PRESS: The methodology of the Public Real Estate Sustainability Switzerland scores

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PRESS: The methodology of the Public Real Estate Sustainability Switzerland scores *

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Abstract

This document presents the methodology followed in the development of the Public Real Estate Sustainability Switzerland (PRESS) scores. The PRESS scores, a pioneering initiative of the Center for Risk Management – Lausanne in collaboration with Quanthome SA, represent a breakthrough in the evaluation of sustainability performance among Swiss real estate investment vehicles. These scores, derived exclusively from publicly available data, address concerns about transparency and the lack of uniformity in the evaluation of real estate investment vehicles. The methodology spans three primary sections: quantitative indicators, offering detailed insights at the building level; textual analysis of investment vehicles annual reports, uncovering ESG strategies; and score aggregation, ensuring equal consideration of Environmental, Social, and Governance pillars. The PRESS scores foster transparency, independence, and sustainability in the Swiss real estate investment vehicles industry, serving as a crucial tool for stakeholders seeking well-informed decisions in the realm of sustainable finance.

Keywords: Real Estate, Switzerland, ESG, Sustainability, Public.

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1 Introduction

The Public Real Estate Sustainability Switzerland (PRESS) scores, an innovative initiative developed by the Center for Risk Management – Lausanne (CRML) in partnership with Quanthome SA, represent a significant advance in the evaluation of sustainability performance among Swiss real estate investment vehicles. These scores are based exclusively on publicly accessible data, guaranteeing availability to various stakeholders, including investors, regulatory bodies, and the general public. This document delineates the methodology used for each individual indicator that comprises the PRESS scores.

The inception of the PRESS scores can be traced back to the 2022 Indirect Real Estate Sustainability Report (CRML, 2023), characterized by inherent limitations. The report faced challenges primarily stemming from the lack of transparency in the assessment of real estate funds. Inaccessible internal data provided by investment vehicles precluded the public disclosure of ESG scores. Furthermore, the absence of uniform measurement methodologies hindered meaningful cross-fund comparisons, particularly with regard to CO_2 emissions (Alessandrini et al., 2023). Lastly, reliance on data provided by investment vehicles raised concerns about the independence and availability of the scoring process. Consequently, we recognize the urgent need for a more independent, transparent, and standardized approach capable of comprehensively addressing these concerns.

The PRESS scores embody a pioneering approach aimed at ensuring consistency in the scoring process across Swiss real estate investment vehicles. Our methodology hinges on the utilization of publicly available data, ensuring complete independence from the investment vehicles under evaluation. This approach fortifies the reliability and uniformity of the scores while eliminating potential biases, thus leveling the playing field for all investment vehicles. By offering these scores openly and free of charge, our objective is to equip stakeholders with the most up-to-date information necessary for well-informed decision making in the domain of sustainable finance. These scores serve as a crucial instrument in promoting transparency, accountability, and sustainability within the Swiss real estate investment vehicles industry, ultimately contributing to a more sustainable future.

The second version of this methodology greatly improves our market coverage and the range of topics we address. Initially, we focused on real estate funds in the SXI Real Estate Funds Broad (2023, SWIIT) index. Now, we cover a wider range of investment vehicles, including not only real estate listed funds but also non-listed funds, foundations, and companies, all of which play an important role in the Swiss economy and deserve a detailed look at their sustainability performance. This expansion covers 128 investment vehicles, representing almost 200 billion CHF in assets under management. We have also broadened our focus to include more topics, such as green areas and capital investment in renovating property portfolios. This updated methodology is a valuable resource for the market.

In this methodology document, we present the construction of each indicator comprised in the PRESS scores. It is structured into three core sections. First, in Section 2 we introduce our quantitative indicators. This section delves into the specific quantitative indicators that form the foundation of the scores. These indicators are meticulously designed to offer a fine-grained analysis of real estate investment vehicles at the building level, including essential factors such as precise CO_2 emissions, building accessibility, and tenant turnover. Second, in Section 3 we expound upon our textual analysis of investment vehicles annual reports, explaining the methodology used in the examination of official reports from real estate investment vehicles. This text mining process uncovers valuable insights from investment vehicles documents, enriching our understanding of ESG strategies and the forward-looking aspects of investment vehicles operations. Third, in Section 4 we provide a detailed account of the construction of scores, clarifying how these individual quantitative and textual indicators are combined to form the overall ESG scores. This comprehensive approach ensures equal consideration of the three pillars of sustainable finance: Environmental, Social, and Governance.

2 Quantitative indicators

The quantitative indicators presented here serve to address two primary challenges encountered in the evaluation of ESG factors in the real estate sector. First, they must quantitatively and systematically represent relevant issues at the building level. Second, their aggregation should effectively capture sustainability management at the investment vehicle level and provide metrics for which real estate fund managers can reasonably be held accountable or influenced through policies, diligence, and management processes (Woodcraft, 2012). However, considering the nature of governance evaluation, three governance indicators are directly evaluated at the investment vehicle level.

Each indicator is initially computed at the building level and subsequently aggregated at the investment vehicle level. Aggregation is weighted by the heated surface area of each building (as defined in Formula 1). The use of heated area for averaging at the investment vehicle level is a common metric in various frameworks and literature.[1]

$$I_p^v = \sum_b^B I_b \times w_b \tag{1}$$

$$w_b = \frac{a_b}{\sum_b^B a_b} \tag{2}$$

where:

I_p^v : Value-weighted indicator of portfolio p

I_b : Value-weighted indicator of building b

w_b : The proportion of heated area in m^2 of building b in the portfolio

a_b : The heated area of building b.

B : The number of buildings of portfolio p.

This notation will be used consistently throughout the definition of all indicators. To ensure the robustness of our analysis, we identify potential outliers in heated area measurements using the interquartile range (IQR) as outlined in Equations 3, 4, and 5:

$$IQR = Q_3 - Q_1 \tag{3}$$

$$\text{Upper outliers} = Q_3 + 1.5 \times IQR \tag{4}$$

[1] This approach might be limited by an initially low coverage of heated area data. In cases of missing values, an estimate is derived by multiplying the number of floors by the floor area. An alternative aggregation option could have been using the sum of the dwelling area in each building or their market value. However, using dwelling area may be less appropriate when investment vehicles also invest in non-residential buildings, and market value can be influenced by external macroeconomic factors. Such metrics are also less commonly used for weighted aggregation in the ESG framework of Real Estate.

$$\text{Lower outliers} = Q_1 - 1.5 \times IQR \quad (5)$$

where Q_1 and Q_3 represent the 1^{st} and 3^{rd} quartiles of the heated area distribution. Subsequently, we subject all potential outliers to individual scrutiny, distinguishing between plausible observations and data errors. Errors are systematically excluded from our dataset.

