COMISIÓN PARA EL MERCADO FINANCIERO

Regulador y Supervisor Financiero de Chile

Documento de Trabajo **N° 03/25**

Assessing Open-End Mutual Fund Liquidity Risk: The Liquidity Coverage Index (LCI)

Nicolás Álvarez · Sebastián Becerra · Macarena Caamaño · Bárbara Llanos · Nicolás Viertel

Agosto 2025
www.CMFChile.cl

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Documentos de Trabajo de la Comisión para el Mercado Financiero (CMF) Financial Market Commission (CMF)
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Assessing Open-End Mutual Fund Liquidity Risk: The Liquidity Coverage Index (LCI)

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Resumen

Este documento presenta el Índice de Cobertura de Liquidez (LCI), una métrica diseñada para evaluar la capacidad de los fondos mutuos abiertos en Chile para satisfacer rescates de cuotas durante períodos de estrés financiero. Al cuantificar el riesgo de liquidez como la relación entre los activos de alta liquidez y los reembolsos netos proyectados en escenarios de estrés en una semana, el LCI ofrece una herramienta práctica -similar a la utilizada en los bancos bajo el marco de capital de Basilea-, para evaluar la resiliencia de los fondos mutuos. Utilizando dos enfoques, un análisis empírico de datos históricos de rescates y un modelo econométrico basado en shocks de tasas de interés, estimamos los colchones de liquidez necesarios para los fondos mutuos chilenos, particularmente aquellos con tenencias sustanciales de instrumentos de deuda pública. En general, la mayoría de los tipos de fondos cumplirían con los umbrales de liquidez necesario para enfrentar rescates anormales, excepto para fondos que son más intensivos en la inversión en instrumentos de deuda, donde cerca de la mitad de ellos presentarían brechas para enfrentar estos rescates en escenarios de estrés. Estos resultados son consistentes con estimaciones previas realizadas por el Fondo Monetario Internacional para Chile (FSAP 2021).

Abstract

This paper introduces the Liquidity Coverage Index (LCI), a metric designed to assess the ability of open-end mutual funds in Chile to meet redemption demands during periods of financial stress. By quantifying liquidity risk as the ratio of highly liquid assets to projected net redemptions in one week under stress scenarios, the LCI offers a practical tool, similar to the one used in banks under the Basel Capital Accord, for evaluating mutual fund resilience. Using two approaches — an empirical analysis of historical redemption data and an econometric model based on interest rate shocks — we estimate liquidity buffers needed for Chilean mutual funds, particularly those with substantial holdings of public debt instruments. In general, most types of funds would meet the necessary liquidity thresholds to face abnormal redemptions, except for funds that are more intensive in their investment in debt instruments, where about half of them would present gaps to face these redemptions in stress scenarios. These findings are consistent with those reported in the International Monetary Fund's Financial Sector Assessment Program (FSAP 2021) report for Chile.

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I. Introduction

The Chilean mutual fund industry plays a relevant role in the financial market by providing liquidity management and investment products, as well as fulfilling a relevant role in bank funding, which is why the resilience this industry shows in situations of financial stress is fundamental to the country's financial stability. The industry must be able to respond to different shocks that affect the valuation of managed assets, in addition to meeting the payment commitments associated with the redemption of shares, ideally without causing or amplifying effects on the rest of the market.

In November 2019 during the Chilean social unrest, some medium and long-term debt funds showed monthly outflows equivalent to 50% of their equity, as a result of significant increases in fixed-income instrument yields. Later, when the economy and the level of assets in the mutual fund industry were recovering, the COVID crisis ensued and again significant redemptions were observed, this time up to 32% of the equity in some funds. Although, in the face of the latest episodes of volatility in the financial markets, the industry has shown some resilience, vulnerabilities have been exposed in some segments.

In a context of financial instability, regulatory mitigation strategies are crucial in reducing a systemic impact as a result of potential massive redemptions of mutual fund shares. In this regard, it should be noted that the management of mutual funds in Chile is regulated by Law 20.712 of 2014 on the Administration of Third-Party Funds and Individual Portfolios ("Ley Única de Fondos"), hereinafter the LUF, the Supreme Decree of Finance No. 129 of 2014 which establishes the Regulation of said Law and various normative instructions issued by the Financial Market Commission, hereinafter the CMF[6].

Within this regulatory framework, various measures aim to decrease the effects that could be generated by information asymmetries in decision-making, massive redemptions that could affect the prices of instruments and the stability of the financial system, ensuring that they are liquidated under market conditions. There are also other legal and regulatory requirements concerning the suitability and good corporate governance of fund management, and the adequate management of risks and asset valuation, which also contribute favorably to appropriate and timely handling stress events.

In particular, with the objective of mitigating the adverse effects derived from massive redemptions, the Chilean legislation contemplates:

- Empowering the CMF to suspend the operations of share redemption or modify the conditions and term of payment in situations of abnormality that arise in the market. This measure is aimed to give investors time to collect information regarding changes in financial conditions so that mass sales caused by panic and uncertainty do not occur.
- Redemption payment for mutual funds must be executed within a maximum period of ten days. An exception to this timeframe exists for daily redemptions involving amounts deemed significant relative to the fund's asset value. In such instances, the redemption and payment mechanism must be specified by the fund manager within the fund's prospectus. This provision enables the manager to more effectively manage the liquidation of financial instruments to meet payment obligations.

[6] Also see the Appendix N° 1 for the new powers outlined in the law that strengthens the resilience of the financial system and its infrastructure regarding mutual funds.

- Requiring collateral from the manager that must be constituted for the benefit of each fund with the objective of ensuring the fulfillment of its obligations, which would partly mitigate the adverse effects that could arise.
- Specific liquidity and depth parameters that must be met by the instruments in which mutual funds invest. These instruments are to be valued at market prices. This framework is intended to, firstly, enhance the fund manager's capacity and ability to liquidate assets to meet obligations arising from abnormal redemptions. Secondly, it aims to ensure that the disposal of these securities aligns with prevailing market conditions at the time of their execution.

The International Monetary Fund, as part of the 2021 Financial Sector Assessment Program (FSAP), analyzed, among other topics, the effects on Type 3 Mutual Funds (medium and long-term debt funds) during the social crisis and the COVID crisis. The results showed that these funds would not have sufficient liquidity to meet the redemption commitments in a stress scenario.

In response to this problem, they formulated a series of recommendations aimed at improving the liquidity management policy of mutual funds. Among these, they propose improving the classification of investment assets by more precise liquidity categories and suggest that it should be a priority to strengthen liquidity requirements in the form of buffers.

Additionally, they pointed to another aspect related to the protection of investors through the application of liquidity management tools to protect the dilution of interests of the participants in a fund in the face of what is known as the "first mover advantage" in episodes of tension. For this, they suggest evaluating the application of the "swing pricing" methodology.

This study aims to contribute to several dimensions. First, with an evaluation of the vulnerabilities that the mutual fund industry may face in terms of liquidity management during financial tension episodes and analyze to what extent they could affect financial stability. Second, it suggests new definitions of liquid assets that could constitute a potential liquidity buffer. Finally, this paper introduces the Liquidity Coverage Index (LCI), a metric designed to assess the ability of open-end mutual funds to handle periods of financial stress.

The LCI is calculated as the ratio of a fund's liquid assets to its expected net redemptions under stressed market conditions. A value above 1 indicates that a fund has sufficient liquid assets to meet redemption requests, while a value below 1 suggests potential liquidity shortfalls. By incorporating both historical redemption data and econometric modeling of market shocks, the LCI provides a comprehensive and flexible tool for evaluating mutual fund resilience, offering significant insights for regulators and investors in managing liquidity risk effectively.

The remainder of this paper is organized as follows: Section II reviews the current approaches to liquidity and solvency stress testing for mutual funds, highlighting their limitations and the need for a new metric. Section III reviews the existing literature and makes a comparison with other metrics. Section IV provides an overview of the Chilean mutual fund industry, focusing on its evolution and key liquidity challenges. In Section V, we present the methodology for estimating liquidity stress scenarios, employing both historical data analysis and econometric modeling techniques. Section VI defines and classifies liquid assets within the Chilean context, while Section VII introduces the Liquidity Coverage Index (LCI) and demonstrates its application to Chilean mutual funds. Finally, Section VIII concludes with recommendations for future research and policy actions.

II. Current Approaches to Liquidity and Solvency Stress Testing

Stress testing has evolved as a critical tool for assessing the resilience of financial entities under adverse conditions. Initially developed for the banking sector, these tests primarily focused on evaluating the prudential capital adequacy of individual banks, aiming to inform supervisory actions or recapitalizations if needed (Adrian, Morsink, & Schumacher, 2020). However, the direct application of solvency stress tests to mutual funds is not appropriate due to the distinct nature of these funds and their risk profiles.

Mutual funds, unlike banks, do not typically face solvency risk. Instead, they are primarily exposed to liquidity risk. These funds pool capital from investors to invest in various assets with differing levels of liquidity, while often providing investors with the right to redeem their investments on short notice. This liquidity transformation creates a potential liquidity mismatch, which can lead to systemic risks, especially during periods of financial stress when large and unexpected redemption requests may occur. The IMF (2021) highlights that while stress in a particular fund may not directly cause systemic impacts, it can trigger broader market turbulence through interconnectedness with other financial institutions.

The need for liquidity-focused stress testing in investment funds has led to the development of specialized methodologies. For example, Bouveret (2017), ESMA (2019), and the IMF (2021) have proposed various liquidity stress testing frameworks specifically tailored for investment funds. These frameworks typically evaluate a fund's ability to meet redemption requests under adverse market conditions without significantly impacting the broader financial system.

One prominent approach is the "Time-to-Liquidation" framework, which assesses how quickly assets within a fund can be liquidated to meet redemption requests. This approach contrasts with static liquidity buffers by considering the dynamic nature of asset liquidity, as influenced by market conditions and the specific characteristics of the securities held by the fund (Lô & Carpantier, 2023). The Time-to-Liquidation approach has been particularly influential in jurisdictions like Luxembourg, where it has been applied to assess the liquidity resilience of a wide range of investment funds.

Similarly, the Banca d'Italia has implemented a supervisory framework that integrates both liquidity and leverage risks into stress testing for open-ended funds. This framework includes regular reporting and stress testing based on the High-Quality Liquid Assets (HQLA) approach, assessing a fund's ability to cope with high redemption pressures using its most liquid assets (Ruzzi, 2024). This methodology emphasizes the importance of liquidity preparedness in mitigating systemic risks, particularly in markets with significant leverage and interconnectedness.

