



FISCAL AFFAIRS

HOW TO

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**How to Set Up a Cash Buffer:
A Practical Guide to
Developing and Implementing a
Cash Buffer Policy**

Fiscal Affairs Department

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Prepared by Yasemin Hürçan, Fatoş Koç, and Emre Balıbek

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HOW TO SET UP A CASH BUFFER: A PRACTICAL GUIDE TO DEVELOPING AND IMPLEMENTING A CASH BUFFER POLICY

Maintaining a cash buffer has emerged as a risk management tool for government cash and debt management. During budget execution, there is considerable cash flow volatility and timing mismatches concerning revenue collections and expenditures, debt inflows, and debt service. Cash balance management aims to address these mismatches and to ensure availability of liquidity in government bank accounts. From a debt management perspective, holding an appropriate level of cash balance serves to mitigate funding risk. Effective cash balance management is even more critical when there is heightened uncertainty about the magnitude and timing of cash flows, as seen during the coronavirus disease (COVID-19) pandemic. This note discusses the role of the cash buffer for managing cash balances and offers practical approaches to developing a policy framework, considering the risk mitigation objectives and the cost of carrying the funds.

Introduction

Cash balance management is an integral component of government cash management. Government cash managers seek to hold a certain level of cash balances in the government's bank accounts to ensure funding is available to meet the government's financial obligations as they fall due. A sufficiently high cash balance typically provides a cushion against cash flow volatility, especially in developing countries where short-term financing options and market access are limited.

A cash buffer policy framework aims at identifying a target cash balance level and formulates a governance structure for managing the buffer. The cash buffer is defined as “the minimum level of cash balances necessary to be sure of meeting day-to-day cash requirements, at all times, under all circumstances, taking

into account the availability of other liquid resources” (Williams 2016).¹ The governance structure refers to the coordination, communication, and investment strategies for managing cash balances.

Cash buffers are often set up as part of the Treasury Single Account (TSA) or main government bank account under the treasury's control.² Consequently, the cash buffer, as defined here, includes funds covered by a TSA or main government bank account, in local and foreign currencies, and available to government cash and debt managers for use in the daily management of the government's short-term liquidity needs and medium- to long-term financing requirements.³ The cash buffer is different from a fund of structural cash surpluses that often accumulate as a result of consistent streams of income from natural resources or exports. Sovereign wealth funds or stabilization funds are usually managed separately from the cash buffer and are subject to a different investment policy that allows for longer-term investment options.

This paper offers a set of policy and technical recommendations for setting up a cash buffer target by taking into account the country practices. Section 2 gives an overview of country practices for cash buffers; Section 3 discusses decision factors for setting the target cash buffer level; Section 4 presents practical approaches to determining the target buffer; and Section 5 discusses other issues that should be considered when developing a cash buffer policy. Issues in identification and investment of surplus government cash—as

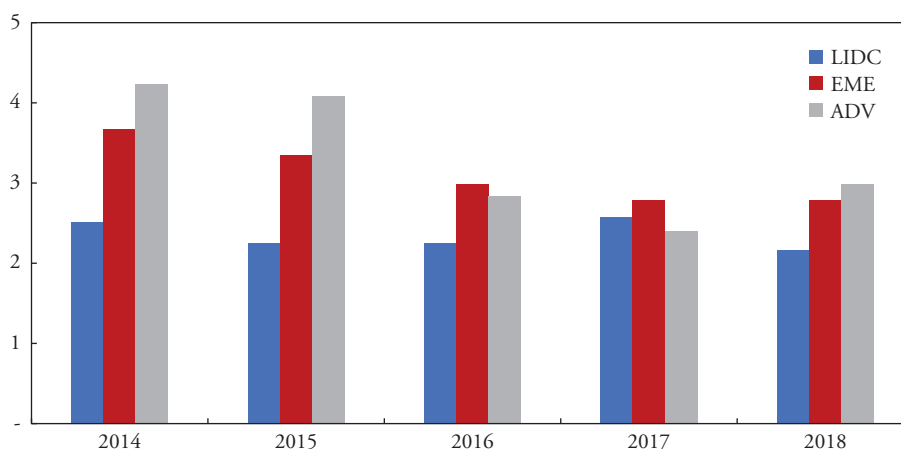
¹In this note, “cash” refers to cash on hand in the government's accounts and its highly liquid assets (for example, money market assets). Credit lines, contingent funding arrangements, and overdraft facilities are not considered as cash; they are complementary to the cash buffer, as discussed in later sections.

²Pattanayak and Fainboim (2011) define the TSA as “unified structure of government bank accounts enabling consolidation and optimum utilization of government cash resources” (Page 2).

³Cash buffer policies are shaped and driven by the explicit decision on a certain targeted level of cash balance and on actions to maintain that target balance. The target buffer level often refers to a lower bound for the government's cash balances. The decision on the cash buffer target is in the form of a performance benchmark or a strategic target that guides debt and cash management operations, which is determined internally or by the ministry of finance/treasury after consultation with the cash and debt managers.

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Figure 1. Central Government Cash Balances at the Central Bank, Year-End
(Percent of GDP)



Sources: IMF's Monetary and Financial Statistics.

Note: Several governments also hold cash balances at commercial banks; these are not captured in the figure.

an integral part of modern cash management—are discussed in the companion how-to-note, “How to Develop a Framework for the Investment of Temporary Government Cash Surpluses.”⁴

Overview of Cash Buffer Practices

Maintaining a cash cushion is common in government cash management. Many countries, from developing to advanced economies, hold consistent cash balances in their central bank accounts, at an average level of 3 percent of GDP at end 2018 (Figure 1⁵ and Annex 1). However, not all countries have systematically and explicitly identified the minimum amount of cash reserves actually needed on a consistent basis, embedded a target cash balance level in their policy frameworks, and structured their cash and debt management operations to achieve this target.

Over the past decade, more governments have adopted cash buffer policies to support the cash and debt management and budget execution functions. A recent survey of Organisation for Economic Co-operation and Development (OECD) countries shows that most member countries (29 out of 35 respondents) maintain cash buffers to mitigate timing mismatches and the risks of deviations in cash flow forecasts (both on the revenue and expenditure sides),

as well as refinancing risks (Cruz and Koc 2018). Cash buffers are part of the policy frameworks in Canada, Portugal, the United States, and other countries. An earlier World Bank (2014) survey reflects on the cash buffer practices of Brazil, Hungary, Morocco, Turkey, and Uruguay. More recently, countries such as Ghana and Pakistan have set up or are considering building up cash buffers as part of their cash and debt management strategies.

Several OECD countries—including Denmark, Hungary, Mexico, and Poland—adapted their cash buffer policies in the aftermath of the 2008–09 crisis. The objective was to boost market confidence in the government's financial capacity and to provide more flexibility in funding options. Country experiences during the European debt crisis highlighted the importance of having a cushion against periods of heightened sovereign stress, as well as against the potential loss of market access.⁶ Greece, Iceland, Ireland, and Portugal, which were at the epicenter of the multi-year European sovereign debt crisis, have reviewed their cash buffer policies to increase the level of balances to boost market confidence in the governments' financial capacity. For example, in Greece, the government's cash reserves were sufficient to cover the debt service for the

⁴See Fainboim, Saxena, and Williams (2020).

⁵The figure is for comparison purposes. Countries do not generally apply a target on cash balances as a percent of GDP.

⁶A 2017 survey on liquidity buffer practices among the OECD countries revealed that the Debt Management Units of 21 countries have modified their practices in the past five years. Furthermore, majority of these countries have reported the changes made in response to changes in funding needs, financial market conditions and access to market financing (Cruz and Koc 2018).

Table 1. Country Examples for Cash Buffer Targets

Country	Cash Buffer Target to Cover
Brazil (2020)	Six months of federal public debt service in the market in domestic currency. Although there is no official target, the government also maintains an additional foreign currency reserve to service the annual foreign currency debt.
Canada (2019/20)	One month of net projected cash flows, including coupon payments and debt refinancing needs
Denmark (2020)	Comparable to the annual refinancing requirement of government bonds
Greece (2019)	Next four years of debt service, excluding treasury bills
Hungary (2020)	Total of six weeks of financing needs
Portugal (2018)	Forty percent of the next 12 months of financing need
Romania (2018)	Four months of gross borrowing needs in foreign currency
Turkey (2014)	An undisclosed percentage of annual debt service
Uruguay (2014)	More than the annual debt service
US (2015)	Total of one week of cash outflows

Note: Years in parenthesis reflect the year of public disclosure for the target.

next four years, assuming that treasury bills are rolled over—about €32 billion as of the end of September 2019 (Greece Public Debt Management Agency 2019).

Governments utilize different methods to determine the target level of their cash buffers. There is no one-size-fits-all methodology to determine the optimal size of the cash buffer. Table 1 presents some examples from countries that publicly disclose their methods for setting the cash buffer target or for making comparisons with their financing needs.

Cash buffers are intended to be held for extended periods, although targets can be reviewed occasionally. The underlying factors, including cash flow forecasting capacity, the debt repayment profile, the cost of carry, and external factors, such as market conditions, change over time and the cash buffers should as well. Several governments have reviewed their cash buffer targets in the framework of their policy responses to the COVID-19 pandemic (see Box 1).

Decision Factors for Setting the Target Cash Buffer Level

The approaches adopted by cash and debt managers in determining the target level depend on a combination of factors. The inputs for the decision relate to the types of risks perceived, the objectives of risk management, the availability of other risk mitigation mechanisms, and the cost of carrying the buffer.

Risk Management Objectives

Cash management is concerned with the management of liquidity risk, i.e. the risk of having insufficient cash in government bank accounts to satisfy

obligations falling due on a specific day. Liquidity risk for governments may stem from various factors, including:

- volatility and unpredictability of budgetary cash flows, which lead to forecast errors; and
- risks in the availability of funding, referring to less borrowing than planned, often caused by undersubscriptions in auctions or delays in loan disbursements.

Cash Flow Volatility and Cash Flow Forecast Errors

Governments face considerable cash flow volatility during budget execution. Timing mismatches between cash inflows (revenues) and cash outflows (outlays) result in conditions of temporary cash surpluses or cash shortfalls, generally independent of a fiscal surplus or deficit. Governments rely on cash flow forecasts to predict this and plan for cash availability for smooth budget execution. Forecast errors refer to the discrepancy between forecasts and outturns, and they reflect the underlying volatility inherent in the nature of the government's cash flows.