2.1 Environmental indicators

Environmental impact assessment in the real estate sector focuses on two key indicators: energy consumption and CO_2 emissions. However, the sector's impact on the environment goes beyond energy use. This section introduces indicators designed to estimate energy intensity, CO_2 emissions, solar panel installations and green areas around buildings for each investment vehicle. The scope of the environmental influence of real estate also includes resource depletion, water usage, and land use, among other dimensions. These additional issues will be progressively added to the quantitative indicators as information becomes available. We also mitigate the impact of such missing information by using a textual measure.

2.1.1 Energy intensity

Regarding energy consumption, real estate bears significant responsibility, accounting for approximately 40% of the final energy consumption in Switzerland (OFEN, 2023a). In alignment with the Swiss Energy Strategy 2050, which seeks to reduce this consumption by around 28% by 2050, the energy intensity indicator plays a critical role in encouraging investment vehicles to improve their energy efficiency efforts. Data on energy intensity are not reported by the investment vehicles at the building level, only at the investment vehicle level. As our CO_2 intensity indicator is measured at the building level, we also calculate the energy intensity at the building level since this is a component of the CO_2 intensity indicator that we cover in the next section.

To construct the energy intensity indicator, we rely on two primary datasets. The first dataset, known as the Geneva Buildings Dataset, comprises a collection of 11,750 buildings located within the canton of Geneva. This dataset provides building level information, such as energy intensity values, and serves as the foundational data source for our estimations. The second dataset comprises a list of 128 real estate investment vehicles, each of them associated with its reported average energy intensity value in kWh/m^2. This secondary dataset serves as a benchmark role in validating our results.

Our methodology employs a Gradient Boosting Algorithm model, a machine learning approach known for its effectiveness. This algorithm iteratively utilizes decision trees to predict energy intensity values with a high degree of accuracy. Within our model, we consider a total of 16 features, encompassing various aspects such as construction year, ground area, Minergie label, building class (e.g. residential or commercial) and surface-related characteristics. This indicator is initially estimated at the building level using our model and is subsequently aggregated at the entity level, as defined in Formula 1. This multi-tiered approach ensures that the indicator is both granular and representative of the investment vehicle's overall energy efficiency performance.

The energy intensity indicator, though insightful, has inherent limitations. Relying on the Geneva Buildings Dataset introduces a potential geographic bias which might limit generalizability. The western part of Switzerland, including Geneva, may have lower renovation rates compared to the rest of the country, potentially leading to a slight overestimation of our model's representation of the overall market. Interpretation should consider the data's origin and potential regional variations in renovation practices within Switzerland.

2.1.2 CO_2 intensity

The real estate sector carries significant responsibility for the ongoing climate crisis, primarily due to its substantial contribution to greenhouse gas emissions (GHG), particularly CO_2. In Switzerland, the real estate sector alone accounts for approximately a quarter of the country's CO_2 emissions (FOEN, 2023b). The imperative to address GHG within this sector goes beyond climate change mitigation; it also involves recognizing these emissions as a potential risk and considering potential future regulations mandating their reporting and reduction.

GHG classification encompasses three distinct scopes: scopes 1, 2, and 3. Scope 1 emissions refer to emissions directly related to the operations of real estate investment vehicles. Scope 2 emissions represent emissions arising from electricity and energy consumption used for heating and cooling within these entities. Scope 3 emissions include emissions generated during both upstream and downstream activities (GRESB, 2018).[2] Nevertheless, the lack of uniformity in the approaches used by investment vehicles to measure emissions remains a challenge (for more details on measurement diversity, refer to Alessandrini et al., 2023). However, our computational method offers a standardized CO_2 metric, which facilitates meaningful comparisons.

The challenge of computing overall CO_2 equivalent emissions arises due to limited data availability. Consequently, a proxy for CO_2 emissions is developed, using energy sources for heating and hot water from the Federal Building and Housing Registry (RegBL).[3] Furthermore, the energy intensity demand for heating and hot water demand, estimated from our Gradient Boosting Algorithm model, is incorporated.

Each energy source is associated with a CO_2 equivalent (CO_2e) factor per square meter of the heating area. This measure covers both scope 1 and scope 2 emissions. Emissions factors are sourced from Intep (2022) and recommended by the recent Swiss Asset Management Association directive (AMAS, 2023). The CO_2 intensity indicator is calculated at the building level using Formula 6 and subsequently aggregated at the investment vehicle level using Formula 1.

$$I_b^{CO_2} = w_b \times f_{sw} + h_b \times f_{sh} \tag{6}$$

where:

$I_b^{CO_2}$: CO_2e emission intensity indicator in building b

w_b: Estimated hot water demand for building b

h_b: Estimated heating demand for building b

f_{sw}: Emission factor for heating system s

f_{sh}: Emission factor for water heating system s.

[2] Significantly, Scope 3 emissions constitute the majority of total emissions from the property sector worldwide, with an average of 86% among the 200 largest listed real estate companies that disclose their emissions (Robecco, 2023). In particular, within the scope 3 emission category, 53% are attributed to downstream operations, occurring mainly during the building use phase. Given these statistics, the measurement and assessment of the emissions from scope 3 may imply substantial significance.

[3] The RegBL dataset contains unique identifiers for buildings and housing, along with key information such as addresses, construction years, floor counts, and heating systems. Managed by the Federal Statistical Office, RegBL plays a crucial role in population censuses and serves as the foundation for the country's building and housing statistics. See FSO (2022) for further details.

We note that RegBL collects information on primary and secondary heating systems, which could be different for hot water and heating. Therefore, we allow different emissions factors when this is the case. The proportion of hot water as a source of CO_2 emissions is approximated to be 12.8% of heating, according to the factors of energy demand in OFEN (2023b).

2.1.3 Share of fossil-based heating system

This indicator measures the proportion of the portfolio that relies on fossil fuels, such as gas or fuel oil, for heating. The calculation uses data from the RegBL, which details the types of heating systems used in various properties. To determine this measure, the area heated by fossil fuels is divided by the total heated area of the portfolio, resulting in the percentage of heating that depends on fossil fuels.