In Spain, the CNMV has conducted liquidity stress tests to identify funds that may struggle under severe market conditions, particularly those investing in less liquid assets like high-yield bonds. These tests have shown that while most funds maintain adequate liquidity, certain categories, such as high-yield bond funds, are more vulnerable in extreme scenarios (Ojea, 2020).

The ongoing development and refinement of stress testing methodologies reflect the evolving understanding of liquidity risks in investment funds. As these frameworks continue to be

applied and enhanced, they provide valuable insights into the vulnerabilities and resilience of the global financial system.

III. Engagement with Existing Literature and Comparison with Other Metrics

A variety of liquidity management tools (LMTs) are available to fund managers. These tools may be categorized as ex ante (preventive, implemented before a liquidity shortfall) or ex post (corrective, activated once liquidity stress has already emerged). Table 1 outlines a selection of the most commonly employed LMTs, with detailed descriptions provided in Appendix No. 2

This study focuses on the liquidity buffer mechanism (ex ante), within the framework of which the introduction and calculation of the Liquidity Coverage Index (LCI) is proposed as an analytical tool. The LCI is intended to serve as a quantitative measure to assess the adequacy of liquid asset holdings in relation to potential short-term liquidity demands, thereby strengthening the resilience of investment funds to episodes of market stress.

Table 1: Liquidity Management Tools (LMTs)

Ex-Ante	Ex-Post
Liquidity buffers	Suspension of redemptions and subscriptions of shares
Extension of notice periods	Redemption gate
Swing pricing	Redemption fee
Dual pricing	Redemptions in kind
Anti-dilution levy	Side pockets

Source: *Authors.*

The LCI proposed in this study builds on and extends existing liquidity metrics used in the financial sector, such as the Liquidity Coverage Ratio (LCR) under Basel III, the Time-to-Liquidation approach, and the Redemption Coverage Ratio (RCR). The LCR, for example, is designed to ensure that banks hold sufficient high-quality liquid assets to cover net cash outflows over a 30-day period. However, its applicability to mutual funds, which face unique liquidity challenges due to their open-ended structure and investor redemption behavior, is limited (King, 2013; BIS, 2013).

Unlike the LCR, the LCI provides a tailored metric that addresses these specific risks by incorporating both historical redemption patterns and stress-testing approaches that simulate market shocks. This comprehensive methodology allows the LCI to offer a more accurate measure of liquidity risk for mutual funds, particularly in emerging markets like Chile, where fund structures and investor behaviors differ from those in more developed markets (IMF, 2021).

The Redemption Coverage Ratio (RCR), used in studies like Bouveret, 2017, measures a mutual fund's ability to meet redemptions by comparing liquid assets to expected redemptions, providing a static view of liquidity risk. However, the RCR does not account for dynamic changes in market conditions or investor behavior. In contrast, the proposed Liquidity

Coverage Index (LCI) expands on the RCR by integrating both empirical analysis of historical data and forward-looking econometric modeling to simulate redemption behavior under various stress scenarios, such as interest rate shocks.

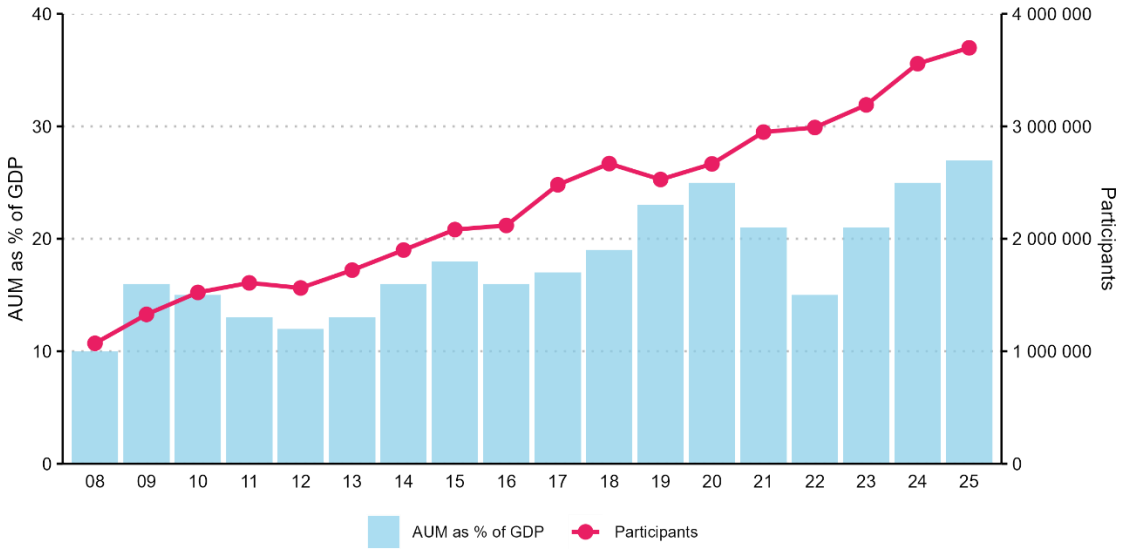
The proposed LCI also extends the work of other researchers who have explored liquidity risk in investment funds (e.g., Bouveret, 2017; Lô & Carpantier, 2023), by combining a static liquidity buffer with dynamic stress-testing elements. This hybrid approach offers regulators a more versatile tool to assess the resilience of mutual funds under varying conditions, providing a novel contribution to the existing literature on liquidity risk management, better suited for capturing the liquidity risks faced by mutual funds.

IV. The Chilean Mutual Funds Industry: Context

a. Evolution and Characteristics of the Industry

Investment in mutual funds has increased significantly since the global financial crisis. Assets under management (AUM), as a percentage of the GDP, have doubled since 2008, which accounted for 27% of the GDP as of June 2025. This growth was also accompanied by an increase in the number of participants, which has almost quadrupled during the same period (**Figure 1**).

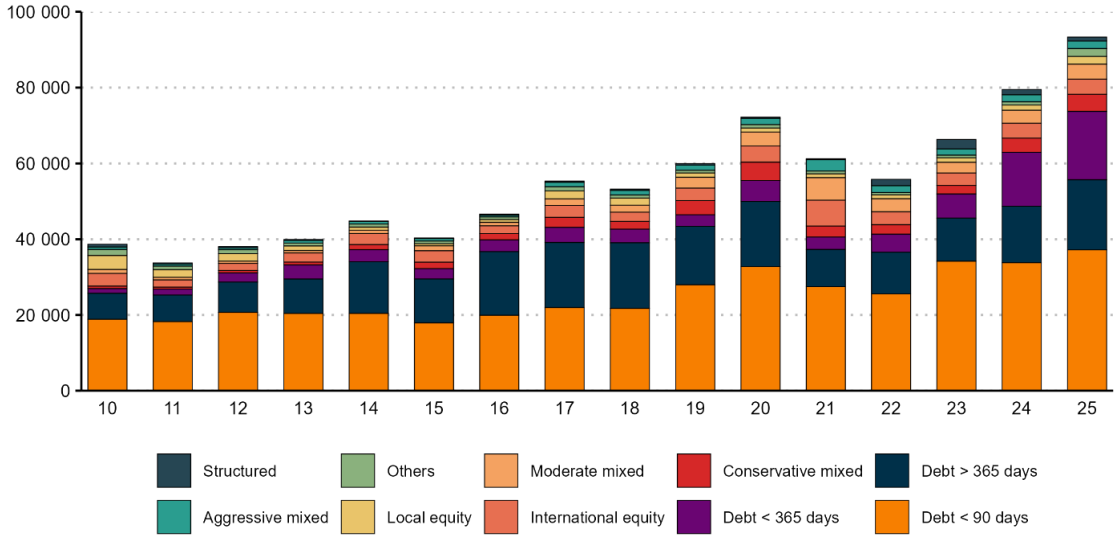
Figure 1: Assets Under Management and Number of Participants
(percentage of GDP, number, 2008-2025)



Source: CMF
Note: The figure shows the evolution of the assets managed by mutual funds as percentage of GDP and the number of participants from December 2008 to June 2025. Real GDP was used to deflate the AUM.

Investments according to the type of fund are mainly concentrated in funds that invest in financial intermediation assets (debt instruments of less than 90 days, commonly called money market funds) and in medium and long-term debt instruments, which as of June 2025 represent 36% and 42% of the total investment portfolio, respectively. Conversely, the relevance of mutual funds that invest in the stock market is lower, representing 6% of the AUM of the system (**Figure 2**).

Figure 2: Investment Portfolio by type of underlying asset
(MMUS$, 2010-2025)



Source: CMF and Association of Mutual Funds.
Note: Others include funds for "qualified investors" and other kind of funds that have been recently created without classification or that have changed their investment strategy.

b. Liquidity Risk of Mutual Funds

Mutual funds allow investors to access capital markets with small amounts of investment and benefit from professional, diversified management and the high degree of liquidity that these funds offer.

The LUF allows for the redemption of shares to be paid within 10 consecutive days from the redemption request, but in practice, managers offer much shorter settlement periods, and some funds even offer payment within one business day.

The growing trend in the industry of more savings channeled into mutual funds, along with the adoption of investment strategies that seek to incorporate assets with higher liquidity premiums to support the portfolio return, significantly raises the need to adequately manage a fund's liquidity to meet redemption requests within the committed deadlines.

This problem becomes more evident in episodes of financial instability, where participants tend to redeem significant amounts in short periods of time, which has a direct effect on investors since to satisfy the higher demand for redemptions, the manager could be forced to liquidate part of the portfolio instruments at market prices with a significant discount (fire sale), affecting the economic value of the share and therefore the final amount received by the investor.

Additionally, in a likely scenario where the fund opts to sell the most liquid assets to meet the first payment commitments, it implies that it will leave the remaining participants of the fund, perhaps less informed investors, with less liquid and riskier assets (until the portfolio is adjusted again). This practice could encourage fund investors in episodes of tension to what is called the "first mover advantage" to avoid greater losses. Those investors who withdraw

earlier could impose higher costs on investors who withdraw later, thereby leaving them exposed to a less liquid portfolio and harder to sell in stress scenarios.

