INTERNATIONAL MONETARY FUND

Real Estate Sector and Financial Stability Risks in Chile

Chile

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Real Estate Sector and Financial Stability Risks in Chile
Prepared by Tatsushi Okuda[*]

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ABSTRACT: The Chilean real estate sector has recently undergone adjustments which have increased the risks for the financial sector, but the system remains overall resilient. In the baseline, the real estate market is expected to modestly recover, and several factors mitigate credit risk. The buffers in the financial sector currently appear broadly adequate to absorb stresses from high long-term interest rates and the tail risk of a real estate crisis. Nevertheless, supervisors should monitor these risks closely, keep advancing in closing data gaps, and continue to extend stress test models to comprehensively capture real estate-specific risk factors.

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Western Hemisphere Department	

CONTENTS

REAL ESTATE SECTOR AND FINANCIAL STABILITY RISKS IN CHILE[1]

The Chilean real estate sector has recently undergone adjustments which have increased the risks for the financial sector, but the system remains overall resilient to such risks. In the baseline, the residential real estate market is expected to modestly recover as the past cuts to monetary policy rates gradually spill over to the sector and global financial conditions loosen; there are initial signs of recovery in the weaker office segment; and several factors mitigate credit risk. Should risks materialize, such as persistently high long-term interest rates and structural shifts in the struggling commercial real estate segment, the buffers in the financial sector currently appear broadly adequate to absorb such stresses as well as those from the tail risk of a real estate crisis. Nevertheless, supervisors should monitor these risks closely, keep advancing in closing data gaps (commercial real estate price indices), and continue to extend stress test models to comprehensively capture real estate-specific risk factors.

A. Introduction

1.   Investors have viewed the Chilean real estate sector as weak since the pandemic. Before the pandemic, stock prices in the construction and real estate sectors closely tracked those of other sectors. Particularly since mid-2021, however, their stocks have lagged the rest of the economy.

2.   The Chilean real estate sector has a significant presence in the economy. The construction sector accounts for about 6 percent of nominal GDP and around 8 percent of total employment, reflecting its labor-intensive nature[2]. The real estate sector contributes even a bit more to nominal GDP (about 8 percent), but its share in total employment is only 1 percent. Compared to regional peers, the size of the construction sector relative to the economy is larger than regional and OECD peers, consistent with fact that Chilean construction firms hold substantial presence in the region, while that of the real estate sector is similar to reginal peers, but moderately smaller than OECD peers.

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[2] Moreover, construction represents 63 percent of total investment in 2023, of which housing and infrastructure construction, respectively, represents one-third and two-third.

Chile: Equity Indices
(Index, 2019=100)

Sources: S&P Global and IMF staff calculations.

Chile: GDP and Employment Shares by Industry (2023)
(In percent)

Sources: BCCh and IMF staff calculations.

Selected Economies: Value Added by Industry (2022)
(In percent)

Sources: OECD and IMF staff calculations.
Note: "Regional peers" consists of Brazil, Colombia, and Mexico. Share of each industry in total value-added.

Selected Economies: Construction Business in Latin America by Firms' Nationality (2022)
(In percent)

Sources: Construcción Latinoamericana and IMF staff calculations.
Note: Total revenues of top 50 firms in Latin America in 2022 by firms' nationality.

3.   The Chilean financial sector has significant exposure to the real estate sector. Mortgage loans account for about 30 percent of banks' loan portfolios, and construction and real estate firms represent around 10 percent and 20 percent of commercial loans for locally funded firms, respectively,[3] while banks have gradually reduced their exposures to these firms. Most of these loans are related to residential real estate rather than commercial real estate. Life insurers' exposure now reaches about 28 percent, with 8 percent real estate investment mostly in commercial real estates such as offices and shopping centers, 8 percent leasing, and the remaining 10 percent for mortgages[4]. They also serve as major investors in real estate funds, while the amount is limited for their portfolio.

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[3] "Locally funded firms" refers to firms that do not report to the CMF. Construction and real estate firms account for about 8 percent and 14 percent of total commercial loans, including those from globally funded firms (which report to the CMF).

[4] Life insurers invest in mortgage letters and loans (letras and mutuos hipotecarios) within fixed-income category.

Chile: Banking Sector's Exposures to the Real Estate Sector
(In percent)

Sources: BCCh, CMF, and IMF staff calculations.
Note: As of December 2023. The decomposition of commercial loans is for locally funded firms that do not report to the CMF.

Chile: Life Insurers' Exposures to the Real Estate Sector
(In percent)

Sources: ACAFI, CBRE, CMF, and IMF staff calculations.
Note: As of December 2023, except for "Real estate fund" (March 2024).

4. **In general, developments in the real estate sector can have implications for financial stability.** The first channel is a direct channel or partial equilibrium effects. Specifically, a) an increase in the Probability of Default (PD) of borrowers related to real estate activities, and b) an increase in Loss Given Default (LGD) due to changes in the values of real estate property collateral, could lead to higher credit costs, ultimately harming banks' capital, absent mitigation factors (e.g., adequate provisions and collateral requirements). The second channel is an indirect channel or general equilibrium effects, involving feedback from real estate-related businesses to the macroeconomy and the PD of general borrowers. In this context, in addition to the first-round effects, potential feedback loops could occur. The specific channels indicated in the literature are, on the demand side, a) housing wealth effect on consumption (Campbell and Cocco 2007; Iacoviello and Neri 2010; Aladangady 2017; Guren et al. 2021) and b) financial accelerator (net worth) channel on investment (Bernanke, Gertler, and Gilchrist 1996, 1999 and Christensen and Dib 2008). Moreover, on the supply side, input-output linkages on intermediate goods demand could be sources of the feedbacks. Against the backdrop, IMF's past Global Financial Stability Reports (IMF 2019 and 2021) focused on this sector.

5. **This study examines risks within the Chilean real estate sector, the financial sector's resilience to the risks, and the authorities' supervisory toolkits.[5]** It builds on earlier work by the Central Bank of Chile (BCCh) and IMF, e.g. the BCCh's Financial Stability Reports (e.g., Box IV.1 2011H2, Box IV.1 in 2012H1, Chapter IV in 2018H2), which analyzed the financial stability implications of the residential real estate sector, the FSRs coverage of developments in the sector and banks' preparedness for the associated risks, and the 2023 Article IV staff report (IMF 2024) on vulnerabilities in the financial sector.

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[5] In the context of the channels indicated above, Annex I shows that the estimated housing wealth effects via the collateral channel in Chile are non-negligible. Additionally, Annex II indicates that the spillovers from the construction and real estate sectors to other sectors, through input-output linkages, are similar to the OECD average.

B. Developments in the Real Estate Sector

Residential Real Estate

6.   Homeownership in Chile is around 60 percent. This is moderately lower than the OECD average (about 70 percent) but is comparable to that of regional peers ([BCCh's 2018H2 FSR](#)). In terms of the structure of housing supply, around two-thirds are houses and one-third are apartments, with more than half of these concentrated in Santiago. Mortgage loans are less frequently used to purchase homes compared to OECD peers despite use of grant to home buyers of nearly 0.5 percent of GDP which exceeds the OECD average (data are as of 2022 in [OECD Affordable Housing Database](#)).

7.   Stagnated demand has led to an excess supply of houses post-pandemic. Home sales, for both houses and apartments, have stagnated while stock of supply has increased corresponding to 3-4 years' worth of typical sales, although it has recently begun to slowly decrease.[6] As a result, (real) house prices have modestly declined and have not recovered to their peak levels in 2021.[7] With rent prices also declining, the recovery of demand for housing properties could take time.[8] Against this backdrop, the government has implemented supporting programs for housing.[9]
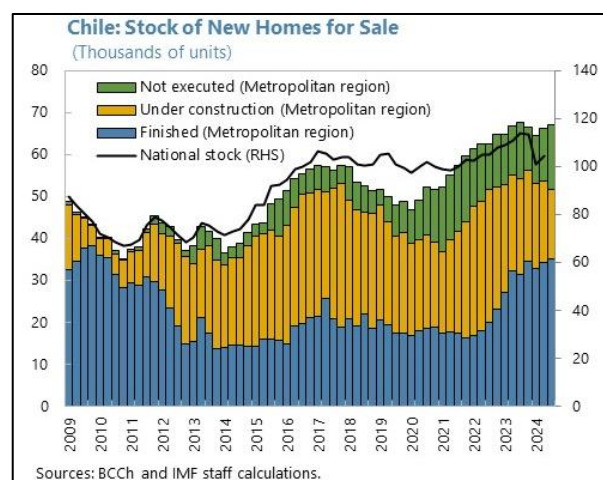
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[6] In parallel, the gap between the number of pre-sales (gross sales) and of final contracts (net sales) has expanded as cancellation rates have increased. The weak demand may reflect lower affordability amid still high house prices as the estimates by the Chilean Chamber of Construction (CChC) indicate that the ratio of house price to annual income in Chile is 11.4 as of 2024. This is higher than in most advanced economies. Moreover, the supply of houses has shifted to higher-end properties. Regarding the stronger demand for apartments than houses pre-pandemic, it was likely related to demographic factors, including strong immigrant flows (for details, see Box IV in the BCCh's 2019H1 FSR).

[7] The consistent increase in house prices until 2021 appears to have been partly driven by strong demand, increases in costs to address regulatory requirements in terms of quality, safety, and sustainability of houses, and during 2021-22, increases in material and labor costs.

[8] The rent index used in this paper is the marginal rent index, developed by [Córdova et al. (2023)](#) and provided by the BCCh. This ensures consistency in the comparison between (marginal) house price and rent indices. The author thanks the BCCh for providing the data. Note that house prices, house and office rents, and mortgage loans in Chile are typically in the Unidad de Fomento (UF) terms, indexed to inflation. The UF is an inflation-indexed unit of account, calculated and published by the BCCh, and it is authorized for pricing credit operations in national currency by banks. For details on the calculation, see [the BCCh's document](#).

[9] For example, in the context of the housing subsidy program, the government increased the maximum eligible home price from 2,200 UF to 3,000 UF and raised the subsidy from 250 UF to 400 UF (July 2024), with doubled savings requirements to facilitate mortgages with an LTV below 80 percent. Moreover, it introduced FOGAES, providing partial guarantees for construction loans, focusing on social housing projects, and FOGAES Vivienda (until December 2024), offering state-backed guarantees up to 10 percent of the mortgage loan for first homes (up to 4,500 UF), reducing provisioning costs for financial institutions. In October 2023, it also introduced a temporary tax benefit for new home purchases via mortgages, applicable from 2024 to 2029.

Chile: Home Sales
(Index 2015=100)

- Total (SII)
- Used apartments (SII)
- Used houses (SII)
- New apartments (SII)
- New houses (SII)
- New home (CChC)

Sources: BCCh, CChc, SII, and IMF staff calculations.
Note: Data for new houses (SII) are provisional for the last 2 quarters.

Chile: Stock of New Homes for Sale
(Thousands of units)

- Not executed (Metropolitan region)
- Under construction (Metropolitan region)
- Finished (Metropolitan region)
- National stock (RHS)

Sources: BCCh and IMF staff calculations.

8.   In the baseline scenario, the market is expected to moderately recover as recent cuts in monetary policy rates gradually spill over to mortgage rates and global financial conditions ease. The decomposition of housing investment and prices, based on the estimated DSGE model (Iacoviello and Neri 2010), indicates that the current price and investment adjustment aligns with the elevated mortgage rates, caused by shocks on the rate, likely reflecting global financial conditions (see Box 1). Chilean mortgage rates closely comove with long-term interest rates, which depend not only on the (current and expected path of) monetary policy rates, but also on global long-term interest rates. Therefore, one can expect the market to modestly recover as global financial conditions loosen, supported also by the feed-through of past monetary policy rate cuts.

Chile: Real House Prices and Rent Price
(Index 2012=100)

- House price (total)
- House price (houses)
- House price (apartments)
- New house price
- Used house price
- Rent price

Sources: BCCh and IMF staff calculations.

Chile: Mortgage Rate
(In percent)

- Mortgage rates
- Monetary policy rate
- 10 year interest rates (RHS)

Sources: BCCh and IMF staff calculations.
Note: Monetary policy rate is in CLP terms (nominal interest rate) while mortgage rates and 10 year interest rates are in UF terms (real interest rates).

Box 1. Structural Analysis on Housing Investment and House Prices

The cyclical fluctuations of housing investment and house prices are decomposed into contributions from structural shocks, based on the estimated macroeconomic model. Specifically, the Dynamic Stochastic General Equilibrium (DSGE) model with a housing sector—developed by Iacoviello and Neri (2010)—is fitted to Chilean data from 2002Q1 to 2024Q1 (Annex I). Deviations from the trend of real housing investment and real house prices are decomposed into contributions from structural shocks, including shocks on mortgage rates.[1]

The estimation results indicate that the current adjustment can be explained by the contributions of the shocks on mortgage rates. The text charts display the decomposition results, grouping the structural shocks into two categories: shocks on mortgage rates and net of other shocks. On both housing investment and house prices, shocks on mortgage rates had a negative impact prior to the Global Financial Crisis (GFC) and since 2022, while they supported these variables during the GFC and the pandemic. Importantly, the changes in the contribution of shocks on mortgage rates from 2021 to 2023 fully explain the declines in housing investment and house prices.

