A TIERING RULE TO BALANCE THE IMPACT OF NEGATIVE POLICY RATES ON BANKS

MATTIA GIROTTI, BENOIT NGUYEN, AND JEAN-GUILLAUME SAHUC

ABSTRACT. Negative interest rate policy makes excess liquidity costly to hold for banks and this may weaken the bank-based transmission of monetary policy. We design a rule-based tiering system for excess reserve remuneration that reduces the burden of negative rates on banks while ensuring that the central bank keeps control of interbank interest rates. Using euro-area data, we show that under the proposed tiering system, the aggregate cost of holding excess liquidity when the COVID-19 monetary stimulus fully unfolds would be more than 36% lower than that under the ECB's current system.

JEL: E43, E52, G21

Keywords: Negative interest rates, excess liquidity, tiering system, bank profitability, interbank market

1. INTRODUCTION

Over the last decade, central banks in Denmark, the euro area, Japan, Sweden, and Switzerland, have implemented a negative interest rate policy (NIRP). A key motive for implementing this policy is to further ease monetary conditions and support economic activity. Yet, NIRP may also affect bank profitability by making reserves in excess of the minimum reserve requirements costly to hold, especially when banks are unable to pass negative rates on depositors. The erosion of banks' net interest margins and profits might eventually impair the bank-based transmission of monetary policy and make NIRP contractionary (Brunnermeier and Koby, 2018; Eggertsson et al., 2019). In an effort to avoid this potential negative side effect from materializing, central banks have introduced different tiering systems for reserve remuneration, which exempt part of banks' excess reserves from negative rates.[1] However, while mitigating the cost for banks, tiering affects the volume of non-exempt excess reserves in the system and the demand and supply in the interbank market. Consequently, exempting

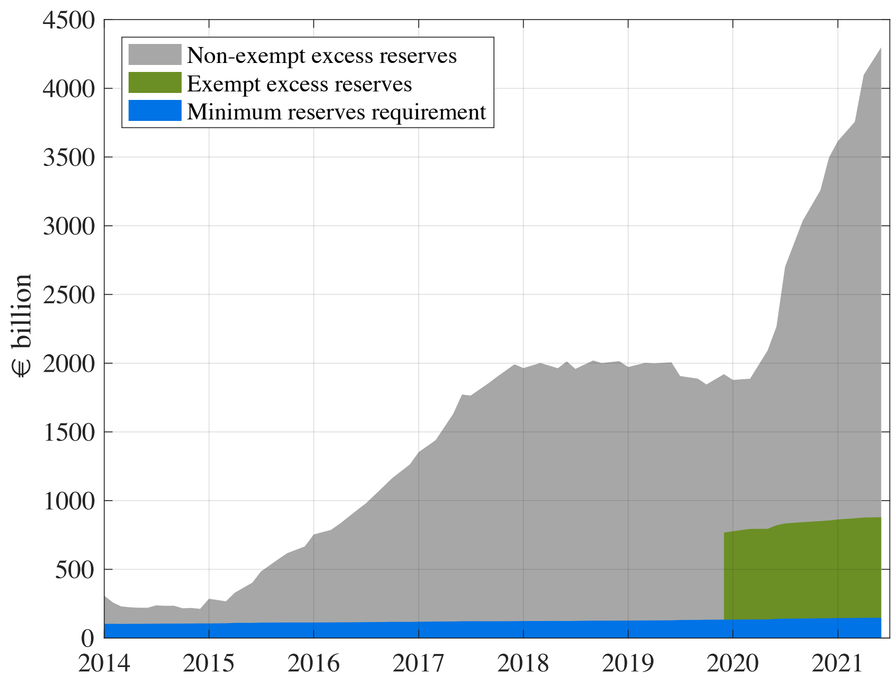
October 2021. M. Girotti (corresponding author): Banque de France, 31 rue Croix des Petits Champs, 75049 Paris, France (e-mail: mattia.girotti@banque-france.fr); B. Nguyen: Banque de France, 31 rue Croix des Petits Champs, 75049 Paris, France (e-mail: benoit.nguyen@banque-france.fr); J.-G. Sahuc: Banque de France, 31 rue Croix des Petits Champs, 75049 Paris, France and University of Paris-Nanterre, 200 Avenue de la République, 92000 Nanterre, France (e-mail: jean-guillaume.sahuc@banque-france.fr). We thank Samuel Vigne (editor), an anonymous referee, Franck Auberger, Olivier Garnier, Christoph Grosse Steffen, Vincent Grossmann-Wirth, Guillaume Horny, Hervé Le Bihan, and Sarah Mouabbi for useful comments. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Banque de France or the Eurosystem. Declarations of interest: none.