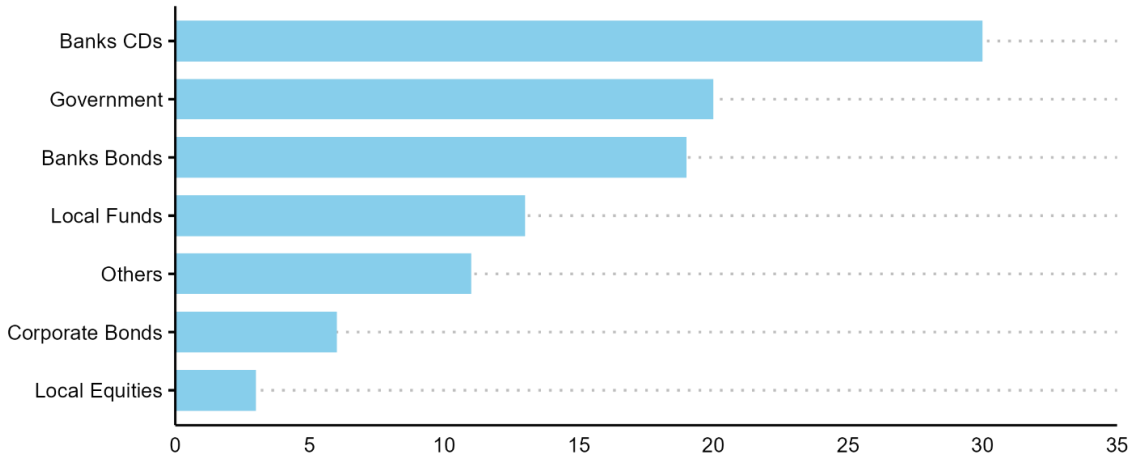
Therefore, the obligation to meet payment commitments and the adverse consequences that could be generated with those participants who do not redeem, reveals the importance of properly managing the liquidity of the funds without significant dilution of the interests of all the participants in the fund.

c. The Role of Mutual Funds in Financial Stability

Inadequate liquidity management can also lead to adverse effects on financial stability, as insufficient liquid assets to meet significant payment commitments from redemptions could force managers to sell fewer liquid assets at discount prices, pushing down their prices in the secondary market.

Consequently, lower market prices can affect the investment portfolios of other market agents (such as pension funds, insurance companies, brokerage firms, etc.) or lead to a deterioration in the overall financial conditions of the market, thereby affecting the funding costs of various institutions. In this regard, there is a vast literature that has aimed to highlight vulnerabilities in financial stability due to the effects of massive redemptions, for example, see Cetorelli, Duarte, and Eisenbach (2016), Coval & Stafford (2007), IMF (2015), and IMF (2021).
In the case of mutual funds, they have a high exposure to financial intermediation instruments and debt issued by banks. Specifically, 49% of the mutual funds' portfolio corresponds to Banks CDs and Bank Bonds as of June 2025 (**Figure 3**).

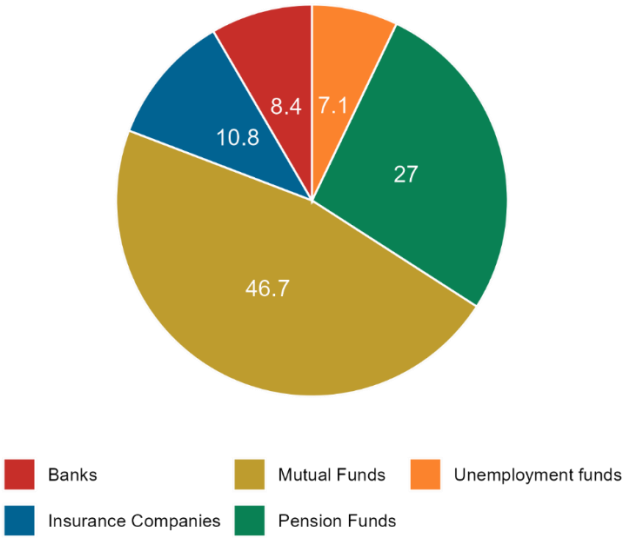
Figure 3: Mutual fund investment portfolio by type of instrument
(Percentage, Jun. 25)



Source: CMF.
Note: The figure shows the composition of the funds' investment portfolio by type of instruments.

From the perspective of banks' financing sources, mutual funds represent 46,7% of the participation of institutional investors in bank funding (**Figure 4**). Therefore, adverse effects on the prices of these instruments due to forced liquidations by managers to face massive redemptions could affect the funding sources of banks and therefore the country's financial stability.

Figure 4: Participation of institutional investors in bank financing
(Percentage, Jun. 25)



Source: CMF.
Note: The figure shows the participation that each institutional investor has with respect to the total that these investors represent in bank financing.

V. Estimation of Liquidity Stress Scenarios: Two approaches

a. Data

The primary data source for this study is the CMF, which provides comprehensive daily data on mutual fund operations, including redemptions, contributions, and asset valuations. The data covers all registered open-end mutual funds in Chile, from January 2000 to June 2025, encompassing various market conditions, including periods of financial stability and instability (e.g., the subprime crisis in 2008, the social unrest in 2019 and the COVID-19 crisis). This long-time span allows for a robust analysis of redemption behavior under different stress scenarios

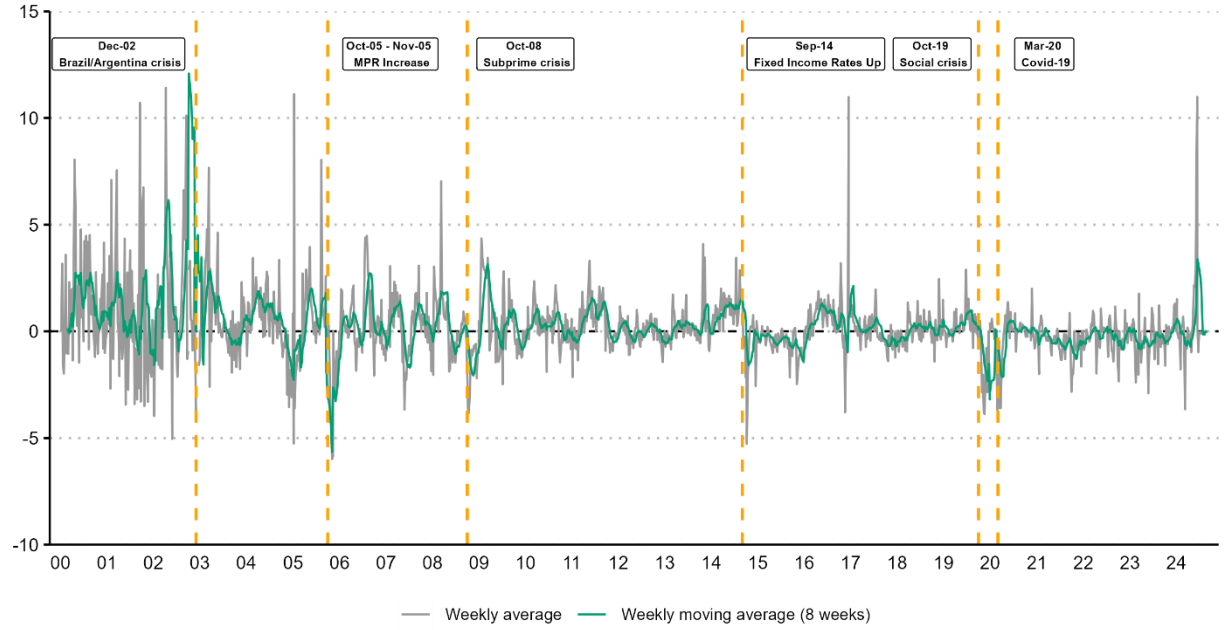
To validate the data, we cross-checked the CMF records with publicly available data from mutual fund reports and other independent financial sources, such as the Association of Mutual Funds of Chile. Additionally, we conducted internal consistency checks to ensure that the reported net asset values and redemption flows were logically aligned over time. Outliers were carefully examined, and any suspicious data points were corroborated with alternative data sources or removed from the analysis to avoid bias. Specifically, fund series with less than 12 months of operations and fund series that were in operation in the last 12 months are eliminated..

Over the years, our country has faced various situations of economic instability and liquidity challenges in the mutual fund industry. This section identifies those episodes where significant amounts of mutual fund share redemption requests have been recorded. For the above, the behavior of net weekly redemptions during the period from January 2000 to June 2025 of mutual funds is analyzed. For this, we use as an indicator the net redemptions as a percentage

of the weekly assets under management (AUM) (see **Appendix N°3**, Methodology for calculating net redemptions)

Focusing on medium and long-term debt funds, the most relevant episodes detected correspond to December 2002 (volatility in Latin American financial markets[7]), October and November 2005 (expectation of an increase in the Monetary Policy Rate), October 2008 (subprime crisis), September 2014 (local fixed income posted losses due to rising interest rates), November 2019 (social crisis), and March 2020 (COVID crisis), as shown in **Figure 5.**

Figure 5: Evolution of weekly net redemptions of long-term debt funds (debt > 365 days) (AUM percentage, 2000-2025)

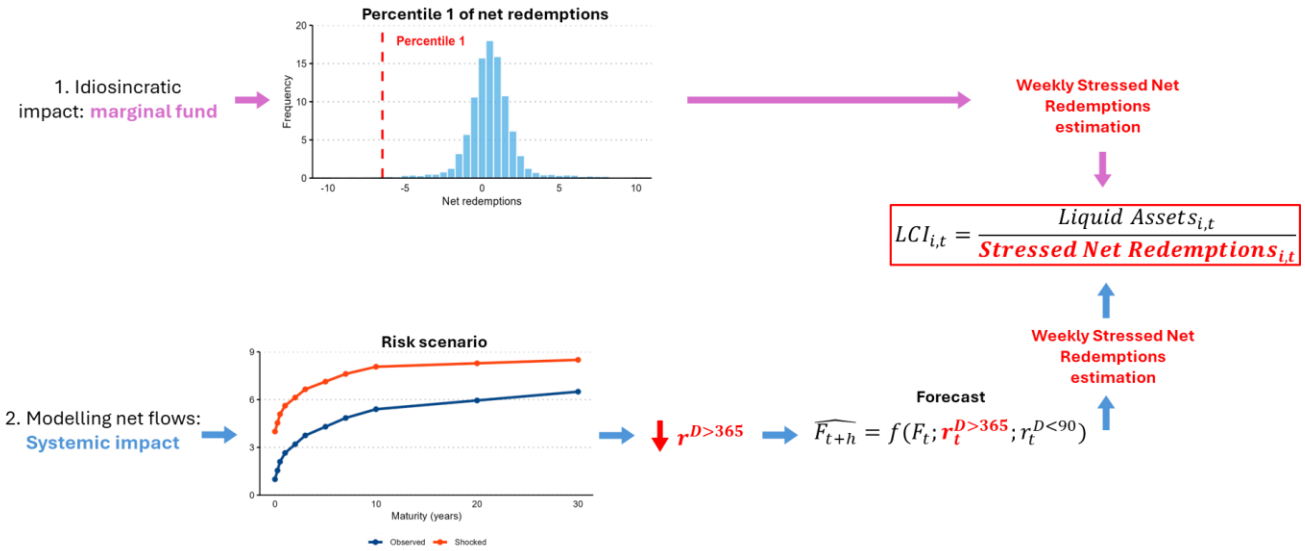


Source: Authors.
Note: The chart accounts for the variation of net redemptions/contributions, which is calculated from the weekly sum of the contributed shares minus the redeemed shares multiplied by the share value of the last day of the previous week. This amount is divided by the total assets of the previous week, obtaining a percentage indicator where values above zero mean that contributions exceeded redemptions and vice versa if less than zero. The figure shows the average of this indicator at the fund level per week and the moving average of 8 weeks. In this figure, for visualization purposes, the top outliers were excluded.