Discrepancies between cash forecasts and outturns have several causes:

- Unrealistic fiscal projections can lead to significant forecast errors.⁷ The initial annual cash flow forecasts for a given fiscal year are generally based on the fiscal aggregates presented in the budget. If the budget preparation process is not credible—that is, expected annual revenues are overestimated and/or expenditures are underestimated in the budget—then a deviation from the initial cash flow forecast is

⁷Budget credibility is a broader macro-fiscal policy framework problem, and the remedies to a noncredible budget are often beyond the control of cash managers.

Box 1. Responding to COVID-19 Challenges: The Case for Cash Buffers

The COVID-19 pandemic has posed many challenges for the economy and public financial management systems, globally. Governments have faced the dilemma of finding additional resources to meet increased spending on health and fiscal stimulus packages, when revenue collection has decreased or has been delayed as economic activity slowed. Cash and debt management offices around the world have encountered a number of tests, including: (1) unexpected increases in borrowing needs; (2) significant market volatility; (3) increasing operational risks due to safety and health risks in workplaces; and (4) increasing unpredictability in government cash flows. These challenges have once again highlighted the importance of accessing liquidity as quickly as possible to manage unanticipated cash flows. Similar to the 2008–09 financial crisis, a combination of surges in funding needs with adverse market conditions has resulted in less successful auctions, with somewhat weaker demand at auctions in some jurisdictions, particularly during the initial phase of the crisis. Even if these are rare market events, they can create market volatility and can unnecessarily increase borrowing costs.

Existing cash buffers have served as a first line of defense against heightened risks for several governments. Denmark¹ and Sweden² referred to their cash reserves or liquid assets in their early policy announcements for addressing the impact of COVID-19.

¹Denmark Central Bank 2020.

²Swedish National Debt Office 2020.

Several other governments already started to recalibrate their cash buffer levels, given higher uncertainty and increasing cash outflows. The US Treasury boosted its cash balances from \$400 billion in January 2020 to \$1.7 billion—a historically high level—by the end of June to maintain prudent liquidity in light of the size and relative uncertainty of COVID-19-related outflows.³ Uruguay revised its financing program to shore up its liquidity buffers by speeding up disbursements from existing arrangements and contracting new loans from multilateral institutions.⁴ In its revised borrowing strategy, Hungary disclosed an objective to increase liquidity reserves by the early execution of international bond issuances during 2020.⁵ As the impact of COVID-19 continues, the existence of a cash buffer will provide governments with access to needed cash until long-term financing becomes available and/or fiscal measures are reintroduced.

³US Department of the Treasury 2020.

⁴Uruguay Ministry of Economy and Finance 2020.

⁵Hungary Government Debt Management Agency 2020.

inevitable as the year proceeds. Over the years, cash forecasters have attempted to adjust cash flow forecasts to budget uncertainties, building on experience and differences between forecasts and actuals; however, it may prove difficult to develop cash forecasts unaligned with the budget process.

- Poor calibration of models and tools employed in generating the cash flow forecasts can also result in errors. The “model risk” refers to deficiencies in the approach adopted to develop cash flow forecasts; it can be significant in cases where cash flow patterns are not stable and change over time.
- Inadequate exchange of information among government agencies can hamper the quality and timely

delivery of forecasts. Forecasts produced by a central cash management unit (CMU), using a top-down approach, based on historical pattern analysis, need to be updated on a timely basis and complemented by information received from the spending and revenue collection agencies, i.e. bottom-up analysis. Inefficient channels of communication between cash managers and their counterparts in ministries, departments, and agencies may lead to a situation in which infrequent but large flows are omitted or are underestimated in projections.

- Lack of a proper understanding of the differences between the budget process and cash management. These often result from timing differences between

when revenues and expenditures are recorded in the budget and the actual date that the corresponding funds are deposited in or withdrawn from the TSA.

- Realization of contingent liabilities (both explicit and implicit) that lead to deviations in cash forecasts. Calls on, for example, guarantees or government insurance schemes may lead to unforeseen cash flows in terms of timing and magnitude. Cash flow forecasts should ideally include estimates for such flows based on such factors as expected losses; however, outturn could be different than expectations, leading to forecast errors.

Factors that lead to forecast errors resulting in liquidity risks can be partly mitigated by steps to improve the operational and institutional framework. These measures include enhancing the forecasting tools, the institutional set-up, and the lines of communication among units. Nevertheless, even if fiscal aggregates are estimated realistically and forecast models are reasonably reliable, a degree of variation between the actual data and the forecast is inevitable, due to inherent volatility in the nature of cash flows.

The magnitude of historical or potential forecast errors for budgetary cash flows is an important consideration in the assessment of potential risks. Typically, the more volatile the nature of cash flows is, the wider the range of forecast errors will be. In some cases, due to institutional constraints, the CMU may lack the adequate capacity to generate the cash flow forecasts within a reasonable margin of error. The cash buffer's purpose is to provide cash availability in case of deviations from forecasts.

(Re)Funding Risks

Risks associated with the borrowing of funds are another major component of liquidity risk. The budget and cash flow forecasts are built on assumptions of a certain level of financing inflows. These cover the external debt, as well as the funds raised in the domestic market to meet the budget deficit and the refinancing needs of previously issued debt. The main objective of the debt management function, often executed by a separate debt management unit (DMU), is to meet the funding needs, considering the costs of borrowing and risks involved.

Even in the case of a balanced budget, principal redemptions will generally be funded by new issuance, that is, by rolling over debt. In debt management, “refinancing or rollover risk” refers to situations in

which debt may have to be rolled over at an unusually high interest cost or in which debt cannot be rolled over at all. The scale of debt operations and their contribution to the liquidity position make funding risk the focal point on the risk map of debt and cash managers.

The refinancing risk is more pronounced when the maturity profile of debt is short and/or is concentrated on or around a particular period. Refinancing risk is a major concern for countries that are characterized by one or more of the following: volatile market conditions, rapidly deteriorating economic indicators, lower credit rating, perception of poor governance, high political risk, high indebtedness, and financial distress (Jonasson and Papaioannou 2018). Against this background, the ability to access cash swiftly avoids potential disruption of funding plans (for example, auction calendars) and supports predictability in public debt management.

Lower-than-expected inflows from the issuance of debt reduce the availability of cash for other budgetary spending. Governments often prepare annual borrowing plans to analyze and communicate their financing strategies in financial markets. The success in implementing the borrowing plan is subject to market conditions. Unfavorable market circumstances—or increased levels of financial market volatility imposed by external conditions or domestic economic and political developments—may result in a shift of investors' sentiments, reducing their willingness to extend credit to the government. Delays in disbursements of foreign loans, especially program financing, have the same effect as undersubscriptions in domestic auctions.

Even when the borrowing plan is executed smoothly, different objectives of debt and cash management may result in the accumulation of funding risk at certain periods. Debt managers, for example, may prioritize a market development objective and prefer to adopt a regular auction calendar with a benchmark bond issuance policy (with larger volumes of bonds through reopenings over a specified period).⁸ This approach may impose different days for borrowing auctions than those required by the government's actual cash needs and may create large debt repayments on a specific day. The resulting risks need to be managed through

⁸A new IMF and World Bank Guidance Note, forthcoming in 2021 (on Developing Government Local Currency Bond Markets) provides a general framework for bond market development.

a short-term borrowing program and/or through the cash buffer.

Funding risk can also stem from auction failures due to storms, cyberattacks, or electronic system disruptions. These operational risk concerns are particularly relevant today, because financial market transactions rely on electronic systems.⁹ Therefore, even DMUs in advanced economies that face less volatile market conditions and that have more accurate cash flow projections keep cash buffers for contingency purposes.

The speed of the government's ability to react to market developments and to revise borrowing plans is an important determinant of the target cash buffer level. This speed might be the major consideration when uncertainty associated with financing flows (borrowing) becomes a concern because of financial market volatility or creditor behavior. The government may need to adjust the timing and size of its auctions to be able to meet financing needs in periods of significant market volatility. In some cases, the authorities may have to offer a different set of financial instruments from the regular offerings, including switching to shorter maturities, changing the currency, or offering floating rate securities. These revisions require a certain timeframe for the decision-making and approval processes. Once approved, the government may also need additional time for market communication to explain the rationale and introduce the new set of instruments to enable market participation. A sufficiently large cash buffer can help the government meet the financing needs within the span of this reaction time.

The 2008–09 financial crisis demonstrated that financial markets could dry up for an extended period, even in advanced economies. Market participants will be more hesitant to lend to the government, especially when they perceive a higher risk with respect to the sovereign's financial position. In such cases, the government may prefer to draw on cash buffers rather than locking in high interest rates that may result from financial contagion or a temporary spike in risk aversion (Guscina, Malik, and Papaioannou 2017).

The capacity of financial markets in terms of meeting the government's urgent liquidity needs is another major factor for the cash buffer decision. Countries with deep and liquid domestic financial markets are usually in a better position to access liquidity

(especially short-term), even during stressed market conditions. For example, Germany and the Netherlands, which have not experienced funding pressures and have continuous access to money markets, do not pursue a target cash buffer policy.

The adequate level of cash buffers for governments with limited or constrained market access can be higher than for mature market countries. Nevertheless, even advanced economies have experienced disruptions in the functioning of their financial markets. If market disruptions coincide with days of high levels of debt service or other cash outlays, the government will be in a difficult position to meet financing requirements; even short-term funds may not be available for technical reasons. An example is the period between October 29–30, 2012, when the financial markets in US remained closed because of "Superstorm Sandy," prompting the US Treasury to revise its cash buffer policy (Box 2).

Availability of Other Mitigation Mechanisms for Risk Management

Overdraft lines and ways-and-means facilities from central banks can also serve as risk mitigation tools and can reduce the size of the needed buffer. Most countries either prohibit or restrict (typically as a small proportion of government budget revenues) short-term central bank funding to the government. If such facilities are at the disposal of the government, the restrictions and the legal period to close the overdraft balance should also be considered in the determination of the size of the cash buffer. If the government has to return the funds within a short period (for example, a month or so), this arrangement may not be enough to meet financing needs over a long period.

Availability of market-based, short-term financing options also reduce the size of the needed cash buffer. These instruments include repurchase agreements, pre-agreed credit, and/or overdraft lines with commercial banks that allow the sovereign to have access to short-term financing. They help offset the deviations in financing and/or cash flows and thereby alleviate the need for a large buffer. In the Slovak Republic, for example, the primary dealers for government securities are obliged to set up a money market credit line to the government for trades on money markets worth at least €100 million, with a minimum tenor of 14 days (AFME 2017).

