Analyse

Adding toes to the carbon footprint
Applying the look-through methodology to improve climate indicator coverage

10 October 2024
Annemarie Berkhout, Trond Husby and Nicolai Riis Ladefoged

Adding toes to the carbon footprint
Applying the look-through methodology to improve climate indicator coverage

Summary

Climate change and its associated risks have become increasingly important for the financial sector over the last decade. The financing of carbon-heavy activities poses risks on the investor side, as the value of carbon-heavy investments decreases in the transition to a net zero economy in 2050.[1] At the same time, financial institutions can play a key role in reaching the goals of the Paris agreement[2] of remaining within 1,5 degrees global warming, by steering their portfolios away from carbon-heavy investments and into a more sustainable direction. To assess climate related risks and opportunities and to guide decision making and monetary policy, statistics on climate change-related risks are crucial.

Led by the ECB and DNB, the European System of Central Banks has developed a range of   climate change-related statistics for the financial sector that have been published in 2023 and 2024 (ECB Statistics Paper, 2024a). These indicators can be used to more effectively analyse climate change-related risks that can affect monetary policy, price stability and the financial system. Among others, these indicators include several carbon emission indicators that quantify a country's financing of carbon emissions and the risks associated to these investments. While still a work in progress, these indicators are calculated for multiple years and financial sectors, and for all euro area countries using the same harmonized methodology, offering a rich set of data that already provides many improvements in terms of quality, comparability and transparency compared to available research.

However, investments *via* investment funds, so-called 'indirect investments', are currently typically not yet included in either the calculation of the ECB's carbon indicators or in other datasets, due to data limitations, which can lead to an underestimation of the Financed Emissions for some financial sectors. For instance, the Dutch combined insurance corporation and pension fund (IC&PF) sector takes up a significant share in the Netherlands' total financial sector, and at the same time this combined sector invests heavily in investment funds. Using detailed investment fund data that is available at the national level, we find that including indirect investments via funds almost doubles the Financed Emissions for the Dutch IC&PF in 2020. This is an important finding since it demonstrates how the IC&PF sector faces additional risk through its investments via funds, which is not visible when looking at the 'direct investments' alone. We also find that, for the period that is studied, the investments of the funds are less carbon intensive (carbon emission normalized by the size of the underlying companies and the size of the investments) than the direct investments of the IC&PF sector itself.[3]

In this analysis we demonstrate the application of the 'look-through' methodology, which allows the user to enrich an investment portfolio with indirect investments. In the context of climate change-related risks, including these indirect investments results in a markedly different and more realistic picture of the carbon footprint of financial institutions, and the transition risks[4] that are associated with this footprint. This study is an important step towards a more complete and accurate overview of financial institutions' carbon footprints. To accurately assess climate risk, we stress the importance of having detailed portfolio information and recommend the implementation of the look-through methodology.

---

[1] The European Commission is committed to make the EU's climate policy fit for reducing net green house gas emissions by at least 55% in 2030, and aims to transform the EU into an economy with no net emissions of greenhouse gases by 2050 (The European Green Deal – European Commission (europa.eu))

[2] The Paris Agreement is a legally binding international treaty on climate change (The Paris Agreement | UNFCCC).

[3] Whether it is the direct (IC&PF) or indirect (IC&PF via investment funds) portfolio that is less carbon intensive, depends on the composition of the direct and the indirect portfolio, which varies over time.

[4] Transition risks involve the risks of a decrease in the value of – in particular – high carbon intensive companies, as a consequence of the societal transition towards a carbon neutral economy in 2050.

Introduction

A substantial part of the Dutch insurance corporations' and pension funds' (IC&PF) securities holdings are invested not directly, but via investment funds as an intermediary party. Focussing on investments in listed shares and corporate bonds for this study, IC&PFs in the Netherlands invested EUR 514 billion directly and an additional EUR 376 billion indirectly in these instruments, at the end of 2021.[5] In view of the increased attention towards climate changes related risks, it has become increasingly important to assess the exposure of investment portfolios to carbon emitting companies, for example by calculating Financed Emissions (FE) and the Weighted Average Carbon Intensity (WACI), two types of carbon indicators (ECB Statistics Paper, 2024a). However, since data on indirect portfolio positions is not always available, indirect investments[6] are often not considered, leading to a possible underestimation of the IC&PF's carbon footprint.

In this analysis we present a methodology which makes it possible to 'look through' an investor's investment fund participations and obtain a more accurate asset allocation. Applying this look-through methodology to the Dutch IC&PF sector, a large part of the assets that underly the investment funds they participate in, are added to the IC&PFs' portfolio, resulting in a better overview of the portfolio's carbon footprint as it now includes indirect positions. Focussing on listed share and corporate bond holdings in non-financial corporations,[7] we find that including indirect portfolio investments causes the Dutch IC&PF sector's FE to increase by 97% in 2020 and by 57% in 2021, for scope 1 emissions. The difference between the two years is mainly caused by having relatively less indirect investments in 2021 compared to 2020. For the WACI, a relative carbon indicator which measures a portfolio's exposure to carbon-intensive issuers, a decrease for scope 1 emissions is observed in 2020 and 2021 when investment via investment funds are included in the portfolio, while for scope 2 emissions we find a slight increase in 2020 and no changes in 2021. This suggests that the carbon intensity of companies present in the indirect portfolio is lower than that of companies in the direct portfolio for scope 1 emissions, and in 2020 slightly higher for scope 2 emissions. In other words: indirect investments are made in economic sectors with relatively less scope 1 emissions, and incidentally more scope 2 emissions, compared to direct investments.

