

Central bank capital management

Citation for published version (APA):

Wessels, P., & Broeders, D. (2023). Central bank capital management. *Journal of Risk Management in Financial Institutions*, 16(3), 304-315.

Document status and date:

Published: 01/01/2023

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Received (in revised form): 23rd February, 2023

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Abstract This paper offers general guidelines for central bank capital management. Capital adequacy is important to be a credible, independent monetary authority over a medium-term horizon. Central banks, however, face several challenges in determining their capital adequacy. Firstly, the amount of capital only plays an auxiliary role in central banks' effectiveness given that they cannot default as long as they have the right to issue legal tender. Secondly, central banks face two types of financial risks: calculable risks from current exposures and latent risks from future exposures. These latent risks, in particular, are difficult to quantify because they stem from contingent policy measures such as quantitative easing and lending of last resort. It is argued that a central bank's target level of capital (1) can be calibrated with a confidence level that is lower than that used for commercial banks and (2) takes latent risks into account that are related to GDP or the size of the financial sector in the economy.

Keywords: *capital, capital management, central banks, latent risks, risk management*

INTRODUCTION¹

Central banks are national authorities with a specific mandate to serve society.² By construction, there is only one central bank in each jurisdiction, and it operates under national laws and with its own statutes. A central bank typically focuses on price stability or on exchange rate stability. Other primary or secondary objectives are, however, also possible, such as employment or financial stability. Under their mandates they typically perform a number of tasks such as issuing fiat money, facilitating payments, executing monetary policy and acting as a lender of last resort. Often central banks also manage

part of the national reserves and hold significant amounts of securities denominated in foreign currency for the purpose of monetary policy interventions. Lending and deposit-taking are the normal operations for central banks *vis-à-vis* commercial banks, to create or absorb liquidity.

In all these operations, central banks accept financial risks, and capital acts as a buffer to absorb these risks. An interesting question, explored in this paper, is how much capital is considered adequate for a central bank. The answer is not straightforward. Central banks are not regulated and there

is little consensus on the minimum amount of capital they need. On the one hand a low capital could be considered sufficient. Central banks have the support of the government, and with their control over the currency, they cannot default. On the other hand, the financial risks of a central bank can be large. Adequate capital is desirable to operate independently from the government and to be credible as a monetary authority. In addition, the financial risks can increase significantly in times of crisis when the central bank takes on new exposures. These additional risks will be referred to as latent risks.

To answer the question, a financial risk management approach will be followed. By exploring the differences between central banks and commercial banks, the capital adequacy for central banks can be based on a confidence level that is lower than the 99.9 per cent used in solvency regulation for commercial banks. However, it is also argued that central banks at the same time should take latent risks into account. The magnitude of these latent risks is related to macroeconomic variables such as gross domestic product (GDP) or the size of the financial sector. Finally, general guidelines are proposed for central bank capital management that are applicable to different types of central banks. These guidelines include the distribution of profits to the government in order to ensure adequate capital in the future. The specific characteristics of a central bank appear in the analysis of the latent risks it is exposed to.

THE IMPORTANCE OF CENTRAL BANK CAPITAL

Central banks should be able to absorb losses — up to a reasonable level — with adequate capital in a stand-alone capacity for the following two main reasons.³ Firstly, adequate capital supports central banks' independence, which is generally accepted as a necessary requirement for a central bank to be effective in executing monetary policy: see, for instance, de Haan and Eijffinger.⁴ Independence is also supported by the legal framework.⁵ The European Central Bank (ECB) distinguishes four types of independence: functional, institutional,

personal and financial.⁶ Financial independence implies that the central bank generates sufficient income to cover costs and to ensure adequate capital over the medium-term horizon (ie 5–10 years). Cukierman argues that a positive amount of capital is a form of insurance against political interference and that a negative capital might jeopardise a central bank's ability to choose its policy independently.⁷ Beyond the medium-term horizon, independence, however, is not absolute as the central bank is subject to democratic authorities controlling legislation, ie the government and parliament. Secondly, adequate capital supports central banks in being credible as a monetary authority. Credibility is essential as consumers need to trust that money holds its value.⁸ A central bank is credible if it is perceived to be able to deploy the necessary strength in executing its monetary operations, especially in exceptional economic circumstances, when more risk taking via additional measures is needed.