[1]Existing empirical evidence suggests that bank profitability has not reduced so far (Lopez et al., 2020). Altavilla et al. (2021) find that sound banks in the euro area managed to charge negative rates on corporate deposits without experiencing deposit outflows, and Bottero et al. (2019) show that Italian banks compensated for the compression of intermediation margins by charging higher fees on banking services.

too much reserves may lead to an upward deviation of the interbank interest rate from the policy rate the central bank is targeting.

In this paper, using euro-area data, we empirically show that there exists a level of non-exempt excess liquidity below which the interbank interest rate moves away from the targeted policy rate. Based on this finding, we develop a rule-based tiering system that is able to *both* reduce the burden of negative rates on banks and ensure that the central bank keeps control of interbank interest rates. We provide an analytical formulation for the tiering rule and delineate its functioning and benefits.

FIGURE 1. Banks' holdings with the Eurosystem



Notes: Non-exempt excess reserves are computed as overall excess reserves minus exempt excess reserves.

Two elements make the euro area an interesting case. First, as a response to the COVID-19 outbreak, the European Central Bank (ECB) launched the Pandemic Emergency Purchase Programme (PEPP), which has significantly increased excess liquidity (see Figure 1). PEPP is a temporary and flexible asset purchase programme of private and public sector securities aimed at preventing a tightening of financing conditions in the euro area.[2] This new programme may ultimately increase excess liquidity

[2]PEPP's purchases of public sector securities are conducted in a flexible manner regarding the allocation across countries. Specifically, temporary deviations from the Eurosystem capital key are allowed if there is need to reduce a specific country's sovereign spreads.

by up to €1,850 bn by March 2022. Second, the tiering system implemented by the ECB in September 2019 exempts a *constant* multiple of banks' minimum reserve requirements and the tiering multiplier was set at six. Since minimum reserve requirements are very stable over time, this system cannot shield bank profitability from negative rates when excess liquidity rises. Hence, euro-area banks may face a significant increase in the cost of holding excess liquidity in the coming months.

To our knowledge, we are the first to define analytically and illustrate an operational framework which is able to reduce the potential adverse effects of NIRP while keeping short-term market rates close to the policy rate targeted by the central bank. By studying the specific case of the euro area, we are able to show that the proposed tiering rule may prove powerful especially when excess liquidity changes rapidly. Our analysis suggests that, when compared to the ECB's current system, our rule would lower by more than 36% the aggregate cost of holding excess liquidity when the PEPP fully unfolds. The reduction varies by country, from –32% for the French banking system to –50% for the Spanish banking system. Overall, the findings of this research could help central banks to more effectively implement negative interest rate policies in the future.

The remainder of the paper is organized as follows. Section 2 analyzes the empirical relationship between the level of excess liquidity in the banking system and the interbank interest rate. Section 3 defines the rule-based tiering system and investigates the implications for euro-area banks. Finally, Section 4 concludes.

