

Occasional Studies

Volume 21 – 3

On the profitability of central banks

DeNederlandscheBank

EUROSYSTEEM

On the profitability of central banks

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This version: 7 May 2024

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Abstract

Central bank profits are important as they help to maintain a strong balance sheet and financial independence from the government. Within the central banking community, annual profits (including seigniorage) are often regarded as an added benefit of central bank operations, but not as an important output metric in its own right. In this study, I show that central bank profits can be steered explicitly (to a certain extent) within the leeway of the primary (policy) mandate, and over a longer period of time. Profitability considerations could be included in the composition of financial assets, the minimum reserves remuneration, and the margin (corridor) between the monetary credit and deposit rates.

In the same way as commercial banks, central banks can use the Return-on-Equity (RoE) concept to price the (banking transformation) services they provide to commercial banks. The RoE target should be higher than the average GDP growth rate, in order for the central bank capital to grow sufficiently over time. But it should be smaller than the RoE of a commercial bank, as the primary objective of a central bank is monetary policy implementation, not profit-making. The study suggests that an RoE target window of 3-7% can be realistic for central banks as an average over the medium term of 5-10 years. However, there will be years with lower or even negative RoEs, as a consequence of policy choices.

Some balance sheet items are autonomous. They have an impact on profitability but are not actively managed, as they are demand-driven (banknotes) or at strategic levels (typically gold, and possibly FX exposures). Therefore, it is important that a central bank understands the future development of its profitability over a longer period using different scenarios. For assets like bond holdings or monetary credit, the RoE can be translated into a desired return margin on top of the marginal funding rate.

With the exit from the low-interest rate regimes, central banks around the world are facing multibillion losses from the materialisation of interest rate risk. In certain cases, this will lead to undercapitalised central banks, underlining the case for explicit management of profitability over the medium term.

1 Introduction

Central banks are generally profitable but this is often taken for granted. Traditionally, central banks earn a good income from seigniorage, driven by the issuance of banknotes, which they invest in low-risk interest-paying assets (like government bonds). In times when interest rates are well above zero, this provides a significant income with very little risk. Perhaps for this reason, central bankers traditionally worry little about their annual profits, and these are often considered a convenient by-product of the monetary policy implementation. There is little mention of them in standard text books (see e.g. Blinder (1998), Bindseil (2014) and Mishkin (2019)).

The past 10 years have shown that central bank profitability is not a given. Many central banks have seen annual profits decline as (policy) interest rates have decreased to zero or below. Large quantitative easing programmes (QE) initially supported profitability to some extent but also locked in low yields for long. And recently, a number of central banks have announced significant losses in the years to come following the large increases in policy interest rates. This is driven by the materialisation of interest rate risk, i.e. higher liability costs than asset incomes. The upcoming multibillion losses for a number of central banks have already generated significant public attention (see e.g. Nordström and Vredin (2022), Bell et al. (2023), Belhocine et al. (2023)).

Central banks earn profits from the services they provide to the society at large (monetary stability) and the financial sector more specifically (provision of liquidity). But sufficient profitability is also important for central banks in order to remain independent and effective. In a recent study, together with Dirk Broeders (Wessels and Broeders (2022)), we argue that a positive capital base covering the financial risks is an important

contributor to central bank independence and credibility. For a central bank with an adequate capital base, the retention of (part of the) annual profit ensures that its capital grows in line with the underlying risks. To achieve this, central banks should make sure they earn sufficient profit over a medium-term horizon, e.g. 5-10 years, to ensure the capital base grows in line with GDP, as a proxy for the growth of risks, see Wessels and Broeders (2022).

In this study, I argue that central bank profits should no longer be ignored and taken as only a consequence of the central bank policy. I offer a generic framework to steer the profitability of the central bank more explicitly, and in relation to the core task of monetary policy implementation. In addition, central banks should monitor and project their profitability and communicate with the public, e.g. when losses are expected. This topic has received little attention in central banking literature but may become more prominent going forward.

To my knowledge, there are no other studies that offer a discussion and framework to steer central bank profitability ex ante. There are theoretical reports that attempt to estimate the aggregate value of future seigniorage, see e.g. Buiters (2008), sometimes in combination with the central bank's net worth, see Ize (2008). Central bank financial strength is the topic of a series of papers initiated by Stella (1997, 2002) with a later overview by Archer and Moser-Boehm (2013).

Early reports on interest rate risk are from Carpenter et al. (2015), for the Federal Reserve and from De Nederlandsche Bank (DNB) in its 2015 annual report (DNB (2015), pp 44, 120). In recent years, there have been many reports of expected central bank losses in the coming years due to the large quantitative easing bond portfolios in combination with rising interest rates (see e.g. Bell (2023) and Belhocine (2023)). All measures discussed are corrective, ex post, ranging from maintaining a steady course until profitability returns (ignoring), to capital injections from the government. In this study, I provide considerations to steer central bank profitability proactively.

2 Why central bank profitability matters

Central banks can create money without limits but should do so while maintaining a strong balance sheet. Central banks can always pay their liabilities when they are due in the domestic currency, simply by issuing new liabilities. And as these central bank liabilities are the legal tender, they will be accepted by everyone. However, these new liabilities are not free money to spend. Every new deposit created or new banknote issued corresponds to a new asset for the central bank, e.g. a government bond or a loan to a commercial bank. Central banks aim to maintain assets of high quality which keep their value. A positive capital base implies that the balance sheet assets act as coverage for the fiat money issued (the liabilities), thus supporting public trust in the currency. Creating money without obtaining good assets will eventually erode the capital base and may lead to public trust declining and inflation increasing undesirably.

A strong balance sheet needs an adequate capital base that grows in line with GDP over the medium term. In recent reports (Wessels and Broeders (2022a, 2022b, 2023)), we argue that a positive capital base that grows with nominal GDP helps to maintain the central bank's financial independence from the government and credibility to the markets and public over the medium term. The capital base should cover the central bank's financial risks, both the calculable and the non-calculable, latent risks. These 'latent risks' are financial risks due to *contingent* policy measures which the central bank may have to deploy on the basis of its mandate, but which are unknown as yet. Examples of such contingent policy measures are a future QE programme or a future lender of last resort programme (LOLR) for a commercial bank. In Wessels and Broeders (2022), we argue that the latent risks grow in line with macroeconomic variables, such as GDP, over a longer period of time.

Central banks contribute to the public finances by earning a profit on the services they provide to the financial sector and society. But good profitability is also important for central banks in order to maintain an adequate capital base over the medium term. For a central bank, the annual profit is usually the main source of capital growth. As the objective is to remain financially independent from the government, the rules should preferably allow sufficient retention of the annual profit by the central bank – instead of having to pay it all out to the shareholder. Especially after years of losses, the central bank capital should be able to grow back to the target level as fast as possible. Capital injections from the government are undesirable, as they may be at odds with central bank independence. In summary, central bank profits should be at the disposal of the central bank and be sufficient (over the years) to grow capital and make up for years with losses or low profits.

An additional benefit of good profitability is that it contributes to a positive perception of the central bank among the general public. Unlike most government authorities, central banks earn their own money from the services they provide to the financial sector. The central bank acts as a bank for commercial banks, providing credit, maturity and liquidity transformations. Therefore, from an economic point of view, the central bank is entitled to a 'fair' profit margin on the services it provides and the risks it takes on the balance sheet. When the central bank capital is at its target level, the surplus in annual profit can be paid out as a dividend to the government. In the end, central bank profits are public money that should not accumulate unnecessarily at the central bank. On the other hand, years of central bank losses may attract bad publicity with the suspicion of inefficiency or even carelessness.

This may lead to lower confidence in the domestic currency and scrutiny towards the central bank measures that caused the losses.

Generally, central bank objectives do not include profitability. Central banks are mandated to maintain price stability and financial stability, and this is viewed as much more important than the central bank profits. A central bank with prominent profitability objectives may be tempted to focus on profits at the expense of price stability or financial stability. Historically, in countries where central bank independence is low, governments have been seen to misuse central banks as a source of income to fill the holes in the public finances. Also, from a public finance perspective, one may view central bank profits as part of an optimal taxation policy, including inflation tax. This notion is not included in this study. Here, we merely argue that medium-term profits should be sufficient to maintain financial independence of the central bank. However, they should not be too large to jeopardize that independence, in that the central bank dividends become an important source of income for the government.

3 What is central bank profitability?

It may seem a trivial question, but in the case of central banks there are various perspectives on what constitutes the annual profit. In this section, I distinguish three of them. The first, and most straightforward, approach simply takes the annual result from the profit and loss account as reported in the annual report.

The second perspective is a broader definition of the annual profit and includes the change in the General Risk Provision (GRP) in a given year. Some central banks (e.g. those in the Eurosystem) have the option to build a GRP. As long as such a GRP can absorb a broad range of expected and unexpected losses, it serves as de facto capital. Such a GRP is an accounting construct that is generally not available to commercial banks. Additions to and withdrawals from the GRP are made before establishing the annual profit and are under the complete control of the central bank board. The use of the annual profit itself is under the control of the shareholder, typically the government in the case of central banks. Therefore, the use of a GRP increases financial independence from the government.