A higher percentage indicates a greater reliance on fossil-based heating, negatively affecting the portfolio's environmental score. This measure highlights the need for significant updates to meet future environmental regulations and align with long-term sustainability goals. Its main purpose is to assess the extent of dependency on non-renewable energy sources and identify portfolios that may require substantial renovations to adopt more sustainable heating solutions.

2.1.4 Share of electric solar panels

This indicator measures the proportion of roof space in the portfolio that has solar panels installed. Data for this analysis is sourced from the Solar Energy database (MeteoSwiss, 2023), which provides detailed information on the installed solar panel areas and the total roof areas suitable for such installations. The calculation involves comparing the total installed solar panel area to the total roof area available for solar panels, expressed as a percentage.

This measure assesses how effectively investment vehicles are utilizing their roof space to contribute to the greening of the Swiss energy market. By maximizing the use of available roof space for solar energy generation, these investment vehicles reduce their reliance on non-renewable energy sources and actively participate in the broader transition towards sustainable energy solutions.

A higher percentage of roof space with installed solar panels indicates a stronger commitment to using available renewable resources. This directly translates into a better environmental score for the portfolio. A higher score reflects the investment vehicle's dedication to environmental sustainability by increasing solar energy production, reducing greenhouse gas emissions, and setting a renewable energy standard in the real estate sector.

2.1.5 Green areas

This sub-indicator measures the ratio of designated green spaces around buildings, aggregated at the portfolio level. The data for this analysis is sourced from the Land: Use, Cover, Suitability database (FSO, 2023), which categorizes land into 100x100 meter pixels, ranging from highly concrete-dense areas to forests. The green area indicator is computed by counting the proportion of green land pixels within a 100-meter radius around each building.

This measure evaluates whether buildings are located in areas that support diverse natural environments and biodiversity.[4] It highlights the current ecological diversity around the properties and the potential for improving local ecosystems through the preservation or creation of green spaces.

A higher value of this indicator signifies a greater proportion of green space relative to built-up and non-green areas, leading to a better score. This positive score reflects a strong commitment to maintaining or increasing biodiversity, promoting urban greening, and contributing positively to environmental health. Buildings with higher green area scores are likely to offer better environmental quality, enhancing the overall sustainability and appeal of the portfolio.

2.2 Social indicators

This section delves into the social dimension of real estate and introduces indicators designed to assess its impact. Specifically, the selected indicators aim to capture the accessibility of assets, rental pricing strategies, the exposure of building occupants to noise pollution, tenant policies, availability of amenities, and the presence of social buildings. It is important to note that while these indicators provide valuable information on user well-being, they do not encompass critical variables such as community engagement, neighborhood integration, or the ratio of rents to in-

[4] The categories considered are fruit growing, viticulture, horticulture, arable land, natural meadows, local pastures, alpine pastures, forest, Bushy forest, other wooded areas, lakes, watercourses, unproductive vegetation, glaciers, snow.

come, among others. At this stage, data on employee policy, such as salary or training programs at the fund management level, are not included as quantitative indicators. However, they are captured through the textual indicator.

2.2.1 Residential accessibility

Residential accessibility is defined as the ability of individuals to reach goods, locations, and services. It is influenced by characteristics of urban planning, such as proximity to stores, educational institutions, healthcare facilities, and recreational areas. Additionally, individual-specific factors, including ability, income, and knowledge, can impact a person's accessibility to these locations. Achieving inclusive accessibility requires consideration of these characteristics in the development of urban areas (Access to Services, 2023). Mixed-use development projects, for example, can reduce the reliance on fuel-based transportation, enhance accessibility, and stimulate the local economy (Herndon, 2011).

This indicator takes into account various forms of accessibility, as shown in Figure 1, including access to healthcare, education, social activities, and transportation. To measure accessibility, we count the number of service entities within a 10-minute walking radius (approximately 700 meters) from the building's location.[5] OpenStreetMap data and RegBL building coordinates are used for these calculations. This score is calculated for fully residential and mix buildings.

Different accessibilities are calculated as shown in Formula 7, and subsequently are aggregated at the building level using Formula 8. Finally, this indicator is aggregated at the portfolio level using Formula 1.

$$RA_b^c = \frac{\sum_{t=1}^{t_c} s_b^t}{t_c} \tag{7}$$

$$RA_b = \frac{\sum_c^C RA_b^c}{C} \tag{8}$$

where:

RA_b: Accessibility for building b

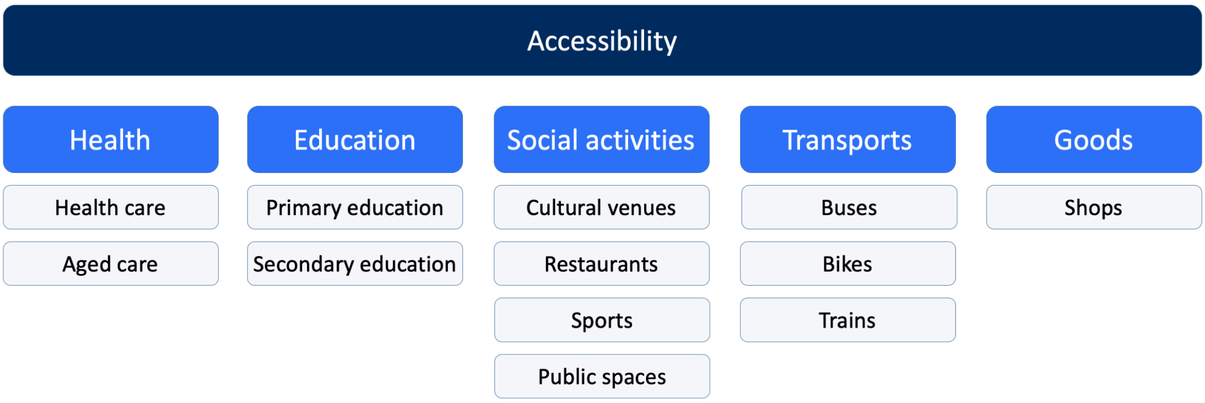
[5] In order to prevent a disproportionately high score resulting from the dominance of a single service type, we have instituted an upper limit of 10 entities. This decision aligns with the understanding that, within a 10-minute walking radius, the marginal utility of an additional service diminishes significantly in areas already characterized by a substantial concentration of that particular service.

s_b^t: Number of entities for the type of service t within a radius of 700 m for the building b

t_c: Number of types of services accessible in category c (e.g., healthcare and age care as types of accessibility within the category health)

C : Number of accessibility categories.