Chile: Monetary Policy and Mortgage Rates
(In percent)

Sources: BCCh and IMF staff calculations.
Note: The nominal mortgage rate is calculated by adding the implied 10-year expected inflation from CLP- and UF-based government bonds to the UF-based mortgage rates.

Chile: Decomposition of the Cycle of Housing Investment
(Deviation from trend, in percent)

Sources: IMF staff calculations.

Chile: Decomposition of the Cycle of House Price
(Deviation from trend, in percent)

Sources: IMF staff calculations.

1/ The shock on mortgage rates represents the deviation of nominal mortgage rates from the estimated Taylor rule, indicating changes in mortgage rates that are exogenous to domestic macroeconomic conditions (net of the contributions from i.i.d. shocks and persistent shocks). While the original model uses short-term (30-day) rates as funding costs for households to purchase homes, this estimation replaces short-term rates with mortgage rates, and regards the i.i.d. monetary policy shock and shocks on inflation objectives as i.i.d. and persistent shocks on mortgage rates, respectively. This adjustment enables the model to capture the weak connection between monetary policy rates and mortgage (long-term interest) rates, as well as potential structural shifts in the relationship between monetary policy rates and long-term interest rates, especially following pension fund withdrawals and the subsequent decline in capital market depth.

9. **House prices do not appear to be misaligned.** Real house prices and standard misalignment measures, price-to-income and price-to-rent ratios[10], increased for over a decade until the pandemic and have since then moderated and stabilized, respectively.[11] The cumulative increases in these variables over the past three, five, and seven years leading up to the peak in real house prices in Q4-2021 are still smaller than those in countries that experienced real estate market imbalances and ultimately real estate crises. Specifically, Chile's cumulative increase of price-to-income and price-to-rent ratios during the past five years were about half of the median five-year increase in real estate crises countries prior to their crises event. The BCCh's 2010H1 FSR (Box 3) finds that over 40 percent of the growth in housing prices is explained by macro-financial factors, including household income, GDP growth, mortgage interest rates, and the IPSA stock index (for similar results see also Idrovo-Aguirre et la. (2021), the BCCh's 2018H2 FSR, and the BCCh's 2024H2 FSR (Box II.1), including the role of demographic variables and construction costs).

Chile: House Price, Price to Income, and Price to Rent
(Index 2015=100)
Sources: BCCh, BIS, CChC, IMF, and IMF staff calculations.

Selected Economies: Real House Price
(Cumulative change, percent)
Sources: BIS, IMF, and IMF staff calculations.
Note:The samples in "Real estate crisis" include US, Spain, Ireland, Latvia, Lithuania and Estonia during the GFC, and Sweden and Japan in the 1990s. The maximum cumulative changes to the peak before the economic downturn in each sample country. Bars and whiskers, respectively, indicate median and inter-quartile ranges.

Selected Economies: House Price to Income
(Cumulative change, percent)
Sources: BIS, IMF, and IMF staff calculations.
Note:The samples in "Real estate crisis" include US, Spain, Ireland, Latvia, Lithuania and Estonia during the GFC, and Finland, Sweden, and Japan in the 1990s. The maximum cumulative changes to the peak before the economic downturn in each sample country. Bars and whiskers, respectively, indicate median and inter-quartile ranges.

Selected Economies: House Price to Rent
(Cumulative change, percent)
Sources: BCCh, BIS, IMF, and IMF staff calculations.
Note:The samples in "Real estate crisis" include US, Spain, Ireland, Latvia, Lithuania and Estonia during the GFC, and Sweden and Japan in the 1990s. The maximum cumulative changes to the peak before the economic downturn in each country. Bars and whiskers, respectively, indicate median and inter-quartile ranges.

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[10] The house price-to-rent ratio for Chile is calculated by dividing general (marginal) house price index (published by the BCCh) by the marginal rent index, developed by Córdova et al. (2023) and provided by the BCCh. Córdova et al. (2023) also show the house price to rent ratios by type of properties and by region. The rental yield (annual rent-to-price ratio) had moved in parallel with mortgage rates until the recent rise in long-term rates (BCCh 2024).

[11] The increase in real house prices relative to rent prices in Chile until 2021 could be attributed to the low ratio of mortgage burden (principal repayment and interest payments) to rent burden, due to long average maturity in mortgage loans (approximately 25 years) and consistent declines in mortgage rates. According to OECD Affordable Housing Database, as of 2017, median of the mortgage burden and rent burden (private market and subsidized rent) as a share of disposable income was, respectively, 15 and 24 percent.

Commercial Real Estate

10.   Since the pandemic, offices have faced a lack of demand; however, there are recent indications of a gradual recovery. According to the indicators in the BCCh's FSRs, vacancy rates have stayed mostly elevated in offices and shopping centers since the pandemic, while the rate has recently declined in warehouses. A closer examination of each sector, based on data provided by the private sector, indicates that in the office sector, rental prices appear to be rebounding, despite both demand (absorption) and supply (production) being low.[12] In the shopping center segment, although the vacancy rate moderately i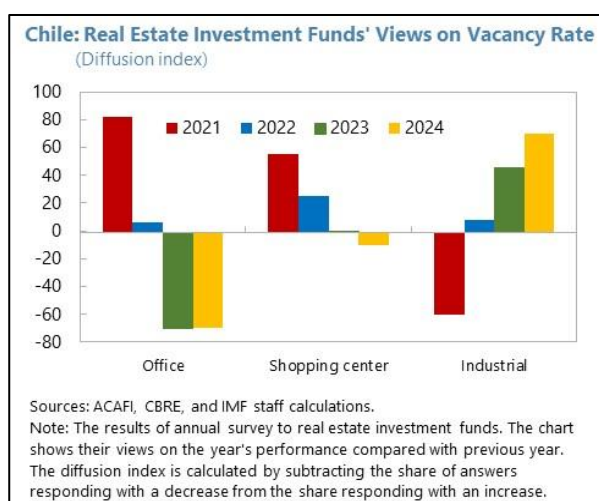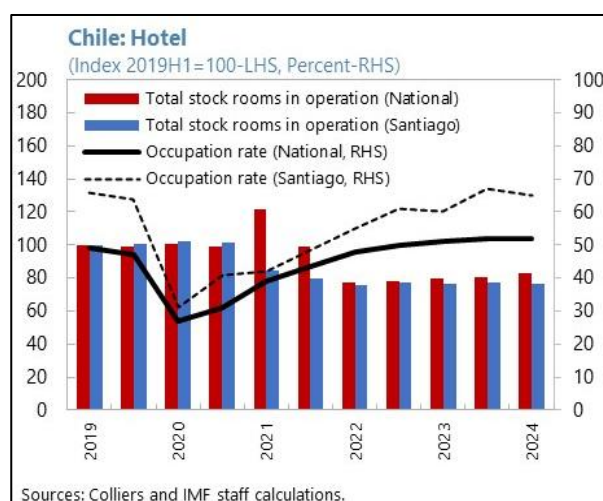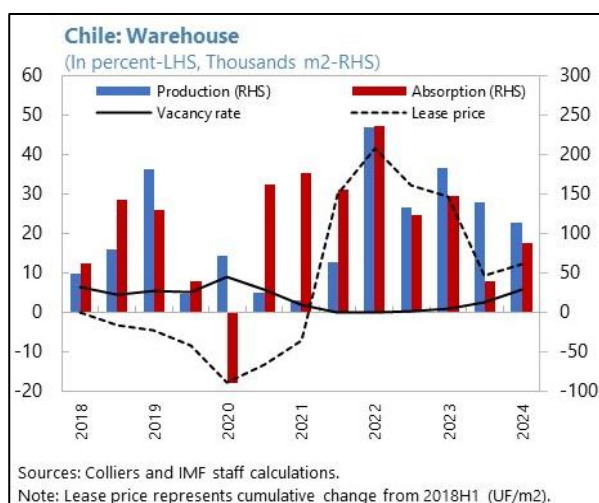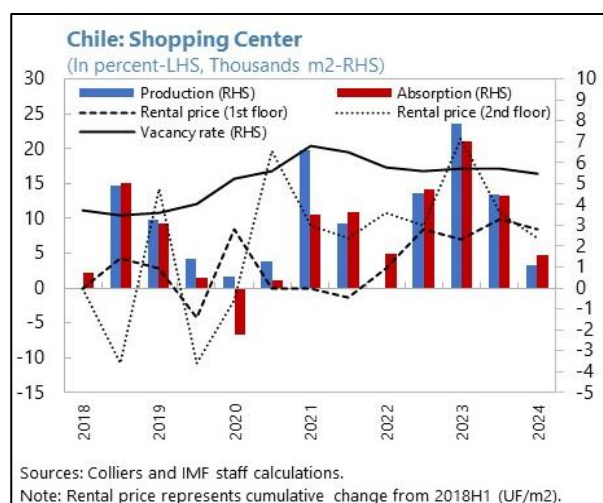ncreased during the pandemic, probably due to lockdowns, the sector has exhibited some dynamism and the vacancy rate has recently been gradually decreasing. In the warehouse segment, the vacancy rate has risen from nearly zero, which reflected an increased demand for e-commerce activities, and lease prices have declined due to recent production outpacing absorption. In the hotel segment, the occupancy rate has been gradually recovering since the sharp decline during the pandemic, although this recovery is partly supported by a reduced number of rooms in operation. Looking ahead, real investment funds expect continued decline in office vacancy and continued increase in warehouse (industrial) vacancy.

Chile: Commercial Real Estate (Overview)
(In percent-LHS, UF per square meter-RHS)
Office vacancy rate
Strip center vacancy rate
Warehouse vacancy rate
Office rent (Class A/A+, RHS)
Office rent (Class B, RHS)
Warehouse rent (RHS)
Sources: BCCh and IMF staff calculations.
Note: Indicators shown in the BCCh's Financial Stability Reports, based on CBRE, Colliers, and GPS data.

Chile: Office (Class A)
(In percent-LHS, Thousands m2-RHS)
Production (RHS)
Absorption (RHS)
Vacancy rate
Rental price
Sources: Colliers and IMF staff calculations.
Note: Rental price represents cumulative change from 2018Q2 (UF/m2).

Chile: Office (Class B)
(In percent-LHS, Thousands m2-RHS)
Production (RHS)
Absorption (RHS)
Vacancy rate
Rental price
Sources: Colliers and IMF staff calculations.
Note: Rental price represents cumulative change from 2018Q2 (UF/m2).
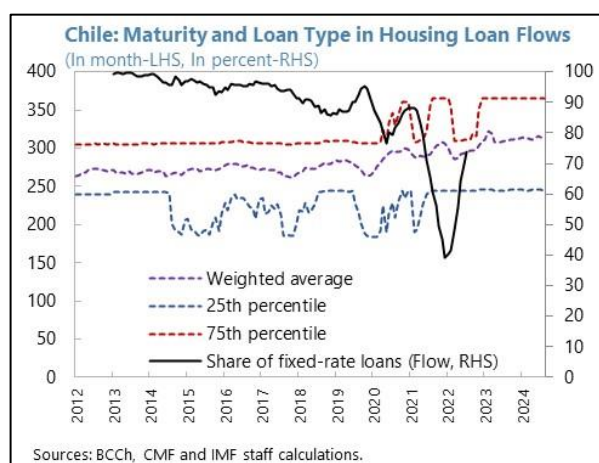
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[12] The recovery in vacancy rates and rents are stronger in Class A offices, rented by large firms and government, than Class B offices, rented by SMEs. In terms of geographical heterogeneity, downtown Santiago area, the epicenter of the 2019 social unrest, has faced significantly elevated vacancy and reduced rents, as many large firms moved to other areas in Santiago.

Chile: Shopping Center
(In percent-LHS, Thousands m2-RHS)

Production (RHS) · Absorption (RHS) · Rental price (1st floor) · Rental price (2nd floor) · Vacancy rate (RHS)

Sources: Colliers and IMF staff calculations.
Note: Rental price represents cumulative change from 2018H1 (UF/m2).

Chile: Warehouse
(In percent-LHS, Thousands m2-RHS)

Production (RHS) · Absorption (RHS) · Vacancy rate · Lease price

Sources: Colliers and IMF staff calculations.
Note: Lease price represents cumulative change from 2018H1 (UF/m2).

Chile: Hotel
(Index 2019H1=100-LHS, Percent-RHS)

Total stock rooms in operation (National) · Total stock rooms in operation (Santiago) · Occupation rate (National, RHS) · Occupation rate (Santiago, RHS)

Sources: Colliers and IMF staff calculations.

