

The negative interest rate policy in the euro area and the supply of bank loans

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Introduction

From the summer of 2014 onwards, the Governing Council of the European Central Bank (ECB) took a series of measures aimed at further easing its monetary policy stance in the face of falling inflation. These measures include the gradual lowering of the deposit facility interest rate – the benchmark rate for euro area markets in times of ample liquidity – taking it into negative territory. This key policy interest rate, which had stood at 0% since July 2012, was cut to –0.1% in June 2014, then to –0.2% in September 2014, and to –0.3% in December 2015, finally reaching a low of –0.4% in March 2016.

The ECB's "negative interest rate policy", synonymous with navigating in uncharted waters, has constantly attracted questions and criticisms from commentators. However, the purpose of this article is not to revisit them in detail: that would involve examining both the presumed distortions at the level of the transmission of this policy and its potentially unwelcome effects on financial stability. Instead, the article sheds specific light on more than three years of experience of negative interest rates in the euro area by concentrating on a single aspect of transmission, namely the bank lending channel. The assumption regarding that channel is that a monetary policy shock produces its effects by affecting the banks' capacity to lend⁽¹⁾.

By adopting that angle, the article essentially aims to understand how a negative interest rate policy can be considered special from the banks' point of view. It thus examines more closely the argument whereby the negative interest rate has an adverse impact on banks' profitability, and hence on their capacity to grant new loans. The

point of view adopted is particularly pertinent in the case of the euro area, since the banks play a dominant role in financing its real economy⁽²⁾. In addition, the relevance of this analysis is clear from the ECB's latest stress tests, which asked about the impact on banks' profitability of various yield curve scenarios (ECB, 2017b).

The article comprises five sections. Section 1 explains the context of the Governing Council's decision to take the deposit facility rate into negative territory from the summer of 2014. Apart from the fact that such a monetary policy practice has not been unusual in recent years in the advanced economies, this section explains that, in the euro area, it became a genuinely integral part of a global strategy aimed at counteracting the decline in inflation by using the real interest rate lever.

Section 2 looks briefly at the efficient transmission of the negative interest rate to financial market rates in the euro area where institutional investors operate. Next, it focuses in particular on the fact that the interest rates remunerating retail customers' deposits were the only ones to resist any further reductions after a given moment. In the remainder of that section we therefore endeavour to ascertain the reason for that rigidity; for that purpose, we refer in particular to the concept of the "physical lower bound of nominal interest rates".

(1) According to this channel, also known as the "bank balance sheet channel", monetary policy affects the banks' capacity to lend by influencing their real value (i.e. their own funds) (see Bernanke and Gertler, 1995).

(2) Although bank disintermediation has accelerated somewhat since the global financial crisis, almost 50% of euro area business finance is still obtained from the banks, while the remaining 50% originates from the financial markets. We are therefore still a long way from the structure of the American financial system, where firms obtain most of their funding (amounting to 75%) from the financial markets while the banks provide the remaining 25% (ECB, 2016a).

Assuming some downward rigidity in retail deposit interest rates, the third section analyses the extent to which, from a conceptual angle, that affects the transmission of the negative interest rate policy via the bank lending channel. It reveals that the negative interest rate may at some point constrain the bank's capacity to lend more to the economy. That constraint is due in particular to downward pressure on the bank's net interest margin. The minimum interest rate below which banks will curb their lending is called the "economic lower bound of nominal interest rates".

Section 4 examines how the banks' characteristics influence the level of the economic lower bound of nominal interest rates, on the basis of data specific to the euro area. The idea is to show that, in practice, certain specific features of the banks will accentuate (or, conversely, offset) the potentially restrictive/tightening effects of the negative interest rate policy.

Finally, the last section presents a more general view of the overall impact on the euro area banks' capacity to lend of the package of monetary policy measures adopted by the Governing Council since the summer of 2014. In particular, it shows how the other monetary policy measures, by complementing and interacting with the negative interest rate policy, can mitigate the potentially adverse effect of that policy on banks' profitability, and hence on lending dynamics. In view of the positive trend in lending dynamics, the low level of interest rates charged on loans and the associated constant easing of lending standards, it seems that the combination of measures has facilitated a smooth transmission via the banks in the euro area.

1. Background to the negative interest rate policy in the euro area

1.1 Negative interest rate policies in the advanced economies since the crisis⁽¹⁾

A negative interest rate policy consists in cutting the *effective* key policy rate below 0%. The effective key policy rate is the benchmark for setting the interest rates applied in the markets. If it is considered necessary for the monetary policy stance to be made more accommodative when the "conventional" policy limits have already been reached, that reduction below zero may form part of the central bank's strategy. Since that reduction is actually a continuation of conventional interest rate policy, it is often applied together with non-standard measures such as asset purchase programmes.

Although the policy was first applied in Denmark (initially from July 2012 to April 2014, and then from September 2014), the ECB was the first central bank of a major currency area to initiate the negative interest rate policy from the summer of 2014. Today, the practice is no longer uncommon among the advanced economies – almost a quarter of global GDP is subject to negative interest rates, as Switzerland, Sweden and Japan have since followed in the footsteps of Denmark and the euro area (from January 2015, February 2015 and February 2016 respectively). The motivation behind this policy is of course closely linked to the ultimate goal of the central banks concerned. For some economies, namely the euro area, Sweden and Japan, the aim is thus to achieve the inflation target. In the case of Denmark and Switzerland, however, the policy is instead aimed directly at the exchange rate target: it is intended to counteract the upward pressure on the domestic currency by discouraging the inflows of capital into the country.

In practice, in most of the economies mentioned, the negative interest rate policy has taken the form of a negative rate of remuneration on banks' deposits with the central bank (excluding reserve requirements). In other words, the banks have to *pay* the central bank to store their excess liquidity there. In principle, this negative deposit rate serves as the benchmark determining all the financing conditions in the economy: the reason is that the jurisdictions in question are in an abundant liquidity situation as a result of the exceptional measures adopted in view of the global financial crisis⁽²⁾.

Since a negative deposit rate means that the banks pay the central bank interest for storing their cash, that implies a direct gross cost for the banks. For that reason, it may be accompanied by an exemption system whereby part of the banks' excess liquidity is not subject to a negative remuneration rate. That is the case in Denmark, Switzerland and Japan, for example⁽³⁾. Such exemptions are intended to reduce the direct gross cost to the banks of holding liquidity while ensuring the appropriate transmission of the negative interest rate to the money and financial markets. Depending on the current and projected future weight of the excess liquidity and how it is distributed on the interbank market, the attainment of this dual objective may require systems of varying complexity

(1) The aim of this section is to take stock of the negative interest rate policies implemented in the advanced economies in recent years. For a more detailed account of each of those policies, see in particular Bech and Malkhozov (2016), Jobst and Lin (2016) or IMF (2017).

(2) Of the countries mentioned, Sweden is the only one where the central bank's (negative) deposit rate is not its effective key policy interest rate, i.e. the rate that genuinely influences financing conditions within the economy. That said, a negative interest rate policy is in force there in so far as the repo rate (the interest rate at which the central bank lends funds to the banks to meet their liquidity needs), i.e. the country's effective key policy rate, has also fallen below zero.

(3) For more details on these exemption systems, see in particular Bech and Malkhozov (2016) or Jobst and Lin (2016).

comprising a dynamic aspect (in other words, the proportion of the liquidity not subject to the negative interest rate is not static). Such systems are generally considered particularly attractive where the negative interest rate is applied in order to defend the exchange rate of the country's currency. If the systems are properly calibrated, they can protect the domestic banking sector to some degree against the negative interest rate. In that sense, they may provide a way of getting closer to the exchange rate target while avoiding imposing a penal interest rate on domestic banks which is (perceived to be) excessively harsh.

1.2 The case of the euro area: an integrated policy for combating the decline in inflation

The ECB has three key policy rates: they form a corridor within which the Eonia – i.e. the overnight interbank interest rate in the euro area – fluctuates. A distinction is made between: (a) the (floor) rate for the deposit facility enabling the banks to place their excess liquidity with the central bank until the following day; (b) the (central) interest rate on the main refinancing operations, and (c) the (ceiling) interest rate on the marginal lending facility enabling the banks to borrow liquidity overnight from the central bank. The euro area is one of the economies where the crisis measures wrought a change in the operational framework of monetary policy, causing it to switch from a corridor system – in which balanced liquidity conditions ensure that the Eonia is close to the central key interest rate – to a floor system – in which abundant liquidity within the banking system drives the Eonia towards the floor policy interest rate, which thus becomes the new benchmark rate for the markets⁽¹⁾.