In this document, we propose two ways to estimate stressed net redemptions, as illustrated in **Figure 6**. The first approach (1.) focuses on the empirical distribution of net redemptions, where we review stressed redemptions within the historical distribution. This method emphasizes the marginal fund and is depicted in the top section, showing the distribution of net redemptions and identifying a critical percentile "x". The second approach (2.) involves forecasting stressed net redemptions by modeling the net flows under an exogenous shock, for instance, an interest rate shock. This is illustrated in the bottom section, where we simulate a risk scenario and forecast the stressed net redemptions, capturing the systemic impact. Both methods lead to the estimation of weekly stressed net redemptions, which are crucial for liquidity calculations.

[7] in December 2002, Argentina was still in crisis after its 2001 collapse, while Brazil faced financial instability due to political uncertainty. These events affected the regional economy, creating instability in South America.

Figure 6: Two ways to perform the estimation: stressed redemptions in the historical distribution or forecast stressed redemptions using a model



Source: Authors.
Note: This figure illustrates two methods for estimating stressed net redemptions (1.) analyzing the empirical distribution of net redemptions and (2.) forecasting stressed net redemptions under some market price shock.

These approaches provide a comprehensive assessment of potential redemption pressures faced by mutual funds under adverse market conditions. The next section VI builds on these estimates by introducing the Liquidity Coverage Index (LCI), a metric designed to evaluate whether funds possess sufficient liquid assets to meet these stressed redemption demands.

b. Empirical Distribution Approach

This approach uses historical data from the CMF to identify periods of abnormal redemptions. Specifically, we analyze weekly net redemption data from January 2010 to June 2025, calculating net redemptions as a percentage of total assets under management (AUM). We identify stressed scenarios by focusing on the lowest percentiles of the redemption distribution by fund type, reflecting extreme liquidity stress periods. Stressed net redemptions are estimated at the fund level and on a weekly basis (see **Appendix N°3** for more details).

We conducted sensitivity analyses to test the robustness of our results against different assumptions regarding the behavior of redemptions. For example, we varied the threshold for defining 'stressed net redemptions' (using both the 1st and 5th percentiles of net redemption distribution) to examine how changes in these thresholds impact the Liquidity Coverage Index (LCI), and using several definitions of "liquid assets". Furthermore, we ran robustness checks by segmenting the data across different types of funds (e.g., equity, fixed income) to ensure that the findings were consistent across various fund categories.

It is observed that the 1st percentile of net redemptions for long-term debt funds is equivalent to 12% of the AUM in a week (**Table 2**). Also noteworthy are the funds of debt of less than

90 days or money markets funds, with high levels of redemption that are usually seasonal but are mitigated by high levels of liquidity, given the nature of those portfolios[8].

Among funds with significant market share, "Debt < 90 days", "Debt < 365 days" and "Debt > 365 days" funds show the most prominent expected shortfalls in net redemptions. This metric, reflecting the average loss below the 1st percentile, reaches 42%, 29%, 20% for these respective fund categories.

Table 2: Empirical distribution of stressed net redemptions, weekly, 2010 – 2025 (AUM percentage)

Fund type	Market Share(1)	Net Redemptions			
		Expected shortfall	Percentile 1	Percentile 5	Percentile 10
International equity	4	-16	-10	-4	-2
Local equity	3	-14	-7	-2	-1
Aggressive mixed	2	-11	-6	-2	-1
Moderate Mixed	4	-8	-4	-2	-1
Conservative Mixed	5	-15	-8	-3	-2
Debt < 90 days(2)	36	-42	-32	-13	-8
Debt < 365 days	21	-29	-18	-6	-3
Debt > 365 days	21	-20	-12	-4	-2
Structured	1	-13	-8	-2	-1
Others(3)	2	-22	-13	-4	-2

Source: Authors.

(1) Based on jun. 25 AUM.
(2) "Debt < 90 days" funds suffer from seasonal redemptions at the end of the month, on Fridays and before public holidays.
(3) Others include funds for "qualified investors" and other kind of funds that have been recently created without classification or that have changed their investment strategy.

c. Econometric Modeling Approach[9]

The econometric modeling approach relies on the Nelson-Siegel framework to estimate the impact of interest rate shocks on mutual fund redemption behavior. Specifically, we simulate a systemic stress scenario by applying a 300-basis point shock to short-term rates and a 100-basis point shock to long-term rates. The yield curve is recalibrated to assess how changes in interest rates affect mutual fund returns and, consequently, investor redemptions.
This scenario is consistent with the stress testing framework employed by the Central Bank of Chile (see Martínez, Cifuentes, and Becerra, 2017), where the probability of such shocks is estimated at 2.1% for short-term rates and 3.5% for long-term rates.

To model the dynamic yield curve, we follow Diebold and Li (2006), building on the Nelson and Siegel (1987) specification. This approach is particularly well-suited to capturing the term

[8] Although money market funds experience seasonal redemptions at the end of the month, on Fridays, and on days before public holidays, this does not pose an issue as they are characterized by holding a portfolio of highly liquid instruments. Therefore, as explained further below, these funds in general have sufficient liquidity to manage both normal and abnormal redemptions in the short term.
[9] This is an example of a stress test exercise specifically applied to funds primarily invested in debt instruments. Additional risk factors could also be considered to apply price shocks that also originate from the equity or foreign exchange markets, in order to extend this exercise to other types of funds, such as equity or balanced funds.

structure of interest rates with a relatively small number of parameters, making it ideal for estimating the impact of rate shocks on mutual fund redemptions.

The model decomposes the yield curve into three components: level (long-term rates), slope (the difference between short- and long-term rates), and curvature (rate changes at different maturities). The parameters (β_0, β_1, β_2, and λ) are estimated using historical data from the Chilean bond market:

$$y_n = \beta_0 + \beta_1\left(\frac{1-e^{-\lambda n}}{\lambda n}\right) + \beta_2\left(\frac{1-e^{-\lambda n}}{\lambda n} - e^{-\lambda n}\right) \quad (1)$$

Where:

- y_n: It corresponds to the average swap interest rate (SPC) at maturity n observed at a given date.
- β_0: It corresponds to the factor that captures the level of the yield curve. It can be interpreted as the rate at which the curve converges in the long term.
- β_1: It corresponds to the factor that captures the slope of the yield curve. $\beta_0 + \beta_1$ is equivalent to the short-term rate.
- β_2: It corresponds to the factor that captures the curvature of the yield curve.
- λ: is a decay parameter that determines the speed at which the effect of shocks dissipates over time

To simulate the systemic stress scenario, we first estimate the Nelson-Siegel parameters β_0, β_1, and β_2 and λ by fitting the model to historical Chilean bond market data. The estimation follows a two-step procedure. First, a grid of candidate values for the parameter λ is defined. For each λ in the grid, the β coefficients are estimated via ordinary least squares (OLS), minimizing the squared differences between observed market yields and model-implied yields across maturities. The optimal $\lambda$is then selected as the value that minimizes the residual sum of squares (RSS), ensuring the best overall model fit. This calibration process allows λ to govern the sensitivity of the slope and curvature components along the term structure.

Once the Nelson-Siegel parameters are estimated, we simulate the systemic stress scenario by applying shocks to the β coefficients. Specifically, β_0, which captures the long-term interest rate, is increased by 100 basis points. Since the short-term rate is defined as $\beta_0+\beta_1$, achieving a 300-basis point shock requires adjusting β_1 by 200 basis points, after accounting for the 100-basis point increase in β_0. The final shocked short-term rate becomes (β_0+100bp) + (β_1+200bp), ensuring the total intended impact of 300 basis points.

These adjusted parameters are then used to re-estimate the yield curve under the stress scenario using full valuation, meaning bonds are re-priced entirely based on the new curve. This allows us to compute the impact on medium and long-term mutual fund portfolio returns. Finally, the changes in returns are linked to net redemption flows through an econometric model that captures the dynamic relationship between interest rate movements and fund outflows[10].

Following Coval et. al. (2007) and Álvarez et al. (2018), the interaction between the interest rate shocks and net redemption flows is modeled using a regression framework that relates the adjusted yield curve to the net flows of medium and long-term mutual funds. This framework includes lagged variables to account for delayed reactions in redemption behavior following interest rate changes. We estimate a model at a weekly frequency, from 2004 to November 2023, that relates the net redemption flow of medium and long-term mutual funds

[10] This shock is applied only to domestic instruments, as the foreign portfolio has a minimal weight in the overall composition, representing less than 1% of the total industry portfolio.

