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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Abstract

This paper evaluates the changes in monetary policy frameworks made by 14 central banks in advanced economies over the period 2007-2018. We draw several conclusions about the evolution of their monetary policy strategies. There has been a tendency among central banks to move towards more narrowly defined inflation targets and to lower the (mid)point of the target. Additionally, transparency and commitment of central banks have been enhanced, and monetary policy toolkit has been expanded.

Keywords: advanced economies; monetary policy framework

JEL codes: E52, E58

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1. Introduction

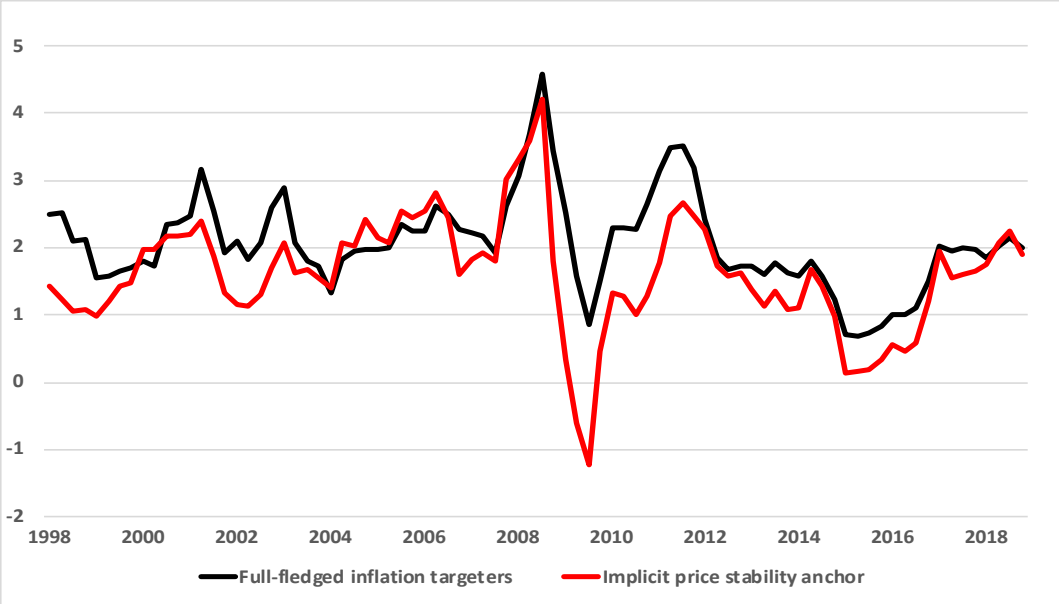
In the aftermath of the global financial crisis, central banks in advanced economies faced a number of challenges in designing monetary policy frameworks suitable for the post-crisis environment. First, inflation has remained persistently low and continues trending downwards in many economies, including the euro area. Second, the crisis urged central banks to pay more attention to financial stability concerns. Third, with nominal interest rates at the effective lower bound (ELB), central banks ran out of conventional monetary policy ammunition to stimulate the economy. Against this background, it was argued that monetary policy strategies used by central banks so far, in particular the strategy of inflation targeting, were too constrained to fight deep recessions and paid too little attention to financial conditions (Constâncio, 2017; Hartmann and Smets, 2018).

In view of the above, there is an ongoing debate about the appropriate monetary policy framework in the post-crisis environment. We contribute to this debate by surveying the international experience of central banks over the last 12 years and evaluating how they adapted their monetary policy frameworks to address the challenges mentioned above.

We examine 14 central banks in advanced economies. Based on central banks' own characterization of their monetary policy frameworks as well as on the taxonomies used in previous literature (see e.g., Stone and Bhundia, 2004; Hammond, 2012; Samarina and de Haan, 2014), we identify 10 central banks that implement a strategy of *full-fledged inflation targeting* (in Australia, Canada, Czech Republic, Iceland, Israel, South Korea, New Zealand, Norway, Sweden, and the U.K.), and 4 central banks that use *an implicit price stability anchor* (in the euro area, Japan, Switzerland, and the U.S.). Although the latter 4 central banks do not recognize themselves as inflation targeters, they formulate their price stability objective in terms of a clearly defined numerical target for inflation. In this sense, they can be considered as having a monetary policy strategy with an *implicit* but not an explicit nominal anchor (Mishkin, 1999).

