

Central Bank Governance and Reserve Portfolios Investment Policies

An Empirical Analysis

Daniela Klingebiel

Carmen Mileva Herrero Montes

Marco Ruiz

James Seward



WORLD BANK GROUP

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Abstract

This paper uses a unique survey data set of 105 central banks to investigate whether investment policies for central bank foreign reserve portfolios are linked to the governance arrangements for reserve management. The paper evaluates whether a central bank's investment decision-making structure impacts how much risk institutions take in their reserve management operations and the level of diversity in their reserve portfolios. Additionally, it explores the implications of the broader governance environment on reserve management. The analysis yields four key findings. First, internal governance arrangements matter for foreign reserve portfolio investment policy; the empirical results indicate that reserve portfolios are more diversified in central banks in which the middle office directly reports to the board. Second, controlling for the level of reserves, the macroenvironment, and the broader governance environment, reserve portfolios are more diversified in central banks where the

back, middle, and front offices are separated. Third, the regression analysis also reveals that central banks in countries where the Ministry of Finance has an obligation to cover negative equity have fewer eligible currencies and are therefore less diversified. Fourth, central banks where boards actively exercise portfolio oversight usually have portfolios with more risk and diversification. Portfolios with longer investment horizons, more currencies, and a broader set of asset classes have performed better historically while limiting downside risk. Given that the analysis controls the broader governance environment, the data indicate that any central bank can improve its internal governance regardless of the external governance environment. This paper contributes to the literature on central bank foreign reserves management and on understanding the importance of governance arrangements in investment policy.

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**Central Bank Governance and Reserve Portfolios Investment Policies:
An Empirical Analysis¹**

Daniela Klingebiel, Carmen Mileva Herrero Montes, Marco Ruiz, and James Seward²

The World Bank, 1225 Connecticut Ave NW,
Washington, DC 20433, USA

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1. Introduction

Governance is crucial for central banks. According to Bossu and Rossi (2019), the concept of central bank governance is multifaceted. They contend that a clearly defined central bank mandate and decision-making structure are essential to support accountability and legitimacy. Such a mandate should elaborate on objectives, functions, and powers, specifying the legal tools available for a central bank to implement its functions. Clear decision-making structures are also necessary to ensure adequate implementation of the mandate. Given the complexity of central banks and the multiple responsibilities they assume, it is crucial to define what to decide, who must decide, and how decisions must be made (Bossu and Rossi 2019).

Our empirical analysis focuses on the governance of reserve management, a key part of central bank governance overall. As foreign currency reserves have significantly increased and represent an essential part of central bank assets, the process for making investment decisions and overseeing results becomes more relevant. We aim to contribute to the reserve management governance discussion with data-driven analysis using a unique survey data set on central bank reserve management practices. Most previous publications on the topic are prescriptive and qualitative. Notably, our research shows that governance arrangements do matter for the investment policy of foreign reserve portfolios.

As the first step in this analysis, we briefly review the literature on central bank governance, focusing on reserve management operations. We then describe the data that we use for empirical research. We use a unique data set collected by the World Bank's Reserve Advisory and Management Partnership (RAMP) using two surveys conducted across 99 central banks in 2018 and 105 central banks in 2019. The surveys collected data on central banks' reserves management activities, including their governance structures, components of their investment policies and asset allocations, and their accounting and profit-sharing methodologies. We also deploy data that describes the broader institutional and macroenvironment in which these central banks operate and proxies for reserve adequacies. We use this data set to address novel research questions to find links between specific governance arrangements and reserve management investment policies. Finally, we conclude and discuss the possible implications of our key findings for the management of reserves.

2. Literature Review

Central banks have various roles and are responsible for a broad list of functions, which have grown significantly over time. While central banks vary substantially in terms of structure and purpose globally, all institutions have critical responsibility for monetary policy, financial system stability, and safeguarding the financial infrastructure's core elements. Managing foreign reserves is typically another essential central bank function (Anasashvili et al. 2020). This section briefly summarizes the literature around central bank legal frameworks, functions, and governance arrangements, focusing on reserves management.

Legal Framework. The legal frameworks of central banks differ widely from country to country. For example, most common-law countries do not have constitutional provisions for the central bank. Countries with these provisions often differ in the rules and authorities concerning central bank functions and mandates that are built into their constitutions (Ortiz 2009). Most central bank laws, however, explicitly define independence, prescribe the central bank's policy goals, and provide discretion and autonomy to achieve those goals through policies and operations (Khan 2017).³ For many central banks, price stability, monetary policy, financial supervision, and reserve management are part of a legislative mandate. (Appendix III contains a brief review of the relationships between financial supervision functions and both the broader governance environment and reserve management.) In other cases, central banks' objectives are implicit in more general economic goals. For example, price stability is critical for realizing stable economic growth. Following the 2008–09 global financial crisis, the objectives and powers delegated to central banks increased significantly to allow for unconventional responses to halt a worldwide financial meltdown (Balls, Howat, and Stansbury 2018). Building on this expansion during the global financial crisis, central bank actions in response to the COVID-19 pandemic have been unprecedented in history in terms of speed, scope, and scale.⁴ Observers of central banks have raised questions about the rapid expansion of new instruments and unconventional monetary policies and the implications of these for central bank independence (De Haan and Eijffinger 2016).

Reserve Management Function. Holding and managing a country's official foreign reserves are among a central bank's core functions (Bossu and Rossi 2019). Central banks' reserve management operations have always been part and parcel of their monetary policy function. Initially, most central banks had currencies backed by gold, and their reserves primarily consisted of gold bullion. With the abolition of the gold standard in 1971, central banks started diversifying their reserves into foreign asset pools.