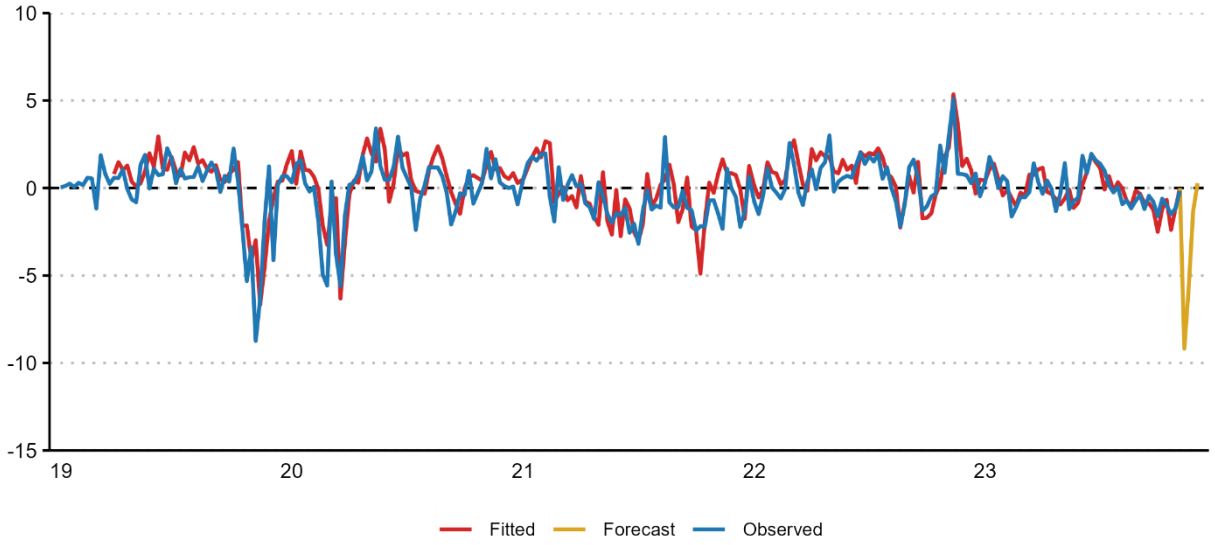
to the excess return of medium and long-term funds (return that was affected by the interest rate shock) over money market mutual funds. As shown in equation 2, net redemptions depend on 12 lags, the contemporary return differential between medium and long-term and money market mutual funds, as well as 12 lags of this same variable[11]. For more details on the results see **Appendix N°4**.

$$F_t = \alpha + \sum_{n=1}^{12} \gamma_n F_{t-n} + \sum_{m=0}^{12} \beta_m (r^3_{t-m} - r^1_{t-m}) + \varepsilon_t \quad (2)$$

Where:

- F_t: It corresponds to the net redemption flow as a percentage of the assets of medium and long-term in period t.
- r^3_t: It corresponds to the weighted return of medium and long-term for period t.
- r^1_t: It corresponds to the weighted return of money market funds for period t.

Figure 7: Weekly Net Redemptions of medium and long-term Funds under a Systemic Stress Scenario
(2019-2023)



Source: Authors.
Note: The yellow line is projected with the coefficients estimated from the entire sample.

In conclusion, we find that, in the face of a systemic shock of 300bp in the short rate and 100bp in the long rate, type 3 mutual funds would experience, on average, weekly net redemptions of 10%, which is consistent with what was found in the empirical distribution.

The insights derived from these empirical and econometric approaches form the basis for constructing the Liquidity Coverage Index (LCI), which is introduced in the next section VII.

[11]The inclusion of 12 lags in the model makes potential endogeneity and omitted variable bias less likely to be concerns. Lagged variables help mitigate simultaneity issues by capturing the delayed effects of interest rate shocks on net redemption flows. Additionally, the weekly frequency of the data provides a more granular analysis, reducing the likelihood of omitted variables influencing both interest rate shocks and redemption behavior. The results are consistent with previous findings, supporting the robustness of the model.

VI. Definition and Estimation of Liquid Assets

Mutual funds require a certain amount of liquid assets within the investment portfolio to cope with normal redemptions or abnormal redemptions that may occur in situations of financial instability, such as those previously described.

The initial goal of this section is to identify the attributes and characteristics that a financial instrument should have to be considered as a liquid asset in the Chilean financial market, based on a review of definitions commonly used in regulations or studies, as well as a quantitative analysis of the liquidity of Chilean assets.

a. Definitions

In the literature, we can find extensive references to definitions of the liquidity of a financial asset. If we go back to Keynes (1930), he considers that an asset is more liquid than another "if it can be converted into cash with more certainty and speed, without implying losses".

On the other hand, Black (1971) describes a liquid asset as one in which four conditions are simultaneously met: (i) there are always buying and selling prices for investors who wish to transact small amounts of the asset, (ii) it has a small price spread for closing or reversing a position, (iii) an investor who is buying or selling a large amount of assets, in the absence of special information, can expect to do so over a long period of time at a price not very different, on average, from the current market price, and (iv) an investor can buy or sell the asset immediately with a discount that depends on the size of the asset bundle.

More concretely, this section collects some definitions and categorizations of assets considered liquid in different regulatory frameworks or used by international organizations.

- **Regulation of Mutual Funds in Chile**. The General Rule No. 376 of the CMF establishes certain liquidity and depth parameters that must be met by the instruments invested by mutual funds. In particular, it states that mutual funds may not invest more than 50% of their assets in values that do not meet the following liquidity and depth requirements:
    - National or foreign debt instrument issued by Banks or financial institutions supervised under the banking regulation of the respective country, by the State of Chile, Central Bank, or other governmental entities belonging to jurisdictions that are not considered high risk in matters of money laundering and terrorist financing.
    - Other fixed-income instruments that have had an average daily transaction of at least US$ 50,000 during the last 90 business days.
    - Equity instruments that meet any of the following conditions:
        - Are considered with stock market presence.
        - Have had an average daily transaction of at least US$ 50,000 during the last 90 business days.
        - Allow the redemption of the investment within a period equal to or less than 10 consecutive days from the redemption request.

- **Regulation in the United States.** Rule 22e-4 of the Securities and Exchange Commission corresponds to the regulation applicable to open funds, except for money

market funds, which establishes instructions related to the liquidity management of funds. Among other things, it requires that each fund classify the liquidity of each portfolio investment based on the number of days within which an investment is reasonably expected to be convertible into cash or sold without the conversion significantly changing the market value of the investment under current market conditions. The established categories are the following:

  - High liquidity investment: Corresponds to cash or any investment that is reasonably expected to be convertible into cash within three business days or less.
  - Moderately liquid investment: Corresponds to assets that can be converted into cash within four to seven consecutive days.
  - Less liquid: Corresponds to assets that can be sold or disposed of within seven consecutive days, but the settlement is reasonably expected to be more than seven calendar days.
  - Illiquid investment: Corresponds to an investment that is reasonably expected not to be able to be sold or disposed of within seven consecutive days.

- **IMF (2021).** It performs a stress test on Chilean mutual funds and pension funds to evaluate liquidity management, for which it classifies and weighs the assets of fixed-income funds in the following way:

  - Central Bank of Chile (BCCH) promissory notes, denominated in pesos or UF[12], to which it provides a weighting equal to 100% of their value.
  - Treasury Bonds (TGR) or bonds of the BCCH, denominated in pesos or UF, to which it provides a weighting equivalent to 90% of their value.
  - Time deposits issued by banks, those with a maturity of less than 90 days are given a weighting equal to 100% and those with a longer term are given a weighting corresponding to 90% of their value.
  - Any other instrument, whether fixed-income or equity, is given a weighting equal to 0%.

- **Basel III and Bank Liquidity Coverage Ratio (LCR)**: For the purposes of calculating the LCR that Chilean banks must comply with, Chapter 12-20 of the Updated Compilation of Standards considers as high-quality liquid assets the following instruments:

  - Instruments issued by the TGR or the BCCH.
  - Financial instruments in the currency of their country of origin issued or guaranteed by States, multilateral development banks, or central banks of foreign countries rated between AAA to A-, or their equivalent.

[12] The Unidad de Fomento (UF) is a readjustability index, calculated and authorized by the Central Bank of Chile, for domestic currency credit operations carried out by banking companies and savings and credit cooperatives. For the purposes of calculating this index, the value of the UF is readjusted daily from the tenth of each month to the ninth of the following month, in accordance with the variation experienced by the Consumer Price Index (CPI) determined by the National Institute of Statistics (INE) – in the calendar month immediately prior to the period for which the UF is calculated and published.

b. Suggestion for the definition of Chilean liquid assets:

In this research we apply different liquidity approximation measures to categorize local fixed-income instruments according to their degree of liquidity. For more details on the referred metrics see **Appendix N°5**.

Based on these results, the following instruments are proposed as liquid assets, whose definitions will be used in the following section with the objective of estimating liquidity buffers in the mutual fund industry.

Table 3: Defining liquid assets for mutual fund portfolios.

Category	Weight	Asset Class
A	100%	Central Banks Notes
		Bank CDs with maturity less or equal than 7 days.
B	90%	Bank CDs with maturity over 7 days.
		Treasury Bonds and Central Banks Bonds

Source: Authors.

VII. Liquidity Coverage Index

Building on the estimates of stressed net redemptions derived in the previous section, we introduce the Liquidity Coverage Index (LCI) as a tool for quantifying the adequacy of liquid assets held by mutual funds. The LCI could use the output from both, the empirical distribution or the econometric modeling approaches to determine if funds can meet redemption requests during periods of market stress

Based on the analysis of net redemptions behavior during instability episodes and the determination of liquid assets, this section proposes a Liquidity Coverage Index (LCI) for mutual fund portfolios, with the purpose of establishing a metric to indicate whether it has enough liquid assets to meet potential abnormal redemptions in the short term.

The proposed LCI is defined as follows:

$$LCI_{t,f,w,y} = \frac{Liquid\ Assets_{f,w,y}}{P_1^t \cdot Total\ Assets_{f,w,y}} \quad (3)$$

Where:

- **Liquid Assets:** correspond to the sum of liquid assets of fund f according to the definition and weights presented in Table 2, at week w and year y.
- $\boldsymbol{P_1^t}$**:** corresponds to the 1st percentile estimated of the weekly net redemptions for each type of fund t over assets (Table 2) or the forecast of the econometric model previously described (equation 2).
- **Total Assets**: correspond to the total assets under management of the fund.

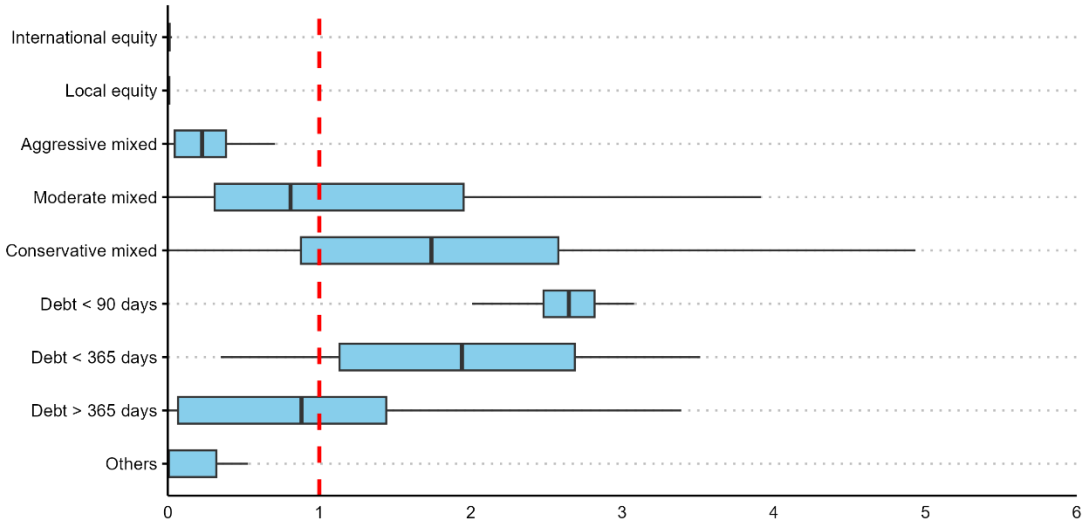
Therefore, an LCI greater than 1 would indicate that the fund can meet the payment commitments of the redemptions requested under financial stress conditions. Conversely, if the indicator is less than 1, it would mean that the fund does not have enough liquid assets to meet such redemptions.