The third perspective includes the changes in the so-called revaluation reserves (RRs), in addition to the changes in the GRP. RRs are accounting constructs to record profits linked to a specific instrument (like a government bond or FX instrument) or certain holdings (e.g. gold). When the price of gold goes up, the profits are added

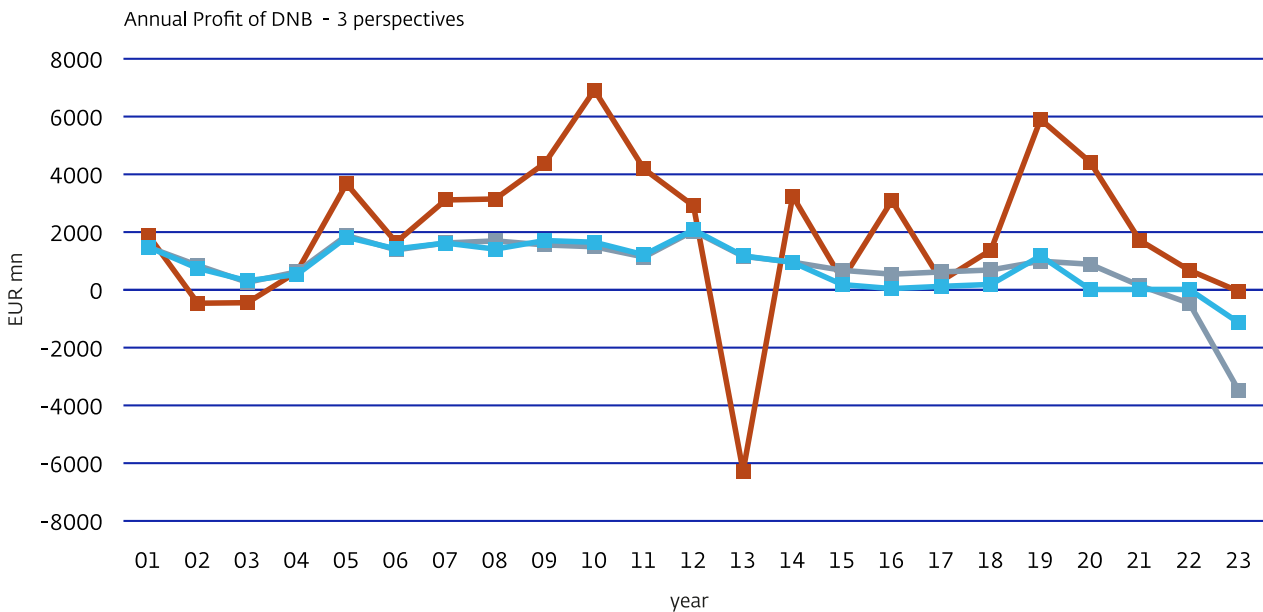
to the gold RR. When the gold price goes down, the losses are taken from the RR. When the RR is completely depleted, any additional losses are taken to the P&L account, diminishing annual profit. This creates an asymmetry where aggregate net profits from price increases (of gold and relevant instruments) are trapped as equity items in the balance sheet, while net losses are taken directly in the P&L.

Due to many years of historical gold price increases, the RRs for gold in the Eurosystem are especially large. In principle, these RRs are bits of shareholder equity which are not labelled as such and accounted for elsewhere on the balance sheet. In the same way, the changes in these RRs are profits or losses not included in the annual profits. Only when the asset is sold or matures (for a bond instrument) the corresponding RR is released and is taken to the P&L account where it ends up as extra annual profit.

In the graph below, the annual profit of DNB is shown according to these three perspectives:

1. Annual profit, as reported in the annual report (blue line). Henceforth we refer to this figure as the “annual report annual profit” or ARAP;
2. Annual profit PLUS changes in the GRP (grey line), i.e. “Provision-adjusted annual profit” or PAAP;
3. Annual profit PLUS changes in the GRP PLUS changes in the RRs (orange line), i.e. the “fully included annual profit” or FIAP.

Graph 1 ARAP (blue), PAAP (grey) and FIAP (orange) for De Nederlandsche Bank (DNB) since 2001, data taken from DNB annual reports (2001-2023)



It can be seen that the fully included annual profit of DNB over the last 20 years is more erratic than the other two. This is a reflection of the sizes of the underlying equity items: at the end of 2022, the shareholder equity (“capital and reserves”) of DNB stood at EUR 8.5 bn, the GRP (“provisions”) at EUR 2.4 bn, whereas the aggregate RRs (“revaluations accounts”) amounted to the enormous figure of EUR 32.9 bn. Clearly, in the case of DNB, changes in the RRs dwarf the ARAP and PAAP. A historical reason for not using FIAP explicitly in the annual report may be this volatile profile over time, yielding big profits one year and huge losses in another, even though it comes closest to the aggregate annual *economic profit*. In the eyes of the public, these large swings may raise concerns about the central bank’s ability to manage profits – even though these swings in FIAP are largely driven by changes in gold prices, which are beyond the control of the central bank.

In the remainder of this study, I focus on the PAAP, as this is the annual profit that will be most relevant to the central bank in steering profitability. What part of the PAAP will be allocated to the provision and what part will become the ARAP is a decision for the central bank board at the end of the financial year.

4 Can central bank profitability be managed?

Central banks can create new money when needed, but they have to work for profits like any other business organisation. Like a commercial bank, a central bank earns its profits from the differential between the returns on assets and the costs of liabilities. When the returns exceed the costs, the central bank realises a profit. In contrast to commercial banks, however, profitability is not the objective for central banks, and is often considered a convenient by-product of their privilege of issuing banknotes and their monetary operations. Central banks are designed for monetary policy and financial stability purposes and their balance sheet items and characteristics are a consequence of these mandates. However, there may be some room for steering profitability, as I argue below.

Central bank balance sheets vary widely across the globe but usually have several items in common. On the asset side, we often find monetary bond portfolios, monetary credit facilities to commercial banks (credit operations), FX exposures and gold. On the liability side, there are usually banknotes in circulation and deposits from commercial banks (reserves, including the “minimum reserves”). Table 1 shows a typical central bank balance sheet, where I have also included an investment portfolio and the capital items (shareholder equity, provisions and revaluation reserves).

Seigniorage refers to the income from the issuance of banknotes. The proceeds from the banknotes are invested in interest-earning assets. Historically, seigniorage provided sufficient income for central banks to run their basic operations. However, in the last 10 years interest rates have been low and we have seen that seigniorage is not a given. In addition, the value of banknotes in circulation is generally driven by public demand, and therefore not manageable by the central bank. With the ongoing digitisation of payments, the use of banknotes may decline in the future. In summary, seigniorage has been a good contribution to the central bank’s profit in the past, but there is no guarantee that it will remain so.

In a similar vein, for many central banks, gold is not actively managed. The central bank holds gold and sometimes also FX exposures at strategic, long-term levels intended for financial stability purposes as anchors for extreme scenarios where trust in the currency is low. Their impact on profitability can be large but this is accepted as a consequence of their policy purpose – as we saw in the case of DNB in the previous section. Central banks with exchange rate objectives and large FX holdings may experience large profits in one year and losses in the next due to FX rate movements.

Table 1 Typical items on a central bank balance sheet

Assets	Liabilities
Gold	Banknotes in circulation
FX portfolio	Deposits from commercial banks
Monetary credit to commercial banks	Revaluation reserves (RRs)
Monetary bond portfolio	Shareholder equity (SE) and provisions (GRP)
Investment portfolio	

Monetary policy portfolios, such as a (government) bond portfolio, lending to banks (monetary credit) and deposit-taking from banks (reserves), are generally managed more actively.

Important parameters for the monetary stance are the sizes of these portfolios and the rates (towards the banks). Clearly, the setting of these parameters – which includes the central bank’s key policy interest rates – is driven by monetary policy considerations, such as the inflation level and outlook. However, as these portfolios often constitute a significant part of the balance sheet, their contribution to the annual profit can also be substantial. Small adjustments to (some of) these parameters may have limited policy impact (or none at all), whereas their impact on profitability may be significant. Below are three examples from the Eurosystem with their impacts on DNB’s profitability (based on the Eurosystem capital key of 5.9%, ECB (2024a)). For an overview of the Eurosystem’s monetary policy framework, see e.g. Kakes, Klaver and Rollingswier (2022).

1. Banks are charged a higher rate on lending operations (the main refinancing operations carrying the MRO rate), than on the deposit facility (with the deposit facility rate, DFR). Since the year 2000, the margin between the MRO rate and DFR has varied between 0.25% and 1.0% (see figure). At the end of December 2023, the outstanding Eurosystem MRO and (T)LTRO loans together stood at about EUR 396 bn¹. DNB’s share is then EUR 23.6 bn and a 50 bps extra margin between the lending rates (of MRO and (T)LTRO) and DFR equals EUR 0.12 bn annually. In 2008, MRO alone has been as high as EUR 350 bn for the whole Eurosystem,

with 50 bps of extra margin equalling another EUR 0.10 bn for DNB annually.