It could also be argued that a central bank does not have to focus too much on adequate capital for several reasons. Firstly, a central bank cannot default as it, in theory, can always meet its liabilities by printing money. The practice of printing money to cover liabilities is, however, unsustainable and there is also a limit to how high the demand for liquidity can be.⁹ An excessive supply of liquidity by a central bank affects interest rates and inflation in a way that is inconsistent with the central bank's objective. Printing money will jeopardise public confidence in the central bank. In this context it is good to note that the ultimate risk for a central bank is not financial insolvency but 'policy insolvency', ie not able to meet its policy objectives.¹⁰ Secondly, the government offers (implicit) support to the central bank. This works if financial markets and the public have trust in the government and the strength of the national economy. And indeed, some central banks operate normally with a negative capital.¹¹ However, the central bank in such a situation relies implicitly on the strength of the government and is therefore not independent. In addition, there may be limits to what it can achieve on its own. Thirdly, seigniorage provides future income for the central bank.¹² However, seigniorage is uncertain and depends on the applicable monetary policy moving forward. In

adverse scenarios seigniorage may be low for a long time or even negative for a number of years.

Therefore, seigniorage does not have the same loss-absorbing capacity as capital has.

Central bank capital management will receive significant attention over the coming years as many central banks face substantial losses following rising interest rates in response to higher inflation.¹³ In case of prolonged and sizeable losses, a recapitalisation may be necessary: see for instance, Stella and Buiter.¹⁴ Both authors argue that a weak central bank balance sheet invariably leads to chronic losses, an abandonment of price stability as the main objective and a decline in operational independence. Nordström and Vredin note that low or even negative capital does not limit the scope of monetary policy, at least not in the short term.¹⁵ However, if the central bank is unable to cover its costs and maintain sufficient financial buffers over a medium to long term, it may need to be recapitalised.

CALCULABLE VERSUS LATENT RISKS

A logical starting point in capital management is that a central bank requires adequate capital to be able to cover the financial risks of its monetary policy implementation in a stand-alone capacity.¹⁶ The differences between two types of financial risks are distinguished here: calculable risks and latent risks. Calculable risks are all financial risks based on the *current* exposures and can therefore be estimated with market practice risk models and metrics (such as Value at Risk or Expected Shortfall). The main financial risks for a central bank are market risk, exchange rate risk, credit risk and interest rate risk.

Gold holdings carry significant market risk. In lending to commercial banks a central bank accepts credit risk; however, these lending operations are collateralised to reduce this risk. In their reserve portfolios, central banks typically focus on securities of high credit quality, although equities and high-yield bonds can constitute a part of the portfolio, leading to market risk and credit risk exposures. The FX portfolio and the reserve portfolio contain exchange rate risk. In quantitative easing (QE) programmes central banks typically also focus on high-quality paper such as government bonds and

investment grade corporate bonds to limit credit risk. In addition to these risks, a central bank is also exposed to interest rate risk that is embedded in the duration mismatch between assets and liabilities.

This mismatch originates from the fact that the values of both assets and liabilities are, to varying degrees, sensitive to changes in interest rates. Currently, for many central banks, the duration of assets is longer than that of the liabilities due to QE. Such a positive duration gap means that central banks suffer losses if interest rates rise.

In addition to calculable risks, a central bank is also exposed to latent risks. Latent risks are financial risks from *future* exposures that the central bank needs to accept under its mandate: see also Archer and Moser-Boehm.¹⁷ Latent risks transform into calculable risks when policy measures, such as lending of last resort, QE programmes or currency interventions, are deployed. The argument is that, in its capital management, a central bank should take latent risks into account, at least to a reasonable extent. The challenge with latent risks is that it is *a priori* unknown where they originate, when they emerge and how large they may be. Therefore, quantifying latent risks is harder than for the calculable risks. Two approaches to assess latent risks are long-term historical analyses and scenario analyses.

The first way to gain insight into the latent risks is by analysing the historical evolution of a central bank's balance sheets and risks. As the latent risks emerge during crises and economic downturns, the comparison between the good and bad economic periods gives an indication of the historical size of latent risks compared to the on-balance sheet risks. As an example, Figure 1 shows the evolution of calculable risks and capital of the Dutch central bank (De Nederlandsche Bank) from 2002 to 2021. Notice that capital grows steadily over time. By contrast the calculable risks change abruptly in some periods. The years 2012 (announcement of Outright Monetary Transactions (OMT)), 2015 (start of Asset Purchase Programme, APP) and 2020 (start of Pandemic Emergency Purchase Programme, PEPP) show the largest change in calculable risks. This erratic risk behaviour is a key property of a central bank's balance sheet and therefore its capital policy should be robust and be able to accommodate a wide

