



Green Urban Development:

The impact investment strategy of Canadian Pension Funds



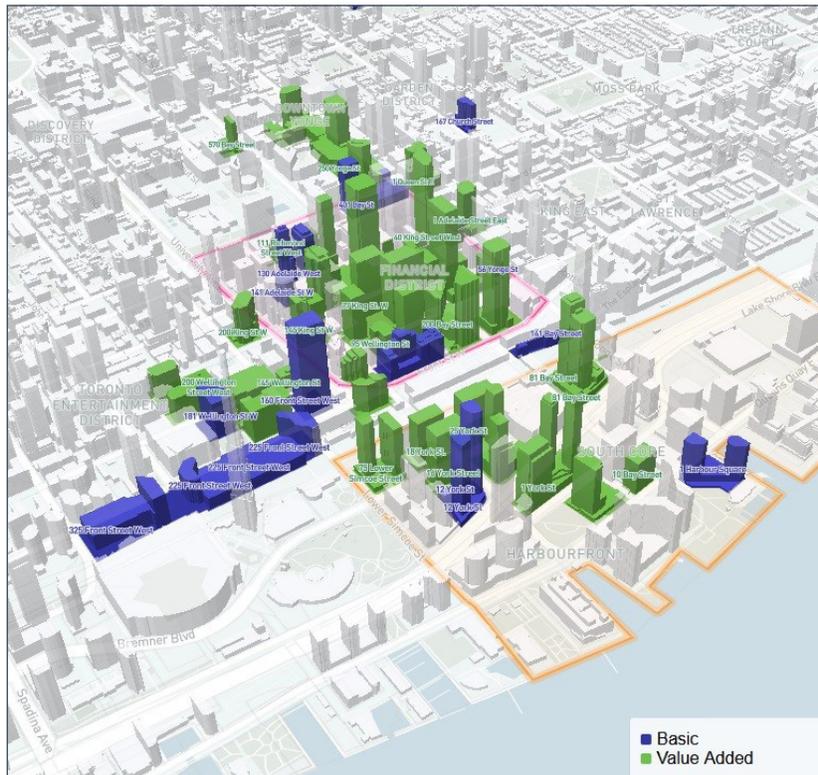
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ABOUT THIS REPORT:

Large Canadian pension funds are known to invest heavily in real assets, which include real estate, infrastructure and land. In this paper, we take the analysis down to the asset level and study how these funds create value and manage risks in the private real estate market.

- We show that large Canadian pension funds are uniquely active in the market of direct real estate investments. Even though they manage just 6 per cent of global pension assets in our data, these funds are responsible for 60 per cent of the total value of direct real estate deals involving a pension fund.
- Their portfolio strategy combines global asset diversification with a local impact strategy that consists of internally developing and greening urban properties. As an example, the map below shows that the area located inside and surrounding the financial district of Toronto (in red) is owned and greened (based on LEED certification) almost exclusively by the top nine Canadian pension funds.



- Using a common benchmarking methodology across funds, we show that this strategy delivers superior performance net of fees while contributing to the green development of major city centres. On average, large Canadian pension funds that directly manage more than 50 per cent of their real estate AUM generated a net value added of 148 basis points between 2005 and 2019.

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This paper investigates the investment strategy that large Canadian pension funds implement in the private real estate market. Even though they manage just 6% of global pension assets in our data, Canadian pension funds are responsible for 60% of the total value of direct real estate deals involving a pension fund. Their portfolio strategy combines global asset diversification with a local impact strategy that consists of internally developing and greening urban properties. Using a common benchmarking methodology across funds, we show that this strategy delivers superior performance net of fees and drives the green development of major city centers.

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I. Introduction

Over the past decade, the literature on retirement investing has shifted its attention away from the Defined-Benefit (DB) model and toward the Defined-Contribution (DC) model in response to the decline of the DB industry in the US and throughout the world. The Canadian pension model, however, provides a remarkable counter-example to this trend (Ambachtsheer 2016, 2021, Beath et. al. 2021, and Lipshitz and Walter 2020). The success of the Canadian model suggests that the combination of strong corporate governance, scale, talent, and controlled investment risk-taking makes it possible to sustain pension programs over the long-term.

The objective of the present paper is to investigate the investment strategies that large Canadian pension funds implement in the private real estate market. It is well known that Canadian pension funds invest heavily in real assets, which include real estate, infrastructure and land. A recent study by Beath et. al. (2021) finds that, among pension funds with over USD 50bn assets under management (AUM), real assets account for 23% of the portfolios of Canadian funds on average but just 10% of the portfolios of non-Canadian funds. In this paper, we take the analysis down to the asset level and study how large Canadian pension funds create value and manage risks in real estate.

Our analysis has three parts. In the first part, we use data from Preqin, a global data provider, and compare hundreds of real estate deals made by large Canadian and non-Canadian pension funds from 2010 to 2018. We show that Canadian pension funds are uniquely active in the market of direct real estate investments. Even though they manage approximately 6% of global pension assets in our data, they are responsible for 60% of the total value of direct real estate deals involving a pension fund.

The strategy of Canadian pension funds is two-pronged. On the one hand, they invest more globally than their peers. On the other hand, they pursue an impact strategy that consists of internally developing, managing, and greening urban properties close to home. Using data on green building certification of newly-built and retrofitted projects by the Leadership in Energy and Environmental Design (LEED) program, we find that Canadian pension funds initiate and complete LEED projects on 27% of their portfolio of direct acquisitions reported in Preqin, whereas non-Canadian funds only do so for 14% of their portfolio. The gap increases once we

focus on direct acquisitions of U.S. office properties where LEED certification is most common. Canadian pension funds are also more likely to purchase real estate assets, activate and complete the LEED certification process, and then re-sell the assets.

In the second part of the analysis, we further investigate the green urban development strategy in large Canadian cities where Canadian pension funds are most involved. To do so, we augment the dataset by manually collecting hundreds of local deals made by the top nine Canadian pension funds from their annual reports and news releases. We then combine this information with data on land parcels and buildings and construct 3-D maps of the funds' LEED value-added activity in Toronto, Montreal, and Vancouver.

In all three cities, the city center has been significantly greened by Canadian pension funds. The patterns are most striking in Toronto, which is Canada's largest city and the home to the head offices of 5 of the 9 largest Canadian pension funds. The area located inside and surrounding the financial district is owned and greened almost exclusively by these funds. We also find that 17 of the 26 Toronto buildings that obtained LEED Platinum -- the highest level of certification -- correspond to Canadian pension fund projects.

Through their real estate subsidiaries, Canadian pension funds do more than obtain LEED certification. They also undertake greenfield projects where they purchase the land and develop the properties. These projects tend to be clustered in up-and-coming districts near the city centers, such as the new Quartier des Gares in Montreal and the South Core district in Toronto. Such concentration is likely to generate housing externalities (Rossi-Hansberg, Sarte, and Owens 2010). The combined impact of these projects on the cities' development is large. In Toronto, three of the 10 tallest office towers currently under construction are developed by Canadian pension funds.

In the third part of the analysis, we evaluate the historical performance of Canadian pension funds' real estate investment strategy. Using data from CEM Benchmarking, a global benchmarking firm, we compare the annual returns of 241 real estate portfolios of Canadian and non-Canadian pension funds from 2005 to 2019. The sample includes 36 funds (8 Canadian) with more than USD 50 billion of AUM. Importantly, the dataset includes the proportion of the real estate portfolio that is managed directly by each fund either through direct property

ownership or through a wholly owned operating subsidiary. 27 funds (14 Canadian) manage more than 50% of their real estate AUM directly.

The major impediment to comparing the performance of real estate portfolios is the lack of consistent benchmarking across funds. Some funds use listed REIT indices as benchmarks, such as the FTSE Nareit U.S. Real Estate Index, while other funds rely on peer-based benchmarks such as the National Property Index (NPI). The difference is important because the returns of REIT benchmarks are marked-to-market whereas the returns of peer-based benchmarks are based on appraisal prices which are often smoothed and lagged (Geltner 1989). Many funds also make adjustments to their benchmarks by adding an inflation index, a private risk premium, or a lag. The lack of consistency across benchmarks makes net value added comparisons across funds open to interpretation.