⁹For example, a prolonged outage in the electronic trading platform due to a combination of hardware and software failures resulted in the postponement of a treasury auction in the UK in April 2015.

Box 2. US Treasury Cash Buffer Policy

The US Treasury, which traditionally held very low levels of cash in its balances, adopted a cash buffer policy in 2015 to protect against a potential loss of market access for auctions while continuing to make forecasted fiscal outflows. In August 2014, the Treasury announced its plans to revise the cash balance management policy, citing the effects of the terrorist attacks on September 11, 2001, and Superstorm Sandy, which caused disruptions to the broader financial system and the Treasury's auction capabilities. The Treasury Borrowing Advisory Committee (TBAC) recommended that the Treasury review its cash balance

policy as part of an overall risk management process. Based on an internal review, the TBAC's recommendations, and an assessment of emerging threats, including potential cyberattacks, the cash balance management policy was revised in June 2015 and a minimum balance target was adopted to hold cash sufficient to cover one week of outflows in the Treasury General Account. In 2018, the average cash balances of the US Treasury amounted to around 1.5 percent of GDP. In 2020, the cash balance policy was again revised as part of the policy responses to COVID-19 (Box 1).

Source: US Department of the Treasury 2015.

The arrangements for continuity of the funding program should also be considered in determining the cash buffer size. For example, several countries that implement a primary dealership system for the distribution of their government securities require their primary dealers to cover (or send competitive bids for) a certain portion of their borrowing requirement.¹⁰ In Spain, each primary dealer must submit bids for a minimum nominal value of 3 percent of the amount allotted by the treasury for each security auctioned, with a certain price range (AFME 2017). Although this is a participation requirement rather than a requirement to purchase, it still ensures a certain amount of funding. In France, the requirement for primary dealers is not only on the submission of bids; they are also required to purchase a predetermined amount of securities over a certain period. The buffer size can potentially depend on the existence and extent of such mechanisms, aiming to meet the remainder of the financing requirement that is uncovered in a given period. The government should also consider how these funding arrangements would work during periods of market stress and whether cash and debt managers would be able to rely on these arrangements for immediate access to required funding.

Several lower-income countries (LICs) have established sinking funds as a complement to the cash

buffer, but there are important differences.¹¹ Sinking funds are usually targeted to be used for a specific set of bonds and loans of higher volume. Sinking funds arrangements usually do not provide the mandate to use these funds to meet timing mismatches in regular budgetary cash flows or financing needs outside of their specified purpose. The sinking fund is depleted after the designated debt service, while the cash buffer is intended to be maintained at the target level for extended periods. Thus, from a purely cash management perspective, a sinking fund is a less flexible instrument and may lead to the accumulation of idle cash balances in different bank accounts.

The Cost of Carry

The size of the cash buffer should be determined in a cost-risk analysis framework. The greater the cash buffer is, the larger is the cushion available to absorb any unexpected variations in funding and cash flows. However, since maintaining idle resources is costly, the level of the liquidity buffer is constrained. Effective cash management should be able to measure the level of liquidity risk exposure and then implement measures to mitigate its potential negative consequences, while taking into account the associated costs of carrying a cash buffer.

¹⁰Primary Dealers are financial intermediaries appointed by the government to perform certain specialized functions in the government securities market.

¹¹"Sinking funds" refer to payments made by the borrower on a regular basis to a special account to set aside the necessary funds for the redemption of its long-term debt.

“Cost of carry” refers to the difference between the cost of holding the cash buffer and the return on these funds, if invested. The cash buffer is often debt-financed, with an associated borrowing cost. In other cases, where the cash buffer is accumulated by primary surpluses, the holding cost is often approximated by the opportunity cost of not using those funds for other purposes, such as to reduce debt or invest in alternative assets. Once a cash buffer is accumulated, instead of being carried for extended periods in government accounts, it can potentially be used to reduce the future financing needs (like a sinking fund). Accordingly, carrying a cash buffer entails an opportunity cost of not reducing borrowing. In the context of sovereign cash and debt management, the cost of carry is akin to the premium on an insurance policy.

The cost of carry of the cash buffer is generally positive. In many country examples, government cash balances, including the cash buffer, are often kept in the central bank. The remuneration rate often relates to the policy rate, depending on the agreement between the government and the central bank. Non-remuneration of government funds kept at the central bank is also common. In cases where government funds can be lent to private commercial banks, the duration of lending is very short (mostly overnight), and the short-term market rates are generally driven by the central bank policy rate. Therefore, the cash buffer often generates a return linked to the very short end of the yield curve—either the policy or the market rate. The borrowing or the opportunity cost, as measured by the alternative use of the cash buffer for reducing borrowing, is generally determined by the rates for longer-term borrowing, in line with the average borrowing maturity.¹² In a usual market environment, the yield curve tends to be positively sloped; longer-term yields are higher than those for the short-term due to differences in levels of risk perception. While the prolonged period of low interest rates has implications for the cost of carrying the cash buffer, what matters for the cost of carry is the margin between long and short-term interest rates, rather than the general level of rates.

The cost of carry can be calculated by comparing the cost of funding with the rate of return on the cash buffer. In general, the cost of the cash buffer can be approximated by the average cost of borrowing. For

¹²In Brazil, the central bank remunerates the buffer at the same rate as its portfolio of government securities, thereby offsetting the borrowing cost (to the extent that the portfolio composition of the bank’s holdings reflects the composition of government debt).

a more detailed analysis of the opportunity cost of carrying the cash buffer, the borrowing cost for instruments to be dropped from the issuance plan (assuming the debt using the cash buffer will lead to reduced borrowing) is needed. In Denmark, a comparison of future short-term rates and current longer-dated financing cost (that is, the term premium) is used as an estimation of the cost over the medium-term. In Portugal, the Agência de Gestão da Tesouraria e da Dívida Pública (ICGP) publishes three different cost measures for the cost of carry based on three different set of assumptions (Box 3). Canada uses treasury bill rates to estimate the cost (Box 4).

Unlike the cost of carry, the benefits of holding a cash buffer are often difficult to quantify. A main benefit is the government’s enhanced ability to meet unexpected cash needs. This ability results in an improved market perception of the sovereign’s capacity to service its liabilities. Accordingly, a quantitative cost-benefit analysis is usually not possible. Nevertheless, countries still measure the cost of carry to judge the cost and assess relative changes across years, weighing these against potential benefits. Portugal, for example, tracks the carrying cost over a three-year period (IGCP 2017).

Practical Approaches to Determining the Target Buffer

The target cash buffer level is often set in alignment with the government’s overall risk management objectives in managing cash and debt. This consideration pertains to the levels of risks perceived and the priorities of the authorities. For example, from a debt management perspective, the cash buffer can act as a cushion for potential market stress that might negatively affect borrowing auctions. In this case, the government will probably resort to the cash buffer less frequently but in larger sizes, when needed. However, if the main rationale for holding the buffer is to guard against budgetary cash flow forecast errors, the cash buffer can be more transactional in nature, and withdrawals can be smaller but more frequent. The cash buffer target can be set on a rolling horizon basis, as a moving target, or as a fixed level, depending on the perception of risks and the government’s ability to manage cash balances actively.

Box 3. The Cash Buffer Policy at the Portugal Treasury and Debt Management Agency

In Portugal, the Agência de Gestão da Tesouraria e da Dívida Pública (IGCP) is the public entity responsible for the integrated management of cash and debt. Having experienced limited access to financial markets in the aftermath of the global financial crisis, the IGCP adopted a conservative policy of maintaining a high cash buffer, starting in 2011 when the economic situation began to normalize. The main purposes of the policy were (1) to enhance market confidence by demonstrating the government's capacity to repay, and (2) to facilitate the recovery of the Portuguese government debt investor base, thereby reducing the Republic's financing cost in the medium term (IGCP 2014). The target cash buffer initially aimed to cover 100 percent of the government's gross borrowing needs in the following 12 months, excluding the rollover of treasury bills. The cash buffer was accumulated mainly through over-borrowing in the context of an IMF-supported program. The target was later reduced, first to 50 percent and then to 40 percent of the next 12 months' financing needs, as Portugal regained

Investment Grade status from credit rating agencies. At the end of 2018, the IGCP cash buffer stood at €9.3 billion, or 4.6 percent of GDP.

The IGCP implements a transparent communication strategy with market participants and rating agencies with respect to its cash buffer year-end target levels, in line with its main objective of keeping the buffer. The IGCP estimates the cost of carrying the cash buffer by using three different approaches to the opportunity cost of not using these funds. These include using (1) the implicit interest rate on the overall debt stock, which is implied by the rates on current outstanding debt; (2) the marginal cost of new funding in the year of consideration; and (3) the marginal cost of funding only using treasury bills (see Box 2.3 in IGCP 2014 for details).

Sources: IGCP 2014 and 2017.

Box 4. The Cash Buffer Policy of the Government of Canada

In Canada, the cash buffer policy is implemented under the framework for prudential liquidity management. The government holds liquid financial assets in the form of domestic cash deposits and foreign exchange reserves to promote investor confidence and safeguard its ability to meet payment obligations in situations in which normal access to funding markets may be disrupted or delayed. Cash consists of money on deposit to the credit of the Receiver General for Canada with the Bank of Canada, chartered banks, and other financial institutions. Cash with the Bank of Canada includes operational balances and a Can\$ 20 billion callable demand deposit held for the prudential liquidity plan. Callable deposits are maintained at this fixed level unless otherwise needed, while the operational balances fluctuate. The average level of balances in fiscal year 2017/18 stood at a level of Can\$ 28.6 billion, around 1.3 percent of GDP.

On each day, excess cash balances are invested via short-term deposits allocated to banks and other financial institutions through auctions that are conducted

in two rounds, one in the morning and one in the afternoon. The morning auctions are fully collateralized to mitigate counterparty risk. The afternoon auctions only concern 10 percent of the remaining excess liquidity, which is invested overnight and is not collateralized. The cost of carry of the cash balances is computed as the difference between (1) the return on government cash balances auctioned to financial institutions (typically around the overnight rate), and (2) the weighted average yield paid on treasury bills. Due to low short-term interest rates in recent years and the upward sloping yield curve, there is a positive cost of carrying cash for the government, because financial institutions pay rates of interest for government deposits that are lower than the rate the government pays on treasury bills.

Source: Canada Department of Finance 2018.