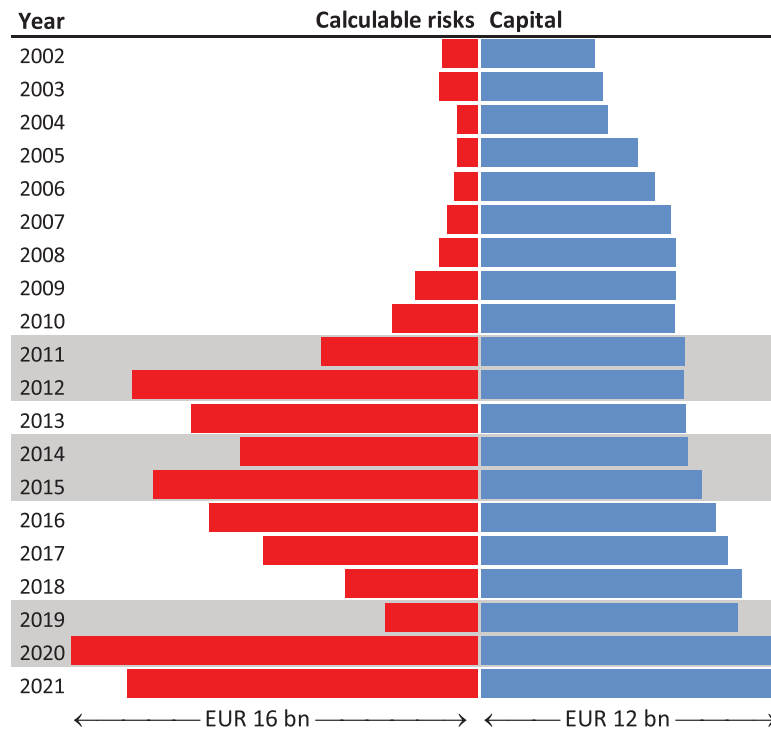


Figure 1: Calculable risks and capital of the Dutch central bank from 2002 to 2021. Capital is the sum of shareholder equity and a General Reserve Fund. The impact of the latent risks appears in the sudden surges in the calculable risks. Updated and taken from DNB (2018)¹⁸

range of states of the economy. If a sufficiently long historical record of risk measurement is available, this gives a first indication of the size of latent risks. Nevertheless, the origin, nature, size and impact of a new crisis will probably differ from previous crises. Analysing the historical profile of calculable risks can only give a limited view of the size and nature of latent risks.

A complementary approach to assess latent risks, therefore, is scenario analysis: see, for example, Broeders, Loman and van Toor.¹⁹ Scenarios have a forward-looking character and can be developed for extreme events leading to additional exposures and therefore latent risks on the balance sheet. A good starting point for these scenarios are the financial stability reports from the International Monetary Fund (IMF), Bank for International Settlements (BIS) and, often, a central bank itself. The main tools for scenario analysis are stress tests and reverse stress tests. A stress test gives insights into the vulnerabilities to specific scenarios for the risk factors. It is a sensitivity analysis. Reverse stress tests

help central banks to identify their core vulnerabilities. Reverse stress testing aims to find combinations of risk factors that yield a particular crucial loss level.

A recent development in central bank risk management is the acknowledgement of climate change related risks as a source of financial risk. Central banks are exposed to climate change through their asset purchase programmes, credit operations and reserve portfolios. Risk assessments in this case are challenging because climate change is surrounded by fundamental uncertainty: see Broeders and Schlooz.²⁰ Nevertheless scenario analysis is also a useful tool here.

THE UNDERLYING DRIVERS OF LATENT RISKS

Although the root cause and size of latent risks are unknown, it is argued that they are connected to macroeconomic variables. The core variable for a central bank is the amount of liquidity it can inject

into the financial system. A central bank can explore in its capital management how this amount relates to the GDP of the country along several dimensions. Firstly, QE policies use the available instruments in financial markets. A QE government bond programme is therefore limited by the size of the outstanding government paper, which in turn may be related to GDP via GDP-to-debt ratios.

Therefore, the latent risks of a QE government bond programme are indirectly proportional to the size of the economy. Secondly, FX reserves used for interventions typically grow with the available money supply in order to be effective in a currency crisis. Here, too, money supply is connected to the size of the economy. Hence, the latent risks from FX reserves may be implicitly connected to GDP as well. Third, the central bank acts as the lender of last resort *vis-à-vis* the banking sector. The aggregate size of the national banking sector is related to its lending to the real economy, which is again related to GDP. Therefore, the latent risks related to this role are proportional to the size of the banking sector.

It is noted that the connections between latent risks and macroeconomic variables are indirect and ignore important aspects of the actual underlying risks. For instance, debt-to-GDP levels or the relative size of the financial sector vary across countries. Also, assuming that the latent risks of lending of last resort are proportional to the size of the banking sector, the role of buffers in the banking sector is ignored. After the Great Financial Crisis these buffers have increased significantly and consequently reduced the underlying latent risks of a banking liquidity crisis. Nevertheless, it seems reasonable that the order of magnitude of the latent risks is related to these macroeconomic variables.