We address these issues by employing a common benchmarking approach. For each fund, we construct a benchmark that consists of a fund-specific geographic blend of listed equity REITs, appropriately (de-) levered, smoothed, and lagged to match the properties of the real estate portfolio's reported returns. Our method delivers benchmarks that closely track the reported portfolio returns, with an average correlation of 93%. Using this consistent benchmarking methodology, we measure the performance of a real estate portfolio in terms of its net return in excess of the benchmark. We refer to this net return as net value added or NVA.

The data show that portfolios of large Canadian pension funds with a high proportion of direct real estate investments outperform their benchmarks. On average, large Canadian pension funds that directly manage more than 50% of their real estate AUM generated a NVA of 148 basis points (bps) between 2005 and 2019. In comparison, the average NVA was 35bps for all Canadian funds in our dataset, negative 215bps for all non-Canadian funds, and negative 167bps for all large non-Canadian funds managing more than 50% of real estate assets directly. The distinct performance of large Canadian pension funds confirms that the green urban development strategy creates financial value net of fees.

Our findings reveal an impact investment strategy that departs from the well-known forms of pension fund activism. Prior research has highlighted the highly active role of U.S. pension funds in the corporate governance of listed companies (Barber 2000, del Guercio and Hawkins 1998, Wahal 1996). The impact strategy of Canadian pension funds is focused on project execution:

they share the ownership of projects with few investors and concentrate their efforts in developing and greening urban properties. Through this model of impact investing, Canadian pension funds create the value from the ground up and drive the sustainable development of large cities. The benefits of this strategy include full control of the assets, direct communication between owners and managers, low fees due to the elimination of financial intermediaries, lower cost of project financing, and the ability to extract the full economic profit from the real estate ventures.

Of course, there are legal and operational risks associated with the development and management of real assets. There are also liquidity risks related to the long-term nature of development projects, and risks associated with the real estate industry as evidenced by the covid-19 pandemic (Ling, Wang, and Zhou 2020). We show, however, that Canadian pension funds have put in place several strategies that mitigate these risks.

First, the evidence suggests that Canadian pension funds restrict this model of impact management to a specific set of projects in real estate. These projects are well defined (i.e. construction of a downtown tower), can be replicated in multiple cities, and have a risk profile that naturally matches the long-term bond profile of the funds' liabilities.

Second, the properties developed by Canadian pension funds are mostly limited to standard multi-use properties located in prime downtown locations of major cities with diversified industries, as our 3-D maps confirm. As such, these projects can be adapted to multiple economic scenarios.

Third, as described earlier, Canadian pension funds combine local green urban development with a globally diversified portfolio of real assets. We also find evidence that Canadian funds increasingly invest in network and data centers around major cities, which tend to do well in extreme scenarios like the current pandemic where retail activity is severely curtailed.

Fourth, the use of wholly-owned real estate operating subsidiaries provides a number of operational advantages such as experience in developing and managing projects, access to a large network of suppliers and retailers that lease the space, protection from legal risks, additional flexibility regarding employee compensation, and the reduction of agency issues.

Our paper contributes to the literature on value-added strategies in the real estate market. Kaiser (2005) defines the gamma as the impact of value-added improvement on expected return of a real estate portfolio. Other studies have highlighted the economic value of green development (Eichholtz, Kok, and Quigley 2010, Fuerst and McAllister 2010, Miller, Spivey, and Florance. 2008). Using the terminology of these papers, we find that the gamma of the green urban development has contributed to the strong performance of Canadian pension funds' real estate portfolios.

The rest of the paper unfolds as follows. In Section II, we conduct a comparative analysis of direct real estate transactions and green urban development between Canadian and non-Canadian pension funds. In Section III, we evaluate the magnitude of green urban development by Canadian pension funds for large Canadian cities. In Section IV, we conduct a performance analysis of this investment strategy. Section V concludes.

II. Comparative Analysis of Direct Real Estate Transactions

We begin the analysis by comparing hundreds of real estate transactions made by large Canadian and non-Canadian pension funds since 2010. Section II.A reviews the data and presents statistics. Section II.B describes how LEED certification can be used as an indicator of green urban development. Section II.C compares the degree to which Canadian and non-Canadian pension funds directly engage in this activity.

A. Direct Real Estate Transactions Made By Pension Funds

We use data from Preqin, a data provider that collects detailed information on thousands of real estate transactions around the world. The information includes deal size, date, location, sector, asset type, and buyer and seller identification. The dataset goes from 1988 to 2018; however, because 99.9% of reported transactions at the property level took place after 2010, we primarily study the 2010-18 period. In total, real estate transactions reported in Preqin during this period amounted to USD 2.44 trillion, 61% of which consisted of U.S. properties. Throughout the paper, dollar values are expressed in USD.

To analyze the deals made by large pension funds, we restrict the sample to deals where buyers include a fund that manages assets for a pension plan that is worth more than \$50bn as of December 31, 2018 according to WillisTower Watson.² We include in this list the wholly-owned real estate operating subsidiaries of these funds.

Table 1, Panel A, reports statistics of these large pension funds. Six of the 88 pension funds in the list are Canadian. We group other funds in the category “Rest-of-World” (RoW hereafter). Approximately 50% of them are U.S. funds. The 6 Canadian pension funds manage about 6% of total pension fund assets. Their median fund size (\$93.35bn) exceeds that of RoW funds (\$81.19bn).

- Table 1 here -

We also report the subset of funds that have made real estate deals reported by Preqin. All 6 Canadian funds do so but fewer than half of the RoW funds (36) do. Unsurprisingly, funds that directly invest in real estate tend to be larger. The median size of RoW funds is \$93.33bn, which is similar to the median size of the large Canadian pension funds.

Table 1, Panel B, presents statistics on the real estate transactions made by these funds. There are 139 buy transactions made by Canadian funds and 146 buy transactions made by RoW funds between 2010 and 2018. A typical transaction value ranges between \$100-110mn.³ In total, these transactions amount to 2.4% of all real estate transactions in the sample of Preqin properties. If we also incorporate transactions where *sellers* include one of these pension funds, then the total value of deals that directly involve a large pension fund corresponds to about 4% of the aggregate value of deals reported in Preqin.

What is striking from Panel B is the extent to which Canadian pension funds are involved in the private real estate market. Between 2010 and 2018, Canadian pension funds directly invested \$32.24bn in real estate properties, while RoW funds directly invested \$22.38bn. In total, Canadian pension funds were therefore responsible for 60% of the total value of real estate

² WillisTower Watson Thinking Ahead Institute, Pensions & Investments, World 300. In total there are 90 funds that manage more than USD 50 billion. Two of these funds, however, are managed by CDPQ. We exclude Norway’s Government Pension Fund as it mainly represents the country’s sovereign wealth fund. This leaves a total of 88 funds.

³ In many cases, transactions consist of portfolios involving multiple properties. We approximate the value of each property as the total value of the deal divided by the number of properties mentioned in the deal.

acquisitions involving a pension fund. This proportion is 10 times greater than the share of total pension fund assets they manage (6% as reported above). Sell transaction reveal a similar pattern. Canadian pension funds directly sold a total of \$20.21bn of real estate properties between 2010 and 2018, whereas RoW pension funds directly sold \$13.8bn.

One possible concern about the reliability of these statistics is that the Preqin dataset only contains a limited fraction of all real estate transactions made by pension funds. In Section IV we mitigate this concern by studying the share of real estate assets directly managed by Canadian and RoW pension funds. Our analysis confirms that the 10-to-1 ratio holds.

In addition to being much larger, Canadian pension funds are more geographically diversified than their peers. We count the total number of foreign countries where pension funds make direct real estate deals that are reported in Preqin. There are 10 foreign countries where deals are made by Canadian pension funds. By contrast, there are on average 2.2 foreign countries where deals are made by funds from a RoW country. In Section IV, we provide additional survey evidence from the CEM Benchmarking database that large Canadian funds have greater foreign exposure to real estate than large RoW funds.