2. Purchase programmes (i.e. the Eurosystem QE bond portfolios) currently constitute a large part of the balance sheet of the Eurosystem and stood at around EUR 4.7 tn at the end of December 2023 (DNB share: EUR 273 bn). These portfolios are financed from deposit facility (i.e. deposits from commercial banks, on which the Eurosystem pays the DFR). Although the yields on the purchase programmes are well below the DFR at the end of 2023 (and therefore the purchase programmes are loss-making), small changes would have had significant impacts. For instance, 10 bps higher yields would have produced an extra EUR 0.28 bn for DNB annually, due to the enormous size of the portfolios. Of course, the yields on the bonds already purchased cannot be changed, but it is relevant when reinvesting or making new purchases.
3. Part of the bank deposits are held as minimum required reserves (MRR). Since October 2022, the interest rate paid on MRR has been lowered by the Eurosystem from the MRO rate to the DFR and further to zero in July 2023. Eurosystem MRR stood at about EUR 165 bn in October 2023 which corresponds to a pro rata DNB share of EUR 9.7 bn. With the MRO rate at 4.5%, the impact of using a zero rate is an increase in DNB’s annual profits of EUR 0.44 bn. The ECB press release states that this was done to “improve the efficiency of monetary policy by reducing the overall amount of interest that needs to be paid on reserves in order to implement the appropriate stance” (ECB, 2023a).

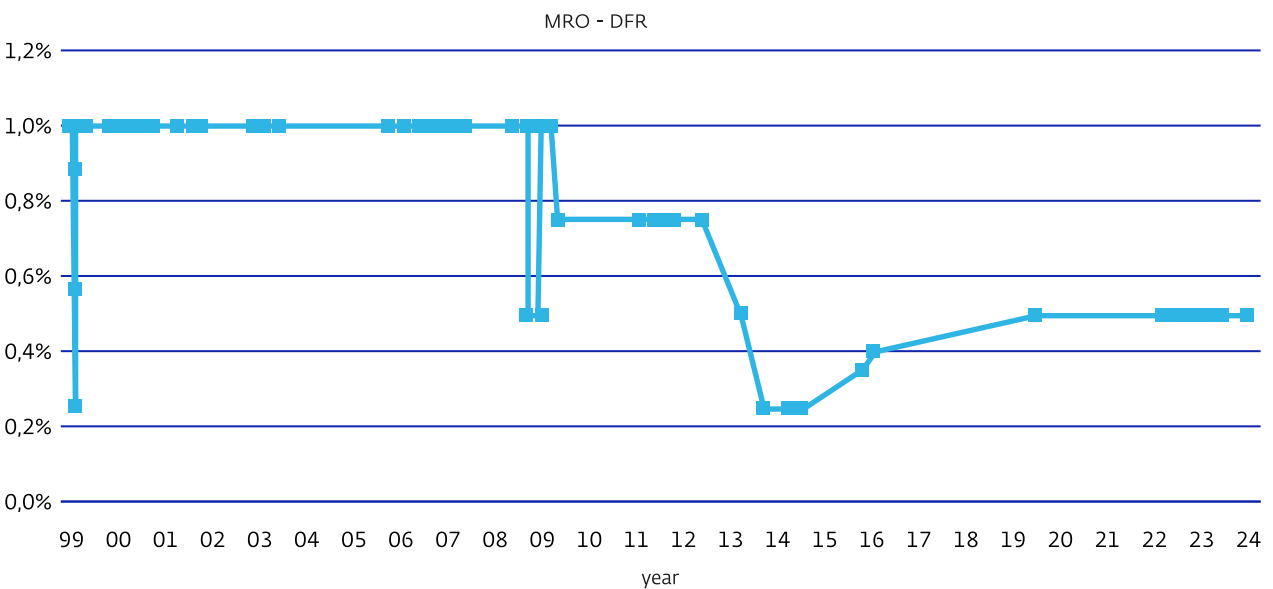
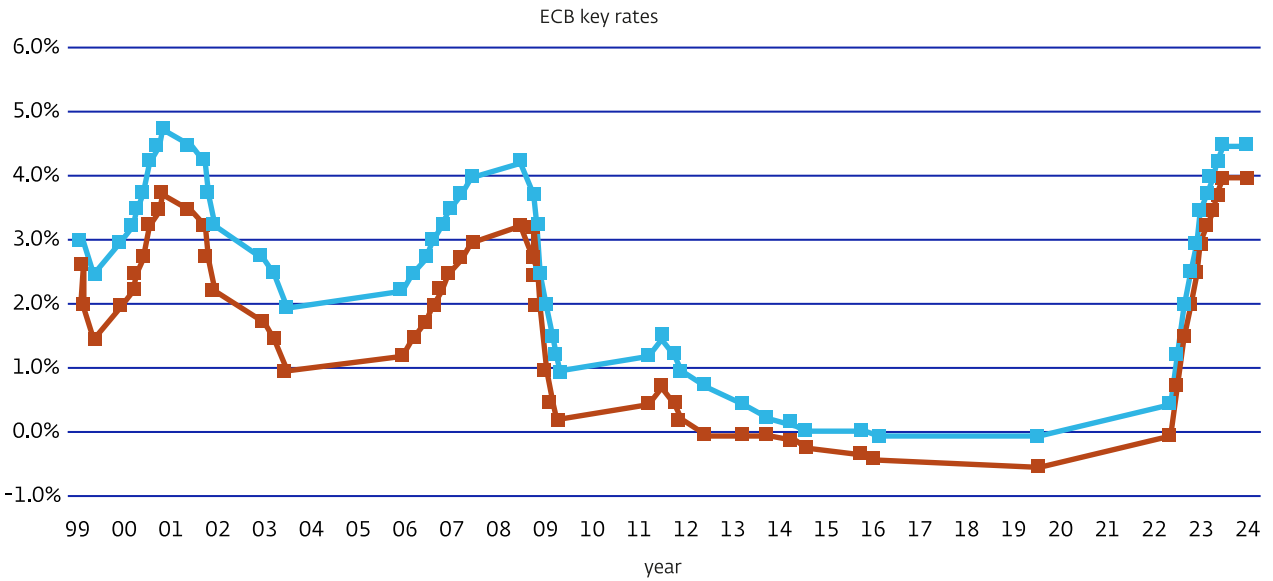
¹ MRO and (T)LTRO stand for Main Refinancing Operations and (Targeted) Long-Term Refinancing Operations respectively. Both are credit facilities for commercial banks. On 13 March 2024, the ECB announced to reduce the spread between MRO and DFR to 0.15% as of 18 September 2024, see ECB (2024b).

All three examples show that monetary parameter adjustments, in a (perhaps) not unreasonable range, could have significant impacts (0.1-0.5 bn) on the PAAP or ARAP of DNB (typically between 0.5 bn and 2 bn in the last 20 years). Still, policy objectives regarding interest rate volatility and market liquidity should of course be leading in the setting of these parameters. For instance, a higher margin (corridor) between MRO and DFR may lead to more volatile market interest rates and discourage use of the lending facilities. The effectiveness of the monetary transmission remains the primary consideration. Finally, in some cases, central banks have activities for which profit is the (or one of the) primary objective(s). In the Eurosystem, the national central banks have their own investment portfolios (limited by a maximum size), also known as non-monetary portfolios. In the case of DNB, own investments stood at EUR 7.3 bn (including FX exposures) at the end of 2022 and contained exposures such as equities and high-yield bonds. Annual income was around EUR 0.10 bn. In the past, the portfolio was significantly higher, with predominantly government bonds

(2015: EUR 27.2 bn, annual income: EUR 0.25 bn). DNB's own investments have been allocated a "risk budget", which determines the maximum amount of risk (i.e. expected shortfall) the investments can consume on an annual basis. This ensures that the risks and profits of the investment portfolio contribute significantly, but do not prevail over the risks and profits from the primary mandate, i.e. the monetary portfolios (DNB annual reports (2015) and (2022)).

In summary, large parts of the central bank balance sheet may be effectively unmanageable from a profitability perspective. This includes autonomous items such as gold and banknotes and sometimes FX exposures. However, monetary portfolios are generally actively managed and may have some room for profitability considerations, e.g. when choosing between two options with a similar contribution to the monetary stance, but different profitability. An own investment portfolio under the full control of the central bank can also be a significant contributor to the annual profit.

Graph 2 Key monetary interest rates of the ECB (first graph, MRO rate (blue) and DFR (orange)) and their differential (second graph), see ECB (2023b)



5 What should adequate central bank profitability be?

In the previous section, we saw that there is room for steering central bank profits. The question that then arises is: what should the level of central bank profitability be ideally? In this section, we discuss what the target profitability could be for a central bank.

The tools for commercial banks to manage profitability can also be used by central banks. Commercial banks often work with the Return on Equity (RoE) measure to manage their profitability. RoE measures the annual profit in relation to the capital invested by the shareholder. Using an overall RoE target for each of the business units, the commercial bank attempts to steer profitability to the desired level. Externally, the RoE target creates transparency and shows ambition towards shareholders and other stakeholders. The RoE measure is defined as follows:

(1)

$$RoE = \frac{\text{net income}}{\text{capital}}$$

Here, net income is the bank's profit, after costs and losses, and capital is the bank's shareholder equity (as the ultimate loss-absorbing buffer).

