The future of monetary policy frameworks

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Ten years after the economic and financial crisis of 2007-09, the recovery in the euro area is resilient and increasingly broad-based even if overall risks remain tilted to the downside. Monetary policy plays a crucial role in supporting that recovery. Through a combination of interest rate cuts and expansions of the Eurosystem balance sheet, the ECB provided the necessary degree of monetary stimulus to prevent an even deeper cyclical downturn and to avert the risk of outright deflation. The continuation of such monetary stimulus remains important to ensure a sustainable adjustment of the inflation process towards levels consistent with the ECB price stability objective.

In advanced economies, many commentators have started discussing whether central banking will eventually return to the pre-crisis *status quo*, or whether the many innovative tools assembled to respond to the crisis will be a permanent feature or even whether monetary policy regime should undergo a more complete overhaul. My intention today is to engage in this discussion which can be divided into two themes: what should central banks' target, and which tools should they use to reach that objective?[1]

In most advanced economies, central banks operate under a strategy that is consistent with the theoretical *flexible inflation targeting* approach and that aims to achieve low inflation, or price stability, as a primary objective. After the global financial crisis, this approach has come into criticism, in particular with regards to perceived weaknesses in fighting deep recessions and the extent to which financial stability concerns should be integrated. A range of alternatives have been proposed, such as nominal GDP or price level targets, increasing the inflation target or even setting policy by a mechanical formula like a Taylor Rule.

The main question that emerged after the crisis from a monetary policy framework perspective refers to what degree financial stability considerations should be included in central banks' competences.

[1] See also Constâncio (2016).

The second theme deals with the specific policy instruments used by central banks in order to achieve their objectives. The pre-crisis consensus in advanced economies was to rely almost exclusively on a short-term interest rate as *the* monetary policy instrument. After the economic and financial crisis, central banks have pushed the short-term interest rate to previously unthinkable low levels – including negative in the euro area and other countries, and have created new instruments to complement or substitute its effects. Given the experience gained with these new instruments, the questions are whether these should become a permanent feature of the central bank toolkit, or whether they remain non-standard measures reserved for extreme circumstances. Should central banks be even bolder than they have been in devising new tools?

Should monetary policy strategies change?

According to Svensson (2008), inflation targeting can be broadly characterised by three elements: 1) an announced numerical inflation target; 2) monetary policy decisions that make the inflation forecast converge to this numerical target, and 3) a high degree of transparency and accountability.

The ECB's monetary policy strategy is consistent with these broad features. The ECB aims to maintain price stability over the medium-term, with an announced objective of annual inflation below, but close to, 2%. Substantial effort has been made to explain the strategy and monetary policy decisions, by holding press conferences after the Governing Council's monetary policy meetings, publishing detailed accounts of these meetings and delivering speeches.

Prior to the financial crisis, the performance of inflation targeting was in practice widely considered as a success.[2] To recall that in the 70s and 80s, a period that now seems in the distant past, the key challenge for central banks was very high inflation, not too low. Empirical evidence suggests that countries that adopted inflation targeting, beginning with New Zealand in 1989, have experienced lower average inflation rates than they did before its adoption. For instance, in a prominent study, Carl Walsh identifies ten inflation-targeting OECD countries and reports that the average inflation rate across countries declined from 9.2% prior to the adoption of inflation targeting to 3.2% after the adoption. Importantly, the decline in the level of inflation was accompanied by a decline in the volatility of inflation and an improved anchoring of inflation expectations.[3]

Flexible inflation targeting implies that the central bank attempts to reach the target gradually in the medium-term and not in the immediate period. Svensson (1997)[4] has shown that this gradualism is equivalent to an objective function that includes both the inflation rate deviation from its target and the output gap. This is close to inflation targeting regimes of central banks with a dual mandate but with primordial importance given to inflation as the variable in relation to which monetary policy is more efficient. On the other hand, Bean (2009, 2013)[5] has shown that no great differences exist between a flexible inflation targeting framework and one with a nominal GDP target. These

[2] See, for instance, Vega and Winkelried (2005), Walsh (2009) and Svensson (2010).

[3] It is fair to say, though, that among the group of industrial countries also those countries that did not adopt inflation targeting have seen on average, lower and less volatile inflation rates over past 20 years than before. How important inflation targeting has been in bringing down inflation rates is still the subject of an active academic debate in relation to other factors such as "good luck".

[4] See Svensson, Lars (1997)

[5] Bean, Charles (2009) and (2013)

similarities should be taken into consideration when understanding the popularity of the flexible inflation targeting framework since the early 90s.

This positive verdict on inflation targeting has been more recently called into question. Typically, opponents of inflation targeting rely on one of the following two arguments. First, some criticise inflation targeting for having failed to prevent the occurrence of the crisis. Inflation-targeting central banks, it is argued, focused too narrowly on inflation stabilisation and payed too little attention to financial developments, such as the rapid increase in house prices or the rise in financial institutions' leverage ratios prior to the financial crisis.[6] Second, inflation targeting is attacked for its apparent inability to speed up the recovery in economic activity and inflation.

Incorporating financial stability considerations into monetary policy decisions

Prior to the crisis, there was a common view that central banks should focus on inflation stabilisation and only care about financial developments should these have direct implications for inflation dynamics. Another view was that by ensuring price stability, monetary policy would also cater for financial stability. The crisis proved that this was not true as a period of moderate inflation coincided with the build-up of financial imbalances and asset price bubbles. It was hard to argue that conventional monetary policy using interest rates could and should be used to address those imbalances or prick asset price bubbles. Indeed, it is difficult to identify bubbles and virtually impossible to calibrate interest rates to produce the desired effects on asset prices. In many cases, the required increase in interest rates would create unnecessary recessionary episodes. The use of monetary policy to "lean against the wind" may be very costly, as Svensson (2016) has demonstrated. In this sense, inflation targeting cannot be blamed for failing to prevent the financial crisis.[7]

Financial stability concerns should be addressed with macroprudential tools, generally of a regulatory nature. Some of these instruments should be given to central banks to be used as complement to monetary policy as has been the case in several countries following the crisis. This principle is reflected in the ECB's new microprudential and macroprudential competences, including the power to top up national macroprudential measures.