An interesting question is whether central bank interventions change the size of the latent risks, for instance, the central bank's exposure to interest rate risk. On the one hand, a successful central bank intervention in a crisis may reduce the likelihood of the crisis accelerating. On the other hand, an excessively flexible or lenient policy may lead to moral hazard in the economy, contributing to the emergence of a new crisis in which the central bank absorbs even more risks.²¹ Since there is no clear indication of the correlation between central bank interventions and the size of the latent risks, it is

assumed that the latent risks do not change due to a central bank's policy actions. Furthermore, central bank (monetary) policy measures are driven by inflation and economic considerations, and not by the impact of this policy on the central bank's own risks and profits. The latter are generally considered as consequences, positive or negative, that simply need to be accepted.

THE CAPITALISATION OF A CENTRAL BANK

In its capital management a central bank can define a capital target. There is, however, little consensus among central banks on the size of the capital target versus the level of financial risks. As a reference point, the role of capital for central banks is compared to its role for commercial banks and the key differences are focused on in Table 1.

Capital for central banks covers both calculable and latent risks. Central banks take on new exposures when policy demands it, regardless of the level of capital available. For commercial banks, risks of existing exposures can increase due to market dynamics, but commercial banks will typically not take on new exposures when capital is short. The goals also differ. For a central bank, capital contributes to independence and credibility over the medium term, whereas for a commercial bank the main goal is to protect its depositors and debt investors. The importance of capital for central banks is auxiliary. For commercial banks it is crucial. Therefore, it can be argued that central banks can operate with a lower amount of capital than commercial banks. In an extreme scenario of massive financial losses, a commercial bank defaults. In the same scenario, a central bank can end up with negative capital but in principle continues to operate. The impact of such an extreme scenario is therefore less existential for a central bank than for a commercial bank. The government and the central bank operate together in a recovery plan for strengthening the central bank balance sheet again.

It is argued that a central bank's target level of capital can be calibrated with a confidence level that is lower than that used for commercial banks. Commercial banks are (roughly speaking) required to maintain a capitalisation that covers the financial risks with the

Table 1: A comparison of the role of capital for central banks and for commercial banks

Capital	Central banks	Commercial banks
Role	Buffer for calculable risks and latent risks	Buffer mainly for calculable risks
Goal	Ensure independence and credibility over the medium term	Protection of the bank's depositors and debt investors
Importance to goal	Auxiliary	High
Affect on public trust	Indirect, with implicit government support	Direct, as trust is fragile
Confidence level	No formal requirements; coverage can be eg at a 99% confidence level	Formal regulatory requirements based on a 99.9% confidence level
Required size	Capital target related to calculable risks and taking into account latent risks; eg proportional to GDP	Directly based on calculable risks
Minimum level	Sometimes self-imposed	Yes, regulatory
Preferred development over time	Target grows gradually with GDP; actual capital can be temporarily below target; <i>ad hoc</i> measures may be needed (eg recapitalisation)	Capital above minimum with a margin; <i>ad hoc</i> measures may be needed (eg new shares issuance)

99.9 per cent confidence level over a one-year horizon. For central banks, there is no such regulatory minimum level. And as the relationship of the target level of capital with the objectives of independence and credibility is indirect, a central bank may work with a lower confidence level of, for example, 99 per cent.²² Central banks sometimes self-impose a minimum level of capital. For commercial banks the minimum is imposed by regulation.

Central bank capital is directly related to dividend policy. Typically, a profit distribution scheme specifies which part of the central bank's profits are retained and which part is transferred to the shareholder in the form of dividends. It seems reasonable and optimal for a central bank to pay out dividends only when they are not needed for capital growth, for instance, in line with GDP growth. Contrarily, the shareholder may prefer to receive stable and predictable dividends from the central bank. This, however, is difficult to accomplish as a central bank's annual profits are volatile, hard to predict and sometimes fully necessary to restore its capitalisation.

SCENARIO ANALYSIS

In this section, an example of balance sheet risk calculations is presented, and the size of calculable

risks and latent risks that could be the basis for determining a target capital is estimated, starting by assuming a balance sheet without taking the latent exposures into account and determining the size of the calculable risks embedded in the balance sheet relative to the available capital. Thereafter the example is expanded by incorporating latent risks.

The central bank has a stylised economic balance sheet as shown in Table 2.²³ The assets consist of gold (G), collateralised credit operations with commercial banks (C), a QE programme with default-free bonds in the local currency (B), and an intervention portfolio with bonds in foreign currency (F). On the liability side are banknotes (N) and deposits from commercial banks (D). Available capital (E) is the residual of all other balance sheet items, ie

$$E = G + C + B + F - (N + D).$$

The first step is to quantify calculable risks. It is assumed that the central bank is exposed to four sources of risk: gold price risk, credit risk, currency risk and interest rate risk. The calculable risk (γ) for the first three risk sources is derived in the following way:

$$\text{Gold price risk: } \gamma_G = \varepsilon_G G$$

$$\text{Credit risk: } \gamma_C = \varepsilon_C C$$

$$\text{Currency risk: } \gamma_F = \varepsilon_F F.$$

Table 2: Initial central bank economic balance sheet

Assets		Liabilities	
Gold (G)	10	Banknotes in circulation (N)	20
Credit to commercial banks (duration 3 years) (C)	30	Deposits from commercial banks (duration 0 year) (D)	60
QE portfolio (duration 7 years) (B)	50	Capital (E)	20
FX portfolio (duration 1 year) (F)	10		
Total assets	100	Total liabilities	100

