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Are institutional investors the culprit of rising global house prices?

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Abstract

Taking advantage of the standard regulation of real estate investment trusts (REITs) around the world, we study the implications for housing markets of the entry of institutional investors in 57 cities in 15 countries for the period 2001–2022. We employ an IV approach based on the exogenous demand for REITs by pension funds triggered by changes to the retired population. We show that residential equity REIT capital flows push up multifamily house prices, and are associated with declining rents, potentially affecting households' homeownership versus renting decisions. Estimating a CS-ECM model, we find that REITs exert long-run effects on housing markets.

KEYWORDS

financialization, house prices, institutional investors, real estate investment trusts (REITs)

1 | INTRODUCTION

The article investigates real estate investment trusts (REITs) as investment funds dedicated to the real estate sectors that have originated in financial markets of both advanced and emerging economies. We focus on the period 2001 to 2022 during which REITs share prices have increased dramatically, and their market capitalization surpassed $2.5 trillion, at 2% of global stock market

capitalization in 2022 (2023 Nareit Outlook).[1] This has coincided with rising global house prices, which have increased steadily since the 2007-09 Global Financial Crisis (GFC), and they have now surpassed their pre-crisis peak. At the same time, the managed real estate market is now worth over $11 trillion globally (2022 MSCI report). Housing markets have been shaped by the entry of institutional investors, especially in the United States (Ghent, 2021; Garriga et al., 2023; Lambie-Hanson et al., 2022; Mills et al., 2019).[2] In this article, we focus on REITs as a unique case study for the impact of institutional investors on housing markets around the world.

Whereas most work on institutional investors has largely focused on a single country (mostly the United States), REITs' relatively stringent regulatory framework is similar across countries, allowing us to study the role of institutional investors across a wide number of countries around the world. In particular, as a means of expanding investors' diversification opportunities, the development of REITs is often encouraged with tax breaks by domestic authorities for its contribution to financial development, both in terms of deepening and widening access to financial markets (Cannon & Cole, 2011; International Monetary Fund, 2008; HM Treasury, 2005). At the same time, in order to maintain their tax benefits and forgo corporate taxation, REITs must abide to particularly stringent regulations in most countries. They are generally required to pay out around 90% of their income as dividend, and also abide by leverage limits in some countries, while maintaining a significant share of their assets (hovering around 75%) invested in real estate. This framework that helps make them attractive to investors, also constrains their financing and investing choices (Brown & Riddiough, 2003; Breuer et al., 2023; Dogan et al., 2019). Indeed, REITs do frequently tap capital markets to expand their operations and hold large share of their portfolios in real estate. In this article, we study how the entry of institutional investors in the real estate market via REITs contributes to house price and rent growth over the period 2001 to 2022 for a representative group of large cities in advanced economies and emerging markets.

Since the collapse registered during the 2007–2009 GFC, house prices around the world have recovered their upward trajectory (Figure 1). REIT prices have followed similar dynamics (Figure 1).[3] The sustained increase in house prices and REIT prices in the post GFC period corresponded to a dramatic increase in REIT capital flows. As shown in Figure 2 (panel a), REIT capital flows have gone from relatively small values in the early 2000s to become more persistent in the post GFC period up until the 2020 COVID-19 pandemic episode, with a temporary retrenchment followed by a dramatic recovery.[4] Preliminary graphical analysis suggests that these dynamics are related, as countries with higher REIT capital flows in the period 2001–2022 also exhibit higher growth in house prices over the same period on average (Figure 2, panel c). The high volatility of REIT valuation and flows motivates us to investigate its implications on the stability of housing markets around the world.

Our main contribution is to provide evidence about the impact of institutional investors on house prices by studying the capital flows of one class of institutional investors, the REITs.[5] The

[1] REITs are listed as one of the major recent displacements in the classic textbook on financial crises "Manias, Panics and Crashes. A History of Financial Crises" (Aliber et al., 2023, p.54).

[2] The presence of institutional investors in rented real estate has recently attracted public outrage and regulators have started to take action in various countries. See, for example, "Barbarians at the garden gate," *The Economist*, 20 November 2021.

[3] The rise of REIT prices has outpaced the general rise in stock markets, thus indicating specific renewed interest by investors in this product.

[4] House prices and rent prices by city, and REIT capital flows by country are reported in Figures 1A–3A in the Appendix.

[5] REITs are proving increasingly popular with institutional investors attracted by their stable cash flow and relatively liquid shares. See the 2023 Nareit Economic Outlook and Moss and Baum (2013) for a survey of market participants.

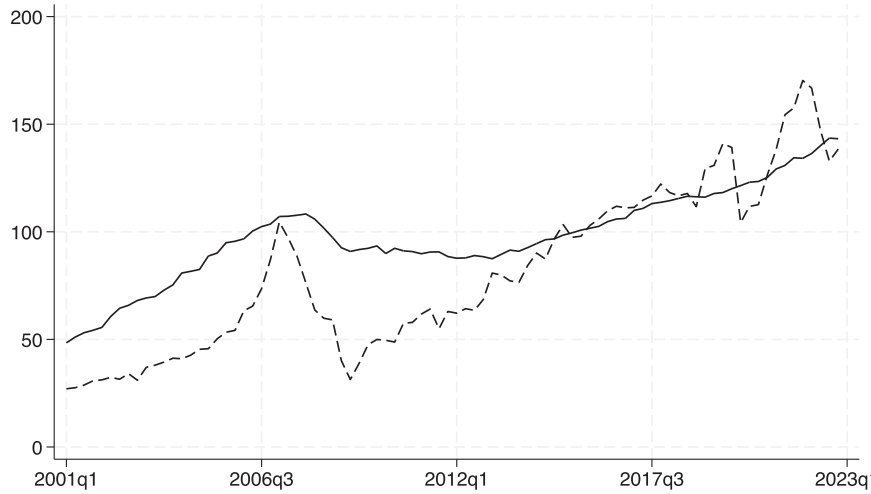

FIGURE 1 Dynamics of the nominal house price index (solid line) and the REIT index (dashed line). The figure shows the median quarterly series of the nominal house price index and REIT price index across countries in our sample. House price data for multifamily properties at city level is from the OECD National and Regional House Price Indices and national sources (see Table A5 in the Appendix for details). The REIT index measures the stock market performance of REITs around the world and it is calculated as the median across the countries in our sample of REIT stock price indices obtained from the GPR REIT and General Indices (in USD), with the exception of Thai REITs price data collected from Orbis. Base year is 2015.

emergence of institutional investors in general has been studied in the US housing market (Ghent, 2021; Lambie-Hanson et al., 2022). Mills et al. (2019) suggest that this trend is primarily driven by tight mortgage markets, large housing supply and technological advances. Garriga et al. (2023) find that smaller institutional investors are more active locally than larger ones and their investment activity matters for house prices and housing affordability locally. There is also a strand of the literature, which studies the impact of speculative activity by retail investors in real estate, again mostly covering the US market (Bayer et al., 2021; Chinco & Mayer, 2016).[6] It is difficult to generalize these findings based on the market structure of the United States to other countries (Andonov et al., 2015; Brounen et al., 2012; Carlo et al., 2021). But, building on the similarity in regulation across countries, we study REITs as uniquely homogeneous investors across countries, and build measures of REIT capital flows for a set of 15 countries including both advanced and emerging markets to study the implications of the entry of these investors in housing markets around the world. As REITs are required to hold a sizeable share of their assets in real estate investments to maintain their tax benefits, we expect REIT capital flows to drive up the demand for real estate and, ceteris paribus, increase house prices. As residential equity REITs build income-generating portfolios of rental multifamily properties, they invest in properties that are not resold in the short term, but they are rather held for rental. This creates a permanent demand for housing that pushes up house prices (Bracke, 2021; Mills et al., 2019). To offer a comprehensive study of the impact on

[6] A strand of the literature studies foreign investors, documenting a significant exposure of house prices to capital flows (Aizenman & Jinjarak, 2009, 2014; Badarinza & Ramadorai, 2018; Barcelona et al., 2021; Cvijanovic & Spaenjers, 2021; Davids, 2020; Favilukis et al., 2013; Favilukis & Van Nieuwerburgh, 2021; Gorback & Keys, 2020; Tillmann, 2013). Private equity entry in real estate also attracted recent attention for its effect on housing affordability (Christophers, 2022; Fields & Uffer, 2016).

FIGURE 2 Residential equity REIT capital flows and house price growth. The figure shows the quarterly series of residential equity REIT capital flows aggregated across our sample of countries in USD billions (panel a), the quarterly house price growth averaged across the countries in our sample in % (panel b), and the 2001–2022 average house price growth and REIT flows (in logs) for the countries in our sample (panel c).

housing markets, we also study the role of REITs in rental markets. As REITs develop and refurbish properties in urban areas with strong rental markets, they potentially increase the supply in areas with excess demand for rental accommodations, thus reducing the appreciation of rents in these cities. Given their potential effects on house prices and rent, REITs may ultimately alter the housing market structure and households' buy versus rent decisions, with possible consequential longer-term effects on house prices.

Our article also speaks to the broader debate on the financialization of housing markets. While there is no unique definition, the term financialization is generally used to indicate the increasing role of finance in the economy (Mazzucato, 2018; Turner, 2010). The UN defines financialization of housing as the "structural changes in housing and financial markets and global investment

whereby housing is treated as a commodity" (UN, 2017, p. 3). Traditionally, the literature has studied the financialization of housing focusing on housing finance, including mortgage market development and the related securitization activity, and its impact on housing markets within and across countries.[7] Widening access to housing for domestic and foreign investors, REITs have the potential to expose housing markets to financial shocks that originate both domestically and internationally, and thus disrupt housing markets. We contribute to this body of work by investigating the effect associated with REITs for the long-run dynamics of house prices around the world.

Focusing on a panel of 57 cities in 15 countries from 2001 to 2022, we estimate the impact of residential equity REIT capital flows on the growth of multifamily house prices and rent prices. We deal with potential endogeneity by employing an instrumental variable (IV) two-stage least squares (2SLS) estimation approach. Our IV strategy identifies a source of exogenous demand for REITs by pension funds driven by shifts in their portfolio allocation triggered by changes in the share of the retired population.[8] We then turn to the identification of a long-run relationship between house prices and REIT capital flows to determine whether the financialization process has significant long-run consequences for housing markets. We estimate these long-run effects by employing a cross-sectionally augmented panel error correction model (CS-ECM) that allows us to deal with both endogeneity issues arising from the feedback effect from house prices to REIT capital flows and omitted common variable biases in the modeling of house price dynamics. We show that house prices respond positively to REIT capital flows, and that this effect is sustained in the long run. At the same time, we find that REITs reduce the pressure on rental markets, as they are associated with declining rent prices. We subject our analysis to numerous tests, including selecting different subsets of REITs and controlling for the sustained growth in REIT capital flows in the post-GFC period and for house price volatility during the COVID-19 pandemic, to confirm that our results are not sample dependent, and our results remain robust.

In the next section we provide details on the residential equity REIT markets around the world. We then describe the construction of the REIT capital flows measure and present the data in Section 3. We set up the research strategy of the article and present the empirical analysis of the impact of REIT capital flows on housing markets in Section 4. Section 5 reports robustness tests. Finally, Section 6 concludes.

2 | INSTITUTIONAL BACKGROUND

2.1 | REIT investment strategies

REITs are companies that invest in real estate either directly by owning and operating properties (equity REITs), or by financing it (mortgage REITs). Our focus in this article is on publicly listed residential equity REITs, that are companies that invest in residential real estate and whose stocks are listed on stock exchanges. Residential REITs are the third largest REIT sector, accounting for

[7] This literature is vast. A large body of work identifies mortgage market development and securitization as key forces behind the rise of house prices, transaction volume and affordability in housing markets, which led to the GFC (Aalbers, 2016; Brunnermeier, 2009; Duca et al., 2010; Dewilde, 2018; Justiniano et al., 2019; Mian & Sufi, 2022). Moreover, these developments in housing finance have increased house price comovement within and across countries (Claessens et al., 2011; Cotter et al., 2015; Choi & Hansz, 2021; Diamond & Rajan, 2009; Landier et al., 2017; Milcheva & Zhu, 2016).

[8] We discuss the role of pension funds in REIT markets around the world in Section 2.2 and we provide an in-depth description of our IV strategy in Section 4.1.1. Tests for instrument validity are reported in Section 5.1.

16.6% of the global REIT industry (2024 Global Property Research 250 REIT Quarterly Report). Although REITs can be classified as institutional investors (i.e., Garriga et al., 2023), their shareholders are both institutional and retail investors (Andonov et al., 2015; Brounen et al., 2012; Carlo et al., 2021). Among institutional investors, REITs are unique because of their tax regime and stringent regulation. Specific thresholds vary by country, but in general to maintain their tax benefits, REITs must satisfy minimum requirements on their dividend payout (around 90%), real estate assets (around 75%), and for some countries limits on leverage (ranging from 45% to 75%) (see Tables A1 and A2 in the Appendix for details on regulation and market sizes across countries). And this regulatory framework has repercussions for the capital structure of REITs (Breuer et al., 2023; Dogan et al., 2019; Ott et al., 2005).

To provide insights on REIT markets and portfolios, we gather details on the investment strategies of the REITs in our sample from the "industry & activities" section of the "company profile" reports from Orbis. Furthermore, where necessary we gather information on REITs operations from their investor reports, financial statements, and websites. We provide details of the investment strategy of the largest international residential equity REITs by country in Table A3 in the Appendix.

In general, REITs strategic investments mainly involve buying and holding income producing properties for rental or leasing. 94% of international REITs in our sample mention renting as one of the main operations. In the United States, the Securities and Exchange Commission specifies that "[…] a REIT must acquire and develop its real estate properties primarily to operate them as part of its own investment portfolio, as opposed to reselling those properties after they have been developed."[9]

In line with the goal of building an income generating portfolio, the main investment sector of US and international residential equity REITs is multifamily real estate in urban centers with well-established rental markets. In the United States, multifamily REITs are two-thirds of the residential equity REIT industry, with a market capitalization of $116.71 billion at end 2022 (FTSE Nareit). Internationally, over 73% of the international residential equity REITs in our sample invest in urban areas. Consistently with the evidence on general buy-to-rent investors in the United Kingdom in Bracke (2021), UK residential equity REITs tend to develop and manage rental properties located in the largest cities. Similarly in Japan, residential equity REITs mainly invest in rental properties in the metropolitan areas of Tokyo and other major cities. The established rental markets in urban areas also attract REIT investments in Canada, France, Ireland, Singapore, Spain, and Thailand. In some countries, investments are less concentrated in urban areas and instead extend to regional as well as urban locations. This is the case in Australia and Israel. Australian REITs tend to develop, invest and manage communities of residential properties for sale and rent. In other countries, such as Bulgaria, Greece, and Turkey, the largest REITs core activities involve the development and sale of residential properties.

2.2 | Pension funds and REITs

Globally, public and private pension funds allocate over $1 trillion of their $16 trillion in assets under management to real estate (2016, Preqin).[10] This is a significant amount, as it represents around 20% of global real estate assets under management, that amount to $4.7 trillion in 2022

[9] SEC Investor Bulletin, available at https://www.sec.gov/files/reits.pdf.