In this analysis, first the methodology behind the look-through of Dutch investment funds is described and applied to the listed shares and corporate bonds investments in non-financial corporations of the Dutch insurers and pension funds sector for the period 2020-2023. Next, the carbon related indicators FE and WACI are calculated for the investment portfolio including indirect investments, for 2020-2021. The indicators are calculated separately for scope 1 and scope 2 GHG emissions. After the results section, we discuss our findings and offer a short summary. Finally, the Appendix contains more details on the securities and carbon emission data used, and the calculation of the indicators.

---

[5] These numbers are based on DNB securities holdings statistics data.

[6] A note on terminology: in this analysis we will use the term 'indirect investments' for investments via investment funds. As a consequence, the term 'direct investments' is a convenient term to describe investments made directly into financial instruments other than investment fund participations. In this analysis a direct investment is not related to a minimal percentual share in an issuer (a common definition of direct investment).

[7] In line with the ECB climate change-related indicators, we focus on the carbon trends in the real economy for the calculation of carbon indicators, restricting the investment portfolio to the exposures related to non-financial corporations. Applying this filter, the IC&PFs direct investment portfolio amounted to EUR 312 billion, the indirect portfolio amounted to EUR 304 billion, in 2021.

Methodology and data

First, this section presents the methodology of the look-through approach. Second, we introduce the two carbon indicators – the Financed Emissions (FE) and the Weighted Average Carbon Intensity (WACI). These indicators are used to illustrate how the inclusion of indirect investments affects climate related indicators. Lastly the scope of the analysis and the classification of carbon emission is briefly described.

Look-through methodology

To calculate the indirect portfolio of an investor, one needs to join each investment fund participation in the portfolio with the underlying investments of the investment fund, in proportion to the ownership share of the investor in the fund. For example, if a pension fund invests in an investment fund and holds 25% of the issued shares, then 25% of the value of the investment fund's underlying holdings are indirectly held by the pension fund. This detailed asset reallocation requires a security-by-security dataset in which all investment funds can be uniquely identified on assets as well as on the liabilities level. For this analysis we use an internal confidential dataset containing monthly holdings and transactions of assets of individual financial companies, including pension funds, insurers and investment funds (see the Data section for more information). While this analysis focuses on the insurers and pension funds sector, the look-through methodology is in fact applicable to all financial sectors, including investment funds themselves, which often invest in other investment funds.

The calculation steps are as follows. Let the holding H of financial company j in investment fund f at time t be written as $H_{j,f,t}$, while the issuance of investment fund shares I by fund f to financial company j at time t is denoted $I_{f,j,t}$. Then, for each financial company j holding an investment fund participation in investment fund f a time t, an ownership share $p_{j,f,t}$ can be calculated as

$$p_{j,f,t} = \frac{H_{j,f,t}}{\sum_j I_{f,j,t}}$$

where the denominator is the total issuance of the investment fund (including foreign holders), calculated by summing over all issued investment fund shares. The issuance of investment fund shares appears on the liabilities side of the balance sheet of the investment funds, while their securities holdings appear on the assets side of the balance sheet. Let the securities holdings S that fund f invests in at time t on behalf of its investors be given by $S_{f,i,t}$ where i denotes the issuing company.

Now, to obtain a more accurate asset allocation of a financial company's holdings via investment fund participation, for each combination of holder j and investment fund f at time t, the ownership share is multiplied by the holdings of the fund

$$H_{f,j,i,t} = p_{j,f,t}\, S_{f,i,t}$$

$H_{f,j,i,t}$ thus specifies financial company j's holdings of securities issued by company i, held through investments placed in fund f at time t. Finally, we sum over investment funds f to obtain the indirect investment portfolio $H_{i,j,t}$ which is appended to the financial company's own investments.

The investment funds under study in this analysis are Dutch investment funds, since the security-by-security dataset does not contain detailed information on foreign funds holdings. Also note that the look-through methodology is applied 'once'. As a consequence, if a fund invests in another fund, the holdings of the

second fund are not looked through and remain present in the indirect portfolio (see also Figure 2 in the Results section).

Carbon indicators

Financed Emissions, FE

The Financed Emissions indicator is a direct measure to quantify the carbon emission an investor finances through its investment portfolio, and can be calculated at individual investor, financial sector or at country level. The FE indicator measures the total greenhouse gas (GHG) emissions of an issuer weighted by the share of the investment over total company value. This indicator can be used to track the financial sector's contribution to the financing of carbon emission over time, which is of major importance in view of the transition to a net-zero economy.

Let investor j's end-of-period holdings of securities issued by company i at time t be denoted $H_{i,j,t}$ (indirect holdings via investment funds can simply be added to this portfolio following the methodology outlined above). Then with $V_{i,t}$ the company value in terms of enterprise value including cash, EVIC, and $E_{i,t}$ the carbon emissions of issuer i, the Financed Emissions FE of investor j's holdings of issuer i at time t is given by

$$FE_{i,j,t} = \frac{H_{i,j,t}}{V_{i,t}} E_{i,t}$$

Due to the absolute nature of the indicator, the total Financed Emissions at portfolio level is calculated by summing over all issuers

$$FE_{j,t} = \sum_i \left(\frac{H_{i,j,t}}{V_{i,t}} E_{i,t} \right)$$

Weighted Average Carbon Intensity, WACI

While the FE indicator is commonly used to measure the total emissions financed through an investment portfolio in absolute terms, it is less suited for comparing sectors or individual financial institutions, due to their large variety in portfolio size. An indirect indicator that does allow comparison between sectors, regardless of their size, is the Weighted Average Carbon Intensity, WACI. The WACI measures GHG emission per million euros of revenue, so-called carbon intensity, weighted according to the investor's portfolio weight.