Let me now turn to the second argument against inflation targeting: its apparent inability to engineer a quicker recovery in economic activity and inflation. To provide you with some additional figures, it took the euro area almost eight years before real GDP reached the 2008 Q1 level again, which marked the previous peak. Likewise, HICP inflation has been considerably below 2% since the second half of 2013, and only more recently started to move closer to its objective. This increase in headline inflation was however mainly driven by rising energy and food prices and not accompanied by the evolution of underlying inflation.[8]

Price and nominal GDP level targeting

[6] See, for instance, De Grauwe (2007) and Eichengreen et al. (2011).
[7] See Svensson (2016).
[8] A fair assessment of the performance of inflation targeting, however, also has to acknowledge that the euro area like all other major inflation-targeting jurisdictions has avoided the risk of falling into a deflationary spiral from materialising.

Against this background, some commentators argue that inflation targets should be replaced with some sort of level target. The two most prominent examples are price level targeting and nominal GDP level targeting, where central bank aim to stabilise the price level and nominal GDP respectively along some target path. Proponents of level targeting strategies argue that they allow for a more powerful management of private sector expectations, leading to better stabilisation outcomes than under inflation targeting.[9]

In the case of a price level target, if there is downward pressure on the inflation rate so that the price level falls below its target path, then future inflation has to be temporarily higher in order to bring the price level back on track. In theory, the private sector would internalise these dynamics and increase its inflation expectations every time there is downward pressure on the price level. In turn, higher expected inflation would mitigate the downward pressure on today's inflation rate. This expectations channel of monetary policy transmission associated with level targeting strategies is especially compelling in a low interest rate environment where the effective lower bound on nominal interest rates limits the scope for counteracting downward pressure on inflation rates by reducing current policy rates.[10] Indeed, in the United States, some central bankers have publicly called for a temporary adoption of a level target.[11]

In spite of these appealing arguments based on monetary theory, level targeting strategies rely on several strong assumptions, and I do not think that they would work in practice. First, the private sector has to be sufficiently forward looking. That is, expectations about future economic conditions must have a significant impact on today's economic decisions. Second, the private sector has to fully understand the strategy and its implications for monetary policy implementation. Finally, the strategy has to be credible, meaning that the private sector must believe that the central bank will indeed, from time to time, deliberately aim for deviations of future inflation from its implicit long-run target to meet its price level target.

I have serious doubts that these conditions are satisfied in practice.[12] And if not, level targeting strategies can easily result in worse stabilisation outcomes than inflation targeting.[13] In this context, I think the Hippocratic principle of "do no harm" also provides sensible advice for central bankers.

Nominal GDP growth targeting

Another proposed alternative strategy is nominal GDP growth targeting or, as economists sometimes call it, "speed limit" policy.[14] Nominal GDP *growth* targeting is different from nominal GDP *level* targeting – as with inflation targeting, past outcomes are not taken into account. Bygones are bygones. Loosely speaking, the nominal GDP target is the sum of an inflation target and an estimate of potential GDP growth. The central bank tightens policy whenever nominal GDP growth is above this target and loosens when it is below. While theoretical analyses suggest that speed limit

[9] See, for example, Svensson (1999), Vestin (2006), Gaspar, Smets and Vestin (2007) and Schmidt (2011).
[10] See Eggertsson and Woodford (2003), and Nakov (2008).
[11] See Evans (2010).
[12] Note also that in the case of nominal GDP level targeting, an additional challenge arises due to the unobservability of potential GDP and measurement errors in real GDP.
[13] See, for instance, Kryvtsov, Shukayev and Ueberfeldt (2008). It is therefore perhaps not surprising that one has to go far back in history to find an example of a level-targeting central bank. In the 1930s, the Swedish Riksbank pursued a price level targeting strategy. See Berg and Jonung (1999).
[14] See, for instance, Walsh (2003).

policies might perform reasonably well in normal times, they are likely to perform rather poorly when policy rates are constrained by the effective lower bound. Following a recession, they imply a much earlier tightening of policy rates than inflation targeting.[15]

Simple interest rate rules

There have been some proposals, especially in the United States, to give a much more prominent role to simple interest rate rules, the most famous example being the Taylor rule, as a guideline for monetary policy decisions.[16] The Taylor rule has been shown to provide a reasonably good ex-post account of movements in the policy interest rate. It suggests that, at any point in time, the short-term interest rate is equal to a constant, plus a weighted sum of the deviations of inflation from target and output from potential, i.e. the output gap.

The alleged advantage of using an interest rate rule to prescribe monetary policy decisions is that it makes monetary policy more predictable and prohibits policymakers from reneging on their policy commitments. By contrast, monetary policy decisions that are not bound by a rule are considered problematic, since they can be driven by short-term considerations and lose sight of their consequences on future expectations.[17] A still active research programme has shown that it is possible to design interest rate rules that perform reasonably well across a wide range of macroeconomic models.[18]

While I do not dispute the informational content that interest rate rules might provide, I strongly oppose the idea that central banks' policy rate decisions should be based on these rules. The key reason is that any specific rule is unlikely to be suited for all possible contingencies. The environment in which monetary policymakers have to act is much more complex than what is assumed in model-based analysis of policy rules. A simple rule that responds to one or two macroeconomic variables and ignores all other indicators of price developments is not able to account for the complexities of the real world. It would be especially odd, given the criticism that monetary policy does not take enough account of financial developments, to put in place a strategy that completely ignores them.