[10] "Pension Funds Investing in Real Estate" in the 2016 Real Estate Spotlight, available at https://docs.preqin.com/newsletters/re/Preqin-RESL-September-16-Pension-Funds-Investing-in-Real-Estate.pdf.

(ANREV/INREV/NCREIF Fund Manager Survey 2022). Among real estate sectors, multifamily is the second largest sector, after office and before retail, and accounts for 21.4% of the distribution of global pension funds allocation (PREA 2017 Investor Report). Andonov et al. (2015) document that over 90% for European funds and around 70% of Australian and Canadian pension funds invest in real estate over the period 1995–2011. A similar share is reported for the United States in a survey of institutional investors by Dhar and Goetzmann (2006) and by Nareit.[11]

Andonov et al. (2015) report that in 2011 pension funds covered by the CEM database (including the United States, Canada, Europe, Australia, and New Zealand) held directly around $60 billion of their assets under management in REITs. This represents an important share of the REIT market, amounting to around 10% of the FTSE EPRA Nareit Global REITs Index. The amount was similar in 2009, at $74 billion and 11% of FTSE EPRA Nareit Global REITs Index (Andonov et al., 2013). However, it is not easy to pinpoint pension funds' exact holdings of REITs, as they commonly hold these positions through asset managers (Brounen et al., 2012). Andonov et al. (2015) document that in the period 1990–2011 over 59% of REIT assets were managed externally by the funds.[12] And asset managers are large holders of REITs. In five different countries, Brounen et al. (2012) show that investor advisors' total share ownership of REITs is substantial, ranging from 28% in France to 57.7% in the United States in 2009. Indeed, the literature argues that pension funds are key investors (Ciochetti et al., 2002; Carlo et al., 2021; Ghent, 2021; Hartzell et al., 2014). Documenting the recent trend of institutional investors into the US single-family real estate sector, Molloy and Zarutskie (2013) explicitly mention attracting investors such as pension funds as a rationale for turning large single-family portfolios into REITs.[13]

Turning to individual countries, pension funds are important investors in US REITs. US pension funds held directly over $34 billion of REIT shares in 2021 (2022, Nareit).[14] The indirect holdings are larger. In a rare detailed study of direct as well as matched managed pension fund holdings, Ciochetti et al. (2002) show that pension funds are the largest institutional holders of US REITs, holding 27.9% of REIT outstanding shares, of which 23.3% are residential REITs, the second largest sector after office. Although they report low direct holdings just above 6%, Brounen et al. (2012) show that US pension fund ownership significantly affects both REIT performance and trading activity. Studying US REIT firm inefficiency, Chung et al. (2012) document a significant, negative effect of pension funds.

Among the larger REIT markets outside the United States, investment trusts are the second largest direct holders of REITs in Japan (holding around 34%), just after banks (48%), while the share held directly by pension funds is lower at 0.6% in 2022 (Japan Exchange Group REIT Investor Report). Given the important share of investments by asset managers, if pension funds hold REITs indirectly, we expect their overall share to be significantly larger. Empirical work supports this. Brounen et al. (2012) show that although relatively small, Japanese pension fund ownership significantly affects trading activity in REITs during extreme market events (in both up and down markets). And the effect is larger than that of other investors.

According to APRA statistics, Australian pension funds held directly around $39 billion in listed properties at end 2022.[15] Although the figure also includes international listed properties

[11] "How Pension Funds are Utilizing REITs" in *REIT Magazine*, 05/27/2022.

[12] See figure 1 in Andonov et al. (2015) for a scheme of the ways in which pension funds invest in real estate.

[13] More in general, attracting institutional investors into the real estate sector was one of the objectives of the introduction of a new taxation reform and the institution of REITs in the United Kingdom in 2007 (Barker, 2004; HM Treasury, 2005).

[14] "How Pension Funds are Utilizing REITs" in *REIT Magazine*, 05/27/2022.

[15] "Quarterly superannuation statistics," APRA December 2022, available at https://www.apra.gov.au/quarterly-superannuation-statistics.

and listed real estate companies other than REITs, pension funds' share is sizeable compared to REIT stock market capitalization.

Along the same line, overall exposure of UK REITs to pension funds can be expected to be larger than their direct holdings, as pension funds are traditionally the largest clients of investment advisors (UK Investment Association 2023 Annual Survey), and investment advisors are the largest holders of UK REITs, holding over 32% of their shares in 2009 (Brounen et al., 2012). Direct holdings of REITs by UK pension funds amounted to 7% of REIT shares in 2016.[16]

Finally, looking at smaller REIT markets, we find significant role of pension funds. Of the global pension funds in CEM database in 1990–2011, Canadian pension funds invest the lowest share of their assets in REITs, 15% compared to an average 30% for funds in other countries. In our sample, we find that the largest public pension fund, the Canada Pension Plan (CPP), reports a $4.41 million holdings in the largest residential equity REIT, Canadian Apartment Properties.

While over 90% of pension funds in Europe report that they invest in real estate (Andonov et al., 2015) and more than half invest in listed real estate companies (Andonov et al., 2013), their direct holdings of REITs are small. European pension funds that invest in REITs hold directly only around 4% of their assets in REITs in 2019 (Mercer European Asset Allocation Survey 2019). In Spain, OECD data indicate that pension funds directly invested $185 million in real estate funds (including but not exclusively REITs) in 2021. In Belgium, the amount reached $258 million in 2020, the last available observation. Nonetheless, these figures are likely to underestimate European pension funds holdings, as they do not include positions via asset managers, which are the main vehicle for pension funds investment in real estate (Andonov et al., 2015) and who are large holders of REITs (Brounen et al., 2012).

Looking at the current shareholder composition of the largest Israeli REITs in our sample, data from the Tel Aviv Stock Exchange indicate that over 7% of their shares are held by pension funds directly, while around 10% of REITs' shares are held by large national insurance and financial firms operating pension funds (such as Migdal, Phoenix, and Clal Holdings).[17] In line with evidence from other countries, this suggests that the overall interest of Israeli pension funds in REITs is expected to be larger than their direct holdings.

In conclusion, although at different level of development, we document how residential equity REITs around the world share similarities in terms of their investment portfolios in multifamily real estate properties with income generating potential. We also argue that although direct data is not available, pension funds are important REIT investors.

3 | DATA

3.1 | Residential equity REITs

We measure REIT capital flows as the net equity capital raised by residential equity REITs for each country in which they have been introduced and for which we have data available. We follow the traditional corporate finance literature (Baker & Wurgler, 2002; Fama & French, 2005; Hovakimian et al., 2004) and the relatively more limited literature on the capital structure of REITs

[16] Beath and Flynn (2018) estimate that UK pension funds hold EUR 5.3 billion in REITs in 2016, which is around 7% of REIT market capitalization.

[17] Tel Aviv Stock Exchange provides Interest Parties reports for quoted stocks, available at https://market.tase.co.il/en/statistics/free_float/market_cap_equity.

(Ling & Naranjo, 2003), and construct the measure of net equity issues as the difference between the change in book equity and the change in retained earnings. The book equity is the difference between total assets and total liabilities, whereas retained earnings are given by net income minus total dividends. Then, we aggregate net equity issues by country of incorporation of the REITs. We remove outliers by winsorizing each series for the full sample period at 1%.[18] We retrieve balance sheet data from Compustat for all REITs with Standard Industry Classification (SIC) code 6798. Amongst the universe of REITs, we are interested in equity REITs who operate in residential housing. We identify residential equity REITs from the global industry classification standard (GICS) codes 60101060, 60106010, and 60106020. There are also REITs that operate in two or more sectors. For these diversified REITs, we manually check information on their business in Orbis and classify them as residential equity REITs if the description of "industry & activities" in the "company profile" report mentions residential operations. Including both active and dead companies, we do not have survivorship bias in our sample. After the screening and matching with data available for all other variables, we have 166 REITs, of which 104 are residential and 62 are diversified REITs with part of their operations in residential real estate.[19] The data coverage includes 15 countries.[20]

3.2 | House price data

For each country in which residential equity REITs operate, we select cities with more than 300,000 inhabitants for which house price data is available. Our selection criteria and definition of a city is based on the UN World Urbanization Prospect (latest revision in 2018). For the United States and United Kingdom, house price data are available for a large number of cities with over 300,000 inhabitants. To avoid over-representing these countries in our dataset, we restricted the sample to the top 10 cities by size for these countries.[21] Real residential house prices are primarily collected from the OECD Regional House Price Database. We focus on house price indices for apartments or multifamily dwellings, as REITs' residential equity investment strategies focus on multifamily properties.[22] Our final sample comprises multifamily real house price data from the OECD Regional House Price Database for Adelaide, Brisbane, Canberra, Melbourne, Perth, and Sydney in Australia; Lyon, Marseilles, and Paris in France; Dublin in Ireland; Athens in Greece; and Nagoya, Osaka, and Tokyo in Japan. When house price data for multifamily dwellings are not available from the OECD database, we turn to national sources. In particular, we rely on national sources for multifamily house price data for Antwerpen, Bruxelles, and Gent in Belgium; Plovdiv,

[18] Results are qualitatively similar when using the raw series. These results are reported in Table A9.

[19] We test the robustness of our results by building a measure of REIT capital flows (1) aggregating capital flows of all equity REITs irrespective of their specialization, (2) focusing on the subsample of REITs dedicated to residential real estate (i.e., not diversified). Overall, our data set includes 765 equity REITs. Results are reported in Section 5.2.

[20] There are 16 countries with active residential equity REITs, but we drop one country, South Africa, due to lack of house price data at city level from public sources. Table A4 in the Appendix gives more details on the composition of our residential equity REIT capital flows. Figure 3A depicts REIT capital flows by country.

[21] We test that our results are robust to the inclusion of the top 25 cities in the United Kingdom and United States and results are confirmed. We report these results in Table A10 in the Appendix.

[22] Most recently, a subset of residential REITs have started to specialize in single-family properties, mostly in the US markets. In our sample, we have 7 single-family residential REITs in the United States, 1 in the United Kingdom and 1 in Canada. We conduct an analysis on this subset in the robustness section. For this analysis, we match the single-family REIT capital flows with house price data for single-family properties. More details are provided in Section 5.2.

Sofia, and Varna in Bulgaria; Singapore; Bangkok in Thailand; Birmingham, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Sheffield, and Southampton/Portsmouth in the United Kingdom; and Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, and San Diego in the United States. Due to unavailable data for multifamily properties, house price data for Haifa, Jerusalem, and Tel Aviv in Israel; Barcelona, Madrid, and Valencia in Spain; and Ankara, Istanbul, and Izmir in Turkey include all types of dwellings. Data for multifamily house price data for Calgary, Montreal, Ottawa-Gatineau, Toronto, Vancouver, and Victoria in Canada are available only from 2017 until 2021, so we rely on the longer series for single-family dwellings available for the full sample period from the OECD. The correlation between the single-family and multifamily series is over 70%. We also run the estimations with the shorter multifamily series and results are qualitatively unchanged (see Table A11 in the Appendix). Details on house price data and sources are available in Table A5 in the Appendix. Our sample includes 57 cities in 12 advanced economies and 3 emerging markets, from January 2001 to December 2022.[23] We conduct our analysis at quarterly frequency.

3.3 | Other housing market data

In addition to house price data, we collect rent prices for multifamily housing from national sources for the cities in Canada, Ireland, Thailand, the United Kingdom, and the United States, and for Paris. When multifamily data is not available, we follow the OECD Housing Affordability Database and collect the consumer price indices (CPIs) for actual rentals for housing. This is the case for cities in Australia, France (Lyon and Marseilles), Japan, Singapore, Spain, and Turkey. Finally, when rent data at city level is not available, we rely on country-wide indices from the OECD Housing Affordability Database. In particular, we rely on country-wide data for Athens, Brussels, Sofia, and Tel Aviv, and we drop other cities in Belgium, Bulgaria and Israel for which rent data are not available. For this reason, our final sample for the analysis of rental markets covers 51 of the 57 cities of the house price data set. All measures are converted to constant 2015 dollar values. Details on data sources and coverage are provided in Table A6 in the Appendix.

To determine the effect on housing supply, we consider the issuance of new permits for residential buildings, or similar, collected from the websites of the relevant statistics department in each country. Details on data sources and coverage are provided in Table A7 in the Appendix.

3.4 | Controls

We employ a set of controls for traditional determinants of the demand for housing at city level, such as population growth, unemployment rate, and income growth (Garriga et al., 2023; Lambie-Hanson et al., 2022). We also control for country-wide determinants, including the rate of growth of the real gross domestic product (GDP), domestic real short-term interest rates, domestic private

[23] Our analysis starts in 2001 when data on pension fund investment regulation for the instrumental variable become available. Due to limits in house price data availability, data series start later for some countries: 2003 for Australia; 2006 for Greece; 2008 for Japan; 2010 for Belgium and Turkey; 2011 for Thailand; 2017 for Israel. Also the sample starts later because REITs have been introduced later for some countries: 2002 in Singapore; 2003 in France; 2004 in Bulgaria; 2007 in the United Kingdom; 2009 in Spain; and 2013 in Ireland. See details on REIT introduction and regulation by country in Table A1 in the Appendix.

TABLE 1 Descriptive statistics.

Variable	Obs	Mean	St dev	Min	Max
Housing market variables					
House price growth (%)	3439	0.44	2.76	−17.19	16.27
Rent growth (%)	2489	−0.005	1.63	−18.36	10.09
Building permits growth (%)	2980	0.32	58.44	−332.14	421.21
Residential REIT flows (bn$)	3439	0.36	0.86	−2.03	5.49
City-level controls					
Population growth (%)	3439	1.02	0.93	−5.87	5.29
Unemployment (%)	3439	7.33	3.87	0.25	29.70
Income growth (%)	3439	3.74	5.62	−36.67	46.63
Country-level controls					
Short-term rates (%)	3439	1.22	2.66	−12.41	24.22
GDP growth (%)	3439	0.41	5.49	−26.55	30.00
Bank flows (bn$)	3439	22.69	134.62	−564.80	840.62
Private credit (%GDP, index)	3439	169.59	37.89	50.00	348.91
Inflation (%)	3439	0.69	1.30	−2.87	24.91
Stock returns (%)	3439	0.85	6.84	−37.24	31.66

Note: Descriptive statistics of the quarterly series of the main variables for the period 2001–2022 for the sample in our baseline model. House prices are quarterly percentage changes in the house price index. Rent growth is the quarterly percentage change in the real rent index. Building permits are the percentage change of the number of new residential building permits issued. Residential REIT flows are national quarterly net equity issues by residential equity REITs in $ billions. Population growth is the percentage change in the city total population. Unemployment is the city unemployment rate. Income growth is the percentage change in household disposable income in the city. Short-term rates are short-term real interest rates in %. GDP growth is quarterly growth in real GDP. Bank flows are real FX and break adjusted changes in foreign bank claims in $ billions. Private credit is the credit to the private nonfinancial sector as % of GDP. Inflation is the annualized inflation rate of the country in %. Stock returns are the log returns of the stock market index in %.

credit as a share of the GDP of the country, and the inflation rate (Aizenman & Jinjarak, 2009). As REITs are financial market instruments, we also control for stock market performance and include stock market returns in the models. To control for the impact of global shocks on the housing markets via international investors through REITs, we include bank flows that are a well-documented source of cross-border credit to the local banking sector (Banti & Phylaktis, 2019; Cesa-Bianchi et al., 2015). Finally, our models include time fixed effects to control for the impact of global factors on housing markets.