The carbon intensity of company i is defined by the ratio

$$CI_{i,t} = \frac{E_{i,t}}{R_{i,t}}$$

where $R_{i,t}$ is company i's revenue at time t. Subsequently, to arrive at the weighted sum of carbon intensities for an investment portfolio, $CI_{i,t}$ is weighted by the value of the investment in company i relative to the investor's entire investment portfolio. This weight w of company i in investor j's portfolio is given by

$$w_{i,j,t} = \frac{H_{i,j,t}}{\sum_i H_{i,j,t}}$$

The WACI for individual investor, financial sector or country j at time t is then calculated by summing the weighted carbon intensities over all issuers in the portfolio

$$WACI_{j,t} = \sum_i w_{i,j,t} CI_{i,t}$$

A close look at the formula shows that changes in WACI over time can be driven by the portfolio weight and the carbon intensity. Changes in the carbon intensity can in fact be further decomposed into two separate drivers: carbon emission and revenue effects. A previous divestment study by DNB provides more guidance on decomposing the change in WACI, and illustrates the dynamics of the different drivers (Berkhout, et al., 2022).

Note that the calculation of the FE and WACI indicators in this analysis closely follows the methodology for the calculation of the ECB climate related indicators. The only difference is the use of a more granular securities dataset in which securities positions are available at holder-issuer level, a requirement for implementing the described look-through methodology. In line with the ECB, the WACI is calculated implementing company revenues in real terms, as revenues are corrected for inflation and exchange rate effects. A balancing methodology has been implemented to account for changes in the composition of issuers in the investment portfolio over time. For further details on the ECB methodology, we refer the reader to the statistical paper that accompanied the ECB's release of climate related indicators (ECB Statistics Paper, 2024a).[8]

Scope

The application of the look-through methodology and the subsequent calculation of carbon metrics focuses on Dutch insurers and pension funds. Due to the unavailability of security-by-security level data on foreign investment funds, holdings of foreign investment funds are not included in this analysis. The look-through results presented cover the years 2020-2023, constrained by the introduction of the monthly reporting framework for securities at DNB in June 2020. Carbon indicators for portfolios that include indirect investments are presented for 2020 and 2021, constrained by the forementioned reporting framework, and the availability of financial information at the company level. FE and WACI (corrected for inflation and exchange rate effects) are calculated for listed shares and corporate bonds issued by non-financial companies. Scope 1 and scope 2 emissions are covered and described in more detail in Box 1. Further details on the securities and GHG emissions data can be found in the Appendix.

---

[8] ECB Statistics Paper Series: Climate change-related statistical indicators

Box 1. Scope 1, 2 and 3 emissions

A company's direct carbon emissions or so-called scope 1 emissions are emissions caused by sources that are controlled or owned by a company (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles). Scope 2 emissions are a company's indirect carbon emissions related to the purchase of electricity, steam, heat, or cooling. Finally, scope 3 emissions are all indirect emissions associated with a company and its products, excluding those covered by scope 2. This includes emissions across a company's value chain, including suppliers, customers and other sources beyond its immediate operations.

This analysis focuses on scope 1 and 2 emissions. Scope 3 emissions are not included as the data currently available is not yet consistent enough and the methodology is not yet aligned (see ECB publication technical annex from the April 2024 release of climate-related carbon indicators (ECB Technical Annex, 2024b)). As scope 3 emissions account for a substantial portion of total emissions in many sectors, including them is a relevant topic for future work.

Results

In this section we demonstrate the application of the look-through methodology to the investment fund participations of the insurance corporation and pension fund (IC&PF) sector in the Netherlands, and present the listed shares and corporate bonds they hold indirectly via funds in the period 2020–2023. Next, we calculate the carbon indicators FE (Financed Emissions) and WACI (Weighted Average Carbon Intensity) for the period 2020–2021 to demonstrate how a more accurate and larger investment portfolio changes the IC&PF sector's financing of carbon emissions and its exposure to carbon intensive companies.

Direct and indirect listed share and corporate bond holdings in non-finanical corporations

For the Dutch IC&PF sector's investments in listed shares and corporate bonds, using internal securities data and filtering on non-financial companies as issuers, Figure 1 shows a breakdown in direct and indirect investments (indirect via Dutch investment funds) at a quarterly frequency from Q3 2020 (when data were first available) to Q4 2023. At the end of 2023, EUR 327 billion was directly invested. When indirect investments held through funds are added (EUR 121 billion), the portfolio increases to EUR 448 billion. This shows that the listed shares and corporate bonds portfolio of the IC&PF sector is significantly larger than what is directly observable from their balances. Since 2020, the share of indirect investments has been decreasing from around 57 percent to 27 percent, as investors are seen to move away from external fund

Figure 1
Listed share and corporate bond holdings in non-financial companies of Dutch insurers and pension funds, at a quarterly frequency. Light blue bars show investments held directly, dark blue bars show investments held via Dutch investment fund participations (indirect investments).