Monetary policy responses to the financial crisis, which I will describe shortly, are an example. Not only did central banks pay increasingly more attention to many new variables, when calibrating policy interest rate to evolving economic and financial conditions but they also had to devise new monetary policy instruments to respond to new types of financial market disruptions. What would have happened in the last ten years, if monetary policy had been delegated to a Taylor-rule auto-pilot?

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[15] See Woodford (2010).
[16] See Taylor (1993).
[17] In the literature, this is called the time-inconsistency problem and goes back to Kydland and Prescott (1977). Barro and Gordon (1983) were the first to study this problem in the context of monetary policy rules versus discretion. Subsequent work has shown that the time-inconsistency problem in monetary policy can also be addressed by an appropriate design of the central bank's objective function. For instance, Rogoff (1985) shows that an "inflation-conservative" central bank, i.e. one that is primarily concerned with price stability, eliminates the classic inflation bias, which arises in monetary models where the central bank has an incentive to engineer above-target inflation. Nakata and Schmidt (2015) study the time inconsistency problem for monetary policy at the effective lower bound and show that Rogoff's inflation-conservative central banker is also welfare-improving in this alternative environment where the problem is one of inflation expectations being too low.
[18] See, for instance, Levin, Wieland and Williams (2003) and Adalid et al. (2005).

Adjustments to interest rate rules and the Effective Lower Bound (ELB)

Even though no central bank applies mechanical interest rules, it is nevertheless possible to estimate *a posteriori* behavioural rules, so that in practice, interest rate decisions can be rationalised in simple regressions dependent on inflation and the output gap. Such rules are also often used to close models supporting monetary policy analysis or they result as the optimal policy from optimising exercises with macro models.

It is therefore useful to use different interest rate rules in models and analyse what their impact on the economy would be. In particular, this is interesting when trying to respond to an important policy question. Given the present low level of inflation how can the risk of interest rates reaching the Effective Lower Bound (ELB) too often be avoided and can this lead to significant losses in terms of the policy objectives?[19]

Until recently, the conventional wisdom was that the lower bound of interest rates was zero, the so-called Zero Lower Bound (ZLB). However, as demonstrated in recent years, the ELB can be below zero, determined by the cost of holding cash instead of remunerated assets, including deposits.

Cash is convenient for transactions but pays no interest and is costly to store securely. It thus loses real value when prices rise. Conversely, bank deposits generally pay interest. Should bank deposits start being charged at negative interest rates depositors would have incentives to withdraw their money. As holding cash is not costless, people may tolerate slightly negative interest rates.

However, as rates become more negative, depositors would withdraw their money, depriving banks of deposits and causing financial instability and reducing banks' capacity to extend credit to the economy. It is therefore impossible for nominal interest rates to fall below this ELB, which is negative but dependent on the cost of storing and insuring cash [20] that nevertheless can be significant.

Kiley and Roberts (2017) investigate the question of the frequency and costs of hitting the ELB, using stochastic simulations with two models from the Federal Reserve Board (FRB): the FRB/US Model and a DSGE model. Using a simple Taylor Rule with a 2% objective for inflation[21] and an equilibrium real rate of 1%, they find that, for the FRB/US model, policy interest rates would be at the ELB 38% of the time with GDP 1.1 percentage points (p.p.) below potential and inflation at 1.2%, so quite a poor performance. The corresponding outcomes for the DSGE model were that policy rates would be 32.5 % of the time at the ELB, with output 2.3 p.p. below potential and inflation, barely above zero, at 0.1%.[22] This illustrates how low levels of inflation and equilibrium real rates can increase the frequency of reaching the ELB with visible deviations from the desirable policy targets.

Adjustments to the rule are then conceived to overcome this problem. Applying a risk adjustment factor to the interest rate[23] in the FRB/US model, the authors find that, with a 0.5 adjustment, and a real rate of 1%, an objective of 2% inflation could be attained with output closer to potential. The

[19] See Kiley and Roberts (2017); Reifschneider (2016)
[20] See Cecchetti & Schoenholtz (2016).
[21] They use $i(t) = r^* + 2 + 1.5(\pi^4(t) - 2) + y(t)$
[22] For an estimated rule for the period 1960-2007, equal to $i(t) = 0.9\, i(t-1) + 0.2\pi^4(t) + 0.15\, y(t) + 0.25\Delta y(t)$, the results for the FRB/US model 31.7%, 2 years, 1.3 p.p. below potential GDP and inflation at 1.2%
[23] $i(t) = r^* - risk\ adjustment + 2 + 1.5(\pi^4(t) - 2) + y(t)$

introduction of the risk adjustment creates, of course, the risk of inflation being above 2% during some protracted periods.

Another attempt is to use a Taylor Rule specified in terms of interest rate changes instead of levels[24], which improves the performance of both models. In the case of the FRB/US model, results are 29.7% of the time at the ELB, GDP 1.4 p.p. below potential and inflation at 1.5% and when the DSGE model is used 10.4% at the ELB, GDP 0.5 p.p. below potential and 1.6% inflation.

Introducing the commitment to keep the policy rate at the ELB until the targets for the output gap (zero) and for inflation (2%) are met, further improves the results: for the FRB/US model the outcomes for ELB, output gap and inflation are, 22%, 0.1 p.p., 2%, respectively; and 9.6%, 0 p.p., 2% for the DSGE model. These outcomes indicate that "Policymakers capable of committing to possibly very accommodative policies can essentially remove the pernicious effects of the ELB" [25]which is a comforting thought for the ECB.