Data is mainly from the IMF, the OECD, and the BIS. We convert nominal series to constant 2015 dollars with the national CPI index. When quarterly data is not available we interpolate annual data at city level using quarterly national data. Details on the variables and data sources are provided in Table A8 in the Appendix.

3.5 | Descriptive statistics

Table 1 reports the descriptive statistics of house price growth, REIT capital flows, and the other variables. The average quarterly change in house prices in our sample is 0.44% with a relatively high variability, ranging from 16.27% to –17.19%. National quarterly residential REIT capital flows

are $360 million on average, ranging from $5.49 billion to –$2.03 billion.[24] To put in context, their capital flows represent approximately 14% of overall equity REIT capital flows. Also, aggregating their capital flows across all countries, global residential REIT capital flows are substantial, at $2 billion on average.

4 | EMPIRICAL ANALYSIS

4.1 | The exposure of house prices to REIT capital flows

We start our empirical analysis with an investigation of the impact of REIT capital flows on house prices in a panel model with city and time fixed effects, as follows:

$$house_{i,j,t} = \beta_0 + \beta_1 flows_{j,t-1} + \beta_2 controls_{i,j,t-1} + \theta_i + \gamma_t + \epsilon_{i,j,t}, \quad (1)$$

where $house_{i,j,t}$ are percentage changes in house prices in city i of country j at time t, and $flows_{j,t}$ are net equity issues by residential equity REITs in country j at time t. *controls* include determinants of the domestic demand for housing at city level, such as population growth, unemployment rate and income growth, as well as national controls, including short-term real interest rates, real GDP growth, bank flows, private credit as a share of GDP, inflation rate, and stock market returns. We test all variables for unit roots, and nonstationary variables such as unemployment rate and private credit are first differenced. We include city and time fixed effects. As common in this setting, we lag all explanatory variables to account for general endogeneity concerns. Since house prices may take longer to respond to some factors, we also study different lags, from 6 months to 1 year. We estimate the model for the full sample period, 2001–2022. Our main coefficient of interest is β_1 that captures the impact of REIT capital flows on house price growth.

4.1.1 | Identification and IV approach

The identification of a causal effect of REIT capital flows on house prices is not trivial. REITs are funds invested in real estate and their value is directly related to the value of the underlying asset, real estate. As asset managers base their investment decisions on expected future values, and house price returns are persistent, the inclusion of lags of REIT flows does not solve our identification challenge. In addition, there are common factors that drive both house prices and REIT capital flows, such as interest rates or economic growth. Although we include an extensive set of controls, we cannot rule out the possibility of omitted variable bias in our estimation. Moreover, given the substantial liquidity differential between the two markets, common factors may affect the more liquid REIT market first and the less liquid housing market subsequently, resulting in an apparent lagged impact of REIT capital flows on house prices (Bond & Chang, 2012). Thus, the inclusion of controls in our model may not completely solve the endogeneity issue and an OLS estimation of our model may be biased.

[24] It is not uncommon for REITs to redeem their shares from time to time (Harrison et al., 2011), and when redemptions are higher than new issues, REIT capital flows are negative on average.

The literature on the effects of financial investments in housing markets has traditionally relied on an IV approach to deal with these endogeneity concerns. The challenge of this approach is identifying an appropriate instrument that affects the variable of interest, be this demand for housing from retail, or foreign investors, while being exogenous to house prices (i.e., Badarinza & Ramadorai, 2018; Cvijanovic & Spaenjers, 2021; Garriga et al., 2023). We follow this literature and provide evidence of a causal link between REIT capital flows and house price growth by employing IV and 2SLS estimation of our model in Equation (1).

Our choice of instrument needs to account for the endogeneity between house prices and REIT capital flows. To do so, our instrument must capture the exogenous variation in REITs' demand for housing as an investment. In other words, as REIT investments in the housing market may be driven by dynamics of house prices in various ways, our instrument for REIT investment activity needs to rule out house price dynamics as a driver. To this end, our choice of instrument for exogenous housing investment demand by REITs is the exogenous demand for REIT instruments by pension funds. To capture this exogenous demand, we consider the change in the share of the retired population in the countries where pension funds are part of the pension system and are allowed to invest in REITs. We employ an indicator of the share of portfolio investments by pension funds that is allowed by regulation to be invested in REITs (this variable is denoted *regulation*). We build this indicator by collecting information on countries' pension systems and the regulation of pension funds' investment activities from the OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers. From the Survey (Table 4, specifically), we extract the share of total investments that is allowed in real estate via financial intermediaries for each year from 2001 to 2022 for the countries in our sample. We then obtain a measure for the exogenous demand for REIT investments by pension funds, by multiplying this indicator by the change in the share of the retired population over total population, as $IV_{i,t} = regulation_{i,t} \times \Delta retired_{i,t}$. Retirement is at the age of 65 for most countries in our sample (World Bank Survey). Hence, our measure $\Delta retired$ is the change in the share of the population over 65 years of age. This data is available for the countries in our sample from the World Bank. The variable *regulation* varies between 0 and 1 and picks up the time variation in regulation. As shown in Figure 3 (panel a), regulation is relatively stable within countries. Hence, most of the variation in our instrumental variable comes from the change in the share of the retired population ($\Delta retired$), which we report in panel (b).

As a valid instrument our IV must be exogenous to house price dynamics and affect REIT investment activity. With respect to exogeneity, the share of retired population in a country is determined by the number of workers that reach the age of retirement and is thus unrelated to house price dynamics. Differently than the share of the current workforce, retired population is also not related to common factors such as the performance of the economy. Although the exclusion restriction is not directly testable, we offer some insights and tests in Section 5.1.

To establish that changes in the share of the retired population affect REIT investment activity and thus have real effects on the housing market, we need to determine that (1) the share of the retired population is a driver of the pension funds' investments in REITs and (2) that pension funds represent a sizeable influence on REIT capital flows and thus affect their investment allocation.

With respect to the first point, pension funds can be private or public and they operate by collecting contributions from their members, as well as their employers, in exchange for the payment of a pension, in the form of a lump sum and/or installments, upon members' retirement. As pension funds receive members' contributions, they invest in a variety of assets, among which there is

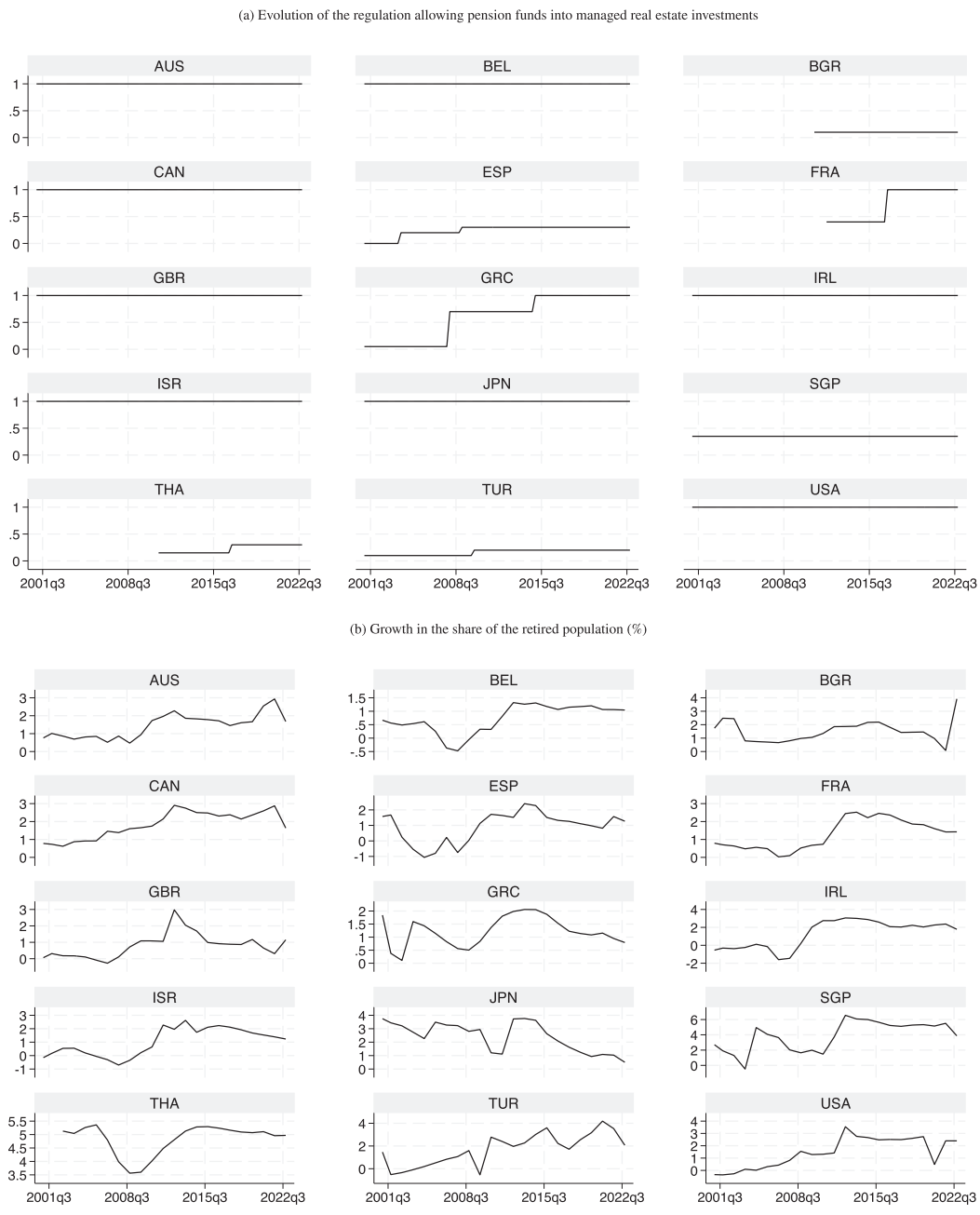

FIGURE 3 Instrumental variable (IV) dynamics. Panel (a) reports the values of the regulation variable indicating pension funds' portfolio ceilings for investments into managed real estate, including REITs. Regulation has a value of 1 when there are no restrictions, and 0 when investments in managed real estate are prohibited. Data is from Table 4 of the 2023 OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers, available at https://www.oecd.org/pensions/annualsurveyofinvestmentregulationofpensionfunds.htm. Panel (b) reports the percentage change in the share of the population over 65 year of age in %. Data are from the OECD historical population data set, except for World Bank data for Thailand. When quarterly data are not available, linear interpolation of annual data are used.

the investment in real estate.[25] REITs are particular instruments. Regulation makes sure that they offer a steady stream of dividends, just as direct investments in real estate. Indeed, although precise numbers vary by countries, REITs are in general required to pay around 90% of their taxable income as dividends to maintain their tax benefits (see Table A1 in the Appendix for details on different requirements across countries). But differently than direct investments, REITs are highly liquid stock market instruments. In fact, it is not uncommon for asset managers to consider REITs as part of their equity as opposed to the real estate portfolio (Moss & Baum, 2013). These characteristics are especially attractive for pension funds with high liquidity needs (Ciochetti et al., 2002; Gerber & Weber, 2007).[26] As pension funds mature, as determined by the increase in the age of their members, they invest more conservatively (Andonov et al., 2017) and they tend to increase their investments in REITs with stable cash flow (Ciochetti et al., 2002; Gerber & Weber, 2007). And residential REITs are low risk and have stable cash flows compared to the highly volatile office and industrial REITs (Brown and Riddiough, 2003; Dogan et al., 2019; Harrison et al., 2011). Unrelated to house price dynamics, the growth of the share of the retired population ($\Delta retired$) is instead related to the current payments obligations of pension funds in the country. To summarize, when the share of retired population increases, pension funds' current payment obligations also increase triggering higher liquidity needs that the funds satisfy by investing in the more liquid and stable cash flow generating REITs. Thus, we expect the exogenous demand for REIT investments by pension funds to increase with the share of the retired population.

Coming to our second point, our identification is based on the assumption that the demand for REIT investments by pension funds is consequential for REITs' investment allocation decisions. Although data on pension funds direct and indirect holdings are not generally available, the literature argues that they are key investors (Ciochetti et al., 2002; Carlo et al., 2021; Ghent, 2021; Hartzell et al., 2014). In Section 2.2, we provide available data and evidence of the role of pension funds in REIT markets around the world. In accordance with the market timing theory of capital structure (Baker & Wurgler, 2002), REITs are likely to issue equity following strong positive returns (Boudry et al., 2010; Harrison et al., 2011).[27] In a VAR framework, Ling and Naranjo (2003) show how US REIT capital flows increase for up to three quarters following a positive shock to returns. And Brown and Riddiough (2003) document how equity issues are used by REITs to fund investment. Thus, as pension funds increase their demand for REIT investments, pushing their price high, *ceteris paribus*, we expect higher REIT capital flows and in turn higher investment by REITs.

To close the link to REIT capital flows, it is important to note that regulations around the world mandate the minimum required investments into real estates over REITs' total assets, as well as minimum dividend payout of around 90% and some also limits to leverage (see Table A1 in the Appendix). Thus, as residential equity REITs look to increase their investments, limits on retained

[25] Some pension funds allow members to decide their investment strategy in various ways. An in-depth review of pension systems is beyond the scope of our article, but we direct the interested reader to the OECD and World Bank Databases and Surveys on countries' pension policy.

[26] This point is important for our selection of the instrumental variable. Indeed, in addition to REITs, pension funds can invest in real estate directly. However, our identification strategy is looking exactly at pension funds' demand for liquid investments with stable cash flow, thus making REITs preferable to direct real estate. For this reason we do not worry about the possibility of funds investing also in real estate, as this will not be related to our proxy of exogenous demand.

[27] Although the evidence in the literature on market timing is mixed, it is important to note that REITs are generally excluded from the sample of firms analyzed in traditional corporate finance studies exactly because of the regulation that affect their financing choices.

earnings (and possibly leverage) mean that they have to access capital markets for funding. Brown and Riddiough (2003) provide evidence that equity REITs tap equity markets to fund investments. Indeed, we find evidence that REITs tap equity market frequently and substantially (Figure 2, panel a). Hence, we expect that the growth of the share of the retired population will impact REIT investments into real estate through its effect on the demand for REITs by pension funds and REIT capital flows.