An RoE target is also useful for central banks. Central banks are in many ways similar to commercial banks. Deposit-taking and lending are common operations for central banks, just as they are for commercial banks. When conducting these operations, both commercial and central banks use their balance sheets to perform a number of economic functions such as credit, maturity and size transformation. In their capacity as 'banks for commercial banks', central banks run many of the typical financial risks that commercial banks also face. Both have capital as a loss-absorbing buffer

and both are highly leveraged, with leverage being defined as the ratio of total assets to available capital. Essentially, the central bank acts as the bank for commercial banks, performing services and risk transformations for the banking sector. However, contrary to commercial banks, central banks usually do not have the option to reduce or hedge their risks as that would be counteractive to the policy objectives. As a result, for instance, the interest rate risk due to the QE portfolio is not hedged with interest rate swaps.

Central banks provide banking services to the financial sector using risky operations, thereby adding value to the commercial banks. They also stand ready to provide backstop operations in case of crises or (liquidity) problems. This is often seen as a public task financed by public money. However, it can be argued that, without prejudice to the primary mandate, the central bank should provide these services at fair prices to the main users of these services. Here, 'fair' means that these prices should be consistent with the prices the commercial banks would have had to pay to other service providers, had these services not been provided by the central bank. An excessively low or high price would mean (implicit) subsidisation or taxation respectively. Using an RoE target could help in achieving fair and consistent prices over the various central bank operations. In other words, with a single RoE target the central bank could ensure that the user of a central bank service pays the price that is proportional to the risk (i.e. the value) of that service. Of course, this should take place within the perimeter of the monetary stance, which is the primary mandate.

Central bank mandates typically refer to maintaining price stability, financial stability and (in some cases) business cycle optimisation.

And these objectives should be pursued in a cost-effective way. One could argue that no RoE target is needed and that preventing central bank losses is already a sufficient objective in this respect. However, as we argue in a previous study (Wessels and Broeders (2022a)), central bank capital should grow in order to keep pace with the increasing central bank balance sheet size and risk profile over the medium term of 5-10 years. The central bank's own annual profit should be the source for capital growth. A way to achieve these goals is to use an RoE target and to price operations accordingly.

The commercial bank RoE targets may not be directly applicable to central banks. Commercial bank RoE targets are the result of equity investors demanding sufficient return vis-à-vis the risks taken, and also in relation to other investment opportunities. Banking supervisors set standards for capital adequacy and risk-taking for commercial banks, limiting excessively high RoE targets. But supervisors also want banks to pursue healthy business models with a sufficient RoE over the years. For the general public, commercial banks are often seen as fulfilling a public function which is consistent with a moderate RoE target.

Central banks generally have the government as the only shareholder and no supervisory authority. So what RoE target level is appropriate for central banks will probably be different from commercial banks. I argue that an appropriate bandwidth for a central bank RoE target is the following:

(2)

average GDP growth < *central bank RoE target* < *commercial bank RoE targets*

At the lower end, the central bank RoE target should be limited by the average GDP growth over the medium term. In our previous study (Wessels and Broeders (2022a)), we argued that central bank capital needs to grow over the years in line with average GDP in order to keep pace with the growth of the calculable and latent risks on the central bank balance sheet. So, if a country has had average GDP growth of 3% over the last 10 years, the central bank may put 3% as the lower limit to its RoE target.

The central bank profits are usually the main source for this capital growth. Capital injections from the government are undesirable as they reduce independence. In order to avoid the probability that capital ends up in negative territory, the central bank may choose to aim for RoEs higher than average GDP growth. If realised RoEs are significantly larger than the average GDP growth over multiple years, the central bank can retain the profit it needs for capital growth and pay out the rest as dividend to the shareholder, i.e. the government. This contributes to a positive perception of the central bank by the public.

At the upper end, the central bank RoE target should not exceed the RoE targets of commercial banks. There are three arguments for this. First, the central bank primarily has a public task that is not readily compatible with a profit objective that exceeds those of commercial banks having profit realisation as their main objective. Second, the central bank is the only entity with the public task of executing monetary policy and issuing legal tender.

This monopoly should not be used (or abused) to pursue higher profits than those of other economic actors. In some cases, the central bank also acts as a competitor to commercial banks as a lender and deposit-taker (for banks) and a buyer (of securities). With an excessively high RoE target, the central bank could be seen as trying to take business away from commercial banks, by taking advantage of its superior credit standing or its role as a standard-setter.

Finally, as the third argument, the central banks' profit is paid in part by commercial banks. The central bank balance sheet consists of lending to commercial banks and taking deposits from commercial banks. The margin between the lending and deposit rates is a contributor to the central bank's profitability. A central bank RoE target higher than those of commercial banks is undesirable as the extra central bank profits will be taken out of the commercial bank profits (at least partly). In an extreme situation, an excessively high central bank RoE target could even lead to unfavourable banking conditions, possibly reducing commercial banks' lending capacity. In that case, it will be at odds with the central bank's objectives stipulated in its primary mandate.

European commercial bank targets for RoE range typically between 8% and 12% (EBA (2015)). Realised levels have been below 10% for most banks over the last 10 years as a result of deleveraging efforts driven by supervisors. For the large Dutch banks, it is even expected to remain lower in the future, at around 7% (Daniels and Kamalodin (2016) and Freriks et al. (2021)). Therefore, an upper limit to the central bank RoE target could be around 7%.

The graph below shows the RoE of DNB according to the three perspectives described earlier. For each annual profit, the RoE is defined in respect of the appropriate equity figure

(3)

$$RoE (ARAP) = \frac{ARAP}{Shareholder\ equity}$$

$$RoE (PAAP) = \frac{PAAP}{Shareholder\ equity + GRP}$$

$$RoE (FIAP) = \frac{FIAP}{Shareholder\ equity + GRP + RRs}$$

The RoEs over the years since 2001 are quite good: averages are in all cases above 8%, although standard deviations are significant, and the trend is downward. The years since 2011 are clearly worse than those between 2001 and 2011. The average RoEs of the ARAP and PAAP are better than those of the FIAP, but, remarkably, the standard deviations are somewhat lower for FIAP. This graph shows that an RoE target between 3% and 7% would have been realistic over the last 22 years, and even for the last 12 years. For the coming years, RoEs for ARAP and PAAP will be bad, probably negative, due to the materialisation of interest rate risk leading to negative profits. Perhaps central bank RoEs are settling on structurally lower levels, underlining the case for explicit steering of profitability (to the extent possible). The RoE for FIAP is harder to predict, as it (mainly) depends on gold price developments.

Graph 3 RoE of DNB since 2001 for ARAP (blue), PAAP (grey) and FIAP (orange)

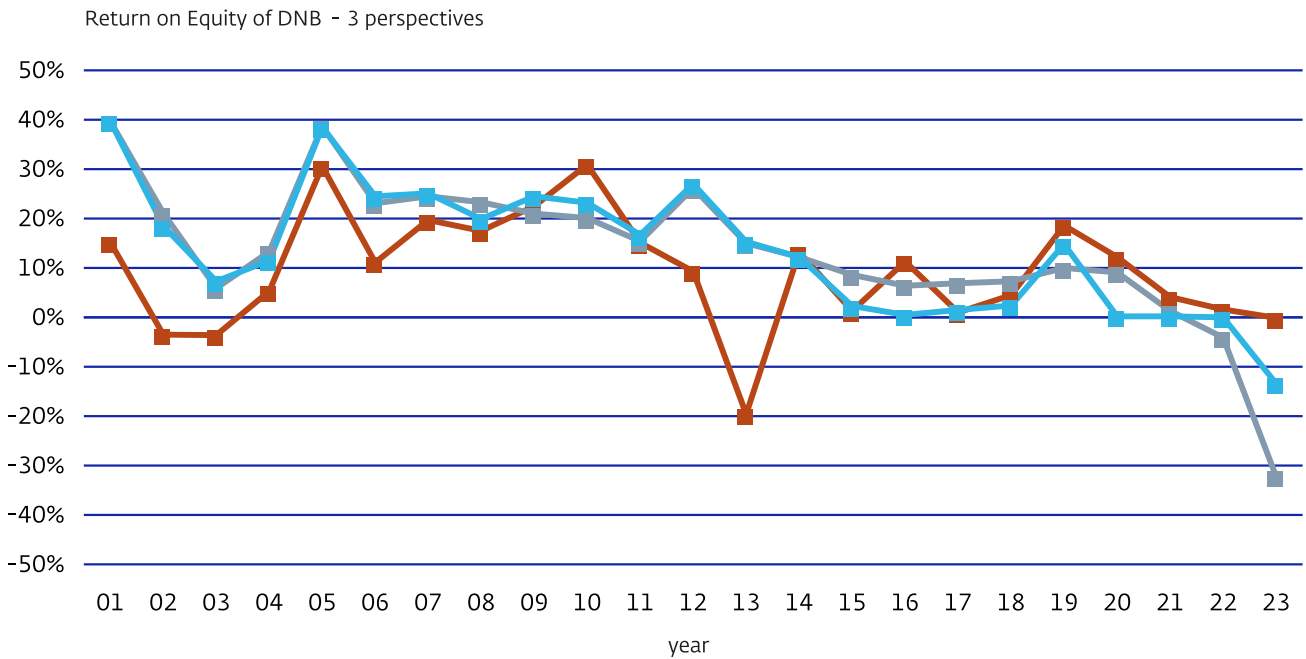


Table 2 Averages and standard deviation of the three RoEs of DNB since 2001

RoE	RoE (ARAP) (blue)		RoE (PAAP) (grey)		RoE (FIAP) (orange)	
	Average	Stdev	Average	Stdev	Average	Stdev
2001-2023	13.6%	13.0%	13.6%	14.4%	9.5%	11.4%
2011-2023	6.1%	10.1%	6.3%	13.1%	5.6%	9.3%

The RoE target for central banks has a long horizon. It should be emphasised that profitability considerations can only be included in part of the central bank balance sheet and operations, and more explicitly in some periods than in other periods, i.e. when monetary policy allows it. Therefore, it is important to realise that the central bank RoE target should have a longer horizon than those of commercial banks. Commercial banks have more room and tools to ensure profitable services, in line with the RoE target, every year. For central banks, there may be years when additional risks must be taken onto the balance sheet, without proper compensation.