In such circumstances, a negative interest rate policy applies in the euro area once the deposit facility rate – which in practice remunerates total excess liquidity⁽²⁾ – is cut below 0%. The Governing Council has adopted a gradual approach here, taking the deposit facility rate further into negative territory with four cuts over the past three years. In June 2014, the rate was thus reduced from 0% (the rate in force since July 2012) to –0.1%. Next,

it was cut to –0.2% in September 2014, then –0.3% in December 2015, ending up at –0.4% from March 2016 onwards.

These reductions below zero formed an integral part of a strategy adopted in order to avert a prolonged period of low inflation⁽³⁾ against the backdrop of a weakening recovery and deteriorating prospects. In practice, the measures therefore aimed to counteract the persistently low inflation in the euro area: since mid-2013, inflation has been running at below the level compatible with price stability as defined by the ECB⁽⁴⁾. Moreover, given the particularly sluggish credit dynamics during the period, some measures were also intended to ensure that the easing was efficiently transmitted to bank lending.

From the summer of 2014, together with the change in interest rates, the Governing Council thus granted the banks some new series of long-term loans on advantageous terms, and phased in an asset purchase programme while constantly adjusting its communication ("forward guidance") on its future policy stance. These various measures were adjusted on several occasions, mainly in response to unexpected economic and financial events that increased the downside risks for inflation. Although we do not intend to examine those measures in detail here, some aspects of the strategy nevertheless merit particular attention.

As regards the actual interest rates, the cuts made in the summer of 2014 and in March 2016 also affected the other two key rates (the interest rate on the main refinancing operations thus declined from 0.25 to 0%, via 0.15 and then 0.05%, while the marginal lending facility rate descended from 0.75 to 0.25%, via 0.4 and then 0.3%). Still on the subject of interest rates, via its forward guidance the Governing Council also constantly reaffirmed that those rates would be held at a historically low level for an extended period. Up to June 2017, it even retained the option of making further reductions if necessary.

The implementation of the expanded asset purchase programme (APP) in March 2015, including purchases of sovereign bonds from the euro area and extended to corporate sector instruments in March 2016, was the main factor driving the considerable expansion of the Eurosystem's balance sheet. That growth, steered by the central bank itself, contrasts with the expansion in 2011-2012 which was due mainly to the banks' demand for funds in the two three-year longer-term refinancing operations. That said, the longer-term loans offered to the banks between June 2014 and March 2017 (the two series of targeted longer-term refinancing operations, TLTRO I and TLTRO II) likewise had a definite quantitative impact

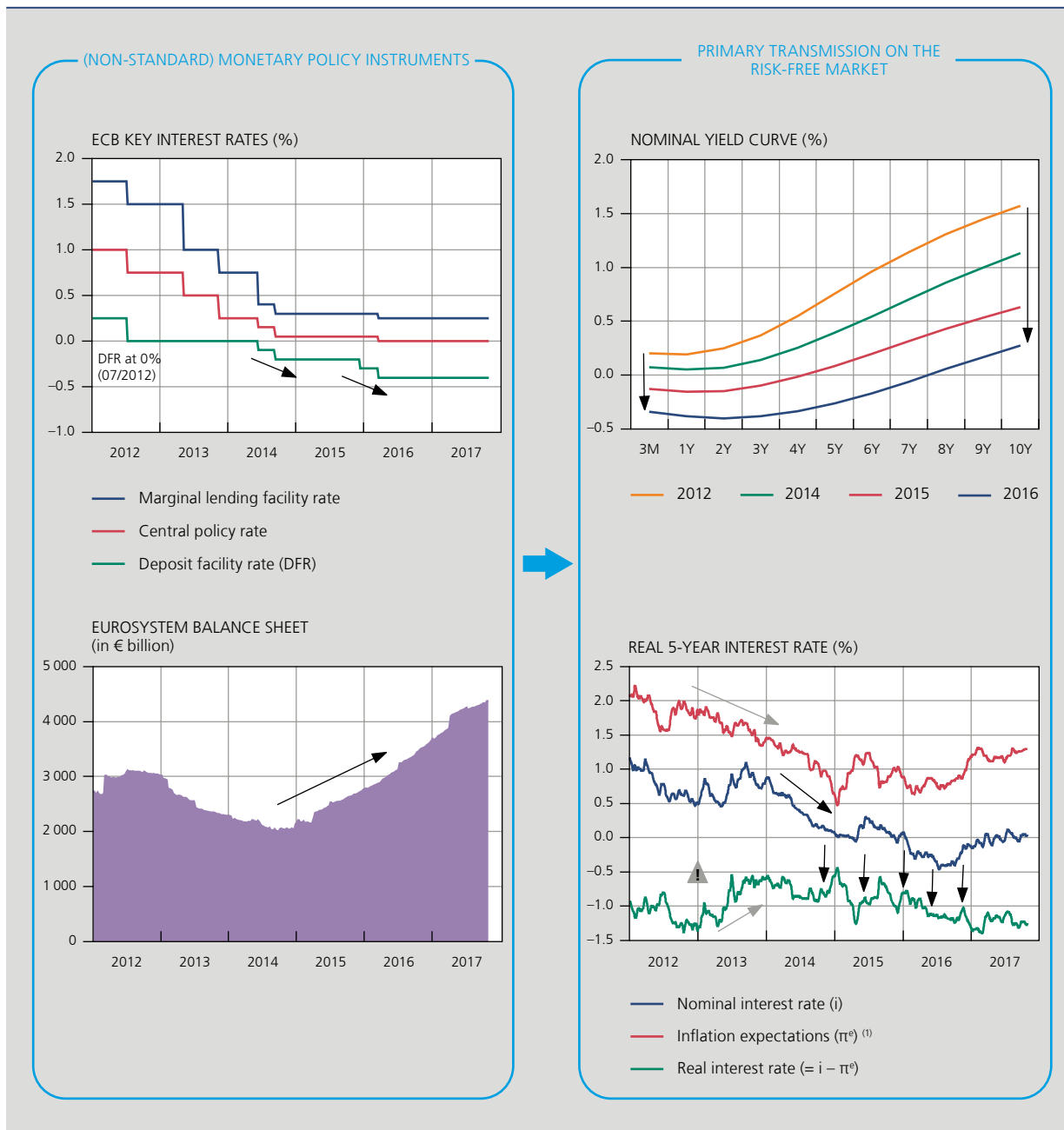
(1) For more information on the evolutions of the volume of liquidity in the banking system since the crisis and its impact on the operational framework of monetary policy in the euro area, see in particular Eser et al. (2017).

(2) The excess liquidity comprises the assets placed in the deposit facility, but also current account assets in excess of the reserve requirements.

(3) For a discussion of the risks and issues associated with a prolonged period of low inflation, see Deroose and Stevens (2017).

(4) During the summer of 2014, while the excess liquidity was due mainly to the banks' demand for funds (i.e. before the expanded asset purchase programme), the reductions in the deposit facility interest rate into negative territory in fact served two purposes: in addition to the monetary easing aimed at the inflation target, the intention was to preserve the Eurosystem's intermediation margin (i.e. in principle the smooth functioning of the interbank market) in view of the simultaneous cuts in the central policy rate. For more details on this point, see Kasongo Kashama (2014).

CHART 1 THE MONETARY POLICY MEASURES TAKEN IN THE EURO AREA FROM THE SUMMER OF 2014 MADE IT POSSIBLE TO STEER THE REAL INTEREST RATE IN A CONTEXT OF FALLING INFLATION



Sources: ECB, Thomson Reuters.

(1) Inflation expectations are derived from the interest rates on swap contracts covering the five-year inflation risk. However, these market data include a risk premium.

while for the first time offering the banks the opportunity to borrow at a negative interest rate⁽¹⁾.

The indicators concerning the first transmission phase (see chart 1) reveal that the measures did not only bring

about a reduction in the nominal risk-free yield curve for the euro area across the whole range of maturities, but also flattened the curve. That flattening was due mainly to the sensitivity of longer-term interest rates to asset purchases. That said, the fact that a negative interest rate policy eliminates – or at least drives down – the initially perceived key policy interest rate limit may also lead to further flattening of the curve (Rostagno *et al.*, 2016). Be

(1) For the second series of operations (TLTRO II), the loan rate may fall to the deposit facility rate applicable at the time of the respective allotments if the banks grant sufficient new loans to non-financial corporations.

that as it may, such an effect on the long-term segment of the curve is somewhat at odds with the traditional scope of monetary policy, which is confined to shorter-term interest rates. By its combined measures, the Governing Council therefore exerted (more) effective influence on one of the key monetary policy levers, namely the real medium-term interest rate. That rate is important in that it can influence the consumption and investment decisions of economic agents, and ultimately inflation dynamics⁽¹⁾. More particularly, on the basis of the breakdown of the risk-free five-year interest rate, it is apparent that the downward pressure on the nominal interest rate curbed the rise in the real interest rate in a context of inflation expectations which were nevertheless clearly declining.