We corroborate our discussion with the results from the first stage of the 2SLS estimation of Equation (1). We report the results in Table 2. In Column (1), we show that the growth of the share of the retired population when pension funds can invest in REITs is significantly associated with REIT capital flows, after controlling for city-level and country-level determinants. That is, an increasingly higher share of the retired population when pension funds are allowed to invest in REITs is associated with higher REIT capital flows. The Kleibergen-Paap *F*-statistics for weak instrument test is 33.70, well above the conventional threshold of 10, allowing us to reject the null and confirm the relevance of our instrument. Furthermore, by comparing the results of the estimation with and without the inclusion of the instrumental variable as a determinant of REIT capital flows (Table 2, Columns 1 and 2), we show that the inclusion of the IV improves the explanatory power of the regression. Looking at other determinants, REIT capital flows increase with household income growth, GDP growth, and private credit. REIT capital flows are negatively associated with the inflation rate and marginally bank flows. Overall, these additional variables indicate a generally positive association of REIT capital flows with good economic and credit conditions.

We conduct multiple tests to support our discussion of the relevance of our instrumental variable and present them in Section 5.1.

4.1.2 | Empirical results

We present the results of the 2SLS IV estimation of our baseline model (1) in Table 3. For comparability, we also report the results of the OLS estimation of the fixed-effect model. Overall, we find that REIT capital flows are positively associated with house price growth. The relationship stays significant after controlling for the well-known determinants of the demand for housing both at city and country level. This effect is not only statistically significant,[28] but also economically meaningful. A standard deviation increase in REIT capital flows results in an annual house price increase of around 3.28%.[29] To compare this effect with well-known macro determinants, our results for fundamental variables suggest that a standard deviation increase in short-term real interest rates reduces annual house prices by 1.08%. Moreover, we find the effect not to be transitory. Looking at further lags (Columns 4–6 in Table 3), house price growth increases with REIT capital flows for up to a year. We confirm the relevance of our instrument with the significant *F*-statistics of the Kleibergen-Paap test from the first-stage estimation that we report in Table 2 and discuss in the previous section.

[28] We cluster standard errors at city level, but our results are robust to alternative treatments of the standard errors. Standard errors on the coefficient associated with REIT capital flows (0.010) are 0.0037 when clustered at country level. The larger standard errors as expected given the relatively lower number of clusters at country versus city level (15 vs. 57). Heteroskedasticity robust standard errors are smaller at 0.0021. Our results remain significant at the conventional 5% in both cases.

[29] To estimate the economic significance, we calculate the effect of a standard deviation move in REIT capital flows on annual house price changes by multiplying the quarterly effect (0.8599×0.0095) by 4.

TABLE 2 2SLS first-stage results.

	(1)	(2)
REIT flows		
Regulation ×Δ retired	0.391***	
	(0.063)	
Population growth	4.730	1.120
	(4.358)	(4.724)
Unemployment	−0.008	−0.014**
	(0.006)	(0.006)
Income growth	0.391*	0.629***
	(0.209)	(0.199)
Short-term rates	−0.003	0.004
	(0.004)	(0.004)
GDP growth	0.626***	0.722***
	(0.133)	(0.162)
Bank flows	−0.000*	−0.000***
	(0.000)	(0.000)
Private credit	0.401**	0.389**
	(0.157)	(0.164)
Inflation	−2.289**	−0.562
	(0.986)	(0.902)
Stock returns	0.447	−0.114
	(0.406)	(0.397)
City FE	Yes	Yes
Time FE	Yes	Yes
R^2	0.47	0.43
First-stage F stat	33.70***	
Cities	57	57
Countries	15	15
Obs	3439	3439

Note: The table reports the results of the first stage of the IV 2SLS estimation of the baseline model in equation (1) in Column (1), and the same regression without the instrumental variable in Column (2). The dependent variable is *REIT flows*, the net equity issues of residential equity REIT. The instrument is the interaction between an indicator for the share of pension funds' portfolios allowed in managed real estate, including REITs, and the growth rate of the relative share of retired population, as $regulation \times \Delta retired$. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market returns. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. First-stage Kleibergen-Paap weak-identification *F* statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10% respectively. The sample period is 2001–2022.

The results on controls are in line with the literature and our expectations. Multifamily house prices tend to increase when both city population and household income grow, and to decline when the unemployment rate increases. The impact of the city-level socioeconomic factors is persistent, and it generally lasts up to a year. Of the country-level macro controls, we find that house price growth is negatively associated with short-term real interest rates, and positively associated

TABLE 3 REIT capital flows and house price growth.

	(1) OLS	(2) IV	(3) IV	(4) IV 6 months	(5) IV 9 months	(6) IV 12 months
House price growth						
REIT flows	0.004***	0.007**	0.010***	0.009***	0.004*	0.008**
	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Population growth	0.674***		0.693***	0.636***	0.603***	0.543***
	(0.163)		(0.157)	(0.157)	(0.166)	(0.175)
Unemployment	−0.002***		−0.002***	−0.001**	−0.002***	−0.002***
	(0.0003)		(0.0004)	(0.0004)	(0.0004)	(0.0005)
Income growth	0.053***		0.052***	0.022	0.045***	0.006
	(0.017)		(0.016)	(0.018)	(0.016)	(0.025)
Short-term rate	−0.001**		−0.001**	−0.0001	0.001**	0.002***
	(0.0004)		(0.0004)	(0.0003)	(0.0004)	(0.001)
GDP growth	−0.038*		−0.032	−0.00002	0.098***	0.025*
	(0.021)		(0.022)	(0.021)	(0.019)	(0.015)
Bank flows	0.00001		0.00001	−0.000002	−0.00002***	−0.00002***
	(0.000004)		(0.000004)	(0.00001)	(0.000004)	(0.000004)
Private credit	−0.024		−0.019	−0.030	0.036**	0.038***
	(0.018)		(0.019)	(0.018)	(0.017)	(0.014)
Inflation	0.484***		0.482***	0.448***	0.598***	−0.031
	(0.069)		(0.072)	(0.096)	(0.055)	(0.147)
Stock returns	0.043***		0.051***	0.058***	0.027**	0.016
	(0.014)		(0.015)	(0.011)	(0.013)	(0.014)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F stat		33.50***	33.70***	33.84***	32.12***	32.57***
Cities	57	57	57	57	57	57
Countries	15	15	15	15	15	15
Obs	3439	3439	3439	3395	3367	3325

Note: The table reports the results of the IV 2SLS estimation of the baseline model in equation (1). The dependent variable is the real house price growth. *REIT flows* are residential REITs' net equity issues. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns. All variables are lagged one period in Columns (1)–(3), and they are lagged 2, 3, and 4 quarters in Columns (4)–(6). The models include city and time fixed effects. Clustered standard errors at the city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of pension funds' investment portfolio allowed to be invested in managed real estate, including REITs, and the growth rate of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. The results of the first stage are reported in Table 2. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

with the inflation rate and stock market return. GDP growth, private credit, and bank flows are significant at longer lags.

4.2 | Do REITs affect house rental markets?

Purchasing, refurbishing and renting properties is the main operations of residential REITs. But, we know little about their aggregate effect on rents. As in the case of house prices, REITs may be associated with increasing rents, by increasing the standard of existing or new rental properties, and demanding higher rents (Garriga et al., 2023; Gurun et al., 2023). But, by expanding the supply of rental properties, their activities could potentially reduce the pressure on constrained rental markets resulting in lower rents, on average. Mills et al. (2019) show that rents are unaffected by buy-to-let investors into single-family housing in the United States and argue that this may be the result of increasing supply of rentals in markets with high demand. To address this empirical question, we estimate Equation (1) with the growth rate of the real rent prices as the dependent variable. By increasing the supply of rental properties in tight markets, and pushing rent prices down, while increasing house prices, REITs may encourage first-time buyers to rent, and postpone homeownership (Beracha & Johnson, 2012). To further explore whether REIT capital flows affect household decision to buy versus rent, we employ the price-to-rent ratio as dependent variable. To determine whether REIT capital flows is related to building construction activity, we subsequently include the growth rate in new residential building permits as the dependent variable and re-estimate our baseline model. Finally, as we document that rents are driven by REIT capital flows, we reestimate Equation (1) including rents as an additional control variable.

We report the results of our estimations in Table 4. We show that REIT capital flows are negatively associated with real rent growth (Column 1). That is, when REIT flows increase, rents tend to decline. The negative association is not transitory, as it is evident, and relatively stronger, at the 1 year horizon (Column 2).

Having documented that REIT capital flows affect both house prices and rent, we turn the attention to their impact on households incentives to buy versus rent their accommodation. In Column (3), we show that REIT capital flows are positively associated with the change in the price-to-rent ratio. However, the effect is significant only at the 1-year horizon (Column 4). As the price-to-rent ratio significantly increases with REIT capital flows, we provide evidence that REITs potentially affect households' decisions of buying versus renting, and are thus altering housing affordability considerations.

To further explore the negative association of REIT capital flows and rent prices, we next turn to the impact of REITs on building construction activity, as an indicator for the supply of housing. If REITs operate by developing and refurbishing residential properties for rental, we expect their operations to significantly increase the housing supply across our sample of cities. Consistently and in line with the time lag between the submission and the issuance of construction permits (Gyourko et al., 2008), we find that REIT capital flows are positively related to residential construction activity at the 1-year horizon as opposed to the shorter horizon (Columns 5 and 6). Finally, we also show that our main results of house price response to REIT capital flows are qualitatively unchanged when rents are included in the model (Column 7).

Overall, our results suggest that by increasing the supply of properties on the rental market, REITs put downward pressure on rents on average, while at the same time they have the potential to significantly affect household decisions to buy versus rent. This indicates that REITs do significantly affect housing affordability.

TABLE 4 REIT capital flows and rental markets.

	(1) Rent growth	(2) Rent growth 12-months	(3) Price-to-rent (growth)	(4) Price-to-rent (growth) 12-month	(5) New permits (growth)	(6) New permits (growth) 12-month	(7) House price growth controlling for rents
REIT flows	−0.011*	−0.021***	0.015	0.026**	−0.031	0.076***	0.009***
	(0.006)	(0.006)	(0.010)	(0.013)	(0.022)	(0.024)	(0.003)
Rent growth							0.087*
							(0.052)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage F stat	10.13***	10.63***	13.29***	12.42***	34.38***	37.39***	23.25***
Cities	51	51	51	51	51	51	51
Countries	15	15	15	15	15	15	15
Obs	2442	2359	2313	2265	2879	2775	2442

Note: The table reports the results of the IV 2SLS estimation of the baseline model in equation (1) for rent prices, price-to-rent ratios, and new building permits. The dependent variables are the real rent growth (Columns 1–2), the growth rate of the price to rent ratio (Columns 3–4), the growth rate of new residential building permits (Columns 5–6), and the real house price growth (Column 7). *REIT flows* are net equity issues by residential REITs. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market return. All variables are lagged 1 quarter in Columns (1), (3), (5), and (7), and they are lagged 4 quarters in Columns (2), (4), and (6). The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of pension funds' investment portfolio allowed to be invested in managed real estate, including REITs, and the growth rate of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification *F* statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

4.3 | Long-run effects of REIT capital flows on house prices

After establishing the causal link between house prices and REITs, we move to explore whether this relationship is relevant in the long run. To do so, we estimate a panel error correction model (ECM) where house price growth is explained by its lagged values, and current and lagged values of REIT capital flows, a set of controls as well as an unobserved set of common factors. The dynamic specification of the model is selected to eliminate serial correlation from the residuals. We select the optimal number of lags based on the SIC criterion on a country-by-country basis and then impose the same lag structure for all countries in our panel for the interpretation of short- as well as the long-run estimations. Moreover, as shown by Chudik and Pesaran (2015), the inclusion of a number of lags of the cross-sectional averages of the dependent and independent variables in the model deals with the omitted variable biases and returns consistent estimators. This model is known as the cross-sectionally augmented ECM, or CS-ECM. One advantage of this methodology is that it allows for a combination of I(0) and I(1) variables, which is the case in our exercise according to the Im-Pesaran-Shin unit-root test. A long-run relationship between the variables is necessary. We thus test our panel for cointegration prior to estimating our model and both the Westerlund test and the Pedroni test for cointegration can reject the null of no cointegration at 1%. We also note that the existence of a statistically significant adjustment term in the ECM is itself evidence of the presence of cointegration. Finally, to justify our use of a CS-ECM model we rely on the Pesaran CD test for cross-section dependence and we reject the null of weak cross-sectional dependence at 1%. We employ mean-group (MG) estimators and allow for an heterogeneous exposure of house prices to REIT capital flows both in the short and the long run across our sample of countries. There is a significant variation in the level of financialization of housing markets across countries, thus we expect differences in both the structure of countries' financial system and the stage of financial development to be reflected in different effects of REIT capital flows on house prices. And these effects will not only relate to short-run dynamics but also long-run effects.

The specification of the CS-ECM is as follows:

$$\Delta house_{i,j,t} = \phi_i(house_{i,j,t-1} - \beta_{0,i} - \beta_{1,i} flows_{i,t}) + \sum_{l=1}^{1} \delta_{1,i,l} \Delta house_{i,j,t-l} + \sum_{l=0}^{1} \delta_{2,i,l} \Delta flows_{i,t-l} +$$

$$+ \delta_{3,i} \Delta controls_{i,j,t} + \sum_{l=1}^{3} \gamma_{i,l} \overline{z_{t-l}} + \mu_i + \psi_t + \epsilon_{i,j,t}, \quad (2)$$

where the long-run effects are captured by β, ϕ is the speed of adjustment, while δ identifies the effect of short-run dynamics. Following the SIC criteria, we include 1 lag of the dependent variable *house* and 1 lag for $flows$. In line with Chudik and Pesaran (2015, p.394), we include enough lags of the cross-sectional averages z to remove cross-sectional dependence, that is 3 lags in our specification. We estimate the model for the full sample period 2001–2022, by applying least squares. As in model (1), *house* is the house price growth, $flows$ are residential REIT capital flows, and *controls* include population growth, unemployment, and income growth at city level and short-term real interest rates, bank flows, real GDP growth, domestic private credit, inflation, and stock market returns at the country level. We include dummies for time and country effects.

Focusing on the long-run impact of REIT capital flows on house prices, we report the CS-ECM estimations in Table 5. We find that REIT capital flows have consequential effects for housing markets in the long run. The positive and significant coefficient indicates that house price growth

TABLE 5 The long-run relationship between REIT capital flows and house price growth.

House price growth	CS-ECM
REIT flows	0.034***
	(0.011)
Adjustment term (ϕ)	−0.306***
	(0.100)
Controls	Yes
Cross-sectional averages	Yes
CD test	0.233
p-ee value	0.82
RMSE	1.59
R^2	0.26
Cross-sections	26
Obs	2068

Note: Results of the estimation of the CS-ECM (1,1,3) model in equation (2). The dependent variable is the real house price growth. *REIT flows* are residential REITs' net equity issues. Lags of the dependent and independent variables are (1,1) determined according to the BIC criterion from individual regressions. Lags of the cross-sectional averages are 3 to clear cross-section dependence following Chudik and Pesaran (2015). City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market returns. Robust standard errors are reported below the coefficients. Statistics of the cross-sectional dependence (CD) test by Pesaran (2015) for weak cross-sectional dependency versus strong dependency, and RMSE are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

increases with REIT capital flows. And this effect is robust to the inclusion of our standard fundamental controls. The effect is large, as a unit increase in net equity issues (in million USD) is associated in the long run with house prices increases of 3.4%. This is economically significant, as quarterly residential REIT capital flows are over $360 million, on average.