Figure 1: Residential accessibility criteria at the building level



2.2.2 Commercial accessibility

The commercial accessibility indicator measures how well a commercial building is connected to and positioned within a busy economic area. It highlights its proximity to other businesses and the ease of access by both public transport and cars. This indicator is important for determining a building's potential to succeed in both local and broader economic environments, thereby increasing its attractiveness and value.

The calculation for this indicator focuses on the concentration of businesses and transportation accessibility. It includes data on public transport and car travel times, which show how long it takes to reach and leave a building.

To ensure each component—business density, public transport, and car travel times—is comparable, they are normalized to fit the same scale. This standardization allows for a combined evaluation of the property's economic connectivity. Business density is assessed by counting the number of businesses within a 700-meter radius, using data from OpenStreetMap and the RegBL. Public transport and car accessibility are determined by examining travel times weighted by the population of each area, reflecting the property's broader economic connections (OFDT, 2024).

The formula to calculate the Economic Cluster score at the building level is:

$$CA_b = \frac{BusinessDensity_b + TransportAccessibility_b}{2} \tag{9}$$

In this formula, CA_b is the score that measures how well-connected a building b is to economic activities, $BusinessDensity_b$ measures the concentration of businesses near the building b, and $TransportAccessibility_b$ indicates the travel time by car or public transport to and from the building. This score is calculated only for fully commercial buildings.

This score is then combined for all properties in the portfolio, providing an overall measure of how economically integrated and valuable the real estate portfolio is. A higher commercial accessibility score suggests better integration into essential economic networks, indicating a greater strategic value of the portfolio. This score reflects not only the current usefulness of the portfolio but also its potential future appeal to businesses seeking prime locations.

2.2.3 Rental pricing

The rental pricing indicator evaluates how rents of individual dwellings within a investment vehicle's portfolios compare to the average rent of buildings in their respective quarter or municipalities. This comparative analysis assesses whether investment vehicles' pricing strategies impose rental premiums or offer discounts to their tenants. The indicator plays a pivotal role in providing stakeholders with insights into the implications of these pricing strategies for tenants within their portfolios.

The methodology for this indicator relies on data collected by Quanthome from rental housing advertisement as well as data from RegBL. The indicator is formally defined as the disparity between the rental price per square meter for a dwelling contained within the investment portfolio of a investment vehicle and the mean rental price per square meter for properties situated within the locality.[6] For the ten most populous cities, the locality corresponds to the urban quar-

[6] For our computations, we utilize the gross rental price, a customary and extensively utilized metric in housing advertisements. This choice is made to mitigate the potential inconsistencies that arise from the heterogeneity between net rent and additional charges, ensuring that disparities in rental prices predominantly signify pricing strategies rather than specific characteristics of the building.

ter.[7] For the other municipalities, the locality aligns with the boundaries of the same municipal area.[8] Rental prices are normalized to a standard three-room apartment to ensure consistent and meaningful comparisons. A positive rental difference indicates that the investment vehicle charges a premium on rental price compared to the average of the locality, while a negative rental difference suggests potential tenant discounts.

A positive premium, which would be perceived as negative from the tenant's standpoint, could reflect compensation for higher living standards in the building, which should be captured by other indicators. If living standards are not higher, the higher rental price only reflects the pricing strategy of the investment vehicle and negatively impacts the S score.

The calculation of the rental pricing indicator is performed at the building level using Formula 10. Subsequently, the indicator is aggregated at the portfolio level using Formula 1.[9]

$$R_b = r_b - r_l \tag{10}$$

where:

R_b : Rental premium or discount for building b

r_b : Rental price per m^2 for building b in locality l

r_l : Average rental price per m^2 for locality l.

2.2.4 Outdoor noise pollution

In Switzerland, a significant proportion of the population — approximately 1 in 7 individuals — is exposed to noise pollution originating from road, air, and train traffic during both daytime and nighttime hours in 2015 (FOEN, 2015). Extensive research has shown the various adverse effects of exposure to noise on critical aspects of health and well-being. For example, noise

[7] For the precise delineation of quarters boundaries, we rely upon a the FSO (2017) database. This database provides neighborhood boundaries for the following major cities: Basel, Bern, Biel/Bienne, Genève, Lausanne, Lugano, Luzern, St. Gallen, Winterthur, and Zürich.

[8] We employ the municipal level as it represents the lowest geographical tier at which we can establish well-defined boundaries for these entities.

[9] To address potential bias from the commercial nature of an investment vehicle, we adjust the indicator based on the proportion of residential dwellings in the portfolio. Consequently, an investment vehicle exclusively focused on commercial properties is not taken into account for this indicator.

pollution has been linked to potential impacts on mental well-being of children (Lim et al., 2018) and has been associated with sleep disorders that increase the risk of cardiovascular disease (Hume et al., 2012). Furthermore, noise disturbances can compromise the overall productivity and comfort of individuals (Mohamed et al., 2021).

Within the realm of real estate, property owners have several avenues for addressing noise-related concerns. They can invest in improving the quality of the building envelope to create sound-insulated living environments or promote sustainable and noise-reducing transportation solutions, such as slow and electro-mobility (FOEN, 2023a). Property owners can also leverage their property rights to influence local regulations, thus directly contributing to the reduction of noise pollution at its source. This underscores the role that real estate entities play in mitigating the impact of noise pollution and fostering healthier living environments for tenants.[10]

To calculate the outdoor noise pollution indicator, we have collected the following maps published by the Federal Office of the Environment (FOEN, 2022): Daytime and nighttime road traffic noise and daytime and nighttime train traffic noise in decibels (dB). These estimates are based on traffic data, vehicle category and type, and location-specific characteristics, such as obstacles or road coverings (FOEN, 2023a).

The formula 11 computes the outdoor noise pollution indicator at the building level and formula 1 aggregates the indicator at the investment vehicle level.

$$I_b^n = \frac{\sum_c^C N_{b,c}}{4} \tag{11}$$

where:

I_b^n : Aggregate of the four types of noise in dB at the building level

$N_{b,c}$: Noise of type c in dB for building b

C : Types of night or day train and road noise.