Despite the relatively encouraging transmission in the first phase, the impact of the package of measures on other key indicators – such as the dynamics of bank credit, risk-taking, activity and, ultimately, inflation – seem more uncertain, regularly giving rise to debate (see for example Woodford (2012) or Borio and Zabai (2016)). Those discussions seem logical in that *none* of the non-standard instruments comprising the package (and therefore not just the negative interest rate) had ever before been tested on such a scale. As we said, the rest of this article concentrates essentially on analysing the question of transmission of the negative interest rate policy (via the banks). Nevertheless, that close examination certainly does not imply that the multidimensional aspect of the monetary policy conducted by the ECB Governing Council in recent years and the appraisal of the full transmission of that policy – especially as regards macroeconomic conditions and the inflation target – should be ignored. However, those aspects are beyond the scope of this article.

2. Downward rigidity of retail deposit interest rates

The complaints from the banks regarding the negative interest rate appear to be concentrated mainly on one point, namely the banks' limited ability to pass on the

reduction below zero in the deposit interest rate paid to savers⁽²⁾. After a brief analysis of the effective transmission of the negative interest rate policy to market rates in the euro area where institutional investors operate, this section therefore examines in more detail the movement in interest rates paid on deposits since mid-2014. It confirms that those rates exhibit some downward rigidity, and presents the more specific reasons which may account for that.

2.1 Transmission of the negative interest rate policy to rates in the economy

When the deposit facility rate was cut below zero, the reduction was passed on quite smoothly in the short- and medium-term money market rates in the euro area. That transmission was effective despite some initial fears, such as those concerning the (technical) capability of those markets to incorporate negative values or to maintain a normal volume of activity under those conditions⁽³⁾. The overnight interest rate and the risk-free rate at one year thus dropped below zero from September 2014.

On the other financial markets, there was no evidence of any specific resistance to lower interest rates. From the summer of 2014, there was no structural widening of the spreads on sovereign bond yields, for example, relative to risk-free interest rates with a corresponding maturity. In the context of a flight to safe havens, the yields on ten-year German government bonds actually dipped below zero on several occasions. The same applies to the (riskier) markets in corporate bonds: apart from a few episodes of financial tension, corporate yields followed a marked downward trend during the cycle of reductions below zero in the deposit facility rate. Some AAA-rated companies actually issued short-term securities with negative yields.

In parallel with the significant fall in nominal interest rates on the financial markets, the euro exchange rate began falling from the second half of 2014. This downward trend occurred both in relation to the US dollar and in effective nominal terms (i.e. against the currencies of the euro area's main trading partners, weighted according to their share in trade). That said, it is extremely difficult to identify the exact contribution of the negative interest rate to the depreciation seen, because the exchange rate is an indicator which is generally subject to a wide range of shocks, including external shocks.

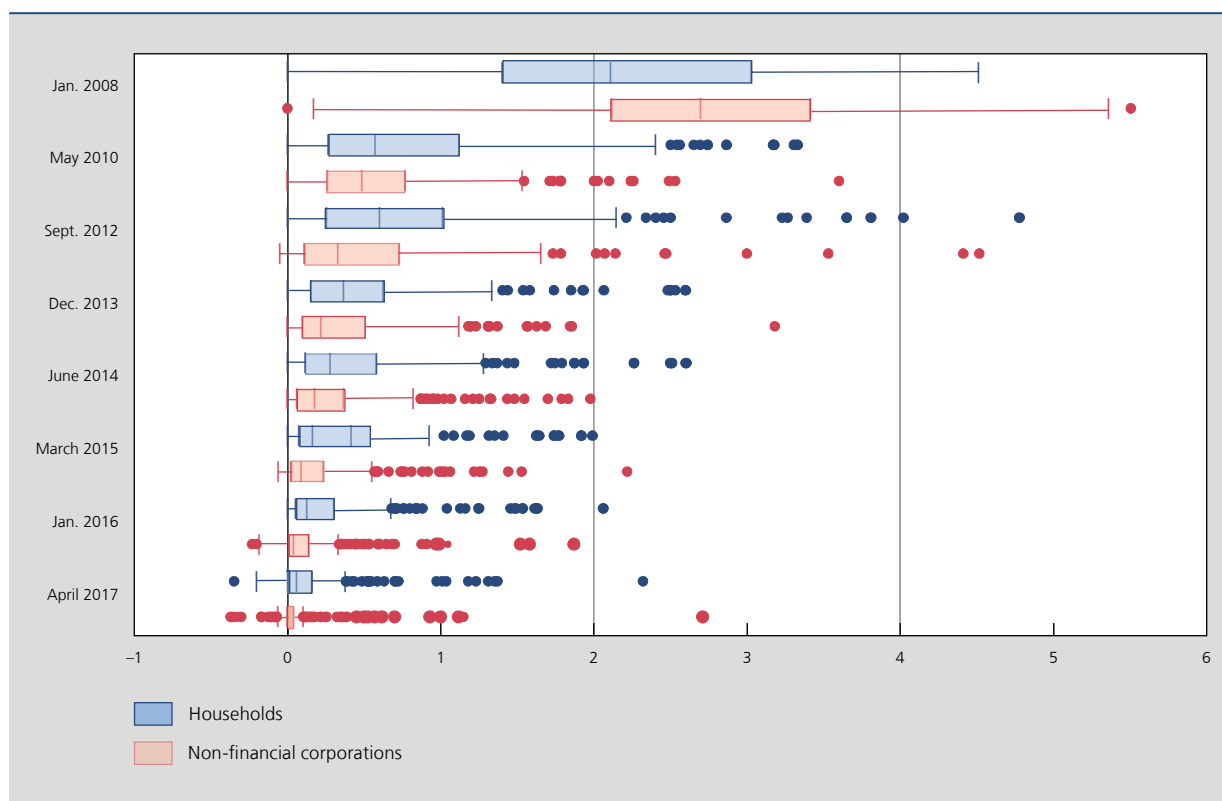
The interest rates paid on the bank deposits of households and non-financial corporations were the only ones to display some resistance to further cuts as they approached 0%, although they did fall steeply and there was

(1) For a more detailed analysis of the role played by monetary policy in the movement in the real interest rate in the euro area in recent years, see De Backer and Wauters (2017).

(2) Some of the criticisms focus particularly on the direct gross cost associated with the negative interest rate, i.e. if the banks deposit excess liquidity with the central bank, they incur a custody fee. We shall come back to this point in section 4, which explains how the banks' characteristics (including the relative weight of excess liquidity on their balance sheet) may influence the effect of the negative interest rate on their loan dynamics.

(3) The effect of the negative interest rate policy on the functioning of the euro area money markets, and in particular the volume of transactions, has attracted much attention. Some argued that such a practice would cause a considerable decline in activity on those markets, casting doubt on the appropriateness of the rates applied there. However, the volume of transactions on the repo money markets (i.e. interbank loans backed by the exchange of collateral) in fact remained relatively stable; the euro area banks were therefore not reluctant to lend to one another at negative interest rates. The decline in the volume of unsecured transactions (i.e. those conducted without collateral) was due largely to the substantial increase in available liquidity in the banking sector following the APP and the change in risk aversion since the crisis (Bindseil, 2017).

CHART 2 DISTRIBUTION OF INTEREST RATES OFFERED BY A SAMPLE OF 283 EURO AREA BANKS ON RETAIL CUSTOMERS' DEPOSITS⁽¹⁾
(in %)



Sources: ECB, NBB.

(1) The rectangle contains the values between the lower and upper quartiles. The vertical line in the rectangle indicates the median. The horizontal lines comprise the values between the lower quartile less 1.5 times the interquartile range and the upper quartile plus 1.5 times the interquartile range. The large dots indicate the extreme values.

a very marked reduction in the distribution between banks from mid-2014 onwards. That rigidity was particularly evident in the case of household deposits. Thus, the number of euro area banks paying negative interest on those deposits was still very small in April 2017⁽¹⁾. That situation is therefore in stark contrast to the picture for the other interest rates, which did not seem to be particularly resistant. A similar phenomenon occurred in the other economies where a negative interest rate policy applied (see for example Arteta *et al.* (2016) or, more specifically in the case of Sweden and Denmark, Madashi and Nuevo (2017)).

2.2 Reasons for the rigidity of retail deposit interest rates

The main reason for the downward rigidity of retail deposit interest rates is the existence of cash – i.e. coins and banknotes – as an alternative store of value offering

a remuneration rate which in principle is equal to 0%. Since economic agents can convert their deposits into cash at any time, the downward rigidity is in fact attributable to the banks' fears of a spate of deposit withdrawals if the remuneration falls too low. Those fears are all the greater as deposits usually form *the* stable source of funding for banks. In practice, however, there are various costs entailed in holding cash; those costs mainly concern storage, transport (including arranging payments) and protection against theft and other incidents (i.e. security and insurance costs). In other words, the nominal remuneration of cash is not strictly equal to 0%. What is known as the "physical lower bound of nominal interest rates" is therefore in negative territory (Cœuré, 2016).