EUR billion

Source: De Nederlandsche Bank

management.[9] This decrease is mainly attributed to the pension fund sector. In fact, insurers have doubled their share of indirect holdings over this period, but this sector is small compared to the pension fund sector.[10]

The data shown in Figure 1 is the result of the look-through methodology applied to Dutch investment funds, and applied once, implying that investments in foreign funds and so-called funds-of-funds investments are not looked-through. Figure 2 shows a breakdown of the Dutch pension funds' and insurers' investment fund holdings in 2021. The IC&PF sector held investments totalling EUR 845 billion in investment funds, of which EUR 726 billion in Dutch investment funds (light blue) and EUR 119 billion in foreign funds (purple). Since data on foreign funds' holdings is not available, the look-through methodology is applied to the Dutch investment funds only, yielding EUR 428 billion in indirectly held investments such as listed shares and corporate bonds, that can be identified (orange). Investments of Dutch funds into other Dutch funds amount to EUR 49 billion (dark blue). These fund investments can in principle be looked-through by applying the methodology multiple times, until all funds-of-funds are eliminated, but are not in scope of this analysis. Of the IC&PF's investments into Dutch funds, a part can currently not be traced (shown in grey) since either the investments are made in foreign funds (EUR 105 billion), or the investments cannot be attributed[11] (EUR 144 billion). While implementing a second-order look-through will increase the look-through coverage, Figure 2 shows that a larger coverage increase is expected from the inclusion of foreign funds' investments (if accessible). Of the EUR 428 billion invested via Dutch investment funds, EUR 304 billion is positioned in listed shares and corporate bonds in non-financial companies (also see data for Q4 2021 in Figure 1).

---

[9] Moving from an investment fund participation to a mandate structure allows for more flexibility in investment policy and may be more cost effective. The rebalancing and its background are further discussed in DNB Statistical News from September 2022: Dutch pension funds sell record amount in assets (dnb.nl).

[10] At the end of 2023, the holdings of the insurance corporations sector amounted to EUR 52 billion while the holdings of the pension funds sector amounted to EUR 396 billion (including direct and indirect holdings, data in Figure 1).

[11] Some of the Dutch investment funds' holdings cannot be attributed to the initial investors (insurers and pension funds) due to two reasons. First, for some of the funds, information on their assets holdings is not present in the securities dataset. Second, due to differences between the funds' reported total issuance and their reported holdings, the calculated investment fund share (see Methodology section) is on average causing an underestimation of the holdings attributed to the initial investors, leaving part of the holdings unattributable.

Figure 2
Breakdown of the investment fund holdings (held by Dutch insurers and pension funds) of Dutch investment funds at the end of 2021. On the left: investments of Dutch insurers and pension funds in foreign funds (purple) and in Dutch funds (light blue). Breakdown: 1) Dutch funds' investments identifiable via the look-through methodology ('indirect investments', orange), 2) Dutch funds in other Dutch funds (dark blue), 3) Dutch funds in foreign funds, 4) investments of Dutch funds with unknown investment portfolio (not traceable or attributable). The dark blue portfolio is not in scope of this analysis, the grey (and purple) portfolios cannot be looked through due to lack of data.

EUR billion
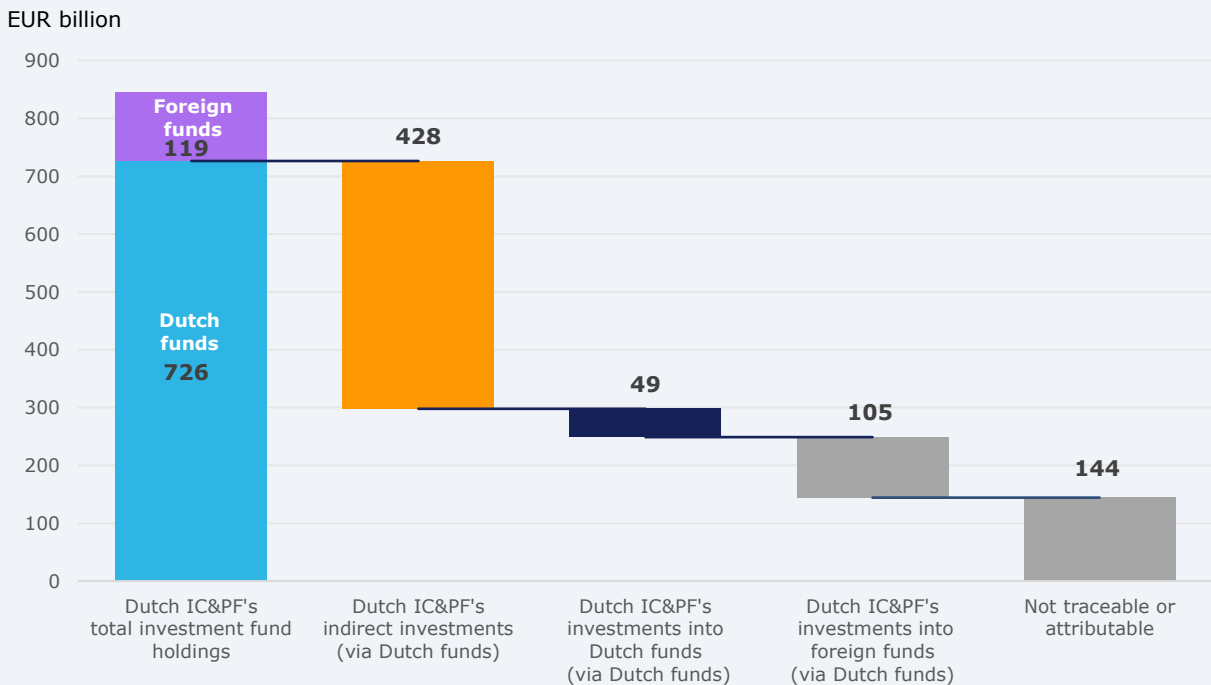
Source: De Nederlandsche Bank