We also find that the adjustment term is negative and statistically significant, confirming the existence of a significant long-run relationship between house price growth and REIT capital flows, and that around 30% of the adjustment is completed within a quarter. Our estimates thus suggest that it takes a little less than an year on average to adjust from disequilibrium.

5 | ROBUSTNESS TESTS

5.1 | Instrument validity

In this section, we report a series of tests to support the validity and relevance of our instrument.

Although the exclusion restriction is not directly testable, we offer some insights and test whether the share of the retired population is related to house price dynamics aside from the pension funds demand, by regressing the change in the share of retired population on house price growth for the periods/countries where pension funds are not allowed by regulation to invest in REITs, thus cancelling out the pension funds channel. In designing this test, we follow the types of tests that are used in the context of shift-share instruments, although our instrument is not

TABLE 6 IV robustness tests.

House price growth	(1) Exclusion restriction test (OLS)	(2) Contemporaneous controls (IV)
Δ*retired*	−1.860	0.013***
	(1.782)	(0.004)
Controls	Yes	Yes
City FE	Yes	Yes
Time FE	Yes	Yes
First-stage F stat		34.30***
Cities	22	57
Countries	4	15
Obs	362	3456

Note: The table reports the results of the regression of real house price growth on the percentage change in the share of the retired population for periods when pension funds are not allowed to invest in REITs by regulation (details of regulation in Table A1 in the Appendix and Figure 3) in Column (1), and the model in equation (1) with contemporaneous controls in Column (2). The dependent variable is the real house price growth. Δ*retired* is the percentage change in the share of retired population. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rate, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns. All variables are lagged one period in Column (1). The model includes city and time fixed effects. Clustered standard errors at the city level are reported below the coefficients. In Column (2), first-stage Kleibergen-Paap weak-identification *F* statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

strictly of this type.[30] We exploit the variation in regulation to shut down the pension funds channel and show that changes in the retired population do not affect house price growth when the channel is closed (i.e., for $regulation = 0$). We report the results in Table 6 (Column 1). This subset is necessarily smaller than our main one, but results suggest that in the absence of a pension fund channel, our effect is not present.

Furthermore, our baseline specification includes a comprehensive set of drivers of house prices capturing the socioeconomic conditions at city and country levels (Aizenman & Jinjarak, 2009; Garriga et al., 2023), alleviating concerns of omitted variable biases. Nonetheless, for robustness we test that including contemporaneous factors does not alter our results, as shown in Table 6 (Column 2). We further confirm that biases from omitted variables are not likely to be affecting our results with the omitted variable bias test developed by Oster (2019). The test determines how important the omitted variables would need to be relative to the observable ones to eliminate the estimated effect. Applying different restrictive assumptions with respect to the explanatory power of the omitted variables following the thresholds in Oster (2019), we find that our estimates are robust and their magnitude is left unaffected. We report the results of the test in Table 7. It is important to note that as the test is applied to OLS models, we compare these coefficients with our results in Column (1) of Table 3.

[30] Although our instrument does have a shift component, the regulatory changes that allow pension funds to invest in REITs, this shift is not global as it takes place at different times for different countries and it happened before the start of the sample period for most countries. This makes the use of standard parallel pretrends and placebo tests not directly applicable to our case.

TABLE 7 IV—Oster (2019) omitted variable bias test.

(a) Baseline test—Beta			
	(1) $\delta = 0$	**(2)** $\delta = 1$ $R_{max} = 1.3(\widetilde{R})$	**(3)** $\delta = 1$ $R_{max} = 2.2(\widetilde{R})$
Baseline (Table 3)			
beta (β_1)	0.0037	0.00348	0.00352
(b) Alternative test—Delta			
		(1) $\beta_1 = 0$ $R_{max} = 1.3(\widetilde{R})$	**(2)** $\beta_1 = 0$ $R_{max} = 2.2(\widetilde{R})$
Baseline (Table 3)			
delta (δ)		6.682	1.847

Note: The table reports the results of Oster (2019) test for omitted variable bias. Panel (a) reports beta (β_1), the coefficient of the main variable of interest (REIT flow) for the baseline model in Equation (1) presented in Table (3) under different scenarios. Column (1) reports the beta for the baseline model with the controls (OLS estimation). Columns (2) and (3) report the betas consistent with the unexplained R^2 assumed to be 1.3 times and 2.2 times the R^2 in the baseline, following Oster (2019), respectively. Panel (b) is based on the alternative approach of measuring the relative importance of any omitted variables, the delta (δ), for the coefficient of REIT flows (β_1) to be equal to zero.

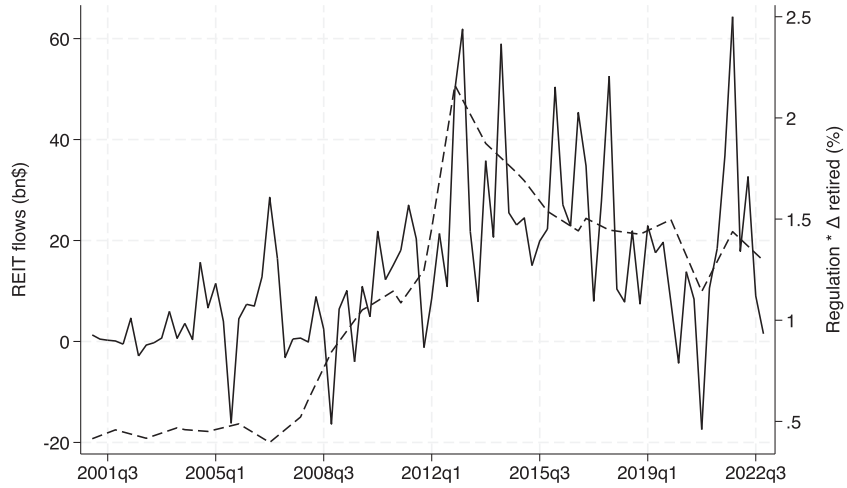

FIGURE 4 REIT capital flows (solid line, left axis) and the IV (dashed line, right axis)—dynamics. The plot reports the dynamics of the aggregate REIT flows (in billion USD) across countries together with the dynamics of the instrumental variable (in %). The instrumental variable is the growth in the share of the retired population interacted with an indicator for the portfolio investment threshold set by regulation allowing pension funds into managed real estate investments, averaged across countries.

In support of the relevance of our instrumental variable and to provide evidence that the IV drives REIT flows, we show that there is a common pattern between REIT flows and the share of the retired population when pension funds are permitted to invest in REITs. As shown in Figure 4, both variables start from relatively low levels in the early 2000s, increase up to the 2012 to then decline at the end of our sample period. Indeed, countries with higher growth in the share of

TABLE 8 IV Placebo test.

	REIT flows
Regulation × Δ*working*	0.079
	(0.082)
Controls	Yes
City FE	Yes
Time FE	Yes
First-stage F test	0.91
Cities	57
Countries	15
Obs	3439

Note: The table reports the results of the first stage of the IV 2SLS estimation of the baseline model in equation (1) with an alternative IV based on the growth in the working population as opposed to the retired population. *REIT flows* are residential equity REITs' net equity issues. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. Kleibergen-Paap weak-identification *F* statistics are reported. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

retired population on average tend to exhibit higher REIT capital flows (see Figure 4A in the Appendix).

Finally, to further verify the validity of our instrument, we conduct a placebo test for the relevance of the growth rate of the share of the retired population as key driver of REIT flows. The validity of our instrument is based on the key role of the retired population in driving pension funds exogenous demand for REITs, and subsequently REITs capital flows. Indeed, the growth in the share of the retired population increases the demand for liquid and stable cash flow assets such as REITs due to its impact on the current *liabilities*. However, when the share of the working population increases, it is the current *contributions* to the pension funds that increase. Hence, there would be no exogenous demand of REITs by pension funds related to changes in the working population. We offer empirical evidence of this by building an alternative IV from the changes in the share of the working population, measured as the share of the total population between 20 and 64 years of age. We employ this alternative IV in the baseline model in equation (1) and report the results of the first stage in Table 8. As expected, we find that the share of the working population when pension funds can invest in REITs is not significantly related to REIT capital flows.

5.2 | Alternative REIT capital flows

In this section, we test the robustness of our results to alternative measures of REIT capital flows.

First, we consider capital flows to all equity REITs, irrespective of their specialization. Second, we focus on the subset of residential equity REITs that are dedicated to residential real estate, excluding diversified REITs. Third, we focus on REITs that are dedicated to single-family residential properties. Institutional investors have traditionally been active in the multifamily (flats or apartments) property market, but recently there has been an increased interest in single-family properties (Allen et al., 2018; Christophers, 2022; Gurun et al., 2023; Mills et al., 2019; Molloy & Zarutskie, 2013). This trend is evident in the United States, but it is emerging in other markets as

well. The subset for this analysis includes 7 US REITs. In our dataset, we have a UK REIT and a Canadian REIT in this category, but we exclude them from our sample due to the low number of observations. For this analysis, we collect house price and rent price data for single-family properties from Zillow. Finally, we measure REIT activity with their performance in the stock market as measured by the returns on REIT indices. This variable is the GPR REIT index for the countries, supplemented by the GPR General Index that includes the returns of all listed property companies when the REIT index is not available. For Bulgaria there is no GPR indices, so we collect market price data from Orbis and we average REIT returns across all REIT stocks available to build the country REIT index.

We report the results for house price growth in Table 9. We confirm our main findings and show that the effect of REITs on house price growth is positive and significant considering the broader group of equity REITs both at the short and relatively longer horizon of 12 months (Columns 1 and 2). The impact of REIT capital flows is an order of magnitude smaller for general equity REIT capital flows as opposed to the specific residential equity REIT capital flows (0.003 vs. 0.01, as reported in Column (3) of Table 3). This is expected as these flows are not specific to the housing sector, but rather include all other sectors such as retail, commercial, industrial, etc.

Next, we focus on the narrower group of dedicated residential equity REITs in Table 9 (Columns 3 and 4) and we show that their impact is in line, if stronger, with the effect documented in the main analysis that includes diversified REITs operating in residential real estate alongside other sectors.

Next, we focus on the narrower group of residential single-family US REITs in Table 9 (Columns 5 and 6) and we show that single-family house price growth is not affected by capital flows into single-family REITs. Hence, we find that the effect is specific to multifamily housing as documented in the main analysis.

Finally, Table 9 (Columns 7 and 8) shows that house price growth is associated with REITs at both the short and 12-month horizons when considering their past stock market performance. That is, when the past REIT stock performance is positive, house price growth increases.

The results for house rent growth on alternative REIT capital flows reported in Table 10 also confirm our main results for rental markets. In particular, we show that rents decline with capital flows toward equity REITs in general (Columns 1 and 2), dedicated residential REITs (Columns 3 and 4), and with REIT past stock market performance (Columns 7 and 8). Similarly to the results for house prices, we do not find any effect on single-family rent prices of capital flows into single-family residential REITs (Columns 5 and 6).

In conclusion, we show that our results for multifamily residential housing markets are robust to alternative measures of REIT capital flows.

5.3 | Sustained REIT flow growth in the post-GFC period and house price volatility around the COVID-19 episode

Looking at the dynamics of REIT flows and house price growth in Figure 2, we see how REIT capital flows have been persistently positive in the period post-GFC. At this time house price growth around the world has generally increased as well. Turning to the end of our sample period, house price growth slowed down markedly during the COVID-19 episode, on average. In this section, we test the robustness of our results to these periods.

First, we reestimate our baseline model for the period post-GFC, starting in 2010. We report the results in Table 11 (panel a). Overall, we confirm the main results for the period of high REIT

TABLE 9 REIT capital flows and house price growth—robustness tests.

House price growth	(1) Alternative REIT flows *(multifamily)*	(2) 12 months *(multifamily)*	(3) Alternative REIT flows *(multifamily)*	(4) 12 months *(multifamily)*	(5) Alternative REIT flows (US only) *(single-family)*	(6) 12 months *(single-family)*	(7) REIT index *(multifamily)*	(8) 12-months *(multifamily)*
General REIT flows	0.003***	0.002*						
	(0.001)	(0.001)						
Specialized residential REIT flows			0.012***	0.009**				
			(0.003)	(0.004)				
Single-family residential REIT flows					0.004	−0.013		
					(0.007)	(0.011)		
REIT index							0.054**	0.023*
							(0.023)	(0.014)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	No	No	Yes	Yes
First-stage F stat	46.52***	49.66***	29.04***	32.36***	14.02***	10.15***	59.16***	74.67***
Cities	57	57	52	52	10	10	57	57
Countries	15	15	12	12	1	1	15	15
Obs	3439	3325	2571	2458	870	840	3439	3325

Note: Results of different specifications of the baseline model in equation (1). The dependent variable is the real house price growth. In Columns (1) and (2), general REIT flows are aggregate net equity issues by all equity REITs irrespective of their specialization. In Columns (3) and (4), specialized residential REIT flows are aggregate net equity issues by equity REITs dedicated exclusively to residential real estate. In Columns (5) and (6), house price growth is the growth in single family real house prices (from Zillow) and REIT flows are net equity issues of single-family residential REITs. In Columns (7) and (8), the REIT index is used in place of REIT flows. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns. All variables are lagged. The models include city and time fixed effects, except for Columns (5) and (6) that only include city fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of investment portfolio by pension funds allowed to be invested in REITs and the rate of change of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

TABLE 10 REIT capital flows and rent growth—robustness tests.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rent growth	**Alternative REIT flows *(multifamily)***	**12 months *(multifamily)***	**Alternative REIT flows *(multifamily)***	**12 months *(multifamily)***	**Alternative REIT flows (US only) *(single-family)***	**12 months *(single-family)***	**REIT index *(multifamily)***	**12-month *(multifamily)***
General REIT flows	−0.005***	−0.012***						
	(0.002)	(0.004)						
Specialized residential REIT flows			−0.018**	−0.023***				
			(0.008)	(0.004)				
Single-family residential REIT flows					−0.118	0.0002		
					(0.068)	(0.008)		
REIT index							−0.012***	−0.024***
							(0.005)	(0.012)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	No	No	Yes	Yes
First-stage F stat	13.61***	13.08***	9.96**	11.92***	2.64	15.89***	46.60***	43.14***
Cities	51	51	46	46	10	10	51	51
Countries	15	15	12	12	1	1	15	15
Obs	2442	2359	1864	1794	310	280	2442	2359

Note: Results of different specifications of the baseline model in equation (1). The dependent variable is the real rent growth. In Columns (1) and (2), general REIT flows are aggregate net equity issues by all equity REITs irrespective of their specialization. In Columns (3) and (4), specialized residential REIT flows are aggregate net equity issues by equity REITs dedicated exclusively to residential real estate. In Columns (5) and (6), rent growth is the growth in single family real rent prices (from Zillow) and REIT flows are net equity issues by single-family residential REITs. In Columns (7) and (8), the REIT index is used in place of REIT flows. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns. All variables are lagged. The models include city and time fixed effects, except for Columns (5) and (6) that only include city fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of investment portfolio by pension funds allowed to be invested in REITs and the rate of change of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

TABLE 11 REIT capital flows and the housing market—subsample periods.