Figure 1 shows weighted-average CPI inflation in the two country groups over the period 1998-2018. Headline inflation has recovered somewhat in recent years but remains lower in both groups in the post-crisis period compared to its pre-crisis level. While in economies whose central banks implement full-fledged inflation targeting CPI inflation was about 2% on average during 2008-2018, in economies with a central bank's strategy of an implicit price stability anchor CPI inflation was only 1.4% on average over the same period.

Figure 1. CPI inflation in advanced economies during 1998-2018



Note: the graph displays GDP-weighted year-on-year quarterly headline CPI inflation for two groups of advanced economies: 10 implement full-fledged inflation targeting (Australia, Canada, Czech Republic, Iceland, Israel, South Korea, New Zealand, Norway, Sweden, and the U.K.) and 4 use a framework of an implicit price stability anchor (the euro area, Japan, Switzerland, and the U.S.).
Data Source: International Financial Statistics IMF.

Based on the publicly available information from various central bank documents, monetary policy reports, official statements, press releases, and legal acts, we identify explicit changes in their frameworks during the period 2007-2018. Some of these changes can be characterized as substantial formal adjustments made by central banks, while other changes can be considered as only minor modifications, clarifications or extensions of the existing frameworks.[2] Table 1A in the Appendix provides a detailed

[2] Note that we focus exclusively on the explicit changes in monetary policy frameworks of the analyzed

overview of all analyzed central banks and changes that we identify in their monetary policy frameworks.

The rest of the paper is structured as follows. In the subsequent sections we examine several aspects of monetary policy frameworks that are of high relevance for monetary policy conduct of a central bank, namely: the formulation of the inflation target, monetary policy mandate, central bank communication, and monetary policy toolkit. Using a textual analysis, we identify if and how each of these aspects has been modified during the analyzed time period. The last section of the paper concludes with a summary and policy implications.

2. Formulation of the inflation target

In this section we examine changes in monetary policy frameworks in terms of the definition, level, symmetry, targeted measure and the horizon of the inflation target.

The definition of the inflation target has not become broader. In fact, while most central banks did not modify the level of the target, some switched to narrower inflation targets. This includes cases when central banks adopted a strict point target (the U.S., Japan), removed a tolerance band around a point target (Sweden)[3], and shifted from a target range to a point target with (New Zealand) or without (South Korea) a tolerance band. The purpose of these adjustments included, among others: i) better anchoring inflation expectations around a (mid)point of the target; ii) reducing inflation uncertainty and inflation deviations from the target; iii) strengthening commitment of the central bank to a price stability objective; and iv) enhancing transparency and predictability of monetary policy.

Next, three central banks lowered a (mid)point of the inflation target - from 3% to 2% (Czech Republic, South Korea) or from 2.5% to 2% (Norway) - as they expected

central banks. That is, we do not account for changes that are merely discussed or hinted informally but has not been officially announced or implemented.

[3] In September 2017, the Sveriges Riksbank returned to a variation band of 1-3 percentage points around a 2 percent inflation target explaining that inflation may vary around the target in the short run which does not mean that monetary policy needs to react to these variations.

lower future inflation due to i.a., domestic structural factors, a downward trend in prices of tradable commodities, and an appreciation of domestic currencies. In contrast, the Bank of Japan increased its price stability target in 2013 from 1% to 2% with an intention to raise long-term inflation expectations towards 2%.