A final possibility to avoid the dangers of falling into the ELB too often would be to increase the inflation target.

Raising the inflation target

Several experts have argued that while central banks may want to stick to the inflation targeting framework, this target should be raises.[26] Arguments for a higher inflation target are typically related to the ELB on nominal interest rates, which constrains interest rate policy. The first argument in favour of raising the inflation target states that the announcement of an increase in the inflation target raises private sector inflation expectations, which lowers real interest rates even if nominal rates are stuck near the lower bound. Lower real rates stimulate consumption and investment and help to raise inflation.

The second argument says that a higher inflation target increases the buffer against the ELB on nominal interest rates in the future. Remember that in the long run, an increase in the inflation target translates into an increase in nominal interest rates of the same size, providing central banks with more room to lower interest rates in response to contractionary disturbances.

The argument for raising the inflation target to create a buffer against occasional episodes of binding effective lower bound on the nominal interest rate is usually made in the context of *transitory* declines in the equilibrium real rate. A stronger version of this argument applies if faced with a situation in which the equilibrium real rate is *permanently* lower.[27] According to standard growth theory, the equilibrium real interest rate has some relation to long-run productivity growth. So this touches on the so-called "secular stagnation" hypothesis recently reinvigorated by Gordon, Krugman, Summers and others.[28] Indeed, there is evidence of declining productivity since the 70s. The issue is whether, and to what extent, the recent Great Recession and the resulting slow

[24] $\Delta i(t) = 0.125[(\pi^4(t) - 2) + y(t)]$ and $i^*(t) = i(t-1) + 0.125[(\pi^4(t) - 2) + y(t)]$ and commit to $i(t) = \max(i^*(t),\ i^{ELB})$

[25] Kiley and Roberts (2017).

[26] See, for instance, Blanchard, Dell'Ariccia and Mauro (2010), and Krugman (2014).

[27] Constâncio (2016).

[28] See Gordon (2016); Gordon (2012); Krugman (2013); Summers (2013); Summers (2016).

deleveraging process have exacerbated this trend, generating permanent costs from the crisis. This is a topic of heated debate at present, not only in the policy arena, but also in academic circles.[29]

All in all, these arguments have merits, particularly for central banks with a dual mandate that includes output stabilisation, but they are too narrowly focused on the benefits associated with staying away from the ELB. As going below the ELB is not possible, fighting recessions and the resulting high unemployment rate becomes more difficult. Increasing the inflation target real interest rates could then be effective to eliminate negative output and unemployment gaps. These benefits of a higher inflation target can be outweighed by the broader costs of higher inflation, depending on the chosen level. Historically, relatively higher inflation has usually been associated with more volatile inflation.[30] Moreover, the ECB and many other inflation-targeting central banks have shown that other monetary policy tools are available when interest rates cannot be lowered further. Against this background, the desirability of higher inflation targets becomes very controversial as economic theory could never specify with certainty the most desirable level within the range of low inflation values. Since the 90s most central banks defined 2% as the appropriate inflation objective, in some cases admitting temporary small deviations around that level. In the case of the ECB, the inflation objective is to maintain in the medium-term a level below, but close to 2%.

Should non-standard monetary policy tools become standard?

Let me now turn to the monetary policy toolkit to be employed in order to achieve central bank targets. More specifically, should the size and composition of the central bank balance-sheet be now thought as a *conventional* tool? Should the use of negative short-term interest rates be exploited more systematically, and possibly facilitated, in reaction to deep recessions? Should central banks exploit innovative transmission mechanisms, for example those suggesting that interest rates should be increased to jolt the economy away from an ultra-low inflation trap?

Size and composition of central bank balance sheets

Traditionally, central banks used only short-term interest rates to steer the economy. A simplified account of the transmission mechanism works as follows: changes in short-term rates are quickly transmitted to other financial market prices, including longer-term rates and lending rates; these changes translate into changes in real rates, because prices tend to remain sticky in the short-run; in turn, real rates affect aggregate and in turn inflation.

As central banks began in the 80s to abandon technical monetarism and adopt interest rates as the main policy instrument to influence economic and financial conditions, their monetary base has adjusted towards the level consistent with banks' demand for reserves, given the current short-term interest rate. The central bank balance sheet, which is to a large extent determined by bank reserves in the perspective of the traditional transmission channels, cannot therefore be used as a monetary policy instrument separate from the short-term interest rate.

[29] For example, Eggertsson and Mehrotra (2014), Caballero, Farhi and Gourinchas (2015) and Eggertsson, Mehrotra, Singh and Summers (2016).
[30] See, for instance, Golob (1994).

This traditional understanding changed dramatically with the outbreak of the global financial crisis in 2008. Since then, the ECB, like many other central banks, has started using its balance sheet as an additional monetary policy instrument while considering other transmission channels to the economy beyond technical monetarism or interest rate effects.
In the first phase of the crisis, marked by the collapse of Lehman Brothers, the balance sheet was used together with the short-term interest rate as a way to offset impairments in the monetary policy transmission mechanism. For example, lending rates in some countries did not respond to cuts in short-term rates, as interbank markets dried up and became segregated along national lines. The ECB responded to the emerging liquidity shortage by providing ample liquidity, at increasingly long durations and against a wider range of collateral.

As of 2014, the nature of balance sheet policies changed. The euro area had entered a prolonged downturn as banks in large parts of the euro area further reduced lending. The sharp fall in oil prices that began in late summer added further disinflationary pressures. In this environment of persistently low inflation rates, the risk of a de-anchoring of private sector inflation expectations was encountered, potentially giving rise to self-reinforcing second-round effects and deflation. Yet with interest rates already close to zero, our ability to use conventional monetary policy to provide additional accommodation was constrained, and we turned to the balance sheet as an unconventional tool.[31] In the second half of 2014, the ECB started to buy asset-backed securities (ABS) under the ABS purchase programme (ABSPP) as well as covered bonds under a third covered bond purchase programme (CBPP3).