2. The Floor Required Excess Liquidity

The interbank interest rate (represented by EONIA in the case of the euro area) depends on the level of (non-exempt) excess liquidity in the banking system. By exempting part of banks' excess liquidity from negative rates, tiering reduces the aggregate volume of excess reserves that banks are willing to trade. Moreover, tiering alters the demand and supply for reserves: banks holding liquidity above their exemption are willing to lend at interest rates above the deposit facility rate (DFR), while banks holding liquidity below their exemption are willing to borrow at negative rates to saturate their exemption.[3]

The relationship between the overall volume of non-exempt excess liquidity and EONIA is expected to be negative: the higher the supply of reserves relative to its demand, the lower the equilibrium interbank interest rate. It means that setting a too high level of exempt reserves would cause EONIA to climb above the DFR. Hence, to correctly set the tiering rule, it is important to first identify the level

[3] The ECB's monetary policy consists of a corridor in which the deposit facility rate and the marginal lending facility rate form the lower and upper limits, respectively.

of non-exempt excess liquidity, called the *floor required excess liquidity* (or FREL), below which EONIA moves away from the DFR.

We determine the FREL by examining the relationship between the normalized EONIA spread at time t, $\tilde{S}_t$, and the level of non-exempt excess liquidity EL_t. $\tilde{S}_t$ is defined as the difference between EONIA and the DFR, divided by the width of the ECB's monetary policy corridor.[4] The normalization ensures that $\tilde{S}_t$ is comprised between 0 and 1. In line with Veyrune et al. (2018), we estimate the following three-parameter logistic function:

$$\tilde{S}_t = \beta_0 + \frac{(1-\beta_0)}{1+e^{(-\beta_1 EL_t + \beta_2)}}, \tag{1}$$

where β_0 indicates the normalized spread associated with very high levels of non-exempt excess liquidity, β_1 determines the curvature of the relationship between $\tilde{S}_t$ and EL_t (a higher value indicates a faster decline in the normalized spread when excess liquidity increases), and β_2 defines the intercept of the logistic function, that is the normalized spread when excess liquidity is nil.

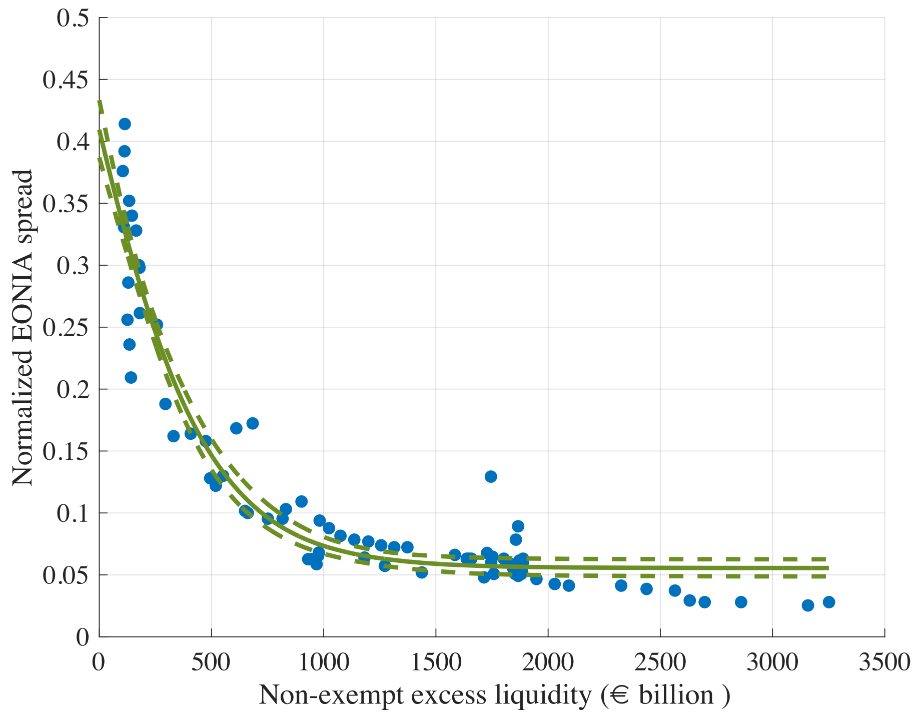
We consider monthly data (derived from daily data by taking monthly averages) from January 2014 to May 2021, and whose source is the ECB website. Excess liquidity is calculated as the sum of current accounts and deposit facility minus marginal lending facility and reserve requirements. Balance sheet items are aggregated across individual monetary financial institutions (MFIs) in each member state by national central banks (at least 95% of the total national MFI balance sheet is accounted for) to derive national contributions to the euro area aggregated balance sheet of the MFI sector. Data on interest rates (EONIA, DFR, and marginal lending facility rate) are extracted from the ECB Statistical Data Warehouse (SDW).[5]