Most central banks continue formulating their inflation targets symmetrically. That is, they are equally concerned if inflation is persistently below or above the target and treat inflation-undershooting and overshooting in the same way. Two central banks with asymmetric targets include the Bank of Japan and the European Central Bank (ECB). Since September 2016 the Bank of Japan implements a framework of Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control, which involves an 'inflation-overshooting commitment' in the context of low realized inflation. This means that the Bank of Japan will expand the monetary base until inflation exceeds the 2% target and stays above it in a stable manner. As for the ECB, according to its formulation of the price stability objective, the Governing Council aims to keep inflation 'below, but close to, 2%' and is committed to avoid both inflation that is persistently too high or too low. However, the ECB's reaction to inflationary and disinflationary shocks may be perceived asymmetrically. The 'close to 2%' goal may be treated as a hard ceiling, implying that inflation-overshooting is considered less desirable than undershooting, as it violates the price stability objective (Rostagno et al., 2019).[4]

Fourth, the targeted inflation measure has not changed in the post-crisis period and is commonly specified in terms of headline CPI (PCE price index in case of the U.S.). Only the Sveriges Riksbank has changed the target variable in 2017 from CPI to CPIF (CPI with fixed interest rate). As the Riksbank explained, the CPIF excludes the effect

[4] Mario Draghi attempted to dissuade this perceived asymmetry by emphasizing that the ECB remains "fully committed to return inflation to 2% without undue delay" and that "our inflation aim doesn't imply a ceiling at 2%" (ECB Press Conference, Introductory Statement, 10 April 2019). In monetary policy decisions in July 2019 it was also stated that "Governing Council is determined to act, in line with its commitment to symmetry in the inflation aim" (ECB Press Conference, Introductory Statement, 25 July 2019).

of changes in mortgage interest rates, making it more suitable as a guidance for monetary policy than the CPI.

Finally, the horizon of the inflation target remains commonly defined in the medium term without a specific length. The medium-term horizon gives monetary policy flexibility to react to economic shocks that do not play out in the very short run. The exception is the Bank of Japan – it used to formulate the price stability objective in terms of reaching an inflation target in the medium to long term, but since July 2018 the horizon has been somewhat modified by aiming to achieve a price stability target "at the earliest possible time".[5]

3. Monetary policy mandate

We evaluate changes in monetary policy frameworks also in terms of monetary policy mandate. All analyzed central banks operate a flexible regime that puts some weight on output stabilization; this aspect has not changed in recent years. Monetary policy regimes have not become more flexible after the crisis. Most analyzed central banks have not adapted their frameworks to include an additional goal of monetary policy. The exception is the dual mandate in New Zealand where since April 2019 monetary policy objectives include price stability and full (maximum sustainable) employment, similarly as is the case in the U.S. While financial conditions are to some extend taken into account in monetary policy decision-making[6], financial stability has not become a formal objective of monetary policy, although this proposal has been frequently discussed by central banks and academics (Blinder et al. 2017). However,

[5] Bank of Japan, Strengthening the Framework for Continuous Powerful Monetary Easing, 31 July 2018 (available at: https://www.boj.or.jp/en/announcements/release_2018/k180731a.pdf).

[6] For instance, in 2018 the Norges Bank have modified its monetary policy mandate to incorporate financial conditions. Based on the new regulation on monetary policy, "inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment, and to counteracting financial imbalances" (available at: https://www.regjeringen.no/en/aktuelt/new-regulation-on-monetary-policy/id2592551/).

financial stability has been included as a separate mandate of national central banks that lies outside of the monetary policy scope.[7]

4. Central bank communication

Two communication tools that have been actively used by the analyzed central banks in the post-crisis years include economic projections and Forward Guidance.

Publishing inflation projections has been normal among central banks even before the crisis. In the post-crisis years all the analyzed central banks started also publishing staff's projections of economic indicators, such as output, output gap, and (un)employment. Two central banks also publish policy makers' projections. In particular, since 2007 the Fed publishes a Summary of Economic Projections as a supplement to the minutes of FOMC meetings. It includes FOMC participants' projections for real GDP growth, unemployment rate, inflation, and the appropriate level of the federal funds rate, accompanied by the 'dot plot'. The Bank of England includes MPC's projections - MPC's best collective judgment about the most probable paths for inflation and output – in its Inflation Reports since the late 1990s.