Holding foreign reserves has various purposes. Most notable are self-insurance for balance-of-payments crises and support of exchange rate policies. In some countries, reserves also support financial stability by providing lender-of-last-resort functions in foreign currency. As a result, reserves protect the country against disruptions and volatility in international capital markets. Over the past two decades, successive financial crises have solidified and validated this approach. Recent research indicates that emerging market central banks holding relatively higher foreign reserves experienced less currency depreciation, smoother credit growth, and more stable credit ratings. Countries with higher levels of reserves also had better access to external funding during the global financial crisis of 2008–09 (Arslan and Cantú 2019). Furthermore, empirical research identifies a relationship between political instability and weak institutions in emerging markets,

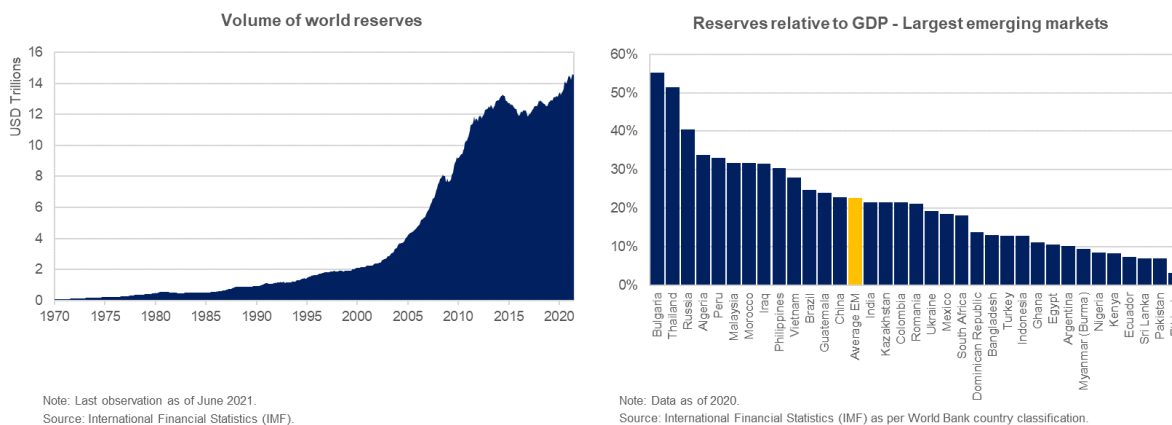
3. For a compendium of such legislation globally, see International Monetary Fund, Central Bank Legislation Database, <https://cbld.imf.org/#/>. Ashraf Khan's 2017 IMF Working Paper (Khan 2017) provides an analysis of the data.

4. See IMF (2020) for a global accounting of the monetary and fiscal policy actions taken by governments worldwide.

resulting in central banks accumulating international reserves as a risk mitigation method to deal with broader economic uncertainties (de la Rosa, 2015).

Foreign reserves have grown significantly over the past four decades, and they are now at record highs (Figure 1). Emerging economies, notably China, have led this trend. Economic development and higher commodity prices have encouraged capital inflows and higher exports in emerging economies. As a result, central banks have intervened in foreign exchange markets and accumulated foreign reserves to curb the appreciation of their exchange rates. As Figure 1 shows, this build-up has been a worldwide phenomenon. On average, emerging market central banks⁵ have accumulated foreign reserve levels at or above 23 percent of GDP (see Figure 1).⁶ Many countries hold reserves far above traditional benchmarks, such as three months of import cover, 20 percent of broad money, and 100 percent cover of short-term external debt repayments. In addition, according to the Assessing Reserve Adequacy (ARA) metric⁷ of the International Monetary Fund (IMF), approximately half of the reported countries have reserves above the adequate level.

Figure 1 Accumulation of Foreign Reserves Worldwide



The buildup of reserves has transformed the way central banks manage these funds. Although they remain invested primarily in government bonds and other conservative instruments, the adoption of nontraditional asset classes, such as mortgage-backed securities, corporate bonds, and equities, is on the rise (Anasashvili et al. 2020).

5. This conclusion draws on the World Bank current country classification. Emerging markets are countries classified as being those with low, lower-middle, and upper-middle incomes.

⁶ This figure is based on available data for emerging markets for 2020, and refers to the GDP-weighted average of official reserve assets.

7. The International Monetary Fund publishes the ARA metric for 65 countries. This metric combines some traditional reserve adequacy variables, like broad money, short-term debt, and imports, to provide a more robust estimate of reserve adequacy. The data and the methodology are available at https://www.imf.org/external/datamapper/Reserves_ARA@ARA/CHN/IND/BRA/RUS/ZAF.

Reserve Management Governance. Reserve management governance refers to the institutional arrangements and processes for policy development and investment of foreign exchange assets. According to de Abreau Faria and Ermes Streit (2016), an effective governance framework ensures clear delegation and separation of responsibilities. Governance arrangements typically establish the policy-making structure; in other words, they determine who is responsible for each type of decision. In addition, these arrangements include reporting lines and oversight mechanisms. Figure 2 depicts a stylized structure of governance arrangements.

Like other central bank arrangements, reserve management governance reflects country-specific institutional, social, and regulatory considerations. Central bank laws are generally not specific and prescriptive about the reserve management function. This allows flexibility to define and adjust governance as markets evolve, asset classes change, and portfolio practices modernize over time.

Despite the importance of country-specific factors, there is agreement on the most relevant principles for reserve management. The IMF Guidelines for Foreign Exchange Reserve Management are an excellent example of generally agreed reserve management principles. The IMF developed this document in consultation with various central banks and international organizations, including the World Bank. According to the Guidelines, the "internal governance structure of the reserve management entity should be guided by and reflect the principles of clear allocation and separation of responsibilities. Sound management of internal operations and risks requires appropriately qualified and well-trained staff, following sound business practices" (IMF 2014). The guidelines further suggest that central bank boards should make decisions at a strategic level and delegate decisions concerning strategy implementation to the investment committees. The operational units implement the decisions made by the board and the investment committee. Such a division of responsibilities results in a three-tier decision-making structure for reserve management operations.

A clear definition of roles and policies is considered critical. The investment policy statement for reserve management is the most suitable place to define eligible asset classes, investment instruments, and transactions (Johnson-Calari and Strauss-Khan 2020). The board's involvement in the investment policy definition is deemed the most effective structure to ensure robust oversight and informed decision-making. Furthermore, the role of every person who participates in the investment process must be defined clearly, along with well-defined documentation of processes, to allow continuous decision-making (Ruiz 2020).

Figure 2 Governance Arrangements



Source: Johnson-Calari and Strauss-Khan (2020).

RAMP (Anasashvili et al. 2020) collected data on how central banks organize their reserve management operations. The survey findings indicate that reserve governance arrangements vary across central banks. Most of the 105 respondents to the 2019 RAMP survey follow a three-tier governance structure. Ninety-two percent of central banks reported that their respective boards approved the reserve management policy, including high-level decisions such as reserve management objectives, risk tolerance, investment horizon, and strategic asset allocation. Moreover, RAMP (Anasashvili et al. 2020) also showed that central banks' boards frequently approve the investment management guidelines, that is, the specific investment rules for managing the portfolio, indicating that many central bank investment committees have limited decision-making power. Many boards also have the responsibility of hiring external managers (Anasashvili et al. 2020). Finally, the survey showed that middle office reporting to the board on risk and return information varies across central banks (see Anasashvili et al. 2020).