Where ε represents the risk weight or an extreme, instantaneous shock in the risk factor.²⁴ These risk weights can be calibrated on historical data on a specific confidence level α , for example 99 per cent on a one-year horizon. For credit risk, the size of the shock depends on the credit risk of the counterparties and that of the posted collateral. However, for the sake of simplicity, it is assumed that the net economic exposure can be captured by a single risk factor. For interest rate risk, the impact of an instantaneous interest rate shock Δi depends on the size and durations of the credit to commercial banks, the QE portfolio, the FX portfolio and the deposits of commercial banks:²⁵

Interest rate risk: $\gamma_R = \Delta i (dur_C C + dur_B B + dur_F F - dur_D D)$.

To aggregate the four calculable risks into a total calculable risk figure Y the following formula is used:

$$Y = (\gamma' \Sigma \gamma)^{\frac{1}{2}}$$

where $\gamma = [\gamma_G, \gamma_C, \gamma_F, \gamma_R]$ is the vector of calculable risks and Σ the correlation matrix of the risk factors.

The size of the calculable risks is quantified using the numerical example in Table 2. Assume the following arbitrarily chosen risk weights $\varepsilon_G = 0.30$, $\varepsilon_C = 0.20$ and $\varepsilon_F = 0.25$ while the shock in the interest rate risk factor is an increase in interest rates of 100 basis points (or $\Delta i = 0.01$). The calculable gold price risk, credit and currency risk are 3.0, 2.5 and 6.0, respectively. The calculable interest rate risk is $\gamma_R = 0.01 (3 \times 30 + 7 \times 50 + 1 \times 10 - 0 \times 60) = 4.5$.

Assuming that all risk factors are uncorrelated (ie Σ is an identity matrix), the total calculable risk amounts to $Y = \sqrt{3.0^2 + 2.5^2 + 6.0^2 + 4.5^2} = 8.5$. This means that, in an extreme scenario, the central bank loses 8.5 on its available capital. Since the available capital is 20, the central bank can absorb the calculable risks.

The second step is to quantify latent risks using scenario analyses. It is assumed that these latent risks can be approximated by a volume effect on the central bank's balance sheet. Three examples of latent risks are assessed.

Scenario 1: A significant expansion of the strategic gold holdings. To assess the latent risks it is assumed that the central bank purchases 5 in gold by creating commercial bank deposits. These changes lead to a higher gold risk of $\gamma_G = 0.30 \times 15 = 4.5$. The total risk amounts to $Y = \sqrt{4.5^2 + 2.5^2 + 6.0^2 + 11.5^2} = 9.1$. The difference in total risk ($9.1 - 8.5 = 0.6$) is a measure of the latent gold risk embedded in the expansion of the strategic gold portfolio.

Scenario 2: A significant expansion of the QE programme to steer inflation. To assess the latent risks it is assumed that the QE portfolio triples in size from 50 to 150 through the purchases of government bonds. This assumption could be linked to the size of the outstanding government debt. The central bank finances this balance sheet expansion by simultaneously creating commercial bank deposits. These changes lead to a higher interest rate risk of $\gamma_R = 0.01 \times (3 \times 30 + 7 \times 150 + 1 \times 10 - 0 \times 160) = 11.5$. The total risk amounts to $Y = \sqrt{3.0^2 + 2.5^2 + 6.0^2 + 11.5^2} = 13.5$. The difference in total risk ($13.5 - 8.5 = 5.1$) is a measure of the latent interest rate risks embedded in the expansion of the QE programme.

Scenario 3: A sharp increase in FX purchases to steer exchange rates. It is assumed that, in an extreme scenario, the central bank quintuples its FX portfolio from 10 to 50 to influence the exchange rate by creating 40 extra in commercial bank deposits. After the intervention exchange rate risk that increases from 2.5 to 12.5. In this scenario total risks will be 15.0 and latent FX risks 6.6.