Since the relationship may be time-varying, we select an estimation period that is both consistent in terms of structural factors and relevant for the near future. The chosen period fulfils these requirements: *(i)* it is characterized by abundant excess liquidity, and *(ii)* it features differences relative to earlier periods in terms of the volatility of autonomous factors and banks' liquidity demand (Hartmann and Smets, 2018; Rostagno et al., 2019).

[4] The width of the corridor is equal to the difference between the marginal lending facility rate ($MLFR_t$) and the deposit facility rate (DFR_t).

[5] Data on minimum reserve requirements and liquidity conditions in the euro area, i.e., the Eurosystem's supply of liquidity in euro, and credit institutions' demand for this liquidity are available here: https://www.ecb.europa.eu/stats/policy_and_exchange_rates/minimum_reserves/html/index.en.html. For individual countries, data by maintenance period are extracted from the ECB SDW and reference codes are: current accounts (ILM.M.COUNTRY.N.L020100.U2.EUR), deposit facility (ILM.M.COUNTRY.N.L020200.U2.EUR), marginal lending facility (ILM.M.COUNTRY.N.A050500.U2.EUR), minimum reserve requirements (BSI.M.COUNTRY.N.R.LRR.X.1.A1.3000.Z01.E), long-term refinancing operations (ILM.M.COUNTRY.N.A050200.U2.EUR), where $COUNTRY \in \{DE, FR, IT, ES\}$. For interest rates, ECB SDW reference codes are: EONIA (EON.D.EONIA_TO.RATE), DFR (FM.B.U2.EUR.4F.KR.DFR.LEV), and marginal lending facility rate (FM.B.U2.EUR.4F.KR.MLFR.LEV).

FIGURE 2. Estimation of the logistic function



Notes: Monthly observations from January 2014 to May 2021. The normalized EONIA spread is defined as the difference between EONIA and the DFR, divided by the width of the ECB's monetary policy corridor. Each dot represents an observation. The plain line corresponds to the fitted logistic curve and the dashed lines represent the 90% confidence interval obtained by bootstrap techniques.

We obtain the following parameter estimates: $\hat{\beta}_0 = \underset{(0.0042)}{0.0557}$, $\hat{\beta}_1 = \underset{(0.0003)}{-0.0035}$ and $\hat{\beta}_2 = \underset{(0.0600)}{0.5104}$, where standard errors appear in parentheses. Figure 2 visualizes our estimation results by plotting the fitted normalized EONIA spread against the level of non-exempt excess reserves (plain green curve), as well as the 90% confidence interval (dashed green curves). The FREL is obtained as the level of non-exempt excess liquidity below which the normalized EONIA spread deviates from its floor β_0 by an amount $\tilde{\varepsilon}$. Inverting Equation 1 gives:

$$FREL = -\frac{\left[\log\left(\frac{1-\beta_0}{\tilde{\varepsilon}} - 1\right) - \beta_2\right]}{\beta_1}. \tag{2}$$