Cash Buffer Target for Debt Management

For debt management purposes, several countries target their cash buffer to cover the whole or a portion of the debt service for a given period ahead. The approach follows these steps:

Step 1: Analyzing the potential duration of periods of stress. A main determinant of the level of the cash buffer from a debt management perspective is the potential duration of the period for heightened market volatility that might affect the demand for the government's offering of financial instruments. Historical market or auction data give the government an understanding of the duration of market disruptions, which have led to undersubscribed borrowing auctions. Country examples show a large variation; in developing and emerging markets, stress periods can be as long as two to four months, unless there is a protracted cause, such as the 2008–09 financial crisis. Examples from peer countries can also provide useful insights.

Alternatively, the government may look to future events that have the potential to influence the issuance of debt securities as planned. For example, the government may want to guard against a potential market stress period during a four-month election cycle, covering the time for campaigns and a possible run-off election due to an inconclusive result. If external financing is more important for meeting debt service, a retrospective analysis of delays in debt disbursements (funds that are not designated for specific expenditures) can be useful to judge the duration of potential periods of stress.

Step 2: Factoring in existing risk mitigation mechanisms. The availability of risk mitigation mechanisms to which the government can resort in periods of stress should be factored into the determination of the cash buffer level. Precommitted funds from primary dealers or available budgetary resources, such as expected primary surplus, can potentially cover some portion of missed targets in financing plans. The government may also analyze historical borrowing data to investigate how much market participation could have been secured during periods of high market volatility. The availability of the overdraft facility and credit lines should also be factored in.

Step 3: Formulating the target cash buffer level. After calculating the inputs from the first two steps, a cash buffer target can be set at a level to cover the remainder of the financing gap. A cash buffer target that can cover financing gaps in a given period can be set using the following formula:

$$\text{Target } CB_t = D_{t,t+n} * (1-C\%) \quad (1)$$

Where: CB_t is the target cash buffer level at the beginning of month t .

n is duration of potential stress period in months (using historical data or forward-looking analysis)

$D_{t,t+n}$ is the projected level of debt service within the timeframe $(t,t+n)$, i.e.

$D_{t,t+n} = \sum_{i=t}^{t+n} D_i$ where D_i is the debt service in month i

C is the ratio of debt service that can be rolled-over/covered with PD commitments and/or other resources (or ratio that has been typically covered in stress periods).¹³ Alternatively, the formula can be set as:

$$\text{Target } CB_t = D_{t,t+n} - C_{nom}$$

where C_{nom} is a nominal amount referring to the total magnitude of risk mitigation mechanisms.

The CB_t given by the above formula will be a moving target on a rolling horizon basis. If the repayment profile is sporadic and not evenly distributed, then $D_{t,t+n}$ can be very different from period to period, and the target cash buffer can fluctuate significantly. Some governments can manage this fluctuation by lending and borrowing short-term funds over periods and/or by adjusting borrowing plans. However, tracking a volatile cash buffer might not be feasible or easily manageable for some governments. A moving target can also have implications for the level of financial market liquidity, particularly if the cash buffer is kept at the central bank and whether or not the central bank has the ability to offset the results of government actions. In such cases, the target cash buffer can be smoothed in several ways:

First, $D_{t,t+n}$ can be replaced with D_{max} , which is the maximum level of cumulative debt service, calculated over rolling horizons, within a decision horizon of N periods (which will be 12 if the decision horizon is one year) as in the following:

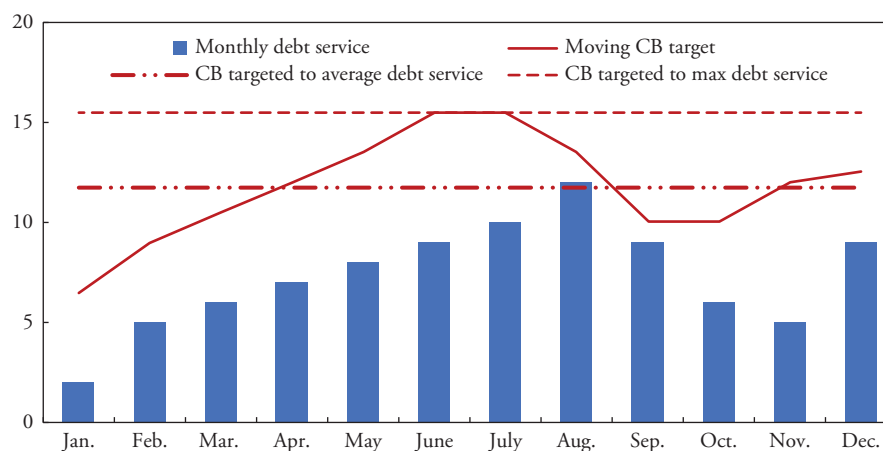
$$\text{Target } CB_t = D_{max} * (1-C\%) \quad (2)$$

$$D_{max} = \text{Max} (D_{t,t+n}), t=1, \dots, N$$

This method helps to guard against shortfalls vis-à-vis the maximum possible level of debt service in a given period. An alternative is taking the average level of debt service, again computed over rolling horizons. However, the averaging method may not be

¹³The formulation here assumes that debt service creates an inherent demand for the new instruments to be issued; thus a percentage of the debt can be rolled over.

Figure 2. Illustrative Cash Buffer Targets for Given Debt Repayment Profile
(Millions of currency units)



Source: Authors.

sufficient to cover some peak levels of debt service if there is high degree of variation in the monthly distribution of repayments.

$$\text{Target } CB_t = D_{avg} * (1-C\%) \quad (3)$$

$$D_{avg} = \text{average } (D_{t,t+n}), t=1, \dots, N$$

Figure 2 illustrates an example for a given debt service profile, assuming that the government intends to meet potential financing gaps over a potential stress period of three months ($n=3$), with 50 percent needs covered through available resources (such as primary revenues and overdraft facilities) and/or pre-commitments by lenders ($C=0.5$). Annex 2 includes a template that illustrates the derivation of target cash buffer levels in Figure 2.

The methods discussed can be further modified and enhanced by means of scenario analyses, such as using varying levels of potential debt rollover (C) for different periods. The government should also measure the cost of carry associated with different alternative target levels and scenarios and weigh them against potential benefits. The cash buffer maintained with a debt management perspective will not be used on a daily basis under normal conditions; accordingly, it can be invested for a longer period, as discussed in Section 5 and in the companion how-to-note.

To provide an additional level of protection, inflows from financing can be discarded in the analysis to allow mitigation of disruptions in market access. The Danish government, for example, set the target level for the 2019 cash balance as Dkr 50–75 billion (2 to

3 percent of GDP), which corresponds to the annual refinancing of government bonds in the coming years (Denmark Central Bank 2019).

In practice, countries revise their methods and their priorities, based on risk perceptions for a given period. The case of Hungary illustrates an evolving approach; the methodology for setting the cash buffer target has been revised several times (Box 5).

Cash Buffer Target for Cash Management

From a pure cash management perspective, the cash buffer policy focuses on budgetary cash flows and aims to mitigate the effects of extended periods of net cash outflows from the TSA balance. The objective is to create a buffer that can be used in periods of cash shortfalls when cumulative outflows surpass inflows, and extra resources are needed. Following are the steps in designing a cash buffer target for cash management purposes, that is, for daily transactions. The approach initially excludes cash flows related to debt (borrowing and redemptions) and addresses the needs of cash management for budget execution.

Step 1: Analyze the potential duration and magnitude of periods of stress. This step focuses on the identification of potential stress periods in TSA balances (extended periods of net cash outflows from the TSA account). To understand the volatility of budgetary cash flows only, receipts from borrowing and debt repayments can be excluded from the analysis. Hypothetical retrospective TSA balances can be con-

Box 5. The Cash Buffer Policy of the Government of Hungary

In Hungary, while the Debt Management Office (ÁKK) is responsible for cash management operations, the cash flow forecasts are the responsibility of the Hungarian State Treasury, which shares these with the ÁKK. The ÁKK is tasked with providing the required liquidity and manages the cash balances. The ÁKK also proposes the cash buffer target for the following year, to be approved by the Minister of Finance. The methodology for target level calculation has been modified several times during the past two decades in response to significant changes in underlying factors.

The ÁKK faced failed auctions in the domestic market during the Asian financial crisis in 1997 and the Russian crisis in 1998. This experience triggered the implementation of a minimum cash buffer policy. Initially, the target for the minimum TSA balance was set as the sum of four to six weeks of the issuance of bonds and 12-month bills, considering the possible forecast error in the funding gap and in other financing flows, such as European Union Funds.

In the aftermath of the 2008–09 financial crisis, the ÁKK revised its cash buffer level upward to cover several months of planned financing needs, which, in turn, helped boost investor confidence. Beginning in 2013, the redemption profile of the Hungarian central government debt changed in such a way that there were several large bond maturities in the first quarter of the year. This situation coincided with increased budget deficits. In response to the heightened risks, the ÁKK modified the cash buffer target to take into

account the redemption profile. The new minimum TSA level was sufficient to cover 50 percent of bond and loan redemptions in the first quarter of the calendar year.

As the monthly debt redemption profile became smoother in the following years, the methodology was revised again in 2017. This approach considered the higher percentiles of daily expenditures and incorporated elements of the 2014 method. Specifically, the minimum TSA balance was set at the 98th percentile of the one-day budgetary expenditures of the previous two years, which also is equal to the 90th percentile of two-day expenditures from the TSA. The ÁKK considers the minimum TSA balance as the binding benchmark. In addition to the minimum level, an “optimal balance,” used when drawing up the financing plan, is calculated based on six weeks of financing needs.