In this section we demonstrated the look-through methodology by applying it to the insurers and pension funds sector. However, note that the method is more general and can be applied to any financial sector holding investment fund participations (including the investment fund sector itself). Moreover, while Figure 1 has a focus on listed shares and corporate bonds obtained via the investment funds, all asset classes can be retrieved using this methodology.

Carbon indicators for direct investments only, and for indirect investments included

How are transition risks[12] due to carbon emission distributed over the direct and indirect investment portfolios? In this section, we calculate an absolute and a relative carbon emission indicator for the Dutch IC&PF sector's portfolios, including look-through data for the period 2020-2021. This section shows how the

_____

[12] Transition risks involve the risks of a decrease in the value of – in particular – high carbon intensive companies, as a consequence of the societal transition towards a carbon neutral economy in 2050.

inclusion of indirect investments changes the size and also the interpretation of the risks arising from investing in carbon intensive companies. We show that the inclusion of indirect investments increases the overall Financed Emissions (FE), reduces the Weighted Average Carbon Intensity (WACI) of the investments for scope 1 emissions, and increases the WACI for scope 2 emissions.
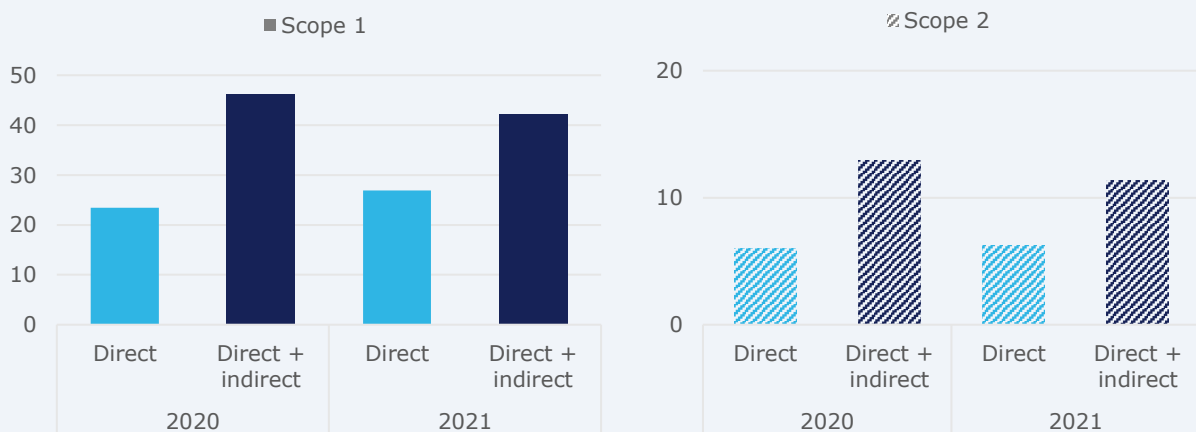
Financed Emissions

At the end of 2021, the Dutch insurers and pension fund sector finances a total of 27 million tons of CO_2 equivalents (scope 1) through direct investments in listed non-financial companies, see Figure 3.[13] For scope 2 emissions the FE indicator sums to 6 million tons. When indirect investments are added to the portfolio, the Financed Emissions increase with 57% to 42 million tons for scope 1, and increases with 83% to 11 million tons for scope 2. At the end of 2020, the effects are in the same upward direction and even more pronounced, with an 97% and 117% increase in FE for scope 1 and scope 2 respectively, when indirect investments are included. In the previous section, we have shown that the portfolio value of the Dutch IC&PF sector increases with 136% in 2020 and 97% in 2021 when indirect investments are added to their investment portfolio. For both years this increase is larger than the increase in Financed Emissions, suggesting that including indirect investments results in – controlled for size – relatively less carbon intensive portfolio. The next section confirms this for scope 1 by considering the relative indicator WACI.

Figure 3
Financed Emissions of the insurance corporation and pension fund sector 2020-2021, for direct investments only (light blue), and for indirect investments via investment funds included (dark blue).

Million tons of CO_2 equivalents

Sources: De Nederlandsche Bank and ISS (including imputed carbon emission and financial data, using the methodologies of the ECB's expert group on climate change statistics).

---

[13] The group-level securities-based indicators for the insurance corporation (S128) and pension fund (S129) sector published by the ECB in 2024 are affected by a compilation issue in the financial sector aggregation that will be fixed in a future release. As a result, the Financial Emissions indicator underestimates the exposure of the S128 and S129 sector. For this publication, DNB has chosen to already implement the fix to this issue. Therefore, the value of the indicators concerning the combined S128 and S129 sector published on DNB's website and in this publication currently deviate from those published by the ECB.