Apart from the specific governance arrangements for reserves management operations, the RAMP survey investigated how central banks organize their operational units. Typically, central banks separate the reserve management function into three different operational units. The first is the front office that plans and executes trades. The second is the middle office, responsible for measuring risks and producing reports. The third oversees the trade settlement and accounting of reserve operations. Even though these operational units have differentiated roles and responsibilities, the location of these individual units in the organizational structure varies, as the RAMP survey showed. Approximately a third of central banks have the front, the middle, and the

back office in the same department, while another third of institutions place them in completely separate departments. The remaining central banks opt for a hybrid approach (Anasashvili et al. 2020).

3. Approach and Objectives

Little quantitative research is available on the link between overall central bank governance and reserve management, despite the critical role that sound reserve management plays in helping, supporting, and maintaining confidence in monetary management (Al Hassan, Farahmand, and Papaianou 2014). As shown above, most publications on reserve management governance are prescriptive and qualitative. Therefore, we contribute to the reserve management governance discussion with data-driven analysis using RAMP's unique survey data on governance and organizational arrangements of central banks and asset allocation and risk measures. Specifically, we investigate whether governance arrangements impact investment policies and central bank risk taking and, if so, precisely which arrangements matter. We also analyze whether organizational arrangements impact central banks' investment policies and whether reporting structures influence central banks' investment policies and risk taking in their reserve management operations. This paper's ultimate goal is to empirically analyze the relationships between a central bank's governance structure for its reserve management operations and its investment policies and risk taking.

4. Methodology and Data

We use correlations and regression analysis to find links between specific governance arrangements and variables related to central banks' reserves investment policies. We start by analyzing correlations between the variables described above and testing for their statistical significance. We then use regression analysis to analyze whether some of the correlation results hold when adjusting for reserve adequacy and indicators that describe the macroenvironment.

We use data groups that capture the governance arrangement, investment policies, and measures of risk taking of individual central banks to test whether governance affects investment policies. First, we use data on governance arrangements for central banks' reserve management operations as an independent variable collected through the RAMP surveys. Second, we utilize RAMP survey data on the composition and risk of reserve portfolios as dependent variables describing a central bank's investment policy. We then deploy three types of control variables to isolate empirically the impact of the governance structure and investment policies.

4.1 Governance and Macroeconomic Variables

We compiled governance variables from multiple sources, collected at the national level, to assess the broader governance environment as a control variable to isolate the effect of the governance arrangements at the central bank level. We also use macroeconomic variables and data on reserve adequacy to further isolate the effects (see Table 1 for a summary).

Table 1 Governance Environment, Macroeconomic, and Reserve Adequacy Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
Governance environment variables					
Government Effectiveness	204	0.0	1.0	-2.4	2.2
Central bank independence	144	2.8	1.2	0	4
Corruption Perceptions Index	179	43.3	18.9	9	87
Governance Pillar Score	143	5.7	2.1	1.1	9.2
Macroeconomic variables					
Country risk score	121	46.6	16.3	13	89
Number of currency crisis (1971–2017)	164	1.5	1.5	0	7
Current account balance (% of GDP)	212	-3.0	9.0	-34	34.8
Reserve adequacy variables					
Reserves to GDP (%)	162	0.2	0.2	0.6	2.0
Reserves to M2 (%)	126	0.4	0.3	0.0	1.9

Governance Variables. We use various indices to measure the broader governance environment in which a central bank operates. First, we use the Government Effectiveness index, as compiled by the World Bank. This index measures the "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies."⁸ The scale runs from -2.5 (lowest) to 2.5 (highest) and covers 204 countries. The index is developed by compiling and summarizing information from over 30 existing data sources that report the views and experiences of citizens, entrepreneurs, and experts in the public, private, and nongovernmental sectors. The rationale for using this variable is that countries with strong governance and effective public sectors usually have well-implemented laws for their central banks. Relatedly, we also use data on central bank independence from the French Treasury. This variable measures the degree of central bank independence in each country. Central banks with no independence are assigned a value of zero, while those with substantial autonomy are assigned a value of 4.⁹ The Directorate General of the Treasury of France surveys this and other institutional characteristics for 144 countries. The survey is based on perception data. The study's results are captured in the Institutional Profiles Database and were last updated in 2016. In addition, clear accountability frameworks and low corruption increase public

8. See https://www.msci.com/documents/10199/e092c439-34e1-4055-8491-86fb0799c38fators/h580f9aa5?country=BRA&indicator=388&viz=line_chart&years=1996,2018 and <https://info.worldbank.org/governance/wgi/Home/Documents>.

9. See <http://www.cepii.fr/institutions/EN/ipd.asp>.

confidence in the central bank. To measure these elements, we use the Corruption Perceptions Index (Transparency International 2019a, 2019b), which scores 180 countries based on experts and business executives' perceptions of the level of corruption in a country's public sector. It is a composite index combining 13 surveys and assessments of corruption collected by various institutions. The index has a scale of 0-100, where zero represents the highest level of perceived corruption and 100 the lowest level of perceived corruption.¹⁰ Finally, we use the Governance Pillar Score (MSCI). This index covers 198 countries to "assess the extent to which a country's long-term competitiveness is affected by its institutional capacity to support long-term stability and functioning of its financial, judicial, and political systems, and capacity to address the environmental and social risks."¹¹ The Governance Pillar Score is included in the MSCI assessment on the environment, social, and governance (ESG) risk of sovereign countries. The best score is zero; the worst is ten. The index is derived from third-party sources and focuses on political rights and civil liberties, stability and peace, control of corruption, and public financial management.

Macroeconomic Variables. We then use the country risk score from the Economist Intelligence Unit's Country Risk Model to control for the macroenvironment. This score rates country risk on a scale from zero (no risk) to 100 (maximum risk), by taking a simple average of the sovereign, currency, and banking sector risk scores of a given country.¹² We included this variable in the analysis to assess the macroenvironment in which central banks operate. Alternatively, we use the number of currency crises and the current account balance as a percentage of GDP as another means of describing the macroenvironment in which the central bank operates.

Reserve Adequacy Variables. Finally, a central bank's risk tolerance and investment policy (number of eligible assets and currencies, portfolio duration, allocation to nontraditional asset classes) are linked to reserve adequacy. All else being equal, a central bank with higher reserve adequacy typically has a higher risk tolerance and can deploy a broader range of asset classes, currencies, and longer duration. Therefore, we use reserve adequacy measures to control for differences in reserve adequacy across central banks. We include two reserve adequacy metrics as control variables: reserves to GDP and to M2. Separately, we also control for GDP per capita and other macroeconomic variables, such as short-term external debt stocks as a percentage of total reserves.