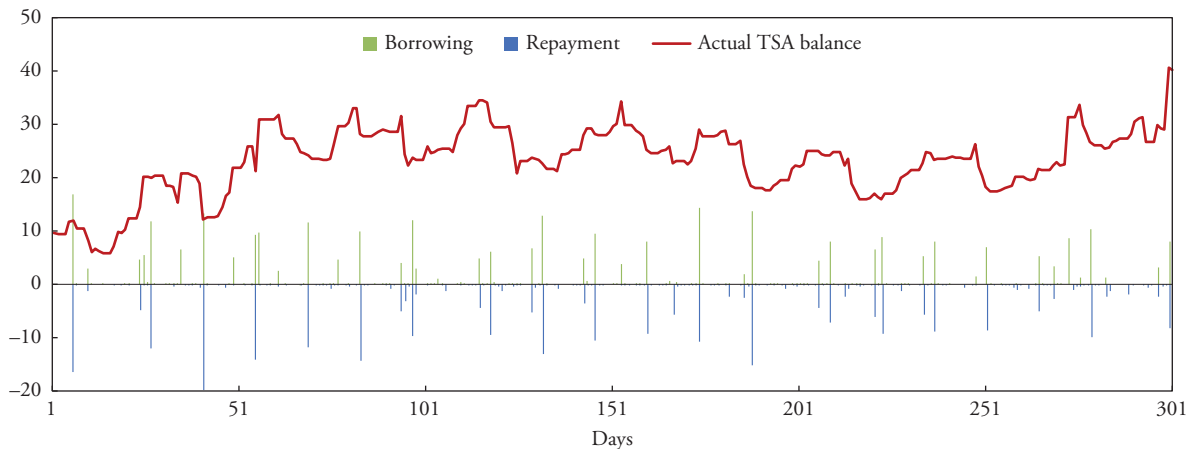
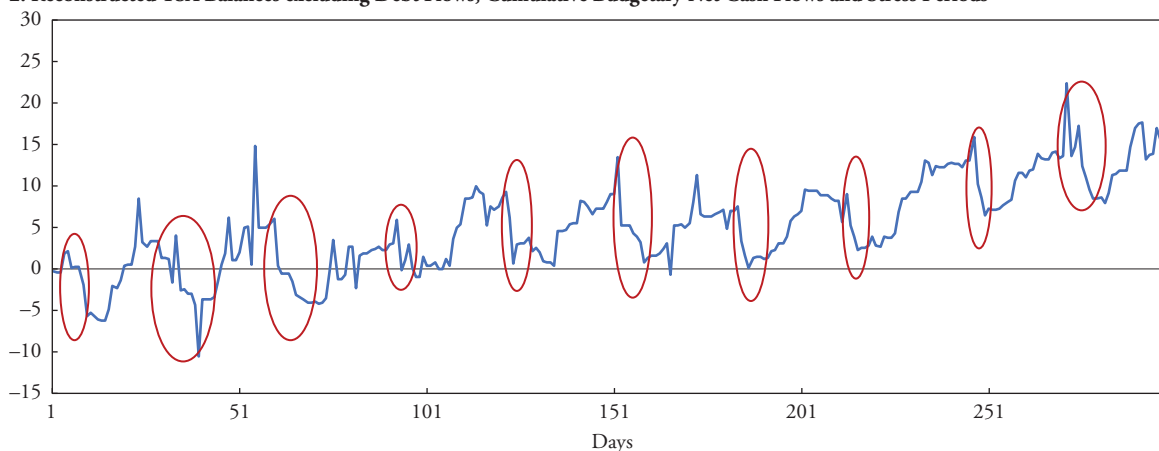
Once the target is agreed, the ÁKK is required to keep the end-of-day TSA balance above the minimum level via debt issuance and liquidity management tools. During implementation, extra cash is raised if the TSA balance were lower than the minimum level, and excess cash is placed to the market if the TSA balance were higher than the target. Foreign currency deposits are part of the overall liquidity buffers, although the policy for internal composition might change from year to year. In addition to target cash buffer policy, the ÁKK uses other contingency funding tools, such as credit lines with commercial banks in foreign currency.

Source: Rez 2018.

structured using historical data on revenues and primary expenditure cash flows to analyze the extent of stress periods in budget execution. Figure 3¹⁴ illustrates such a hypothetical case, where the TSA balance is reconstructed on the basis of cumulative net cash flows of revenues and primary expenditures without the impact of financial flows (i.e., not including borrowing and debt service cash flows).

¹⁴Figure 3.2 depicts a reconstructed cash balance on the basis of cumulative net cash flows, excluding borrowing and repayment. The balance starts with a magnitude of 0 at a certain date, changed cumulatively with the net magnitude of revenues and primary expenditures.

If detailed data for budgetary cash flows are not available, the changes in past TSA balances can be used to deduct daily changes. These daily first differences should be adjusted to eliminate the impact of financing flows for which detailed data are usually available. The hypothetical TSA balance can then be reconstructed using this first difference data after netting out financial flows. Netting out financial flows is not needed in a holistic approach that considers liquidity risks from both budgetary flows and debt. In this case, the net changes in TSA can directly be used to assess stress periods.

Figure 3. Actual and Reconstructed TSA Balances*(Billions of local currency units)***1. Actual TSA Balances****2. Reconstructed TSA Balances excluding Debt Flows, Cumulative Budgetary Net Cash Flows and Stress Periods**

Source: Authors.

Alternatively, the government can use cash flow forecasts to analyze periods of net cash outflows. In environments of cash rationing, historical data are biased because outflows only reflect cash availability and can take place not when they are required, but when there is cash. In such cases, the government must rely on forecasts rather than use historical data. This approach also holds when major changes are expected in the timing and magnitude of cash flows.

If cash forecasts are used as a basis of cash buffer calculations, then the deviations between cash forecasts and actual figures in historical data also need to be considered.

Step 2: Factor in forecast errors. The next step is to factor in the forecast errors in the calculation of the cash buffer if cash forecasts are used. Doing this

also requires historical data analysis. The average and highest margin of errors in historical forecasts should be calculated by comparing forecasts with outturns on a consistent basis. The forecast errors should reflect the cumulative deviations between cash flow forecasts and outturns over the stress period identified in step 1.

Step 3: Factor in existing risk mitigation mechanisms. After analyzing the cash flow volatility and forecast errors, cash managers decide availability of risk mitigation mechanisms to which the government can resort in these periods of stress and prevent liquidity risk. These may include overdraft facilities and other financing options. Cash managers should discuss the stress periods and required buffers with the debt management offices. If debt management offices can issue treasury bills or resort to other short-term borrowing

Box 6. Applying Methods from Inventory Modeling to Cash Buffer Targets

In logistics, the safety stock refers to the additional quantity of an item held by a company in inventory to reduce the risk that the item will be out of stock. Although there are various sophisticated approaches to safety stock modeling, a simple formula for the safety stock is given by [z-score * the lead time (to replenish stock) * standard deviation of demand]. The z-score is a statistical figure also known as standard score. For example, to satisfy demand with a 95 percent confidence level, it is necessary to carry extra inventory equal to 1.65 standard deviations of demand variability, assuming a normal distribution. This is equivalent to a Z-score of 1.65.

With analogy, in cash balance management, the lead time can correspond to the desired period of coverage under stress conditions (periods of extended cash outflows), and demand volatility can be estimated by the standard deviation of changes in cash balances. Data from several country examples suggest that daily changes in TSA balances (not the balances themselves) show a symmetrical distribution (typically around a level close to zero, assuming that flows are fully financed, that is, the total magnitude cash inflows match outflows within the year). Actual historical data can be tested to see whether they fit a normality assumption. In such a case, building on the principles

of safety stock modeling for logistics, the following formula gives the target cash buffer:

$$\text{Target CB} = z \cdot \sqrt{m} \cdot \sigma_d - OD \quad (6)$$

Where: m is the desired period of coverage (in days)
 Z is the z-score (also known as the standard score).
 Z-score for a 95 percent confidence level is 1.65

σ_d is the standard deviation of daily changes in the TSA

In general, for data on government cash balance changes, tails are likely to be fatter than those of a standard normal distribution, due to some relatively infrequent but high-volume transactions, such as capital expenditure and salary payments. In the presence of fat tails, depending on the risk tolerance of the government, it might be more prudent to use higher z-scores to capture tail risks. The formula can also be modified if data can be explained with another distribution.

Annex 3 includes a template for a simplified example illustrating the derivation of cash buffer targets using formulas (4) and (6).

to cover both the stress periods and forecast errors in cash forecasting, the cash buffer does not need to be large. However, if sudden distributions or high market volatility in the capital markets are expected for those periods, depending on the availability of the overdraft facility and credit lines, the cash buffer levels should include an additional margin.

Step 4: Formulate the target cash buffer level. A cash buffer target that can cover financing gaps in a given period can be set using the following formula. This formulation is based on capturing the maximum net outflow during preidentified stress periods.

$$\text{Target CB} = [\max_j \sum_{i=1}^{m_j} (\text{Net outflow in day } i)]. \quad (4)$$

$$(1+x\%) - OD$$

Where: m_j is duration of stress period j in days (using historical data or forward-looking analysis)

X is the historical daily forecast error (if forecasts are used). If historical data are used, this can also be

interpreted as a scaling factor if level of cash flows are expected to rise (for example, due to inflation)

OD is the level of cash available through existing mechanisms (such as overdraft).

This method identifies the stress periods with the highest magnitude of cumulative cash outflows in a given period timeframe. The level of net cash outlays in this period then serves as the basis for the CB target.

An alternative is to take the average level of net outflows in stress periods:

$$\text{Target CB} = [\text{average}_j \sum_{i=1}^{m_j} (\text{Net outflow in day } i)]. \quad (5)$$

$$(1+x\%) - OD$$

For additional prudence and simplicity, net flows can be replaced with outflows in the formulation. US, for example, held a cash buffer to cover one week of outflows from the government's account until recently (Box 2).

Another practical way is to apply ideas from inventory modeling, as discussed in Box 6.

A Joint Cash Buffer Target

The cash and debt management perspectives are not mutually exclusive in terms of the cash buffer target. A cash buffer of sufficient size can help the government to mitigate risks—that is, serve the objectives of coping with cash flow volatility and forecast errors—and to secure debt service and financing. Ideally, the government should have a unified cash buffer management policy. Cash and debt managers should decide the overall cash buffer target to avoid over-borrowing and to minimize the cost of carry.

One approach is to include cash flows from financing and repayments in the analysis for the cash management buffer. In Canada, in 2017–18, the government's overall liquidity levels were maintained to cover at least one month of net projected cash flows, including coupon payments and principal (Box 4). In this case, the cash flows used in formulas (4) and (5) will be inclusive of debt service and borrowing. For formula (6), net TSA changes should include effects of debt flows.

A two-tiered structure can also be created. The tiers differentiate between (1) a “safety” (Tier-1) buffer that is to be resorted to less frequently (such as for purposes of meeting debt service in periods of market stress) and that can be invested in longer-term instruments if options exist; and (2) Tier-2 that is to be used to meet the transactional needs arising from regular daily cash flow volatility.¹⁵ The cash buffer will be the total of the two components, the first one calculated based one of the formulas (1), (2), or (3); and the second tier based on formulas (4), (5), or (6).