[10] In Switzerland, residential noise level limits are set at 60 dB during the day and 50 dB during the night.

2.2.5 Tenant policy

The decision to relocate is influenced by a variety of factors, including personal circumstances, family changes, and job opportunities. However, the tenant's satisfaction with their current living or working environment can also play a crucial role and sometimes be the reason for seeking a change.

An article published by Raiffeisen Bank highlights that 13% of individuals decide to move due to dissatisfaction with their current living conditions or property management (Neff, 2020). To capture this effect, two sub-indicators, "New residents delta" and "Rental advertisement delta", have been developed. Each of these metrics assesses the number of individuals or advertisements per dwelling or heated area in relation to the same metric at the municipality level. These metrics indicate whether a building experiences more or fewer moving than the average of the municipality.[11]

2.2.5.1 New residents delta

The new residents delta sub-indicator relies on the STATPOP dataset from 2021, specifically the number of residents living in a hectometer for less than a year, assumed to be new residents. To estimate the number of new residents for each building, the value at the hectometer level is attributed to the building based on its share of dwellings in the hectometer, as described in Equation 12. A one-unit difference in this indicator equals one additional new resident per dwelling. Then the average number of new residents per municipality is calculated, as shown in Equation 13.

Finally, the indicator, which represents the difference between these two metrics, is calculated at the building level using Equation 14.

$$R_b = R_{hm} \times \frac{D_b}{\sum_b^{B \in hm} D_b} \tag{12}$$

$$R_m = \frac{\sum_{hm}^{HM \in m} R_{hm}}{\sum_b^{B \in m} D_b} \tag{13}$$

[11] In alignment with the rental pricing indicator, we rescale tenant policy metrics with the proportion of residential properties, thereby mitigating bias arising from a commercial focus.

$$R_b^{delta} = R_m \times D_b - R_b \tag{14}$$

where:

R_b : Estimated number of new residents in a building located in hectometer hm

R_{hm} : Number of new residents in hectometer hm

D_b : Number of dwellings for the building b

R_m : Average number of new residents per dwelling in municipality m

R_b^{delta} : Difference between the expected number of new residents and the actual number of new residents.

Finally, the indicator is aggregated at the investment vehicle level using Formula 1.

2.2.5.2 Rental advertisement delta

The rental advertisement delta sub-indicator relies on rental advertisements collected from rental ad websites. The methodology is similar to the one used for the new residents delta, with one distinction: the normalization of advertisements per building is done with the heated area instead of the number of dwellings. This adjustment is necessary as rental advertisements may include both residential and commercial properties, with the latter lacking dwellings.

$$I_b^{Ads} = \frac{\sum_b^{B \in m} A_b}{\sum_b^{B \in m} a_b} - \frac{A_b}{a_b} \tag{15}$$

where:

I_b^{Ads} : Building b difference from municipality m in terms of advertisement per heated surface

A_b : Number of advertisements per building b.

The indicator is aggregated at the investment vehicle level using Formula 1.

2.2.6 Amenities

The amenities indicator assesses the availability of public parks and sports facilities within a 10-minute walk from each building in a portfolio, highlighting the access to natural and recreational spaces. This indicator utilizes data from OpenStreetMap, which identifies the locations of public parks and sports areas. This allows for a precise measurement of green and recreational areas available around each property.

The presence of amenities like parks and recreational facilities is crucial for tenant well-being and significantly enhances their quality of life. Investment vehicles that prioritize properties with abundant amenities not only contribute to the planning and enhancement of urban spaces but also make them more attractive and livable. A higher count of these accessible amenities leads to a higher score for this indicator, reflecting the investment vehicle's commitment to fostering community engagement and promoting a healthy lifestyle. Emphasizing the integration of green spaces and recreational opportunities is crucial for sustainable urban development.

2.2.7 Share of social buildings

This indicator quantifies the proportion of buildings within the portfolio designated for critical social functions. Data for this indicator is sourced from RegBL, focusing on specific categories that include community housing, educational and research buildings, and hospitals and health establishments.

The calculation measures the total square meters of buildings in these categories as a percentage of the entire portfolio. This metric serves to emphasize the role of the investment vehicles in contributing to societal needs through the provision of essential services such as healthcare, education, and community housing.

Investing in buildings that serve societal functions, despite adding complexity due to their specialized nature and regulatory environments, demonstrates a commitment to social responsibility in property investment. A higher proportion of these social buildings within the portfolio leads to a higher score for this indicator, reflecting the portfolio's role in enhancing community well-being and infrastructure. These properties meet specific community needs and strengthen the social fabric of the communities they serve.

2.2.8 Elevators access

This sub-indicator measures how much of the portfolio can be accessed via elevators, which is essential for people with limited mobility. It uses data from rental advertisements to check if buildings have elevator access. Additionally, buildings constructed after 2002 with either eight or more dwellings, those classified as commercial buildings or buildings for recreational or cultural use, museums and libraries, educational and research buildings, hospitals and health establishments, and community housing are assumed to have elevators, based on compliance with the Disability Discrimination Act (Assemblée fédérale de la Confédération suisse, 2002).

This measure is important because it ensures that people with limited mobility can easily move around and use the properties. While it specifically examines elevator access, overall accessibility also relies on entrance designs, door widths, ramps, and accessible restrooms. However, data on these additional aspects of accessibility is currently unavailable.

A higher percentage of area accessible by elevators leads to a higher score for this indicator. This higher score shows the portfolio's commitment to being inclusive, making it more attractive to a wider range of tenants and visitors. It also shows compliance with regulations and reflects a commitment to inclusivity, ensuring that the properties are accessible and welcoming to everyone.

2.3 Governance

In Switzerland, real estate fund managers often delegate the direct management of their assets to property management companies (Bonnet and Pollard, 2021). As a result, evaluating governance practices using building-level data can be challenging. The indicators in this section aim to capture trends in good governance practices at the investment vehicle level.

2.3.1 Minergie

Buildings with Minergie labels are not only energy and resource efficient but also provide a comfortable living environment for tenants. Furthermore, the decision to renovate a building and label it with Minergie, or to purchase or construct a Minergie-compliant building lies within the hands of the fund's managers. Additionally, the greenness of assets shows a positive correlation with good governance practices (Robinson and McIntosh, 2022).