In practice, the level of that limit varies from one economic entity to another. For smaller entities, such as households, the cost of holding cash is generally accepted to be relatively low; that explains the particularly strong rigidity of deposit interest rates for retail customers.

(1) This extrapolation is based on the sample of 283 banks in chart 2.

That limit also has a dynamic aspect. The longer the period of negative interest rates that the economic agents expect, the more opportunity they will have for amortising the significant fixed costs associated with holding cash (insurance costs for large entities), and hence reducing the average cost per unit of currency held. In practice, if the persistence of negative interest rates is correctly anticipated, that could therefore have the effect of bringing the physical lower bound closer to 0 %.

An entire section of the economic literature⁽¹⁾ examines strategies for reducing the physical lower bound of nominal interest rates. Possible strategies include issuing banknotes in smaller denominations, introducing an exchange rate for converting bank deposits into cash, or simply abolishing cash altogether. These solutions could create additional scope for monetary policy in a prolonged period of low inflation (Goodfriend, 2016).

The monetary illusion phenomenon, i.e. the propensity to reason in nominal terms rather than in real terms, is another possible reason for the downward rigidity of deposit interest rates. Since they think in nominal terms, economic agents will in fact tend to perceive a negative nominal interest rate as theft, or at the very least as something abnormal. They will therefore choose to convert their liquid resources into cash or some other form (gold, etc.) rather than keep them in deposit accounts bearing a negative nominal rate of remuneration. In this case, too, it is the banks' fear of losing their most stable funding source that explains the downward rigidity of deposit interest rates.

The monetary illusion is generally also associated with a psychological/cognitive distortion⁽²⁾. In fact, many real interest rates (i.e. if the effect of inflation is taken into account) have already been negative for a number of years in the euro area. In other words, even though inflation and a negative nominal interest rate may have the same impact on real purchasing power, the negative interest rate is seen as costing more. Why? Because in the case of inflation, the economic agent ends up with the same nominal amount, whereas the negative nominal interest rate implies the payment of interest. In general, the monetary illusion is therefore manifested primarily among non-institutional investors such as households. That explains the stronger downward rigidity of retail deposit interest rates.

(1) See in particular Goodfriend (2000), Buiters *et al.* (2003), Buiters (2009), Kimball (2013), Rogoff (2014) or McAndrews (2015).
 (2) However, Borio and Zabai (2016) point out that the monetary illusion phenomenon is not always necessarily a sign of irrationality on the part of economic agents.
 (3) The interest rate applied to the livret A also forms the basis for calculating the rate on a number of other savings accounts ("comptes spéciaux sur livret du crédit mutuel", the "livre d'épargne populaire", the "livret d'épargne-entreprise" and the "compte d'épargne-logement").

Finally, legal restrictions are the last reason for the downward rigidity of deposit interest rates. In this case, the rigidity is directly imposed by law. Legal systems of this kind exist in France (the interest rate applicable to the livret A – a specific savings account with a ceiling – can be revised by the government twice a year and stood at 0.75 % in October 2017⁽³⁾) and in Belgium, where – pursuant to a Royal Decree – the minimum interest rate on regulated savings deposits was 0.11 % in October 2017 (i.e. a basic minimum rate of 0.01 % and a minimum fidelity premium of 0.10 %). Such bank accounts are generally reserved for households and associations, the aim being to protect small savers.

3. Potential restrictive effects of the negative interest rate policy on lending

To understand how the downward rigidity of retail deposit interest rates can affect the efficient transmission of a reduction in the key policy rate below zero, it makes sense to look at the actors who are the first to be affected, namely the banks.

3.1 Effects of a reduction in the key policy rate on banks' balance sheets

In order to explain the transmission by the banks, we shall conduct a conceptual examination using a stylised balance sheet of a commercial bank whose main activity consists in collecting retail deposits and granting loans to the real economy. As well as granting loans, the bank holds marketable securities, and it deposits its excess liquidity with the central bank (see chart 3).

The effect on the bank of a negative interest rate policy is assessed dynamically and in relation to the counterfactual situation in which the interest rate has not fallen (see chart 4). This is a purely economic assessment. We therefore ignore the effects of accounting rules and

CHART 3 SIMPLIFIED BANK BALANCE SHEET

Assets	Liabilities
Securities	Own funds
Loans	Retail deposits
Reserves at the central bank	

bank regulations on the recording of the bank's gains and losses, and hence on its results (i.e. the change in its own funds). In addition, throughout the analysis, we impose "business as usual behaviour" on the bank in order to isolate the direct effect of the negative interest rate policy. In other words, we do not introduce the (immediate) option for the bank to adjust the composition of its balance sheet (e.g. by taking more risks or diversifying its activities) after the key interest rate is cut below zero. However, we would point out that, in reality, these accounting and regulatory effects and the banks' response are significant factors which may change the simple, schematic reasoning presented in the rest of the article. That said, our simplified framework is still useful as a starting point for seeing how a negative interest rate policy affects the banks.

For simplicity, we also assume that retail deposit interest rates remain totally rigid after the negative interest rate policy has been deployed.

In the framework defined, a reduction in the key interest rate affects the bank via three channels: (a) capital gains, (b) loan quality and demand for loans, and (c) the net interest margin.

The capital gains channel

In principle, a reduction in the key interest rate is passed on to other market rates. A widespread fall in interest rates therefore automatically implies an increase in the price of existing bonds, and typically triggers a rise in share prices (owing to the lower discount rates on the cash flows associated with those assets). If the bank decides to sell the bonds and shares that it is holding, it realises capital gains. Those gains correspond to the difference between the price at which it bought the assets and the price at which it resells them. Where bonds are concerned, the longer their average maturity (i.e. their duration), the more sensitive their price to a decline in interest rates. In other words, the capital gains realised will be greater the more long-term bonds the bank holds.

Capital gains are recorded when securities are sold; they are therefore restricted in time. In our example, we assume for simplicity that the sale takes place immediately after the interest rate cut and concerns all the bank's marketable securities. In chart 4, which presents a dynamic illustration of the situation, the light green bar thus indicates the immediate positive effect on the results due to the sale of the negotiable assets which have gone up in price. In other words, as the capital gains realised generate profits, then all other things

being equal, the bank's own funds (in the economic sense) are driven upwards as soon as the interest rate falls.

The light green dotted bars indicate that the reinvestment of the security sale proceeds in securities of the same type generates periodic losses of interest. If the key rate had not fallen, the bank selling the negotiable securities would not have made any capital gains but it would nevertheless have been able to reinvest the proceeds of the sale in other similar securities without affecting its net interest margin. Conversely, if the key interest rate is cut below zero, the reinvestment of the sale proceeds (including the capital gains) implies a smaller net interest margin for the bank. As a result of the cut in the key rate, the newly acquired securities produce a lower yield, but the associated funding costs are unchanged because it is assumed that the interest rate on retail deposits displays total downward rigidity⁽¹⁾.

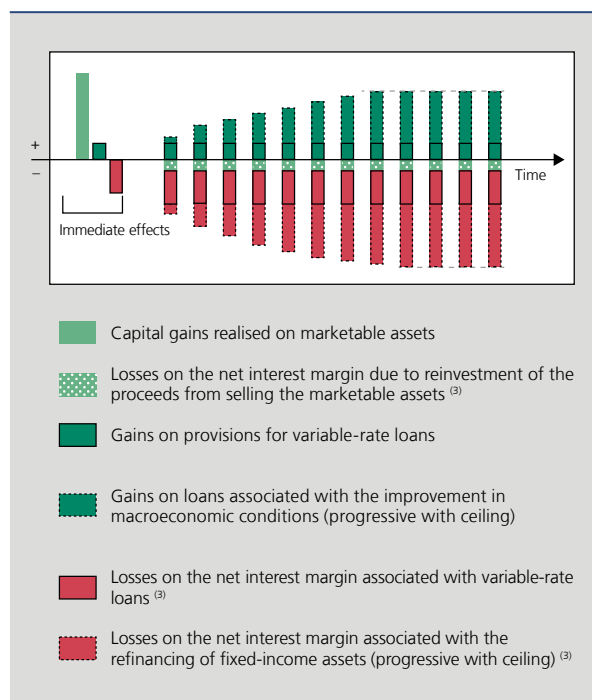
The loan quality and loan demand channel

Apart from capital gains realised on the securities portfolio, a cut in the key interest rate leads to gains on the bank's loan portfolio. Some of those gains are immediate and concern loans at variable rates. As the interest rates on those loans are linked to – fluctuating – market reference rates, they will quickly be adjusted downwards if the key interest rate is lowered. For borrowers, that means that their loans become easier to repay. The bank thus faces lower default rates and achieves savings on the precautionary provisions made for these loans, compared to the counterfactual situation in which the interest rate has not fallen. Such gains are not only immediate but also continue throughout the period in which interest rates remain lower. In chart 4, they are represented by dark green bars surrounded by a continuous line.

