Central bank tools for steering short-term interest rates

Renaud Beaupain[1] Yann Braouézec[2]

19 June 2018

Forthcoming in *Reflets et perspectives de la vie économique, 2018*

Abstract

In a context marked by manipulation attempts and by declining money market activity, this paper takes a new look at reference interest rates. More specifically, we discuss the operational tools used by central banks to steer those rates and we compare the operational frameworks of the Federal Reserve in the United States and of the European Central Bank in the euro area. We show how the interest rate corridor has provided a ceiling and a floor to the unsecured overnight interest rate in Europe and how the corridor implemented by the Federal Reserve at the peak of the financial crisis was subsequently adjusted to offer an effective floor to its interbank market, notably through the implementation of an overnight reverse repurchase agreements program.

Résumé

Dans un contexte marqué par des tentatives de manipulation et par une diminution notable de l'activité des marchés monétaires, cet article traite des taux d'intérêt de référence. Plus spécifiquement, nous discutons des outils opérationnels à la

[1] IESEG School of Management (LEM-CNRS). email: r.beaupain@ieseg.fr
[2] IESEG School of Management (LEM-CNRS). email: y.braouezec@ieseg.fr

disposition des banques centrales pour gouverner ces taux et nous comparons les cadres opérationnels de la Réserve fédérale américaine et de la Banque centrale européenne. Nous montrons comment, en Europe, le corridor de taux d'intérêts fournit un plafond et un seuil au taux d'intérêt du marché monétaire à maturité un jour et comment le corridor introduit par la Réserve fédérale au cours de la crise financière a été par la suite ajusté afin d'établir un seuil effectif à son marché interbancaire, particulièrement par l'introduction d'un programme de repo inversé à maturité un jour.

Keywords: Operational framework, interest rate corridor, central bank facilities, overnight reverse repurchase agreements

JEL Codes: E520

Introduction

Short-term references interest rates such as the EONIA (and the Euribor) in Europe or the fed funds rates (and the USD Libor) in United States play an important role in the real economy as they contribute to shape the interest rates offered by banks to households and to small enterprises. They also play an important role in financial markets not only because they represent the cost of borrowing in the interbank lending market but also because they are used in various financial contracts such as interest rate derivatives (swaps, interest rate options, interest rate futures, etc.) and floating-rate loans and mortgages (residential mortgage-backed securities, commercial mortgage-backed securities, etc.) with thousands of billions of dollars outstanding. For instance, Duffie and Stein (2015) report that, for the sole case of interest-rate derivatives, USD 100 trillion are Libor-dependent.[3]

Following notable manipulation attempts of reference interest rates and in a context of declining money market activity, reference interest rates have recently received significant attention from both policymakers and investors. In this paper, our aim is to review the tools used by monetary policy authorities to *steer* reference interest rates, that is, to (try to) maintain an overnight benchmark interest rate such as the EONIA in Europe or the fed funds rate in the United States within a specified corridor (which is typically an interval). As we shall discuss, maintaining the overnight benchmark interest rate within a corridor is not always an easy task and this has notably led the Federal Reserve in 2013 to experiment and then organize overnight reverse repurchase agreements (ON RRP) in order to reach this objective.

In the first section of this paper, we review the tools contained in the operational frameworks of central banks to implement their monetary policy decisions. More specifically, we discuss the reserve requirements and the corridor system and we consider how these tools were adjusted during the recent financial crisis. Our analysis then turns to the decision taken by the Federal Reserve to implement overnight reverse repos in order to steer the fed funds rate within a corridor. As a comparison, the European case is also discussed. In the second

[3] Note that in this paper we will not discuss the Libor scandal. See for instance Duffie and Stein (2015) for a comprehensive overview.

section, we examine the evolution of the other reference short-term interest rates in the money market such as the Euribor and the USD Libor rates, especially at longer tenors. We finally conclude the paper and briefly discuss the future of reference interest rates.

1. The corridor system and the possibility for the benchmark overnight interest rate to exit from this corridor

There are two well-known types of frameworks that are used to implement monetary policy: the interest rate corridor and the reserve requirements. While a (pure) interest rate corridor system on the one hand relies on standing central bank facilities, the (pure) reserve regime on the other hand makes use of reserve requirements (see Whitesell, 2006). In practice, however, monetary authorities actually make use of a mix of the two frameworks, that is, they may use a corridor system with reserve requirements.