Chile: Real Estate Investment Funds' Views on Vacancy Rate
(Diffusion index)

2021 · 2022 · 2023 · 2024

Office · Shopping center · Industrial

Sources: ACAFI, CBRE, and IMF staff calculations.
Note: The results of annual survey to real estate investment funds. The chart shows their views on the year's performance compared with previous year. The diffusion index is calculated by subtracting the share of answers responding with a decrease from the share responding with an increase.
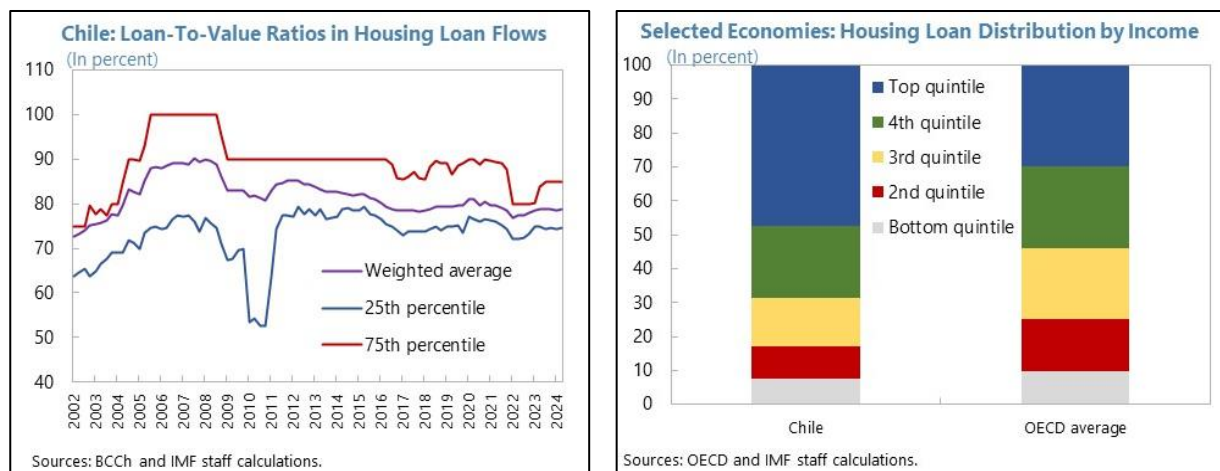
Housing Loans

11.   Most housing loans are fixed-rate (in real term), with maturity of 20 to 30 years and loan-to-value (LTV) ratios around 80 percent, primarily concentrated among high-income households.[13] During the low-rate environment of the pandemic, the share of mixed-rate loans—those with fixed rates for the first five years that then switch to variable rates—has increased, and as of 2023, about 10 percent of the mortgage debt stock is

Chile: Maturity and Loan Type in Housing Loan Flows
(In month-LHS, In percent-RHS)

Weighted average · 25th percentile · 75th percentile · Share of fixed-rate loans (Flow, RHS)

Sources: BCCh, CMF and IMF staff calculations.

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[13] Mortgage loans operate under a full recourse system. This means that if a borrower defaults and the proceeds from the foreclosure sale fall short of covering the loan repayment, the creditor has the right to seek the remaining balance from the borrower's other assets, not just those tied to the mortgage. This framework discourages strategic defaults, and instances of default are largely linked to macroeconomic factors. Micco et al. (2012) provide an overview of Chilean mortgage markets, including the factors contributing to the resilience of mortgage borrowers.

indexed to mixed rates, predominantly among high-income households (see also Chapter V of the BCCh's 2023H1 FSR). As of 2023, variable-rate loans comprise only 3 percent of the total housing loan stock. Loan principal and interest payments are denominated in the UF, meaning they reflect real terms; thus, higher CPI inflation leads to increased repayments and interest rates for borrowers, whose incomes are not indexed to inflation. LTV ratios are concentrated around 80 percent, which is considered the threshold for non-high LTV according to a rule of thumb, and have remained stable.[14] Furthermore, the distribution of housing loans by income level shows that the share of high-income borrowers in Chile is significantly higher than the OECD average.

Chile: Loan-To-Value Ratios in Housing Loan Flows (In percent)

Sources: BCCh and IMF staff calculations.

Selected Economies: Housing Loan Distribution by Income (In percent)

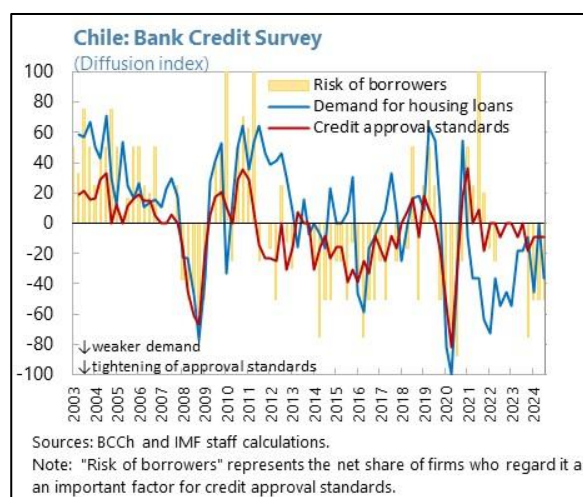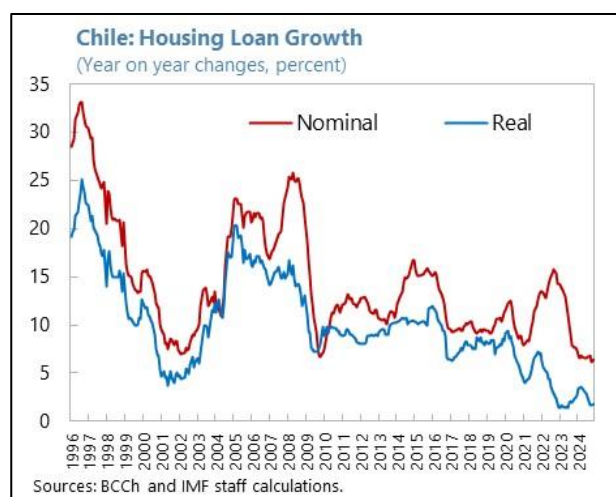Sources: OECD and IMF staff calculations.

12.   The housing loan growth is at a historical low amid elevated mortgage rates, which remain significantly higher than pre-pandemic levels. These rates are closely tied to long-term interest rates and have been relatively unaffected so far by recent cuts in monetary policy rates. Bank credit surveys suggest that weak demand, amid high borrowing costs, is the primary factor influencing the subdued credit growth.[15] Note that under the same level of mortgage rates, compared with 10 years ago, the financial burdens for borrowers are now significantly higher because of the higher house price levels (Chilean Banking Association <ABIF> 2024a).[16] According to the BCCh (2024), this weakness in demand could also be contributed by the recent decrease in or even the negative margin between rental yield and mortgage rates. At the same time, credit standards have tightened slightly, indicating a modest decline in borrower creditworthiness.

[14] Alegría et al. (2021) note that the tail of the distribution (90th percentile) was flexibly adjusted based on alerts from the authorities.

[15] The diffusion index (DI) for "credit approval standards" ("demand for housing loans") is calculated as the difference between the number of banks that responded indicating credit approval standards were less restrictive (credit applications became stronger) and the number of banks that responded indicating the standards were more restrictive (credit applications became weaker), expressed as a percentage of total responses. Hence, the decrease in the degree of negative values indicates that credit approval standards (demand for housing loans) are still tightened (became weaker).

[16] According to estimates by the CChC, the financial burden and required household income for the same type of houses, assuming a 20 percent down payment, nearly doubled from October 2019 to June 2024.

Chile: Housing Loan Growth
(Year on year changes, percent)

Nominal — Real

Sources: BCCh and IMF staff calculations.

Chile: Bank Credit Survey
(Diffusion index)

Risk of borrowers
Demand for housing loans
Credit approval standards

↓weaker demand
↓tightening of approval standards

Sources: BCCh and IMF staff calculations.
Note: "Risk of borrowers" represents the net share of firms who regard it as an important factor for credit approval standards.

Commercial Loans to Construction and Real Estate Sector

**13.   The growth of credit to construction and real estate firms has stagnated amid tightened lending standards and weak sector dynamism.** Since 2023, amid declining monetary policy rates, nominal credit growth to the construction sector has been nearly zero, while the real estate sector has experienced a gradual decline, reaching zero.[17] According to bank credit surveys, banks have tightened their credit approval standards due to the declining creditworthiness of these firms, and they report weak demand resulting from developments in the sector. This perspective on weak credit demand aligns with the real economy data, which show that building permits for residential, industrial, and office projects have all been on a downward trend.

Chile: Commercial Loan Growth
(Year on year changes, percent)

Commercial loans (total)
Construction
Real estate

Sources: BCCh and IMF staff calculations.

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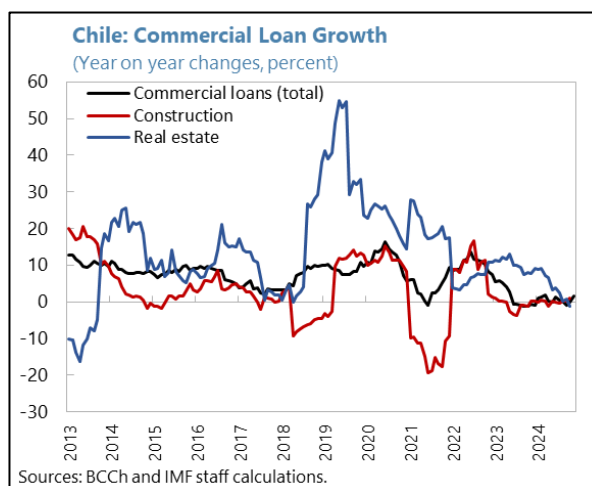
[17] Loans to construction firms tend to be shorter than those to real estate developers. Real estate developers typically use bank loans to finance the cost of building properties, while using their own funds to invest in land.

Chile: Real Estate and Construction Firms

Chile: Building Permits
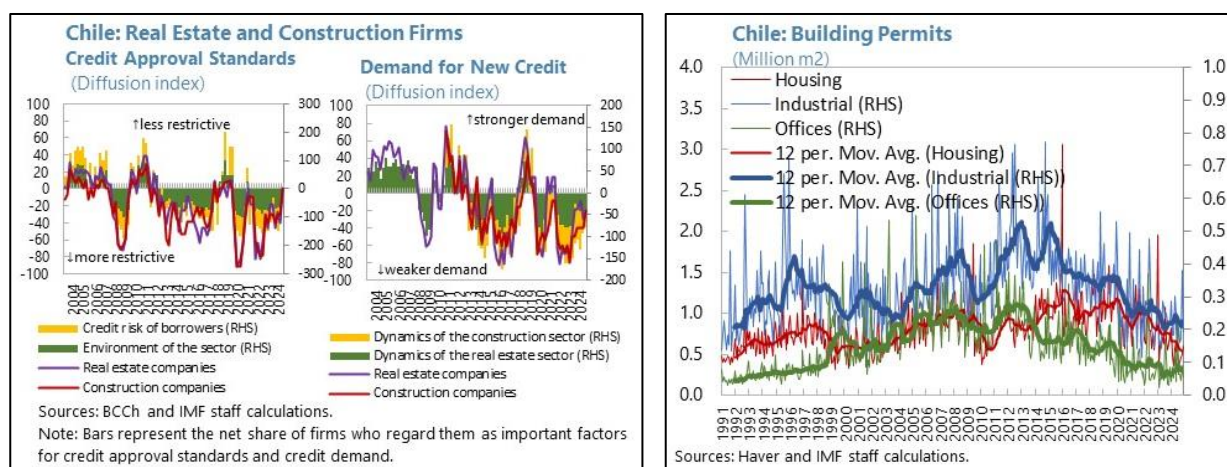
Real Estate Investment Fund

14.   The size of the real estate investment fund sector remains limited, although it has trended upward.[18] These funds invest in office, commercial, industrial, and residential properties, resulting in diversified exposures across segments at the aggregate level. However, at the individual fund level, they tend to focus their investments more heavily on specific sectors (see also CBRE and ACAFI, 2024). As of the end of 2023, investments by funds in the commercial real estate sector accounted for 11 percent of total monitored office properties and 25 percent of industrial properties, based on surface area data from CBRE, while they are becoming more exposed to infrastructures such as data centers. Some real estate investment funds appear to be experiencing financial stress due to valuation losses, while the relatively small size of the sector indicates that these losses are unlikely to pose a systemic risk.[19]

