a *higher* level of the interest rate on reserves than in the corridor system

1 Ó. Arce., G. Nuño, D. Thaler and C. Thomas (2018). *A Large Central Bank Balance Sheet? Floor vs Corridor Systems in a New Keynesian Environment,* Banco de España, Working Paper 1851. As discussed in the main text, this was the fundamental mechanism for monetary policy conduct before the crisis.

2 In the model, for plausible calibrations the remuneration of households' deposits is always very close to the interbank rate and, in the floor system, it is exactly the same as the interbank rate.

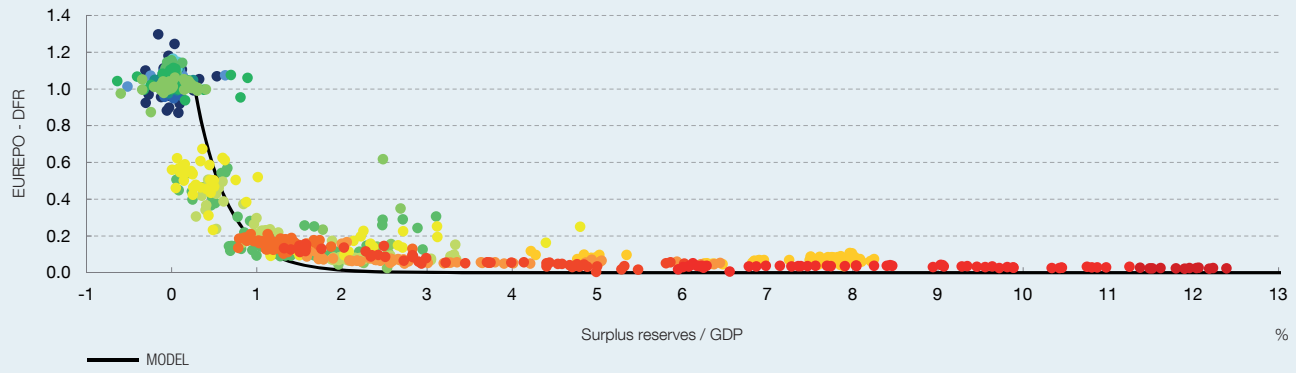
and, consequently, there will be more scope to cut it when faced with negative shocks. The magnitude of this additional headroom is equivalent to half the width of the symmetrical corridor. For example, the difference between the European Central Bank's pre-crisis deposit and lending facility rates was 200 basis points (bp); in this case, the gain in terms of room in a floor system would be 100 bp.

The red and blue lines in Charts 2, 3.1 and 3.2 exemplify this comparison by showing the economy's response to a negative demand shock in a version of the model which is calibrated for the euro area. In a corridor system scenario, where the central bank maintains its balance sheet size at low levels (the blue lines in Charts 2 and 3.1), the deflationary effect of the shock is strong enough to make the central bank reduce the rate on the deposit facility to its lower bound and hold it there for several quarters.[3] The red lines in Charts 2 and 3.2 show the same situation, but starting out from a steady state with the floor system, i.e. with a central bank balance sheet which is large enough for the reserve rate to be equal to the interbank rate at any given time and, therefore, it starts out from a higher initial level. In this case, the central bank has more room (100 bp in this example) to lower the deposit facility rate. This results in a greater fall of the interbank rate and, by extension, of other market rates. As a result of this greater stimulus, the impact of the crisis is mitigated – by reducing the decline in activity and prices – to such an extent that the central bank does not actually consider it necessary to reduce the remuneration of reserves to its lower bound.

The above comparison assumes that in the corridor system the central bank does not introduce any measures to expand its balance sheet. The dark blue broken lines in Chart 2 and the solid lines in Chart 3.3 depict a third scenario, where the central bank starts out with a corridor system but expands its balance sheet through a temporary government bond purchasing programme implemented contemporaneously with the recessionary shock. This situation would roughly mirror the recent experience of central banks in the main advanced economies. Using

Chart 1
RELATIONSHIP BETWEEN SURPLUS RESERVES AND THEIR OPPORTUNITY COST IN THE EURO AREA (a)

The chart shows the historic relationship between surplus bank reserves deposited at the ECB and the opportunity cost of these reserves, defined as the difference between the collateralised interbank interest rate (Eurepo) and the deposit facility rate (DFR). The line shows the results obtained by the economic model used.