Next, the LCI is calculated for all types of funds to get an industry-level view using the empirical distribution approach, which reveals certain particularities, such as the high liquidity of money market and short-term funds as opposed to medium and long-term debt funds, which is explained by the nature and investment strategy followed by each type of fund.

Therefore, it is suggested that liquidity requirements should primarily focus on the latter group, as well as on conservative or moderate balanced funds with significant exposure to long-term debt instruments as underlying assets.

In contrast, equity funds and aggressive balanced funds - given their relatively small AUM and the characteristics of their underlying assets- should not be considered a priority for the initial application of liquidity requirements. Similarly, structured funds, due to their predefined investment horizons and the contractual features that limit the likelihood of large-scale redemptions under stress, should not be a target of this liquidity buffer tool.

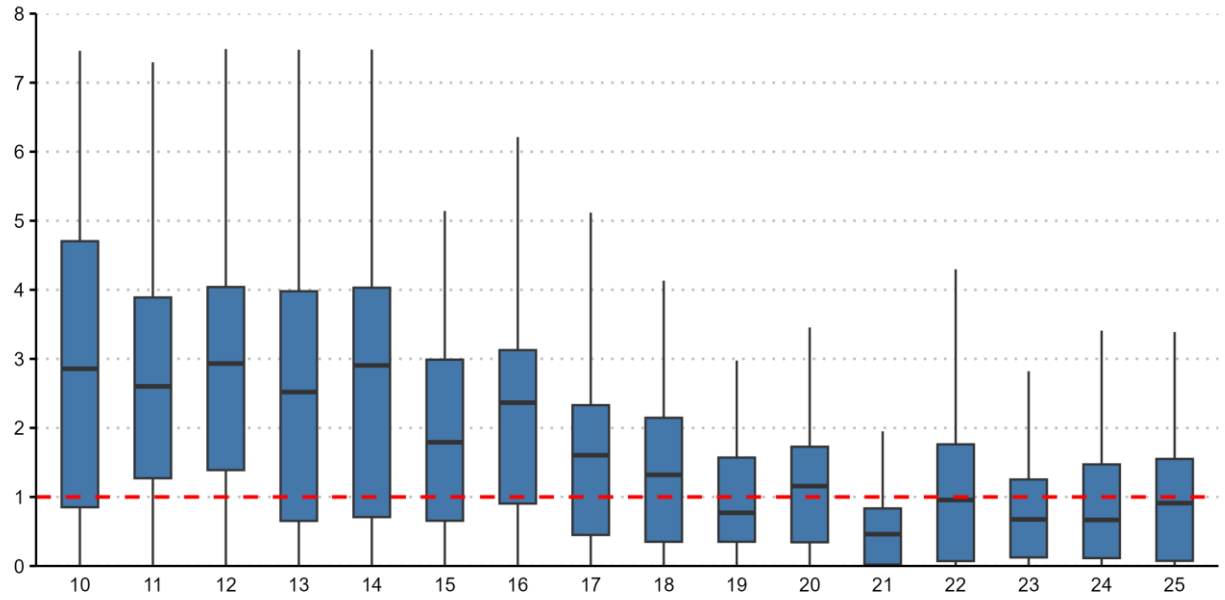
Figure 8: LCI distribution for all fund types
(times stressed net redemptions, as of June 2025)



Source: Own elaboration.
Note: The figure shows the distribution of the LCI for all types of funds as of 2025. The flows of redemptions/contributions net weekly (see Annex 1) are stressed by multiplying them by the 1st percentile of the distribution of each type of fund (see Table 2). Liquid weekly assets follow the definition Table 2. Structured funds not included since their portfolios vary over time. Others include funds for "qualified investors" and other kind of funds that have been recently created without classification or that have changed their investment strategy.

The time series dynamic of the LCI was computed for medium and long-term fixed-income mutual funds (classified as "debt > 365 days"). The results are reported in Figure 9, which depicts the distribution of LCI values at year-end for each period and as of June 2025.

Figure 9: LCI distribution for medium and long-term debt funds[13]
(times stressed net redemptions, 2010-2025)



Source: Own elaboration.
Note: The figure shows the distribution of the LCI at the end of each year and in June 2025. The flows of redemptions/contributions net weekly (see Annex 1) are stressed by multiplying them by 0.12 corresponding to the 1st percentile of the distribution of debt > 365 days funds (see Table 2). Then, the sum of the weekly assets weighted by the definition of liquid assets (see Table 2) is divided by the stressed flows to obtain the LCI. The horizontal line marks 100% coverage of liquid assets against a 12% outflow of the funds.

Based on the results obtained, firstly, it is observed that the liquidity levels of the medium and long-term debt mutual funds portfolio have followed a decreasing trend over the last 10 years. Secondly, although the median LCI of these funds at a system level is close to or greater than 1 for most of the period analyzed, there are funds that do not have sufficient liquid assets to cover the stressed net redemptions. For example, as of June 2025, approximately half of the debt > 365 days funds have an LCI of less than 1[14].

Our analysis indicates that a significant proportion of debt mutual funds in Chile fall below the LCI threshold of 1, suggesting potential liquidity vulnerabilities during periods of financial stress. These findings are consistent with those reported in the International Monetary Fund's Financial Sector Assessment Program (FSAP) report for Chile (2021).

[13] See Appendix N°6 to see the LCI evolution for the rest of the funds.
[14] The accuracy of the Liquidity Coverage Indicator (LCI) could be significantly influenced by the definition of a liquid asset. To assess this, a sensitivity analysis was performed using various definitions of liquid assets. These definitions included those from Basel III and the Bank Liquidity Coverage Ratio (LCR) standards, as well as the definition used by the IMF FSAP report for Chile (2021). The analysis revealed no substantial differences in the LCI calculations compared to the definition proposed in this study.

VIII. Concluding remarks

This paper proposes the Liquidity Coverage Index (LCI) as a tool to measure mutual funds' ability to meet redemption requests under stressed market conditions and it is determined as the ratio between the liquid assets held by the fund in its investment portfolio and the stressed net redemptions that the fund manager must meet in a time horizon of one week. The estimation of stress scenarios is conducted using two approaches, the first approach focuses on the empirical distribution of weekly net redemptions, where we review stressed redemptions within the historical distribution and the second approach involves forecasting stressed net redemptions by modeling the net flows under an exogenous shock. Our analysis indicates that most funds would satisfy this metric, except for some segments within the medium and long-term debt funds, where about half of them have an LCI of less than 1.

Building liquidity buffers requires balancing competing forces. While it mitigates liquidity risk, it comes at the cost of potentially lower returns, as highly liquid assets typically offer lower yields compared to less liquid investments. Overly stringent liquidity requirements can also sacrifice potential returns for investors. Therefore, finding the right balance is crucial for ensuring both financial stability and attractive returns within the mutual fund industry.

Based on these findings, some policy recommendations and best international practices aimed at enhancing the resilience of mutual funds during periods of financial stress could be considered by regulators:

1. Implement Minimum Liquidity Requirements for High-Risk Funds

Introduce a minimum liquidity coverage index for mutual funds with substantial holdings in long-term or less liquid debt instruments, such as medium and long-term debt funds, ensuring that funds maintain a sufficient buffer of liquid assets to meet projected redemption demands during stressed market conditions.

By implementing a minimum liquidity requirement, regulators could help ensure that these funds maintain enough liquid assets to withstand sudden redemption pressures, thus reducing the risk of fire sales and broader market disruptions.

2. Adopt Enhanced Liquidity Stress Testing Frameworks

Require all mutual funds to conduct regular liquidity stress tests incorporating both historical and hypothetical scenarios, including those based on extreme market shocks. These tests should be tailored to the specific liquidity profiles of each fund, with results reported to the regulatory authority on a periodic basis.

Liquidity stress testing is a key tool for identifying potential vulnerabilities and ensuring that funds are prepared for adverse market conditions. By mandating regular stress tests, regulators could better monitor the liquidity position of mutual funds and take preemptive actions to prevent systemic risks. The stress testing framework should include different redemption scenarios, such as sudden large redemptions and gradual but persistent outflows, to capture a range of potential risks.

3. Enhance Transparency and Disclosure of Liquidity Risks

Strengthen disclosure requirements for mutual funds, requiring them to provide more detailed and timely information on their liquidity risk management practices, including the composition of their liquid assets, redemption policies and results of liquidity stress tests.

Enhanced transparency can empower investors to make more informed decisions and reduce information asymmetry in the market. Disclosure of liquidity management practices and stress test results will provide greater visibility into the liquidity risks of mutual funds, allowing investors to better assess the safety of their investments and avoid panic-driven redemptions during times of market stress.

4. Introduce Swing Pricing and Other Anti-Dilution Tools

Swing pricing adjusts the net asset value (NAV) of a fund to account for the costs associated with large redemptions or subscriptions, thereby protecting remaining investors from the dilution of their interests. Encourage or mandate the adoption of swing pricing or similar anti-dilution mechanisms by mutual funds (see table 1 and Appendix N° 2), particularly those that are more susceptible to liquidity mismatches (see IOSCO 2023 and FSB 2023).

Swing pricing can help mitigate the "first mover advantage," where early redeemers benefit at the expense of those who stay invested. By implementing this tool, funds can reduce the risk of destabilizing redemption runs and protect the interests of all investors. Additionally, this practice aligns with recommendations from international regulatory bodies like the International Organization of Securities Commissions (IOSCO).

5. Develop Contingency Planning Requirements for Mutual Funds

Require mutual funds to develop and maintain detailed contingency plans for handling liquidity crises, including pre-defined actions to be taken during periods of extreme market stress. These plans should be regularly reviewed and updated to reflect changing market conditions and fund-specific risk profiles.

Contingency planning is crucial for managing unexpected liquidity events effectively. By requiring funds to have well-defined plans in place, regulators can ensure that fund managers are prepared to respond swiftly and effectively to mitigate potential market impacts. This measure can also promote better governance and risk management practices within the mutual fund industry.