Scenario 4: A surge in the liquidity provision to the commercial banking sector. It is assumed that credit to commercial banks increases by a factor of four. The

Table 3: Assessment of calculable and latent risks

			Scenario 1	Scenario 2	Scenario 3	Scenario 4
		Initial balance sheet	Gold purchases	QE programme	FX purchases	Liquidity provision
Risk source	Risk weight (ϵ_i)	Calculable risk (y_i)	Calculable risk (y_i)	Calculable risk (y_i)	Calculable risk (y_i)	Calculable risk (y_i)
Gold price risk	30.0%	3.0	4.5	3.0	3.0	3.0
Exchange rate risk	25.0%	2.5	2.5	2.5	12.5	2.5
Credit risk	20.0%	6.0	6.0	6.0	6.0	24.0
Interest rate risk	100 bps	4.5	11.5	11.5	4.9	7.2
Total risk ($Y = (\sum y_i^2)^{1/2}$)		8.5	9.1	13.5	15.0	25.4
Latent risk ($Y' - Y$)			0.6	5.1	6.6	16.9

central bank funds this additional credit by simultaneously increasing the commercial banks' deposits on the liability side of its balance sheet. Compared to the initial balance sheet, this operation affects both credit risk (that surges from 6.0 to 24.0) and interest rate risk (from 4.5 to 7.2). The total risks now amount to 25.4 and reveal substantial latent risks of 16.9. The central bank has sufficient available capital in relation to the latent risks in Scenarios 1, 2 and 3. However, the latent risks in Scenario 4 would increase the central bank's total risks in excess of its available capital. Table 3 summarises the main features of the analysis.

A CLOSER LOOK AT CAPITAL

So far, the word 'capital' has been used as a generic term for describing a central bank's buffer that is available to absorb losses on a stand-alone basis. In practice, various kinds of buffers are observed. The main form of capital that provides unlimited loss-absorbing capacity is shareholder equity, ie statutory capital plus retained earnings. A General Reserve Fund (GRF) is also a buffer providing unlimited loss-absorbing capacity. Central banks often have the possibility of accruing such a GRF. It acts in a similar way to capital in that it absorbs financial losses. Additions to and withdrawals from a GRF are typically under the control of the central bank itself. In this way, a GRF provides further independence compared to retained earnings, on which shareholder approval is usually needed. These and other elements of capital policy should be made

public in a way that can be easily understood by stakeholders and the public. After all, central bank capital is public money.

It is argued that other forms of buffers do not have features comparable to shareholder equity and a GRF. Some central banks have revaluation reserves for specific assets. Because revaluation reserves are only available to absorb losses on specific assets, their use as a general buffer is limited. Only when the asset is sold or reaches maturity is the revaluation reserve released.

Future profits or seigniorage cannot be treated as capital either. Seigniorage is uncertain and depends on monetary policy. If monetary policy demands it, seigniorage may be low for a long time or even negative for a number of years. Similarly, a government guarantee is also not equivalent to shareholder equity or a GRF. A significant loss under the guarantee will trigger a process between the central bank and the government to establish the size and timing of a payment under the guarantee. An actual transfer of resources from the treasury to the central bank usually requires legislative approval. By definition, the central bank is not financially independent in such a situation. Furthermore, Stella and Lonnberg show that even in cases where the treasury is responsible for maintaining the central bank financially strong, it may choose to do so in a cosmetic fashion,²⁶ for instance by providing the central bank with a deferred asset which is to be paid out of the central bank's own retained earnings. As it is the role of capital to provide unconditional loss-absorbing capacity on a *stand-alone* basis, a

government guarantee is not the most effective instrument.²⁷

A central bank that is part of a currency union, such as the Eurosystem, benefits from the collective strength of the system but still needs adequate capital to be independent from its government. Although the collective central banks in the currency union provide implicit support, the control of an individual central bank over its risks is lower than for a stand-alone central bank. In addition, every individual central bank should contribute to an adequate capitalisation of the union on an aggregate basis.

GUIDELINES FOR CENTRAL BANK CAPITAL MANAGEMENT

In this section, the key findings from the previous sections are translated into a set of guidelines that can serve as a basis for central bank capital management.

Guideline 1:

A central bank's capital policy has a target capital level that may correspond to a lower confidence level than the Basel capital requirements for commercial banks.

A central bank cannot default on its own currency. Therefore, a central bank's capital is auxiliary in ensuring stand-alone effectiveness, independently of the government. In contrast to the Basel requirements for commercial banks, the central bank's capital target may cover the financial risks with a lower level of confidence, eg 99 per cent on a one-year horizon.

Guideline 2:

A central bank's capital policy is based on an assessment of financial risks, covering both calculable risks and latent risks.

A central bank needs adequate capital in order to absorb the financial risks in a stand-alone capacity. In doing so, a central bank can use the risk management concepts and risk metrics that are best practice for commercial banks to assess calculable risks. An important difference as compared to commercial banks is that central banks are exposed to latent risks in addition to calculable financial risks.

The central bank capital policy should take these latent risks into account. Historical analyses and scenario analyses can give an indication of the order of magnitude of these latent risks.

Guideline 3:

A central bank's capital policy has a target capital level that is stable relative to the key macroeconomic variables and sustainable for a long term.