Banks that are subject to reserve requirements must maintain a sufficient level of reserves with their central bank over a period of time called the reserve maintenance period. Although the duration of this period depends on the central bank (two weeks in the United States and six weeks in the euro area), the underlying mechanisms are however similar. First, reserve requirements are determined based on the size of the institution: they are computed from amount of "reservable liabilities" (United States) or from level of deposits (euro area) held by each institution. Second, the requirements must be satisfied on average over the maintenance period, therefore allowing the actual reserves of a bank to actually fluctuate from day to day, essentially due to the (idiosyncratic or market-wide) liquidity shocks that it faces. Third, to balance their reserves, banks can either rely on the central bank directly (essentially through collateralized open market operations) or can access the unsecured interbank money market to borrow or lend their excess liquidity between the operations organized by the central bank.

The corridor system for the implementation of monetary policy is usually defined by two types of *overnight* interest rates, a *floor interest rate*, which is the

overnight interest rate at which eligible banks can invest (i.e., lend) their (excess) liquidity on their bank account at the central bank, and a *ceiling interest rate*, which is the overnight interest rate at which banks can borrow liquidity from the central bank. The corridor system is typically designed to steer short-term interest rates towards a target defined by the central bank. In principle, the overnight benchmark interest rate such as the EONIA[4] in Europe or the federal funds rate in the United States, which represent in both cases the (volume-weighted average) interest rate at which banks *borrow* in the interbank lending market, should be at each time *t* within the corridor. If we denote by $\underline{R}$ and $\overline{R}$ the floor and ceiling interest rate respectively that prevails at a given time *t* and R_t^{bench} the overnight benchmark interest rate at time *t*, it should be the case that

$$R_t^{bench} \in [\underline{R}, \overline{R}] \qquad \text{for } \textit{each time } t$$

where *t* is a given day. In the specific case of the European Central Bank (ECB), the ceiling interest rate is the rate of its marginal lending facility while the floor interest rate is its deposit facility rate. On 30th November 2017, while the rate of the marginal lending facility stood at 25 basis points, the deposit facility rate was -40 bps.[5]

Recently, in the United States, the Federal Reserve (hereafter, the Fed) has adopted a similar corridor system to better reach its target interest rate. Since October 2008, the Fed now pays a positive interest rate on bank reserve balances[6] and this interest rate plays the role of the floor interest rate, the equivalent of the deposit facility in Europe. On the other hand, the rate at which banks can borrow from the Fed, the discount rate, also sometimes called the "primary credit rate", stands as a ceiling interest rate. Once again, in principle, the overnight benchmark interest rate (the fed funds rate) thus should lie within the corridor, as in Europe. However, after October 2008, the overnight fed funds rate has repeatedly been

[4] EONIA stands for Euro Overnight Index Average and is computed from the unsecured overnight transactions reported by a panel of market participants.

[5] Following a decision by the Governing Council, the rate of the deposit facility of the ECB entered negative territory on 11th June 2014 and has remained negative since this date.

[6] Similar to the situation in Europe, the Federal Reserve actually makes a distinction between the rate on required reserve balances and the rate on excess reserve balances.

below the interest rate on reserves. Williamson (2016) reports that the fed funds rate has been 5 to 20 basis points *lower* than the interest rate on excess reserves (IOER) and this fact seems puzzling at first glance. When the overnight fed funds rate R_t^{bench} is below the interest rate on reserves $\underline{\mathrm{R}}$, this means that at least some banks can borrow money from a counterparty *i* at an interest rate R_i which is *lower* than the known interest rate $\underline{\mathrm{R}}$, that is $R_i < \underline{\mathrm{R}}$. In such a case, it may be the case that $R_t^{bench} < \underline{\mathrm{R}}$. If not, it must be the case that $R_t^{bench} > \underline{\mathrm{R}}$. When a bank can borrow an amount *A* at time *t* at an interest rate $R_i < \underline{\mathrm{R}}$, it can invest this amount *A* at the Fed to earn the interest rate on (excess) reserve balances $\underline{\mathrm{R}}$. The resulting profit of that bank thus is equal to $\pi = A\,(R_i - \underline{\mathrm{R}}) > 0$ and this constitutes an elementary arbitrage opportunity since the profit $\pi > 0$ can be realized *without taking any risk*. As clearly discussed in Frost et al. (2015) and Ihrig et al. (2015) (see also Bech and Klee, 2011), the very reason of the existence of such an arbitrage opportunity is related to the nature (indeed the composition) of the market participants in the federal funds market. It turns out that large and active lenders such as the Government-Sponsored Enterprises (GSEs) or money market funds (MMFs), which are indeed not banks, are *not eligible* to earn the interest rate on excess reserves. As a result, when lending an amount *A*, these non-banks may accept an interest rate which is below $\underline{\mathrm{R}}$ and this explains why the fed funds rate may actually be lower than $\underline{\mathrm{R}}$, the interest rate on excess reserves. As a result, the IOER cannot in itself constitute a floor interest rate for the fed funds market because of the presence of such non-bank participants. To obtain an effective lower bound for the fed funds rate, the Fed decided to add a "new" instrument to its operational framework through the implementation of overnight reverse repurchase agreements (ON RRP). The purpose of this program is essentially twofold. First, it aims at withdrawing excess liquidity from non-bank institutions (see Grossman-Wirth and Vari, 2016), and second, it encourages arbitrage, that is, it encourages non-banks to participate in overnight reverse repos to obtain a known positive interest rate on their liquidity (see e.g., Ihrig et al., 2015). If all non-bank institutions are aware of this alternative, then, all these non-banks should never (rationally) lend at a rate below the interest of the ON RRP, something