Another part of the gains realised on the loans is due to the improvement in macroeconomic conditions associated with the cut in the key interest rate. As the monetary policy action takes some time to influence activity, those gains are not felt immediately after the cut in the key interest rate

(1) From an economic point of view, if the bank chooses to keep its securities in its portfolio or to sell them when interest rates fall, that does not make any difference to its results in the long run, all other things being equal. If the bank keeps its securities in its portfolio, the decline in interest rates will not affect its results, at least not until the securities mature. It will then invest the principal repaid in new securities of the same type but offering lower interest; that will reduce its net interest margin if, at the same time, its funding costs remain rigid. If the bank sells its securities, it will realise immediate capital gains but the reinvestment of the proceeds of that sale in new securities of the same type, offering a lower yield owing to the decline in interest rates, will imply a loss of interest (still in relation to the counterfactual situation in which the key interest rate has not been reduced). It is possible to demonstrate that the periodic losses of interest up to the maturity of the securities sold in fact correspond exactly to the capital gains realised at the start. That therefore means that the sale of the securities has no effect on the bank's results if the whole period up to the maturity of the securities sold is taken into account: the capital gains are exactly offset by the loss of interest on the reinvestment. The net interest losses due to the rigidity of the funding costs thus occur – as in the case of the securities being kept in the portfolio – once the securities originally held in the portfolio reach maturity.

CHART 4 ILLUSTRATION OF THE TOTAL EFFECT ON A BANK'S ECONOMIC RESULTS OF A REDUCTION IN THE KEY INTEREST RATE BELOW ZERO⁽¹⁾⁽²⁾



Source: NBB.

- (1) The total effect on the result is assessed in relation to the counterfactual situation in which the key interest rate is not lowered. The size of the gains and losses and their time profile are purely an illustration. In practice, the size and time profile of the gains and losses of each bank will depend on the structure of the bank's balance sheet (see section 4 of this article).
- (2) The diagram assumes that (a) the bank's liabilities excluding its own funds consist entirely of retail deposits on which the interest rates remain totally unchanged when the key rate falls below zero; (b) the bank does not hold shares and sells all its marketable fixed-income bonds as soon as the key interest rate falls. It also reinvests the proceeds of those sales (including capital gains) in marketable fixed-income bonds of the same type; (c) the bank's activity is based mainly on its intermediation margin (loans – deposits): it does not receive any trade margin or other fees or commission; (d) the bank generally conforms to "business as usual" behaviour.
- (3) Effects directly linked to the downward rigidity of retail deposit interest rates.

but appear gradually, as indicated by the time profile of the dark green bars surrounded by a dotted line in chart 4. Three main channels can be identified here. First, the increase in the price of the assets used as loan collateral will lead to a fall in the rate of losses in case of default. Next, the increase in the borrowers' nominal incomes will make it easier for them to repay their loans (be they at fixed or variable interest rates), reducing the default rates and the associated provisions. Finally, the recovery will render the potential borrowers' projects more profitable, and that will boost demand for loans and lead to volume gains on the bank's intermediation activity⁽¹⁾.

The net interest margin channel

The last channel through which a cut in the key interest rate affects a bank is the net interest margin channel.

This is different from the previous two channels since it is here that the downward rigidity of retail deposit interest rates will primarily apply, and therefore where the specific differences between a key interest rate cut in negative territory as opposed to a reduction in positive territory will become apparent.

A bank whose main activity consists in collecting retail deposits and granting loans relies on maturity transformation in order to generate profits. It raises relatively short-term funding while tending to grant longer-term loans. A reduction in the key interest rate in positive territory will not cause the net interest margin of such a bank to shrink but could even actually increase it for a time, as the bank may benefit from the faster reduction in interest rates on its liabilities (short) compared to the interest rates on its assets (typically longer), all other things being equal (Heider *et al.*, 2017).

However, in the case of an interest rate cut in negative territory, deposit interest rates display downward rigidity. If the interest rates on the assets adjust without any particular resistance, the reduction in the key interest rate will then result in downward pressure on the bank's net interest margin if the bank's behaviour is unchanged. The losses are of two types. On the one hand, they concern the margin made on the stock of variable-rate loans (the red bars surrounded by a continuous line in chart 4). That margin shrinks immediately since the rates on such loans are adjusted straight-away whereas they are still funded by deposits at rigid interest rates. On the other hand, the losses also concern the margin made on the stock of fixed-rate loans and non-negotiable fixed-income bonds held in the portfolio until maturity (namely the red bars surrounded by a dotted line). Those losses are gradual, the speed at which they increase depending on the pace of portfolio refinancing. The ceiling is reached once the whole stock of fixed-rate loans and fixed-income bonds has been renewed.

3.2 The economic lower bound of nominal interest rates

The dynamic analysis of the three channels through which a reduction in the key policy interest rate affects a typical commercial bank leads to two key conclusions. In our framework, if the key policy rate is reduced in positive territory, the bank's results are driven higher, whatever the length of the period of lower interest rates. The

(1) As already mentioned, our analysis is "static" as regards the bank's behaviour. More specifically, we assume here that the bank does not change its lending behaviour following the reduction in the key interest rate. We only assume that the bank adjusts its supply in response to the stronger demand from borrowers, and does so for all new loans requested which meet a predetermined critical level of profitability.

mechanisms of the three channels are then grouped together under the usual name of the "bank lending channel": since a reduction in the key interest rate drives up the bank's net value, it is likely to encourage an increase in lending by the bank (Bernanke and Gertler, 1995).

Conversely, if the reduction in the key interest rate takes place in negative territory, it has an ambiguous effect on the bank's results, and hence also potentially on the bank's scope for lending. The overall effect is all the more difficult to ascertain because of the differences in the time profiles of the gains and losses associated with the three channels. The length of the period in which the interest rate cut in negative territory applies is therefore important for assessing the measure's overall effect: in particular, the impact on the net interest margin persists whereas the effect of the capital gains is limited in time.

This last point suggests the existence of another lower bound for nominal interest rates, in addition to the physical lower bound: the economic lower bound of nominal interest rates. If, for a given interest rate cut in negative territory for a set period of time, the sum of the associated gains and losses for the banks – appropriately discounted – proves to be negative, a contractionary phenomenon may emerge. By depressing the banks' results, the reduction in the key interest rate may in fact discourage banks from lending. The economic lower bound of nominal interest rates is thus defined as the level of interest rates beyond which such a contractionary phenomenon may emerge. If such a limit is reached, that implies a reversal of the traditional bank lending channel: the reduction in the policy rate exerts downward pressure on lending dynamics. That is why it is also called the "reversal rate" by Brunnermeier and Koby (2017).

In practice, the economic lower bound of nominal interest rates is not necessarily lower than zero. Retail deposit interest rates may actually display strong rigidity above that level, e.g. if they are regulated by law. The economic lower bound may therefore already concern cuts in the key interest rate to a level which is not negative but is relatively close to zero.

Another point which should be mentioned is that the limit depends on an estimate by the banks themselves. In that assessment, the dynamic aspect is important. The level of the limit may thus change according to the expected duration of the period of negative interest rates. That highlights the dangers of a negative interest rate policy

(1) However, it should be noted that a prolonged period of negative interest rates may at the same time weaken the initial psychological resistance of retail customers in regard to negative interest rates. That may give the banks additional scope for reducing their funding costs.

maintained for an excessively long period⁽¹⁾. If the period is constantly extended, then it is possible, for example, that at a certain point the capital gains initially recorded are totally "swallowed up" by the expected direct losses on the net interest margin. From then on, the periodic gains associated with the improvement in loan quality and the revival of demand will be potentially insufficient on their own to compensate for those losses.

Nonetheless, we must point out that our conceptual analysis assumes that the banks do not change their behaviour on account of the reduction in the key interest rate. In reality, however, the banks may decide to make substantial changes to their business model in order to produce the optimum response to the new interest rate environment, e.g. by expanding their activities that generate revenue other than interest income. That could, for instance, preserve the dynamics of lending, which is equivalent to driving down the economic lower bound of nominal interest rates.

4. Which bank characteristics influence the effect of the negative interest rate policy on lending?

The diversity of the channels via which the negative interest rate affects the banking sector's profitability implies that the composition of the banks' balance sheet and, more generally, their business model and the time profile, determine the gains and losses associated with a given reduction in the interest rate to less than zero.