Note that $\tilde{\varepsilon} = \varepsilon \,/\, (MLFR - DFR)$, where ε represents the deviation of EONIA from the DFR in basis points (bps). There is no consensus on the size of deviation needed to state that EONIA is un-anchored. However, we can infer plausible thresholds based on the volatility of the EONIA spread in our sample. The standard deviation of the EONIA spread is approximately 5 bps in the full estimation period, which comprises years with low excess liquidity, making a 5 bps difference a relatively large deviation. Conversely, between January 2017 and September 2019, which is a period with a particularly abundant excess liquidity (see Figure 1), the standard deviation of the EONIA spread is only 0.6bps, indicating that a deviation up to this value may well realize even when EONIA is anchored. Consequently, Table 1 displays the FREL associated with ε varying between 1 and 5 bps. Once considered the uncertainty around the parameter estimates, it appears that the FREL is comprised between €548 and €1249 billion and, as expected, the higher the ε the lower is the corresponding FREL.

TABLE 1. Floor-required excess liquidity estimates (in € billion)

ε	Lower bound (5%)	Median	Upper bound (95%)
+5 bps	548	597	658
+4 bps	609	664	735
+3 bps	686	754	840
+2 bps	797	879	974
+1 bps	973	1084	1249

Notes: Estimations obtained using monthly data from January 2014 to May 2021. ε represents the deviation of EONIA from the DFR in basis points. The median, lower and upper bounds are obtained using the bootstrap distribution of the logistic parameter estimates.

3. A RULE-BASED TIERING SYSTEM

The tiering system we design determines the volume of exempt excess liquidity at time t, EX_t, as a function of the tiering multiplier M_t and the volume of required reserves RR_t:

$$EX_t = M_t \times RR_t. \tag{3}$$

The tiering multiplier that aims both at keeping the interbank interest rate anchored to a specific policy rate and at reducing the cost of excess liquidity for banks is defined as:

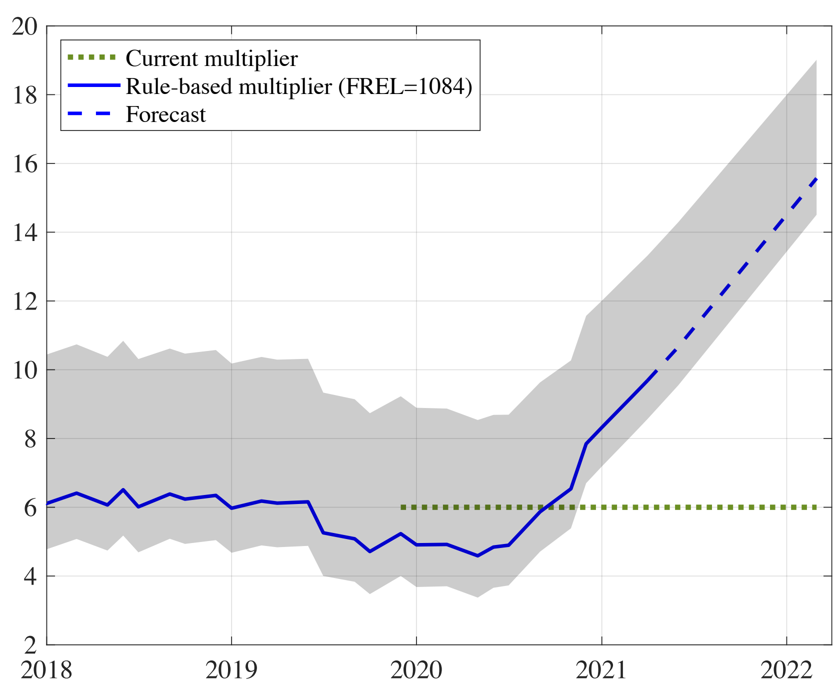
$$M_t = \frac{EL_t - \Omega_t - FREL}{RR_t}, \tag{4}$$

where Ω_t represents the liquidity created by the central bank when it lends to the banking system at an interest rate not higher than the policy rate at which it aims to anchor the interbank interest rate. Depending on the context and the jurisdiction, Ω_t may be nil.