In terms of industry sectors, Canadian pension funds invest in a balanced mix of assets. About 41% of their real estate portfolio is invested in office space, 31% is invested in mixed-use properties, and 19% is invested in residential properties. In comparison, RoW funds invest the majority of their portfolio in office properties (46%).

B. LEED Certification as a Type of Green Value-Added Strategy

In order to measure the pension funds' involvement in green value-added activity, we use data from the LEED certification program that is available on the USGBC website. The LEED certification is pertinent because it focuses on environmental initiatives that add value to an asset, as confirmed by Eichholtz, Kok, and Quigley (2010), Fuerst and McAllister (2010), and Miller, Spivey, and Florance (2008). According to the U.S. Green Building Council (USGBC) website, LEED certification provides: i) *instant recognition for the building*; ii) *faster lease up rates*; iii) *higher resale value*; iv) *healthier indoor space*; v) *lower use of energy, water, and other resources*; and vi) *brand enhancement*.⁴ The capital investment that is required to obtain a

⁴ The information is available at <https://new.usgbc.org/leed>.

LEED certification usually ranges from 2.5% to 9.4% of the property’s value depending on the certification level (Kats et al, 2003; Matthiesen and Morris, 2004; Nyikos et. al, 2012), which is significant.

The information made available by USGBC includes the street address, level of certification achieved (e.g. Platinum, Gold) and the dates at which the certification was requested and approved for every certified building. Of the 141,076 projects listed in the USGBC LEED database, about 2% are located in Canada, 81% in the U.S., and 17% in the rest of the world. These statistics indicate that the LEED analysis is most applicable to North American properties, which aligns well with the high number of U.S. deals reported in Preqin.

We combine LEED data with the property-level data from Preqin and introduce the following terminology. A “LEED value-added (VA)” investment corresponds to a real estate investment where the fund actively seeks some form of LEED certification *after* having acquired the property and before selling it. This action could either be the registration of a new project, the certification of an existing project, or both. A “premium” investment is one where the fund purchases an asset already LEED-certified and does not make LEED upgrades to it. A “basic” investment is one that does not have any LEED certification throughout the sample.

In the Appendix, we show how LEED certification varies by sector and geography in our sample of Preqin properties. The results reveal that office and mixed-use properties in the U.S. and Canada are the most likely to be LEED-certified.

C. The Predominance of LEED Value-Added Activity Among Canadian Funds

We now analyze the LEED value-added activity of Canadian and RoW pension funds. In the first set of rows of Table 2, Panel A, we report the portfolio allocation in basic, premium, and LEED value-added properties.⁵ Canadian funds invest 27% of their assets in LEED-VA strategies. In comparison, RoW funds invest only 14% of their assets in LEED-VA strategies and a

⁵ In the Appendix, we break down the different types of LEED value-added activity: LEED registration only, LEED certification only, and the combination of registration and certification. Across all types of funds, the bulk of value-added projects involves the full LEED certification process.

predominant share in basic strategies (74%). The evidence therefore indicates that Canadian pension funds are significantly more involved in green urban development than RoW funds.

Once we account for the fact that LEED certification is most common in U.S. office space, the gap between Canadian funds and RoW funds' involvement in LEED-VA strategies becomes even more pronounced. In the second set of rows of Panel A, we report the composition of basic, premium, and LEED value-added *within* the portfolio of U.S. office properties. Canadian funds invest approximately half (48%) of their portfolio of direct U.S. office acquisitions into LEED value-added assets, whereas RoW funds only invest 20% of their portfolio in these assets.

- Table 2 here -

Panel B of Table 2 provides additional insights into the nature of these LEED-VA assets. We zoom in on the 39 properties that were bought by the pension funds and then sold again between 2010 and 2018. The table confirms the dominance of Canadian pension funds in this market, as the majority of transactions (24) were made by Canadian pension funds.

The Panel shows that Canadian pension funds are more likely to directly purchase properties, increase their value through LEED-certification, and then re-sell the properties afterwards. Buy-and-sell transactions indeed represent a greater fraction of total transaction volume for Canadian funds (17%) than for RoW funds (5%), which indicates greater turnover. Moreover, these transactions are mostly LEED-VA transactions for the Canadian funds (61%) whereas virtually all transactions made by RoW funds are either basic or premium.

In the final part of our analysis based on Preqin data, we focus on the geographical breakdown of basic, premium, and LEED-VA assets for all buy deals made by Canadian funds. Panel C of Table 2 shows that LEED-VA assets amount to 41% of their investments in Canadian properties, 35% of their investments in U.S. properties, and 0% of their investments in other foreign properties. Therefore, Canadian funds are much more likely to conduct internal green value-added activity for real assets close to home. We explore this point further in the next Section.

III. Green Urban Development In Large Canadian Cities

We now investigate in greater depth the green urban development strategy implemented by Canadian pension funds in large Canadian cities where the pension funds are most involved. Section III.A quantifies and illustrates through maps their engagement in Toronto, Montreal, and Vancouver. Section III.B describes their investments in greenfield projects. Section III.C analyzes the geographic concentration of these projects, and Section III.D discusses the use of subsidiaries to run the projects.

A. *Ownership and Green Development of Toronto, Montreal, and Vancouver*

Because data from Preqin only include a limited number of Canadian deals, we augment the dataset by manually collecting hundreds of real estate transactions from the funds' annual reports and press releases for the 9 largest Canadian pension funds: AIMCo, BCI, CDPQ, CPPIB, HOOPP, IMCO, OMERS, OTPP, and PSP. The information we collect includes the street address, building use, and the date of the development or acquisition of the property.

In order to capture building size, we obtain mapping data on land parcels and buildings. This information is available online for Toronto, Vancouver, and Montreal – Canada's three largest cities.⁶ We convert addresses into geocodes, geocodes into land parcels, and land parcels into buildings. The use of land parcels as an intermediary step allows us to address cases where the geocode does not directly intersect with building data. These cases arise for buildings that only take up a fraction of the land parcel and buildings with varying sections of elevation.⁷ Our spatial matching procedure ensures that all buildings owned by Canadian pension funds are properly captured.

We combine this dataset with data on LEED certification available from the Canadian CAGBC website.⁸ With this information, we recreate the basic, premium, and LEED-VA categories using

⁶ This information is available at <https://open.toronto.ca>, <https://opendata.vancouver.ca>, and <http://donnees.ville.montreal.qc.ca>.

⁷ Buildings with varying elevation are categorized as a collection of sub-buildings. Therefore, without the use of land parcels as an intermediary step, we would only capture the part of the building that intersects with the geocode data.

⁸ This information is available at www.cagbc.org.

the same definitions as in Section II.⁹ We then construct 3-D maps of the properties developed and/or acquired by the top 9 Canadian pension funds in each city. Figure 1 presents a map of the Toronto downtown area where the pension fund activity is most pronounced. The blue and green colors respectively indicate basic and LEED-VA investments. The red boundaries delineate Toronto's financial district.

- Figure 1 here -

The map clearly illustrates the magnitude of green urban development by large Canadian pension funds. Almost all buildings in Toronto's financial district are directly owned by these funds.¹⁰ The vast majority of these buildings have obtained some form of LEED certification under the funds' ownership, as evidenced by the dominance of green-colored buildings. Once we move away from the city center, the proportion of buildings owned by pension funds rapidly declines. Figures 2 and 3 present equivalent 3-D maps for Montreal and Vancouver. The dark green color on the Montreal map indicates a premium investment. Both maps show the same pattern. Canadian pension funds own and green a large proportion of properties in the downtown areas, and their activity rapidly declines outside these areas.¹¹ Altogether, these figures reveal a systemic pattern of impact investing that is in line with the insights from Section II.