4.2 RAMP Survey Variables

RAMP's global surveys on reserve management practices are the source for information on central banks' governance arrangements, investment policies, and measures of risk taking. RAMP conducted two surveys in 2017 and 2019 with responses from 99 and 105 central banks, respectively.¹³ The RAMP survey data are unique. For the first time, data on governance

10. See <https://www.transparency.org/en/cpi> and

https://images.transparencycdn.org/images/2019_CPI_SourceDescription_EN-converted-merged.pdf.

11. See <https://www.msci.com/documents/10199/e092c439-34e1-4055-8491-86fb0799c38f>.

12. See <https://www.eiu.com/n/solutions/country-risk-model/>.

13. Anasashvili et al. (2020); see

<https://openknowledge.worldbank.org/bitstream/handle/10986/33657/K880541.pdf?sequence=1&isAllowed=y>.

arrangements of reserve management investment operations were collected systematically across central banks globally. In addition to questions on governance arrangements and investment policies, the surveys also included questions on asset allocation, portfolio management, risk management, performance and risk reporting, and transparency. Table 2 lists the survey variables we used to test our set of questions empirically.

Table 2 Summary Statistics of RAMP Survey Variables¹⁴

Variable	Obs.	Mean	Std. Dev.	Min	Max
Governance - Dummy variables					
Independent investment committee	105	0.2	0.4	0	1
Middle office reports to the board	105	0.9	0.3	0	1
Middle office reports to the investment committee	105	0.8	0.4	0	1
Back office, middle office, and front office are in the same department	105	0.3	0.5	0	1
Back office, middle office, and front office are in separate departments	105	0.3	0.5	0	1
Obligation to cover negative equity	93	0.6	0.5	0	1
Governance - Continuous variables					
Transparency of reserve management policies (degree of)	95	0.4	0.3	0	1
Composition of reserve portfolio - Continuous variables					
Number of eligible currencies	100	7.9	4.3	1	20
Number of eligible assets	97	6.8	2.8	1	14
Allocation to nontraditional assets (%)	71	10.1	17.0	0	72
Estimated risk of the portfolio	71	1.0	0.3	0.8	2.9
Investment horizon – Total tranching and untranching portfolio (months)	57	35.3	30.7	1	126
Duration – Total tranching portfolio (months)	52	22.4	18.9	1	84
Duration – Liquidity tranche (months)	64	7.8	12.6	1	76
Duration – Investment tranche (months)	62	32.1	31.5	3	180

With respect to governance arrangements, we consider as independent variables those indicated in the RAMP survey results as differing across central banks and which could therefore influence central bank investment policies and risk taking. We use dummy variables for the following governance arrangements:

- (1) We consider an investment committee independent if it approves the investment management guidelines, that is, the specific investment rules for managing the portfolio.
- (2) We explore whether the middle office reports directly to the board.
- (3) We also consider whether the middle office reports performance and risk metrics to the investment committee.

14. The survey question specifically asked whether the middle office reports to the board on performance and risk metrics and compliance with the investment management guidelines.

(4) We test whether a central bank organizes its reserve management operations in one department.

(5) We further assess whether the reserve management operations are arranged in separate departments.

(6) Finally, we probe the impact of the Ministry of Finance’s obligation to cover the central bank’s negative equity.

Relatedly, we further probe transparency on the risks and returns of reserve management operations to the board as a continuous variable.

We use RAMP survey data collected as continuous data on the number of eligible currencies and asset classes and the allocation to nontraditional asset classes as dependent variables as a reflection of a central bank's investment policies. We also deploy RAMP data to compute the measures of risk as reflected in a central bank's current asset allocation: (1) estimated risk of the portfolio, (2) investment horizon (measured at the total portfolio level for both tranching and untranching portfolios), and (3) duration (measured at the total portfolio level and at the liquidity or investment tranche level).

5. Descriptive Statistical Results

We run simple correlations for the various independent governance variables to identify patterns in the data. The correlations are run to develop context and show empirical relationships between critical elements of reserve management. The full results of the correlation analysis are found in Appendix I.

Independent Investment Committees. We test whether there is a positive statistical correlation between the independence of the investment committee and the characteristics of the investment guidelines. As explained above, we define an investment committee as independent if it is responsible for approving the investment guidelines. Table 3 indicates that an independent investment committee is negatively correlated with the number of eligible currencies and asset classes. Similarly, duration is negatively correlated with an independent investment committee.

Table 3 Independence of the Investment Committee and Reserve Portfolio Metrics

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Independent investment committee	-0.233*	-0.102	-0.148	-0.282**	-0.108	-0.14

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

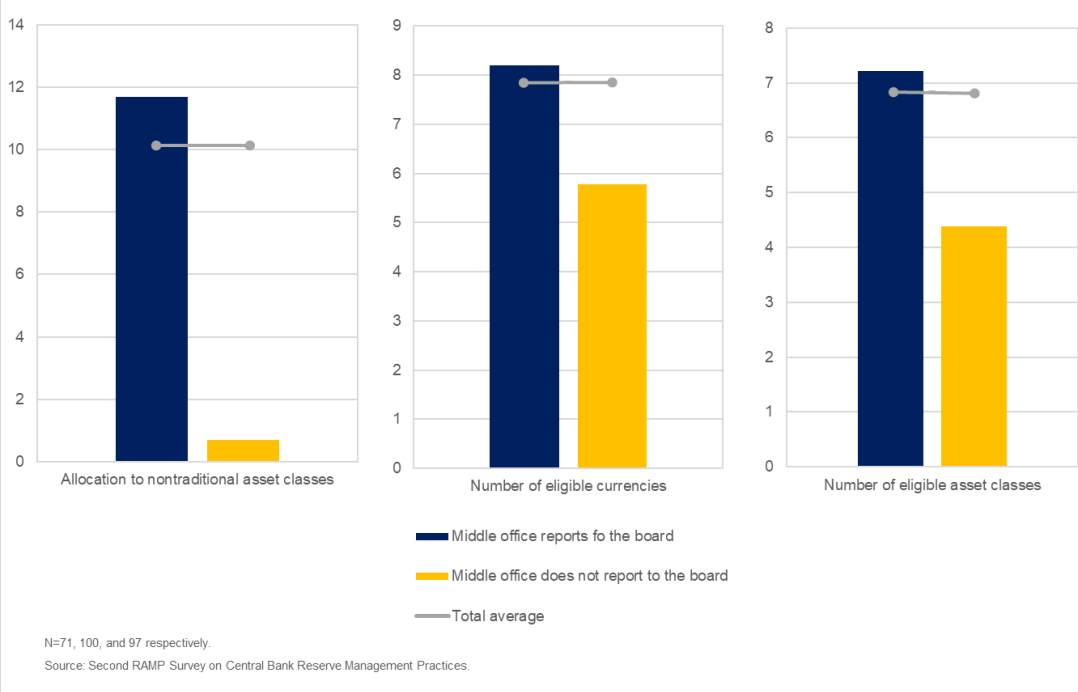
Middle Office Reporting Directly to the Board. Additionally, we find a statistically positive correlation between the middle office's reporting and a central bank's risk-taking and investment policies (Table 4). When the middle office reports directly to the board, we observe a higher allocation to nontraditional assets and more diversified reserve portfolios as the number of currencies and asset classes increases (see Figure 3).