Forward Guidance has been used as an unconventional communication tool under conditions of the ELB on policy rates and low inflation and was aimed at increasing effectiveness of monetary policy by clearly stating future policy intentions. This is known as 'Odyssean' Forward Guidance which implies a central bank's commitment to future monetary policy actions.[8] Forward Guidance can be classified as open-ended, time-contingent, or state-contingent. Open-ended Forward Guidance gives no precise indication of timing or conditions under which monetary policy may be tightened in the future. Time-contingent Forward Guidance provides an explicit conditional

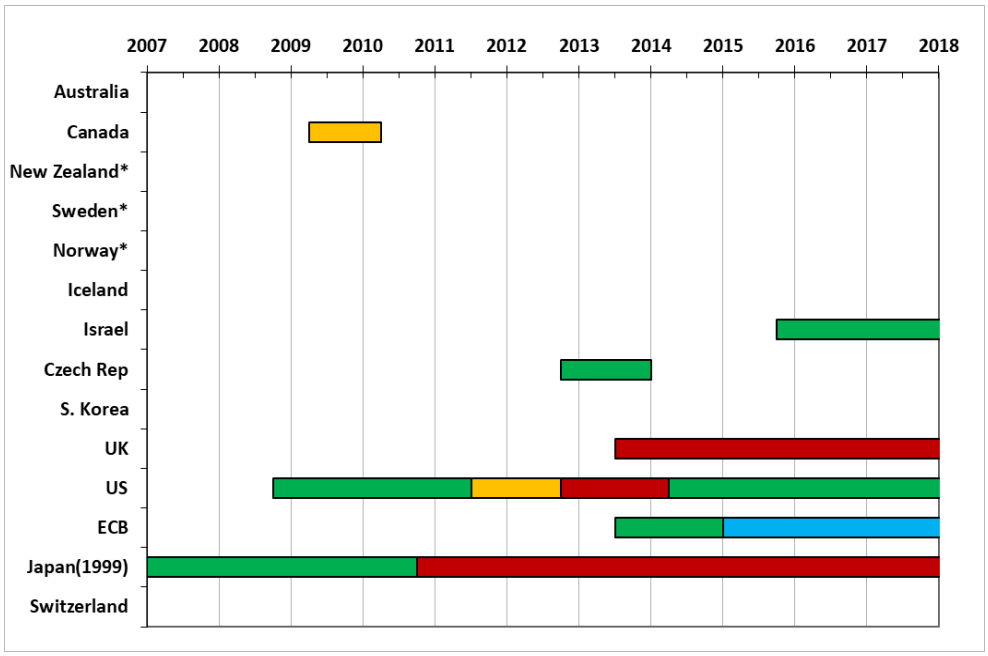
[7] The exception is the ECB which does not have a financial stability mandate but contributes to the efforts of responsible national authorities.

[8] Three central banks (in New Zealand, Norway, and Sweden) have been using Delphic Forward Guidance since 1997, 2005, and 2007, respectively, by publishing projections of policy rates. Unlike Odyssean, Delphic Forward Guidance excludes a commitment – that is, forecasts of interest rates are not treated as promises (Moessner et al., 2017).

commitment about the exact date when the monetary policy stance would be likely to change. State-contingent Forward Guidance formulates a threshold for certain economic indicators that should be met before policy rates may be changed.

During 2007-2018, 7 out of 14 analyzed central banks have implemented Forward Guidance of some kind, most frequently as open-ended (see Figure 2). All of them have included a price stability (inflation) objective in their formulation of Forward Guidance.[9] Only the Fed bases Forward Guidance on the dual mandate of full employment and an inflation target. In this sense, Forward Guidance has solidified a central bank's commitment to a price stability objective, although the scale of the commitment varies across central banks. Currently, four central banks still use Forward Guidance, suggesting that this communication tool may become a permanent element of their monetary policy frameworks.

Figure 2. Forward Guidance in 14 central banks during 2007-2018



Note: the graph displays the use of Forward Guidance by 14 central banks during 2007-2018, distinguished as open-ended (green), time-contingent (yellow), and state-contingent Forward Guidance. The blue bar denotes a combination of time- and state-contingent Forward Guidance. * New Zealand, Norway, and Sweden use Delphic Forward Guidance by publishing projections of policy rates.