acknowledged by the Fed on its website[7]: "*any counterparty that can use the ON RRP facility should be unwilling to invest funds overnight with another counterparty at a rate below the ON RRP rate, just as any depository institution eligible to earn interest on reserves should be unwilling to invest funds overnight with another counterparty at a rate below the interest rate on excess reserves*". In some sense, the implementation of ON RRP, announced on 17 September 2014, led to the creation of a "double floor" in the federal funds market: one for the banks, but which cannot be the effective floor and one for the overall market since non-bank institutions are eligible to lend at the rate of the ON RRP.

Figure 1 depicts the evolution of the IOER, the effective fed funds rate as well as the evolution of the ON RRP rate since the initiation of the ON RRP program (September 2013) up to end November 2017. The Figure clearly shows that, over this period, the fed funds rate is always below the IOER but always above the ON RRP rate. As expected, the ON RRP thus constitutes the effective floor interest rate for the fed funds rates.

[7] See https://www.federalreserve.gov/monetarypolicy/overnight-reverse-repurchase-agreements.htm

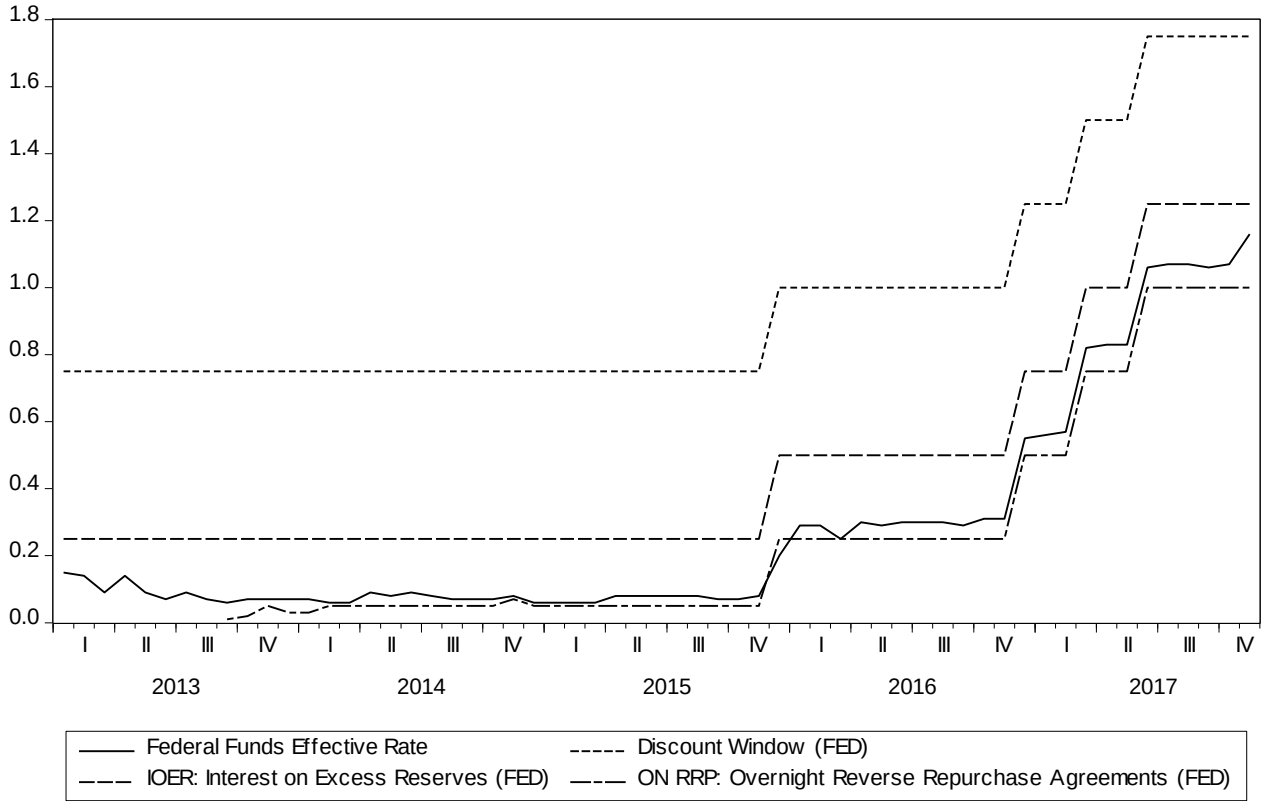

Figure 1. This Figure depicts the evolution of the federal funds rate (solid line) and the ceiling of the corridor formed by the discount window and its floor for banks (the interest rate on excess reserves) or non-bank participants (the overnight reverse repos). The data is from Thomson Reuters Datastream and covers the period from January 2013 to November 2017.

The proportion of funds allotted through the overnight reverse repurchase agreements reported in Figure 2 confirms that at these specific operations money essentially flows to money market funds and government-sponsored enterprises and only very marginally to banks and primary dealers. This picture appears stable over the September 2013 to June 2017 period and remains in line with the discussion reported in Frost et al. (2015).

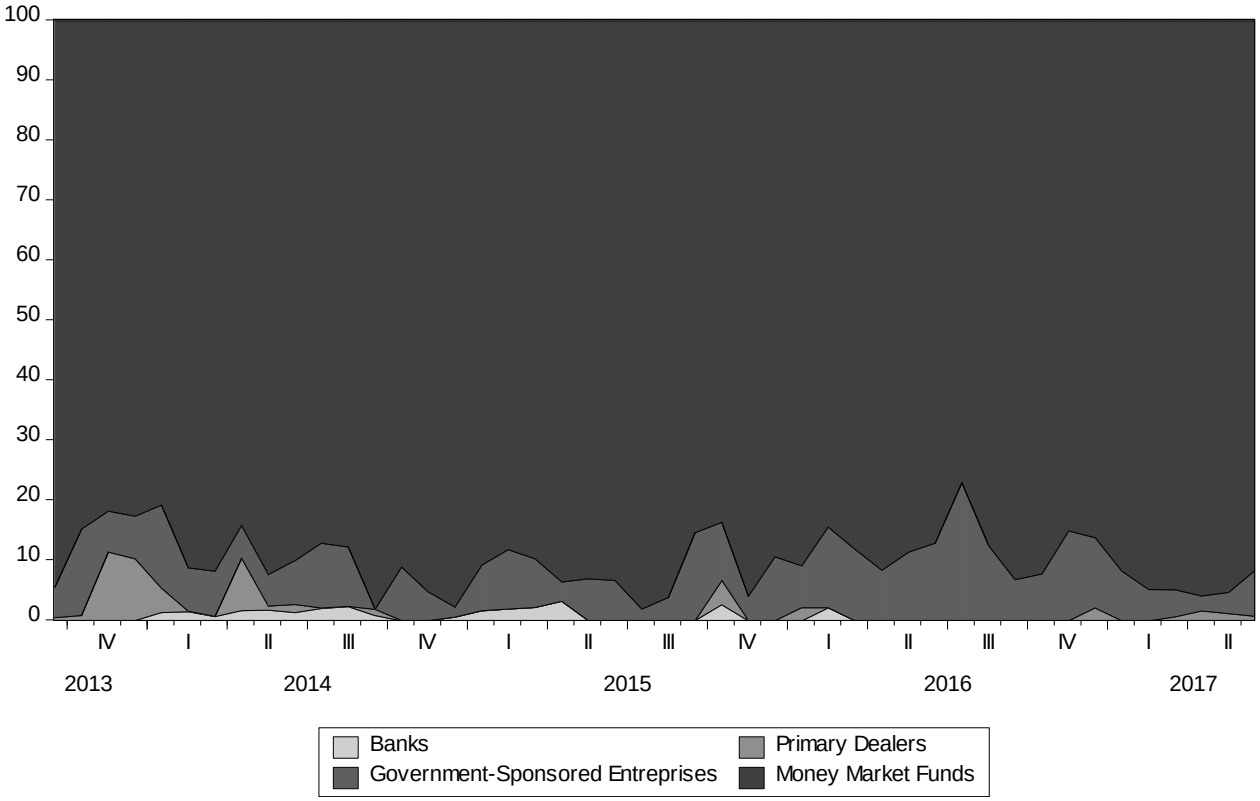

Figure 2. This Figure reports the breakdown (in percentage) of the overall amount allotted through overnight reverse repurchase agreements to (a) banks, (b) primary dealers, (c) government-sponsored enterprises (GSEs) and (d) money market funds. The data covers the period from September 2013 to June 2017 and is from the Federal Reserve Bank of New York.