To see better the intuition behind Equation 4, we stay in the euro-area context. To keep the EONIA spread close to zero, a volume of excess liquidity equal to the FREL, must be left non-exempt. Additionally, the part of excess liquidity created by the ECB when it lends to banks at an interest rate not higher than the DFR is not costly to hold for banks and should also be left non-exempt. In practice, this part of excess liquidity corresponds to that created with the third series of targeted longer-term refinancing operations conducted after March 2020. The rest of excess liquidity is a pure cost for banks and may be exempt.

We provide a parametrization for M_t. We set the FREL at €1,084 bn, which corresponds to adopting a conservative approach for the admitted EONIA spread (see Table 1). The resulting rule-based tiering multiplier for the January 2018–March 2022 period is depicted by the plain line in Figure 3. The shaded area identifies alternative multipliers for FREL comprised between €548 and €1,249 bn, while the dotted line depicts the current multiplier. To determine the dynamics up to March 2022, we forecast excess liquidity to rise in line with the net purchases conducted by the ECB under the PEPP (in such a way that the full envelope of €1,850 bn is exhausted by March 2022) and the asset purchase programme (whose net purchases amount to €20 bn per month). Also, we assume that required reserves will grow at the rate observed since January 2019 and autonomous factors stay constant.

FIGURE 3. A rule-based tiering multiplier

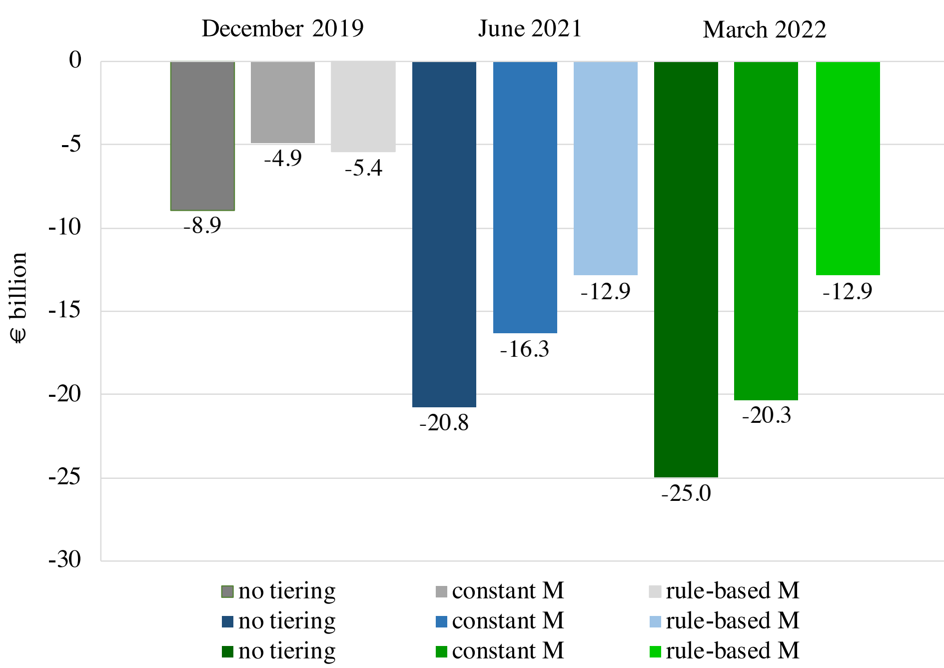


Notes: The shaded area corresponds to the evaluation of the tiering multiplier for FREL comprised between €548 and €1,249 bn.

Figure 3 shows that the baseline rule-based tiering multiplier is consistent with the current multiplier until the summer 2020. In addition, the rule-based multiplier well adapts to the forecasted rise in excess liquidity and reaches a value of 15.57 in March 2022.