Sources: central banks' publications.

[9] The Bank of England initially used unemployment in its Forward Guidance; from 2017 it formulates Forward Guidance in terms of inflation.

5. Monetary policy toolkit

To stimulate economic recovery and restore the functioning of financial intermediation after the crisis, central banks extensively used accommodative monetary policy measures (see e.g., CGFS, 2019). As a result, the monetary policy toolkit has been expanded.

The expansion of instrumental toolkit involved firstly a broader use of refinancing operations at longer horizons, on a larger scale and higher frequency, with an expanded set of counterparties and eligible collateral. The goal of refinancing operations has changed too. While in the past they were used primarily to 'fill the asset side of the balance sheet' and to signal the policy stance, since the crisis the objective has shifted toward supporting sufficient bank funding conditions.

Ten central banks in our sample also used dollar-liquidity swap lines with the Fed. In addition, eight central banks in small open economies conducted foreign exchange interventions to ease foreign currency liquidity tensions and weaken their domestic currencies.

Under the ELB on policy rates, seven central banks in the analyzed sample experimented with balance sheet policies to provide further monetary policy accommodation. These tools included targeted liquidity provisions, negative deposit facility rates, asset purchase programs (for private and public securities), and QQE with yield targeting (Bank of Japan).

The extensive use of monetary policy instruments resulted in a substantial increase in the size of central bank balance sheets, from 16.3% of GDP in 2007 to 38.4% of GDP in 2018 on average for 14 analyzed central banks. For 5 central banks that carried out Quantitative Easing the average size of balance sheets increased even more, from 11.8% of GDP in 2007 to 43.6% of GDP in 2018.

Most of these extraordinary measures were considered as temporary solutions under extreme circumstances. It remains to be seen whether and to what extent they will be permanently incorporated into the monetary policy toolkit.

6. Conclusions

Based on the evaluation of 14 central banks in advanced economies, we draw several conclusions about the evolution of their monetary policy strategies after the crisis. First, no central bank in our sample has formally abandoned its existing framework so far. However, the design of monetary policy strategy has been high on the central banks' agenda in recent years. The Fed is about to conclude a review of its policy framework and the review of the ECB's monetary policy strategy has been implicitly announced. The revision primarily concerns the formulation of the price stability objective, with some academics and policy makers proposing alternative frameworks such as average-inflation targeting or price-level targeting (see e.g., Bernanke, 2017; Bullard, 2018; Evans, 2019; Svensson, 2020).

Second, currently used monetary policy frameworks have not been sufficiently adjusted to address the problem of persistently low inflation. While some academics advocated increasing the level of inflation targets up to 4% (see e.g., Blanchard et al., 2010), no central bank has opted for this solution. On the contrary, there were cases of central banks lowering the (mid)point of the target. This may reduce the room for maneuver by the central bank in the future: it would be more difficult to stimulate the economy when inflation drops below the target.

Third, although some economists proposed increasing flexibility as a way to adapt monetary policy frameworks to the post-crisis environment (see e.g., Banerjee et al., 2013), it is in contrast with the recent tendency of central banks to move towards tighter inflation targets and stronger commitments.

Last, financial stability has not been formally added into the monetary policy mandate. However, all central banks have a separate mandate for financial stability and use macroprudential policy tools to address financial stability concerns. Some unconventional monetary policy measures may have contributed to financial stability by restoring deficiencies in the monetary policy transmission mechanism and by providing necessary accommodation under the ELB on policy rates.