A central bank's calculable risks can be erratic over time due to the transformation of latent risks into calculable risks. Latent risks are likely to be proportional to macro developments such as GDP and the size of the banking sector. A capital target based on, for example, nominal GDP and calibrated conservatively may cover the calculable risks and latent risks to a large extent.

Guideline 4:

A central bank's capital policy focuses on buffers that are directly and unconditionally available to absorb losses.

The loss-absorbing capital should not be subject to any conditions specifying what losses can be absorbed. In addition to shareholder equity, a general reserve fund can be part of capital provided it has a wide-ranging loss-absorbing capacity for a broad range of assets and risk types. Revaluation reserves for specific types of assets and guarantees from the government are not equivalent substitutes for shareholder equity and a GRF.

Guideline 5:

A central bank's capital policy relies on the central bank's own profitability for capital growth.

The central bank should use its annual profit as the source of capital growth. If the annual profit is insufficient to achieve the capital target, the central bank should be allowed to make this up in later years. Capital which is temporarily below its target level is not problematic as long as recovery is feasible in the medium term (five to ten years). Full retention of annual profit should be undisputed if necessary to strengthen capital. Excess profits, when the capital target is reached, should be paid out to the shareholder in the form of dividends.

Guideline 6:

A central bank's capital policy is robust and objective.

As both annual profits and calculable risks show erratic behaviour, a central bank's capital policy should be robust and be able to accommodate a wide range of states of the economy, from good to bad. Defining a capital target and linking it to GDP creates objectivity. The impact of short-term developments such as losses or sharp increases in calculable risks to capital should be clear and undisputed, preferably based on pre-defined, objective criteria, with limited discretion.

Guideline 7:

A central bank's capital policy is simple and transparent.

The capital policy should be made public in a way that can be easily understood by stakeholders and the public. Every year the central bank should explain how capital is growing in relation to the target and the calculable risks. The effectiveness of the capital policy could be evaluated and published on a regular basis, for instance every five years.

These general guidelines are a starting point. How they work out in practice depends on the specific situation of a central bank.²⁸ For instance, Bell *et al.* show that the timing, size and volatility of reported profits and losses and dividend payments depend on three mechanisms: accounting approach, income recognition and distribution rules and risk transfer agreements with the fiscal authority.²⁹ Furthermore, the political economy dynamics may influence a central bank's capital management.

CONCLUSION

Central bank capital management is important in order to be effective as a monetary authority, independently of the government. In this context, it is argued that central banks face several challenges in determining their capital adequacy. First, the role of capital is different compared to commercial banks, where it is essential for solvency. For central banks capital plays an indirect, auxiliary role contributing to independence and credibility. Nonetheless adequate capital is necessary to maintain confidence that the central bank is effective in implementing

monetary policy and able to absorb the corresponding financial risks on a stand-alone basis, independently of the government. Secondly, different from commercial banks, central banks face 'latent risks' in addition to the calculable financial risks from current exposures. These latent risks are financial risks from future exposures that the central bank must accept under its mandate if needed. The size of these latent risks is proportional to, for instance, GDP or the size of the banking sector. It is argued that a central bank's target level of capital can be calibrated with a confidence level that is lower than that used for commercial banks due to the absence of default risk, yet, at the same time, should take into account latent risks. A set of guidelines is proposed to develop such a central bank capital policy.

References and notes

- 1 An extended version of this paper can be found in Wessels, P. and Broeders, D. (2022) 'On the Capitalisation of Central Banks', DNB Occasional Studies, Vol. 20–4.
- 2 Reis, R. (2013) 'Central Bank Design', *Journal of Economic Perspectives*, Vol. 27, No. 4, pp. 17–43.
- 3 Archer, D. and Moser-Boehm, P. (2013) 'Central Bank Finances', BIS Papers, No. 71.
- 4 Haan, J. de and Eijffinger, S. (2019) 'The Politics of Central Bank Independence', in Congleton, R. D., Grofman, B. and Voigt, S. (eds), 'The Oxford Handbook of Public Choice, Volume 2', Oxford University Press, Oxford.
- 5 For instance, in the case of the Eurosystem, Article 7 of the 'Protocol on the statute of the European system of central banks and of the European central bank', deals with the independence (2002) European Central Bank, available at https://www.ecb.europa.eu/ecb/pdf/orga/escbstatutes_en.pdf (accessed 13th March, 2023).
- 6 See ECB Convergence Report, June 2022.
- 7 Cukierman, A. (2011) 'Central Bank Finances and Independence: How Much Capital Should a CB Have?', in Milton, S. and Sinclair, P. (eds), 'The Capital Needs of Central Banks', Routledge, pp. 33–46.