As Figure 3 illustrates, in the euro area, the Euro Overnight Index Average (EONIA) has always remained within the corridor formed by the standing facilities of the European Central Bank. In other words, while the rate of the marginal lending facility has constituted a ceiling for the overnight market rate, the rate of the deposit facility of the ECB has determined its effective floor. These dynamics are largely explained by the different composition of the interbank money market of the euro area, which, in contrast to the US federal funds market, is mainly composed of financial institutions eligible to the operations and facilities of the central bank. Market participants have consequently generally access to the central bank facilities, which therefore clear the market (i.e., transactions would not occur outside of the corridor, since they would then occur at penalty rates relative to the rate of the central bank facilities). The market exists for the range of rates standing inside the corridor.

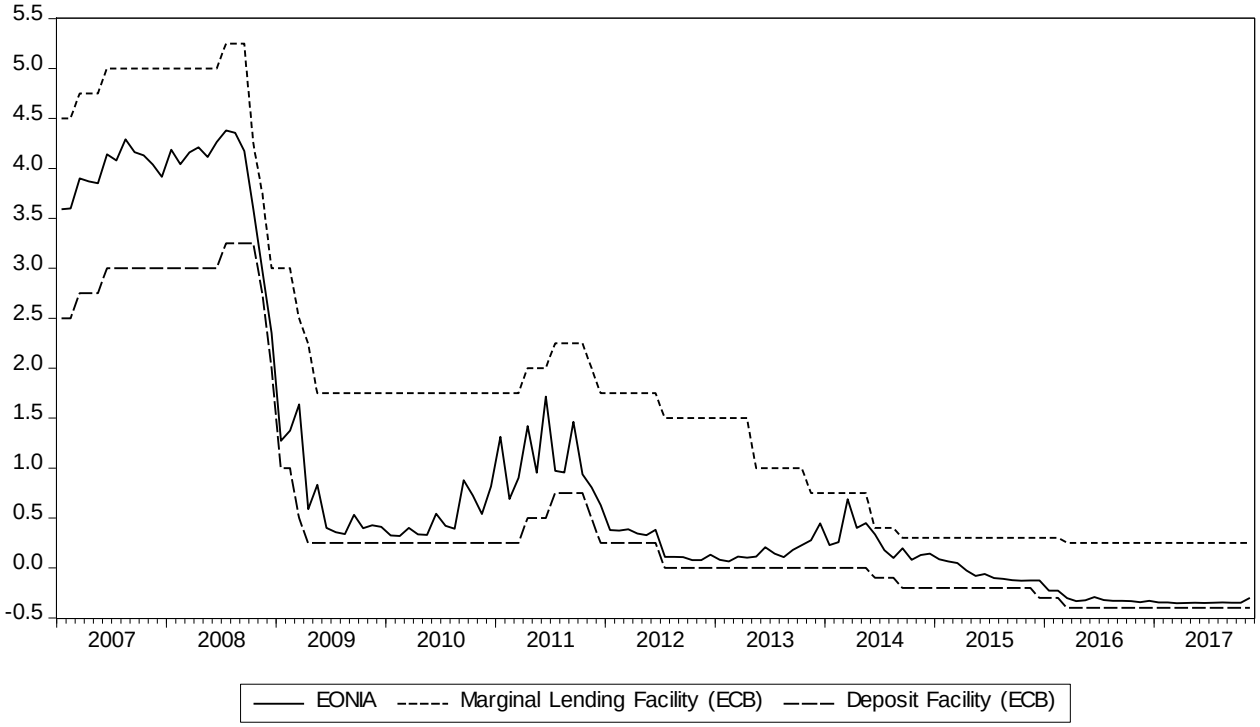

Figure 3. This Figure shows the dynamics of the overnight money market in the euro area from January 2007 to November 2017. The solid line is the EONIA, the dashed lines are the rate of the marginal lending facility and of the deposit facility. The data is from Thomson Reuters Datastream.

2. The corridor and the other money market reference rates

The above analysis illustrates the influence of the operational framework for the implementation of the monetary policy on the overnight market rates. Being the shortest-available maturity, these rates are the anchoring points of the whole respective yield curves through which monetary policy decisions are transmitted to longer maturities. The EONIA anchors the yield curve of the euro area and the yield curve in the United States is similarly linked to the fed funds rate. We now turn our analysis to an examination of the dynamics of longer tenors in the money market and of how these rates were impacted by the operational tools used by the central banks.