4.1 Financing via retail deposits

Since the rigidity of the remuneration of retail deposits is a central specific aspect of the negative interest rate, the proportion of that source of funding for each bank is a key determinant of the potential impact of the negative interest rate on the bank's profitability. If a bank benefits less from a reduction in its funding costs because the interest rates on the deposits that it has are rigid, its net interest margin will shrink and that could depress its results. Empirical analyses of euro area banks prove the existence of this effect. Claessens *et al.* (2017) demonstrate, for example, that a reduction in the key interest rate always causes a decline in the banks' net interest margin, but the effect is greater at low levels of interest rates. In an analysis aimed at identifying the specific role of deposit interest rate rigidity, Ampudia and Van den Heuvel (2017) find that when interest rates have been cut to zero or below, the markets have seen that as detrimental to the banks' future profitability, especially

for banks with a larger proportion of deposits: their stock market valuations fell more steeply following decisions to cut the policy interest rate to zero or below. According to this analysis concerning 56 euro area banks, further policy interest rate cuts in that environment would have a negative impact on the share price of banks with a very high proportion of deposits (i.e. banks above the 90th percentile in the distribution of the proportion of household deposits). Conversely, the impact on the stock market value of banks with fewer deposits does not appear to differ significantly from zero⁽¹⁾.

Furthermore, as the contraction of the net interest margin squeezes the banks' current or future profitability, it may cause them to limit the transmission of monetary policy via the bank lending channel. To verify and quantify that impact, we carried out an econometric analysis of the provision of bank loans to businesses following the interest rate cut decided in June 2014, using a difference-in-differences model applied to a panel of 256 euro area banks on

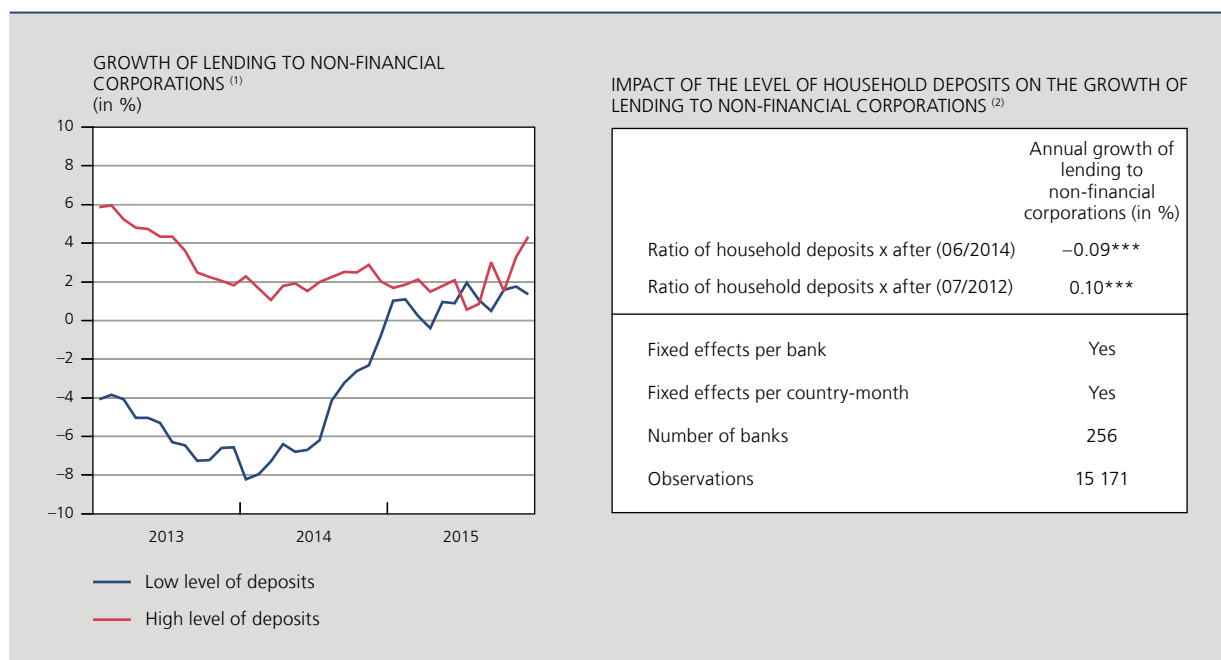
a monthly basis⁽²⁾. In the first instance, we compared the growth of lending to non-financial corporations according to the share of retail deposits on the balance sheet of the bank in question⁽³⁾. Next, to check whether a reduction in interest rates in negative territory has a different effect from a reduction in positive territory, we added a term that refers to the July 2012 cut in the effective key policy interest rate to zero. The equation used is this:

$$\begin{aligned}
 growth_credit_{it} = & \alpha + \beta (dep_ratio_{i5/2014} \times \\
 & after(6/2014)) + \theta (dep_ratio_{i6/2012} \times after(7/2012)) \\
 & + \gamma_i + \varphi_{ic} + \varepsilon_{it}
 \end{aligned}$$

The dependent variable is the annual growth of lending to non-financial corporations. *dep_ratio* indicates the proportion of household deposits compared to bank i's balance sheet total in the period preceding the interest rate cut. It is included in the equation in interaction with two binary variables, one referring to the period after the July 2012 interest rate reduction, and the other referring to the period after the June 2014 interest rate reduction, i.e. when the ECB's deposit facility rate became negative for the first time. The analysis covers the period from January 2011 to December 2015. Since the analysis is performed over a relatively short period after implementation of the negative interest rate, we can assume that any

- (1) The study also shows that interest rate cuts in strictly positive territory were considered profitable for the banks (as they lead to a rise in their stock market value, although that beneficial impact is weaker in the case of banks with more deposits).
 (2) For more information on the structure of the database used, see Boeckx *et al.* (2017).
 (3) The results of this specification are not shown here because they are similar to those of the extended equation.

CHART 5 LENDING DYNAMICS AND RELATIVE SHARE OF RETAIL DEPOSITS ON BANK BALANCE SHEETS



Source: NBB.

- (1) "Low level of deposits" refers to banks in the lowest quartile of the distribution of the proportion of deposits on the balance sheet total. "High level of deposits" refers to banks in the highest quartile.
 (2) *** corresponds to the 1% statistical significance threshold.

changes in the banks' business model were fairly limited. In order to take account of the specific characteristics of the individual banks and the economic and financial situation at that time, we included fixed effects per bank and per country-month.

The results show that a larger proportion of household deposits in relation to the assets implies a smaller increase in lending to non-financial corporations in the 18 months following the introduction of the negative interest rate. More specifically, each additional percentage point of household deposits (compared to the balance sheet total) causes a 9 basis point reduction in the year-on-year growth of lending to businesses. The impact of the July 2012 interest rate cut was the opposite, with a stronger rise in the growth of lending where household deposits formed a larger share of the balance sheet.

This conclusion is similar to that of Heider *et al.* (2017), who find that banks holding more deposits lend less to businesses after the implementation of a negative interest rate than banks with fewer deposits. They also find that the banks with a higher proportion of deposits concentrate their loans on riskier businesses: an increase in the ratio of deposits is associated with lending to businesses whose return on assets is relatively more volatile. Unfortunately, our database does not enable us to analyse any possible effects on risk-taking by banks.

The analyses presented here, based on difference-in-differences models, only reveal a relative effect resulting from comparison of the behaviour of individual banks. These models therefore do not indicate that the negative interest rate has any adverse effect – in absolute terms – on lending. Instead, they show that the greater the ratio of retail deposits on a bank's balance sheet, the more slowly the bank's lending will grow in relation to the average bank. That does not permit any conclusions regarding the effect of the negative interest rate on the average bank's lending. Chart 5 shows that credit growth remained positive after the June 2014 interest rate cut, both for banks with a high ratio of deposits and for those with fewer deposits. However, section 5 will demonstrate that this is not necessarily due purely to the easing effect of the negative interest rate.

The impact of the volume of household deposits on banks' profitability, and ultimately on lending, may also be influenced by the margin available to the banks for lowering the interest rate on their deposits at the time of the rate cut. That margin will determine how soon and to what degree the banks will have to contend with negative pressure on their net interest margin. However, we are not dealing with an absolute concept here: for

example, legal restrictions which vary from one country to another may impose different lower limits for certain deposit interest rates. That makes it very challenging to test this hypothesis.