In years of crises, for instance, when credit and liquidity are scarce, the central bank must step in to support the proper functioning of the banks and the financial system, regardless of profits. In years of low inflation, massive bond purchases are intended to push down long interest rates, and will not yield the appropriate risk premia for the central bank. In those years, the RoE target may not be achievable. But in other years, there may be more room to use profitability considerations and steer towards a medium-term RoE target.

As the RoE target would be an important tactical parameter for the medium term, the central bank could involve the government in the decision process. In the end, it is the government as shareholder bearing the ultimate risk of recapitalization of the central bank when needed (following large losses). This risk tolerance is therefore shared between central bank and government. On the other hand, involving the government in this process may also lead to pressure towards higher RoE targets, reducing central bank independence. Therefore, the type and extent of government involvement in setting the medium-term RoE target probably depends on the specific case.

In conclusion for this section, a central bank could use an RoE target as a tool to maintain sufficient profitability over the medium-term horizon, within the boundaries dictated by the central bank's primary, monetary mandate. An RoE target could be useful, as the central bank provides services to the banking sector and the economy that have economic value. A target between the average GDP growth rate (at the lower end) and the RoEs in the commercial banking sector (at the upper end) could be appropriate. In practice, this may be between 3% and 7%. An example from DNB over the last 22 years shows this is realistic. The RoE target should correspond to an average over the medium term, as large parts of the central bank balance sheet (such as gold and banknotes) are not managed by the central bank, and in some years there may be less room for profitability considerations than others (e.g. due to monetary policy or crisis measures).

Obviously, many challenges remain for central banks' use of RoE in practice. I have already mentioned that the monetary stance may leave little room for pricing considerations, for instance in a low-rate environment. But also, capital should not be negative, as is the case for some central banks. But even when capital levels are low compared to the risk profile, 3-7% RoE targets may not be sufficient to grow back to adequate capital levels over the medium term. In such a case, the calculated risk numbers (being significantly higher) could be used as a proxy for capital in the denominator of the RoE target. Also, there is some criticism of the use of the RoE metric, as it may encourage risky behaviour, especially in times of deleveraging². Finally, an RoE target is not usable for specific items on the central bank balance sheet such as banknotes, gold and minimum required reserves, as we will see below.

² RoE = Return on Assets times Leverage factor, where the Leverage factor equals Total assets over capital. If leverage declines, while Return on Assets remains constant, RoE will also decline. See Van As, Broeders and Van Toor (2022).

6 How can central bank profitability be managed? A framework

Central banks use their balance sheets to fulfil their mandates and earn profits. But how should the RoE target for the whole central bank be translated to the various balance sheet items? In this section, I use a Risk-adjusted Return on Capital, or RAROC, approach (see e.g. Hull (2018) and Heijnen, van Hensbergen and Wessels (2017)) to derive a desired return for each asset based on the RoE target. With this approach, in principle, each asset could contribute to the overall RoE in a way that is proportionate to the risk it entails. I focus on the PAAP metric, as this is likely to be of most interest to the central bank.

This method works on the basis that capital is allocated to balance sheet items that carry financial risk. Generally, this concerns market or credit risks related to balance sheet items on the *asset* side. One could perhaps find a way to allocate financial risk such as interest rate risk to liability items, but for the sake of simplicity I will assume that all financial risks are related to assets. This implies that profits from liabilities such as seigniorage on banknotes or income from minimum reserves are not manageable using this framework and the RoE target, as we will see below³.

3 These profits from liabilities could still be included in a different way, e.g. by subtracting them from the overall RoE target. In this way, a lower RoE target could be used for the risky assets, while at aggregate balance sheet level the overall RoE target is still met. For this purpose a forecasting tool or ALM model is very useful, see subsection 6.5.

6.1 Splitting the balance sheet into mini balance sheets

A typical central bank balance sheet is shown in Table 3.

Table 3 Typical items on a central bank's balance sheet, with between brackets their sizes (first symbol) and their returns (second symbol)

Assets	Liabilities
Gold (G, r_G)	Banknotes in circulation (B, -)
FX portfolio (F, r_F)	Deposits from commercial banks (D, r_D)
Monetary credit to commercial banks (M, r_M)	Revaluation reserves (RRs, r_{RR})
Monetary bond portfolio (Q, r_Q)	Capital (C, RoE) (Shareholder equity (SE) + Provision (GRP))
Investment portfolio (I, r_I)	

For each item, the capital letter represents the size (in the local currency) and the lower case "r" the return. In addition to the balance sheet identity ($G+F+M+Q+I=B+D+RR+C$), income and expenses must also be balanced:

(4)

$$RoE C + r_{RR} RRs + r_D D + O = r_M M + r_Q Q + r_I I + r_G G + r_F F$$

The banknotes B do not enter into this equation because there is no associated (proportional) cost. The symbol O contains the operational costs (i.e. staff, utilities and other expenses). In addition, I have added the return r_{RR} for the revaluation reserves RRs, as it is not included in the RoE. Minimum reserves have not been included here, in order to keep things simple.

Equation (4) is not very practical for the management of RoE, as it refers to the entire balance sheet and there are many parameters. Therefore, in order to determine a profitability target for each asset separately, I have rearranged this balance sheet by splitting it into smaller (mini) balance sheets. Each mini balance sheet in Table 4 refers to a single asset category and is again balanced, i.e. the asset size equals the liabilities. Together they all add up to the entire balance sheet. For visual representation, each mini balance sheet is separated by a full line and, for reference, accompanied on the left side by a capital letter referring to the asset (except in the case of (B), which refers to the liability, i.e. "banknotes").

Table 4 The central bank's balance sheet split into mini balance sheets, where each part is again balanced (having equal assets and liabilities)

The item Deposits from commercial banks is used to close the mini balance sheets as the "marginal funding liability". Please note that for the banknotes (B) mini balance sheet, there is no associated asset (=0), so in order to close the mini balance sheet (artificially) a negative amount of Deposits from commercial banks D_B equal to B is included. All mini balance sheets together add up to the entire balance sheet.

	Assets	Liabilities
G	Gold (G, r_G)	Revaluation reserves (RRs, r_{RRS}) Deposits from commercial banks (D_G, r_D)
B	0	Banknotes in circulation (B) (-/-) Deposits from commercial banks (D_B, r_D)
F	FX portfolio (F, r_F)	Capital (C_F, RoE) Deposits from commercial banks (D_F, r_D)
M	Monetary credit to commercial banks (M, r_M)	Capital (C_M, RoE) Deposits from commercial banks (D_M, r_D)
Q	Monetary bond portfolio (Q, r_Q)	Capital (C_Q, RoE) Deposits from commercial banks (D_Q, r_D)
I	Investment portfolio (I, r_I)	Capital (C_I, RoE) Deposits from commercial banks (D_I, r_D)

Two key concepts are used here. The first is that the capital C is the risk-absorbing buffer for four asset categories, i.e. the FX portfolio (F), Monetary credit to commercial banks (M), Monetary bond portfolio (Q) and the Investment portfolio (I). The capital is split into four parts corresponding to the assets, which add up to the total capital, $C=C_F+C_M+C_Q+C_I$. This split of capital can be done in many ways, including on the basis of expert judgment, but the most practical method would be based on risk estimations, e.g. with a risk model. Suppose the ratio in risk of F:M:Q:I is 1:2:3:4 (completely arbitrary), then the ratio in $C_F:C_M:C_Q:C_I$ is also 1:2:3:4. The risk can be measured by Value-at-Risk or Expected Shortfall or another risk metric (see Wessels and Broeders (2022a)).

The second concept involves the use of the item Deposits from commercial banks as the "marginal

funding liability". The reasons for this are discussed further in the next subsection. Here it is important to note that this item is split and closes each of the mini balance sheets: $D_G = G-RRs$, $D_F = F-C_F$, $D_M = M-C_M$, $D_Q = Q-C_Q$, $D_I = I-C_I$. Only the Banknote (B) mini balance sheet is treated differently: as there is no asset directly associated with banknotes, and all subitems D_i must add up to the total Deposits from commercial banks, a *negative* item ' $-D_B$ ' is introduced in the (B) mini balance sheet. In this way: $B=D_B$ (closing the mini balance sheet) and: $D=D_G-D_B+D_F+D_M+D_Q+D_I$ (all D_i 's adding up to the total D; please note again the minus sign in front of D_B). Using the marginal funding liability in each mini balance sheet is important, as it completes the funding composition of each asset. Together with a desired RoE, it drives the returns the assets should make, as will be shown below.