Other Considerations in Adopting a Cash Buffer Policy

Setting up a cash buffer policy requires a careful planning phase that considers the implications for fiscal and monetary policies, in addition to the asset-liability management framework of the government.

Balance Sheet Management: Fiscal Policy and the Borrowing Strategy

Adopting a policy of cash buffer targets has implications for the management of the government's balance sheet. The government's cash balance constitutes an

important portion of the government's financial assets. Switching to a policy of cash buffer targets from a strategy of keeping low reserves, or increasing the target level, results in changes in the composition of the balance sheet. One option is to issue additional debt to raise cash, which can cause an expansion of both sides of the government's balance sheet. Countries have often resorted to over-borrowing (that is, borrowing more than is required by the fiscal deficit) to accumulate the funds needed (Cruz and Koc, 2018). The government can also generate liquid assets by selling off other financial or fixed assets, such as privatization. The implications of these alternatives should be carefully considered within a balance sheet management perspective, taking into account any longer-term effects.¹⁶

Over-borrowing to build a cash buffer may require an adjustment to the borrowing strategy. The government will have to choose the right instruments to meet the extra funding needs if the amount is significant. The process of raising additional funds in the domestic market may require a phased approach to mitigate the pressure on market liquidity and interest rates. The feasibility of this needs to be analyzed to see whether the market has the absorption capacity. Additional communication with market participants may be required to convey the objectives of the government.

Front-loaded over-borrowing for the cash buffer will also have an effect on debt service costs, which should be weighed against the potential benefits over the medium-term. Portugal and Turkey adopted a cash buffer policy within the framework of IMF-supported programs, mitigating some part of the potential pressure from over-borrowing by means of the availability of extra funding. In Hungary, the cash buffer target was increased in the aftermath of the 2008–09 financial crisis using IMF and EU funds (Rez 2018). In 2011, Canada announced plans to borrow an additional amount of Can\$ 5 billion over the following three years, in line with its plans for prudential liquidity management, that is, the cash buffer policy.¹⁷

Fiscal windfalls and one-off revenues can be saved in the cash balances to create a cash buffer. Diverting budgetary resources and/or one-off revenues for cash buffer build-up has implications for fiscal policy and might include an adjustment of non-discretionary

¹⁶See International Monetary Fund (2018) for a general discussion of public sector balance sheet management.

¹⁷Annex 2 of Budget 2011, Debt Management Strategy for 2011–12, <https://www.budget.gc.ca/2011/plan/ann2-eng.html>.

¹⁵For a discussion on investment policy considerations for cash buffers, see Fainboim, Saxena, and Williams (2020).

spending for a given period. Such an adjustment will require political commitment and ideally will be part of the fiscal strategy; it will be important to communicate this to stakeholders, including the general public. Without this adjustment, the diversion of budgetary revenues will require additional borrowing to meet the funding gap. Saving such revenues also means giving up the opportunity to reduce borrowing.

Once established, the availability of funds in the cash buffer should not generate incentives to increase spending. The funds should only serve to mitigate timing mismatches in cash flows and funding delays. A high-level commitment within the government is required to maintain the cash buffer policy in the medium-term and resist potential spending pressures. The capacity to ringfence the cash buffer resources is an important precondition for the success of a cash buffer policy.

Monetary Policy

The cash buffer policy should be well communicated to the monetary authority. Flows in and out of government balances have direct links to general monetary liquidity in financial markets.¹⁸ The process of building the buffer and developing the government's policies to keep the balances near the target level will be important considerations for the central bank in designing and implementing monetary policy. The government also needs to understand the policy framework of the central bank and to stay informed about the general monetary conditions and planned monetary market operations. Close communication with the central bank will facilitate the plans for and the timing of borrowing operations.

Additional borrowing for the cash buffer will drain funds from the financial markets if the balance is held at the central bank. The central bank aims to ensure the availability of a certain level of money supply for the functioning of the financial markets and the real sector; accordingly, the central bank needs to harmonize its liquidity management policy with the government's cash buffer strategy. The ministry of finance and the central bank should avoid conveying a conflicting policy framework picture to the financial markets.

¹⁸Pessoa and Williams (2012) look at the interaction between treasury cash management and monetary policy operations within the wider context of the respective economic responsibilities of the ministry of finance and the central bank, while focusing on institutional arrangements for an effective relationship.

In periods of scarce liquidity in financial markets, over-borrowing for cash buffer purposes will amplify the magnitude of the shortage. Under these circumstances, the government's borrowing from the market to build up reserves at the central bank can be costly. The ministry of finance needs to have an understanding of the market situation and the bank's desired levels of liquidity in the financial system to be able to design and implement an effective borrowing strategy. Uncoordinated action by the ministry of finance may dictate an unwarranted policy action by the central bank to compensate for the extra drain of liquidity.

The process of building up a cash buffer can be easier if there is already excess liquidity in the financial system. In such a case, the government's withdrawal of funds can facilitate the central bank's operations in sterilizing the excess. The instruments available to the central bank are often very short-term; sterilization of funds over extended periods of excess liquidity can be operationally cumbersome and financially costly for the bank. However, if the government can mop up this liquidity for its own policy objectives, this drain of cash from the banking system can support the central bank's monetary policy operations. Doing this does not compromise the independence of the central bank because the government is aiming at its own target.

The government's commitment to maintaining its buffer keeps an equivalent level of liquidity outside of the banking system for extended periods. Therefore, the government's ability to forecast its cash balances and take the necessary measures to keep the cash buffer at the targeted levels in a stable manner is of paramount importance for the central bank in planning its own liquidity management operations. The central bank will factor in the target buffer in monetary projections. Deviations from the target may require action from the bank to be able to meet its liquidity management objectives.

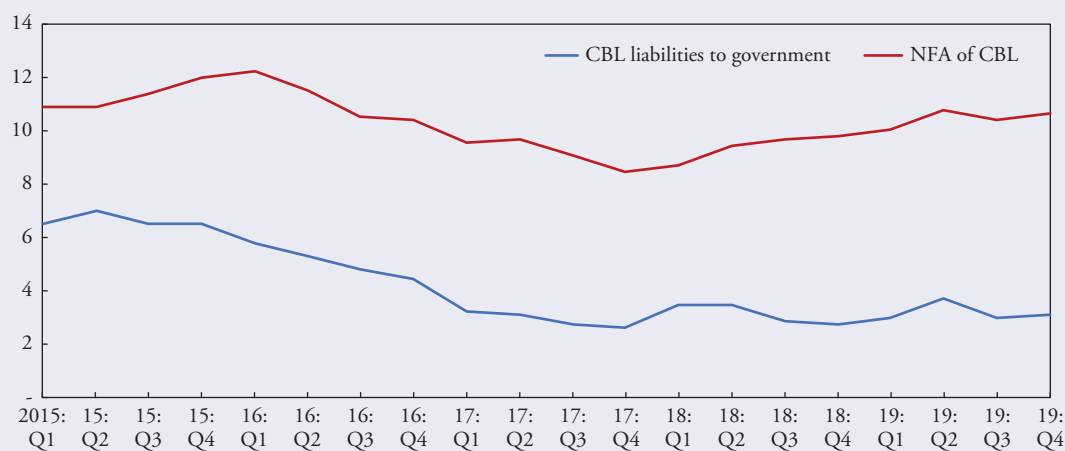
Fluctuations in the government cash balance can move other components of the central bank's balance sheet, including international reserves. If a part of cash buffer is kept in foreign currencies, any change in that portion of the buffer will have a direct effect on the level of reserves. In some policy settings, even movements in local currency balances can influence the level of reserves (See Box 7 for the case of Lesotho). In such settings, the establishment of a cash buffer can smooth out the volatility in the central bank's balance sheet, helping to achieve the net foreign asset or international reserve targets.

Box 7. Volatility in the Central Bank Balance Sheet: The Case of Lesotho

In Lesotho, the main anchor of economic policy is the exchange rate peg between the local currency, Loti, and the South African Rand. The peg is attained by maintaining net international reserves (NIR) at a level that is sufficient to guarantee that for every Loti issued, there is a basket of foreign currency equivalent reserves. In practice, the level of reserves has been moving almost concurrently with the fluctuations in the level of the government's cash balances at the Bank of Lesotho. One reason for this is the close integration of the local financial markets with those of South Africa. Cash flows leaving the government accounts

end up increasing banking system liquidity, which is then invested in the neighboring market, exchanging local currency into Rand. As Loti funds move out of TSA balances, foreign currency liquidity leaves the central bank balance sheet. This moves the central bank's net foreign assets in parallel to the government's cash balances. The periodicity of cash inflows to the government's accounts (from revenues transferred from the South African Customs Union) augments the frequency of these fluctuations, complicating the task of the Central Bank of Lesotho (Box Figure 7.1).

Box Figure 7.1. Lesotho: Central Bank Liabilities to Central Government vs Central Bank Net Foreign Assets
(Billion LSL)



Source: Central Bank of Lesotho, Quarterly Economic Review Reports.

Investment Policy

Governments can benefit from investing the cash buffer in terms of cost savings, because unremunerated balances increase the cost of carry. Cruz and Koc (2018) show that an overwhelming majority of OECD countries with a cash buffer policy have an investment policy to achieve a return on cash balances with prudent risk limits. The cash buffer is often held at the central bank in the form of demand and/or time deposits.

The government has to decide on the investment horizon, investment instruments, and currency composition of the cash buffer, depending on the market

and cash flow profile.¹⁹ Money market instruments in particular, repo, and deposits with the central bank or commercial banks are the most common instrument choices. However, funds that are kept for meeting debt service needs over longer periods are more suitable for longer-term investment. Canada maintains an important portion of its reserves as “callable” demand deposits at the Bank of Canada (Box 4). In terms of currency composition, the asset-liability management approach is often used to determine a suitable structure for a cash buffer. For example, most OECD countries have a liquidity buffer that contains only the local currency

¹⁹For a fuller guide on investment policy considerations for cash buffers, see Fainboim, Saxena, and Williams (2020).

in line with the fact that sovereign borrowings in the OECD area are predominantly in the local currency.

The investment framework should be complemented by a credit risk management policy. Investing the cash buffer creates exposure to credit risk, which can be defined as the risk that a counterparty will default or be downgraded. Holding cash in central banks mitigates such credit risks. Several countries—including Denmark, Hungary, Mexico, and the US—maintain cash buffers at the central government’s account at central banks to avoid the credit risk associated with investing. However, accounts in central banks usually generate lower remunerations than those at private banks. To manage credit risk arising from cash buffers, restrictions on the credit quality of institutions, as well as on the size of the credit risk exposure to a single counterparty, can be imposed by means of a guideline or policy document.