- Figures 2 and 3 here -

The maps likely understate the true level of green value-added activity by Canadian pension funds for several reasons. It may be that we have not identified the full list of properties owned by the top 9 pension funds, as only the largest deals are made publicly available. It may also be that some of the remaining downtown properties are owned by Canadian pension funds outside the top 9. Additionally, several of the non-LEED-certified buildings in blue correspond to buildings under construction that are expected to obtain LEED certification in the future. Finally,

⁹ For deals where we only observe the year of acquisition instead of the exact date, we assume that a LEED action that takes place in the same year counts as a value-added activity.

¹⁰ We use the boundaries provided by the Wikipedia page https://en.wikipedia.org/wiki/Financial_District,_Toronto. The boundaries are Queen St W to the north, Yonge St to the east, Front St to the south, and University Ave to the west.

¹¹ For Montreal's and Vancouver's financial districts, we set approximate boundaries based on publically available information.

the building maps for Montreal and Vancouver are from 2016 and 2009 respectively, so any building developed after these dates is missing from the maps.

An additional statistic of interest is the proportion of buildings that obtained LEED Platinum, the highest level of LEED certification. Only 4% of all Canadian projects have obtained Platinum certification according to the CAGBC database. In Toronto, 26 buildings have obtained it. 17 of these buildings (65%) correspond to LEED-VA projects by 5 of the top 9 Canadian pension funds. These results further confirm that Canadian pension funds have played a leading role in bringing Toronto's properties to the highest LEED standards.

B. Beyond LEED-VA Development: Greenfield Projects

LEED-VA activity only represents a fraction of the Canadian pension funds' urban development. Canadian pension funds also undertake large greenfield projects where they purchase the land and develop the properties themselves.

The maps in Figures 1 and 2 show that Canadian pension funds are highly active in developing up-and-coming districts near the city centers. In Toronto, Canadian pension funds developed the majority of towers in Toronto's emerging South Core district near the waterfront, as delineated by the orange boundaries on the map. These towers include the Telus Tower (HOOPP), RBC WaterPark place (OMERS) and CIBC Square (CDPQ). In Montreal, pension fund activity is highest in the Quartier des Gares that was established in 2015 (again delineated by the orange boundaries). Examples of development projects in this district include the Deloitte Tower and Tours des Canadiens (OTPP).

To quantify local greenfield activity by Canadian pension funds, we use data from the Council on Tall Buildings and Urban Habitat (CTBUH) which provides information on the developers of skyscrapers for each major city.¹² We focus on Toronto because the information available is the most complete. Toronto ranks among the world's top cities in terms of the number of skyscrapers taller than 150m that are completed (#19 with 72 buildings) and under construction (#4 with 36 buildings).¹³

¹² The data is available at www.skyscrapercenter.com.

¹³ This information is available at <https://open.toronto.ca>. Statistics on the number of buildings come from www.skyscrapercenter.com.

The proportion of buildings developed by Canadian pension funds is large. Three of the tallest 10 towers in Toronto that are under construction are Canadian pension fund projects. We also find that towers developed by these funds are more likely to obtain Platinum certification. For example, if we focus on the 50 tallest towers in Toronto that are either completed or under construction, 2 of the 5 towers already developed by Canadian pension funds have obtained LEED Platinum. In contrast, only one of the 11 towers developed by non-pension funds has obtained it. That tower, Scotia Plaza, obtained LEED Platinum in 2020 after the Canadian pension fund AIMCo became a major shareholder in 2016.

C. Concentration in Green Urban Development Activities

Canadian pension funds do the majority of green urban development in highly localized markets. If we define Montreal as the home market of CDPQ and PSP and Toronto as the home market of CPPIB, OTPP, OMERS, and HOOPP, we find that, for each fund, the home market represents at least 75% of its LEED-VA projects that we have collected across all three cities.

Within a city, pension funds tend to concentrate their investments in one location. A good example is OTPP's recent investments in Montreal's Quartier des Gares (Windsor Station, Deloitte Tower, and the multiple Tours des Canadiens) which are all located within a few steps of the central train station. Another example is OMERS's large investment in Quartier DIX30, a 2.3 million square feet multi-use complex in Brossard, which is a municipality part of the Greater Montreal area that will soon serve as a station for the Réseau express métropolitain (REM) network.

Focusing on local projects brings multiple advantages. It allows the fund to work in an environment that it knows well and thus better manage the operational risks (Huffman, 2002). In a sense, concentration acts as a risk mitigant from an operational perspective. Working on local projects also allows the fund to align the risk of its pension liabilities to its assets, since local properties correlate more with the fund's liabilities than foreign properties do. Finally, developing a complete neighborhood allows the fund to generate housing externalities (Rossi-Hansberg, Sarte, and Owens 2010).

D. The use of Real Estate Subsidiaries

Most Canadian pension funds do green urban development through a wholly-owned subsidiary. Examples of subsidiaries include Ivanhoe Cambridge (CDPQ), Cadillac Fairview (OTPP), Oxford Properties (OMERS), QuadReal (BCI), HOOPP Realty (HOOPP), and AIMCo Realty (AIMCo).

The use of a subsidiary provides a number of advantages. One advantage is experience. Subsidiaries such as Cadillac Fairview, which was purchased by OTPP in 2000, have acquired decades of experience in developing and managing hundreds of real estate projects. Experience not only helps to identify valuable development opportunities and manage operational risks, but also to establish long-term relationships with suppliers and retailers that lease the space.

Another advantage has to do with protection from legal risks. Because subsidiaries are limited-liability entities, they do not engage the funds' investments outside the subsidiary.

A third advantage is additional flexibility regarding employee compensation. Compensation contracts in limited partnership funds tend to be long, complex, and different from contracts of buy-side institutional funds (Phalippou 2009). Having a subsidiary makes it easier for pension funds to set up these types of contracts while keeping the investments in-house.

By fully owning the subsidiary, Canadian pension funds can also mitigate agency conflicts that arise when ownership is fragmented. Typical conflicts include expropriation or inefficient use of funds by managers when investors have limited ability to control the firm's assets. Having large shareholders can mitigate these problems because they have both a general interest in profit maximization and sufficient control over the assets of the firm (Shleifer and Vishny 1997).

IV. How successful is the Canadian direct real estate investment strategy?

We now conduct a performance analysis of Canadian pension funds' real estate investments. Section IV.A introduces a common benchmarking method across funds. Section IV.B describes the dataset used for the performance analysis. Section IV.C presents the performance results.

A. Benchmarking Method and Performance Metric

The major impediment to comparing the performance of real estate portfolios is a lack of consistent benchmarking. We illustrate this issue in Table 3 by summarizing the properties of the benchmarks used by the 241 real estate portfolios in our sample (described in the next Section). While some funds use listed REIT indices, fixed hurdle rates, inflation rates, and interest rates-based benchmarks, most funds (around 70%) use peer-based benchmarks which rely on the appraised returns of private real estate reported by asset managers or asset owners (e.g., NPI, IPD Canada, MSCI PREA). Peer-based benchmarks are often customized in a variety of ways through the use of lags, currency adjustments, leverage adjustments, or risk premia. The clear lack of consistency leaves performance comparisons across funds in terms of net value added open to interpretation.

- Table 3 here -

We address this issue by employing a common benchmarking method. For each fund in our sample, we construct a benchmark portfolio of local and foreign REIT indices that is appropriately (de-) levered, smoothed, and lagged to match the properties of the fund's reported return. We then calculate the net value added (NVA) of the fund's portfolio in relation to its inferred benchmark.

Let $R_{i,t}$ be the real estate return net of fees reported by fund $i \in \{1, \dots, I\}$ from year $t - 1$ to year t . The fund's benchmark portfolio B_i contains a local REIT index, a global REIT index, and a local A-rated corporate bond index. These indices have returns $R_{LOCAL,i,t}$, $R_{GLOBAL,i,t}$, and $R_{BOND,i,t}$. We denote by g the proportion of the REIT portfolio invested in the global REIT index, and by b the proportion of the total benchmark portfolio invested in the bond index. The return of the benchmark portfolio is

$$R_{B,i,t} = b \cdot R_{BOND,i,t} + (1 - b) \cdot \left((1 - g) \cdot R_{LOCAL,i,t} + g \cdot R_{GLOBAL,i,t} \right).$$

The parameter g governs the geographic mix of the benchmark and the parameter b determines its leverage. A positive (negative) value of b indicates that the benchmark has lower (higher) leverage than the REIT portfolio.