In January 2015, the ECB announced its expanded asset purchase programme (APP), including government bonds, to fight the risk of the period of low inflation becoming too prolonged, thereby significantly expanding the monetary base. A broader range, beyond traditional transmission channels, was considered, comprising: the direct effect on securities prices purchased and respective lowering of medium-term rates; the portfolio rebalancing by banks and non-bank investor that get liquidity and will buy other assets spreading these effects to other asset classes; finally, the signalling effect influencing expectations of future inflation and the likely path of the key policy rates. [32] The APP allowed us to further apply downward pressure on the term structure of interest rates by compressing risk premia out along the yield curve and improving private sector financing conditions.

Quantitative Easing (QE) has been effective both in the U.S. and in the euro area. The concept of a "shadow interest rate"[33] has been used to calculate the effect of unconventional measures (QE, forward guidance, negative rates, etc) in a comparable way with policy interest rates when these are constrained by the ELB. The term structure of interest rates is used to find "What policy rate would generate the observed yield curve if the policy rate could be taken negative?" (Krippner 2012, p. 2). As we have seen, holding cash provides protection against negative interest rates that could attain significant values in the absence of cash as an alternative. A shadow curve is obtained from calculating the value of a call option to hold cash at the ZLB and subtracting it from the actual yield

[31] See Constâncio (2014).
[32] For the role of these channels in the euro area, see Andrade, Breckenfelder, De Fiore, Karadi and Tristani (2016).
[33] Due to Black (1995); Krippner (2012; Krippner (2014); Wu and Xia (2016); for updated values calculated by Wu and Xia see *http://www.frbatlanta.org/cqer/researchcq/shadow_rate.cfm* ; Wu and Xia (2017)

curve. Several methods to calculate the shadow rates based on different models of the yield curve produce different outcomes, which somewhat diminishes the practical usefulness of the concept.

Balance sheet measures have contributed to a major easing of euro area financing conditions and, through this channel, a more robust and sustained economic recovery.[34] Given their effectiveness, what role should central banks' balance sheets play in the future?

An important question is to investigate, in the case of a continued low inflation regime with low interest rates, whether a conventional monetary policy of using interest rates would be sufficient to address the next recessionary episode. Using the FRB/US model, Reifschneider (2016)[35] analyses several scenarios and concludes that both forward-guidance and QE would be necessary.

Beyond this justification, there are good arguments to preserve the instrument in the policy toolkit. They stem from structural changes that have occurred in financial markets. In particular the increased role of secured money market transactions; the importance of a broad set of market rates beyond the overnight rate; the growing relevance of non-bank institutions in market-based finance; and finally, the scarcity of safe assets that affects the functioning of markets and the management of collateral.

These arguments are behind proposals recently presented in Jackson Hole by Duffie and Krishnamurthy, and by Greenwood, Hanson and Stein.[36] They stress the importance of the Fed's reverse repurchase agreement (repo) programme (RRP) through which it repos against cash securities it has in its balance sheet. The first group of authors advocate using the programme to involve more counterparties and to affect several interest rates, thereby contributing to a better transmission of monetary policy. Recent internal work at the ECB also detects similar pass-through imperfections in European markets.

The second set of authors consider the necessity of central banks keeping a big balance sheet as a way to steer the supply of safe assets, particularly through RRP, to create very short-term safe assets, fostering greater financial stability by avoiding the unsuccessful attempts by the private sector to fulfil that role, as seen before the crisis. This is an important issue as the attempt to create private safer assets was behind the expansion of a shadow banking sector that played a significant role in the crisis. An appropriate concept of shadow banking conflates entities and activities involved in a vast array of services related to securitisation, repos and securities financing transactions (SFTs), as well as OTC derivatives. The latter allow for risk transformation and exchange via swaps, comprising credit default swaps, interest rate or forex swaps. Several of these activities can be conducted either by regulated banks or by non- regulated institutions. Two aspects make these activities relevant: first, they contribute to the creation of a credit system based on secured short-term market funding; second, these new liquidity instruments are akin to money but are not counted in the usual monetary aggregates.[37]

[34] For a broad overview of the impact of the APP, see Andrade et al. (2016).
[35] See Reifschneider (2016).
[36] See Duffie and Krishnamurthy (2016) and Greenwood, Hanson and Stein (2016).
[37] See Greenwood, Hanson and Stein (2015).

These two features – the emergence of a new market credit system and the significance of new forms of money– is what justifies the "shadow banking" designation.[38]

The origins of this new credit system relate to the emergence of very sizeable cash pools that could not find safety in banks' insured deposits and were in search of safer forms of placing that cash in the short-term.[39] Securitisation, with tranches and enhanced ratings, repos creating inside liquidity as well as risk transformation and exchange via OTC derivatives were the three main instruments created to place these "safer" private short-term assets.

The crisis came when crashing housing prices raised doubts about securitisations and when chains of inside liquidity created by repos with re-hypothecation and re-use of the same securities[40] collapsed with rising haircuts and resulting illiquid markets. That is why Gary Gorton characterises the 2007/2008 financial crisis as a "run on repo".