Table 4 Reporting to the Board and Investment Policies

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Middle office reports to the board	0.227*	0.193*	0.345***	0.114	0.153	-0.006

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Figure 3 Reporting to the Board and Investment Policies



Organization of Operational Units. We do not find any statistically significant correlation between the organization of the operational units and the diversification of reserve management portfolios or their risk taking. As discussed earlier, the RAMP surveys show that central banks typically clearly separate front-, middle-, and back-office functions. However, we did not find a link between putting all functions in the same or different departments and the level of risk and diversification.

Obligation to Cover Negative Equity and Reserve Portfolio Metrics. Our empirical analysis shows that central banks that do not receive financial support from the government tend to have a more diversified strategic asset allocation with lower overall portfolio risk, even when controlling for distribution policies (see Table 5). Countries in which finance ministries have an obligation to cover central banks' negative equity also have riskier macroenvironments. This observation is consistent with the result that the obligation to cover negative equity is more common in countries with weaker governance. It also may indicate that the necessity of government support for the central bank may be higher in such environments as the economy is less stable and prone to unforeseen shocks that the central bank is not well prepared to manage with existing resources.

Table 5. Obligation to Cover Negative Equity and Investment Policies

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Obligation to cover negative equity	-0.200*	-0.201*	-0.251**	-0.172	-0.309**	-0.067
No obligation to cover negative equity and transfer of realized income (partial and full)	0.221*	0.063	0.211**	-0.004	0.193	0.06
Obligation to cover negative equity and transfer of realized income (partial and full)	-0.201*	-0.217**	-0.230**	-0.153	-0.202	0.011

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

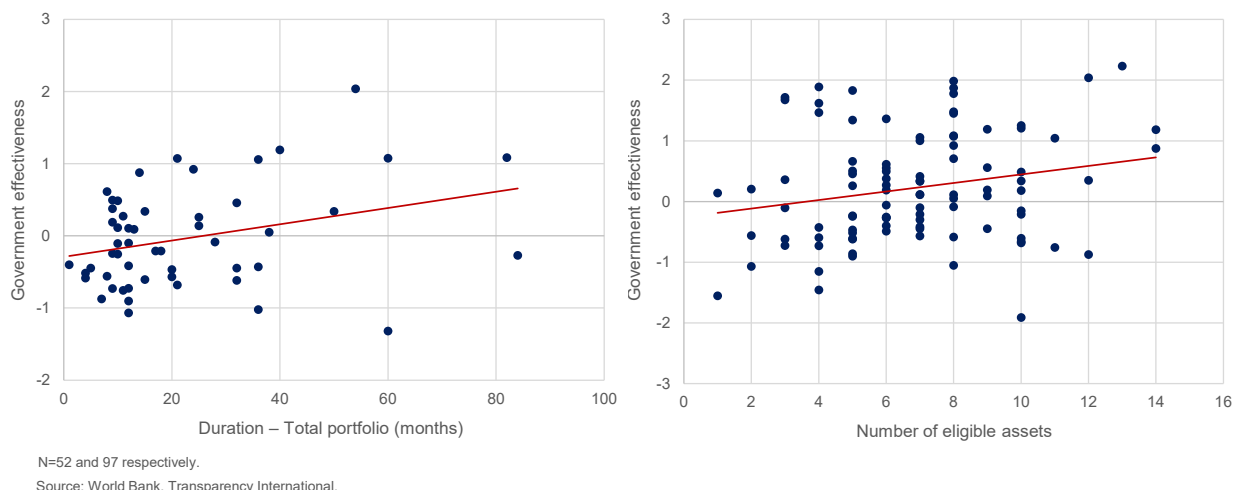
The Broader Institutional Environments and Reserve Portfolio Metrics. Our analysis finds that the broader governance environment in which central banks operate correlates with certain investment policy types (see Table 6). As the table indicates, the government effectiveness index has a strong, statistically significant positive correlation with duration risk and portfolio diversification, measured as the number of eligible asset classes and the allocation to nontraditional asset classes (see Figure 4). Because of these findings, we will use indices that describe the broader institutional environment as control variables in our regressions.

Table 6 Government Effectiveness and Characteristics of Investment Policies

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Estimated risk of the portfolio	0.275**	0.268**	0.253*	0.265**
Allocation to nontraditional assets	0.162	0.114	0.177	0.239**
Number of eligible currencies	0.06	0.076	0.041	0.146
Number of eligible assets	-0.032	0.091	0.204*	0.217**
Investment horizon – Total tranching and untranching portfolio (months)	0.347**	0.348***	0.182	0.237*
Duration – Total portfolio (months)	0.219	0.346**	0.087	0.308**
Duration – Liquidity tranche (months)	0.349**	0.451***	0.225*	0.433***
Duration – Investment tranche (months)	0.250*	0.124	0.185	-0.008

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Figure 4 Investment Policies and Government Effectiveness



6. Multivariate Regression Results

We use regression analysis to delve into some of the correlation analysis on central bank governance and risk. We test the extent to which governance arrangements matter for risk taking and diversification in foreign reserves portfolios while controlling for the broader governance environment in which central banks operate, the level of reserve adequacy, the macroenvironment, or country risk.¹⁵ Additional regression results are found in Appendix II.