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Appendix N°1. Law that Strengthens the Resilience of the Financial System and its Infrastructures[15]

1. *CMF Attributions.* To establish a minimum investment requirement of the fund in liquid assets, as well as the authority to establish the definition of liquid assets. The above is determined through CMF's General Norms.

   For determining such limits, the active and passive positions of the funds must be considered, as well as the terms and propensity for liquidation of their shares, among other factors.

2. *BCCh Attributions.* The Central Bank, for reasons based on safeguarding the stability of the financial system, may exceptionally buy and sell in the open market to financial institutions supervised by the CMF and to pension funds, securities and commercial papers issued by banking institutions The above excludes stocks, and bonds without a fixed maturity date and subordinated bonds.
   These *purchase* and sale operations in the open market may be carried out purely and simply, or subject to a repurchase or resale agreement, under the financial conditions established by the Bank.

[15] "Ley N° 21.641 (2023), Fortalece la resiliencia del sistema financiero y sus infraestructuras"

Appendix N°2. Liquidity Management Tools (LMTs)

Nro	LMT	Definition
1	Suspension of redemptions and subscriptions of shares	Temporarily prohibiting participants from redeeming or acquiring shares of the fund **(an existing tool in Chile, but in a restrictive manner)**
2	*Redemption gate*	Temporary and partial restriction of participants' right to redeem their shares, so that investors can only redeem a certain portion of their shares **(an existing tool in Chile, but in a restrictive manner)**
3	Extension of notice periods	It involves extending the notice period that participants must give to fund managers when redeeming their shares.
4	*Redemption fee*	It's a fee, within a predetermined range that considers the cost of liquidity, paid by participants to the fund when redeeming shares, ensuring that participants remaining in the fund are not unfairly disadvantaged.
5a	Swing pricing	A predetermined mechanism by which the redemption value of fund shares is adjusted through the application of a factor ("swing factor") that reflects the cost of liquidity.
5b	*Dual pricing*	A predetermined mechanism by which the subscription and redemption prices of fund shares are set by adjusting the redemption value of the shares through a factor reflecting the cost of liquidity.
6	Anti-dilution levy	A fee that a participant pays to the fund when buying or redeeming shares, which compensates the fund for the liquidity cost incurred due to the size of that transaction, and ensures that other participants are not unfairly disadvantaged.
7	*Redemptions in kind*	Transfer of assets held by the fund, instead of cash, to meet participants' redemption requests
8	Side pockets	Segregating certain assets, whose economic or legal characteristics have significantly changed or become uncertain due to exceptional circumstances, from the other assets of the fund

Appendix N°3. Methodology for calculating net redemptions

The data source for determining net contributions corresponds to the daily information of mutual funds that is sent according to the instructions contained in Circular No. 1,850, covering the period from January 2000 to October 2025.

Certain adjustments are made to avoid biases or distortion of results. First, fund series with less than 12 months from the start of operations are removed, and secondly, fund series that were in the last 12 months of operation are removed, considering that new funds or those about to be eliminated are rapidly forming or selling their assets.

To avoid biases due to the price effect in the period contemporary to the net of contributed quotas, the quota value of the previous period is considered, as is the case with assets. Net redemptions are calculated on a weekly basis, based on the following formula.

$$Weekly\ net\ redemptions_{f,w,y} = \sum_{i=1}^{n_{f,w,y}} \left(\frac{\sum_{d=1}^{7} \left[\left(Contributions_{f,i,d,w,y} - Redemptions_{f,i,d,w,y} \right) \cdot F^{a}_{f,i,d,w,y} \cdot VC_{f,i,d=7,w-1,y} \right]}{Total\ assets_{f,d=7,w-1,y}} \right) \quad (4)$$

Where:

- d: corresponds to the day of the year, where $d \epsilon \{1,365\} \mid 01-jan-y \rightarrow d = 1, 31-dec-y \rightarrow d = 365$ for series i.
- w: corresponds to the week of the year y, where $s(d) = \left\lceil \frac{d}{7} \right\rceil$.
- $n_{f,w,y}$: corresponds to the amount of series for the given fund.
- $F^{a}_{f,i,d,w,y}$: corresponds to the adjustment factor (which arises from adjustments in the distribution of shares).
- $VC_{f,i,d=7,w-1,y}$: corresponds to the net asset value (NAT) per share.

Appendix N°4. Econometric Model for Net Redemption Flow

The estimation results indicate that recent lags have the greatest impact when projecting stressed redemption flows, as the first lag of flows (t = 1) and the first lag of spreads (contemporaneous observation at t = 0) have the largest coefficients. Additionally, these lags are statistically significant at the 99% level.

Table 4: Estimation Results

	Flows	Spread
$t = 0$		1.550^{***}
		(0.200)
$t = -1$	0.474^{***}	0.336
	(0.033)	(0.209)
$t = -2$	0.029	0.282
	(0.036)	(0.209)
$t = -3$	−0.001	0.401^{*}
	(0.036)	(0.210)
$t = -4$	0.020	0.013
	(0.036)	(0.211)
$t = -5$	0.001	0.044
	(0.036)	(0.210)
$t = -6$	0.044	−0.200
	(0.036)	(0.211)
$t = -7$	−0.006	0.031
	(0.037)	(0.211)
$t = -8$	−0.017	0.206
	(0.037)	(0.212)
$t = -9$	0.050	−0.097
	(0.037)	(0.212)
$t = -10$	−0.041	0.017
	(0.037)	(0.213)
$t = -11$	0.016	−0.056
	(0.037)	(0.213)
$t = -12$	−0.035	0.094
	(0.033)	(0.212)
Constant		0.003^{***}
		(0.001)
Observations		956
Adjusted R^2		0.348
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Authors.

Appendix N°5. Liquidity estimation of Chilean assets

In this section, metrics are constructed and analyzed that serve as inputs to categorize local fixed-income instruments according to their degree of liquidity.

- **Estimation of aggregated Turnover in the capital market:** the estimates of the previous exercise were focused only on the liquidation of instruments by the mutual fund industry. Here we focus on the analysis of liquidity in the Chilean capital market. The proxy for liquidity that we will use is based on the estimation of a ratio that indicates how many days it would take to convert 100% of the total stock of the main national instruments into cash, through the calculation of equation (5).

$$Turnover\ Capital\ Market = \frac{Total\ Stock}{Average\ daily\ transactions} \quad (5)$$

Where:

- **Total Stock:** For fixed income instruments, it corresponds to the stock of each instrument at the end of the previous year, while for local equities it corresponds to the market capitalization on the last day of the previous year.
  Average daily transactions: correspond to the average daily transactions recorded during the respective year. This indicator and the following ones take into account stock exchange transactions and over-the-counter (OTC) market transactions.

The estimated liquidation periods of fixed income instruments and local equities during the last 5 years, under the assumption that 100% of each instrument is liquidated, indicate that the most liquid assets in terms of Turnover, by far, are the Central Bank Notes, which have average liquidation periods of 10 business days, followed by Treasury bonds and Banks CDs (76 days each), and then Central Banks Bonds (140 days). Meanwhile, the liquidation Turnover of Bank Bonds and Corporate Bonds were equivalent to 207 and 353 business days, respectively.

Table 5: Turnover by instrument of the Chilean financial system
(number of business days)

Instruments	2019	2020	2021	2022	2023	Average
Central Bank Notes	9	9	11	13	12	10
Treasury Bonds	36	51	81	110	103	76
Banks CDs	55	75	89	62	100	76
Central Bank Bonds	36	32	309	124	198	140
Banks Bonds	161	200	219	243	210	207
Corporate Bonds	289	261	366	398	453	353
Securitized Bonds	2,032	492	2,087	1,706	2,856	1,835

Source: Authors based on information from Riskamerica, BCS and BCCh.

Notes: The Indicator corresponds to the stock of instruments at the end of the previous year divided by the average daily transactions of the respective year. Therefore, it tells us in how many business days the available stock of instruments would be sold.

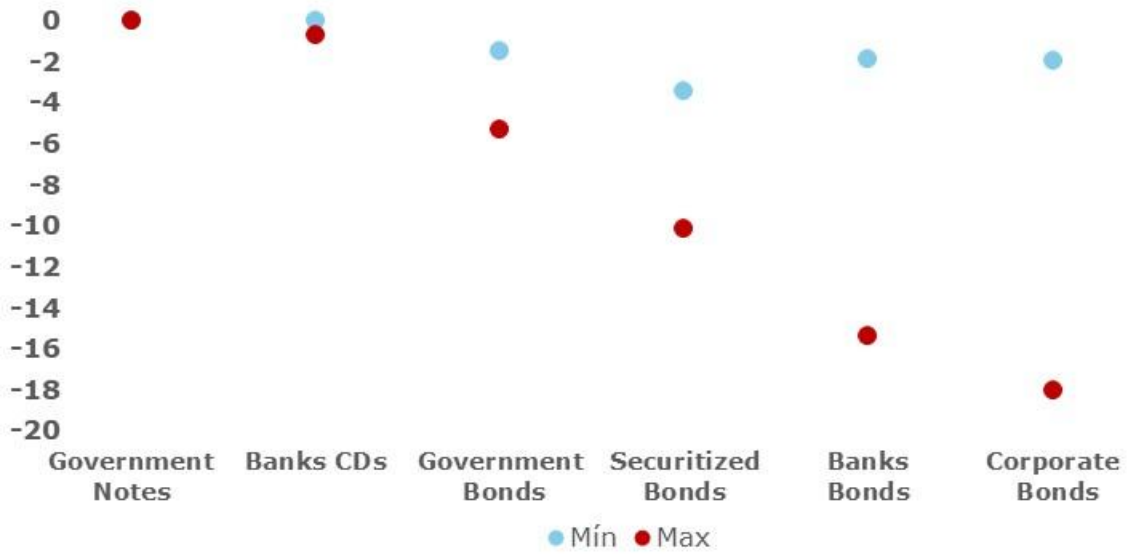
Finally, Securitized Bonds have liquidation periods well over 1000 days, which makes them the least liquid instruments under this metric.

- **Price impact in stressed markets:** here, the possible markdowns or valuation losses that financial asset prices may suffer when sold in the secondary market during times of financial stress are estimated.

The methodology used involves determining the maximum ranges of price drops from a representative sample of bond price indices (bank, corporate, and government) and intermediation instruments (time deposits and government promissory notes) that occurred during the last 5 years, with the purpose of capturing the exceptional volatilities recorded in the financial markets as a consequence of the "Social Crisis" and the "Covid-19". The selection of the sample of the indices was carried out considering factors such as the risk classification, duration, and currency of the assets.