To build the Minergie indicator, the share of the surface labeled with Minergie is used.[12] As most of the buildings with the Minergie label adhere to the Minergie standards, no differentiation is made between the different labels.

$$Minergie_p = \sum_{b}^{B} m_b \times w_b \tag{16}$$

where m_b is a variable equal to 1 if building b has a Minergie label. Last, the indicator is aggregated at the investment vehicle level using formula 1.

2.3.2 Board gender

The board gender indicator is a quantitative metric used to assess gender diversity within the composition of the board of directors collected at the fund level. This indicator is designed to evaluate the extent to which a real estate investment vehicle's board of directors reflects gender parity or deviates from it. To calculate the Board Gender Gap, comprehensive data on the composition of each investment vehicle's board of directors are collected, including the total number of board members and the number of male and female directors.

$$BoardGenderGap_p = |0.5 - ShareOfWomen_p| \tag{17}$$

where:
$ShareOfWomen_p$: Share of women in the investment vehicle board of portfolio p
$BoardGenderGap_p$: Deviation from perfect parity in absolute percentage point.

A Board Gender Gap of 0 indicates perfect gender parity, meaning that the board of directors has an equal representation of male and female members. Positive values indicate an overrepresentation of male or female directors on the board.

[12] Our data is cross-referenced with the figures presented in the annual reports. In the event of inconsistencies, the highest value is selected.

2.3.3 Ratification of international treaties

The indicator of ratification of international treaties assess the extent to which a real estate investment vehicle or vehicle's group has committed to international treaties and agreements related to ESG factors. This indicator is designed to measure the investment vehicle's participation in global sustainability efforts and its alignment with international standards.

To calculate the number of ratified international treaties, a predefined list of international treaties and agreements related to ESG factors is used.[13] These treaties typically cover a wide range of ESG topics such as climate change, human rights, labor standards, and anti-corruption measures. Information is collected on whether the investment vehicle or vehicle's group has ratified or signed these relevant international treaties. Each treaty that the investment vehicle has ratified contributes to the count. The indicator of ratification of international treaties is calculated as a simple sum of the number of treaties ratified by the investment vehicle or vehicle's group.

A higher value for the indicator of ratification of international treaties indicates that the investment vehicle or vehicle's group has committed to a higher number of international treaties related to ESG factors, reflecting a stronger commitment to global sustainability and responsible investment.

2.3.4 Sustainability reporting and web communication

The indicator for sustainability reporting and web communication is used to assess the extent to which a real estate investment vehicle or vehicle's group provides dedicated sustainability reporting and maintains a separate webpage dedicated to sustainability issues. This indicator aims to evaluate the vehicle's commitment to transparency and communication of its sustainability efforts.

To calculate the indicator of sustainability reporting and web communication, two key el-

[13] The treaties are the following: Climate Action 100, Global Investor Coalition on Climate Change, International Labour Organization, Principles For Responsible Investment, Re100, Task Force On Climate Related Financial Disclosures, UN Environment Programme Finance Initiative, UN Global Compact, World GBC Net Zero Carbon Buildings Commitment, Global Reporting Initiative, Carbon DisclosureProject, Sustainability Accounting Standards Board, Ethos Engagement Pool, Swiss Sustainable Finance.

ements are considered: the presence of a standalone sustainability report, separate from the investment vehicle's annual report, and the presence of a webpage on the investment vehicle's website solely dedicated to sustainability-related information. Each element is assessed separately, with a binary value of 1 assigned if the element is present and 0 if it is absent.

The indicator for sustainability reporting and web communication is calculated as a simple sum of the binary values for both elements. If both elements are present, the sum is 2; if only one element is present, the sum is 1; if neither element is present, the sum is 0. This indicator is important for three main reasons. Firstly, it shows a commitment to transparency by providing a standalone sustainability report and a dedicated webpage. This transparency benefits stakeholders such as investors, regulators, and the general public, as it allows them to easily access and understand the investment vehicle's ESG efforts. Additionally, having a dedicated sustainability webpage improves the accessibility of ESG data, making it more user-friendly. Furthermore, maintaining a separate sustainability report encourages the investment vehicle to thoroughly address and report on its sustainability initiatives, promoting accountability for its ESG performance.

2.3.5 Capital expenditures

The capital expenditures to value ratio is an important financial measure that shows how much an investment vehicle spends on maintaining and improving its properties. This ratio provides insights into property value management and sustainability efforts, adding a forward-looking dimension to our analysis. It helps assess which investment vehicles are actively investing in the renovation of their real estate portfolios, acting as a predictor of future strong environmental performance. Development investments are excluded from this indicator.

This ratio compares the money spent on building renovations to the total value of the portfolio. Information for this measure comes from the financial part of annual reports and tracks investment in property improvements relative to their market value. This indicator acts as a proxy for the renovation rate. A higher ratio indicates active investment in making properties better and more sustainable, which is crucial for maintaining a competitive edge and meeting regulatory standards. It demonstrates a strong commitment to sustainability and efficient property management.

2.3.6 Spatial diversification

The spatial diversification indicators are essential for understanding and managing the risks associated with the geographic locations of properties within a portfolio. Cantonal and Distance diversification indicators use data to measure how spread out the properties are, which helps in reducing potential risks from local disruptions or natural events, respectively. By focusing on both cantonal and distance diversification, these indicators provide a comprehensive view of how geographical factors can impact the safety and performance of a real estate investment portfolio.

2.3.6.1 Cantonal diversification

This indicator uses location data from RegBL to analyze how investments are spread across different cantons. The cantonal diversification index is calculated based on the Simpson index formula, defined as follows:

$$S_c = 1 - \sum_{c=1}^{C} p_c^2 \tag{18}$$

$$S_c^{max} = 1 - C \times \left(\frac{1}{C}\right)^2 \tag{19}$$

$$D_c = \frac{S_c}{S_c^{max}} \tag{20}$$

where:
p_c: Proportion of buildings in canton c, with C the number of cantons
D_c: Ratio of the Simpson index in the canton, S, to its theoretical maximum value, S^{max} in canton c.

By evaluating how properties are distributed, this indicator helps to lessen transitional risks that come from local issues like changes in real estate laws. A more widespread distribution across cantons generally means less risk from these local issues, leading to a higher score for this indicator. This approach is key to managing risk effectively, ensuring that local economic changes or regulations have a minimized impact on the overall portfolio.