Independent Investment Committee. We examine if approving the investment guidelines at the board or the investment committee level makes any difference for reserve management operations. In most central banks, either can have this role. The most significant advantage of leaving this decision to the board is that it has more authority. However, central bank board members may not be financial experts and have less time to focus on reserve management policy. By contrast, the investment committee has less authority, but it can meet more often, and the members usually understand operational nuances and have financial expertise. We test whether the independence of an investment committee influences central bank investment policies, as suggested in our correlation exercise. As explained, as reserve adequacy, the general macroenvironment, and government effectiveness may influence a central bank's risk taking as expressed in their investment policy, we control for these factors. We do not find with any statistical significance that having the investment committee approve guidelines matters, even when different control variables are used to describe the macroenvironment (see Table 7).

15. This choice of variables was influenced by a general-to-specific regression (GETS) run as a way of selecting the most relevant variables out of a relatively large sample of variables when fitting a regression model.

Table 7. Measuring the Impact of an Independent Investment Committee on Investment Policies ¹⁶

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Independent investment committee	-0.544 (0.810)	-1.668 (1.297)	-0.270 (0.239)	4.038 (11.305)
Government Effectiveness	0.380 (0.435)	0.971 (0.728)	0.211 (0.148)	14.590** (7.062)
Reserves to GDP (%)	4.129** (1.669)	5.223* (2.808)	-0.789 (0.760)	-5.334 (24.260)
Short-term external debt stocks, % of reserves	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.019** (0.009)
Current account balance (% of GDP)	0.064 (0.044)	-0.069 (0.072)	-0.008 (0.014)	-0.533 (0.615)
Number of currency crisis (1971–2017)	0.141 (0.234)	0.653 (0.394)	-0.062 (0.074)	0.621 (3.841)
Constant	5.932*** (0.709)	5.877*** (1.194)	2.007*** (0.268)	22.020** (10.539)
Observations	83	85	63	48
R-squared	0.172	0.112	0.102	0.305

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Middle Office Reporting Directly to the Board. We find evidence that reporting lines impact investment policies. Our regression analysis confirms the importance of direct communication between the board and the middle office. We observe that reserve portfolios are more diversified in terms of eligible assets and currencies in central banks where the middle office presents reports to the board. This finding is significant, considering that we control for reserve adequacy and a country's macroenvironment as well as the broader governance environment (see Table 8). These results are robust when using different specifications for macro risks (see Appendix II), and the results also hold when subsampling the data by income level and level of reserves.¹⁷ However, there does not seem to be a significant difference between the groups.

¹⁶ Each of the columns in this table refers to a different regression with the column name as dependent variable (number of eligible asset classes, number of eligible currencies, estimated risk of the portfolio, and investment horizon).

¹⁷ The data was divided into high-income countries and low-income countries, on the one hand, and by level of reserves, above and below US\$15 billion, on the other hand.

Table 8. Measuring the Impact of the Middle Office Directly Reporting to the Board on Investment Policies ¹⁸

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Middle office reports to the board	2.854*** (0.797)	3.098** (1.373)	-0.045 (0.262)	1.304 (12.801)
Government Effectiveness	0.421 (0.403)	1.043 (0.710)	0.229 (0.150)	14.347** (7.044)
Reserves to GDP (%)	4.065** (1.547)	5.072* (2.748)	-0.765 (0.772)	-5.020 (24.300)
Short-term external debt stocks, % of reserves	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.019* (0.010)
Current account balance (% of GDP)	0.059 (0.039)	-0.055 (0.068)	-0.003 (0.013)	-0.616 (0.585)
Number of currency crisis (1971–2017)	0.255 (0.219)	0.774* (0.390)	-0.065 (0.076)	0.564 (3.843)
Constant	3.182*** (0.995)	2.745 (1.732)	2.005*** (0.384)	21.414 (16.198)
Observations	83	85	63	48
R-squared	0.287	0.149	0.082	0.303

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Organization of Reserve Management Operations and Investment Policy. We find support that how institutions organize their reserve management operations matters for the investment policy of central banks. Central banks in which the front, middle, and back office are in the same department have, on average, significantly shorter investment horizons. As macrovolatility, levels of reserves, and the broader governance environment may influence the investment horizon of central banks' reserve operation, we include these in the regression as control variables (see Table 9).

¹⁸ Each of the columns in this table refers to a different regression with the column name as dependent variable (number of eligible asset classes, number of eligible currencies, estimated risk of the portfolio, and investment horizon).

Table 9. Measuring the Impact of the Organizational Structure of Reserve Management Operations on Investment Policies

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Back office, middle office, and front office are in the same department	-0.842	-1.532	-0.243	-15.575*
	(0.603)	(1.010)	(0.194)	(8.952)
Government Effectiveness	0.388	1.019	0.220	17.076**
	(0.431)	(0.723)	(0.147)	(6.974)
Reserves to GDP (%)	4.110**	5.188*	-0.702	-6.832
	(1.651)	(2.796)	(0.758)	(23.460)
Short-term external debt stocks (% of reserves)	0.000	-0.000	-0.000	0.016*
	(0.000)	(0.000)	(0.000)	(0.009)
Current account balance (% of GDP)	0.066	-0.054	-0.006	-0.885
	(0.041)	(0.069)	(0.013)	(0.581)
Number of currency crisis (1971–2017)	0.153	0.661*	-0.048	1.374
	(0.232)	(0.392)	(0.074)	(3.738)
Constant	6.122***	6.111***	2.012***	25.570**
	(0.719)	(1.215)	(0.267)	(10.165)
Observations	83	85	63	48
R-squared	0.188	0.120	0.106	0.350

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Obligation of the Ministry of Finance to Cover Central Bank Negative Equity. The distribution of profits and losses within the government is a sensitive issue for central banks. Although central banks commonly share their earnings with ministries of finance, there are questions regarding the source of those profits (i.e., foreign exchange revaluation or changes in market prices) and the timing (i.e., realized versus unrealized). Despite significant variation in their practices, central banks tend to make partial distributions of realized profits. Our regression analysis confirms that the finance ministry's obligation to cover central banks' negative equity influences investment policy. Reserve portfolios in countries where finance ministries must cover negative equity are less diversified in terms of eligible currencies, even when controlling for reserve adequacy and the macro and broader governance environment. On average, central banks operating in countries where the Ministry of Finance had an obligation to cover negative equity held 2.4 to 2.7 fewer eligible currencies across the various regression specifications (see Table 10). It appears that this obligation impacts investment policies narrowly, as we cannot find any robust results for asset diversification or level of risks, nor for the investment horizon.