In recent years, excess liquidity and negative interest rates in some countries’ money and debt markets have had an impact on the cost of carry. For example, the investment opportunities for governments’ cash accounts in some countries, especially in the Eurozone, have shrunk in an environment of negative interest rates, although the borrowing costs also declined. This has led to revisions of cash buffer policies in some countries (such as Latvia, Portugal, and Slovenia). The revisions to cash buffers include the redefinition of the target level (especially where the discrepancy between short and medium-long-term interest rates is high), increased focus on active liquidity management, and diversification of investment options and counterparties.

Governance Framework

The cash buffer policy should be based on a well-defined governance framework. The introduction and implementation of a cash buffer require careful consideration of several governance challenges or aspects, including coordination with relevant stakeholders, transparency of target policy, and regulatory issues.

A cash buffer entails changes in the regulatory framework underpinning government cash and funding operations. This is especially the case when the cash buffer is accumulated via over-borrowing. In this respect, an important challenge for the introduction of a cash buffer may be a regulatory one, particularly in countries where the legal constraints (for example,

a debt rule or an annual borrowing limit) effectively limit the amounts of prefinancing. Once the decision for a cash buffer policy is made at a strategic level, the legal framework should be adapted accordingly. In some cases, the design of the buffer in terms of target level and sources reflects the existing legal and operational requirements. For example, borrowing requirement projections can cover the target amount, or the buffer can be accumulated through short-term financing instruments, such as treasury bills.

Efficient management of cash balances requires a timely flow of information and an effective coordination mechanism among relevant parties. As discussed, several entities, including the central bank, the treasury, and/or the ministry of finance, are involved in various planning, investing, and managing aspects of the cash buffer. For example, CMUs and DMUs should coordinate with the central banks on issues of liquidity management, mainly to ensure that the monetary authority is aware of any cash leaving or entering the financial system, which is useful for monetary policy operations. In addition, DMUs should liaise with CMUs, as well as other relevant departments, to receive up-to-date information on cash forecasts to determine the borrowing requirements. Such an exchange of information enables the CMUs and DMUs to excel at short-term cash flow forecasts, which, in turn, helps them to make informed decisions on the size of the cash buffer.²⁰

CMUs and DMUs benefit from organizing regular meetings and holding ad hoc interactions to address coordination and communication issues. In some cases, the governance framework, including the coordination among the relevant parties, is formalized through a legal document or a memorandum of understanding that outlines the terms and details of activities, including the requirements and responsibilities of each party. Committees might be set up to reinforce communication and enhance sustained coordination among the relevant units, as done in Canada, Poland, and Turkey. In terms of the timing, committee meetings can be planned around key milestone activities, such as announcements of government funding plans. In some cases, committees have also decision-making power over the size and investment activities. For

²⁰Williams (2010) discusses how cash management interacts with other government policies, the need for a close coordination or integration between debt and cash management, the potential benefits of that coordination or integration to financial market development, and the implications for monetary policy.

example, this is the case in Canada, where the committees among the central bank and ministry of finance coordinate work on funding and investment activities at a strategic level.

The governance arrangements for the management of the cash buffer can be incorporated in a regulatory framework to ensure consistency over time. These arrangements would include the objectives of the cash buffer, the framework for setting and reviewing the target, the arrangements for the sharing of information and coordination between institutions and departments, and the investment policy. The ringfencing of the cash buffer should be made part of the regulatory framework by defining the conditions under which the cash buffer can be used. The regulatory framework should also define the degree of permissible deviation from the target and the measures to be taken when there is a deviation. A section in an existing regulation, such as public financial management or treasury regulation or a new ad-hoc regulation, can be considered to define the governance framework.

Another aspect of governance framework is the public communications strategy. Public disclosure of the cash buffer policy has a positive signaling effect on market participants, which, in turn, enhances the credibility of the governance. Besides the general policy, disclosing the actual level of the cash buffer further increases the fiscal transparency and market confidence. This has been the case in many countries, including Canada, Denmark, Italy, and US. However, policymakers need to be mindful of the volatility in government cash accounts due to seasonal and idiosyncratic patterns. Against this background, some countries with a cash buffer disclose the information about the policy without providing information on the actual and target level of the buffer to avoid potential misperceptions.

Concluding Remarks

A cash buffer is a tool to manage liquidity and refunding risks. From a cash management perspective, it plays a critical role in mitigating any adverse impacts of mismatches in cash flows, as well as errors in cash flow forecasts, by ensuring that the right amount of liquidity is available when needed. From a debt management perspective, it helps to address the funding risk that may arise from unanticipated increases in borrowing needs or temporary interruptions to funding sources. Since the early 2000s, a growing number of countries has adopted cash buffer policies; the

experiences of these countries suggest that the policy framework for a cash buffer needs to be structured carefully. In several countries, the existing cash buffers served as a first line of defense against heightened risks during the COVID-19 pandemic.

The design of the cash buffer should carefully consider the sources and potential impact of risk in cash and debt management. Quantitative analyses of cash flow volatility and forecast errors, as well as the potential duration of stressed periods, are key elements of such an assessment process. Quantitative analyses should be complemented by qualitative assessments, such as consideration of existing risk mitigation mechanisms and access to money markets. Countries with limited access to deep financial markets should take a more cautious approach.

There is a trade-off between costs and risks in setting up a cash buffer. On the one hand, the level of the buffer should be sufficient to meet the financing needs during the periods of liquidity strains. On the other hand, excess cash balances should be avoided, given the cost of funding. The cost-risk trade-off changes with the discrepancies between short- and medium-long-term interest rates.

The cash buffer target can be formulated simply by taking into account the potential duration of periods of stress and the existing risk mitigation mechanisms; it can be further modified and enhanced using scenario analyses. Country practices indicate that buffer levels are often calculated as a percentage of net or gross cash flows and/or of debt maturing in the short-term. Although this note makes a distinction between cash buffer policy for debt management and cash management for methodological purposes, it indicates that these two perspectives are not mutually exclusive. Ideally, a cash buffer should be sufficient to mitigate the risks stemming from both cash and debt management.

The cash buffer target levels should be set in line with the government's overall risk management objectives in managing cash and debt. This note proposes simple methodological approaches to calculate target levels that take into account the projected level of debt service or net cash outflows for a given period, the historical periods of stress, as well as the consideration of expected future events that might cause periods of stress. In addition, cash buffer formulations fine tune the target level by factoring in existing risk mitigation measures and potential forecasting errors.

The cash buffer has implications for the overall sovereign balance sheet. The target level, composi-

tion, and investment policy of the cash buffer might entail adjustments in the size and timing of financing program, as well as the use of fiscal revenues, including one-off inflows, such as privatization.

A key aspect of a cash buffer framework is to ensure effective communication and coordination mechanisms. Clearly, the management of different parts of the government's balance sheet fall under the responsibility of different institutions. Maintaining close contacts with the key stakeholders that are involved in the various facets of the cash management, and exchanging information on the cash buffer policy, ensure the

effective management of government bank accounts, as well as of funding transactions. Coordination between the government and the central bank is also important from a monetary policy implementation perspective.

To ensure regular communication, countries can benefit from forming committees among the relevant institutions to work on funding and investment activities at a strategic level. In addition to governmental institutions, public communication of the cash buffer policy is important from both market confidence and fiscal transparency perspectives.

Annex 1. Central Government Cash Balances at the Central Bank (Percent of GDP)¹

	2014	2015	2016	2017	2018
Albania	1%	1%	1%	1%	3%
Algeria	26%	13%	5%	3%	8%
Angola	8%	10%	10%	5%	6%
Azerbaijan	8%	11%	7%	2%	2%
Barbados	1%	1%	0%	0%	4%
Belarus	3%	5%	4%	6%	6%
Belize	7%	1%	1%	2%	2%
Benin	1%	2%	1%	2%	4%
Bolivia	14%	12%	12%	11%	8%
Botswana	1%	1%	2%	1%	3%
Brazil	10%	15%	17%	16%	19%
Bulgaria	8%	7%	12%	10%	9%
Burkina Faso	2%	2%	4%	2%	2%
Burundi	4%	4%	4%	4%	5%
Cabo Verde	2%	3%	2%	2%	2%
Cambodia	6%	8%	10%	11%	13%
Cameroon	0%	1%	0%	2%	2%
Central African Republic	1%	0%	1%	2%	2%
Côte d'Ivoire	2%	3%	3%	3%	3%
Czech Republic	0%	2%	4%	5%	5%
Denmark	11%	8%	5%	6%	6%
Dominica	1%	2%	3%	5%	7%
Gabon	0%	0%	0%	2%	2%
Georgia	2%	3%	3%	3%	2%
Ghana	4%	2%	2%	3%	2%
Grenada	1%	2%	2%	1%	3%
Guatemala	1%	1%	1%	1%	2%
Haiti	6%	4%	4%	4%	4%
Honduras	3%	3%	2%	2%	2%
Hungary	3%	2%	3%	2%	3%
Iceland	25%	17%	10%	6%	7%
Indonesia	1%	1%	1%	1%	1%
Iraq	1%	3%	2%	3%	8%
Israel	1%	2%	2%	2%	2%
Japan	2%	3%	4%	3%	3%
Kazakhstan	5%	5%	2%	2%	2%
Kenya	3%	2%	3%	2%	2%
Korea	5%	4%	4%	3%	3%
Kuwait	1%	2%	3%	5%	4%
Lesotho	19%	18%	10%	3%	4%
Macedonia, FYR	7%	5%	5%	4%	5%
Mauritius	4%	5%	7%	3%	1%
Mexico	2%	2%	2%	2%	3%
Moldova	2%	2%	3%	4%	4%
Mongolia	2%	2%	4%	5%	1%
Mozambique	5%	4%	4%	7%	4%
Namibia	1%	7%	3%	3%	4%
Nepal	4%	4%	9%	13%	4%
New Zealand	1%	1%	1%	1%	3%
Nicaragua	1%	2%	2%	3%	2%
Niger	3%	2%	1%	3%	1%
Nigeria	1%	1%	2%	1%	2%
Norway	4%	3%	5%	5%	5%
Panama	9%	8%	7%	4%	4%
Paraguay	5%	4%	4%	4%	4%
Peru	7%	10%	8%	5%	4%
Poland	1%	1%	1%	1%	1%
Rwanda	3%	3%	3%	3%	4%