- 8 Braun, B. (2016) 'Speaking to the People? Money, Trust, and Central Bank Legitimacy in the Age of Quantitative Easing', *Review of International Political Economy*, Vol. 23, No. 6, pp. 1064–92.
- 9 Ricardo, R. (2013) 'The Mystique Surrounding the Central Bank's Balance Sheet, Applied to the EUROPEAN Crisis', *American Economic Review: Papers & Proceedings* Vol. 103, No. 3, pp. 135–40. In this paper he argues that there is a common misconception that the central bank can just print banknotes. This is incorrect, as the amount of banknotes is endogenously determined because of the central bank's commitment to keep the amount of banknotes on par with the amount of excess reserves, so that agents in the economy can always exchange excess reserves for banknotes and *vice versa*.
- 10 Stella, P. and Lönnberg, A. (2008) 'Issues in Central Bank Finance and Independence', IMF Working Paper WP/08/37.
- 11 For an interesting and thorough analysis on central bank negative capital see Bolt, W., Frost, J., Shin, H. S. and Wierds, P. (2023) 'The Bank of Amsterdam and the Limits of Fiat Money', DNB Working Paper No. 764.
- 12 Seigniorage income is derived from the difference in interest rate on the assets and the interest rate on liabilities. The latter is zero in the case of banknotes. Alternatively, seigniorage is sometimes also referred to as the difference between the face value of banknotes and their production costs.
- 13 Bell, S., Chui, M., Gomes, T., Moser-Boehm, P. and Pierres Tejada, A. (2023) 'Why Are Central Banks Reporting Losses? Does it Matter?', *BIS Bulletin*, No. 68, BIS, available at <https://www.bis.org/publ/bisbull68.htm> (accessed 13th March, 2023).
- 14 Stella, P. (1997) 'Do Central Banks Need Capital?', IMF Working Paper WP/97/83 and Buiter, W. (2008) 'Can Central Banks Go Broke?', CEPR Policy Insight No. 24.
- 15 Nordström, A. and Vredin, A. (2022) 'Does Central Bank Equity Matter for Monetary Policy?', Sveriges Riksbank, Staff Memo.
- 16 The focus here is on financial risks. Other types of risks, such as operational, legal and reputational risks, are in practice also relevant.
- 17 They discuss that central banks with wide-ranging crisis management responsibilities may build up extra buffers in normal times, to match possible emergency demands. See Archer, D. and Moser-Boehm, P. (2013) 'Central Bank Finances', BIS Papers, No. 71.
- 18 DNB (2018) 'Naar een bestendig kapitaalbeleid voor DNB', Eindrapport werkgroep kapitaalbeleid DNB.
- 19 Broeders, D., Loman, H. and van Toor, J. (2019) 'A Methodology for Actively Managing Tail Risks and Uncertainties', *Journal of Risk Management in Financial Institutions*, Vol. 12, No. 1, pp. 44–56.
- 20 Broeders, D. and Schlooz, M. (2021) 'Climate Change Uncertainty and Central Bank Risk Management', *Journal of Risk Management in Financial Institutions*, Vol. 14, No. 2, pp. 121–30.
- 21 See, for instance, Ferguson, N., Kornejew, M., Schmelzing, P. and Schularick, M. (2023) 'The Safety Net: Central Bank Balance Sheets and Financial Crises, 1587–2020', CEPR Discussion Paper No. 17858, Centre for Economic Policy Research, available at <https://cepr.org/publications/dp17858> (accessed 13th March, 2023).
- 22 This is the confidence level that the central banks of the Eurosystem use. ECB (2015) 'The Financial Risk Management of the Eurosystem's Monetary Policy Operations'.
- 23 Revaluation reserves are not used in this example. In practice, the risk of, for instance gold, could also be covered by a revaluation reserve on gold.
- 24 Rather than one single scenario it is also possible to do Monte Carlo analysis. See, eg Bindseil, U., Manzanares, A. and Weller, B. (2004) 'The Role of Central Bank Capital Revisited', ECB Working Paper, No. 392.
- 25 For simplicity any duration of banknotes is ignored as they have no explicit maturity or coupons. There are, however, other ways to consider the duration of banknotes. First, consumers have the option to exchange banknotes for a deposit at the bank at any given time. Secondly, a country or a central bank has the option to stop circulating banknotes and move to a cashless society. Both give a finite duration to banknotes.

- 26 Stella, P. and Lonnberg, Å. (2008), 'Issues in Central Bank Finance and Independence', IMF Working Paper WP/08/37.
- 27 A central bank could report the guarantee as an asset, while it is a liability for the government. In that sense the guarantee can economically be interpreted as the central bank directly financing the government, something that is not allowed in some jurisdictions.
- 28 Since 2018 De Nederlandsche Bank has a capital policy based on these principles. See, DNB (2018) Naar een bestendig kapitaalbeleid voor DNB, Eindrapport werkgroep kapitaalbeleid DNB, Tweede Kamer, available at https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2019Z11620&did=2019D23917 (accessed 13th March, 2023).
- 29 Bell, S. *et al.*, see ref 13.