Given that the addition of indirect investments increases the portfolio size, the increase in Financed Emissions comes as no surprise. FE is an absolute carbon indicator, therefore changes in the underlying portfolio size are expected to have an almost directly proportional effect on the level of the FE, unless the portfolio composition is altered significantly. In the (unlikely) case that a direct and look-through enriched portfolio have the same composition, the FE will increase linearly with the portfolio size. Any other FE development reveals a shift in the composition of the underlying portfolio (see Discussion).

Weighted Average Carbon Intensity, WACI

The WACI is a measure of a portfolio's average carbon intensity, in which the portfolio constituents are weighted by their share in the portfolio. This weighing makes it a relative measure that allows one to compare portfolios regardless of their size. At the same time, the carbon intensity quantifies the issuer's emissions, normalized to the issuer's economic activity. Note that the WACI presented here has been corrected for inflation and exchange rate volatility (ECB Statistics Paper, 2024a), also see (Janssen, et al., 2021).

Figure 4 shows the WACI of the IC&PF sector in 2020 and 2021 split by scope 1 and scope 2 emissions, for direct investments only, and for indirect investments also included. In 2020, the WACI calculated based on companies' scope 1 emissions decreases by 8% when indirect investments are included in the portfolio. This means that the portfolio that includes investments via investment funds is less exposed to carbon intensive companies. When the WACI is calculated based on scope 2 emissions, the WACI increases by 7%. For 2021, the inclusion of indirect investment has a different effect. For scope 1, the WACI decreases by 15%, while for scope 2 it remains the same. The changes in WACI are mainly attributed to changes in portfolio composition, discussed next.

Figure 4
WACI for the Dutch insurers and pension funds sector (scope 1 and scope 2) in tons of CO2e per million EUR revenue, for 2020 and 2021, for direct investments only (light blue) and for also including indirect investments via investment funds (dark blue).

Tons of CO_2 equivalents per EUR million revenue
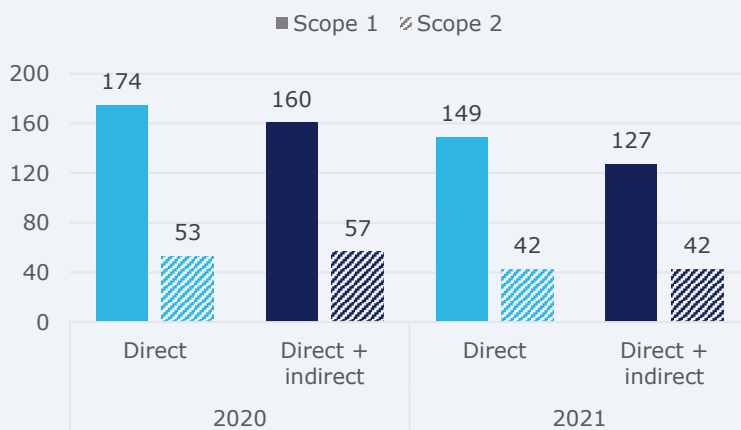
Sources: De Nederlandsche Bank and ISS (including imputed carbon emission and financial data, using the methodologies of the ECB's expert group on climate change statistics).

Discussion

Including positions held via investment funds, that is, including indirect investments, increases – obviously - the total value of the portfoliothat is analysed. But as the coverage of the portfolio increases, the relative composition changes as well. This causes changes in the carbon indicators Financed Emissions (FE) and Weighted Average Carbon Intensity (WACI), and each indicator is affected in its own manner.

The FE shown in Figure 3 increase for both scope 1 and scope 2 emissions, in 2020 as well as in 2021. Since FE is an absolute indicator, this increase is easily explained by the increased size of the investment portfolio under analysis: by analysing more investments, the associated carbon emissions also increase. From Figure 1 it follows that the portfolio increase by including indirect investments was 136% in 2020 and 97% in 2021. For scope 1 emissions, FE increased by 97% and 57% in 2020 and 2021 respectively, and with 117% and 83% for scope 2 emissions. The fact that FE increases more strongly in 2020 than in 2021 may be partially explained by the relatively larger increase in portfolio size in 2020 compared to 2021.

Financed Emissions are affected both by absolute portfolio increase and by compositional changes, but the WACI is only affected by the latter since the WACI has been normalized against portfolio value. When the indirect investments from funds are included in the IC&PF sector's portfolio, the distribution of investments across different economic sectors changes. As an example to illustrate these composition effects: investments in sectors that are typically intensive in terms of direct carbon emissions (scope 1 emissions), such as the energy sector, constitute a smaller share of the investment portfolio when including indirect investments as compared to when only direct investments are considered. This shift in composition results in a decrease in the portfolio's WACI for scope 1 emissions, because the relative exposure to 'direct carbon intensive' sectors has decreased.[14] At the same time, the portfolio that includes indirect investments contains relatively more investment in sectors that may be more intensive in terms of 'indirect carbon emissions' (scope 2 emissions, also see Box 1) such as construction and primary production. This can explain the (small) increase in WACI for scope 2 emissions, as seen in Figure 4 (in 2020). A more detailed analysis into the compositional portfolio changes for scope 1 versus scope 2 (and other compositional effects) is needed to fully explain the changes in carbon indicators. A study on the sectoral effect on carbon indicators is relatively straightforward, but requires the investment data to be correctly classified according to an economic sector classification scheme such as NACE. Due to data quality issues a full sectoral breakdown is currently left out of this analysis.