Chile: Size of Real Estate Fund

Chile: Asset Allocation of Real Estate Fund (2023)
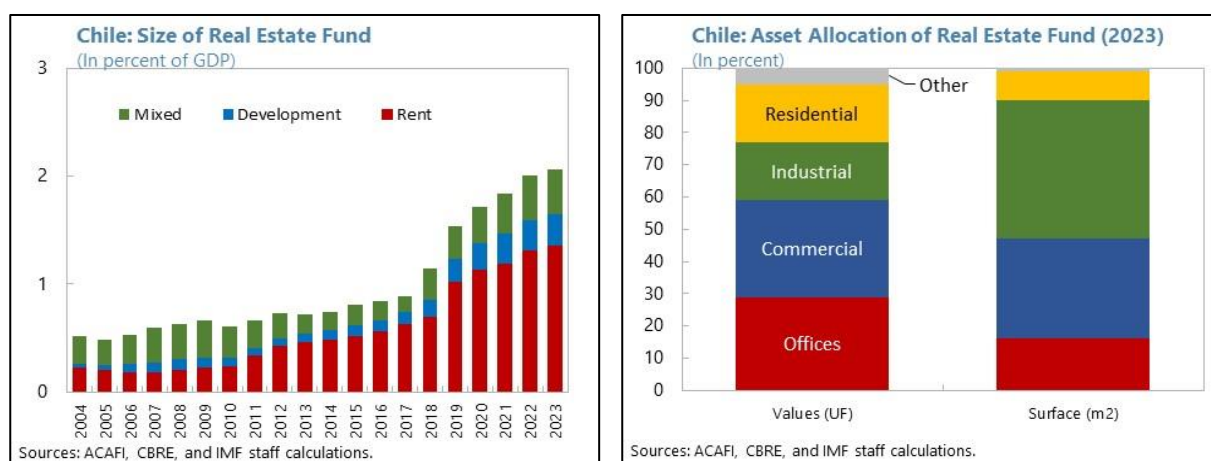
[18] A real estate investment trust (REIT) does not exist in Chile. Also, foreign investor participation in Chilean real estate investment fund is nearly zero, according to the Chilean Association of Investment Fund Administrators (ACAFI).
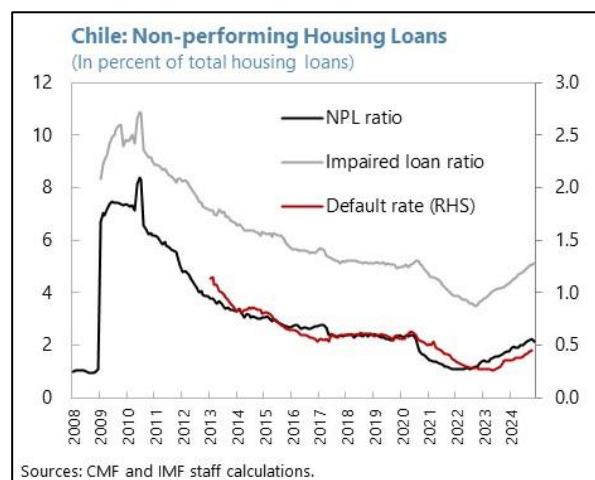
[19] Further mitigating factors are a limited number of closed-ended real estate investment funds whose initial terms are scheduled to expire during 2024 and 2025, as prescribed in the prospectus, and the internal regulations of each fund providing the managers with time to liquidate assets to avoid losses.

C. Credit Risk

15.   Mortgage borrowers overall appear resilient, but vulnerabilities arise from the high leverage of some borrowers which need to be carefully monitored. The indebtedness of mortgage borrowers does not seem to have worsened, as at the aggregate level, household-debt-to GDP and mortgage debt-to-GDP ratios have stabilized since the pandemic. Additionally, at micro-level, household leverage and financial burdens appear to be improving.[20] However, borrower leverage is quite heterogeneous, with some individuals exhibiting high levels of debt,[21] and it is reported that, during 2012-13, a significant portion (about 16 percent on average) of mortgage loans was coupled with unsecured consumer loans to finance down payments, although this fraction decreased

Chile: Non-performing Housing Loans
(In percent of total housing loans)

- NPL ratio
- Impaired loan ratio
- Default rate (RHS)

Sources: CMF and IMF staff calculations.

from 21 percent to 14 percent over the sample period.[22] This suggests that as many borrowers are significantly leveraged, the risk of rapidly increasing interest payments on consumer loans (used to finance down payments) in a high-interest-rate environment could lead to greater financial strain, particularly in the early years of the loans. Although the size of vulnerable borrowers may not pose a systemic risk, it is essential to monitor this situation. Furthermore, from the perspective of banks' credit risk assessments, the enactment of the Law to establish a consolidated debt registry in July 2024 is expected to help banks' risk management practices (Box II.2 in the BCCh's 2018H2 FSR and Box V.2 in the BCCh's 2021H1 FSR).
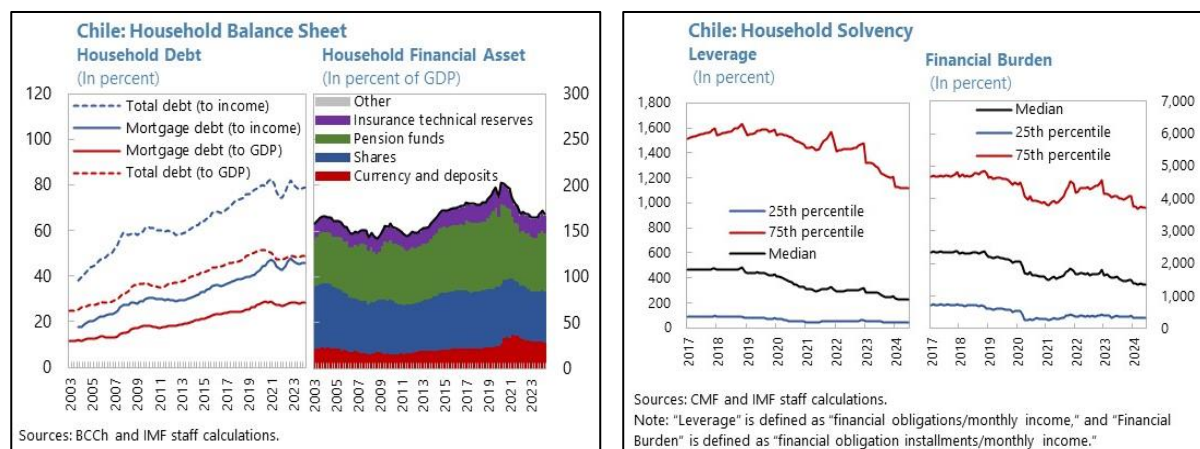
16.   Non-performing loan (NPL) ratios in housing loans have moderately rebounded, likely as part of the normalization process. Following a decline after the GFC, NPL ratios further decreased during the pandemic, due to increased household liquidity from pension fund

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[20] The analysis in the BCCh's 2024H2 FSR, based on households' microdata, indicates that the bank debt-to-income (leverage) and financial burden ratios for the median household in each income group (based on nominal income in Chilean peso terms) are now comparable to pre-pandemic levels, showing no improvements, contrary to what is depicted in this chart. This suggests that the increase in nominal income, rather than a decrease in the nominal amount of debt and repayments relative to the same level of nominal income, is more likely to have contributed to the improvements shown in the chart.

[21] According to the BCCh's 2018H2 FSR, at the end of the first half of 2018, nearly 30 percent of bank mortgage debt was held by borrowers with two or more mortgages. Most of these borrowers have their real estate assets located in the same region, indicating that these properties are likely not second homes for personal use but rather investment properties intended for rental purposes.

[22] Oda and Sepulveda (2014), using data from 2012-13, examined the unsecured loans granted to mortgage borrowers shortly before or after their mortgage approval. They found that approximately 16 percent of granted mortgages were paired with an unsecured loan. The amount of unsecured loans accounted for about 10 percent of the total mortgage loans, and the average monthly payment for these unsecured loans was around 80 percent of the mortgage payments, largely due to higher interest rates and a shorter average term to maturity of about five years. According to private banks, this type of financing behaviors seems to have basically disappeared at present.

withdrawals. Since 2022, these ratios have risen again and approach pre-pandemic levels, likely reflecting the ongoing normalization of household liquidity.

Chile: Household Balance Sheet

Sources: BCCh and IMF staff calculations.

Chile: Household Solvency

Sources: CMF and IMF staff calculations.
Note: "Leverage" is defined as "financial obligations/monthly income," and "Financial Burden" is defined as "financial obligation installments/monthly income."

17.   The creditworthiness of construction and real estate firms appears to be gradually deteriorating. Since the pandemic, the liquidity ratios and financial leverage of publicly listed construction firms appear to have worsened, while those of publicly listed real estate firms have remained relatively stable. A comparison in 2023 between publicly listed (l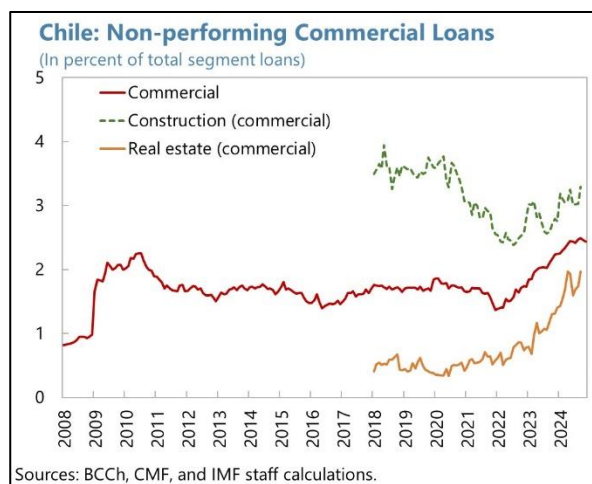arge) firms and all firms indicates that smaller firms tend to face more challenging business conditions, characterized by lower profitability and liquidity ratios.[23] Compared to regional peers, both construction and real estate firms appear more vulnerable, showing lower profitability, lower liquidity ratios, and higher leverage. These observations seem consistent with the developments in construction activity and business conditions of the construction firms.[24] Moreover, to alleviate liquidity pressures, some real estate developers seem to be starting to rent out properties (inventories) until they find buyers.

Chile: Financial Soundness of Publicly Listed Firms

Sources: CMF and IMF staff calculations.
Note: Median of the firms within each industry.

Selected Economies: Financial Soundness of Firms (2023)

Sources: Orbis and IMF staff calculations.
Note: Median of the firms (including non-publicly listed ones) within each industry. "Regional peers" consists of Brazil, Colombia, Mexico, and Peru.

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[23] Large construction firms operate globally or in regional peers (mainly Peru), diversifying their business portfolios, according to their financial statements.

[24] According to the CChC, the real construction investment dropped by -1.0 percent in 2023, driven by private housing construction (-2.5 percent). Financial conditions and debt levels of construction companies have weakened since the pandemic due to quarantines, rising material and financing costs, temporary labor shortages, and longer construction times.

18.   **Non-performing loan ratios in the construction and real estate sectors have recently been rising.**[25] This trend is consistent with the deterioration of creditworthiness in these sectors. In the construction sector, however, according to the business confidence survey for construction firms, their negative outlook on business and financial conditions has recently shown a modest rebound, approaching neutral levels. This might be because many projects have recently been completed, alleviating liquidity pressures for construction firms, while increasing liquidity stresses for real estate developers.[26] It is also possible that it partly reflects the easing of access to loans due to FOGAES program, introduced by the government in April 2023 and running until December 2024, which provides partial guarantees for loans to construction firms (see also ABIF, 2024b).

Chile: Non-performing Commercial Loans
(In percent of total segment loans)

Sources: BCCh, CMF, and IMF staff calculations.

19.   **Changes in the values of real estate properties can potentially lead to credit costs through the decline in collateral values.** Not only are housing loans primarily backed by these properties, real estate assets are often used als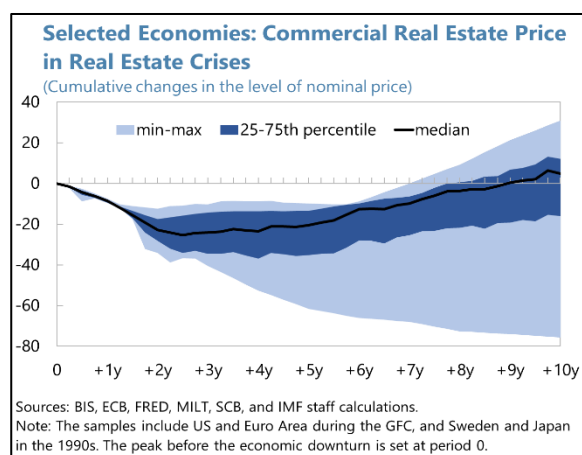o as collateral for commercial loans, particularly for SMEs. Given that past real estate crises in other countries have resulted in significant and prolonged declines in both residential and commercial property prices—for the median country it took a decade or more for residential/commercial prices to return to pre-crises levels, the risk of deterioration in Loss Given Defaults due to falling collateral values is important.

Chile: Businesss Confidence Survey-Construction Firms
(Diffusion index)

Sources: BCCh, Chilean Institute of Rational Business Administration and IMF staff calculations.
Note: Diffusion index is calculated as (percentage of positive responses - that of negative responses + 100)/2.

Chile: Share of Guaranteed Loans
(In percent)

Sources: Banco de Chile and IMF staff calculations.
Note: Due to the lack of sector-level statistics on collateralized loans, this chart is based on the financial statements of Banco de Chile, one of the six domestic systemically important banks (D-SIBs), while this figure is expected to reflect system-level patterns. Banco Santander Chile, another D-SIB, also reports that all mortgages and approximately 60 percent of commercial loans are collateralized.