Table 10. Measuring the Impact of the Obligation of the Ministry's of Finance to Cover Central Bank Negative Equity on Investment Policies

Independent variable	(1) Number of	(2) Number of	(3) Estimated risk of	(4) Investment
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	eligible assets	eligible currencies	the portfolio	horizon – Total tranching and untranching portfolio (months)
Obligation to cover negative equity	-0.414 (0.756)	-2.728** (1.280)	-0.063 (0.235)	-7.680 (10.882)
Government Effectiveness	0.171 (0.492)	0.260 (0.841)	0.170 (0.168)	8.933 (8.211)
Reserves to GDP (%)	4.516** (1.709)	5.292* (2.926)	-0.298 (0.791)	9.021 (26.845)
Short-term external debt stocks (% of reserves)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.039** (0.018)
Current account balance (% of GDP)	0.065 (0.043)	-0.084 (0.072)	-0.004 (0.013)	-0.840 (0.606)
Number of currency crisis (1971–2017)	0.134 (0.235)	0.511 (0.404)	-0.032 (0.073)	0.324 (4.122)
Constant	5.930*** (0.834)	7.401*** (1.432)	1.797*** (0.307)	21.772 (14.276)
Observations	77	78	58	43
R-squared	0.178	0.141	0.055	0.321

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

7. Conclusions and Policy Implications

Effective governance is essential for central banks and their reserve management function. Multiple authors have analyzed central bank governance arrangements around the world. These publications conclude that governance practices vary from country to country, but some principles seem broadly relevant for achieving positive outcomes. Notably, empirical evidence points to the importance of central bank independence and transparency for monetary policy. Different publications agree that setting up a proper governance structure is the cornerstone of a successful investment operation in reserve management. However, most publications on reserve management governance are prescriptive and qualitative.

We contribute to the discussion on reserve management governance with data-driven analysis. Our novel empirical study indicates that specific governance arrangements impact investment policy and risk taking in central banks' reserve management operations, controlling for the macroeconomic environment, reserve levels, and the broader governance environment.

We find that three types of governance factors relate to diversification and risk in foreign reserve portfolios. First, direct communication between the board and the middle office often coincides with more diversified reserve operations. Notably, the result holds when controlling for reserve adequacy, and country risk indicates that anchoring risk taking at the board level allows reserve managers to have more diversified portfolios in terms of eligible assets and eligible currencies, everything else equal. Second, we find that the organizational structure for reserve operations has an impact on investment policy. Having all three units responsible for managing the reserve operations in the same department, with the same reporting line, affects central banks' ability to

take risks, as reflected in the investment horizon. Controlling for the macro and governance environment and reserve adequacy, central banks with the same reporting lines for the front, middle, and back office, on average, have a significantly shorter investment horizon. We also find that this result is robust across different specifications. Third, countries where the Ministry of Finance is obligated to cover negative equity have, on average, investment policies with fewer eligible currencies than do countries where the Ministry of Finance does not have such obligations.

The most important policy implication of our analysis is the critical role of the board in reserve management. Central banks where boards actively exercise portfolio oversight usually have portfolios with more risk and diversification. While the ability and tolerance for risk taking vary across central banks, portfolios with longer investment horizons, more currencies, and more asset classes have performed better historically, while keeping downside risk limited. Given that we control the broader governance environment, our data indicate that any central bank can improve its internal governance regardless of the external governance environment. Several central banks in our database have implemented robust reserve management practices, even without optimal external governance environments.

Appendix I: Correlation Results

Table I.1 Central Bank Independence and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Independence of central bank	1			
Corruption Perceptions Index	0.472***	1		
Governance Pillar Score	0.346***	0.690***	1	
Government Effectiveness	0.440***	0.928***	0.720***	1
GDP per capita	0.383***	0.803***	0.609***	0.784***

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.2 Country Risk and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness	Country risk score
Country risk score	-0.484***	-0.828***	-0.638***	-0.880***	-0.712***

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.3 Transparency of Reserve Management Policies and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Transparency of reserve management policies	0.298***	0.117	0.082	0.084

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.4 Transparency of Reserve Management Policies and Country Risk

Variables	Country risk score
Transparency of reserve management policies	-0.222*

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.5 Investment Policies and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Estimated risk of the portfolio	0.275**	0.268**	0.253*	0.265**
Allocation to nontraditional assets	0.162	0.114	0.177	0.239**
Number of eligible currencies	0.06	0.076	0.041	0.146
Number of eligible assets	-0.032	0.091	0.204*	0.217**
Investment horizon – Total tranching and untranching portfolio (months)	0.347**	0.348***	0.182	0.237*
Duration – Total portfolio (months)	0.219	0.346**	0.087	0.308**
Duration – Liquidity tranche (months)	0.349**	0.451***	0.225*	0.433***
Duration – Investment tranche (months)	0.250*	0.124	0.185	-0.008

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.6 Country Risk and Investment Policies

Variables	Country risk score
Estimated risk of the portfolio	-0.408***
Allocation to nontraditional assets	-0.423***
Number of eligible currencies	-0.041
Number of eligible assets	-0.157
Investment horizon – Total tranching and untranching portfolio (months)	-0.404***
Duration – Total portfolio (months)	-0.384**
Duration – Liquidity tranche (months)	-0.521***
Duration – Investment tranche (months)	-0.296**

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.7 Independence of the Investment Committee and the Broader Governance Environment

Variables	Independence of Central Bank	Corruption perception index	Governance Pillar Score	Government effectiveness
Independent Investment Committee	-0.018	-0.186*	-0.180*	-0.204**

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.8 Independence of the Investment Committee to Approve Investment Policy and Portfolio

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Independent investment committee	-0.233*	-0.102	-0.148	-0.282**	-0.108	-0.14

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.9 Reporting to the Board and Investment Policies

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Middle office reports to the board	0.227*	0.193*	0.345***	0.114	0.153	-0.006

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.10 Obligation to Cover Negative Equity and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Obligation to cover negative equity	-0.194*	-0.479***	-0.357***	-0.483***

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.11 Obligation to Cover Negative Equity and Investment Policies

Variables	Allocation to nontraditional assets	Number of eligible currencies	Number of eligible assets	Duration – Total portfolio (months)	Duration – Liquidity tranche (months)	Duration – Investment tranche (months)
Obligation to cover negative equity	-0.200*	-0.201*	-0.251**	-0.172	-0.309**	-0.067
No obligation to cover negative equity and transfer of realized income (partial and full)	0.221*	0.063	0.211**	-0.004	0.193	0.06
Obligation to cover negative equity and transfer of realized income (partial and full)	-0.201*	-0.217**	-0.230**	-0.153	-0.202	0.011