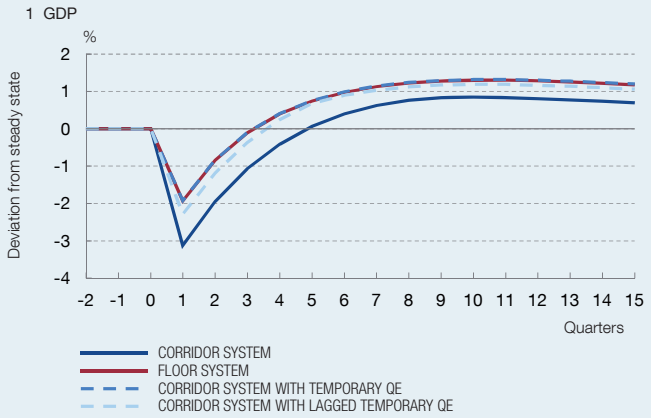


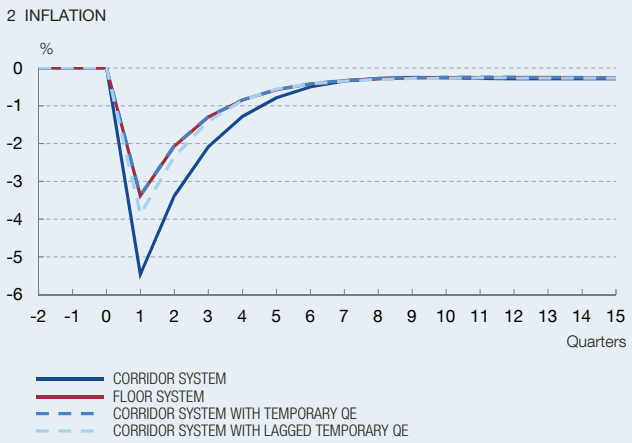
SOURCE: Banco de España, based on the model of Arce, Nuño, Thaler and Thomas (2018).

a The colours indicate the year, from dark blue which corresponds to the beginning of the sample (1999) through to red (2019).

3 Arce *et al.* (2108) op. cit. In the model, the central bank adjusts its interest rates (assuming a constant distance between the upper and lower bounds of the corridor) so that the interbank rate, that is the central bank's operating target, follows a simple Taylor rule which responds to deviations in inflation from its target. This is so *except* when the rate on the deposit facility implementing the desired interbank rate collides with its lower bound; in this case, the central bank loses its ability to continue reducing rates to return inflation to its target.