(a) Post-GFC period of sustained REIT flow growth (2010–2022)				
	(1)	**(2)**	**(3)**	**(4)**
	House price growth		**Rent growth**	
	baseline	**12 months**	**baseline**	**12 months**
REIT flows	0.016***	0.012**	−0.012**	−0.023***
	(0.004)	(0.006)	(0.005)	(0.004)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Time (years) FE	Yes	Yes	Yes	Yes
First-stage F stat	27.35***	25.62***	14.54***	15.77***
Cities	57	57	57	57
Countries	15	15	15	15
Obs	2495	2468	2082	2032
(b) Controlling for house price moves during COVID-19 pandemic				
	(1)	**(2)**	**(3)**	**(4)**
	House price growth		**Rent growth**	
	baseline	**12 months**	**baseline**	**12 months**
REIT flows	0.010***	0.008**	−0.011*	−0.021***
	(0.003)	(0.004)	(0.006)	(0.005)
Dummy COVID	−0.013*	0.004	0.009*	−0.011*
	(0.008)	(0.008)	(0.005)	(0.006)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
First-stage F stat	33.69***	32.57***	9.78**	10.51***
Cities	57	57	57	57
Countries	15	15	15	15
Obs	3439	3325	2442	2359

Note: Results of different specifications of the baseline model in equation (1) for the period post-GFC (2010–2022) in panel (a), and including a dummy for the COVID-19 period in panel (b). The dependent variable is the real house price growth in Columns (1)–(2) and real rent growth in Columns (3)–(4). Controls include population growth, unemployment rate, and income growth at city level, and domestic short-term real interest rate, real GDP growth, bank flows, domestic private credit growth, inflation rate, and stock market returns at country level. All variables are lagged. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of investment portfolio by pension funds allowed to be invested in REITs and the change in the relative share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2010–2022 in panel (a), and 2001–2022 in panel (b).

capital flow growth in the post-GFC period for both house price growth (Columns 1 and 2) and rent growth (Columns 3 and 4).

To further control that our results are not driven by extreme moves in house prices, we augment the baseline model with a dummy for the period around the pandemic from 2020 to 2022. We report the results in Table 11 (panel b). Overall these results confirm that the impact of REIT capital flows on house price growth and rent price growth is not driven by the market conditions around the COVID-19 pandemic episode.

These results provide further support for the role of REIT capital flows in housing markets, taking into consideration different dynamics across market distress episodes.

6 | CONCLUSION

The role of institutional investors in housing markets has attracted considerable recent attention, but the focus of the empirical literature linking institutional investors and house price dynamics have mostly been on the US housing markets. This article exploits the relatively similar regulatory framework of REITs around the world to tackle the question of the relevance of institutional investors in housing markets from a cross-country perspective. Although REITs have been relatively less studied in the literature, they have registered dramatic increases in their valuation and capital flows in the last decade. Importantly, differently from other institutional investors, REITs' regulatory framework puts pressure on their need for external capital to pursue investment.

We document that residential equity REITs are important drivers of multifamily house prices, as well as rent prices. Interestingly, while capital flows into REITs are associated with higher house prices, the relation with rents is negative. This indicates that residential equity REITs offer a potential channel for reducing the pressure on constrained rental markets. Indeed, we show that REITs operations are associated with increasing construction activity. We also show that the effect is specifically related to multifamily housing, whereas we do not find any effects on single-family housing.

Moreover, our analysis suggests that the impact of residential equity REITs on multifamily house prices is consequential for the long-run developments of house prices. This indicates a likely significant impact of financialization on the structure of the housing market, and how REITs contribute potentially to the build-up of vulnerability to the stability of housing markets around the world.

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APPENDIX A

TABLE A1 Regulation of REIT industry.

Country	Date of introduction	Other forms/names	Dividend requirements (% of net income)	Real estate related asset requirement (% of total assets)	Leverage restrictions (LTV or debt % total assets)
Australia	1985	Unit trusts, such as listed property trust (LPT), managed investment trust (MIT), attribution managed investment trust (AMIT)	100% for MITs	100% for public unit trusts, MITs and AMITs	none
Belgium	1995 (SICAFI), 2014 (REITs)	BE-REIT	80%	100%	65% of assets (at fair value)
Bulgaria	2004	Special purpose investment company (SPIC)	90%	70%	Short-term debt below 20% of income-generating assets
Canada	1994	—	none	80%	none
France	2003	F-REIT or societes d'investissements immobiliers cotees (SIIC)	95% (and 70% of capital gains)	80%	none
Greece	1999	REIC	50%	80%	75%
Ireland	2013	—	85%	75%	50% of assets (market value)
Israel	2006	—	90% (and 100% of capital gains)	75%	60% of income-yielding real estate assets (80% of rent related real estate & 20% of other assets)
Japan	2000	J-REIT	90%	95%	55% to 60%
Singapore	2002	S-REIT	90%	75%	45% to 50%
Spain	2009	Spanish REIT, SOCIMI	80% of profits from income on exempted assets (50% of capital gains)	80%	none

(Continues)

TABLE A1 (Continued)

Country	Date of introduction	Other forms/names	Dividend requirements (% of net income)	Real estate related asset requirement (% of total assets)	Leverage restrictions (LTV or debt % total assets)
Thailand	1992 (PFPO), 2007 (REITs)	Property fund for public offering (PFPO) (before 2007)	90%	75%	10%
Turkey	1995	REIC	none	100%	5× shareholders' equity
United Kingdom	2007	UK-REIT	90%	75%	interest cover ratio of 1.25
United States	1960	—	90%	75%	none

Note: The table presents key details of the regulatory framework around REITs in the countries in our sample. Details are from the EPRA Global REIT Survey 2022, available at https://www.epra.com/application/files/5316/7040/5763/EPRA_Global_REIT_Survey_2022_ONLINE.pdf.

TABLE A2 REIT market size.

Country	(1) Market Capitalization (mln$ 2022)	(2) … as a % of GDP	(3) Share of FTSE EPRA Nareit Global REITs Index (2022)	(4) Number of Equity REITs in our sample	(5) … of which Residential (including Diversified active in residential sector)
United States	1,320,153	5.13%	67.01%	247	45
Japan	117,798	2.77%	7.48%	64	16
Australia	89,142	5.27%	3.87%	60	8
United Kingdom	77,692	2.51%	4.85%	60	16
Singapore	70,155	14.07%	3.50%	51	1
Canada	59,915	2.77%	2.98%	50	14
France	38,525	1.39%	0.98%	31	5
Spain	22,390	1.58%	0.39%	56	27
Belgium	21,237	3.64%	1.16%	17	4
Thailand	12,665	2.56%	—	61	7
Turkey	7001	0.77%	0.05%	34	10
Greece	2608	1.20%	—	5	2
Israel	2562	0.49%	—	6	3
Bulgaria	725	0.80%	—	19	6
Ireland	686	0.13%	0.04%	4	2

Note: The table presents key statistics about the size of REIT markets in the countries in our sample. Data for Columns (1) to (3) is from the EPRA Global REIT Survey 2022 available at https://www.epra.com/application/files/5316/7040/5763/EPRA_Global_REIT_Survey_2022_ONLINE.pdf. GDP data are from the World Bank. Data reported in Columns (4) and (5) relate to our data set of equity REITs from Compustat. We first select all REITs with Standard Industry Classification (SIC) code 6798, we then select residential equity REITs with the global industry classification standard (GICS) codes 60101060, 60106010 and 60106020. There are also REITs that operate in more than one sector and for these diversified REITs, we manually check information on their business in Orbis and classify them as residential equity REITs if the description of "industry & activities" in the "company profile" report mentions residential operations.

TABLE A3 Largest international REITs by country.

Country	(1) Largest residential equity REITs	(2) MKT CAP (mln$ 2022)	(3) Sector	(4) Operations (residential only)	(5) Location of residential properties
Japan	Nomura Real Estate Master	5698.07	Diversified	Purchase and management of rental apartment buildings	Metropolitan areas (Tokyo (75%), Chukyo area and Kinki area (25%)
	Daiwa House REIT	3940.61	Diversified	Purchase and management of rental apartment buildings	Metropolitan areas (Tokyo (66%) and other central and Kinki areas)
	Advance Residence	3336.65	Residential	Purchase and management of rental apartment buildings	Central Tokyo (over 70%), Tokyo metropolitan area and ordinance-designated cities
Australia	Stockland	5751.53	Diversified	Development and marketing of residential properties, as well as management of rental residential communities and apartments	Nationwide (including urban areas)
	Mirvac Group	5229.01	Diversified	Development and marketing of residential properties, and management of rental residential communities and apartments	Large cities
	Ingenia Communities Group	1086.37	Residential	Development, investment and operation of managed rental accommodation for senior citizens	Nationwide (including urban areas)
United Kingdom	Land Securities Group	5404.35	Diversified	Development and marketing of residential properties (apartment buildings, including mixed-use urban neighbourhoods)	Large cities (including Central London)
	LXI REIT	2262.56	Diversified	Investment in rental properties including serviced apartments	Nationwide
	PRS REIT	574.43	Residential	Development and management of rental properties including family homes	Large cities (and other regional areas)
Singapore	Capitaland Ascott Trust	2606.63	Residential	Investment in rental properties including serviced residences and rental housing properties	Singapore and abroad

(Continues)

TABLE A3 (Continued)

Country	(1) Largest residential equity REITs	(2) MKT CAP (mln$ 2022)	(3) Sector	(4) Operations (residential only)	(5) Location of residential properties
Canada	Canadian Apartment Properties	5348.53	Residential	Investment and management of multi-unit rental properties, including apartment buildings, townhouses, and manufactured home communities	Major urban centers across Canada
	Boardwalk	1663.69	Residential	Development, investment and management of multifamily rental communities	Urban areas around the country
	Killam Apartment	1392.20	Residential	Development, investment and management of rental apartment buildings and home communities	Major urban centers
France	Altarea SCA	2624.19	Residential	Development and management of rental properties, including apartments and individual houses	Ile-de-France region and south of France
	Fonciere Dev Logements	518.80 (2016)	Residential	Acquisition, development and management of rental properties including apartment buildings	Countrywide, including urban areas
	ANF Immobilier	423.29 (2017)	Diversified	Investment and management of rental properties	Large cities
Spain	Vivenio Residencial	967.38	Residential	Acquisition, refurbishment, and sale of residential properties, as well as management of rental properties including apartments	Urban areas
	Elix Vintage Residencial	432.71	Residential	Acquisition, rehabilitation and management of rental properties including apartments	Central Madrid and Barcelona
	Fidere Patrimonio	405.07	Residential	Investment, acquisition, development and management of rental properties including apartments	Large cities (mainly Madrid)

(Continues)

TABLE A3 (Continued)

Country	(1) Largest residential equity REITs	(2) MKT CAP (mln$ 2022)	(3) Sector	(4) Operations (residential only)	(5) Location of residential properties
Belgium	Xior Student Housing	1024.96	Residential	Development and management of student housing	Belgium and international
	Care Property Invest	446.18	Residential	Development and management of residences for elderly residents	Antwerpen and countrywide
	Home Invest Belgium	398.51	Residential	Development and management of rental properties including apartments	Mostly in Brussels and some other locations in the country
Thailand	Land & Houses Freehold REIT	55.78	Residential	Investment and management of rental units and apartment projects	Bangkok area
	Multi-national Residence	8.45	Residential	Investment and management of rental properties including private houses, apartments, serviced apartments, and condominiums	Bangkok and other provinces
	Trinity Freehold & Leasehold	7.29	Diversified	Investment, development, marketing of residential properties, as well as management of rental properties	Bangkok area
Turkey	Emlak Konut GYO	1782.35	Residential	Development and marketing of residential properties including apartments and home communities	Istanbul and other urban areas
	Torunlar GYO	1036.94	Diversified	Development and marketing of residential properties including apartment buildings	Istanbul and other urban areas
	Ozak GYO	801.83	Diversified	Development and marketing of residential projects	Urban areas around the country
Greece	Prodea Real Estate	2268.41	Diversified	Development and marketing of residential properties, and management of rental properties	Urban areas in Greece and international (Cyprus and South East Europe)
	Intercontinental International REIC	71.79	Diversified	Development and marketing of residential houses, apartments, townhouses	Urban areas

(Continues)

TABLE A3 (Continued)

Country	(1) Largest residential equity REITs	(2) MKT CAP (mln$ 2022)	(3) Sector	(4) Operations (residential only)	(5) Location of residential properties
Israel	REIT 1	965.39	Diversified	Development and marketing of residential properties, and management of rental properties including single and multifamily residences and apartments	Countrywide including Tel aviv (34%), Central Israel (44%) and other areas
	REIT Azorim-Living	208.24	Residential	Development and marketing of residential properties, and management of rental properties	Countrywide
	Megureit Israel	185.23	Residential	Development and management of rental properties including single-family homes, apartment buildings and townhouses	Urban areas around the country
Bulgaria	Bulgarian Real Estate	36.10	Diversified	Development and marketing of residential properties	Urban areas countrywide
	Roi Property Fund REIT	26.33	Diversified	Development and marketing of residential properties, as well as management of rental properties	Not specified
	Prime Property GG REIT	12.65	Diversified	Development and marketing of residential projects	Urban areas countrywide
Ireland	Irish Residential Properties	686.09	Residential	Development and management of multi-unit rental real estate	Major urban centers
	Yew Grove	96.21 (2020)	Diversified	Development and management of rental properties	Urban areas countrywide

Note: The table provides information on the investment strategy and portfolios of the largest international residential equity REITs in our sample, gathered from Orbis, financial statements, and REIT websites. In Column (2), stock market capitalization (MKT CAP) is reported in $ million as of end 2022 for most REITs, excluding those that were delisted (last available year is in bracket). Sector "Diversified" in Column (3) includes residential. In Columns (4) and (5), operations and location are exclusively about the residential real estate business and do not include information related to other sectors in which diversified REITs operate.

TABLE A4 Residential equity REIT capital flows by country.

Country	Aggregate capital flows into residential REITs (2001–2022) (% of GDP)	Aggregate capital flows into residential REITs (2001–2022) (bn$)
Australia	1.22%	16.42
Belgium	0.35%	1.62
Bulgaria	0.12%	0.07
Canada	0.40%	9.33
France	0.15%	4.19
Greece	0.34%	0.81
Ireland	0.22%	1.02
Israel	0.26%	1.19
Japan	0.06%	2.85
Singapore	0.59%	2.82
Spain	0.16%	2.01
Thailand	−0.01%	−0.08
Turkey	0.28%	6.81
United Kingdom	0.39%	16.54
United States	0.34%	86.68
Total	4.87%	152.27

TABLE A5 Detailed description of house price data.