To simulate the appraisal-based returns of private real estate, we smooth and lag the (de-)levered market returns of listed equity REITs. The smoothed return $R_{B,i,t}^S$ of the benchmark portfolio is estimated as

$$R_{B,i,t}^S = s \cdot R_{B,i,t} + (1 - s) \cdot R_{B,i,t-1},$$

where s is the smoothing parameter.¹⁴ A low value of s indicates a high degree of smoothing.

Given a lag parameter l (in trading days), we obtain the benchmark return $R_{B,i,t-l/D}^S$, where D is the number of trading days during the year.

We then solve for the combination of the four parameters (g, b, s, l) that meets two conditions: (i) the fund's reported return $R_{i,t}$ has maximal correlation with the benchmark return $R_{B,i,t-l/D}^S$, and (ii) the fund's reported return $R_{i,t}$ has a beta of one with respect to $R_{B,i,t-l/D}^S$. The details of the optimization are provided in the Appendix.

The first condition ensures that the benchmark is comparable to the fund's real estate portfolio in terms of its geographical mix, smoothing, and lag properties. The second condition ensures that the benchmark has the same volatility as the fund's real estate portfolio. Under this condition, the difference between the fund's reported return $R_{i,t}$ and the benchmark return $R_{B,i,t-l/D}^S$ corresponds to the net value added of the fund's real estate portfolio in year t :

$$NVA_{i,t} = R_{i,t} - R_{B,i,t-l/D}^S.$$

We calculate the fund's average NVA over the sample period as

$$\overline{NVA}_i = \sum_{t=2005}^{2019} NVA_{i,t}$$

and use it as our main performance metric.

Our method has several advantages. It is easy to implement, consistently applicable to real estate portfolios around the World, and relies on listed benchmarks that are investible and give real-

¹⁴ Because time-series of S&P REIT indices we use only become consistently available across countries in the early 2000s, we use 3 return values of the indices to estimate the smoothed return of the benchmark portfolios (i.e. $RB_{i,t}$, $RB_{i,t-1}$, $RB_{i,t-2}$). Their weights are re-scaled so that they sum up to 100%, and earlier index returns are assigned a weight of zero.

time information about the risks present in these portfolios (Gyourko and Keim, 1992). It also provides a reliable way to estimate the average NVA for a *group* of funds, whereas peer-based benchmarks imply (by definition) an average NVA of zero for the peer group. This last feature is important in the context of our study, since our purpose is to estimate the NVA for the group of large Canadian pension funds that directly manage their real estate portfolio. Another advantage of our method is that it works well even in the absence of information about the geographic mix, leverage, smoothing, and lag properties of a fund's real estate portfolio.

One possible limitation of our approach is the risk of over-fitting the data due to the multi-dimensional nature of the optimization. To reduce this risk, we restrict the number of values that the parameters g , b , s , and l can take. The proportion of global REITs g is allowed to vary in 0.05 increments from 0 to 1. The smoothing parameter s can take four possible values: 0.5 (maximum smoothing), 0.67, 0.75, and 1 (no smoothing).¹⁵ The lag parameter l varies from 0 to 520 trading days. The weight in the bond portfolio b is set such that the fund's reported return $R_{i,t}$ has a beta of one with respect to $R_{B,i,t-l/D}^s$ for a given combination of parameters g , s , and l . In the next Section we verify that the inferred parameter values are consistent with survey results about the funds' actual investments.

Figure 4 illustrates the ability of a de-levered, smoothed, and lagged REIT index to match the return properties of a private real estate portfolio. We consider the NCREIF National Property Index (NPI), which tracks a portfolio of U.S. properties, and construct the benchmark portfolio from the S&P U.S. REIT index using the methodology described above.

- Figure 4 here -

Panel A of Figure 4 plots the annual return of both indices from 2005 to 2019. The returns of the S&P REIT index (dotted grey) are twice as volatile as those of the NPI in black (19% vs. 9%), and the correlation between both times-series is low (15%). Without adjustments, the REIT index is a poor benchmark for the NPI.

¹⁵ We set a lower bound of 0.5 for the smoothing parameter s , consistent with the estimates of Barkham and Geltner (1994). If we use values of s below 0.5, the volatility of the smoothed benchmark portfolio becomes so small that it is no longer possible to match the volatility of the fund's reported return unless we apply an unreasonably high degree of leverage.

In Panel B of Figure 4, we adjust the leverage ratio of the REIT index based on the results of our estimation. The model suggests a value of $b = 0.52$. The result is a significant de-levering of the REIT index, which reduces its volatility to 11%. However, the correlation between the adjusted REIT and the NPI remains low (9%).

In Panel C of Figure 4, we smooth the adjusted REIT index. The model suggests a value of $s = 0.67$, which is in the range of estimates by Barkham and Geltner (1994) and Brown and Matysiak (1998). The correlation between the smoothed REIT index and the NPI increases to 41%.

In Panel D of Figure 4, we lag the smoothed series by using the model-predicted value of $l = 272$ trading days. The returns of the smoothed and lagged benchmark look nearly identical to those of the NPI. The correlation between the lagged index and the NPI is equal to 93%. The lag value predicted by the model is consistent with Gyourko and Keim (1992) who find that fourth-quarter lags of REIT returns work best in predicting the returns of the NPI index.

Altogether, this exercise confirms that using REIT benchmarks and adjusting for their geographical mix, leverage, smoothing, and lag structure makes it possible to evaluate the performance of private real estate portfolios across funds.

B. Data

We use data from CEM Benchmarking, a Toronto-based global benchmarking company that has collected detailed annual cost and performance data from more than 1000 pension, endowment, and sovereign wealth funds of 18 countries. We retain funds that report a minimum of five years of real estate returns from 2005 to 2019. The choice of 2005 as the starting date comes from the fact that i) we require several years of REIT data to apply the smoothing procedure, and ii) the S&P REIT indices we use become consistently available across countries in the early 2000s. We eliminate 10% of funds with the lowest return correlation between the benchmark and the funds' real estate portfolio, as well as funds for which the inferred leverage coefficient is either negative or above 5. All remaining funds have a benchmark correlation above 74%. The average benchmark correlation is 93%.

Consistent with our analysis in Section 2, we categorize a fund as *large* if it manages more than \$50 bn in 2018.¹⁶ Table 4 reports summary statistics for the full sample and the subset of large funds. In total, there are 241 funds from 8 countries (55 Canadian), including 36 large funds (8 Canadian). The majority of RoW funds (140) are U.S. funds. We also study the subsets of Canadian and RoW funds that directly manage more than 50% of the real estate portfolio. These features characterize the Canadian pension funds that are highly involved in the green urban development strategy.

Table 4, Panel A, reports the average proportion of assets invested in real estate for Canadian and RoW funds in 2019. Large Canadian pension funds invest significantly more in real estate (14%) than their peers (8.5% for RoW funds). This result is in line with Beath et. al. (2021), who find that Canadian pension funds rank first globally in terms of the proportion of AUM invested in real assets.

- Table 4 here -

The table also reports the proportion of real estate assets managed directly. The gap between Canadian and RoW funds is considerable. Large Canadian funds invest 81% of their real estate portfolio directly, while RoW funds invest 16% of their real estate directly. Moreover, 7 of the 8 large Canadian funds invest more than 50% of their real estate portfolio directly, while only 4 of 28 large RoW funds do so. This significant difference is again consistent with Beath et. al. (2021) who find that Canadian pension funds rank first globally in terms of the proportion of total assets managed in-house (see also Andonov, Eichholtz, and Kok 2015).

Together, these statistics confirm our finding in Section 2 that Canadian pension funds are about ten times more active than their peers in the direct real estate market. Their share of private real estate managed directly is equal to $0.14 \times 0.81 = 12\%$. In comparison, for RoW funds the average share of private real estate managed directly is equal to 1.2%. One Canadian pension fund is therefore equivalent to ten RoW funds of the same size in this market.