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Table 1A. Monetary policy frameworks in 14 central banks during 2007-2018

Central banks	Target definition and level	Target horizon	Targeted measure	Monetary policy mandate	Central bank communication	Monetary policy toolkit
Reserve Bank of Australia	R 2-3%	medium term	headline CPI	price stability	staff's projections	- policy rate cut - refinancing operations - FX interventions - swap line with the Fed
Bank of Canada	PB 2±1%	medium term	headline CPI	price stability	staff's projections Apr 2009–Apr 2010: FG, time contingent	- policy rate cut - refinancing operations - swap line with the Fed
Czech National Bank	PB 2010: from 3±1% to 2±1%	medium term	headline CPI	price stability	staff's projections Nov 2012-Dec 2013: FG, open-ended	- policy rate cut - refinancing operations - FX interventions
Central Bank of Iceland	P 2.5%	on average	headline CPI	price stability 2010: 'Inflation targeting-plus' - inflation target is combined with a managed exchange rate regime	staff's projections	- policy rate cut - refinancing operations - FX interventions
Bank of Israel	R 1-3%	within 2 years	headline CPI	price stability	staff's projections Oct 2015–Nov 2018: FG, open-ended	- policy rate cut - refinancing operations - government bonds purchases (sterilized open market operations) - FX interventions

Reserve Bank of New Zealand	2013: from R 1-3% to PB 2±1%	medium term	headline CPI	Apr 2019: dual mandate - price stability and maximum sustainable employment	staff's projections Since 1997: Delphic FG	- policy rate cut - refinancing operations - swap line with the Fed - FX interventions
Norges Bank	P 2018: from 2.5% to 2%	medium term	headline CPI	price stability	staff's projections Since 2005: Delphic FG	- policy rate cut - refinancing operations - swap line with the Fed - quota-based deposit system
Bank of Korea	2010: from PB 3±0.5% to 3±1% 2013: from PB to R 2.5-3.5% 2016: from R 2.5-3.5% to P 2%	medium term	headline CPI	price stability	staff's projections	- policy rate cut - refinancing operations - swap line with the Fed - FX interventions - targeted liquidity provisions
Sveriges Riksbank	2010: from PB 2±1% to P 2% 2017: from P 2% to PB 2±1%	within 2 years	Since Sep 2017: CPIF (CPI with fixed interest rate)	price stability	staff's projections Since 2007: Delphic FG	- policy rate cut - refinancing operations - swap line with the Fed - negative deposit facility rate - targeted liquidity provisions - government bond purchases
Bank of England	P 2%	at all times	headline CPI	price stability	staff's and MPC's projections Aug 2013–Jan 2014: FG, state contingent	- policy rate cut - refinancing operations - swap line with the Fed

					(with threshold) Since Feb 2014: FG, state contingent (without threshold)	- targeted liquidity provisions - government bond purchases - private securities purchases
European Central Bank	R below, but close to 2%	medium term	headline HICP	price stability	staff's projections Jul 2013-Dec 2014: FG, open-ended Since Jan 2015: FG, time- and state-contingent	- policy rate cut - refinancing operations - swap line with the Fed - negative deposit facility rate - targeted liquidity provisions - government bond purchases - private securities purchases
Bank of Japan	P 2012: 1% 2013: move from 1% to 2%	2012: medium to long term Jul 2018: 'at the earliest possible time'	headline CPI	price stability	staff's projections Feb 1999-Sep 2010: FG, open-ended Since Oct 2010: FG, state contingent	- policy rate cut - refinancing operations - swap line with the Fed - FX interventions - negative deposit facility rate - targeted liquidity provisions - government bond purchases - private securities purchases - QQE with yield curve control
Swiss National Bank	R 0-2%	medium term	headline CPI	price stability	staff's projections	- policy rate cut - refinancing operations - swap line with the

						Fed - FX interventions - negative deposit facility rate - private bond purchases
Federal Reserve System	P 2012: 2%	medium term	PCE price index	dual mandate - price stability and maximum sustainable employment	staff's and FOMC's projections Dec 2008–Jun 2011: FG, open-ended Aug 2011–Nov 2012: FG, time contingent Dec 2012–Jan 2014: FG, state contingent Since Mar 2014: FG, open-ended	- policy rate cut - refinancing operations - targeted liquidity provisions - government bond purchases - private securities purchases

Sources: central banks' publications, ReFIT (2017), CGFS (2019).
Notes: P - point target, PB – point target with a tolerance band, R – range target, FG – forward guidance, OMO – open market operations, FX – foreign exchange.

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