When the share of a certain issuer in a portfolio changes due to adding positions to the portfolio at a fixed moment in time (such as indirect investments), a change in WACI can be due to emission effects or revenue effects. To disentangle these effects a decomposition methodology should be applied, which can show whether a decrease in WACI is caused by decreased emissions or increased revenues (Berkhout, et al., 2022). The recent ECB publication on climate change statistical indicators applies a decomposition methodology to the change of the WACI *over time* (ECB Statistics Paper, 2024a). For the Dutch insurers and pension funds sector, invested in nonfinancial companies, the WACI decreased by 14% over the period 2020-2021 (see Figure 5, data from ECB publication[15]), and this change over time is attributed for a significant part to increasing revenues (attributed to after-corona effects) that cause the WACI to decrease. A similar plot for the Dutch investment fund sector shows that for this sector the WACI has decreased even more, also largely caused by increased revenues, having a downward effect on the WACI (which in turn

_____

[14] Note that even for small variations in portfolio share, the effect on the carbon indicators can be significant if the investments are relatively carbon-heavy.

[15] Analytical indicators on carbon emission (see Data Access).

affects the pension funds' and insurers' WACI via their investments in these investment funds). Even though a decomposition *over time* cannot be one-to-one related to a decomposition over the addition of portfolio positions at a fixed point in time, and even if the mentioned differences in changes over time should be interpreted with great caution given the very limited timeframe, the overall quality of the data, and the Pandemic, it is possible that revenue effects are also playing a role in the decrease in WACI that is under study here. A similar decomposition can be easily applied to the portfolio in this analysis and will show which part of the change can be attributed to emission effects, and which part to revenue effects.

Figure 5

Decomposition of the WACI of Dutch insurance corporations and pension funds over time, data from ECB publication on climate related indicators.

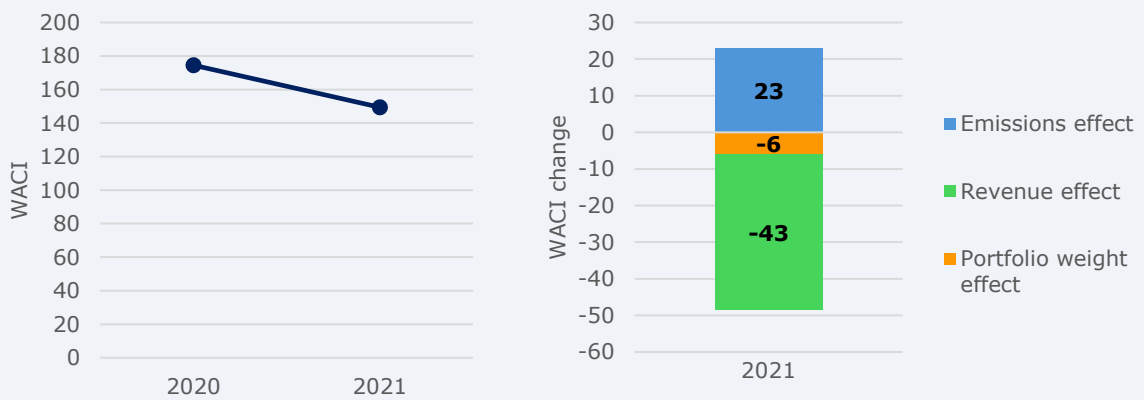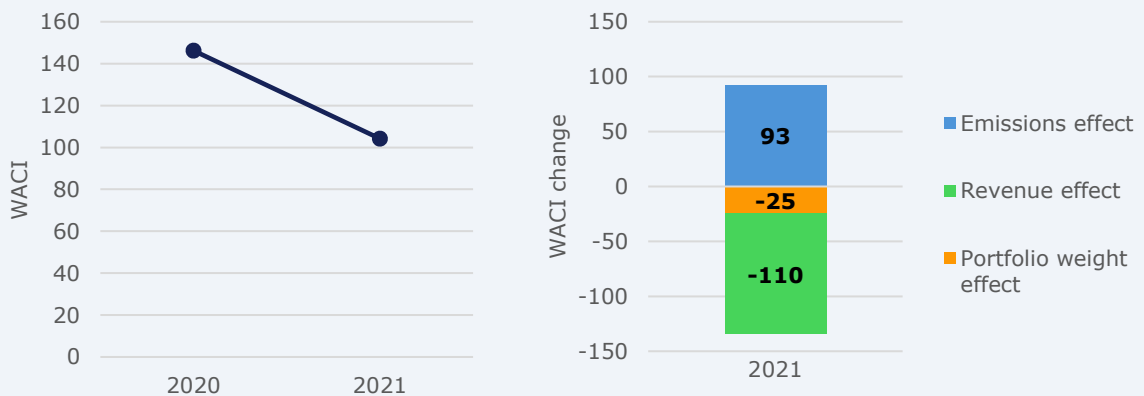Both axes in tons of CO_2 equivalents per EUR million revenue

Figure 6

Decomposition of the WACI of Dutch investment funds over time, data from ECB publication on climate related indicators.