In contrast to the fed funds rate and to the EONIA, the USD Libor as well as the Euribor are not based on actual transactions executed by market participants, but are computed from the rates declared by a panel of participating institutions who report on their perceived market conditions. Specifically, the reported rates correspond to trimmed averages of the submissions of individual banks, where the most extreme contributions are removed.[8] Figure 4 shows the evolution of USD Libor rates from January 2007 to November 2017, where the shaded area represents the spread between the one-week and one-year tenors.[9] The solid curve depicts the dynamics of the three-month tenor. Similar to the evolution of the federal funds rate, it turns out that USD Libor rates were also influenced by the way the monetary policy was implemented in the United States during the crisis period. Most notably it appears that while the lower bound of the shaded area (the USD Libor 1W) repeatedly goes below the floor formed by the interest rate on excess reserves (IOER), it never goes below the overnight reverse repo rate (ON RRP), which stands as its effective floor. A similar picture is observed for longer tenors of the USD Libor.

[8] Libor and Euribor fixings are based on different trimming levels. More details on the calculation methodologies and on the panel compositions are reported on the websites of their administrators. See the ICE Benchmark Administration website for the Libor and the Euro Money Markets Institute (EMMI) website for the Euribor.
[9] Note that, although an overnight tenor of the USD Libor exists, it is not examined here for comparability reasons with the Euribor, where this tenor is not reported.

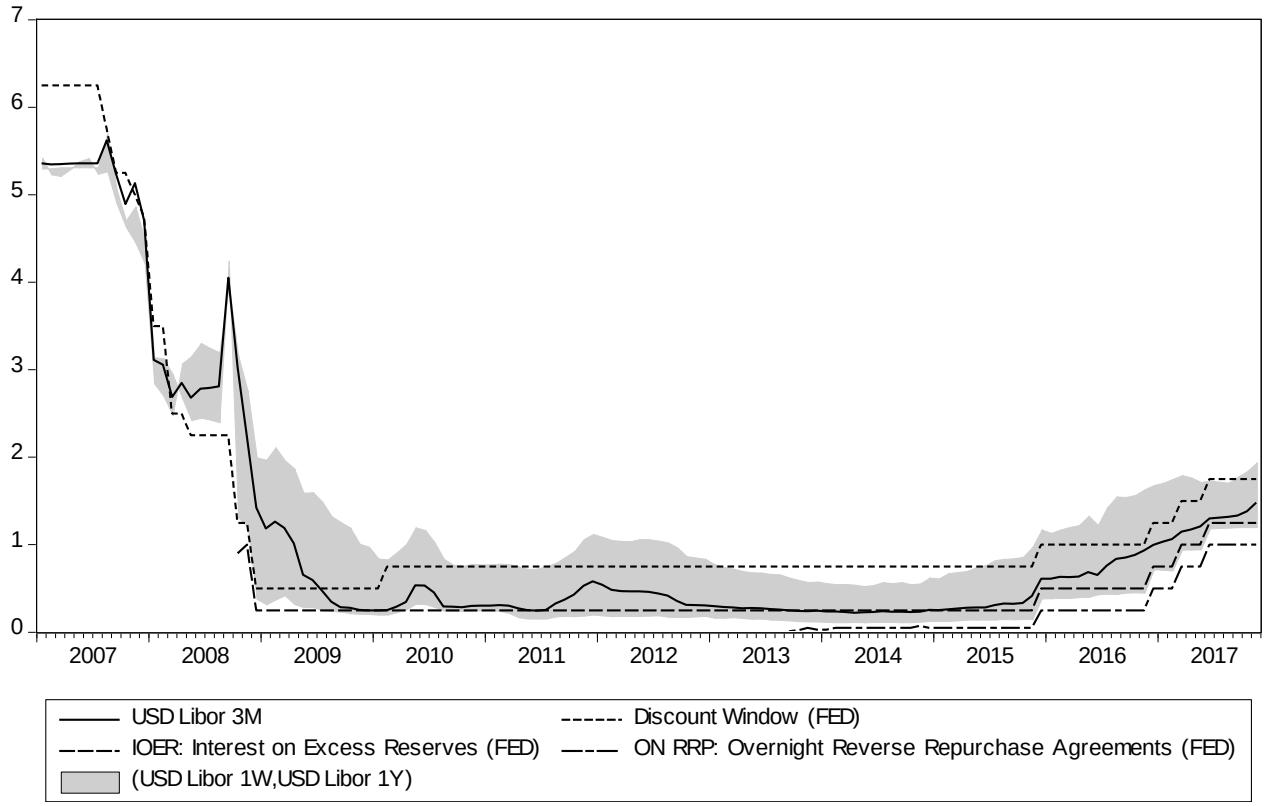

Figure 4. This Figure reports the evolution of USD Libor rates (the shaded area represents the distance between the 1W and 1Y tenors and the solid black curve is the 3M tenor). The Figure also reports the Federal Reserve discount window rate, the interest rate on excess reserves (IOER) and the rate of the overnight reverse repurchase agreements (ON RRP). The data is from Thomson Reuters Datastream and covers the period from January 2007 to November 2017.