The mini balance sheet (B) for banknotes is different compared to the others. As mentioned, in this set-up, the banknotes carry no financial risk, and therefore no capital allocation. Therefore, there is no asset (=0) and an RoE target cannot be used. However, there is a need for a *negative* marginal investment liability to close the mini balance sheet. Conceptually, a *negative* marginal investment liability is equivalent to a positive “marginal funding asset”, in which the proceeds of the banknotes are invested. It is as if the proceeds of the banknotes are invested in a deposit at the central bank. It may seem artificial, but an advantage of this approach is that the mini balance sheet (B) corresponds directly to the classical interpretation of seigniorage, i.e. the returns from banknotes come from a risk-free interest-paying asset (i.e. a deposit at the central bank).

The mini balance sheet for Gold (G) is also different from the other mini balance sheets. For simplicity, I assume in this discussion that the RRs are exclusively linked to gold (and not to other assets), and that gold does not need capital C_G , in addition to the revaluation reserves RRs, i.e. the RRs more than suffice in absorbing the risks connected to gold price movements.

In this subsection, I have not included minimum required reserves (MRRs) as a separate liability of the central bank. These MRRs could be included in this framework by splitting them off in Table 3 from the item Deposits from commercial banks, using size ‘MRR’ and cost ‘ r_{MRR} ’. The resulting mini balance sheet will be similar to that of Banknotes, where again a *negative* marginal investment liability (with size D_{MRR} equal to MRR) is needed to

close it. Also other balance sheet items could be included in Table 3.

6.2 The marginal funding liability and the marginal funding rate

In this framework, the item Deposits from commercial banks takes on the role of “marginal funding liability” used to close each of the mini balance sheets. As a result, the funding composition of each risky asset is made up of Capital (used to absorb the risks) and Deposits (as the central bank’s internal funding resource).

The reason for using Deposits as the marginal funding liability is that it is the most flexible item on the central bank balance sheet and completely under the control of the central bank. The central bank can easily create new Deposits by extending Monetary credit (M), making new Investments (I) or buying FX instruments (F), Gold (G) or bonds for the Monetary bond portfolio (Q). All these actions involve commercial banks, either directly or as an intermediary, resulting in the increase in Deposits. Conversely, Deposits can be reduced by selling these items or terminating credit. Banknotes are not flexible and not under the control of the central bank and, therefore, not fit for the role of marginal funding liability. The amount of banknotes B is driven by demand from the general public and is not manageable by the central bank. In the same way, Capital is scarce and not fit for the role of marginal funding liability.

As the item Deposits from commercial banks is the marginal funding liability, the deposit rate acts as the central bank’s “marginal funding rate”⁴. The marginal funding rate is the rate that the central bank must pay as funding to obtain

4 This is different for non-shared assets of a National Central Bank in the Eurosystem, see annex.

additional assets. For example, if a central bank buys a government bond from a commercial bank for 100, that government bond will appear on the left-hand (asset) side of the balance sheet of the central bank. At the same time, on the right-hand (liability) side, the central bank creates a deposit of 100 for the commercial bank, being the money paid in return for the government bond. Altogether, this transaction implies that the central bank balance sheet has grown by 100 with the deposit rate being the additional funding cost.

The deposit rate is the marginal funding rate but also an important monetary policy rate. The Deposits for commercial banks and the deposit rate have key roles in the central bank's monetary policy implementation. The dual role of the Deposits to commercial banks is not a coincidence. As the central bank controls the size of the item Deposits from commercial banks and the deposit rate, it is an effective tool to manage the monetary stance and effectively drive commercial banks to adjust their own client interest rates⁵. In the same way, using the framework of this section, the internal departments of the central bank are charged the deposit rate as the funding rate for their assets (i.e. G, F, M, I). For instance the central bank investment team (balance sheet item "I") knows it has to generate its income on top of the deposit rate. In commercial banks, such an internal rate is sometimes also called a "funds transfer price". The relevant central bank department can show that it makes sufficient profit on the asset it manages, or it shows that the policy implementation is accompanied by lower profits or even losses.

6.3 The desired return for a central bank asset

In the previous subsections, we split the balance sheet into mini balance sheets. This allows for a practical formulation of the desired return per asset. First, I break down formula (4) into the various mini balance sheets. The formula for the four portfolios F, M, Q and I can be easily derived:

(5)

$$RoE_i C_i + r_D D_i + O_i = r_i \quad \text{for } i = F, M, Q, I$$

Here, the index i is the size of the FX portfolio (F), the Monetary credit portfolio (M), the Monetary bond portfolio (Q) or the Investment portfolio (I). This formula (5) describes the RoE_i for item i in terms of the allocated capital C_i , the amount of Deposits D_i used (with costs r_D) and the allocated operational costs O_i . The RoE of item i also depends on the (average) return r_i for asset category i . Here, $O = O_G + O_B + O_F + O_M + O_Q + O_I$ reflects a splitting of the operational costs of the central bank into those of the various activities, e.g. based on input from the central bank's internal Finance & Control department.

This formula (5) is more practical than formula (4) and allows for risk-based and cost-based management of the relevant assets. It is important that the central bank has a good way to allocate capital C_i based on the calculated risks, and costs O_i . For instance, if the central bank board decided to set a desired return RoE_i^* for the investment team running the investment portfolio, this would imply the following desired return r_i^* for the investment activities:

⁵ The exact importance of the deposit rate as a monetary policy rate depends on the operational framework of the central bank, see Bindseil (2014, 2016). In a supply-driven operational framework, the central bank actively manages the amount of liquidity (the Deposits) whereas in a demand-driven (corridor) framework, it allows commercial banks to take up the amount of Deposits they need.

(6)

$$r_I^* - r_D = (RoE_I^* - r_D) \frac{C_I}{I} + \frac{O_I}{I}$$

Here, the difference $r_I^* - r_D$ is the margin that should be earned in excess of the deposit rate r_D . Formula (6) is derived from (5) using $D_I = I - C_I$ and the asterisk indicates a desired level instead of the realised quantity. The same formula (6) could be used to calculate desired return levels for the FX portfolio (F), the Monetary credit portfolio (M) and the Monetary bond portfolio (Q), simply by exchanging the letter I for F, M or Q. However, given that M and Q, and perhaps F primarily serve a policy objective, formula (6) may not be directly applicable. Still, it may be insightful to calculate and understand the desired return levels from an RoE perspective (for F, M and Q).

Effectively, formula (6) suggests the desired 'profit margin' $r_I^* - r_D$ that the central bank's investment department should make on top of the deposit rate r_D in order to realise a profit corresponding to the amount of risk and making up for the costs. This is much like the way in which a commercial institution would calculate its desired rate of return for a business activity. From a risk and profitability perspective, all portfolios should get the same RoE^* , but due to the central bank's policy objectives, differentiation may be required.

The Investments item on the central bank's balance sheet can be managed in a similar way to a business item on a commercial bank's balance sheet. For the investment team, the marginal funding rate r_D is a given, being a key monetary policy rate. The RoE_I^* and C_I are set by the

central bank board or a mandated committee (e.g. the Risk Management Committee, see section 6.5), with C_I being the "risk budget" or the amount of risk that can be taken. The size of the invested portfolio I and the operational costs O_I are manageable by the investment team, within certain bandwidths. Together, these quantities dictate the profit margin $r_I^* - r_D$ that the investment team should make on its investments.

6.4 Using profitability considerations in the monetary portfolios

The Monetary credit portfolio and the Monetary bond portfolio are unique to the central bank but have many similarities to commercial bank activities. The Monetary credit portfolio resembles a commercial bank's portfolio of loans. The Monetary bond portfolio has similarities to a commercial bank bond portfolio. The important difference is that central banks manage these portfolios from a monetary policy viewpoint. Traditionally, the central bank board or monetary policy committee⁶ focuses on the key rates without paying much attention to the risks (represented by the allocated capital, C_M, C_Q), the costs (O_M, O_Q) and the resulting RoE. These latter quantities are merely accepted consequences of the monetary policy decisions. Formula (6), however, provides an opportunity to include profitability considerations in the Monetary credit and Monetary bond portfolios more explicitly.

Central banks are known to take other considerations into account in defining the monetary policy stance. Most central banks, for instance, use risk management considerations in their monetary policy, reducing the likelihood of

6 Or Governing Council in case of the Eurosystem. Henceforth I will use central bank board generically, as the governing body in charge of steering monetary policy.

losses by focusing on high-quality purchases and collateral. Nowadays, many central banks analyse the climate change impacts of their policies and attempt to reduce their ecological footprints. The Eurosystem is required by its mandate to support the general objectives of the European Union as long as they do not conflict with the primary mandate of price stability. Under this objective, the Eurosystem includes climate change considerations in its collateral framework and corporate bond purchases.