Country	Cities	Sample period	Tenure	Variable description	Data source
Australia	Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney	2003–2022	Multifamily	Average transaction prices for new and existing multifamily dwellings	OECD National and Regional House Price Indices (from Australian Bureau of Statistics)
Belgium	Antwerpen, Bruxelles, Gent	2010–2022	Multifamily	Median transaction prices of apartments	Statistics Belgium
Bulgaria	Plovdiv, Sofia, Varna	2015–2022	Multifamily	Average transaction prices for new and existing dwellings (apartments)	National Statistical Institute of Bulgaria
Canada	Calgary, Montreal, Ottawa, Toronto, Vancouver, Victoria	2001–2022	Single family*	Average transaction prices for new single-family dwellings	OECD National and Regional House Price Indices (from Statistics Canada)
France	Lyon, Marseilles, Paris	2001–2022	Multifamily	Average transaction prices for existing multifamily dwellings	OECD National and Regional House Price Indices (from National Institute of Statistics and Economic Studies)
Greece	Athens	2006–2022	Multifamily	Bank of Greece valuation data collected by the credit institutions and indices provided by private sources. Covers new and existing apartments. Average values.	OECD National and Regional House Price Indices
Ireland	Dublin	2005–2022	Multifamily	Average transaction prices for new and existing multifamily dwellings	OECD National and Regional House Price Indices (from Central Statistical Office)
Israel	Haifa, Jerusalem, Tel Aviv	2017Q4–2022	All	Average transaction prices for new and existing dwellings	Central Bureau of Statistics

(Continues)

TABLE A5 (Continued)

Country	Cities	Sample period	Tenure	Variable description	Data source
Japan	Nagoya, Osaka, Tokyo	2008–2022	Multifamily	Average transaction prices for new and existing multifamily dwellings (Condominiums)	OECD National and Regional House Price Indices (from Ministry of Land, Infrastructure, Transport and Tourism)
Singapore	Singapore	2001–2022	Multifamily	Average resale prices of flats	Department of Statistics Singapore
Spain	Barcelona, Madrid, Valencia	2007–2022	All	Average transaction prices for new and existing dwellings	National Statistics Institute
Thailand	Bangkok	2011–2022	Multifamily	Average transaction prices for condominium in Bangkok and vicinities	Bank of Thailand
Turkey	Ankara, Istanbul, Izmir	2010–2022	All	Appraisal value of existing dwellings	OECD National and Regional House Price Indices (from Central Bank of the Republic of Turkey)
United Kingdom	Birmingham, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Sheffield, Southampton/Portsmouth	2001–2022	Multifamily	Average transaction prices for new and existing flats and maisonettes	HM Land Registry
United States	Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, San Diego	2001–2022	Multifamily	Zillow Home Value Index (ZHVI) is the typical value for condo/coop (USD) in the 35th to 65th percentile range	Zillow

Note: The table presents the data details and sources for house prices included in our analysis. House price data may be available from the listed sources for longer periods than indicated, but the sample period of our analysis begins in 2001 when the OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers starts and ends in 2022, the latest year available. Also to note that some countries do enter our data set later, when REITs have been introduced. Specific dates when REITs are introduced are reported in Table A1. *Multifamily house price data for Canadian cities are available from Statistics Canada starting from 2017. We use these data in a robustness exercise (see Section 3.2 for a discussion).

TABLE A6 Detailed description of rent data.

Country	Cities	Sample period	Tenure	Variable description	Data source
Australia	Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney	2001–2022	All	CPI—Actual rental cost	Australian Bureau of Statistics (Table 9, Consumer Price Index)
Belgium	Country-level only	2001–2022	All	CPI—Actual rental cost	Statistics Belgium
Bulgaria	Country-level only	2001–2022	All	CPI—Actual rental cost	OECD
Canada	Calgary, Montreal, Ottawa, Toronto, Vancouver, Victoria	2001–2022	Multifamily	Historical Average Rents—Apartments	Canada Mortgage and Housing Corporation
France	Paris (no city level data for Lyon and Marseilles)	2001–2022	All	Rent index—All sectors—Paris urban area	National Institute of Statistics and Economic Studies (INSEE)
Greece	country-level only	2001–2022	All	CPI—Actual rental cost	OECD
Ireland	Dublin	2008–2022	Multifamily	RTB Average Monthly Rent Report—Apartments—All bedrooms	Residential Tenancies Board
Israel	Country-level only	2001–2022	All	CPI—Actual rental cost	OECD
Japan	Nagoya, Osaka, Tokyo	2001–2022	All	Tokyo: House rent private (Ku- Area Tokyo). Others: House rent, less imputed rent	Official Statistics of Japan
Singapore	Singapore	2001–2022	All	Rental Index of Private Sector Residential Properties	Urban Redevelopment Authority
Spain	Barcelona, Madrid, Valencia	2002–2022	All	CPI—Housing, water, electricity, gas and other fuels	Spanish National Institute of Statistics (INE)
Thailand	Bangkok	2010–2022	Multifamily	Monthly average rent apartment (1 bedroom) in city center	Statista
Turkey	Ankara, Istanbul, Izmir	2005–2022	All	CPI—Actual rental cost	Turkish Statistical Institute

(Continues)

TABLE A6 (Continued)

Country	Cities	Sample period	Tenure	Variable description	Data source
United Kingdom	Birmingham, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Sheffield, Southampton/Portsmouth	2015–2022	Multifamily	Price Index of Private Rents, UK—Flats	ONS
United States	Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, San Diego	2015–2022	Multifamily	Zillow Observed Rent Index (ZORI) is a smoothed measure of the typical observed market rate rent across a given region, by computing the mean of listed rents that fall into the 40th to 60th percentile range for all apartments	Zillow

Note: The table presents the data details and sources for rent prices included in our analysis. Rent data may be available from the listed sources for longer periods than indicated, but the sample period of our analysis begins in 2001 when the OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers starts and ends in 2022, the latest year available. Also to note that some countries do enter our data set later, when REITs have been introduced after 2001. See the specific dates in Table A1.

TABLE A7 Detailed description of residential building permit data.

Country	Cities	Sample period	Tenure	Variable description	Data source
Australia	Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney	2017–2022	Multifamily	Building approvals, private sector dwellings excluding houses (number)	Australian Bureau of Statistics
Belgium	Antwerpen, Bruxelles, Gent	2001–2022	Multifamily	Building permits issued in Belgium during the reference period. New residential dwellings, apartments.	Statistics Belgium
Bulgaria	Plovdiv, Sofia, Varna	2015–2022	All	Building permits issued for construction of new buildings by district. Number of residential permits	National Statistical Institute of Bulgaria
Canada	Calgary, Montreal, Ottawa, Toronto, Vancouver, Victoria	2001–2022	All	Residential buildings. All types of work. Value of permits (*1000) (data for multiple dwellings only available for 2018-2022)	Statistics Canada
France	Lyon, Marseilles, Paris	2001–2022	Multifamily	Number of authorized housing units. Type of housing: Collective and Residence, by department	Ministere de la transition ecologique et de la cohesion des territoires
Greece	country-level only	2001–2022	Multifamily	Building permits (residential, multi-dwelling buildings) issued by the Urban Planning Offices of Greece, on the basis of the Statistical Questionnaires on Building Activity	Eurostat from the Hellenic Statistical Authority (ELSTAT)
Ireland	Dublin	2001–2022	Multifamily	Planning permissions granted for new houses and apartments. Units for which permission granted: Private flats/apartments	Central Statistics Office (CSO)
Israel	Haifa, Jerusalem, Tel Aviv	2001–2022	All	Construction permits, residential dwellings	Central Bureau of Statistics
Japan	Nagoya, Osaka, Tokyo	2008–2022	All	Number of construction-started residential buildings	Official Statistics of Japan

(Continues)

TABLE A7 (Continued)

Country	Cities	Sample period	Tenure	Variable description	Data source
Singapore	Singapore	2001–2022	All	Contracts awarded by private residential sector	Department of Statistics Singapore
Spain	Barcelona, Madrid, Valencia	2001–2022	Multifamily	Number of permits. Type of dwellings: new residential multifamily dwellings	Spanish National Institute of Statistics (INE)
Thailand	Bangkok	2001–2022	All	Land development licenses nationwide (unit), Bangkok	Bank of Thailand
Turkey	Ankara, Istanbul, Izmir	2002–2022	Multifamily	Number of dwelling units according to construction permits	Turkish Statistical Institute
United Kingdom	Birmingham, Leeds, Liverpool, Manchester, Newcastle, Nottingham, Sheffield, Southampton/Portsmouth	2009–2022	All	Permanent dwellings started, England. District by tenure. Private enterprise	Ministry of Housing, Communities and Local Government
	Glasgow	2001–2022	All	Private new build starts	Scottish Government
	London	2006–2022	Multifamily	London planning approvals (all boroughs, market tenure, residential multifamily (excludes house, terraced house, bungalow, semidetached house)	Greater London Authority
United States	Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, San Diego	2001–2022	All	New private housing structures/units authorized by building permits	U.S. Census Bureau

Note: The table presents the data details and sources for residential building permits included in our analysis. Residential permit data may be available from the listed sources for longer periods than indicated, but the sample period of our analysis begins in 2001 when the OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers starts and ends in 2022, the latest year available. Also to note that some countries do enter our data set later, when REITs have been introduced after 2001. See the specific dates in Table A1.

TABLE A8 Description of other control variables.

Variables	Abbreviation	Data description and source
City-level data:		
Population growth	*Population growth*	Sofia, Plovdiv, Varna (Bulgaria): quarterly district total population from the National Statistical Institute of Bulgaria; Barcelona, Madrid, Valencia (Spain): quarterly resident population from the Spanish National Institute of Statistics (INE); all other cities: annual population of urban agglomerations from the UN database. When quarterly data is not available, linear interpolation from annual data is used.
Unemployment rate	*Unemployment*	Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney (Australia): Quarterly unemployment rate, Australian Bureau of Statistics (ABS); Antwerpen, Bruxelles, Gent (Belgium): quarterly unemployment rate from Statistics Belgium; Sofia, Plovdiv, Varna (Bulgaria): unemployment rate from the OECD City Database; Calgary, Montreal, Ottawa, Toronto, Vancouver, Victoria (Canada): quarterly unemployment rate from Labour force characteristics of Statistics Canada; Lyon, Marseilles, Paris (France): quarterly unemployment rate localized by department from the National Institute of Statistics and Economic Studies (INSEE); Athens (Greece): quarterly unemployment rate from OECD Short-Term Regional Statistics; Dublin (Ireland): quarterly ILO Unemployment Rate (15–74 years) from the Central Statistics Office; Haifa, Jerusalem, Tel Aviv (Israel): quarterly unemployment rate from OECD Short-Term Regional Statistics and the Labour Monthly Survey from Central Bureau of Statistics of Israel; Nagoya, Osaka, Tokyo (Japan): quarterly unemployment rate for regions (Kinki, Tokai, Southern-Kanto) from the Labour Force Survey/Basic Tabulation Historical data of the Official Statistics of Japan; Singapore: unemployment rate from the World Bank; Barcelona, Madrid, Valencia (Spain): unemployment rate from the Spanish National Institute of Statistics (INE); Bangkok (Thailand): national unemployment rate from the World Bank; Ankara, Istanbul, Izmir (Turkey): unemployment rate from OECD City Database and the Turkish Statistical Institute; Birmingham, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Sheffield, Southampton/Portsmouth (United Kingdom): quarterly unemployment rate (aged 16+) from the ONS; Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, San Diego (US): quarterly unemployment rate from the Local Area Unemployment Statistics of the US Bureau of Labor Statistics (BLS). When quarterly data is not available, interpolation of annual data from quarterly unemployment rate national data is used.

(Continues)

TABLE A8 (Continued)

Variables	Abbreviation	Data description and source
Household disposable income growth	*Income growth*	Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney (Australia): gross household disposable income per capita, Australian Bureau of Statistics, Australian National Accounts: State Accounts, Table 12. Household Income Account and Per Capita; Antwerpen, Bruxelles, Gent (Belgium): average household income per capita from Statistics Belgium; Sofia, Plovdiv, Varna (Bulgaria): average household income per capita from the National Statistical Institute of Bulgaria; Calgary, Montreal, Ottawa, Toronto, Vancouver, Victoria (Canada): household disposable income, Canada, provinces and territories from Statistics Canada; Lyon, Marseilles, Paris (France): disposable income of private households by NUTS 2 regions from Eurostat; Athens (Greece): household disposable income from the Hellenic Statistical Authority; Dublin (Ireland): disposable income of private households by NUTS 2 regions from Eurostat; Haifa, Jerusalem, Tel Aviv (Israel): average gross monthly income per capita from the Income Survey of the Central Bureau of Statistics; Nagoya, Osaka, Tokyo (Japan): quarterly disposable income for worker's households from the Official Statistics of Japan; Singapore: average household income from work from Singapore Office of Statistics; Barcelona, Madrid, Valencia (Spain): disposable income of private households by NUTS 2 regions from Eurostat; Bangkok (Thailand): GNI per capita from World Development Indicators of the World Bank; Ankara, Istanbul, Izmir (Turkey): household disposable income from Turkish Statistical Institute; Birmingham, Leeds, Liverpool, Manchester, Newcastle, Nottingham, Sheffield, Southampton/Portsmouth (United Kingdom): gross disposable household income by combined authority and city region: annual growth in GDHI per head of population, from the ONS; Chicago, Dallas, Houston, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Antonio, San Diego (US): County and MSA personal income summary: per capita personal income from the Bureau of Economic Analysis. When quarterly data is not available, linear interpolation from annual data is used.

(Continues)

TABLE A8 (Continued)

Variables	Abbreviation	Data description and source
Country-level data:		
Indicator for pension funds allowed to invest in real estate via financial intermediaries	*Regulation*	OECD Annual Survey of Investment Regulation of Pension Funds and Other Pension Providers (Table 4). Quarterly series is from linear interpolation.
Share of population over 65 years of age	Δ*retired*	Annual data from the World Bank. Quarterly series is from linear interpolation.
Cross-border bank flows	*Bank flows*	Quarterly FX and break adjusted changes of external claims of reporting banks vis-à-vis banks of each country from the BIS Locational Statistics.
Domestic real GDP growth rate	*GDP growth*	Quarterly series from the National Account of the IMF.
Domestic real short-term interest rates	*Short-term rates*	Quarterly series from the IMF and OECD (providing the end-of-the-period interest rates).
Domestic private credit (% GDP)	*Private credit*	Quarterly series of credit to private non-financial sector from all sectors in percentage of GDP and adjusted for breaks from the BIS. Supplemented for Bulgaria with quarterly data from the Monetary and Financial Accounts, Depository Corporations, Domestic Claims, Claims on Private Sector from the IFS of the IMF.
Inflation rate	*Inflation*	Quarterly series from the OECD, supplemented: for Bulgaria with quarterly data from the National Statistical Institute of Bulgaria; for Thailand with quarterly data from the BIS; and for Singapore with quarterly data from the Singapore Office of Statistics.
Stock market returns	*Stock returns*	Own calculation of log-returns from the stock price index quarterly data of the OECD Main Economic Indicators (providing quarterly averages of end-of-the-month figures), supplemented with quarterly data from the IFS of the IMF for Thailand.