2.3.6.2 Distance diversification

The Distance diversification measure calculates how far apart each property in the portfolio is from the others, using Euclidean distances and geolocation data from RegBL. The calculation is as follows:

$$SRE_f = \sum_{i \in f}^{I} SRE_i \tag{21}$$

$$AVGDist_i = \sum_{j \in f}^{J} Dist_{i,j} \times \frac{a_j}{a_f} \tag{22}$$

$$AVGDist_f = \sum_{i \in f}^{I} AVGDist_i \times \frac{a_i}{a_f} \tag{23}$$

where:
a_f : Total square meters in portfolio f
$Dist_{i,j}$: Distance measured between buildings i and j
$AVGDist_i$: The weighted average distance between building i and all buildings in portfolio f
$AVGDist_f$: The weighted average distance between all buildings in portfolio f.

This assessment helps to manage physical risks that are specific to certain locations, such as proximity to natural disaster zones or economically unstable areas. The more spread out the properties are, the less likely it is that a local problem will affect the entire portfolio. A higher value for this indicator suggests better risk management, indicating that the portfolio is well-prepared to handle potential local setbacks and maintain stability.

3 Textual indicators

This section outlines the methodology employed for our textual analysis of ESG performance in Swiss real estate investment vehicles. The focus is on three key aspects: dataset description and classification, creation of the ESG dictionary, and the text mining process. Additionally, we include a robustness check to address potential language bias.

3.1 Data

The dataset comprises disclosed statements from Swiss real estate investment vehicles. It encompasses various types of PDF files, including annual reports, sustainability reports, semi-annual reports, group annual reports, group sustainability reports.[14] The data set for each investment vehicle includes all available filings. The naming convention for these documents consists of an eight-character individual code for each investment, followed by the reporting year, and ending with a four-character file type code. This naming convention provides crucial information to easily identify and classify each file based on its name. The dataset encompasses files in three different languages: English, French, and German.

3.2 ESG Dictionary

In our approach to measure ESG performance through text analysis, we employ a dictionary-based method. This method uses a specific dictionary composed of words indicative of superior ESG performance. By quantifying the frequency of these dictionary words within a given text, we can infer the text's ESG performance level. Through this dictionary-based approach, dictionary enrichment via neural network techniques, and translation capabilities, our aim is to provide a comprehensive and accurate assessment of ESG performance based on textual data.

3.2.1 Description

The foundation for our initial dictionary is derived from the work of Baier et al. (2020). We utilize their updated dictionary as of July 2022, which incorporates several additional terms.[15] The initial dataset comprises 491 entries, each representing a single English word. These entries cover nouns, verbs, and abbreviations. Some words in the dictionary include meaningful inflections that capture various forms of a root word, such as "cleaner," "cleanest," and "cleaning." The words in the ESG dictionary from Baier et al. (2020) are categorized into three overarching topics: Environment, Social, and Governance. Furthermore, many words are subcategorized

[14] Group reports are incorporated into the database upon public disclosure of the investment vehicle's affiliation.

[15] The ESG dictionary has been sourced from Florian Kiesel's professional website Kiesel (2022), one of the co-authors of Baier et al. (2020).

into specific categories and subcategories. This classification system provides a comprehensive and granular overview of the word list, with three main topics, ten categories, and forty subcategories. By leveraging this comprehensive ESG dictionary, we gain a deeper understanding of the language and terminology associated with environmental, social, and governance aspects.

3.2.2 Adaption

To tailor the dictionary to the specific context of real estate, we undertake a procedure to identify potentially crucial ESG-related words that may be absent from the dictionary and incorporate them to enhance it. Both Baier et al. (2020) and Kiriu and Nozaki (2020) employ strategies that involve term-document matrix reduction to construct and refine their ESG dictionaries. However, Baier et al. (2020) does not specify the precise type of model and the specifications of the models they employ. Similarly to Kiriu and Nozaki (2020), we utilize the skip-gram model implemented through the word2vec algorithm to identify missing words and potentially enrich the dictionary.

To learn word associations from a large corpus of text and discover which words are related to specific concepts, we utilize a neural network model. This model, once trained on a dataset, can, given a word as input, produce output words that are highly correlated with the input and tend to appear in similar contexts. For this purpose, we use the word2vec library.[16] By capturing word context, the word2vec method can detect both semantic and syntactic similarities.[17,18]

After training the continuous skip-gram model on English company documents, we initially employ the words used to name the Topics and Categories, according to the procedure followed by Baier et al. (2020). To maintain the conciseness of the dictionary, we extract the top 10

[16] The word2vec method converts each word in the text into a vector, where each word occurrence is marked, effectively transforming a text into a large matrix. This matrix allows us to identify words that frequently occur in proximity to each other.

[17] Semantic similarities pertain to word meanings, while syntactic similarities relate to sentence structure and word placement.

[18] The word2vec method offers two models: the Continuous Bag-of-Words Model (CBOW) and the Continuous Skip-gram Model. The CBOW model predicts a word based on its context, while the continuous skip-gram model predicts surrounding words given the current word. According to the creator of the word2vec method Mikolov et al. (2013), apart from having greater complexity and requiring more time, the continuous skip-gram model tends to perform more accurately on semantic tasks, while CBOW excels at syntactic tasks. This suggests that the continuous skip-gram model is better suited for predicting word meanings, while CBOW is better suited for modeling word order. Therefore, the skip-gram model is more appropriate for the purpose of supplementing the ESG dictionary.

positively correlated words for each word and exclude any words already present in our dictionary. Then, we filter for meaningful additions. The recommendations of the trained model align largely with the existing dictionary, affirming that the base dictionary provided by Baier et al. (2020) is suitable for this dataset. However, we identify some valuable additions.

3.2.3 Translation

After improving the English ESG dictionary, the next step is to translate it into German and French. To accomplish this, we employ the Googletrans library in Python, which utilizes Google Translate. Once we obtain the translated word lists in German and French, we cross-reference them manually using dictionaries to ensure accuracy. In cases where different English words translate to the same foreign word, we include only one translation to prevent duplication. For example, both ”citizen” and ”citizens” translate to ”Bürger” in German. Therefore, ”Bürger” appears only once in the German dictionary to avoid double counting. Additionally, some English words have foreign translations consisting of two separate words. For instance, ”groundwater” translates to ”eaux souterraines” in French. As our model uses single words as dictionary entries, we denote such cases by introducing a hyphen, resulting in ”eaux souterraines” becoming ”eaux-souterraines” in the dictionary. This translation process ensures that the ESG dictionary covers relevant terms in German and French, enabling accurate analysis of documents in multiple languages within the model.