The case of the euro area is examined in Figure 5 which reports the dynamics of the corresponding Euribor rates. The shaded area similarly represents the distance between the one-week and one-year tenors for each time *t* and the solid curve is the three-month Euribor. Similar to the USD Libor, Euribor rates are computed daily from the declared market conditions faced by a panel of financial institutions participating in the benchmark. Importantly, in the case of the Euribor, all reporting institutions are European banks eligible to the central bank facilities. As the Figure illustrates, the corridor of the rates determined by the ECB also drives money market reference rates beyond the overnight maturity. Specifically, between January 2007 and November 2017, Euribor rates only occasionally went below the lower bound formed by the deposit facility rate of the central bank.[10] A

[10] More specifically, over this period, there are 14 days on which the Euribor 1W fell below the deposit facility rate of the ECB. However the 3M and 1Y tenors both remained above the floor of the corridor.

striking feature of the euro situation is that, since June 2014, the ECB has decided to introduce a *negative rate* on the marginal deposit facility, that is, the floor interest rate $\underline{R}$ is now negative. This floor interest rate was first equal to -10 bps and, since March 2016, it is now equal to -40 bps. As a result, as we observed in Figure 3, the EONIA, that is, the overnight benchmark interest rate for the euro area, has also been negative since 2015.

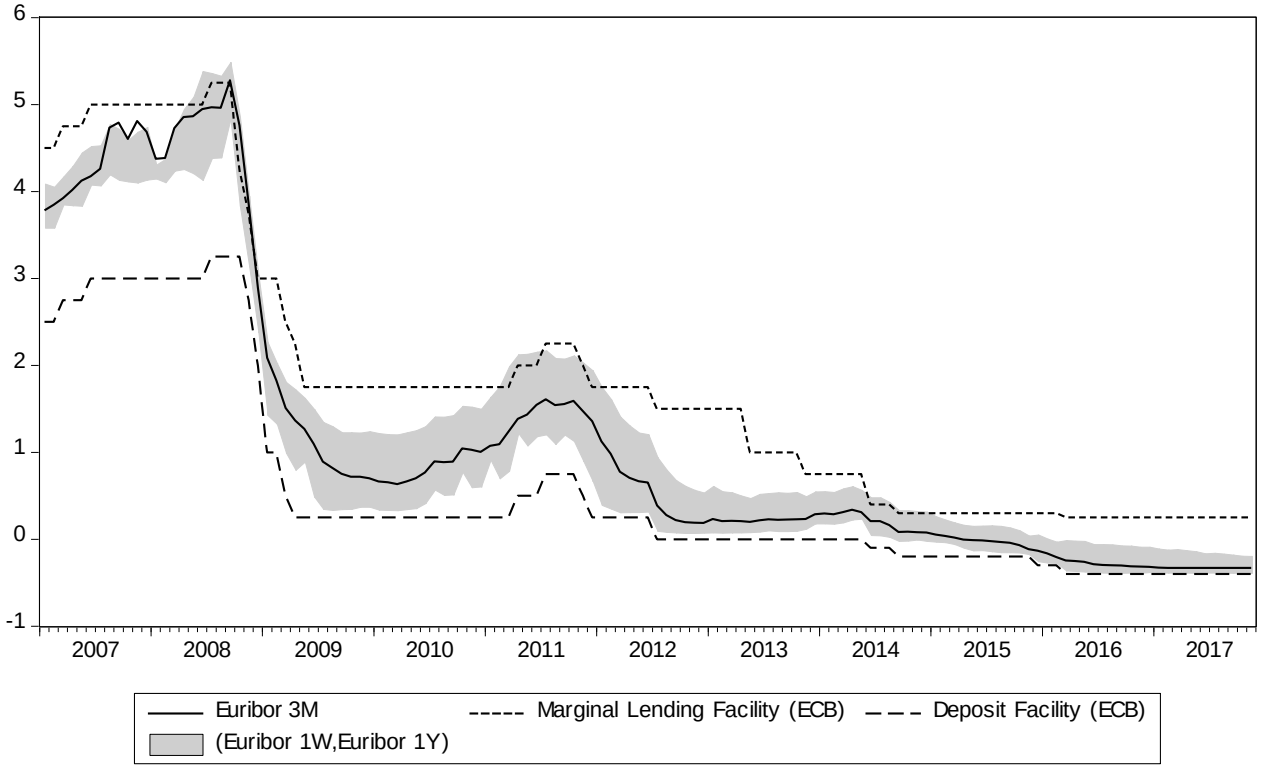

Figure 5. This Figure shows the dynamics of Euribor rates (the shaded area represents the distance between the 1W and 1Y tenors and the solid black curve is the 3M tenor). The Figure also reports the corridor formed by the marginal lending and deposit facilities of the ECB. The data is from Thomson Reuters Datastream and covers the period from January 2007 to November 2017.