Chart 2
MAIN MACROECONOMIC VARIABLES





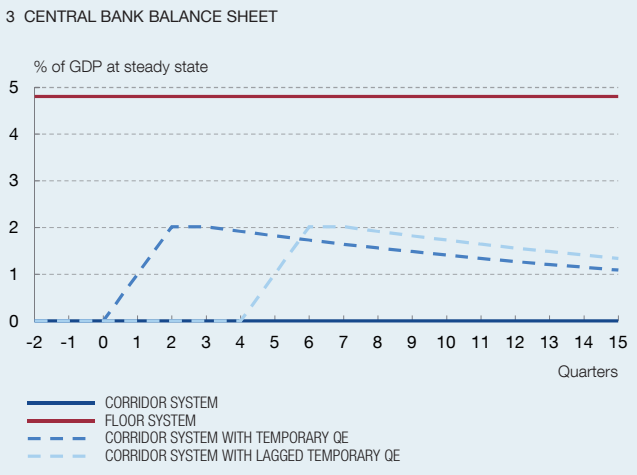
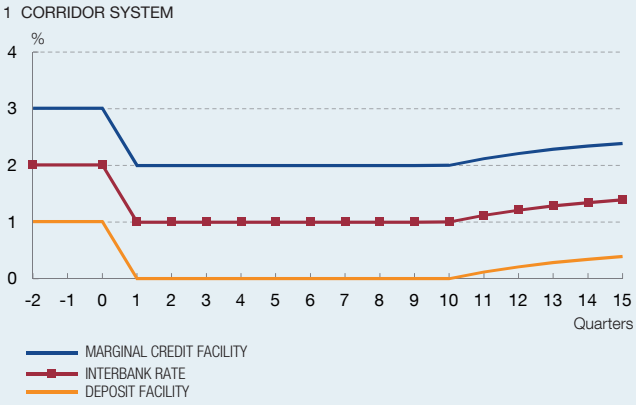
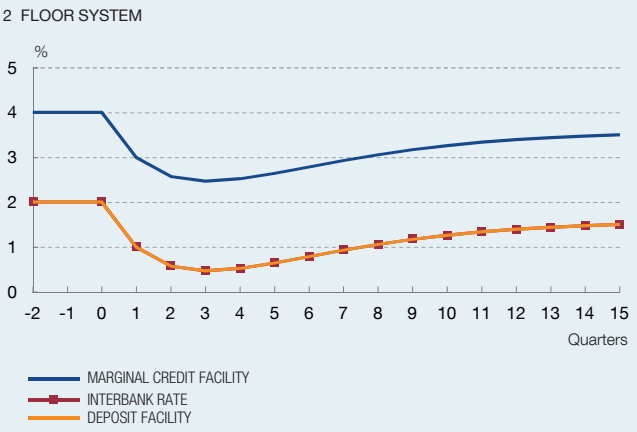
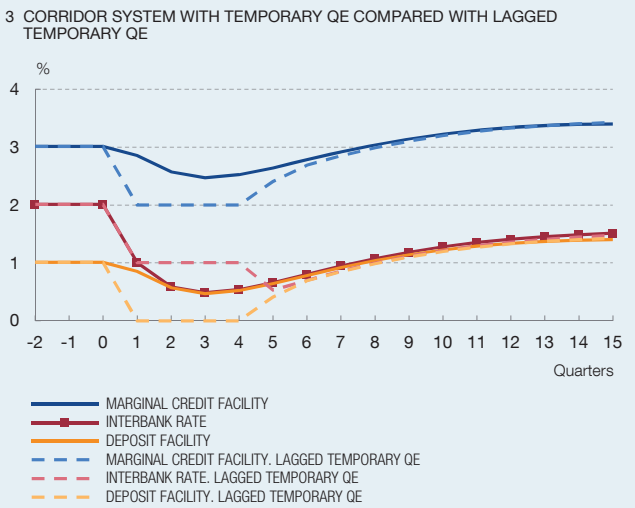


Chart 3
POLICY AND INTERBANK INTEREST RATES IN A CORRIDOR/FLOOR SYSTEM







SOURCE: Banco de España.

this measure, the central bank manages to squeeze the spread between the interbank and reserve rates and, therefore, achieves an additional decline in the interbank rate and in other market rates. As a result of the attendant additional stimulus the stabilisation of GDP and inflation is similar to that in the floor system. However, this equivalence hinges crucially on the central bank having the ability to trigger its asset purchases as soon as the adverse shock arises, something which may be complex in practice (for example, for operating or institutional reasons). The light blue broken lines in Chart 2 and the broken lines in Chart 3.3 show an alternative scenario where the central bank starts to purchase assets a year after the recession has begun. In this case, the stimulus is smaller and, consequently, GDP and inflation fall more than in the two above-mentioned cases.

In short, a floor system provides direct control of market interest rates and more room to cut benchmark rates in response to negative shocks. Although a corridor system which implements temporary asset purchase programmes can achieve very similar monetary stimulus, these programmes must be expedited. In practice, however, the triggering and implementation of asset purchase programmes may be delayed, which reduces their effectiveness. The opposite is the case with interest rate policy, which is, operationally speaking, generally less complicated to change.