3.3 Text Processing

To extract information from PDF documents, we begin by using the pdfminer library in Python to extract all textual content. Our goal is to preserve as much semantic information as possible while simplifying and reducing the dimensionality of the textual data. Many words in documents are broken up by line breaks into two separate words with hyphens at each end. We identify these split words, remove the hyphens, and join them in their natural and recognizable form. To reduce data dimensionality and eliminate noise, we remove elements that do not contribute meaningful value, such as uppercase characters, punctuation, and special characters. Numbers and single-character words are also removed. We identify two-worded translation terms and replace the blank space with a hyphen to form a single word.

3.4 Information Extraction

After individually processing each document to improve textual quality and reduce data dimensionality, we proceed with information extraction. Given that sentiment analysis may not always be the most effective method for predicting firm performance, as demonstrated in Lee et al. (2018), we adopt a dictionary-based approach. In this approach, the structure of the sentence is not a primary consideration; instead, we count the frequency of each word and condense this information into a vector.

To determine the language of an investment vehicle's documents, we use the translated ESG dictionary. Specifically, for each language, we utilize the corresponding ESG dictionary to count the total number of ESG terms used in a document. The language in which the most ESG terms appear is assigned as the corresponding language of the document. Once we have a vector of translated dictionary word frequencies for each document in its respective language, we consolidate all translated dictionary word frequency vectors for investment vehicles that have multiple types of disclosed documents into a unified vector per investment vehicle. In order to reduce at maximum any language bias, we always pick English documents when available.

3.5 Computation of ESG textual indicators

The calculation of ESG textual indicators for each investment vehicle involves a step-by-step process. Initially, we obtain the total word count of the investment vehicle's documents, providing an overall measure of the available text for analysis. Subsequently, we determine the word count for each of the three ESG pillars: Environment, Social, and Governance. This entails counting the frequency of relevant words associated with each pillar within the investment vehicle's documents.

To assess the significance of each ESG pillar, we calculate the relative frequency. This is achieved by dividing the word count for each pillar by the total word count of the documents. Our relative frequency approach offers a proportional representation of the importance of each pillar within the investment vehicle's ESG performance.

This method provides a quantifiable measure of the presence and communication of E, S, and G within official documents of an investment vehicle. An investment vehicle with a higher score in a particular pillar indicates a greater focus on addressing future challenges, implementing better disclosure practices, and employing diverse strategies to mitigate potential risks associated with that specific aspect of ESG pillars.

4 ESG scores

To provide a comprehensive assessment of each entity and facilitate cross-comparison, individual indicators are standardized onto a common scale. These standardized indicators are then aggregated to calculate ESG scores and ESG pillar scores. These scores offer a holistic evaluation of each investment vehicle.

The transformation of separate indicators into ratings occurs on a scale ranging from 0 to 10, where 0 represents the least favorable outcome, and 10 signifies the most favorable result. Our rating methodology is an adaptation of the approach outlined by Refinitiv (2020).

In our scoring methodology, we employ the percentile rank scoring method presented by Refinitiv (2020) to minimize the influence of outliers. In instances where data is missing, we assign a score of 0 to ensure that it is rated as less favorable than the least favorable data point. The final score for each indicator is determined by the percentile position of the metrics. In the case of indicators with positive polarity the score (S_f^+) is calculated as follows:

$$S_f^+ = \frac{\text{nb of vehicles with a smaller value} + \frac{\text{nb of vehicles with the same value}}{2}}{\text{nb of vehicles with a value}} \times 10 \tag{24}$$

For indicators with negative polarity, the reverse percentile, denoted as S_f^-, is calculated as:

$$S_f^- = 10 - S_f^+ \tag{25}$$

The ESG pillar scores are computed as weighted averages of a set number of indicators. The Environmental pillar scores are based on 5 indicators, the Social pillar scores rely on 9 indicators, and the Governance pillar scores are determined by 7 indicators. The indicators within each pillar are assigned equal weights, ensuring that each indicator contributes equally to the final pillar score. Some exceptions apply to subindicators, where weights are distributed evenly across specific policy-related questions to maintain balance and avoid overemphasizing particular information. Additionally, the weight of the residential and commercial accessibility indicators is adjusted according to the residential share of buildings in each investment vehicle. The resulting pillar scores range from 0 (least favorable) to 10 (most favorable). Figure 2 provides the detailed weights for each indicator.

Figure 2: Indicator weights

To enrich our quantitative scores, we incorporate results from our textual analysis. We apply the same scoring methodology, where a higher relative count of words per pillar is associated with a higher score. Textual scores contribute one third of each pillar's final score. This integration of textual analysis addresses potential backward-looking biases inherent in quantitative scores and captures additional ESG strategies that may not be fully reflected in the quantitative assessments.

The overall ESG score is an unweighted arithmetic mean of the scores from the Environmental, Social, and Governance pillars. Equal weights are assigned to the three pillar scores, ensuring a balanced consideration of all three dimensions of sustainable finance.

4.1 Rating Methodology

To enhance the interpretability of our ESG scores, we implement a rating system that categorizes the ESG, Environmental, Social, and Governance scores into groups based on the 8th percentiles. This rating system allows for a quick reading of our evaluation and helps minimize the over interpretation of minor differences in scores.

The scores are divided into eight categories, ranging from the highest performance (AA) to the lowest (D). The rating categories are as follows: AA, A, BB, B, CC, C, DD, and D. Each category corresponds to a specific percentile range, ensuring a clear and straightforward representation of the performance of each investment vehicle.

This rating method provides a concise summary of the evaluation, making it easier to understand at a glance. By grouping the scores, we also address potential error margins that could arise from small unit differences in the scores, offering a more robust assessment of each investment vehicle's performance.

The overall ESG rating for each investment vehicle is derived from this method, offering a balanced and comprehensive view of its sustainability performance. This approach ensures that the ratings are both easy to interpret and reliable, contributing to a more effective evaluation process.

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