We live now in a collaterised financial system where unsecured interbank transactions have been continuously declining.[41]The increased demand for safe assets and the relative shortage of official sector safe assets were responsible for the attempt to create private "safer" assets whose value proved to be illusory at the first stressful situation. This shortage of safe assets facing a huge demand is one of the important causes behind the very low levels of government bonds yields. As Caballero and Farhi (2017) stated "Short-term rates feature a widely noted downward secular trend and a sharp drop during the Great Recession. The evolution of the expected return on equity is markedly different: It features the same downward trend as the short-term interest rate until the early 2000s but then remains more or less stable. The disconnect between a stable expected return on equity and a declining short-term interest rate is particularly salient after 2002, and even more so since the beginning of the Great Recession. …The stark divergence between safe and risky expected rates of return is suggestive of an increased shortage of safe assets".[42]

The disconnect between low rates of government bonds and the real rates of return of capital invested by non-financial firms, indicates that any concept of natural rate of interest cannot simply be a result of the marginal productivity of real capital as Wicksell and other neo-classical economists believed. On the other hand, the excess of demand for official safe assets pushed up their prices i.e. lowered their yields until they reached levels near the ZLB. When interest rates could no longer adjust down to establish market equilibrium, the adjustment variable became the output moving into a recession. At the international level, the loss of interest rates as an equilibrium variable made rendered the exchange rate the variable of interest which provoked a type of "currency wars".[43]

These explanations back the calls by Krishnamurthy et al (2016) and Greenwood et al (2016) for sizeable central bank balance sheets. Unlike in the U.S. where the share of deposits in total bank funding has gradually declined, deposits and corporate bonds still account for the bulk of financing in Europe, with ABS and money-like debt playing only a marginal role. In fact, the predominantly bank-

[38] See Constâncio (2014).
[39] See Pozsar (2011); Claessens and Ratnovski (2014); Singh (2012) "; Perotti (2013); Pozsar (2014).
[40] See Singh and Stella (2012).
[41] See Gorton and He (2016).
[42] Caballero and Farhi (2017).
[43] Caballero, Farhi and Gourinchas (2015).

based nature of the European financial system allows us to consider the possibility of going back to a "leaner" balance sheet, once the situation is normalised, with lending to banks remaining the main channel for managing liquidity and steering short-term interest rates.[44]

The rationale behind the "lean" balance sheet is to minimise the intermediation role of the central bank and related potential market distortions. Nevertheless, the structural changes that I just mentioned may also start taking place in Europe eventually and we have to reflect on the possible limitations of monetary policy transmission by only influencing the very short end of money-market rates.

The discussion of which interest rates to focus on is closely intertwined with the issue of central bank counterparties. The ECB has traditionally granted access to monetary policy operations to a broad range of financially sound credit institutions. That approach enabled us to swiftly provide liquidity to various financial market segments during the crisis, when more active central bank intermediation was warranted. Nevertheless, non-banks are beginning to play a greater role in the European financial landscape, and are likely to take an even greater role as the capital markets union deepens and broadens financial markets in Europe.

This development is not neutral for market rates in the euro area. Secured money market rates, backed by high quality collateral, have for a while been trading well below the ECB deposit facility rate, which normally sets a floor for short-term money market rates. In part, this discount is explained by the activity of non-banks who do not have access to central bank facilities and are accepting interest rates below the deposit facility rate. The discount is, of course, also attributed to the APP which has reduced the availability of high quality collateral at the same time as market demand for that collateral has increased. Understanding the root causes of these observed outcomes better is crucial for the central bank when making decisions about future counterparty eligibility and the choice of money market rates used to assess monetary policy transmission.

Negative interest rates

A notable addition to the ECB's set of non-conventional tools has been negative nominal interest rates. The ECB first introduced a negative interest rate on its deposit facility in June 2014, setting it initially to -0.10%. Later, the ECB lowered the deposit facility rate further in three steps to -0.40% by March 2016 and has kept it at that level ever since. Other central banks, including those of Denmark, Switzerland, Sweden and Japan, have also experimented with negative policy rates in recent years.

A negative nominal interest rate on the deposit facility means that commercial banks must pay for parking their deposits with the ECB. It incentivises credit creation and a greater velocity of circulation of excess reserves held at the central bank. Negative rates stimulate the economy via the usual channels: lowering *real* yields and bank lending rates at various maturities, encouraging borrowing and real activity. In this context, negative policy rates have been an effective tool in the euro area, lowering not only short-term rates but also rates at longer maturities via expectations.

The successful use of negative policy rates in the euro area and in other countries suggests that this instrument may become part of the conventional toolkit of central banks for fighting recessions. However, one needs to take into account that there is still an effective lower bound on nominal

[44] See Bindseil (2014) for a short discussion of the concept.

interest rates as discussed earlier: the presence of non-trivial costs of storing and handling currency means that the effective lower bound is somewhere below zero.

From an economic perspective, what may be even more important is the possibility that below a certain threshold, called by some economists the "reversal rate", policy rates going further into negative territory may become counterproductive. This would happen because of the detrimental effect of negative interest rates on bank profitability and lending, especially in an environment in which banks are largely financed with retail deposits at non-negative nominal interest rates.[45]

All in all, under current monetary arrangements, negative rates can only be seen as a special tool with limited room for manoeuvre, to be used only in extreme circumstances. This has always been the actual intention underlying the ECB negative rate policy – to boost aggregate demand, closing the output gap more quickly, helping to normalise inflation and subsequently interest rates in the wake of a particularly severe recession.

Abolishing cash altogether

Given that the limitations in the use of negative rates as a monetary policy tool ultimately stem from the ELB, some economists have entertained even more radical proposals such as: to tax cash to lower the ELB or to eliminate the ELB by abolishing currency altogether.[46] These would reduce or remove the arbitrage opportunity to escape negative rates by substituting deposits for cash.