Conclusion

Despite the Libor manipulation scandal revealed a few years ago, benchmark interest rates (such as the Euribor and Libor, which are derived from the declarations of a panel of market participants, as well as the EONIA or the fed funds rate, which are in contrast computed from actual transactions) still take major importance not only for market participants but also for policymakers and central

bankers. In his July 2017 speech, Andrew Bailey, Chief Executive of the British Financial Conduct Authority (FCA), nevertheless announced that the end of the Libor would occur in 2021, mainly due to the absence of active underlying markets[11] rather than as a result of the Libor scandal. While Bailey (2017) asks the natural question – what happens to the Libor at the end of 2021 – the answer provided is however not very precise: the Libor could still be produced but it "would no longer be sustained through the mechanism of the FCA". In a comment published on the website of the Risk magazine, Darrell Duffie also considered the question of what should be done with the Libor, which , like the Euribor, is a singular reference rate in that it is an *unsecured* interest rate based on *declarations* (and therefore not derived from actual market transactions). As observed by Duffie (2017), with the collateralization of swaps and more generally of over-the-counter derivatives, it would be more natural to use secured rates to "discount and hedge their cash flows". According to the author, the remaining challenge is to reduce their reliance on interbank offered (IBOR) interest rates to the benefit of overnight benchmarks. In that respect, the ECB has (recently) announced the preparation of a new overnight rate that, while sharing common features with the current EONIA (it will similarly rely on effective transactions executed between market participants), will however differ in several ways. While the technical details of the new benchmark remain to be precisely determined, the ECB will follow the recommendations of the International Organization of Securities Commissions (IOSCO) regarding the optimal features of such a rate. In a recent document published in September 2017, the ECB notably discusses the significant reasons why interest rate benchmarks take such a crucial importance to the "smooth functioning of the financial market" (ECB, 2017). With the adoption and implementation of the FR 2420 Report of Selected Money Market Rates in the United States in April 2014, the Federal Reserve now also promotes greater transparency on the determination of its overnight market rate, notably by reinforcing the set of publicly available details on the federal funds market.

[11] The end of the Libor means, to be precise, the end of the regulation by the FCA, which has regulated the benchmark since the Libor scandal. See for instance https://www.fca.org.uk/news/press-releases/fsa-finalises-proposals-regulation-and-supervision-benchmarks.

It is definitely too early to anticipate what will be the most popular reference interest rates in the years to come. It is however clear that future benchmark rates could be based on effective transactions (rather than on declarations) and should be less open to manipulations by market participants. Annihilating manipulations is a difficult task but, as is well-known, the computations of the Euribor and Libor fixings could be based in the future on the median of the submissions rather than on their (trimmed) mean, which would further restrict manipulations.

References

Bailey, A. (2017). The Future of Libor. FCA speeches.

Bech, M. L. and Klee, E. (2011). The mechanics of a graceful exit: Interest on reserves and segmentation in the federal funds market. *Journal of Monetary Economics* 58 (5), 415-431.

Duffie, D., and Stein, J. C. (2015). Reforming LIBOR and other financial market benchmarks. *Journal of Economic Perspectives 29*(2), 191-212.

Duffie, D, (2017). What to do about Libor? *Risk.net*

European Central Bank (2017). Why are benchmark rates so important? https://www.ecb.europa.eu/explainers/tell-me-more/html/benchmark_rates_qa.en.htm

Frost, J., Logan, L., Martin, A., McCabe, P. E., Natalucci, F. M. and Remache, J. (2015). Overnight RRP operations as a monetary policy tool: Some design considerations. Finance and Economics Discussion Series 2015-010.

Grossman-Wirth, V. and Vari, M., (2016). Existing low interest rates in a situation of excess liquidity: The experience of the Fed. Quarterly Selection of Articles, *Banque de France Bulletin*, Autumn.

Ihrig, J. E., Meade, E. E. and Weinbach, G. C. (2015). Rewriting monetary policy 101: What's the fed's preferred post-crisis approach to raising interest rates? *The Journal of Economic Perspectives* 29(4), 177-198.

Whitesell, W. (2006). Interest rate corridors and reserves. *Journal of Monetary Economics* 53(6), 1177-1195.

Williamson, S., (2016). Interest rate control is more complicated than you thought. Federal Reserve Bank of St. Louis *Regional Economist* 24 (2), 15-17.