4.2 Composition and duration of bank assets

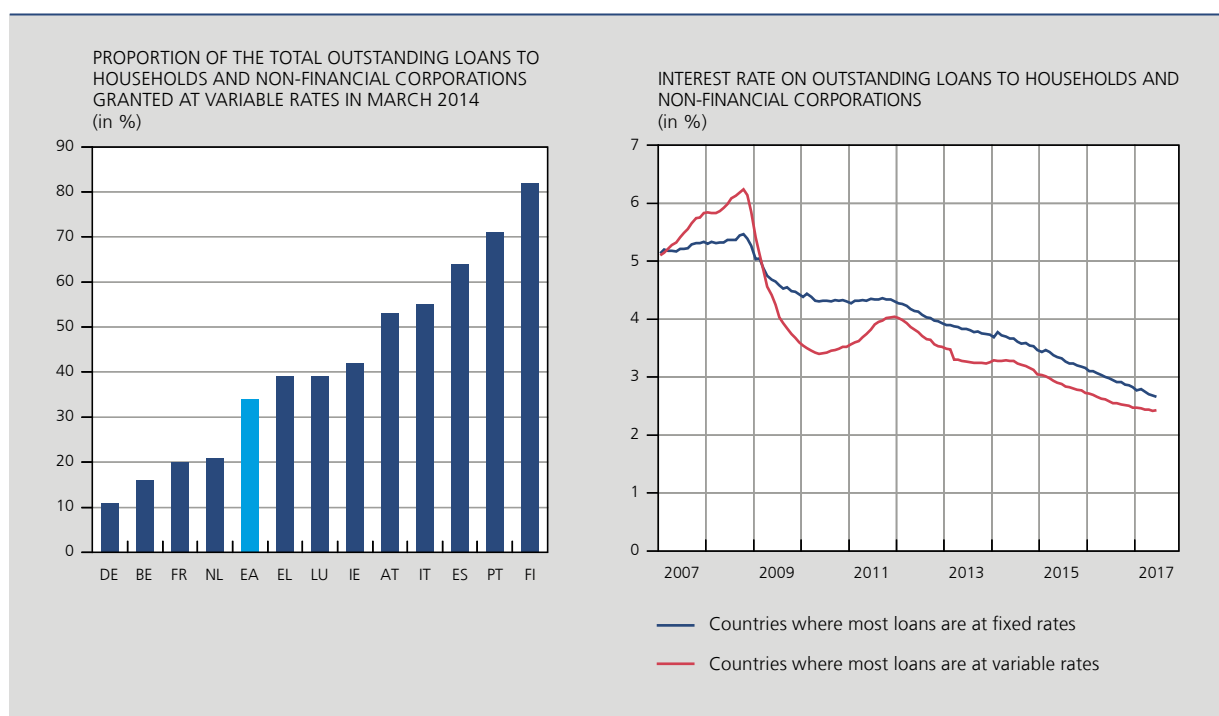
The economic lower bound of interest rates is also likely to depend on the composition and duration of banks' assets. It may be beneficial for the banks to hold assets with a longer duration, on which the interest income is less susceptible to interest rate changes. A portfolio of long-term bonds or fixed-interest loans can guarantee the bank a stable interest income until the bonds or loans mature, implying that in the meantime they maintain a higher net interest margin (all other things being equal), since their funding costs are adjusted – albeit only partially – as a result of the interest rate cut.

In the case of loans, it is the rate fixation period rather than the loan duration that largely determines the speed of adjustment to the new level of interest rates. The reference rates for loans at variable interest are generally market interest rates which, as already mentioned, have responded strongly to the reductions in the policy interest rate, even in negative territory. This shows that variable-rate loans, and especially those on which the interest rate is revised after a relatively short time, can lead to a considerable loss of interest income on the banks' existing portfolio.

The proportion of variable-rate loans varies greatly between the euro area countries, as each country has its own well-established practices or customs, especially as regards household mortgage loans. That disparity is reflected in differences in the impact of key interest rate changes. Banks which mainly lend at fixed rates may also be affected by interest rate changes when refinancing the loans, although the effect is less automatic and systematic. However, if the refinancing process comes with a fee for the lender, the negative impact on the income of the bank concerned is partly mitigated (at least in the short term).

The volume and maturity of the fixed-income bonds in the portfolio of marketable securities also determine the sensitivity of the bank's profitability to the negative interest rate. Thus, a larger proportion of bonds in the balance sheet total and a longer residual maturity are associated with a less detrimental impact on profitability, because the value of the securities held increases when the interest rate falls, and the rise is all the greater the longer their maturity. Conversely, if banks hold few bonds or have more short-dated securities, the capital gains generated

CHART 6 LENDING AT VARIABLE INTEREST RATES COMPARED TO LENDING AT FIXED RATES IN THE EURO AREA



Sources: ECB, own calculations.

by a reduction in interest rates will be smaller. Banks are then less able to offset future losses on their net interest margin if the change in their funding costs is only partial.

More generally, the proportion of marketable securities that banks hold seems to attenuate the adverse impact of the negative interest rate on the supply of loans to non-financial corporations. If the same economic analysis as before is applied first to banks with a higher proportion of marketable assets⁽¹⁾ and then to those with a lower proportion (the upper and lower quartiles of the distribution respectively), the results differ significantly. For banks with a large volume of marketable assets, the deposit ratio did not hamper the growth of lending to businesses in a period of negative interest rates (as the coefficient was considerably lower than for banks holding fewer negotiable assets, and was not significantly different from zero). In contrast, for banks with a small volume of marketable assets, the impact of household deposits on growth escalates (-22 basis points as opposed to an average of -9 basis points). By attenuating the adverse effect of the negative interest rate on bank profitability, the rise in the value of securities also seems to temper its potential negative impact on lending.

(1) The sum of the debt instruments (issued by the public or the private sector, but other than by banks) and private sector shares (excluding banks) in proportion to the balance sheet total.

In the end, the banks' assets with the shortest maturity and the greatest sensitivity to interest rates are the excess liquidity that they deposit at the central bank in excess of their reserve requirements. A bank will incur losses on its excess reserves if the interest rate applied to them is lower than the marginal cost of their financing (Buiter and Rahbari, 2016). Although those losses are not confined to periods of negative interest rates, it is likely that, when the interest rate falls below zero, the marginal cost of funding will be relatively high for banks holding a large proportion of household deposits, owing to the rigidity of their remuneration. If banks hold a large volume of excess liquidity, that may therefore depress their interest income and – in the event of rigid funding costs – their profitability. However, there are several factors that influence the size of that impact.

First, although the weight of the excess liquidity in the balance sheet total of euro area banks has increased substantially since the beginning of 2015, it is still relatively low (6% in August 2017), especially compared to the ratio of retail deposits (22% on that same date). Thus, a reduction of less than 3 basis points in the household deposit interest rate would offset the loss of net interest income resulting from a 10 basis point reduction in the ECB deposit facility rate.

Second, the strong rise in excess liquidity in recent years is the counterpart to the securities purchased by the Eurosystem under the APP. In so far as those securities were held by the banks themselves, they generated capital gains for the banks when they were sold.

The third and final point is that the distribution of the excess liquidity between banks is an important factor for assessing the impact: if it is concentrated mainly on banks with a small ratio of retail deposits, the effect on the sector's profitability should be very small⁽¹⁾.

4.3 Has the supply of bank loans suffered as a result of the negative interest rate?

However, it must be said that neither the data so far nor the analyses mentioned here show any contractionary effect attributable to the negative interest rate in absolute terms, as defined by Brunnermeier and Koby (2017)⁽²⁾. In general, the implementation of the negative interest rate policy in the euro area was accompanied by an acceleration in lending and a steep decline in bank debit interest rates. Interest rates on loans fell by significantly more than the average reference interest rate on the interbank market (i.e. the rate at which banks can raise funding on that market) (ECB, 2017a). These positive developments are borne out by the banks' answers to questions concerning the impact of the negative interest rate on lending, included in the quarterly bank lending survey in the euro area. Despite the adverse impact on net interest income, the negative interest rate seems to have had a positive impact on the volume of lending and helped to drive down debit interest rates (ECB, 2017c). At the same time, some euro area banks have focused more on activities generating fees and commissions in order to offset the fall in their net interest income (ECB, 2016b).

However, it is still difficult to identify the specific contribution of the negative interest rate to the observed movement in debit interest rates and bank lending, as the ECB implemented other measures at the same time, such as forward guidance, asset purchase programmes, and targeted longer-term refinancing operations. The next section examines the interactions between the negative interest rate and those measures.

(1) Baldo *et al.* (2017) show that the distribution of the liquidity depends partly on the banks' business models: investment banks and clearing institutions thus tend to accumulate more excess liquidity in relation to their balance sheet total. That suggests that excess liquidity does not present a risk for the transmission of monetary policy to bank lending.

(2) However, an analysis by Goldman Sachs Economic Research (Hazell and Pill, 2016) shows that the growth of lending to businesses declines following a reduction in interest rates if those rates are at very low levels or below zero.

5. Interactions and complementarity between the negative interest rate policy and the other monetary policy measures

The effects and the transmission channels of the various monetary policy measures adopted by the ECB since June 2014 interact and complement one another. The combination of those measures may therefore also have specific additional consequences for the banking sector's profitability and for the transmission via the banks.