In the same vein, a central bank can also include profitability considerations in setting the monetary stance. The central bank could investigate which parameters allow for profitability considerations within the perimeter of the monetary stance. Some parameters are likely to be essential for monetary policy implementation and profitability cannot even be a minor consideration. The most important interest rate probably falls into this category. However, depending on the type of operational framework used, other parameters may be less prominent for the monetary policy stance and could be set with the inclusion of profitability considerations. The margin between the credit and deposit rates could fall into this category.

For instance in case the operational framework features a supply-driven implementation of commercial bank liquidity (the Deposits), the margin between credit and deposit rates (also, the interest rate corridor) is less important than in a demand-driven implementation, where the margin plays a role in managing the size of the commercial bank demand, see Bindseil (2014, 2016). Recently, the Governing Council of the ECB announced to adjust the operational framework from (de facto) supply-driven to one where commercial bank demand plays a more important

role, see ECB (2024b). As a result, there may be less room for profitability considerations in this new operational framework going forward.

With the introduction of QE, the deposit rate has been the key monetary parameter for many central banks in a de facto supply-driven operational framework. The large Monetary bond portfolios and Monetary credit programmes have given rise to high levels of overliquidity (extra deposits) on the central bank balance sheets. This has led to the deposit rate r_D becoming the main driver in the transmission to commercial bank client rates. The rate of return r_M on the portfolio Monetary credit to commercial banks became less prominent as a monetary parameter. As the margin between the credit and deposit rates, $r_M - r_D$, is a significant contributor to the central bank's profit, in such supply-driven operational framework, the credit rate r_M could be set with the inclusion of profitability considerations (using Formula (6)). With such a framework, the central bank could manage the monetary transmission with the appropriate policy rate (r_D), but it could also steer profits.

Of course, the central bank board should make sure that such margins do not end up too high and interfere with monetary policy transmission. In the end, monetary policy is the primary mandate and monetary considerations, financial stability etc. should receive priority. This is especially relevant in the case of operational frameworks where the amount of liquidity is allowed to depend on market demand and the interest rate margin (or corridor) is a parameter to steer that demand, see Bindseil (2014, 2016), which is the case for the Eurosystem going forward, see ECB (2024b). But even if profitability considerations are discarded due to the priority of monetary considerations, the central bank could

do so consciously, knowing the risks it takes and knowing the lower profitability it accepts. By using formula (6), the central bank risk department could show to the board the impact of its monetary policy decisions on profitability, possibly for many years (as in the case of long-term bond purchases under Quantitative Easing policies, for example).

In order to show that formula (6) can give reasonable outcomes, I apply it to the DNB situation over the year 2020 (DNB Annual Report (2020)). To simplify this exercise, I focus on the portfolio of Monetary credit to commercial banks and the interest rate risk that results from it:

- $M = 141.5$ bn (the size of the Monetary credit portfolio);
- $C_M = \text{EUR } 6.5$ bn (assuming allocated capital equals the reported risk figure and half of the interest rate risk of 13.0 bn is allocated to the Monetary credit portfolio);
- $O_M = \text{EUR } 210$ mn (assuming half of the DNB's staff and administrative costs of EUR 246+174 mn = EUR 420 mn are allocated to the Monetary bond portfolio);
- $r_D = -0.5\%$ (the Eurosystem Deposit Facility Rate at that time);
- $\text{RoE}_M^* = 5\%$ (for illustrative purposes, not actually the case for DNB at that time).

Then, using formula (6) with these numbers, we obtain what seems a reasonable figure:

$$r_M^* - r_D = (\text{RoE}_M^* - r_D) \frac{C_M}{M} + \frac{O_M}{M} = 5.5\% \times 0.046 + 0.0015 = 0.40\%$$

So, using these assumptions, this is the margin that would be desired between the deposit rate for banks and the lending rate for banks in order to cover costs and risks and to realise a 5% return on equity. This compares well with reality, as the actual margin at that time stood at 0.5% (with the

DFR at -0.5% and the MRO rate at 0%). I should stress that this calculation is purely indicative, i.e. to show that including costs and risks does not necessarily produce unreasonable parameters. The assumptions are rather high-level, especially for the allocated costs and risks associated with the Monetary credit portfolio of DNB at that time, as these are not specifically stated in the Annual Report.

6.5 Tools and governance

In order to deploy a framework like the one suggested in this study, the central bank risk department needs two important tools:

(1) An Asset and Liability Management (ALM) model is very welcome to project the central bank balance sheet and profitability into the future under different scenarios (Bakker et al. (2011)). With an ALM model, one can analyse the profitability impact of the balance sheet items that are not managed, such as gold, banknotes and possibly FX, minimum reserves, and the impact of the portfolio parameters that can be adjusted, such as the margin between deposits and lending to banks. Using a base case future scenario, it will produce an understanding of how the profitability develops under neutral circumstances. Changes to the base case allow for testing the sensitivity of the profitability to certain parameters and understanding stressed scenarios. See e.g. Broeders, Loman and van Toor (2019) for ways to design these. If the central bank board decides not to include profit margin considerations in the monetary policy settings, the ALM model can show the medium-term impact of these decisions. DNB uses its ALM model to communicate profitability expectations and risks to the public on (at least) an annual basis. In a recent letter, DNB informed the Minister of Finance of approximately EUR 9 bn in losses

over the years to come, due to the materialization of interest rate risk, see DNB (2022b).

(2) A risk model (e.g. Value-at-Risk or Expected Shortfall) is needed to estimate a risk number for each asset type. These risk numbers can be used to allocate capital amounts to each asset (C.). The risk model should estimate for each exposure the complete risk profile, including credit risk, interest rate risk (or duration risk) and market risk. More than one model may be needed for different risks. Such a model should use the desired risk quantile (e.g. 99 percentile, see Wessels and Broeders (2022a)) and differentiate between key characteristics of the assets, such as credit quality, market volatility and duration. A risk model is important in order to understand what the allocated capital is for each asset type, which again is needed to calculate the desired margin over the deposit rate via formula (6).

Both these tools, the ALM model and a risk model, are very common in a commercial bank environment, although not every central bank may have them yet.

In addition, the central bank should define a clear governance of how profitability considerations can (or cannot) be used. Both in case of the Eurosystem and DNB, a “Risk Management Committee” is responsible for assessing the risk profile and profitability outlook. Also in both cases, the committee is chaired by a senior manager independent from the monetary policy governance, and its members include risk management experts. The committee informs the decision-making bodies on the risk and profitability impact of policy measures under consideration. In this way profitability is explicitly considered when new measures are decided – whether it is included or not, it is done so consciously.

7 Discussion

The framework presented in this study can be seen as a toolbox. Not all tools have to be used, nor do all tools have to be used at the same time. Profitability considerations can be included in monetary portfolios without using an explicit RoE target. And an ALM model can be used to analyse future scenarios without aiming to improve profitability. Nevertheless, it is good practice to think about profitability and understand its drivers. Periods of low profitability should be anticipated and communicated to the public (see e.g. DNB (2022a)). Longer periods with losses will lead to lower capitalisation and need a plan to restore capital.

When a central bank decides to use the framework in this study, it is important to do so for a number of years. As central bank profitability can be volatile from year to year, it is not manageable to the same extent as the profitability of a commercial bank. Balance sheet items can be split into three categories:

- Items where profitability considerations cannot be included (such as gold and banknotes);
- Items that are necessary to execute the primary objective, but where profitability could be included as a secondary consideration (e.g. monetary portfolios); and
- Items where profitability is the primary objective (such as a central bank's own investments).

Contributions from category (1) to central bank profitability should simply be taken as a given. Category (2) can be steered (to some extent) but will not contribute in line with the RoE target every year due to primary objective considerations. Therefore, a single RoE target is useful at aggregate central bank level, but flexibility and patience are required in its use in

the various balance sheet items and over time. It may be practical to use different RoE targets for different balance sheet items in different years. In addition, the (expected) income from banknotes, minimum reserves and gold may justify lower RoE targets for category (2).

Not all central banks may be able or willing to use the framework. First, if capital and profitability are not a concern, the ideas in this study will not be helpful. But even if annual profits are relevant, it may seem like a lot of work with only little room for steering. Indeed, an important step is to analyse how much room for steering there is in the monetary portfolios. A significant improvement in profitability may come at the expense of a minor monetary impact. Some central banks may judge that any monetary impact, even a minor one, must prevail over profit considerations. This last point is especially relevant in a financial crisis situation, when quick and effective measures are necessary and financial compensation is not an argument. Finally, some central banks have limited influence on the monetary portfolio parameters, for instance those in the Eurosystem. For these central banks, it may not be worth the trouble attempting to steer profitability. Although it may still be useful to understand the drivers and analyse the future scenarios in order to timely inform the government and public about possible losses.

It is also important to note that losses incurred cannot be repaired with this framework. Due to the rising interest rates in recent years, many central banks face annual losses in the years to come. These losses are due to long-duration fixed-rate banking book exposures with low rates. Although it is useful to analyse scenarios and the impact of various decisions, there is no way to undo these losses, as the damage for the

central bank has already been done⁷. The central bank can analyse how long these losses will continue and use this in communication with the public. Using the framework of this study, it is also possible to estimate the risks of new bond purchases and understand the minimum margin desired from a profitability perspective.