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Table I.12 Obligation to Cover Negative Equity and Country Risk

Variables	Country risk score
Obligation to cover negative equity	0.549***

*Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).*

Appendix II: Additional Regression Results

Table II.1 Measuring the Impact of Having the Middle Office Report to the Board on Investment Policies¹⁹

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Middle office reports to the board	2.544*** (0.757)	2.262* (1.263)	0.0365 (0.251)	-8.061 (11.46)
Reserves to GDP (%)	2.375 (1.445)	3.755 (2.479)	-0.330 (0.668)	-18.82 (19.93)
Government Effectiveness	0.625** (0.306)	0.322 (0.512)	0.254** (0.117)	14.07*** (4.892)
Constant	3.865*** (0.756)	5.050*** (1.254)	1.736*** (0.267)	41.58*** (11.00)
Observations	91	94	66	53
R-squared	0.201	0.073	0.076	0.156

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table II.2 Measuring the Impact of Organizational Structure on Investment Policies²⁰

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Back office, Middle office, and Front office are in the same department	-0.834 (0.584)	-0.869 (0.954)	-0.247 (0.189)	-14.83* (8.311)
Reserves to GDP (%)	2.700* (1.518)	4.102 (2.508)	-0.273 (0.659)	-19.35 (19.20)
Government Effectiveness	0.701** (0.321)	0.401 (0.516)	0.222* (0.118)	14.53*** (4.768)
Constant	6.231*** (0.492)	7.169*** (0.801)	1.848*** (0.181)	38.74*** (6.111)

¹⁹ Each of the columns in this table refers to a different regression with the column name as dependent variable (number of eligible asset classes, number of eligible currencies, estimated risk of the portfolio, and investment horizon).

²⁰ Each of the columns in this table refers to a different regression with the column name as dependent variable (number of eligible asset classes, number of eligible currencies, estimated risk of the portfolio, and investment horizon).

Observations	91	94	66	53
R-squared	0.118	0.049	0.101	0.200

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table II.3 Measuring the Impact of Requiring the Ministry of Finance to Cover Negative Equity²¹

Independent variable	(1) Number of eligible assets	(2) Number of eligible currencies	(3) Estimated risk of the portfolio	(4) Investment horizon – Total tranching and untranching portfolio (months)
Obligation to cover negative equity	-0.977 (0.703)	-2.403** (1.179)	0.0702 (0.223)	-7.063 (10.02)
Reserves to GDP (%)	3.562** (1.637)	4.414 (2.755)	-0.151 (0.684)	-19.22 (22.62)
Government Effectiveness	0.345 (0.403)	-0.317 (0.666)	0.258* (0.139)	11.14* (6.363)
Constant	6.327*** (0.622)	8.437*** (1.047)	1.655*** (0.203)	39.26*** (8.733)
Observations	82	84	61	46
R-squared	0.122	0.079	0.067	0.143

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

²¹ Each of the columns in this table refers to a different regression with the column name as dependent variable (number of eligible asset classes, number of eligible currencies, estimated risk of the portfolio, and investment horizon).

Appendix III: Central Bank Governance and Financial Supervision

Central banks often have mandates regarding financial stability and supervision, but often central bank legislation is less specific about the clear functions and responsibilities of central banks in this regard (Ortiz 2009). Nonetheless, elements of this task, such as the lender-of-last-resort function or oversight of the payment system, have long been central bank functions (Freixas et al. 2000).²² Although the trend since the 1990s has been toward consolidation of financial supervisory functions, these changes have primarily focused on consolidating functions in an agency separate from the central bank. Despite those developments, according to the results of a survey of 160 countries completed in 2019, approximately 68 percent of central banks still have banking supervisory responsibilities (Anginer et al. 2019).

Empirical evidence on the link between central bank independence and financial supervisory responsibilities remains limited. Some research has shown that central bank independence exercises a positive impact on bank soundness and that central bank involvement in banking supervision mitigates the adverse effects of financial crises (Doumpos, Gaganis, and Pasiouras, 2015). However, this more extensive mandate can impact the central bank's autonomy, decision-making, and transparency. Initial findings from the research explored in this report indicate that countries with better overall governance environments and lower country risk usually have an entity different from the central bank for financial supervision, as seen in Table III.1. The variables used here are described earlier in the paper, and as a measure of whether central banks also have supervisory responsibilities, we use the World Bank's regulation and supervision survey (World Bank 2019). This comprehensive survey covers multiple subjects on banking regulation and supervision practices 160 jurisdictions. We use this survey to establish whether the central bank or a separate entity is responsible for financial supervision. This variable aims to analyze whether reserve management is different in central banks with more responsibilities and more complex governance structures. The survey's last edition was in 2019.²³

Table III.1 Financial Supervision and the Broader Governance Environment

Variables	Independence of central bank	Corruption Perceptions Index	Governance Pillar Score	Government Effectiveness
Central bank is financial supervisor	-0.086	-0.268***	-0.281***	-0.291***

Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).

Regarding the impact on reserve management, the correlations suggest that countries where the central bank is also a financial supervisor tend to have an independent investment committee to which the middle office reports (see Table III.2). This arrangement may result in a lower risk appetite in managing reserves and imply that the central bank accounts for and manages the

22. Henry Thornton (1802) and Walter Bagehot (1873) developed the classic doctrine of lender of last resort. According to Bagehot, in a panic situation monetary authorities should lend unsparingly but at a penalty rate to illiquid but solvent banks. See Freixas et al. (2000) for further background.

23. <https://www.worldbank.org/en/research/brief/BRSS>.

risks of a more volatile governance environment in which it operates. As other findings of this paper show, in deficient overall governance environments central banks tend to have independent investment committees because the independent committee can help safeguard decisions made by a weak and/or politically influenced board. However, the literature and data are scant on whether a central bank with supervisory functions impacts decision-making on reserve management and policy. This question may be another line of future inquiry and research.

Table III.2 Financial Supervision and Governance of Reserve Management

Variables	Independent Investment Committee	Middle office reports to the investment committee	Obligation to cover negative equity
Central bank is financial supervisor	0.255**	0.243**	0.277**

*Note: The significance level of the pairwise correlations is displayed with asterisks, where *** stands for a p-value below 0.01 (i.e., extremely significant), ** stands for a p-value below 0.05 (i.e., very significant), and * stands for a p-value below 0.1 (i.e., significant).*

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