By removing the lower bound, abolishing cash would provide monetary policy with ample room for manoeuvre in the case of severe cyclical downturns. Abolishing cash would also hamper some illegal activities and promote transparency. Last but not least, society would benefit from economising on the costs of storage and use of currency, which are non-trivial.

There are in my view however, substantial drawbacks to consider, and reasons why many policymakers are reluctant to seriously consider this proposal. Cash has survived throughout the centuries as a reliable transaction technology and as a store of value. Its elimination would be a major break with a long-standing social convention. It remains popular: a recent survey carried out for the ECB found that 80% of transactions in the euro area at the point of sale are in cash. People who prefer to hold currency may perceive its abolition as an assault on their freedom and in particular, on their right of anonymity. And savers may think the abolition of cash, coupled with a negative nominal interest rate on deposits, as an unfair wealth tax.

There could also be broader macroeconomic instabilities triggered by the abolition of currency. The arguments about the risks of persistently low interest rates for financial stability are clear. If the lower bound was removed, these risks would presumably increase, especially in the form of asset price bubbles and excessive leverage.

To sum up, while abolishing cash may allow monetary policy to cut interest rates deeper into negative territory in extreme situations, this would come with significant costs of its own. In light of all these uncertainties, a prudent policymaker should be very cautious before proceeding with these

[45] The precise level of the reversal rate depends on macro-prudential policy and financial regulation, as well as other parameters of the economic environment (see Brunnermeier and Koby, 2016).

[46] Goodfriend (2016); Agarwal and Kimball (2015); Buiter (2009); Rogoff (2014).

radical proposals, even if digitalisation may gain ground and eventually prevail – as we start to observe in some countries.

Helicopter money

Another old idea which has received renewed attention recently is Friedman's proposal of using "helicopter money". Friedman's helicopter money drop is supposed to exert upward pressure on real activity and inflation because of a wealth effect: real money holdings of private agents rise at a given price level, making private agents wealthier and inducing them to spend. In a more modern context, one would need to increase private agents' claims on the public sector, relative to private agents' liabilities to the public sector.

The "helicopter money" policy recently proposed however, operates through different channels than those in Friedman's original thinking: it is expansionary fiscal policy financed by the central bank. There are, however, two types of helicopter money policy. The first one is combined with fiscal policy, having the central bank temporarily financing an increase in public expenditure thus avoiding additional public debt issuance and its potential Ricardian effects when debt is very high. The second one is by directly distributing money to consumers by means of crediting their deposit accounts. This could be done by the Treasury as a form of expenditure or by the central bank itself. Both cases can therefore be seen as examples of fiscal policy with monetary financing.[47]

The Treasury would increase expenditure (or cut taxes) and the central bank would credit the Treasury account against a perpetual bond (a *consol*) with a zero coupon. A debate ensued about whether this would be cheaper than normal bond financing when the central bank is doing QE and paying interest on the bank reserves. When consolidating the central bank account in the public sector, the maturity of public debt is changed from the perpetual bond into short term liabilities (reserves) the central bank has towards the banks. If bank reserves are remunerated and all rates near zero, then monetary financing would not be much cheaper. On the other hand, if bank reserves are not remunerated, this would be a hidden tax on banks as a real cost of monetary financing. Notwithstanding the costs of the two ways of financing the accrued deficit (yields of bonds and remuneration of reserves), some conclude that the use of helicopter money would have practically the same effect as increasing the budget deficit by issuing a bond and implementing QE. QE would purchase and replace the issued bond (public debt) by another public sector debt (bank reserves in the central bank). This reasoning assumes that either form of financing would have the same impact on private expenditure which would only be true if all economic agents with Ricardian behaviour, in forming their expectations, would consolidate the central bank and the Treasury balance sheets. This is however not likely.

Monetary financing can therefore be more effective as it disguises the fact that there is an increase in government debt. This is reinforced by the fact that the majority of consumers does not see very long-run budget constraints and does not decide on the basis of "permanent income". As Muellbauer (2016)[48] states: "The research of Deaton (1981), Carroll (1992, 1997, 2001) and Kaplan et al. (2016) suggests that, faced with liquidity constraints and individual uninsurable income risk, most

[47] See Bernanke (2000); Bernanke (2003); Buiter (2014); Turner (2013); Cecchetti and Schoenholtz (2016); Muellbauer (2016).
[48] Muellbauer (2016).

households have a much more short-term outlook on the future. Overt monetary finance or cash distributions to households are therefore likely to have a demand-stimulating effect just when it is needed.[49]

However, "helicopter money" type of policy is forbidden by the Treaty on the Functioning of the European Union which clearly prohibits direct financing of fiscal policy that is a competence of governments in the euro area.

The Neo-Fisherian view

The experience of Japan in the last two decades has motivated a more radical theoretical idea. Persistent ultra-low policy interest rates may not be the right medicine for lifting inflation close to the target. While this idea may be of limited practical relevance, it is important to understand its logic.

The view maintained by a small but influential group of economists is that low interest rate policies are in fact just validating beliefs that deflation in the current circumstances is inevitable.[50] These economists argue that central banks should instead adopt an entirely different framework, known as Neo-Fisherianism, in order to lift inflation from its undesirably low rate.

Their analysis starts with the so-called Fisher equation, which is present in modern macroeconomic models with Euler equations. The Fisher equation postulates that the current *real* interest rate equals the difference between the current *nominal* interest rate and inflation expected in the following period.

The Fisher equation: $i = r^* + \pi^e$

In its simplest form, Neo-Fisherianism argues that the real interest rate (r^*) is determined by real factors independent of monetary policy in the long-run, and hence a permanent *rise* in the nominal interest rate must be followed by a corresponding *increase* in inflation in the long-run,. It is a long-term view that inverts the original equation. The proponents accept that in the short-run, an increase in the interest rate would lower expenditure and GDP, consequently lowering inflation.