(continued)

Annex 1. Central Government Cash Balances at the Central Bank (Percent of GDP)¹
(continued)

	2014	2015	2016	2017	2018
Senegal	3%	1%	1%	1%	2%
South Africa	2%	2%	2%	1%	2%
St. Kitts and Nevis	5%	2%	2%	3%	3%
St. Vincent and the Grenadines	2%	1%	1%	2%	2%
Suriname	1%	2%	5%	2%	2%
Sweden	6%	6%	6%	5%	5%
Tajikistan	5%	6%	5%	10%	6%
Tanzania	1%	0%	1%	2%	2%
Thailand	1%	3%	1%	1%	2%
Togo	3%	1%	3%	3%	3%
Turkey	1%	1%	1%	2%	1%
Uganda	7%	5%	5%	4%	4%
Ukraine	1%	3%	2%	2%	1%
Uruguay	5%	6%	5%	4%	4%
Zambia	2%	2%	1%	1%	1%

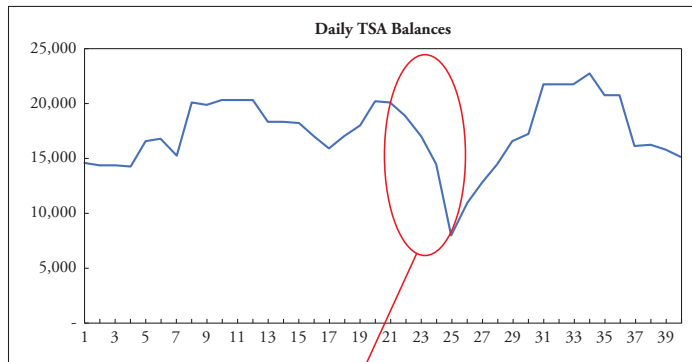
¹IMF's Monetary and Financial Statistics. Select countries with cash balances over 1 percent of GDP at the end of 2018. Figures depict year-end balances. Several governments also hold cash balances at commercial banks, which are not captured in the figure.

Annex 2. Template for a Cash Buffer Target for Debt Management

	Monthly debt service	3-month debt service	Moving CB target	CB targeted to average debt service	CB targeted to max deb service
Jan	2.0	13.0	6.5	11.7	15.5
Feb	5.0	18.0	9.0	11.7	15.5
Mar	6.0	21.0	10.5	11.7	15.5
Apr	7.0	24.0	12.0	11.7	15.5
May	8.0	27.0	13.5	11.7	15.5
Jun	9.0	31.0	15.5	11.7	15.5
Jul	10.0	31.0	15.5	11.7	15.5
Aug	12.0	27.0	13.5	11.7	15.5
Sep	9.0	20.0	10.0	11.7	15.5
Oct	6.0	20.0	10.0	11.7	15.5
Nov	5.0	24.0	12.0	11.7	15.5
Dec	9.0	25.0	12.5	11.7	15.5
Jan	10.0				
Feb	6.0				
	Maximum 3-Month Debt Service		31.0		
	Average. 3-Month Debt Service		23.4		
	Coverage (C) from other means		50%		

Annex 3. Template for a Cash Buffer Target for Cash Management

Day	TSA balance	Change in the TSA balance	5-day net flow
1	14,671		
2	14,445	(226)	
3	14,357	(89)	
4	14,293	(64)	
5	16,631	2,338	
6	16,845	215	2,174
7	15,305	(1,541)	859
8	20,177	4,872	5,820
9	19,864	(313)	5,572
10	20,334	470	3,704
11	20,334	-	3,489
12	20,334	-	5,030
13	18,346	(1,988)	(1,831)
14	18,394	48	(1,470)
15	18,222	(172)	(2,112)
16	17,000	(1,222)	(3,334)
17	16,000	(1,000)	(4,334)
18	17,000	1,000	(1,346)
19	18,000	1,000	(394)
20	20,286	2,286	2,064
21	20,165	(121)	3,165
22	18,922	(1,243)	2,922
23	17,052	(1,870)	52
24	14,502	(2,550)	(3,498)
25	8,000	(6,502)	(12,286)
26	11,000	3,000	(9,165)
27	12,821	1,821	(6,101)
28	14,474	1,653	(2,579)
29	16,610	2,137	2,108
30	17,250	640	9,250
31	21,793	4,543	10,793
32	21,793	-	8,972
33	21,793	-	7,320
34	22,758	965	6,148
35	20,747	(2,010)	3,497
36	20,804	56	(989)
37	16,210	(4,594)	(5,583)
38	16,310	100	(5,483)
39	15,810	(500)	(6,948)
40	15,210	(600)	(5,538)



Formula (4)

Max Stress Period - m_1 (Days)	5	from observed data
Max 5-day Net Outflow	12,286	from observed data
Potential error (X)	10%	assumption
Overdraft facility available (O)	3,000	from the Central Bank
CB Target	10,515	

Formula (6)

Max Stress Period - m_1 (Days)	5	from observed data
St Deviation of Change in TSA	2,096	from observed data
z-score	2.00	choice
Overdraft facility available (O)	3,000	from the Central Bank
CB Target	6,372	

References

- Agência de Gestão da Tesouraria e da Dívida Pública (IGCP). 2014. “Government Debt and Cash Management Annual Report 2014.” IGCP, Lisbon.
- Agência de Gestão da Tesouraria e da Dívida Pública (IGCP). 2017. “Government Debt and Cash Management Annual Report 2017.” IGCP, Lisbon.
- Association for Financial Markets in Europe (AFME). 2017. *European Primary Dealers Handbook*. Updated Q3 2017. Brussels, Frankfurt, London: AFME.
- Canada Department of Finance. 2018. *Debt Management Report 2017–18*. Ottawa: Government of Canada.
- Cruz, P., and F. Koc. 2018. “The Liquidity Buffer Practices of Public Debt Managers in OECD Countries.” OECD Working Papers on Sovereign Borrowing and Public Debt Management, No. 9, OECD Publishing, Paris. <http://dx.doi.org/10.1787/3b468966-en>.
- Denmark Central Bank. 2019. “Danish Government Borrowing and Debt 2018.” Report, Danmarks Nationalbank, Copenhagen, January. <http://www.nationalbanken.dk/en/governmentdebt/publications/Pages/Danish-government-borrowing-and-debt-2018.aspx>.
- Denmark Central Bank. 2020. “The Danish Government Has a Good Starting Point to Finance the Expenses Related to Corona.” Analysis No. 6, Danmarks Nationalbank, Copenhagen, April.
- Fainboim, I., Saxena, S., and Williams, M. 2020. “How to Develop a Framework for the Investment of Temporary Government Cash Surpluses.” International Monetary Fund, Washington DC.
- Greece Public Debt Management Agency. 2019. “Funding Strategy for 2020”. Athens, Greece, December. <http://www.pdma.gr/en/component/content/article/17-investor-relations-library/2675-funding-strategy-for-2020?Itemid=197>
- Guscina A., S. Malik, and M. Papaioannou. 2017. “Assessing Loss of Market Access: Conceptual and Operational Issues.” Working Paper No. 17/246, International Monetary Fund, Washington, DC. <https://www.imf.org/en/Publications/WP/Issues/2017/11/15/Assessing-Loss-of-Market-Access-Conceptual-and-Operational-Issues-45347>.
- Hungary Government Debt Management Agency. 2020. “Revised Debt Management Outlook.” April. <https://akk.hu/akk-publications/publications>, Budapest.
- International Monetary Fund (IMF). 2018. *Fiscal Monitor: Managing Public Wealth*. Washington DC, October.
- Jonasson, T., and M. Papaioannou. 2018. “A Primer on Managing Sovereign Debt-Portfolio Risks.” IMF Working Paper 18/74, International Monetary Fund, Washington, DC. <https://www.imf.org/en/Publications/WP/Issues/2018/04/06/A-Primer-on-Managing-Sovereign-Debt-Portfolio-Risks-45746>.
- Pattanayak, S., and I. Fainboim. 2011. “Treasury Single Account: An Essential Tool for Government Cash Management.” IMF Technical Notes and Manuals, International Monetary Fund, Washington DC. <https://www.imf.org/external/pubs/ft/tnm/2011/tnm1104.pdf>.
- Pessoa, M., and M. Williams. 2012. “Government Cash Management: Relationship between the Treasury and the Central Bank.” IMF Technical Notes and Manual, International Monetary Fund, Washington, DC. <https://www.imf.org/external/pubs/ft/tnm/2012/tnm1202.pdf>.
- Réz, A. 2018. “Public Cash Management in Hungary: The Role of the Government Debt Management Agency.” Presentation at PEMPAL Treasury Community of Practice Cash Management Thematic Group Meeting, Vienna, November. https://www.pempal.org/events/tcop-cash-management-thematic-group-meeting_eng.
- Swedish National Debt Office. 2020. “Debt Office Is Well-Prepared for Financing Crisis Package.” Press release, March 16. Stockholm.
- Uruguay Ministry of Economy and Finance. 2020. “Uruguay Sovereign Debt Report,” Montevideo, May.
- US Department of the Treasury. 2015. “Quarterly Refunding Statement of Acting Assistant Secretary for Financial Markets Seth B. Carpenter,” June 5, Washington DC. <https://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Pages/Official-Remarks.aspx>.
- US Department of the Treasury. 2020. “Treasury Presentation to the Treasury Funding Advisory Committee.” Fiscal Year 2020, Q3 Report. August, Washington DC.
- Williams, M. 2010. “Government Cash Management: Its Interaction with Other Financial Policies.” IMF Technical Notes and Manual, International Monetary Fund, Washington, DC, <https://www.imf.org/external/pubs/ft/tnm/2010/tnm1013.pdf>.
- Williams, M. 2016. “Targeting the Cash Balance: The Cash Buffer.” Presentation at PEMPAL Treasury Community of Practice Cash Management Thematic Group Meeting, March 2016, Ankara. https://www.pempal.org/sites/pempal/files/event/attachments/pempal-mike_williams_targeting_the_cash_balance_mar16.pptx.
- World Bank Group. 2014. “The Target Cash Buffer: Government Bond Market Peer Group Survey Analysis.” Capital Markets and Corporate Governance Service Line Finance & Markets Global Practice, August. <http://pubdocs.worldbank.org/en/361801442253296095/FS-Gemloc-PGD-May-6-2014-Survey-Analysis.pdf>.