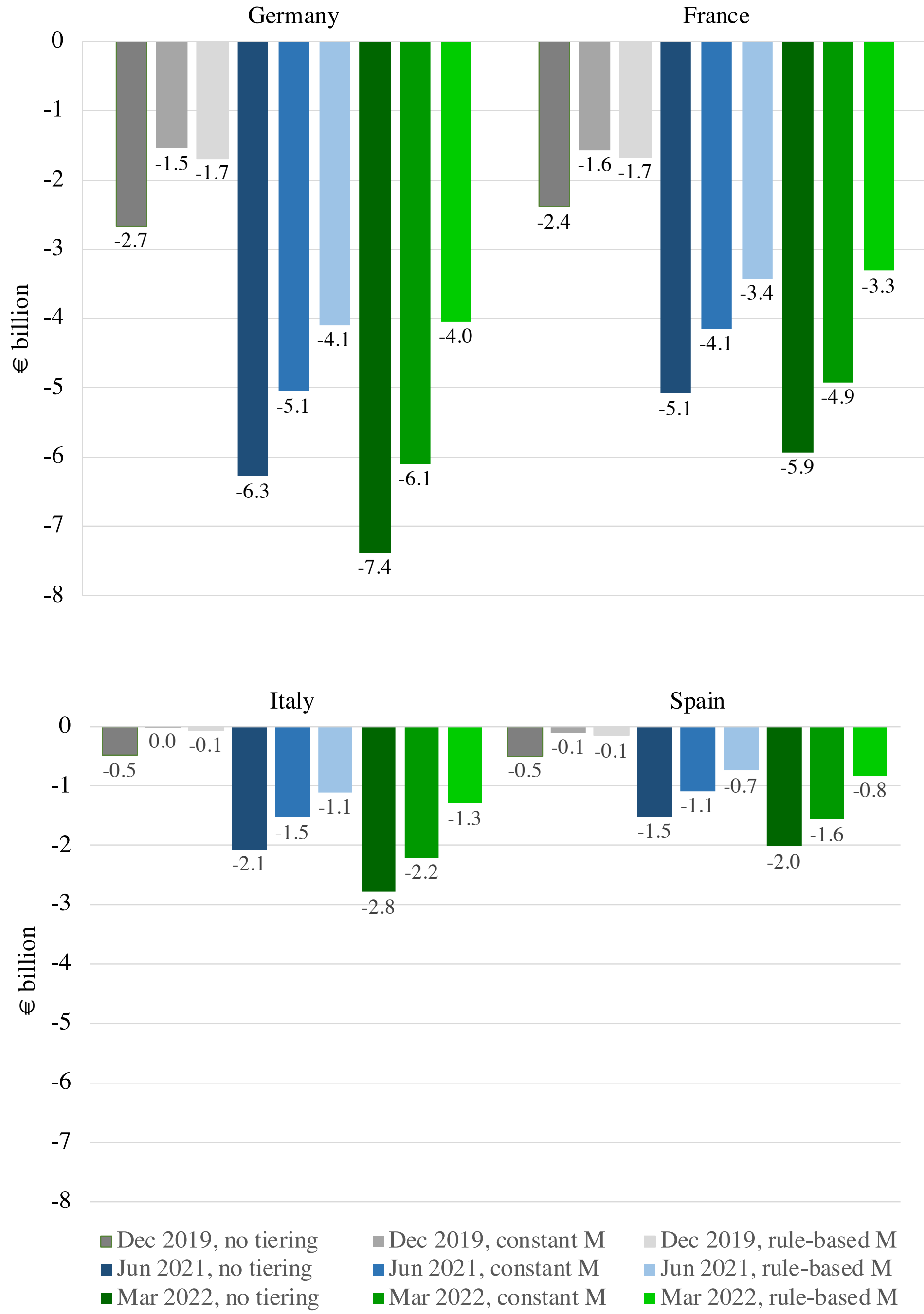
We now investigate the implications for bank profitability of implementing our rule-based tiering system. We compare the cost of holding excess liquidity in three different scenarios: *(i)* without tiering, *(ii)* with a constant multiplier equal to six; and *(iii)* with our rule-based multiplier based on a FREL equal to €1,084 bn. Figure 4 presents the results for three dates: December 2019 (i.e., after the implementation of the current tiering system and before the COVID-19 outbreak), June 2021, and March 2022 (i.e., when the PEPP is expected to end). Each bar depicts the annualized cost of holding excess liquidity for the euro-area banking system and is a function of the volume of excess liquidity and required reserves at that date, the DFR and the presence and type of tiering. To evaluate the cost in March 2022, we follow the same hypotheses regarding the forecasted dynamics of excess liquidity and required reserves that we consider in Figure 3.