TABLE A9 REIT capital flows and housing markets—raw flow series.

	(1) House price growth	(2) House price growth 12 months	(3) Rent growth	(4) Rent growth 12 months
REIT flows	0.011***	0.007**	−0.009*	−0.018***
	(0.003)	(0.002)	(0.005)	(0.005)
Controls	Yes	Yes	Yes	Yes
City *FE*	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
First-stage F stat	48.50***	45.46***	11.38***	11.29***
Cities	57	57	51	51
Countries	15	15	15	15
Obs	3439	3325	2442	2359

Note: The table reports the results of the IV 2SLS estimation of the baseline model in equation (1) with the raw REIT capital flow series. The dependent variables are the real house price growth (Columns 1–2), and real rent growth (columns 3–4). *REIT flows* are net equity issues by residential REITs, not winsorized. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market return. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of pension funds' investment portfolio allowed to be invested in managed real estate, including REITs, and the growth rate of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification *F* statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

TABLE A10 REIT capital flows and housing markets—larger US and UK samples.

	(1) House price growth	(2) House price growth 12 months	(3) Rent growth	(4) Rent growth 12 months
REIT flows	0.011***	0.005**	−0.006*	−0.019***
	(0.002)	(0.002)	(0.003)	(0.003)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
First-stage F stat	10.57***	10.28***	17.78***	19.60***
Cities	87	87	81	81
Countries	15	15	15	15
Obs	5817	5613	3372	3289

Note: The table reports the results of the IV 2SLS estimation of the baseline model in equation (1) for a larger sample of cities including the top 25 cities in the United States and United Kingdom. The top 25 cities according to the latest Zillow data set include the following additional cities: Austin, Charlotte, Columbus, Denver, El Paso, Jacksonville, Louisville, Miami, Nashville, Orlando, Portland, San Francisco, San Jose, Seattle, and Tucson. The top 25 cities for the UK according to the UN World Urbanization Prospects (The 2018 Revision) include the following additional cities: Bournemouth, Brighton, Bristol, Cardiff, Coventry, Edinburgh, Kingston upon Hull, Leicester, Middlesbrough, Newport, Preston, Reading, Southend-On-Sea, Stoke-on-Trent, and Sunderland. The dependent variables are the real house price growth (Columns 1–2), and real rent growth (Columns 3–4). *REIT flows* are net equity issues by residential REITs. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market return. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of pension funds' investment portfolio allowed to be invested in managed real estate, including REITs, and the growth rate of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

TABLE A11 REIT capital flows and housing markets—multifamily only.

	(1) House price growth	(2) House price growth 12 months
REIT flows	0.010***	0.007*
	(0.003)	(0.004)
Controls	Yes	Yes
City FE	Yes	Yes
Time FE	Yes	Yes
First-stage F stat	41.76***	38.84***
Cities	48	48
Countries	15	15
Obs	2656	2578

Note: The table reports the results of the IV 2SLS estimation of the baseline model in equation (1) for the subset of cities for which multifamily house price series is available (including Canada). The dependent variable is the real house price growth. *REIT flows* are net equity issues by residential REITs. City-level controls include population growth, unemployment rate, and income growth. Country-level controls include domestic short-term real interest rates, real GDP growth, bank flows, domestic private credit, inflation rate, and stock market return. The models include city and time fixed effects. Clustered standard errors at city level are reported below the coefficients. The instrument is the interaction between an indicator for the share of pension funds' investment portfolio allowed to be invested in managed real estate, including REITs, and the growth rate of the share of retired population, as $regulation \times \Delta retired$. First-stage Kleibergen-Paap weak-identification F statistics are reported below the estimations. Significance of the coefficients is reported as ***, **, and * for 1%, 5%, and 10%, respectively. The sample period is 2001–2022.

Figures A1–A4

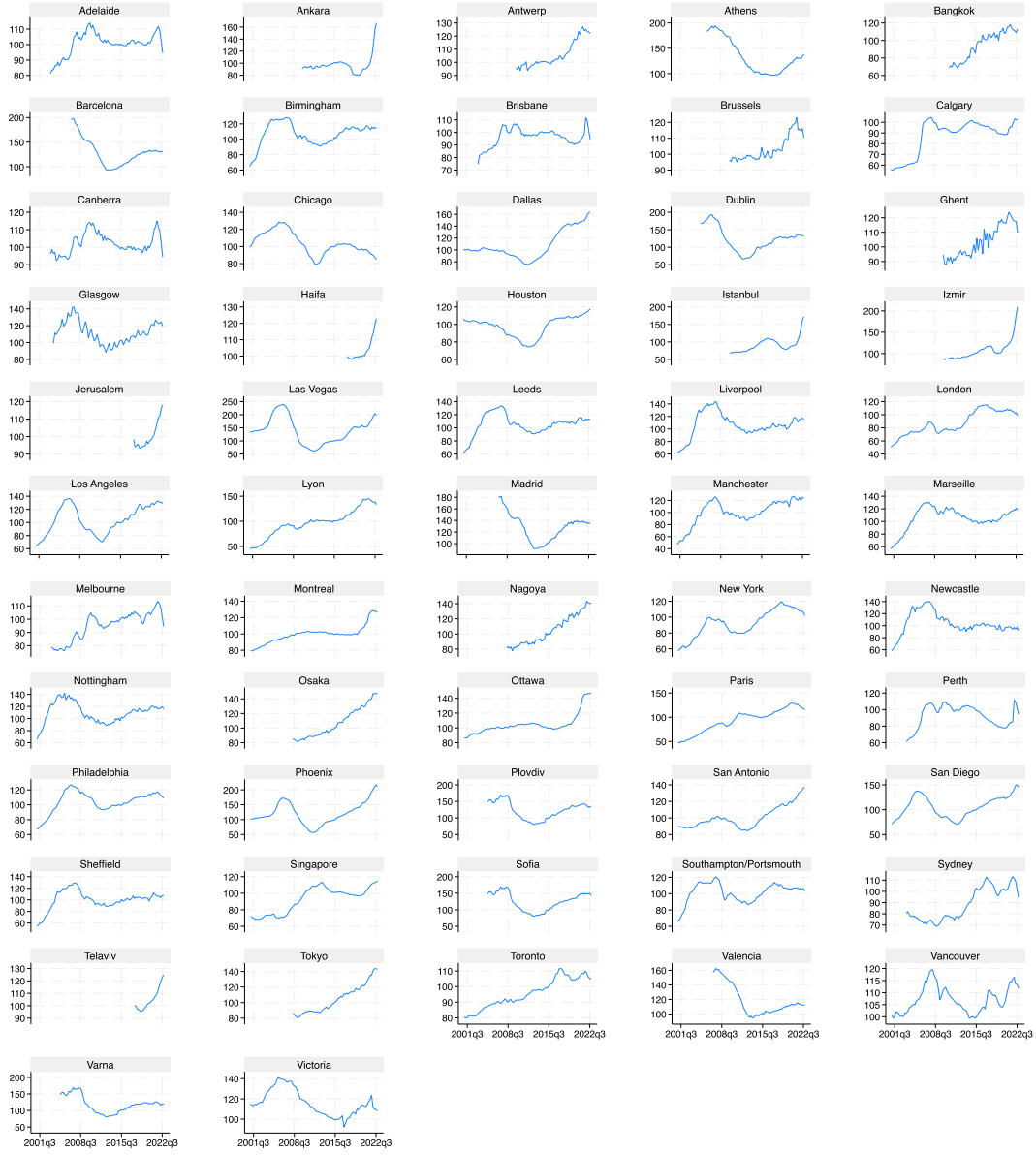

FIGURE A1 House prices by city (constant 2015 dollars). [Color figure can be viewed at wileyonlinelibrary.com]

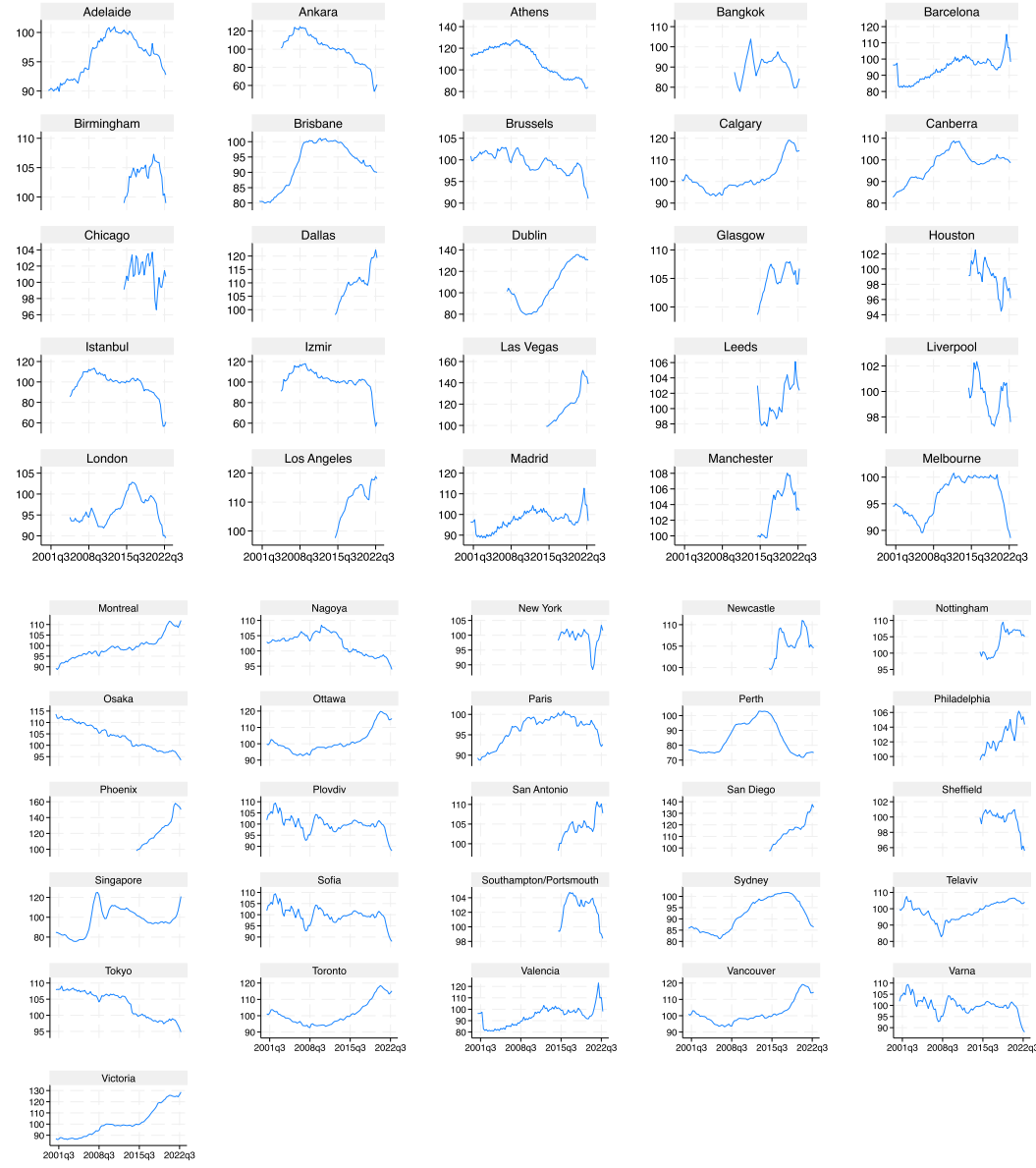

FIGURE A2 Real rent prices by city (constant 2015 dollars). [Color figure can be viewed at wileyonlinelibrary.com]

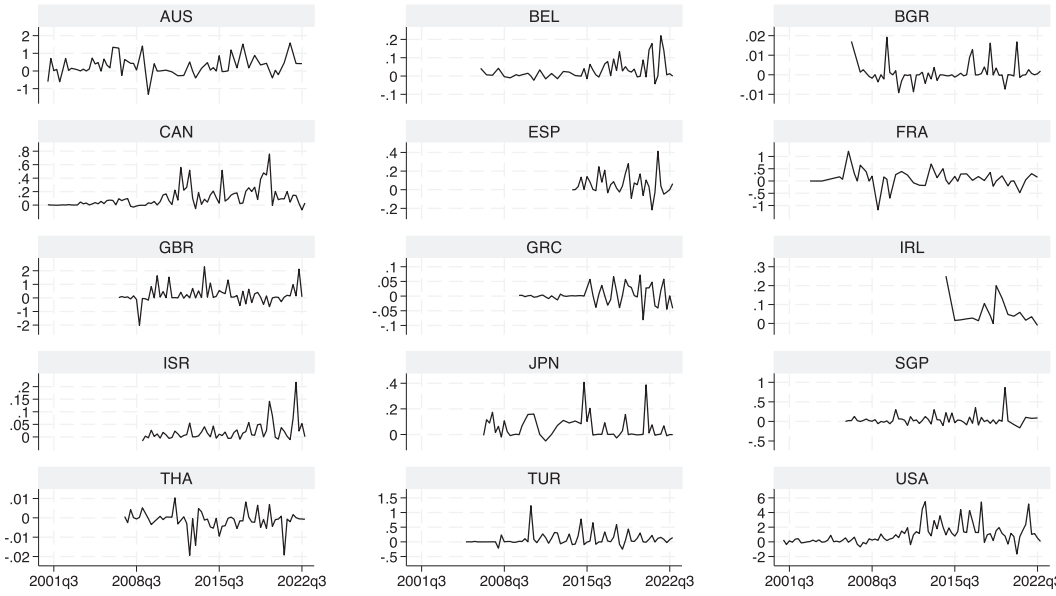

FIGURE A3 REIT flows by country. The plot shows the aggregate quarterly residential equity REIT capital flows by country of incorporation (in $ billion).

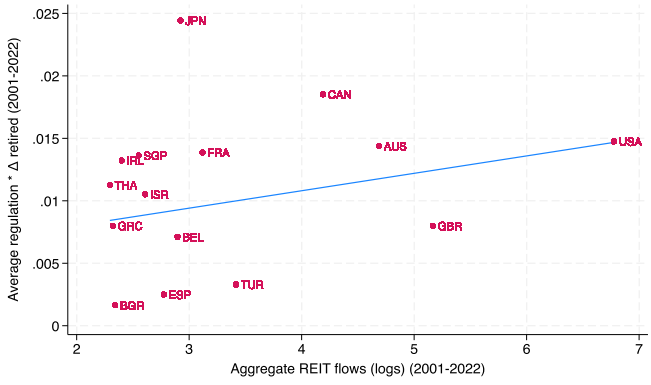

FIGURE A4 REIT flows and the IV. The plot reports the relationship between aggregate REIT flows (2001–2022) in logs and average instrumental variable (2001–2022) by country. The instrumental variable is the growth rate of the share of the retired population interacted with an indicator for the portfolio ceilings set by the regulation allowing pension funds into managed real estate investments. [Color figure can be viewed at wileyonlinelibrary.com]