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[25] The recent increase in NPL ratios in commercial loans is concentrated among SMEs that received government guarantees during the pandemic. FOGAPE-COVID and FOGAPE-Reactive, introduced in April 2020 and January 2021, respectively, provided guarantees to SMEs for working capital loans (the BCCh's 2024H2 FSR).

[26] According to Aninat et al. (2024), the default rate of construction firms significantly rose through 2022-23 (from 4 to 9 percent), before starting to level off in 2024 to 8 percent. In contrast, the default rate of real estate developers has been consistently increasing, reaching at 5 percent, above the pre-pandemic range (1-2 percent).

Selected Economies: Residential Real Estate Price in Real Estate Crises
(Cumulative changes in the level of nominal price)

Sources: BIS, ECB, FRED, MILT, SCB, and IMF staff calculations.
Note: The samples include US, Spain, Ireland, Latvia, Lithuania, and Estonia during the GFC, and Finland, Sweden and Japan in the 1990s. The peak before the economic downturn is set at period 0.

Selected Economies: Commercial Real Estate Price in Real Estate Crises
(Cumulative changes in the level of nominal price)

Sources: BIS, ECB, FRED, MILT, SCB, and IMF staff calculations.
Note: The samples include US and Euro Area during the GFC, and Sweden and Japan in the 1990s. The peak before the economic downturn is set at period 0.

Risk Scenarios

20.   Persistently high long-term interest rates and stagnation in the office sector could exacerbate challenges in the residential and commercial real estate markets, with potential spillover effects on construction and real estate firms.[27] Historically, monetary policy rate cuts have not always resulted in declines in long-term interest rates, especially when global interest rates remain high, which is currently the case. Should long-term interest rates remain elevated for a prolonged time, this could further weaken the creditworthiness of borrowers in the construction and real estate sectors and delay the recovery of construction activity. Also, if the weak demand for offices implies structural shifts, as surveys of real estate investment fund suggest a lack of investment, this could have lasting negative impacts on life insurers' investment portfolios. To prepare for these risk scenarios, it is essential to closely monitor the adequacy of NPL provision and collateral coverages for real estate-related loans and the concentration of life insurers' portfolios in underperforming segments, such as offices.

Selected Economies: Interest Rates
(Percent)

Sources: BCCh and IMF staff calculations.
Note: The interest rate of Chilean 10 year bonds is UF based.

Chile: Real Estate Investment Funds' New Investment Plan
(Percent)

Sources: ACAFI, CBRE, and IMF staff calculations.
Note: The results of annual survey to real estate investment funds. The chart shows share of real estate investment funds that plan to invest in each segment.

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[27] The spillovers of external stress via foreign investors appear contained. Although foreign investors in Chile have the same property rights as local citizens and face very few restrictions on property purchases, their participation in the Chilean real estate market remains low, according to authorities and the private sector, while statistics on foreign investment participation are not available.

D.   Preparedness of Financial Sector

21.   NPL provision coverage for housing loans and commercial loans is around pre-pandemic levels at the aggregate level, and the banks loans are conservatively collateralized. For housing loans, banks accumulated additional provisions during the pandemic when NPL ratios were low, and the current levels of these provisions are now similar to pre-pandemic levels. This suggests that NPL ratios are so far aligning with banks' expectations. At the bank level, those with lower provision coverage in the pre-pandemic period have since improved their levels. A mitigating factor for mortgage loans is their concentration in domestic systemically important banks (D-SIBs), which account for 94 percent, which is higher than their share in commercial and consumer loans at 85 percent and 83 percent, respectively. NPL provision coverage for commercial loans shows a similar pattern to that of housing loans. However, a closer examination reveals that NPL provision coverage for real estate firms has recently declined at a faster rate than for total commercial loans, while coverage for construction firms appears to have increased. In this regard, according to the authorities, these loans are conservatively collateralized,[28] and banks have recently accumulated more collaterals rather than further provisions.
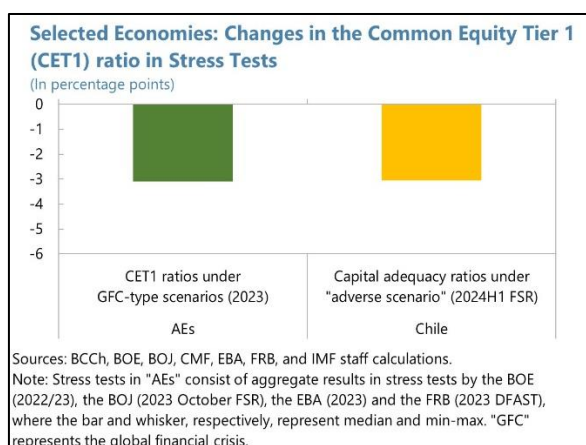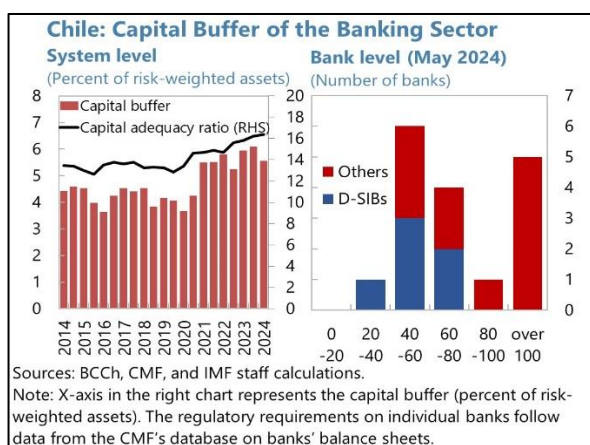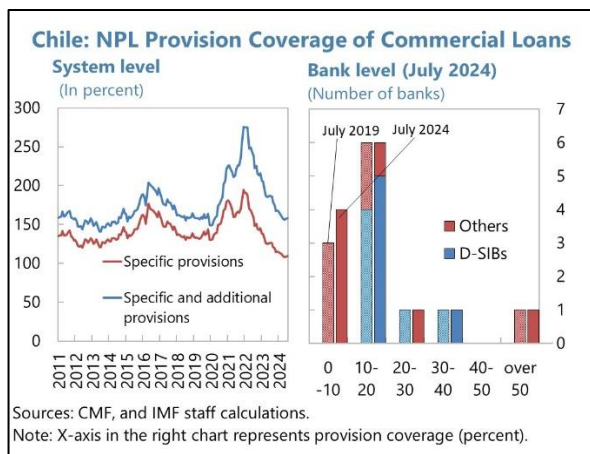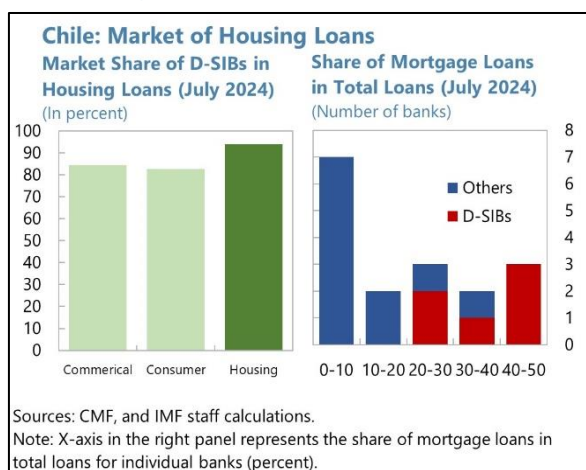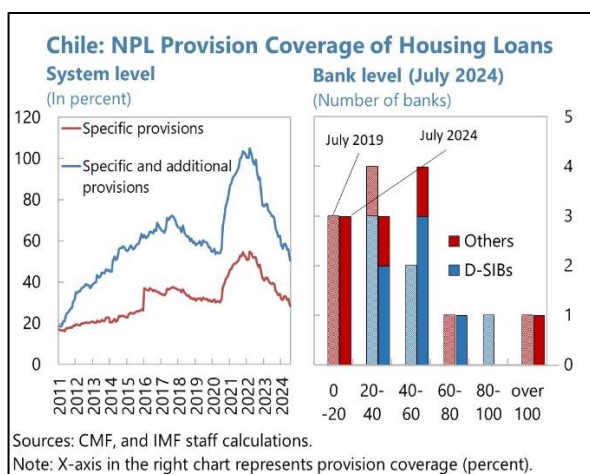
22.   Banks' capital ratios and capital buffers (capital ratios minus capital requirements) have increased since the pandemic, indicating stronger resilience. At the aggregate level, the banking sector's capital adequacy ratios have risen significantly, largely due to the steady implementation of Basel III capital requirements. Simultaneously, capital buffers have also increased, reaching approximately 5-6 percent. Banks with lower capital buffers are primarily D-SIBs, partly due to higher capital requirements. Given that declines in capital ratios during GFC-type scenarios (in the US, Europe, and Japan) range from 2-5 percent, which is close to the decline in capital ratio in the BCCh's stress test, this 5-6 percent buffer can be considered adequate.[29] Moreover, the BCCh's exercise (Box II.1 in the 2024H2 FSR), on the resilience of banks against an abrupt drop in real estate prices (the market value of collateral) suggests that even a substantial decline in the real estate prices would not significantly harm the solvency of the banks, thanks to conservative collateral valuations under the regulations, where the values assigned reflect the appraisal at the time the loan was granted and do not include the increase in housing prices over the last decade.[30]

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[28] About 90 percent of commercial loan exposures related to real estate is covered by the real estate collaterals, which is significantly higher than the coverage for other sectors (40 percent) (Box II.1, the BCCh's 2024H2 FSR). Regarding mortgages, the vast majority have LTV ratios of less than 80 percent. Additionally, the collateral valuations conducted by banks are conservative, in line with CMF regulations, as they are based on values at the time of granting the loan and do not reflect the increase in house prices over the past decade.

[29] Although the definitions of CET1 ratios and Chilean capital adequacy ratios differ, the changes in these ratios should be comparable to some extent, as both are primarily influenced by profits and losses. In fact, in the top-down bank stress tests in the BCCh's 2024H2 FSR, the declines in capital adequacy ratios and CET1 ratios are similar.

[30] The exercise indicates that a 20 percent drop in house prices would increase provision requirements by 0.33 percent of banks' risk-weighted assets (i.e., a decline in capital ratios by 0.33 percent). In the case of a 30 percent decrease in the market collateral values for commercial loans to real estate and construction sectors, provision requirements would increase by 0.26 percent of the risk weighted assets.

Figure 1. Preparedness of Banking Sector

Chile: NPL Provision Coverage of Housing Loans

System level
(In percent)

Bank level (July 2024)
(Number of banks)

Sources: CMF, and IMF staff calculations.
Note: X-axis in the right chart represents provision coverage (percent).

Chile: Market of Housing Loans

Market Share of D-SIBs in Housing Loans (July 2024)
(In percent)

Share of Mortgage Loans in Total Loans (July 2024)
(Number of banks)

Sources: CMF, and IMF staff calculations.
Note: X-axis in the right panel represents the share of mortgage loans in total loans for individual banks (percent).

Chile: NPL Provision Coverage of Commercial Loans

System level
(In percent)

Bank level (July 2024)
(Number of banks)

Sources: CMF, and IMF staff calculations.
Note: X-axis in the right chart represents provision coverage (percent).

Chile: Provision for Real Estate and Construction Firms
(In percent)

Sources: Banks' disclosures, and IMF staff calculations.
Note: "Provision" represents the weighted average of the provision ratio of D-SIBs and "NPL" indicates the non-performing loans ratio of the financial system.

Chile: Capital Buffer of the Banking Sector

System level
(Percent of risk-weighted assets)

Bank level (May 2024)
(Number of banks)

Sources: BCCh, CMF, and IMF staff calculations.
Note: X-axis in the right chart represents the capital buffer (percent of risk-weighted assets). The regulatory requirements on individual banks follow data from the CMF's database on banks' balance sheets.

Selected Economies: Changes in the Common Equity Tier 1 (CET1) ratio in Stress Tests
(In percentage points)

Sources: BCCh, BOE, BOJ, CMF, EBA, FRB, and IMF staff calculations.
Note: Stress tests in "AEs" consist of aggregate results in stress tests by the BOE (2022/23), the BOJ (2023 October FSR), the EBA (2023) and the FRB (2023 DFAST), where the bar and whisker, respectively, represent median and min-max. "GFC" represents the global financial crisis.

23. Capital buffers and leverage among life insurers have remained stable, while real estate investments are concentrated among major insurers. Exposures to real estate investment vary significantly across life insurers, with most of those having high exposures are among the top eight insurers by asset size. This concentration could be seen as a mitigating factor, as large insurers typically benefit from diversification in their portfolios. However, it also suggests that their exposures to the real estate sector could pose systemic risk implications for financial stability. At the aggregate level, life insurers' capital buffers have been stable, comfortably above regulatory requirements, and financial leverage has also remained stable at the level below regulatory maximum of 20. However, the top eight insurers tend to have lower capital buffers and higher leverage.