FIGURE 4. Cost of holding excess liquidity for the euro-area banking system



Notes: The figure depicts the annualized cost of holding excess liquidity for the euro-area banking system at three selected dates and for three different scenarios: no tiering, a constant tiering multiplier equal to 6, and a rule-based tiering multiplier. The rule-based tiering multiplier is based on a FREL equal to €1,084 bn: its value is 5.23 in December 2019, 10.67 in June 2021, and 15.57 in March 2022.

FIGURE 5. Cost of holding excess liquidity by country



Notes: The figure depicts the annualized cost of holding excess liquidity for the banking systems in Germany, France, Italy and Spain at three selected dates and for three different scenarios. The scenarios are those in Figure 4. The rule-based tiering multiplier is based on a FREL equal to €1,084 bn: its value is 5.23 in December 2019, 10.67 in June 2021, and 15.57 in March 2022.

The cost of holding excess liquidity increases dramatically over time, both without tiering and with the constant tiering multiplier. On the contrary, this rise is mitigated with our rule-based tiering multiplier. In this case, the cost of excess liquidity would be €12.9 bn in both June 2021 and March 2022.

This means that relative to the cost under the current tiering system, the aggregate cost of holding excess liquidity would be more than 20% lower in June 2021 and more than 36% lower in March 2022.

Note that the rise in the cost of holding excess liquidity between December 2019 and June 2021 under our rule-based tiering system is explained by our choice of not exempting the part of excess liquidity corresponding to the ECB's loans lent an interest rate not higher than the DFR. Since such loans appeared only after March 2020, there is a greater part of excess liquidity that is non-exempt in June 2021 than there is in December 2019. If we added the gains associated with those loans to the cost of excess liquidity, the *net* cost of holding excess liquidity would attain a level close to €3 bn in both June 2021 and March 2022. Overall, this means that the rule-based multiplier we propose is able to keep the cost of holding excess liquidity relatively stable over time.

Figure 5 replicates this evaluation for each of the four main countries of the euro area: Germany, France, Italy and Spain.[6] The figure reveals that if the current tiering system were maintained, the cost of holding excess liquidity would considerably increase for all banking systems between December 2019 and March 2022. The introduction of our rule-based tiering would reduce this burden and the impact would be different across countries. The French and Spanish banking systems stand, respectively, at the lower end and at higher end of the distribution. Relative to the cost under the current tiering system, the cost of holding excess liquidity would be 17% lower in June 2021 and more than 32% lower in March 2022 for French banks. Conversely, that cost would be more than 36% lower in June 2021 and 50% lower in March 2022 for Spanish banks. The impact on German banks is more similar to that on French banks, while the impact on Italian banks is more similar to that on Spanish banks.

4. Conclusions

This paper designs a rule-based tiering system that allows to reduce the burden of negative rates on banks while ensuring that the central bank keeps control of interbank interest rates. This system would be particularly useful in case policy rates needed to be kept negative for long time.

[6] For this exercise, we attribute forecasted euro area-level excess liquidity to each country in proportion of the Eurosystem capital key. Also, we assume that required reserves will grow at the country-specific rate observed since January 2019.

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