Table 4, Panel B, reports the average inferred values of the l , s , b , and g parameters of the benchmark portfolios. The values are close to the inferred parameters of the NPI benchmark and

¹⁶ For a small proportion of funds the information on 2018 is unavailable. So their AUM value corresponds to the latest available year.

also stable across groups of funds, which confirms that the benchmark methodology works well. For example, the average smoothing parameter is $s = 0.62$ for Canadian funds and $s = 0.63$ for RoW funds.

We note that heterogeneity in the bond parameter b does not necessarily indicate heterogeneity in the gross asset-to-net asset leverage ratio of the real estate portfolios. The reason is that the underlying REIT indices have varying leverage ratios. For example, the average Canadian fund has a lower bond weight than the average RoW fund ($b = 0.22$ vs 0.13) but a slightly higher leverage ratio (1.3 vs. 1.24) due to the high leverage of Canadian REITs. The low leverage ratio (1.24) of the 7 large Canadian funds with high direct real estate management can be explained by the fact that a subset of them use leverage at the *total* fund level. The overall leverage is used in part to fund real estate investments at low cost.

We verify that the leverage ratios inferred from our estimation are consistent with the 2020 CEM Global Leaders survey of 26 of the largest institutional investors in the CEM database. As of 2019, the surveyed leverage ratios ranged from 1.07 to 1.79 with an average value of 1.47. This is in line with the range of leverage ratios reported in Panel B.

In Table 4, Panel C, we report the inferred geographic mix for the real estate portfolios of Canadian, U.S., European and UK pension funds. The inferred mix takes into account the geographic mix of the underlying REIT indices. According to our estimation, the average exposure to local markets ($1-g$) was 74% for funds from Europe and UK and 79% for U.S. funds from 2005 to 2019. These values are again close to the results from the 2020 CEM Global Leaders Survey. According to the survey, the average exposure of European and UK funds to local markets was 70% and that of US funds was 82% at the end of 2019.

For Canadian pension funds, the average exposure to the local market (79%) exceeds the average local exposure reported in the CEM Global Leaders survey (57% at the end of 2019). The survey estimate, which confirms the global diversification strategy pursued by Canadian funds, is lower for two reasons. First, funds in the survey are larger than the typical Canadian fund and invest a

greater proportion of their assets abroad than smaller funds. Second, the foreign real estate exposure of Canadian pension funds has increased since 2005.¹⁷

C. Performance of Canadian Pension Funds

We now compare the net value added of Canadian and RoW funds. For each subset of these funds, we report the average, median, and standard deviation of the NVA across funds in Table 5, Panel A.

- Table 5 here -

Quite strikingly, large Canadian pension funds that invest the majority of their assets directly have the highest NVA among all groups of funds in our sample. Their average NVA of 148bps is statistically significant and economically large. Their median NVA of 295bps is also large, confirming that the large average is not driven by outliers. These results indicate that the green urban development strategy pursued by these funds delivers superior performance net of fees.

The success of Canadian pension funds is not restricted to the 7 largest funds managing more than \$50 bn of real estate investments. The average NVA of the 14 Canadian funds that directly manage a majority of their real estate investments was 138 bps over the sample period. These funds make up 25.5% of Canadian funds and together fully explain the average NVA of Canadian funds ($0.255 * 138 = 35$ bps). For the other Canadian funds, which manage fewer than \$50 bn and a minority of their real estate investments directly, the average NVA was approximately zero.

We verify that the value added of Canadian pension funds is not just the result of managing assets directly (Andonov, Eichholtz, and Kok 2015).¹⁸ Using RoW funds as a control group, we find that RoW funds that directly invest a majority of their real estate portfolio outperformed their benchmark by 45bps on average between 2005 and 2019. While this NVA value is positive, it is 100bps lower than that of comparable Canadian funds. For the small sample of RoW funds

¹⁷ According to the annual reports published by large Canadian pension funds, the proportion of their real estate assets invested in Canada has generally decreased from 2009 to 2017. For example, PSP's share decreased from 51% to 21%, CDPQ's share decreased from 43% to 32%, AIMCo's share decreased from 97% to 71%, CPPIB's share decreased from 56% to 15%, and HOOPP's share decreased from 99% to 69%.

¹⁸ The performance analysis in Andonov, Eichholtz, and Kok (2015) uses benchmark returns from the funds' reported real estate benchmarks. Using our common benchmarking approach, we also find that direct real estate management generally leads to superior performance.

that are both large and invest a high proportion of assets directly, the average NVA was negative 167bps. These statistics confirm that the investment model used by large Canadian pension funds is distinct.

Several reasons could explain why the real estate portfolios of RoW funds generally underperformed their benchmarks (their average NVA was negative 215 bps). One explanation is that their share of real estate assets managed externally was high and thus may have entailed higher costs than for funds with a high proportion of direct real estate management (Beath et. al., 2021). Another possible explanation is that several large U.S. funds suffered large losses during the 2008 Great Financial crisis due to highly leveraged positions and subsequently de-levered their portfolio as part of the re-structuring.¹⁹

In Panel B of Table 5, we report the average return of real estate portfolios across the different groups of funds from 2005 to 2019. For each fund, the average annual return is estimated in local currency as the sum of the average return of the corresponding benchmark portfolio over the full period and the fund's average NVA. This calculation allows us to make use of the full sample period for each fund and therefore avoid a situation in which we compare funds' average returns over short and different time periods.

There is a high level of heterogeneity in the funds' return performance. Part of the performance gap is driven by the performance of local real estate markets. For example, between 2005 and 2019 Canadian pension funds generated an average return of 8.5% while RoW funds generated an average return of 4.3%. This return differential is partly due to the booming real estate sector in Canada.

The NVA is another important contributor of fund return performance. Consider for example the heterogeneity in the NVA within the group of Canadian pension funds, which all invest heavily in Canada. The average return of the 7 large Canadian pension funds with a high share of direct investments was 9.7% in 2005-2019. This is 1.2% greater than the average return of all Canadian funds. Such outperformance is significant considering that the 7 large funds have a *lower* implied leverage ratio than the average Canadian fund.

¹⁹ For example, CalPERS posted a negative total return of -48.7% in the first nine months of 2009 according to "CalPERS considers real estate clearout" by Richard Lowe, IPE Real Assets, 14 Dec 2009.

Overall, our performance analysis confirms that the real estate strategy implemented by large Canadian pension funds has created significant value in 2005-2019 net of fees.

D. Conclusion

This paper investigates the investment strategy that large Canadian pension funds implement in the private real estate market. We show that these funds are uniquely involved in the market of direct real estate transactions. Their two-pronged strategy combines global asset diversification with internal development and green certification of local urban properties. Through their investment decisions, Canadian pension funds play a leading role in driving the green development of major Canadian city centers.

Our findings highlight a possible framework for other large pension funds to follow. The green urban development strategy generates long-term value for pensioners and contributes to sustainable urban development. The use of wholly-owned real estate subsidiaries makes it possible to build expertise, reduce fees, and mitigate risks ranging from construction delays to corporate governance problems that can arise from having a large number of shareholders with conflicting priorities. One interesting question that arises from our analysis is whether smaller pension funds can directly implement a scaled-down version of this model. We leave this question to future research.

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Figure 4: Application of Benchmarking Method to the NPI Index

This figure displays the evolution of the National Property Index (NPI, solid black) and its REITs-based benchmark (dotted grey) between 2005 and 2019. We construct the benchmark by de-levering, smoothing, and lagging the S&P U.S. REIT index in a way that maximizes the correlation between the benchmark and the NPI. Panel A reports the REIT index unmodified. Panels B, C, and D report the incremental impacts of the leverage, smoothing, and lag adjustments on the benchmark. For leverage, the benchmark corresponds to a mix with a 48% weight in the REIT index and a 52% weight in the AAA-corporate bond index. The smoothing parameter is $2/3$. The lag is 272 trading days.