Chile: Share of Real Estate Investment by Life Insurer (March 2024)
(Number of insurers)

Sources: CMF, and IMF staff calculations.
Note: X-axis represents the share of real estate investment (percent). "Top 8" represents 8 largest insurers in terms of asset size.

Chile: Capital Buffer of the Life Insurance Sector
System level (In percent)
Insurer level (March 2024) (Number of insurers)

Sources: CMF, and IMF staff calculations.
Note: "Capital buffer" represents capital over required capital. X-axis in the right chart represents capital to required capital (percent). 2024 in the left chart represents March-2024. "Top 8" represents 8 largest insurers in terms of asset size.

Chile: Leverage of the Life Insurance Sector
System level (In percent)
Insurer level (March 2024) (Number of insurers)

Sources: CMF, and IMF staff calculations.
Note: X-axis in the right chart represents liability to equity (percent). 2024 in the left chart represents March-2024. "Top 8" represents 8 largest insurers in terms of asset size.

24. Life insurers appear to be resilient to stress from the real estate sector. In terms of market risks from real estate investment, the book values of the investment are significantly lower than current market values, due to regulatory valuation method, where the values assigned reflect the appraisal at the time the investment was made. The CMF's stress testing exercise assuming a drop in real estate prices between 25 and 30 percent in the past did not raise significant concerns (IMF 2014) and more recent stress text exercise in December 2022, assuming the similar magnitude of stress confirmed that life insurers could withstand against shocks from real estate. Therefore, life insurers appear to be resilient against shocks on the real estate sector. Nonetheless, given the higher exposures, lower capital buffers, and higher leverage of the top insurers, close monitoring of the investment portfolios of major insurers and their impact on financial soundness is warranted.

E. Regulatory and Monitoring Framework

25. **Regulations governing banks concerning real estate-related loans are comprehensive, and the CMF regularly conducts supervisory stress testing exercises.** They primarily focus on capital requirements and loan loss provisions, with an implicit loan-to-value (LTV) limit in place, while the guidelines of the stress test require banks to incorporate real estate-related risk factors. Basel III regulations for risk-weighted assets have already been implemented, ensuring that credit risk associated with real estate related loan exposures is appropriately accounted for, in line with international standards, while estimates of PDs depend on banks' models and judgments.[31] With respect to loan loss provisions, Chilean provisioning structure is a forward-looking system set by domestic GAAP (see Raddatz, 2015). Therefore, a close examination of banks' estimates for the

Chile: Mortgage Loan Regulation

	LTV	DTI	Term to maturity
Letter of Credit	<75 percent	<25 percent	>1 year
Endorsable	<80 percent	-	1-30 year
Non-endorsable	-	-	-

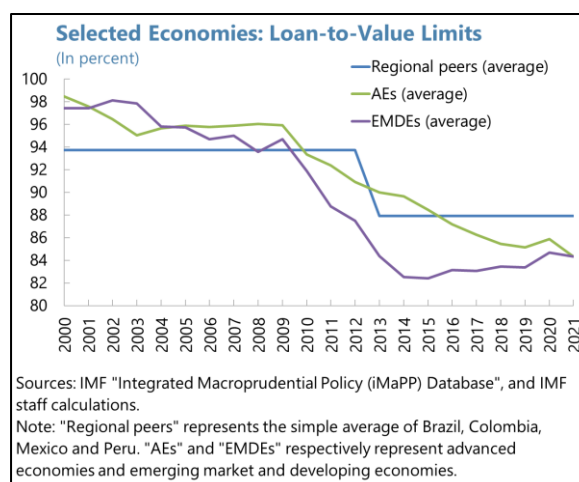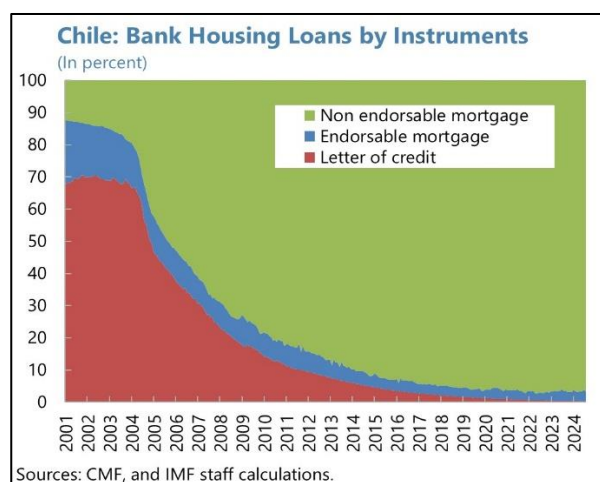Sources: CMF and Oda and Sepulveda (2014).
Note: LTV=Loan-to-value ratio and DTI=Debt-to-income ratio. "Letter of Credit" is a security issued by the lending bank, and once issued, the letter of credit is traded in a secondary market, while the originator bank retains the credit risk. "Endorsable" loans are financed entirely with the lending bank's resources, but can be transferred to another bank, while the originator retains all responsibility on debt services and other loan management activities. "Non-endorsable" loans are fully financed by the bank's resources, but cannot be transferred to another bank.

parameters related to credit risk-weighted assets and provisions is warranted. Currently, most loans are non-endorsable mortgages,[32] which are not subject to restrictions based on LTV or debt-to-income (DTI) ratios. Nonetheless, as mentioned earlier, LTV ratios are typically concentrated around 80 percent due to a regulatory change introduced by the SBIF (now CMF) in January 2016, which linked mortgage loan loss provisions to LTV ratios. This change significantly increased provisions for loans with an LTV exceeding 80 percent, thereby establishing 80 percent as an implicit LTV limit.[33] Compared to other countries, this implicit LTV ratio appears to be comparable. Additionally, the CMF develops a stress scenario for the ICAAP (Internal Capital Adequacy Assessment Process), which includes adjustment to house pries (40 percent decline in the latest stress test), and to assess the impact of this scenario, the CMF uses both bottom-up stress tests and its own top-down models. Within the bottom-up stress tests, Chilean banks are required to examine the impact of real estate sector developments on collateral values (see the guideline published in 2024).

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[31] The calculation of credit risk-weighted assets for business loans follows the simplified standard method outlined in Basel III. For housing loans, the risk weight generally increases with both the LTV ratio and the number of mortgages a borrower holds, while the risk weight for certain loans adheres to the Basel III standard model. For more details, see Aguilera et al. (2020) and Arata and Venegas (2024).

[32] Over the past two decades, the share of non-endorsable mortgages in housing loans has rapidly increased (until the 1990s, see). The BCCh's 2008H2 FSR (Box V.1) summarizes mortgage market regulations.

[33] According to Calani and Pailacar (2022), the LTV ratio decreased 9.8 percent for the median debtor, due to the regulatory change, while loan loss provisions (relative to mortgage loans) rose from 0.7 to 0.9 percent from 2014-16.

Chile: Bank Housing Loans by Instruments
(In percent)
Sources: CMF, and IMF staff calculations.

Selected Economies: Loan-to-Value Limits
(In percent)
Sources: IMF "Integrated Macroprudential Policy (iMaPP) Database", and IMF staff calculations.
Note: "Regional peers" represents the simple average of Brazil, Colombia, Mexico and Peru. "AEs" and "EMDEs" respectively represent advanced economies and emerging market and developing economies.

26.   Chilean life insurers' real estate investments are constrained by specific investment limits and the CMF conducts supervisory stress testing exercises. Specifically, exposure limits for domestic real estate properties for Chilean life insurers are set at 25 percent of technical provisions and regulatory (risk) capital. Within this limit, investments in domestic residential real estate and non-residential real estate are, respectively, capped at 5 percent of technical provisions and

regulatory capital, with a property valuation required at the time of acquisition. The investment in foreign real estate is limited to 3 percent. Moreover, exposure limits for mortgage loans are set at 30 percent of technical provisions and regulatory capital (OECD 2015). The CMF regularly examines the resilience of the real estate sector by conducting stress testing exercises. The recent exercise (December 2022) covered stress credit risk scenarios for mortgage

Chile: Investment Limit on Life Insurers

Instrument	Limits
Domestic real estate (Total)	25 percent of RT+PR
Residential real estate	5 percent of RT+PR
Commerical real estate (Subject to lease agreement)	5 percent of RT+PR
Foreign real estate (Total)	3 percent of RT+PR

Sources: CMF
Note: "RT" and "PR", respectively, mean technical reserves and risk (regulatory) equity. There are also joint invest limits.

loans, including a drop in collateral values, and a market risk stress scenario for real estate investment and leasing exposures (stressing real estate prices in accordance with standard global magnitudes). Moreover, methodological documents on risk-based capital suggest that insurers should establish a capital requirement for market risk related to real estate investments, which corresponds to the market values of the real estate multiplied by a factor of 20 percent (also used by CMF when requesting bottom-up stress tests from life insurers). More recently, in July 2024, the CMF published a regulation enforcing reporting requirements for investments made by insurance companies, including those related to real estate, which will allow the authorities for a deeper monitoring of life insurers' exposures and risks.
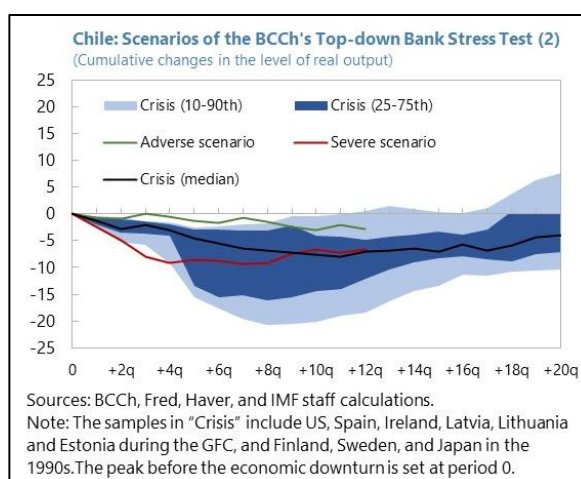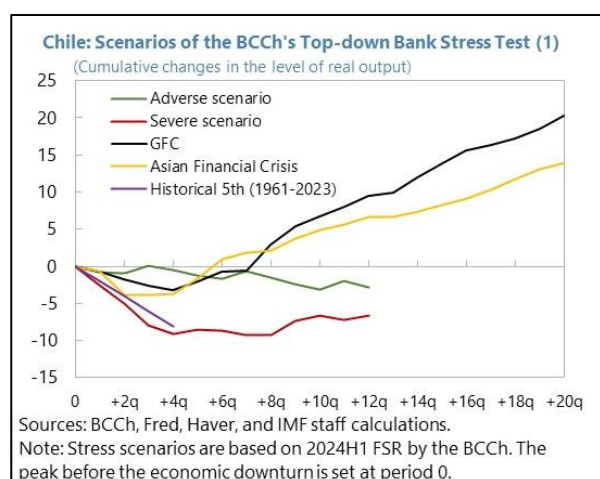
27.   Regarding the BCCh's regular top-down bank stress tests, the model could be expanded to tail risks related to real estate crises and address relevant data gaps. The top-down bank stress tests (e.g., Alfaro and Sagner 2011 and Martínez, Cifuentes, and Becerra 2017) do

not specifically target real estate crises.[34] However, the magnitude of stress in the "severe scenario" is adequate for assessing banks' resilience in such situations as it is comparable to past real estate crises in other countries and the GFC-type stress scenarios in major advanced economies. The BCCh also has tools to separately assess the impact of the real estate crises on relevant sectors, such as top-down stress test models for firms. In particular, the default probability of real estate developers and construction debt is shocked at the firm level—specifically, with increases in long-term interest rates, drops in economic activity, and an increase in inflation (Córdova et al. 2021). The results are presented in the BCCh's FSRs under the term "debt at risk." However, in the top-down bank stress tests, scenarios for commercial real estate prices—often considered in advanced economies— appear to be excluded, likely due to data gaps in (aggregate) commercial real estate price indices.[35] In this regard, while banks' exposures to commercial real estate sector is so far limited, addressing the data gap in the indices is crucial. In the top-down bank stress test model, real estate-related risk factors are also not utilized to estimate credit costs for commercial loans,[36] and the channel in which the values of collateral affect LGDs does not seem to be implemented in the model.[37] To fully assess the propagation of the real estate crisis through the financial system and the macroeconomy, it is useful to incorporate these channels into the top-down bank stress test model.
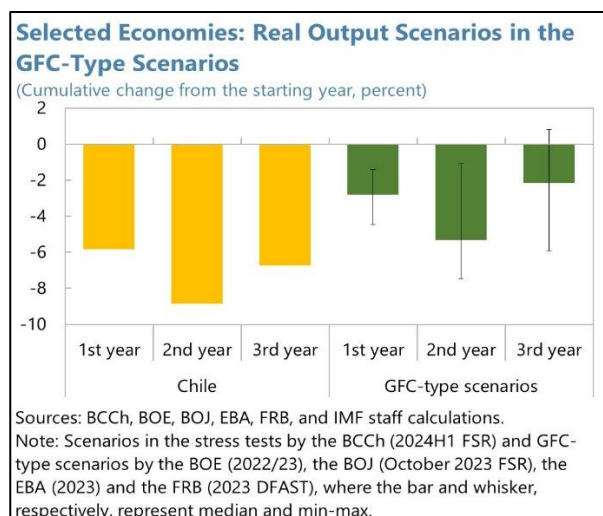

Chile: Scenarios of the BCCh's Top-down Bank Stress Test (1)
(Cumulative changes in the level of real output)

Adverse scenario
Severe scenario
GFC
Asian Financial Crisis
Historical 5th (1961-2023)

Sources: BCCh, Fred, Haver, and IMF staff calculations.
Note: Stress scenarios are based on 2024H1 FSR by the BCCh. The peak before the economic downturn is set at period 0.