The main challenge for this view has been to spell out the *market forces* that would push inflation up in the wake of a nominal rate hike. Inflation expectations here are assumed to automatically adjust upwards to the new higher nominal interest rate. It is as if firms look at high nominal interest rates, associate them with high inflation and simply raise their prices accordingly.

A slightly more elaborate version of the argument is based on a modern specification of the demand for change in output in a DSGE model stemming from an Euler equation. Writing a simple model with an output gap and inflation, we have[51]:

1) $y_t = E_t\, y_{t+1} - \sigma^{-1}(i - E_t\, \pi_{t+1} - r^*)$

2) $\pi_t = \kappa y_t + \beta\, E_t\, \pi_{t+1}$

[49] Deaton (1991); Carroll (1992); Carroll (1997); Carroll (2001); Kaplan, Moll and Violante (2016).
[50] See Bullard, (2010), Schmitt-Grohé and Uribe (2014) and (2017), and Cochrane (2016).
[51] See Woodford (2003) pages 245-246.

The model could be closed by treating the rate of interest *i* as exogenous or adding a Taylor-type interest rate rule. Ignoring for simplicity, the second term in the right hand side of 2) and substituting equation 2) in equation 1) we have a deterministic (perfect foresight) equilibrium as a solution to

3) $\pi_t = \pi_{t+1} - \kappa\sigma^{-1}(i - \pi_{t+1} - r^*)$

In the long-run steady state when π is constant, the expression in parenthesis has to equal zero, which implies the verification of the Fisher equation $i = r^* + \pi^*$ or $\pi^* = i - r^*$ where π^* is the long-run equilibrium inflation rate dependent on *i* which is fixed by the monetary authorities.

A more advanced way of presenting the neo-fisherian view is reflected on a series of papers by Schmitt-Grohé and Uribe[52] (2001 with Benhabib), 2014 and 2017). The authors show that in simple DSGE models with a ZLB and Taylor Rule type of equation, obeying the Taylor principle of an inflation coefficient higher than one, there are two or more equilibria and there is a path from the good equilibrium with positive inflation to a bad equilibrium of very low or negative inflation. In a liquidity trap, the Taylor rule does not work and the Fisher equation takes charge, leading to a steady-state equilibrium of low inflation. The only way to steer the economy to the good equilibrium is to increase the interest rate and wait for agents with rational expectations to lead the economy for the good long-run level.

Several economists reacted against such a pure theoretical conjecture as it does not explain how the economy would go from the bad equilibrium to the good one when other equilibria may also exist in these models, implying trajectories with very protracted recessions. Woodford and García-Schmidt (2015)[53] show why it is not correct to just assume that "that the outcome associated with a given policy commitment should be a perfect foresight equilibrium, even when the commitment is fully credible […].We argue that predicting what should happen as a result of a particular policy commitment requires that one models the cognitive process by which one imagines people to arrive at particular expectations taking that information into account. […]Rather, we deny the practical relevance of the perfect foresight solutions (or more generally, rational-expectations solutions) of the model under the thought experiment of a permanent interest-rate peg".

In reality, other outcomes of the policy experiment are possible. There are many trajectories that output and inflation may follow before reaching their higher long-run level and some trajectories may imply very protracted recessions. There is no reason to discard the practical relevance of these alternative outcomes. Neo-Fisherianism will remain a theoretical academic curiosity that will not be a part of future monetary frameworks.

Recent developments in the euro area support this belief. Rather than increasing its key interest rates, the ECB has kept them at near-zero level for a very long period. This policy is working and euro area inflation is starting to adjust towards levels consistent with the ECB price stability objective. A sustainable adjustment has not yet occurred, but it comforts our belief that we have moved our interest rate tool in the right direction.

[52] Benhabib, Schmitt-Grohé and Uribe (2001), Schmitt-Grohé and Uribe (2014) and (2017).
[53] García-Schmidt and Woodford (2015).

Concluding remarks

The extraordinary events of the past decade have encouraged a vigorous debate on the optimal strategy and conduct of monetary policy. Such debate is always welcome and it is important for central banks to reassure themselves, as well as the public, that they are carrying out their mandates in the best possible way.

Judging by the opinion of a majority of central bank governors and academics,[54] the prediction is that monetary policy will try to keep the flexible inflation targeting regime, coupled hopefully with some form of macroprudential policy. This would imply a return to leaner balance sheets and interest rates as main policy instruments, keeping nevertheless other tools available for less regular situations.

I believe that this strategy of flexible inflation target also works for the euro area and can remain central to any future monetary policy framework. However, one of the lessons from the crisis is the need for better mechanisms to mitigate financial stability risks with central banks being given more macroprudential tools to complement their policy toolkit. In part, the ECB's new competences for macroprudential policy, albeit incipient, will certainly help in that direction.

In the future, once sustainable convergence to our inflation objective has been achieved, the management of short-term interest rates should again become the main monetary policy tool. However, we should not try to predict what the more distant future may bring. For instance, it is not certain that the Eurosystem's balance sheet will go all the way back to the pre-crisis levels as the future normal. This may not be the case, especially if the unsecured interbank market continues to shrink thus requiring the Eurosystem to aim at a broader spectrum of interest rates as well as to focus on other types of transmission channels or even other counterparties.

In fact, central banks should remain open to ways of addressing future challenges as the financial system architecture evolves. The cautionary tale implied by the crisis is that central banks should keep in their toolkit many instruments that may be necessary in stressful situations. Let us not assume that crises will not happen again. As Voltaire said "We should not insult the future by trying to foresee it".

[54] See Blinder, Ehrmann, de Haan and Jansen (2016).

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