The results suggest that in terms of price impact, in stress scenarios, corporate bonds show a greater deterioration, with valuation losses ranging from -1.9% to -18.1%. The difference is explained because within the subcategory with the greatest deterioration are the Corporate Bonds with a duration of less than 5 years from instruments classified as BBB, assets that are reasonably more volatile.

Figure 10: Impact on prices in stress scenarios
(percentage change in weekly prices, Jan.19 to Dec.23)



Source: Authors based on information from "LVA Índices".
Note: The figure shows the maximum ranges of falls of a representative sample of bond price indexes and intermediation instruments that occurred during the last 5 years. The selection of the sample of the aforementioned indices was carried out taking into consideration factors such as the risk classification, duration and currency of the asset, and in the case of corporate bonds, the indices of instruments with risk category BBB- and higher are used.

Bonds issued by banks take the second place in terms of price impact in stress situations, followed by bonds issued by the government (Central Bank Bonds and Treasury Bonds), and further away are the intermediation instruments, whether issued by banks or the government.

- **Amihud Liquidity Ratio:** Amihud (2002) defines an indicator that measures the impact that the variation in price, per monetary unit traded, as follows:

$$Amihud_{i,t} = \frac{1}{N}\sum_{t=1}^{N}\frac{|r_t|}{V_t} \qquad (6)$$

Where:

- N: corresponds to the number of days with positive volume in month.
- r_t: corresponds to the daily return.
- V_t: corresponds to the amount traded on day.

The interpretation of this ratio is based on the fact that one instrument is less liquid than another when it has a higher ratio, as the price experiences a greater fluctuation with respect to a smaller volume traded. This indicator is calculated based on data from daily fixed-income transactions over the last 10 years, whose results are summarized in Table 5:

Table 6: Amihud Liquidity Ratio (*)
(ratio)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
Central Bank Notes	0.01	0.02	0.18	0.01	0.01	0.02	0.00	0.00	0.02	0.10	0.04
Central Bank Bonds	0.17	0.12	0.14	0.25	0.16	0.55	0.37	0.32	0.12	0.00	0.22
Bank Bonds	0.66	0.56	0.45	0.48	0.30	0.52	0.37	0.36	0.29	0.24	0.42
Treasury Bonds	0.35	0.25	0.38	0.38	0.22	0.22	0.33	1.12	0.90	0.72	0.49
Corporate Bonds	0.70	0.66	0.77	0.90	0.75	0.95	1.33	0.89	0.77	0.40	0.81
Banks CDs	0.27	1.39	0.48	0.92	0.41	2.53	0.25	1.59	1.23	1.31	1.04
Securitized Bonds	5.22	0.52	0.96	0.10	0.12	0.26	1.02	3.13	0.51	0.01	1.18

(*) Values multiplied by 10^{11}.

Source: Own elaboration based on Amihud (2002).
Note: In the case of Banks CDs, the indicator was calculated for deposits of 7 days or less, which averaged 0.19, and for those over 7 days 1.12, which were then weighted according to the traded amount giving a weighted average of 1.04 that is shown in the table. It should be noted that term deposits are instruments with a shorter maturity compared to bonds and, in addition, they tend to have a lower frequency of transactions in the secondary market compared to such instruments.

The results suggest that the Central Bank Notes, closely followed by the Central Bank bonds, Bank bonds and Treasury bonds, are the most liquid instruments. Conversely, the assets with the least liquidity would be Securitized Bonds.

- **Presence Indicator:** With the daily transaction data, the presence of different instruments in each year can also be calculated. For this, it is calculated how many days an instrument is traded, during the business days that can be possible traded. Table 6 shows that the Central Bank Notes, Treasury bonds, and Central Bank bonds are the instruments with the highest presence during the period considered, trading

on average more than half of the recorded business days. On the other hand, securitized bonds are the instruments that are traded the least number of times.

Table 7: Presence Indicator
(percentage of total business days)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
Central Bank Notes	82	74	76	73	74	70	99	88	75	87	80
Treasury Bonds	81	79	78	76	74	80	80	81	79	80	79
Central Bank Bonds	83	79	74	69	69	69	73	58	47	38	66
Banks Bonds	53	49	47	45	43	38	32	28	27	22	39
Corporate Bonds	41	36	34	35	38	33	30	25	25	21	32
Banks CDs	33	25	27	27	29	28	27	25	34	32	29
Securitized Bonds	22	14	8	24	16	24	26	5	12	4	16

Source: Own elaboration.
Note: The presence indicator calculates the number of days an instrument is traded in relation to the possible days on which it could be traded. It should be noted that Banks CDs are instruments with a shorter maturity compared to bonds and, in addition, they tend to have a lower frequency of transactions in the secondary market compared to such instruments.

- **Summary:** The following table presents a summary of the previously calculated liquidity metrics classified by the average ranking in which they are positioned in each one, where the first place (1) corresponds to the most liquid instrument and the last place (7), to the least liquid. In the last column, they are ordered according to the simple average of the ranking obtained in each metric.

Table 8: Liquidity indicators ranking

	Turnover Capital Market	Price Impact	Amihud	Presence Indicator	Total Ranking
Central Bank Notes	1	1	1	1	**1**
Treasury Bonds	3	3	4	2	**2**
Central Bank Bonds	4	3	2	3	**2**
Banks CDs	2	2	6	6	**4**
Banks Bonds	5	6	3	4	5
Corporate Bonds	6	7	5	5	6
Securitized Bonds	7	5	7	7	7

Source: Own elaboration.

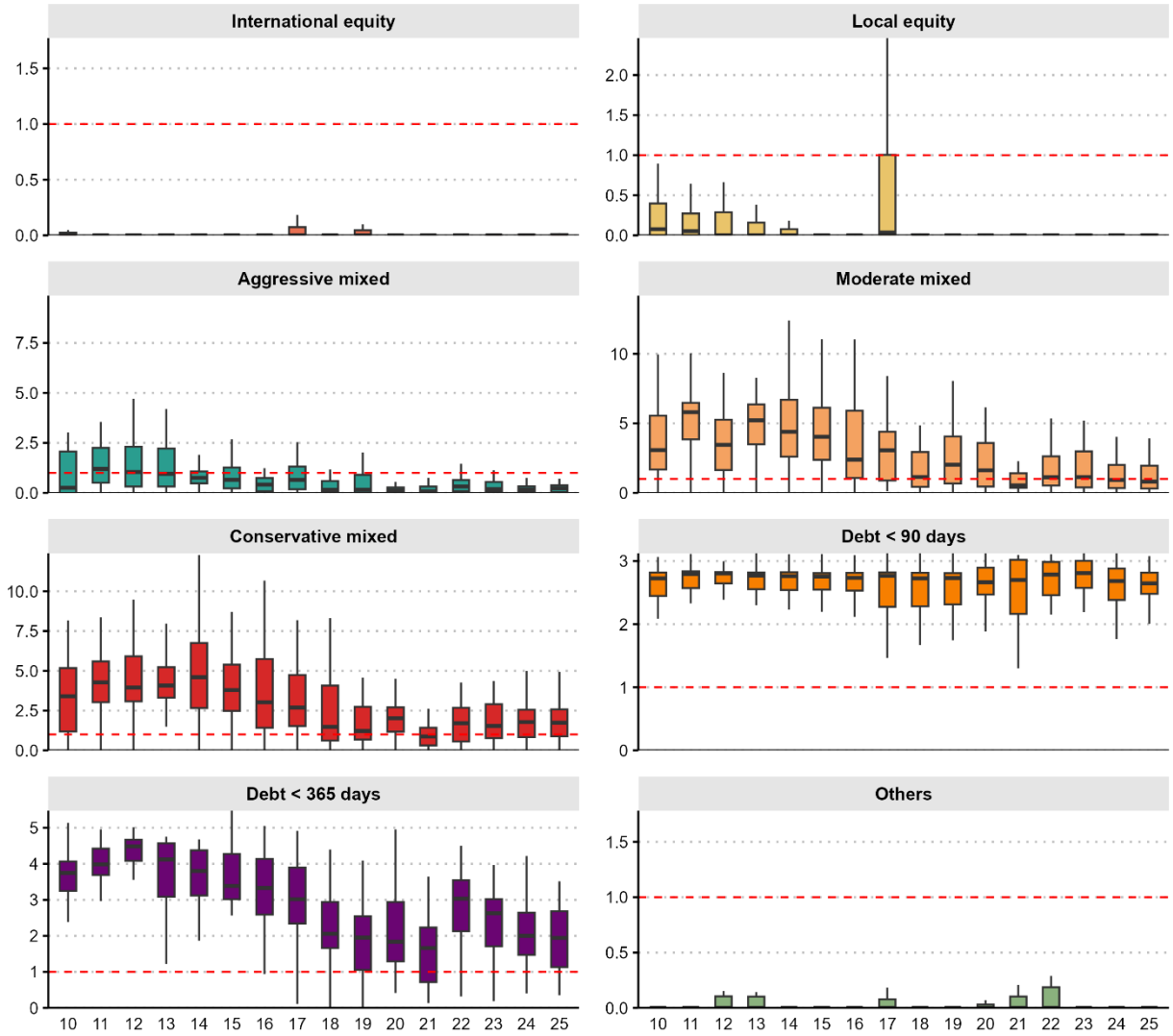
Appendix N°6. LCI evolution

Breaking down the distribution of the other mutual fund categories over time, the trend remains consistent with what is shown in Figure 8. Funds with high equity exposure (international equity, local equity and aggressive mixed) barely hold liquid assets, concentrating the distribution of the indicator close to zero.

Regarding other debt funds, conservative and moderate mixed funds follow a very similar distribution, with a downward trend in recent years. The same occurs with short-term debt funds (debt < 365 days), which show less dispersion than mixed funds.

As expected, money market funds predominantly invest in highly liquid instruments, maintaining a fixed LCI close to 3.

Figure 11: LCI Distribution over time
(times stressed net redemptions, as of June 2025)



Source: Own elaboration.
Note: The figure shows the distribution of the LCI at the end of each year and in June 2025. The flows of redemptions/contributions net weekly are stressed by multiplying them by the 1st percentile of the distribution for each fund type (see Table 2). Then, the sum of the weekly assets weighted by the definition of liquid assets (see Table 2) is divided by the stressed flows to obtain the LCI. The horizontal line marks 100% coverage of liquid assets against stressed outflows of the funds. Structured funds not included since their portfolios vary over time. Others include funds for "qualified investors" and other kind of funds that have been recently created without classification or that have changed their investment strategy.