Chile: Scenarios of the BCCh's Top-down Bank Stress Test (2)
(Cumulative changes in the level of real output)

Crisis (10-90th)   Crisis (25-75th)
Adverse scenario   Severe scenario
Crisis (median)

Sources: BCCh, Fred, Haver, and IMF staff calculations.
Note: The samples in "Crisis" include US, Spain, Ireland, Latvia, Lithuania and Estonia during the GFC, and Finland, Sweden, and Japan in the 1990s. The peak before the economic downturn is set at period 0.

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[34] In general, the advantage of top-down bank stress test models, compared with bottom-up stress test models, is that they enable authorities to evaluate private banks' risks from the same perspective and conduct timely examinations.

[35] House prices are endogenously determined based on macroeconomic developments in stress scenarios, with cumulative declines of about 20 percent.

[36] The top-down bank stress test models in major advanced economies consider the real estate prices as risk factors for non-housing loans (Correia, Seay, and Vojtech 2022 and DFAST 2024 Supervisory Stress Test Methodology).

[37] The current module for loss from housing loans appears to incorporate residential real estate prices as a determinant of credit loss. However, it aims to capture the impact on PDs, while the effects on LGDs are not explicitly considered, making it difficult to disentangle the transmission channels. Top-down bank stress test models in advanced economies often more broadly link LGDs with real estate or land prices (see DFAST 2024 Supervisory Stress Test Methodology for the U.S., Budnik et al. 2023 for Euro Area and Abe et al. 2023 for Japan).

Selected Economies: Real Output Scenarios in the GFC-Type Scenarios
(Cumulative change from the starting year, percent)

Selected Economies: Real Estate Price Scenarios in the GFC-Type Scenarios
(Cumulative changes from the starting point to the bottom, percent point)

Sources: BCCh, BOE, BOJ, EBA, FRB, and IMF staff calculations.
Note: Scenarios in the stress tests by the BCCh (2024H1 FSR) and GFC-type scenarios by the BOE (2022/23), the BOJ (October 2023 FSR), the EBA (2023) and the FRB (2023 DFAST), where the bar and whisker, respectively, represent median and min-max.

Sources: BOE, EBA, FRB, and IMF staff calculations.
Note: Scenarios in the stress tests by the BOE (2022/23), the EBA (2023) and the FRB (2023 DFAST), where the bar and whisker, respectively, represent median and min-max.

F.   Overall Risk Assessment and Policy Recommendations

28.   As a baseline, the current adjustment in the real estate sector is expected to have only a limited impact on the financial sector. Analysis based on an estimated DSGE model indicates that the recent adjustment in the residential real estate sector is primarily a result of past shocks on mortgage rates, suggesting that the sector will modestly recover as the loosening of the global financial conditions and the past cuts to monetary policy rates gradually propagate to long-term interest rates. In the commercial real estate sector, offices have recently begun to show initial signs of recovery. While several mitigating factors contribute to the resilience of borrowers, pockets of vulnerability—particularly among highly leveraged mortgage borrowers—should be closely monitored, and the establishment of a consolidated debtor registry should proceed smoothly.

29.   Risk scenarios include persistently high long-term interest rates and structural stagnation in the office segment. Elevated long-term interest rates could further weaken the creditworthiness of borrowers in the construction and real estate sectors, and lead to losses for banks. Additionally, weak demand in the office markets may imply structural shifts, which could negatively impact life insurers' investment portfolios. However, according to the stress tests and exercises conducted by the BCCh, the current capital buffers of banks and their collaterals for loans appear sufficient to absorb stresses from these risk scenarios, including tail risks associated with a real estate crisis. Furthermore, since real estate investments are primarily concentrated among major life insurers, their diversified portfolio should provide some resilience to such stresses. The supervisor's bottom-up stress testing frameworks for banks and life insurers appear to adequately incorporate real estate-related factors.
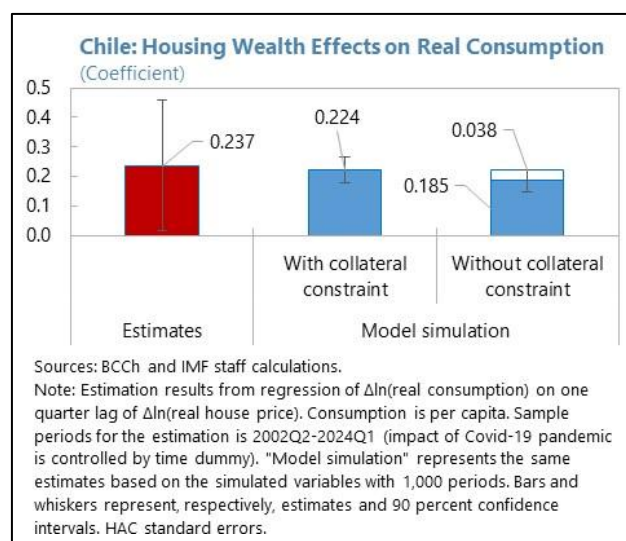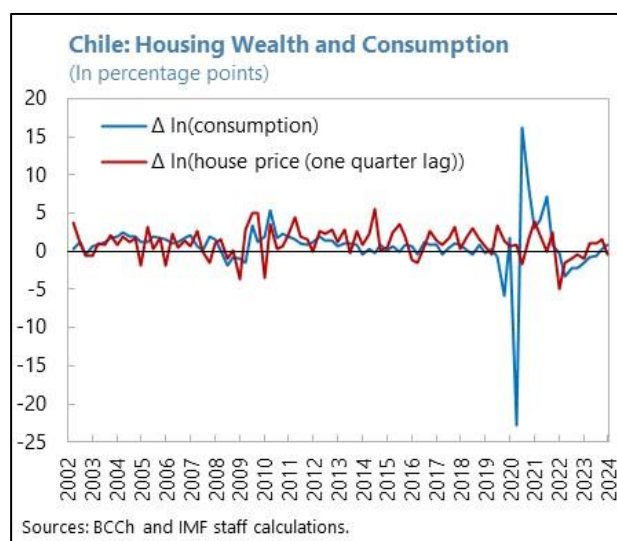
30.   The authorities should prepare for the risks associated with a prolonged adjustment in the sector, as well as the tail risk of a significant downturn. To address these risk scenarios, it is essential to closely monitor the adequacy of NPL provision coverage and collaterals, specifically for loans to construction and real estate firms. Moreover, examining life insurers' portfolio concentration in weak segments, such as offices, is warranted. To prepare for a potential tail risk of a

real estate crisis, directly evaluating banks' resilience to significant stress from a pronounced downturn in the real estate sector is crucial. While the "severe scenario" in the BCCh's top-down bank stress test appears comparable to past real estate crises in other countries and the BCCh has tools to separately assess the impact of real estate crises on relevant sectors, the top-down bank stress test does not fully model the specific risk factors associated with the real estate sector. Specifically, incorporating real estate sector variables as risk factors for commercial loans, modelling the impact of collateral value fluctuations on credit costs, and addressing data gaps in the commercial real estate price indices will help the authorities to assess the propagation of the real estate crises for the financial sector and the macroeconomy.

Annex I. Housing Wealth Effects in Chile

1.   Housing wealth effects via collateral valuation are analyzed using an estimated model with Chilean data. We conduct counterfactual simulations using the estimated DSGE model (Iacoviello and Neri 2010; for an overview of the model and parameterization, see Annex Box). In this model, fluctuations in housing prices affect consumption, and these effects are reinforced by the degree of financial friction, as measured by the share of credit-constrained agents and the loan-to-value ratio. To measure the spillovers, we regress percentage changes (log differences) in aggregate consumption on lagged percentage changes in real house prices, including a constant term.[1] This equation can be interpreted as a reduced-form approach to capturing the direct and indirect effects that fluctuations in housing wealth have on aggregate consumption, although both variables are endogenous in the model.

2.   Simulation results suggest the existence of a non-negligible direct collateral effect in Chile. In the simulated output of the model, regressing consumption growth on lagged growth in housing wealth yields a coefficient of 0.224 for changes in housing wealth, which falls within the 90 percent confidence interval of the estimate from the analogous regression on actual data.[2] This positive value captures, both in the model and in the data, the influence of common macroeconomic factors as well as the direct effect of changes in housing wealth on consumption through the collateral channel. However, comparing this estimate with that from the model without collateral effects allows us to disentangle the collateral effects. In fact, the regression based on the output from the model without collateral effects provides a coefficient of 0.185 for changes in

Chile: Housing Wealth and Consumption
(In percentage points)

Δ ln(consumption)
Δ ln(house price (one quarter lag))

Sources: BCCh and IMF staff calculations.

Chile: Housing Wealth Effects on Real Consumption
(Coefficient)

0.237   0.224   0.038   0.185

With collateral constraint   Without collateral constraint
Estimates   Model simulation

Sources: BCCh and IMF staff calculations.
Note: Estimation results from regression of Δln(real consumption) on one quarter lag of Δln(real house price). Consumption is per capita. Sample periods for the estimation is 2002Q2-2024Q1 (impact of Covid-19 pandemic is controlled by time dummy). "Model simulation" represents the same estimates based on the simulated variables with 1,000 periods. Bars and whiskers represent, respectively, estimates and 90 percent confidence intervals. HAC standard errors.

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[1] This lag is included to mitigate the endogeneity problem. The estimate of the collateral effect is robust if lagged changes in consumption are controlled.

[2] This estimate does not represent the marginal propensity to consume in response to an increase in housing wealth.

housing wealth, which is smaller than the case where collateral effects are included. This difference of 0.038 implies the existence of non-negligible collateral effects in housing wealth effects.[3]

Box 1. Overview of the DSGE Model and Parameterization

The DSGE model with a housing sector (Iacoviello and Neri 2010) includes four essential elements to align the model with the data. Specifically, (i) a multi-sector structure (housing and non-housing goods); (ii) financing frictions within the household sector; (iii) nominal rigidities; and (iv) a comprehensive set of shocks, including housing preference shocks. Elements (i) and (ii) are crucial for considering the role of the housing sector in the model, while (iii) and (iv) are incorporated to capture the various views on the sources and propagation mechanisms of business cycles, as described in canonical dynamic equilibrium models used in monetary policy analysis (e.g., Christiano, Eichenbaum, and Evans 2005 and Smets and Wouters 2007). Since this study uses this model to analyze the extent to which the cyclical fluctuations of the housing sector align with interest rates (mortgage rates), these elements are important.
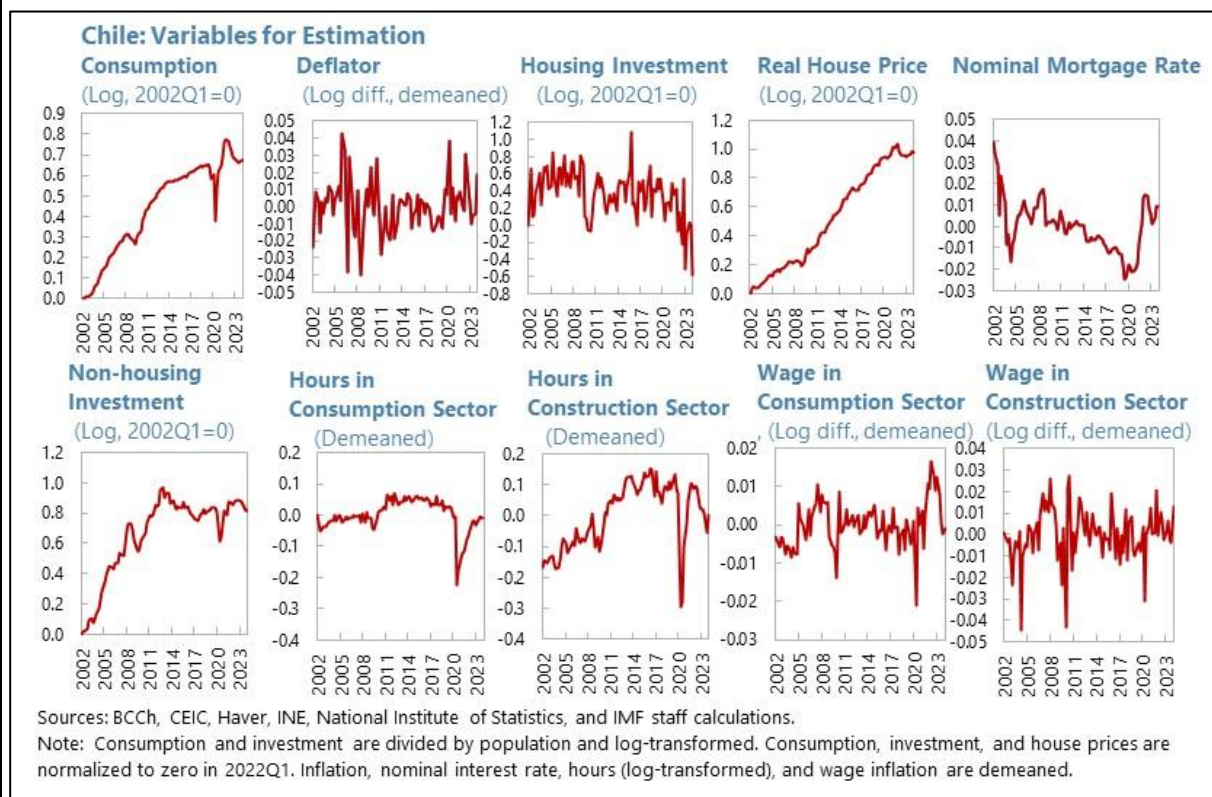
The housing sector in the model has two main features. On the supply side, it exhibits sectoral heterogeneity: the non-housing sector produces consumption and business investment using capital and labor, while the housing sector produces new homes with capital, labor, and land. On the demand side, it incorporates a collateral channel: both housing and consumption contribute to households' utility,[1] and housing can serve as collateral for loans. Because housing and consumption goods are produced using different technologies, the model generates endogenous dynamics in both residential versus business investment and housing prices. Fluctuations in house prices simultaneously affect households' borrowing capacity and the relative profitability of producing new homes, creating feedback effects that influence the spending behaviors of both households and firms.