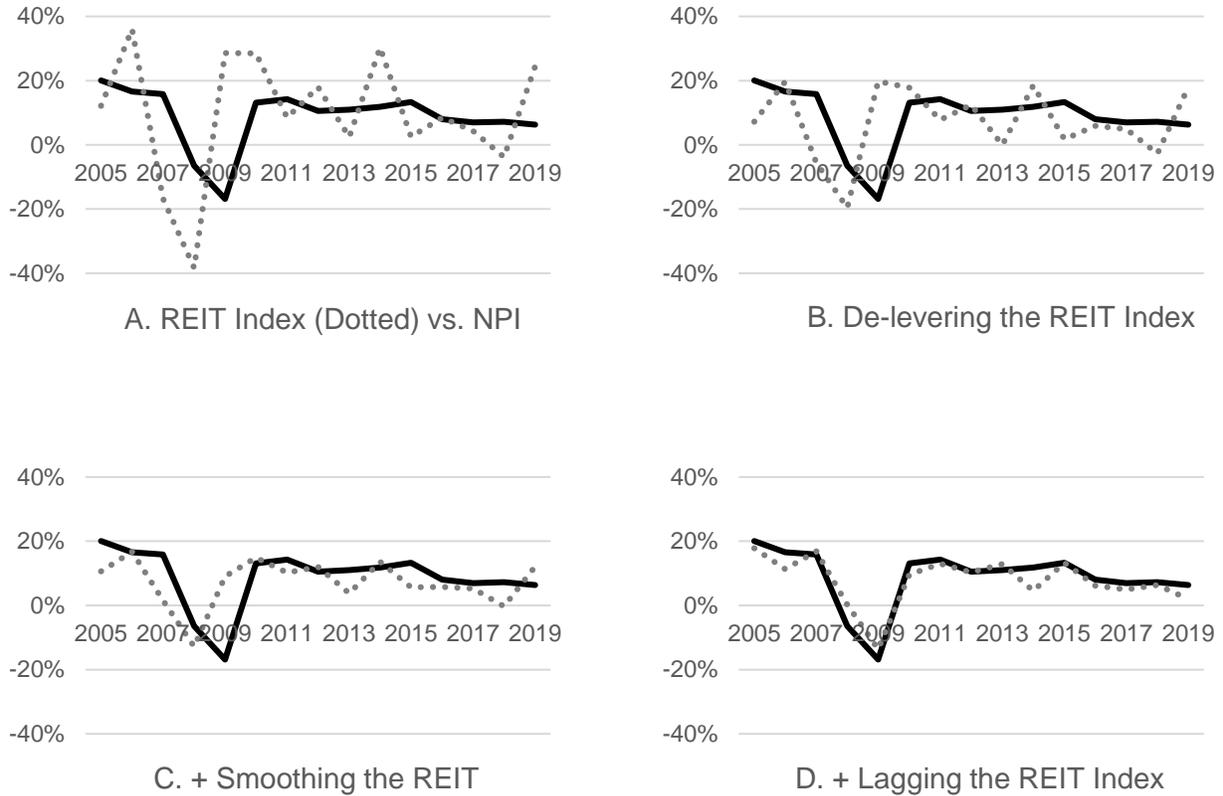


Table 1: Summary Statistics of Real Estate Deals by Pension Funds

This table displays summary statistics of direct real estate deals made by Canadian and Rest-of-World (RoW) funds that manage assets for a pension plan with more than USD 50bn of AUM in 2018. Panel A presents summary statistics about i) all funds, and ii) funds that directly invest in real estate. Statistics include the total number of funds, the median AUM, and the proportion of aggregate AUM managed by each group of funds. Panel B presents statistics about the direct real estate deals made by these funds between 2010 and 2018, where the data are obtained from Preqin. The first two sets of rows correspond to buy and sell transactions respectively. Deal size is reported at the asset level. The third and fourth sets of rows report the geography and sector distribution of buy deals. The number of foreign countries corresponds to the average number of foreign countries where deals were made by all funds of a particular country.

Panel A: Pension Funds		
	Canadian Funds	RoW Funds
All funds		
Number of funds	6	82
Median AUM (USD Mn)	93,352	81,192
% of total AUM	0.06	0.94
Funds that directly invest in RE		
Number of funds	6	36
Median AUM (USD Mn)	93,352	93,329
Panel B: Real Estate Deals		
	Canadian Funds	RoW Funds
Buy Deals		
Number of deals	139	146
Median size (USD Mn)	111	105
Total (USD Mn)	33,236	22,380
Sell Deals		
Number of deals	102	127
Median size (USD Mn)	166	83
Total (USD Mn)	20,217	13,796
Geography		
Number of foreign countries	10	2
Sector (%)		
Residential	0.19	0.09
Office	0.41	0.46
Retail	0.03	0.18
Mixed Use	0.31	0.13
Other	0.05	0.15

Table 2: Comparison of green value-added activity across pension funds

This table displays the degree of LEED value-added activity by Canadian and Rest-of-World (RoW) funds between 2010 and 2018. Panel A focuses on buy deals. The first (second) set of rows reports the percentages of all (US office) properties that are basic, premium, and LEED-VA. Panel B focuses on properties that were bought by Canadian and Rest-of-World (RoW) funds and then sold again between 2010 and 2018. The first set of rows reports the number of these deals, their total value, and the proportion of their total value relative to the total value of buy deals. The second set of rows provides the breakdown of these deals into basic, premium, and LEED-VA investments. Panel C zooms in on the LEED value-added activity by Canadian funds and provides the breakdown for properties located in Canada, U.S., and other countries. For each geography, we report the percentages of all properties that are basic, premium, and LEED-VA.

Panel A: Buy Deals			
	Canadian Funds	RoW Funds	
All Properties			
Basic	0.60	0.74	
Premium	0.13	0.13	
LEED-VA	0.27	0.14	
US Office Properties			
Basic	0.23	0.46	
Premium	0.29	0.34	
LEED-VA	0.48	0.20	
Panel B: Buy-and-Sell Deals			
	Canadian Funds	RoW Funds	
Buy-and-Sell Deals			
Number of deals	24	15	
Total (USD Mn)	5,745.44	1,069.64	
% of Buy Deals	0.17	0.05	
All Properties			
Basic	0.36	0.96	
Premium	0.03	0.04	
LEED-VA	0.61	0.00	
Panel C: Geography Breakdown for Canadian Funds			
	Investment Type		
	Basic	Premium	LEED-VA
Geography (%)			
Canada	0.59	0.00	0.41
U.S.	0.48	0.17	0.35
Other	1.00	0.00	0.00

Table 3: Properties of Real Estate Benchmark Portfolios

This table summarizes the properties of real estate benchmark portfolios reported by pension funds. The sample includes 241 funds in the CEM Benchmarking database. We categorize benchmarks into different types and include the range of premia (in basis points) reported by the funds.

Count	Benchmark Type	Range (bps)	
		Min	Max
177	Property Index		
9	Premium	-120	300
37	Lag		
30	Customized blend		
17	Inflation Linked		
17	Premium	300	550
2	Rolling N year		
7	Public Market		
1	Stock		
4	Bond		
4	REIT		
3	Premium	100	700
3	Lag		
40	Other		
13	Own benchmark		
1	Stock		
6	Bond		
7	Property		
5	Inflation		
6	Premium	150	600
7	Absolute	600	900
1	Country premium		
12	Unidentified		

Table 4: Summary Statistics of Pension Fund Real Estate Portfolios

This table displays summary statistics on the real estate portfolios of Canadian and Rest-of-World (RoW) funds. The sample includes 241 funds in the CEM database. For each group of funds, we report in Panel A the average value of the funds' AUM, proportion of assets invested in real estate, and proportion of the real estate portfolio that is managed directly as of 2018. Panel B reports average parameter values of the funds' REITs-based benchmark portfolios over the 2005-2019 period. The parameters include the lag (in trading days), degree of smoothing, and proportion of the benchmark invested in a local bond index. The fifth column reports the benchmarks' corresponding gross asset-to-net asset leverage ratio. Panel C reports the geographic mix of the benchmark portfolios.