In general, the presence of a lower bound may inhibit the central bank's ability to ease monetary policy further (Goodfriend, 2016). The negative interest rate may therefore be regarded as a measure that reinforces the effect of both conventional and non-standard monetary policy (Rostagno *et al.*, 2016). Under conventional policy, reductions in the interest rate below zero may thus have a bigger impact on financial conditions than interest rate cuts in positive territory if they change the perception of the lower bound of key policy interest rates. In the context of the euro area, the negative interest rate thus amplified the effect of the forward guidance (Cœuré, 2016): since interest rates are expected to remain low in the future, the reduction below zero in fact lowered future rate expectations, causing the rest of the yield curve – well beyond the short segment – to move downwards.

At the same time, some other ECB measures reinforce the effect on the yield curve of the interest rate cuts in negative territory, particularly the forward guidance and the asset purchase programme, the impact of which is more marked on the medium and long segments of the yield curve. Thus, apart from the downward shift caused by the interest rate cuts, the yield curve flattened out, and that may have varying effects on banks' profitability. On the one hand, since the banks normally gain from a steeper yield curve, that may further dent their profitability, as the assets previously held are replaced with assets generating lower interest income, implying direct losses on the net interest margin unless the funding costs are adjusted to the same degree.

On the other hand, the simultaneous implementation of the various measures helps to reinforce the easing of financial conditions, and in so doing, to enhance the beneficial effect of the interest rate reduction on the euro area's economy. Consequently, the aim of the measures – namely, to boost the economy and inflation – could be attained more quickly, thus reducing the period of time in which interest rates have to remain at very low levels, and hence the potentially adverse impact that a long period of negative interest rates may have on the banks.

Furthermore, the additional fall in longer-term interest rates resulting from the forward guidance and purchase programmes drives up the value of the marketable assets held by the bank, as explained above. The capital gains derived from the appreciation of those assets will therefore be larger for the banks than if the negative interest rate were the only measure applied by the central bank.

The negative interest rate also complements the implementation of the asset purchase programmes (also known as quantitative easing programmes) by encouraging the portfolio rebalancing which is typical of these programmes: the fact that the bank obtains negative marginal income on its excess reserves prompts it to reallocate those reserves, i.e. to convert them into other types of assets. The negative interest rate may therefore lead to increased lending (including interbank loans) or increased exposure to riskier assets (including assets denominated in other currencies). The interaction between the negative interest rate and the asset purchases could thus enhance the latter's effectiveness.

The quantitative easing programmes may also alter the composition of the banks' balance sheet and hence their profitability, as the asset purchases imply a strong rise in excess liquidity in the banking system. Although the distribution of the excess liquidity depends on the strategies and options of the individual banks, the reduced duration of the assets of at least some banks – resulting from their liquidity holdings – may exacerbate the pressure on their profitability if, at the same time, they face relatively rigid funding costs. These effects will be more marked if the key interest rates drop significantly below zero, but also if they remain below zero for longer than expected. The purchase programmes also have a dynamic dimension (with growing excess liquidity) additional to that of the negative interest rate policy.

These pressures may be all the more severe if the asset purchase programmes are accompanied by an increase in the volume of deposits, and retail deposits in particular, either directly if the central bank buys securities from retail customers and the latter deposit their gains with euro area banks, or indirectly if the second-round effects of the purchases imply an increase in lending to households and businesses (for an intuitive explanation of that effect, see Cordemans *et al.*, 2016).

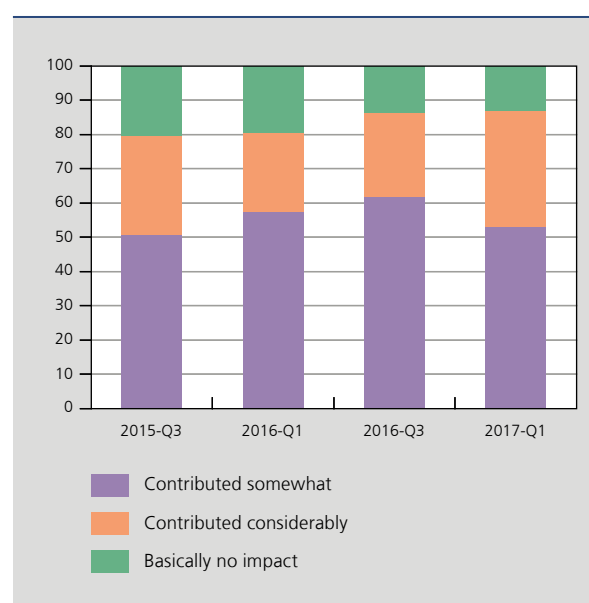
These interactions have repercussions on the sequencing of the monetary policy measures, as regards both their implementation and their withdrawal. According to Brunnermeier and Koby (2017), to maximise the impact of the measures via the bank lending channel, the key interest rates need to reach their lower bound before

the implementation of a quantitative easing programme is considered. The reason is that, when there is no expectation of any further interest rate cuts (which would enhance the value of the assets held on their balance sheet), the holders – including the banks – are more disposed to sell the assets to the central bank under a purchase programme. Conversely, if interest rates have not reached their lower bound, the holders may prefer to keep the assets that they hold, thus undermining the effectiveness of the purchase programme. Moreover, this precise sequencing implies that the banks can achieve the capital gains associated with the reduction in interest rates until the lower bound is reached, attenuating the potential adverse impact of the negative interest rate on the net interest margin. An unexpected interest rate cut after the sale of the assets would be associated with a smaller capital gain (or a reduction in the remuneration on the excess liquidity created by the sale of the assets), and that could impair the banks' resilience in prolonged periods of negative interest rates (and hence the transmission of the easing to the economy).

For the banks, the complementarity of the measures also has consequences in relation to the sequencing of the withdrawal of the various measures: terminating the purchase programme first could steepen the yield curve (the term premium would increase), and that could moderate

CHART 7 IMPACT OF THE TLTROS ON LENDING TO NON-FINANCIAL CORPORATIONS

(in % of banks answering the question "To what extent have the funds obtained from past TLTROs contributed to lending to non-financial corporations?")



Source: ECB, quarterly Bank Lending Survey for the euro area.

the potentially negative impact of a prolonged period of negative interest rates on the banks' profitability, while keeping short-term interest rates at relatively low levels.

The complementarity between the negative interest rate and the TLTROs is more specific and more bank-centred. These operations, which aim to encourage bank lending to businesses, provide very cheap medium-term funding for the participating banks⁽¹⁾: they thus exert downward pressure on the banks' funding costs (both directly, for those borrowing funds, and indirectly, by offering an additional source of funding competing with traditional sources such as bank bond issuance or interbank loans, and driving down their yields). More particularly, the second series of TLTROs implemented since June 2016 offers funds for a period of up to four years at an interest rate potentially equal to the deposit facility rate. In October 2017, the liquidity created by the TLTROs amounted to € 758 billion, or 42 % of the excess liquidity in the euro area's banking system, and 2.4 % of the banks' balance sheet total.

By reducing the banks' funding costs, the TLTROs attenuated the negative impact of the rigidity of deposit interest rates on the banks' net interest margin, and therefore on lending. According to the responses of the quarterly bank lending survey in the euro area, the banks consider that the TLTROs boosted lending to non-financial corporations.

Conclusion

In recent years, the negative interest rate policy, together with other non-standard monetary policy measures, has become an additional tool for central banks. Although its use is widespread, both to combat deflationary risks and

to control exchange rates, it has its limitations as regards monetary transmission via the banks.

Those limitations are due to the existence of a lower bound at around 0 % for retail deposit interest rates. This lower bound implies downward rigidity of the banks' funding costs once the key interest rate has fallen too low, and especially if it drops below zero.

The downward rigidity of the banks' funding costs may create downward pressure on their net interest margin, and ultimately constrain their ability to lend more to the economy. Also, the longer the period of negative interest rates, the greater the likelihood of contractionary effects on lending dynamics. However, the banks may also benefit from capital gains and the improvement in the macroeconomic conditions associated with monetary easing. Thus, the ultimate effect of the negative interest rate on the banks' profitability and on their lending will depend on the composition of the banks' balance sheet.

Furthermore, the negative interest rate policy in the euro area is not an isolated measure. The interactions and the effects of complementarity with other monetary policy measures may attenuate the potentially restrictive effect of a negative interest rate policy on the banks' profitability and on their capacity to lend more. The combination of measures may also facilitate transmission, helping to achieve the monetary policy objectives more quickly and limit the length of time for which the negative interest rate is necessary. Developments in lending in the euro area since the implementation of the negative interest rate policy seem to indicate a smooth transmission via the banks.

(1) For more information on the TLTROs, see for instance ECB (2017d).

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