The model is estimated using Chilean data from the 2000s, following the calibration and estimation strategy of Iacoviello and Neri (2010). In terms of the calibrated parameters that have counterparts in the literature on Chilean macroeconomic models (Martínez et al. 2020 and Calani et al. 2022), discount factor in the original paper (0.9925) is within the range in the literature (0.9829-0.9997). In terms of capital share, because the range in the literature is 0.33-0.34, it is set as 0.33. Given the implicit LTV limits discussed in the main text, the key parameter—the LTV ratio for impatient households—is set at 0.8.[2] All other parameters are calibrated following the original paper. The estimated parameters, including shock structures, are derived using a standard Bayesian approach (the Metropolis algorithm) with Chilean macroeconomic data from 2002Q1 to 2024Q1 (for details of estimation strategy, see web Appendix C of Iacoviello and Neri, 2010). Specifically, ten observable variables are used for estimation: consumption, the deflator, housing investment, real house prices, the interest rate (nominal mortgage rate), non-housing investment, hours worked in the consumption and construction sectors, and nominal wages in both sectors.[3] Then, the means of posterior distribution are used as parameters. The key estimated parameter, the share of labor income accruing to credit-constrained agents, is estimated to be about 30 percent.[4]

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[3] In Chile, home equity loans, which are often cited as a source of collateral in housing wealth effects, are not prevalent. However, due to the full recourse system for housing loans, stagnation in house prices could financially strain mortgage borrowers and spill over into consumption. Note also that the model implicitly assumes full accessibility to mortgage loans and thus cannot directly capture the low affordability of mortgage loans.

Box 1. Overview of the DSGE Model and Parameterization (concluded)

Chile: Variables for Estimation

Consumption (Log, 2002Q1=0)	Deflator (Log diff., demeaned)	Housing Investment (Log, 2002Q1=0)	Real House Price (Log, 2002Q1=0)	Nominal Mortgage Rate

Non-housing Investment (Log, 2002Q1=0)	Hours in Consumption Sector (Demeaned)	Hours in Construction Sector (Demeaned)	Wage in Consumption Sector (Log diff., demeaned)	Wage in Construction Sector (Log diff., demeaned)

Sources: BCCh, CEIC, Haver, INE, National Institute of Statistics, and IMF staff calculations.
Note: Consumption and investment are divided by population and log-transformed. Consumption, investment, and house prices are normalized to zero in 2022Q1. Inflation, nominal interest rate, hours (log-transformed), and wage inflation are demeaned.

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1/ The model has shocks on this housing preference. The shocks may either represent genuine shifts in households' tastes for housing or serve as a catchall for unmodeled disturbances that can affect housing demand. The shocks could also be caused by an increase in net immigration to Chile.

2/ The impact of the past shocks on mortgage rates on the cyclical fluctuations of the housing sector is broadly robust to higher values of LTV limits (0.8-0.9). For U.S., Iacoviello and Neri (2010) set it as 0.85.
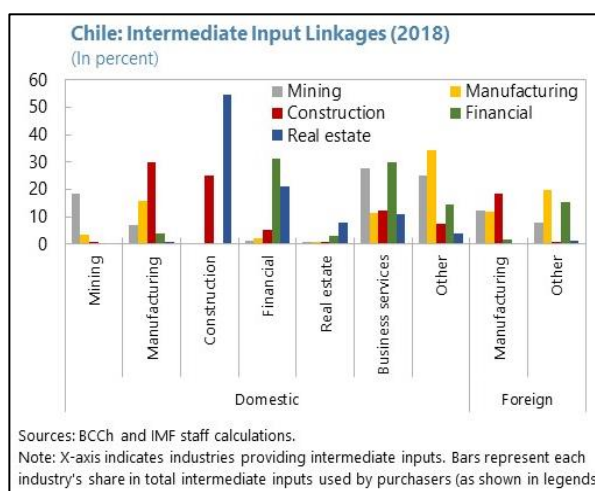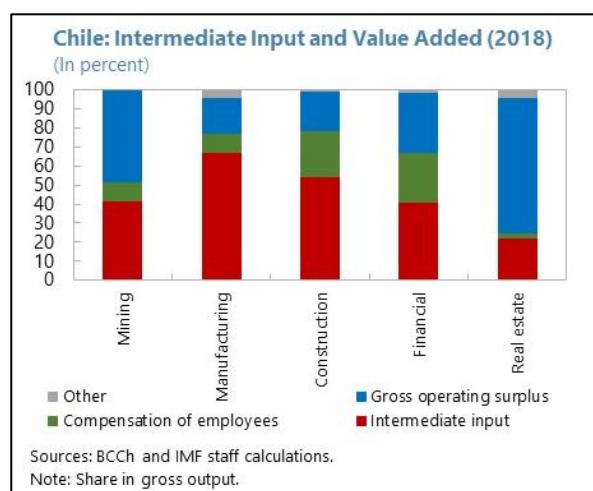
3/ For data transformation, see Iacoviello and Neri (2010). The consumption sector is represented by all sectors excluding construction. Due to data limitations, housing investment is proxied by building permits for total new housing, while non-housing investment is proxied by gross fixed capital formation. For calculating hours, average hours worked are the same for both the consumption and construction sectors (i.e., the indicator for all sectors is applied), whereas employment data are specific to each industry.

4/ A possible interpretation of this high share is that it reflects that mortgage borrowers are concentrated in high-income households, which have a larger impact on consumption. This estimate is broadly robust even when the consumption series excludes the impact from a consumption boom due to pension fund withdrawals.

Annex II. Input-Output Linkages and Inter-Sectoral Spillovers

1.   The Chilean construction and real estate sector have different input-output linkages.
The Input-Output table indicates that the labor share (compensation of employees) in the
construction sector is higher than in other industries, whereas the labor share in the real estate
sector is low. Instead, the real estate sector has a high gross operating surplus. According to the
structure of intermediate inputs across these sectors, the domestic and foreign manufacturing
sectors supply the domestic construction sector, and the domestic financial sector, along with the
construction sector, provides inputs to the domestic real estate sector. Additionally, the business
services sector supplies various inputs to both the construction and real estate sectors.

Chile: Intermediate Input and Value Added (2018)
(In percent)

Sources: BCCh and IMF staff calculations.
Note: Share in gross output.

Chile: Intermediate Input Linkages (2018)
(In percent)

Sources: BCCh and IMF staff calculations.
Note: X-axis indicates industries providing intermediate inputs. Bars represent each
industry's share in total intermediate inputs used by purchasers (as shown in legends).
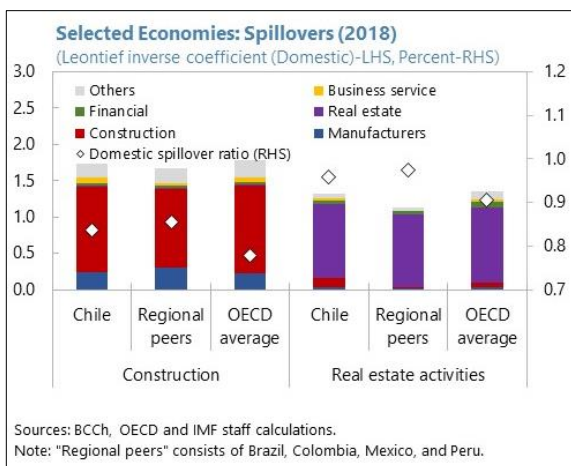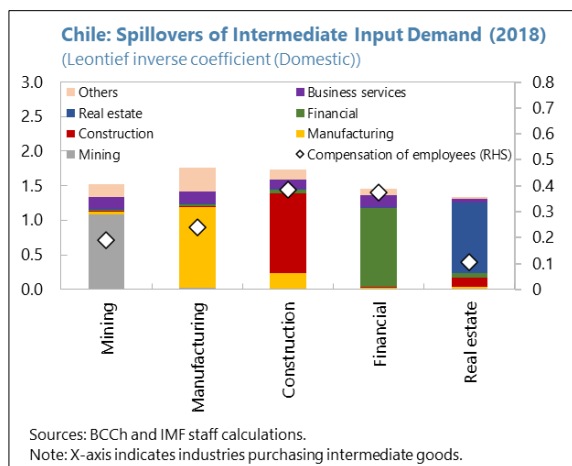
**2.   While the construction sector has large spillover effects on intermediate input
demands and employee compensation, such effects are limited for the real estate sector.** [1] On
the one hand, spillover effects based on the Leontief Inverse matrix indicate that a one-unit increase
in production in the construction sector mainly increases production in the manufacturing and
business services sectors. The spillover to domestic manufacturers is moderately smaller than that of
regional peers but comparable to the OECD average. On the other hand, a one-unit increase in
production in the real estate sector mainly raises production in the construction sector, which is

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[1] The (non-competitive import type) Leontief Inverse matrix $(I - A^d)^{-1} = I + A^d + A^{d^2} + \cdots$ shows how output in
each domestic sector rises in response to a unit increase in final demand, where I is the identity matrix and A^d is the
input-coefficient matrix for domestic suppliers from the input-output table. The input-coefficient matrix A^d is derived
by normalizing the input-output matrix, dividing it by the vector of total output, which represents the economic
structure of the system. Therefore, spillover effects to intermediate domestic goods demand from a unit increase in
intermediate domestic goods demand from an increase in final demand for specific domestic industry is calculated as
$(I - A^d)^{-1}$ where I and $A^d + A^{d^2} + \cdots$, respectively, represent the direct demand for the industry and indirect
demands via supply chain (spillover effects). Spillover effects on compensation of employees are calculated by
multiplying the spillovers to each domestic industry's gross output by its labor share, and thus the effects increase as
the share of spillovers to industries with higher labor shares increases, assuming a fixed amount of spillovers to total
gross output. Domestic spillover ratio is calculated as the ratio of the spillovers to gross output of domestic suppliers
to those of total suppliers (including foreign suppliers). The spillovers to gross output of total suppliers are calculated
based on another type of the Leontief Inverse matrix $(I - A)^{-1}$ where A represents the input-coefficient matrix
covering both domestic and imported intermediate goods.

larger than that of regional and OECD peers. In terms of domestic spillover ratios in Chile, they are similar to those of regional peers but higher than those of OECD peers.

Chile: Spillovers of Intermediate Input Demand (2018)
(Leontief inverse coefficient (Domestic))

Legend: Others, Business services, Real estate, Financial, Construction, Manufacturing, Mining, Compensation of employees (RHS)

X-axis: Mining, Manufacturing, Construction, Financial, Real estate

Sources: BCCh and IMF staff calculations.
Note: X-axis indicates industries purchasing intermediate goods.

Selected Economies: Spillovers (2018)
(Leontief inverse coefficient (Domestic)-LHS, Percent-RHS)

Legend: Others, Business service, Financial, Real estate, Construction, Manufacturers, Domestic spillover ratio (RHS)

X-axis: Chile, Regional peers, OECD average (Construction); Chile, Regional peers, OECD average (Real estate activities)

Sources: BCCh, OECD and IMF staff calculations.
Note: "Regional peers" consists of Brazil, Colombia, Mexico, and Peru.

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