Panel A: Summary Statistics				
	Number of Funds	AUM	% Real Estate	% Direct
Canadian Funds				
All	55	26,747	0.10	0.27
Large	8	143,985	0.14	0.81
Direct (50%+)	14	80,481	0.12	0.86
Large and Direct (50%+)	7	150,474	0.14	0.90
R.o.W Funds				
All	186	27,845	0.07	0.07
Large	28	118,384	0.08	0.16
Direct (50%+)	13	39,919	0.09	0.81
Large and Direct (50%+)	4	73,182	0.08	0.77
Panel B: Inferred Benchmark Parameters				
	Lag (l)	Smoothing (s)	Bond (b)	Gross / Net
Canadian Funds				
All	220	0.62	0.22	1.30
Large	217	0.58	0.23	1.28
Direct (50%+)	204	0.58	0.24	1.26
Large and Direct (50%+)	238	0.60	0.24	1.24
R.o.W Funds				
All	196	0.63	0.13	1.24
Large	199	0.57	0.12	1.24
Direct (50%+)	159	0.58	0.05	1.39
Large and Direct (50%+)	92	0.58	0.04	1.37
Panel C: Inferred Geographic Mix of Benchmark				
	Canada	U.S.	Europe	Other
Canadian Funds	0.79	0.14	0.02	0.05
U.S. Funds	0.01	0.79	0.06	0.14
Europe/UK Funds	0.00	0.18	0.74	0.07

Table 5: Net Value Added and Expected Return

This table displays statistics of the net value added (NVA) for Canadian and Rest-of-World (RoW) funds. The sample includes 241 funds in the CEM database. For each group of funds, we report in Panel A the cross-sectional average, median, standard deviation, and standard error of the funds' average NVA in basis points between 2005 and 2019, and in Panel B the cross-sectional average, median, standard deviation, and standard error of the real estate portfolio's average return net of costs. For each fund, the average return is calculated as the sum of the benchmark portfolio average return and the fund's average NVA.

Panel A: Net Value Added (basis points)					
	Count	Average	Median	Standard Deviation	Standard Error
Canadian Funds					
All	55	35	79	361	49
Large	8	122	149	248	88
Direct (50%+)	14	138	176	239	64
Large and Direct (50%+)	7	148	295	255	96
R.o.W Funds					
All	186	-215	-227	427	31
Large	28	-68	-35	324	61
Direct (50%+)	13	45	-83	693	192
Large and Direct (50%+)	4	-167	-139	287	143
Panel B: Average return					
	Count	Average	Median	Standard Deviation	Standard Error
Canadian Funds					
All	55	0.085	0.091	0.036	0.005
Large	8	0.095	0.094	0.020	0.007
Direct (50%+)	14	0.096	0.097	0.020	0.005
Large and Direct (50%+)	7	0.097	0.102	0.021	0.008
R.o.W Funds					
All	186	0.043	0.045	0.041	0.003
Large	28	0.058	0.060	0.029	0.006
Direct (50%+)	13	0.069	0.053	0.067	0.018
Large and Direct (50%+)	4	0.053	0.060	0.019	0.009

Internet Appendix for
“Green Urban Development: The Impact Investment
Strategy of Canadian Pension Funds”

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This Internet Appendix presents additional empirical results and provides more details about the benchmark estimation method.

1. LEED Activity Around the World

In the main text, we use LEED certification activity as a proxy for green value-added investments. We now show that LEED certification varies by sector and geography in our sample of Preqin deals involving a pension fund.

Table A.1, Panel A, reports statistics about LEED green building certification on Preqin deals made by all large pension funds between 2010 to 2018. For each industry sector and geography, we report the percentages of properties that are not LEED certified (“basic”), properties that were already LEED-certified prior to the acquisition by pension funds and did not receive additional certification afterwards (“premium”), and properties where pension funds actively sought some form of LEED certification after having acquired the property and before disposing it (“LEED-VA”). We see that mixed-use and office-space properties in Canada and the U.S. are the most likely to qualify as premium or LEED-VA.

Table A.1, Panel B, reports the geography distribution of all LEED projects reported in the USGBC database. The distribution is weighted either by the number of projects or their square footage. We see that LEED projects are predominantly based in the U.S.

In Table A.2, we break down the different types of LEED value-added activity: LEED registration only, LEED certification only, and the combination of registration and certification. For both Canadian and RoW funds, the bulk of value-added projects goes beyond registration and generally involves the full LEED certification process.

2. Estimation of Benchmarking Method

In the estimation of our benchmarking methodology, the weight in the bond portfolio b is set such that the fund’s reported return $R_{i,t}$ has a beta of one with respect to the benchmark return $R_{B,i,t-l/D}^s$ for a given combination of parameters g , s , and l .

We define β_i as the univariate beta of the fund’s real estate portfolio with respect to the benchmark. By definition, β_i satisfies

$$\beta_i = \frac{cov(R_{i,t}, R_{B,i,t-l/D}^S)}{var(R_{B,i,t-l/D}^S)} = \frac{N \cdot E(R_{i,t}, R_{B,i,t-l/D}^S) - E(R_{i,t}) \cdot E(R_{B,i,t-l/D}^S)}{N \cdot E((R_{B,i,t-l/D}^S)^2) - E(R_{B,i,t-l/D}^S)^2}$$

where N corresponds to the number of annual observations of the return $R_{i,t}$ and $E(X)$ is the expectation operator.

Solving for $\beta_i = 1$ implies

$$N \cdot E(R_{i,t}, R_{B,i,t-l/D}^S) - E(R_{i,t}) \cdot E(R_{B,i,t-l/D}^S) = E((R_{B,i,t-l/D}^S)^2) - E(R_{B,i,t-l/D}^S)^2.$$

For a given combination of parameters g , s , and l , solving for the remaining parameter b amounts to solving the quadratic equation above. If no solutions are found, there is no benchmark such that the fund has a beta of one for the combination of parameters g , s , and l . When one or more solutions are found, we select the values of the parameters b , g , s , l that maximize the correlation between the fund return $R_{i,t}$ and the benchmark return $R_{B,i,t-l/D}^S$.

Table A.1: Green value-added activity by pension funds

This table reports aggregate statistics about LEED green building certification. Panel A shows the LEED breakdown of all deals in Preqin made by large pension funds between 2010 to 2018. For each industry sector and geography, we report the percentages of properties that are not LEED certified (“basic”), properties that were already LEED-certified prior to the acquisition by a pension fund and did not receive additional certification afterwards (“premium”), and properties where pension funds actively sought some form of LEED certification after having acquired the property and before disposing it (“LEED-VA”). Panel B reports the geography distribution of all projects in the USGBC database. The distribution is weighted either by the number of projects or their square footage.

Panel A: LEED Breakdown of All Preqin Deals			
	Investment Type		
	Basic	Premium	LEED-VA
Sector (%)			
Hotel	1.00	0.00	0.00
Industrial	0.95	0.00	0.05
Land	1.00	0.00	0.00
Mixed Use	0.56	0.10	0.34
Niche	1.00	0.00	0.00
Office	0.51	0.22	0.27
Residential			
	0.94	0.03	0.03
Retail	0.80	0.07	0.13
Geography (%)			
Canada	0.59	0.00	0.41
US	0.52	0.18	0.30
Other	0.95	0.02	0.03
Panel B: Geography Distribution of all LEED Projects			
	Canada	US	Other
Weighting of projects (%)			
Number	0.02	0.81	0.17
Square-footage	0.01	0.66	0.33

Table A.2: Types of Value-Added Activity

This table reports the different types of LEED value-added activity by Canadian and Rest-of-World (RoW) funds between 2010 and 2018. Types include LEED registration only, LEED certification only, and LEED registration and certification.

	Canadian Funds	RoW Funds
Type of LEED-VA (%)		
Registration Only	0.17	0.08
Certification Only	0.41	0.58
Reg & Cert	0.42	0.35