⁷ Even though the QE exposures will lead to losses for a number of central banks, on the consolidated level of all public finances, government and central bank, the picture often looks more positive. Governments have benefited from the purchases of central banks with cheaper financing costs which are locked in for a long period. Therefore, the current central bank losses often directly correspond to lower costs for the government.

8 Conclusion

In this study, I argue that central bank profitability is important to ensure a healthy capital position in the future and maintain financial independence from the government. Central banks can steer profitability explicitly (to some extent) by including it as a consideration in the monetary portfolios. This may be feasible without losing monetary effectiveness. Return-on-equity (RoE) targets are widely used in the commercial banking sector and could also be used by central banks. A central bank is entitled to a fair profit margin for the banking transformation services it provides to the commercial banks. Central bank targets for RoE should be above the average GDP growth but below the target RoEs of commercial banks, typically 3-7% for many central banks.

The RoE target can be used to determine desired margins for asset classes, such as monetary credit to commercial banks. Steering profitability for a central bank requires a multi-year perspective, as policy implementation remains the primary objective. Tools such as risk models and ALM models are useful to allocate capital and understand the impact of balance sheet items that are not managed, such as gold and banknotes.

Many central banks worldwide are aware of the role of profits and the main drivers of profitability. Within the Eurosystem, (adverse) scenarios have been analysed for years to assess the sizes of buffers and the impact of rising interest rates (leading to years with losses). And recently, the ECB included the principle of “efficiency” explicitly in the updated operational framework, see ECB (2024b). Under this principle it is stated that a “financially sound balance sheet supports central bank independence” which should allow the use of profitability considerations. Also, DNB uses a risk budget (i.e. a part of the capital) that is specifically allocated to the investment portfolio.

However, both at DNB and within the Eurosystem, no explicit RoE targets are yet being used, to my knowledge.

With the significant losses that a number of central banks expect over the coming years as a result of the rising interest rates, it may become useful to start considering profitability more explicitly in the deployment of central bank policy. This study attempts to offer some guidance on that question.

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Annex: A national central bank in the Eurosystem

The balance sheet of a Eurosystem NCB

The balance sheets of national central banks (NCBs) in the Eurosystem are more complex than that shown in Table 1. NCBs in the Eurosystem have shared items, such as monetary credit for banks, banknotes and deposits from commercial banks. For these items, the aggregate amounts of the Eurosystem are allocated proportionally to the NCB, according to the Capital Key K_c of the Eurozone country. Items such as gold, the monetary government bond portfolio,

the FX portfolio and the Investment portfolio are specific to the NCB and not shared within the Eurosystem. As a result of this combination of shared and non-shared (national) items, the economic balance sheet⁸ of each NCB does not add up (i.e. total assets \neq total liabilities) and an additional balance sheet item is needed: the intrasystem claim or intrasystem liability, see Table 5. Every NCB has either a net intrasystem claim or a net intrasystem liability. All intrasystem claims and liabilities over the Eurosystem as a whole add up to zero.

Table 5 Typical items on the balance sheet of a national central bank (NCB) in the Eurosystem

For a number of items, income and costs are shared. For other items, they are for the account of the NCB. In order to close the economic balance sheet, each NCB has a net intrasystem claim or liability.

	Assets	Liabilities
Shared	Monetary credit to commercial banks Monetary bond portfolio (covered bonds, corporate bonds)	Banknotes in circulation Deposits from commercial banks
Not shared	Gold Monetary bond portfolio (government bonds) FX portfolio Investment portfolio <i>Intrasystem asset</i>	Revaluation reserves (RRs) Shareholder equity (SE) and provisions (GRP) <i>Intrasystem liability</i>

By analogy with a standalone central bank, the framework of this study can be directly applied by the Governing Council (GovC) of the ECB to steer the profitability of shared items of the Eurosystem such as Monetary credit to commercial banks and the Monetary covered bond and corporate bond portfolios. The item Deposits from commercial banks is the marginal funding liability, and the

corresponding rate, the Deposit Facility Rate (DFR), is the marginal funding rate r_D .

From the perspective of the NCB, steering profitability is more challenging, as large parts of the balance sheet are not under the direct control of the NCB board. In addition, the Monetary government bond portfolio⁹ also follows GovC

⁸ The economic balance sheet contains the exposures on which the NCB receives the returns and runs the risk, i.e. after allocating the shared items. As a result, the economic balance sheet differs from the accounting balance sheet which contains these items before sharing.

⁹ The Public Sector Purchase Programme (PSPP).

decision-making, although financial results and risks are not shared. As a result, the NCB can effectively only manage the profitability of its FX portfolio and the Investment portfolio (assuming gold is not actively managed).

The desired return on the NCB investment portfolio

For the NCB Investment portfolio, the formulas (5) and (6) change a little. The marginal funding liability for the NCB Investment portfolio is a combination of the Deposits from commercial banks and the intrasystem liability.

This can be understood as follows: when the NCB makes an investment in the Investment portfolio (e.g. by buying a EUR 10 mn bond from a commercial bank), a deposit is created in the item Deposits from commercial banks (a shared item, plus EUR 10 mn). The aggregate balance sheet of the Eurosystem has grown (by EUR 10 mn on both sides). This EUR 10 mn Deposit from commercial banks is shared within the Eurosystem and therefore only a small part (a percentage equal to the capital key K_C) is allocated to the NCB. The remainder of the new Deposit from commercial banks, a percentage equal to $(1-K_C)$, is allocated to the rest of the Eurosystem. As a result of this mechanism, the intrasystem liability of the NCB grows by $(1-K_C) * \text{EUR } 10 \text{ mn}$ in order to close the NCB's balance sheet. And the NCB marginal funding liability consists of the Deposits from commercial banks for a percentage K_C and of the Intrasystem liability for a percentage $(1-K_C)$ ¹⁰.

Within the Eurosystem these balance sheet items, Intrasystem liability and Intrasystem claim, are charged or remunerated at the Main Refinancing Operations (MRO) rate. This MRO rate is also the interest rate charged on the Monetary credit to commercial banks (r_M) and is currently significantly higher than the deposit facility rate (DFR, or r_D) paid on the Deposits from commercial banks. As a result, for each investment I the NCB has the following balance between costs and income:

(7)

$$RoE_I C_I + r_D K_C (I - C_I) + r_M (1 - K_C) (I - C_I) + O_I = r_I I$$

Which is a little more complicated than formula (5). The first term on the left-hand side, $RoE_I C_I$, is still the capital contributing to the funding of I . For the part not funded by capital, $I - C_I$, the marginal funding liability is used. The second term, $r_D K_C (I - C_I)$, is the cost of the Deposits of commercial banks directly allocated to the NCB. The third term, $r_M (1 - K_C) (I - C_I)$, is the cost of the intrasystem liability. Next, I define the following rate r_{NCB}

(8)

$$r_{NCB} = K_C r_D + (1 - K_C) r_M$$

This rate r_{NCB} acts as the 'effective marginal funding rate' for the non-shared Investment portfolio of the NCB. And formula (7) reduces to formula (5) with the only difference that r_D is replaced with r_{NCB} .

¹⁰ As a side remark, this mechanism also has the peculiar effect that when the NCB of a country A buys a bond of EUR 10 mn for its Investment portfolio, the balance sheets of all other NCBs (not related to this transaction) also grow by $K_{CX} * \text{EUR } 10 \text{ mn}$, i.e. on the liability side in the item Deposits from commercial banks and on the asset side in the item intrasystem claim. Here K_{CX} is the capital key of the other NCB X. As the intrasystem claim (r_M) is remunerated at a higher rate than the Deposits from commercial banks (r_D), this implies that the other NCB X receives income $(r_M - r_D) K_{CX} * \text{EUR } 10 \text{ mn}$ on the investment of the NCB of country A. Conversely, if the NCB of A divests, the opposite happens and NCB X loses income.

(9)

$$RoE_I C_I + r_{NCB} (I - C_I) + O_I = r_I I$$

Then, the desired return r_I^* for the NCB Investment portfolio is

(10)

$$r_I^* - r_{NCB} = (RoE_I^* - r_{NCB}) \frac{C_I}{I} + \frac{O_I}{I}$$

Where again RoE_I^* is the desired RoE_I for the NCB Investment portfolio.

Here we can see a peculiar effect: the effective marginal funding rate for the NCB Investment portfolio r_{NCB} depends on the capital key K_C and therefore differs between NCBs. At the start of 2024¹¹, a large NCB such as the Bundesbank (K_C is 26.6%) has an effective marginal funding rate of 4.37%, while the central bank of Malta (K_C is 0.13%) has 4.50% (effectively, the MRO rate). DNB has a K_C of 5.91% and an effective marginal funding rate of 4.47%. This variety in effective funding rates across the Eurozone NCBs is not very large, but with a large (multibillion) investment portfolio it will have a measurable impact. These differences are due to the fact that the Deposits from commercial banks (being the marginal funding liability for the entire Eurosystem) are remunerated differently from the intrasystem liabilities and claims.

¹¹ At the start of 2024, the MRO rate is 4.50% and the DFR is 4.00%.

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