Both axes in tons of CO_2 equivalents per EUR million revenue

Source: European Central Bank: Analytical indicators on carbon emissions (europa.eu)

Conclusion and future work

Data and statistics on sustainable finance are key for the financial sector, which is increasingly facing the risks caused by climate change. For a portfolio's risk management it is crucial to have the most accurate information on all portfolio positions. In the case of positions held in investment funds it is not immediately visible which are the underlying companies that are initially issuing securities, and that may pose risk to the investor.

In this analysis, we apply a look-through methodology, which allows the user to 'look through' investment fund participations, and to enrich the initial investment portfolio with the investments made via these funds. A more accurate portfolio can give a more accurate picture of the portfolio risks, for example in the case of carbon emissions that are financed via the investments. A carbon heavy portfolio can pose risks to the investor, given the current transition to a less carbon intensive economy. In this study the look-through methodology is applied to the Dutch insurance corporations and pension funds (IC&PF) portfolio. Subsequently we calculated carbon emission indicators following the ECB methodology (ECB Technical Annex, 2024b) for the original portfolio and the portfolio including indirect investments. This analysis thus demonstrates how the look-through methodology can be used to create a more accurate picture of financial institutions' transition risks.

We find that inclusion of investments via investment firms significantly increases the portfolio value, and moreover changes its composition. As expected, the increase in portfolio value (when indirect investments are included) results in an increase in Financed Emissions. For the Weighted Average Carbon Intensity (WACI), a relative indicator, we find that including indirect investments results in a decrease for scope 1 emissions in both 2020 and 2021; for scope 2 emissions the WACI changes less notably. The change in WACI finds its origin in the shift in portfolio composition, as explained in the Discussion section. While the root of the decrease in WACI is in the change in portfolio composition, the underlying mechanism is a difference in carbon intensity (due to different emissions and revenues) between the companies underlying the direct, and the companies underlying the indirect investments. In line with the recent ECB publication on climate change-related indicators (ECB Statistics Paper, 2024a), increased revenues in the period 2020-2021 possibly played a role in the change in carbon intensity that underlies the change in WACI when indirect investments are included.

Future work

There are several ways to increase the look-through coverage. Given that indirect holdings of foreign funds take a larger share in the missing data than funds of funds (as shown in Figure 2), an important step is to obtain access to the investment portfolios of foreign funds. On the other hand, even though a second-order look-through will add little to the total look-through portfolio, there are no constraints on the data side and it is relatively easily implemented in the code.

As discussed in the main text and discussion, a more complete assessment of the drivers of the changing WACI can be made by applying a decomposition study (also applicable to FE), breaking down the change in WACI into carbon emission and revenue effects. Future work should include an investigation into the underlying causes of the changes in carbon emission and revenue (in case of the WACI). For example, we have discussed how the change in portfolio composition is the result of indirect investments being distributed differently over economic sectors than direct investments. Future work should include a more detailed investigation into economic sector effects using a full NACE (or similar) breakdown. In addition one can look at other possible causes of portfolio composition changes when indirect investments are included, such as more or less exposure to certain issuer countries, or more or less exposure to specific industries.

References

Berkhout, A., Dijk, J. J. and Husby, T. G. 2022. *Dynamics of the carbon footprint of financial institutions: a decomposition approach.* DNB Analyse, 2022.

ECB Statistics Paper. 2024a. *Statistics Paper Series: Climate change-related statistical indicators.* Statistics Committee Expert Group on Climate Change and Statistics and Working Group on Securities Statistics, 2024a.

ECB Technical Annex. 2024b. *Technical annex: Climate change-related statistical indicators.* Statistics Committee Expert Group on Climate Change and Statistics and Working Group on Securities Statistics, 2024b.

Janssen, A., Dijk, J. J. and Duijm, P. 2021. *Misleading Footprints Inflation and exchange rate effects in relative carbon disclosure metrics.* DNB Occasional Studies, 2021.

Appendix

Securities data

Information on insurance corporations, pension funds and investment funds holdings of assets is obtained from a confidential dataset provided by DNB, consisting of enriched monthly securities reporting statistics data. The dataset contains security-by-security portfolio investment positions of individual holders and issuers, on a monthly frequency, both assets and liabilities. The time period used for this analysis is 2020 to 2023. Individual securities are identified by their International Securities Identification Number (ISIN), while holders and issuers are identified by the Register of Institutions and Affiliates Database (RIAD) number or Legal Entity Identifier (LEI). Holders, issuers and instrument are classified according to their respective European Systems of Accounts (ESA) institutional sector code. The primary variable of interest is the value of the end-of-period holdings, and the data is analysed at an annual frequency (quarterly for Figure 1), meaning end-period holdings on 31 December represent year. To apply the look-through approach, the holdings from specialised investment funds that act on behalf of pension funds and insurance companies are replaced by 'looked-through' holdings: the security holdings of each relevant investment fund are distributed in proportion to the ownership share of each pension fund and insurance company in each mutual fund. Finally, all holdings are aggregated to the financial sector level.

CO_2 emissions data

Data on company-level (scope 1 and 2) carbon emissions, enterprise value including cash, EVIC, and firm revenue are obtained from the ISS Climate Core dataset. This commercial dataset contains information on a company's carbon footprint, including absolute emissions and carbon intensity metrics representing the GHG emissions per million EUR of revenue as a proxy of the carbon efficiency per unit of output. The information is available on 25,000+ companies and issuers of corporate debt, with a yearly frequency dating back to 2012. The variables for each company are reported by the company's ISIN codes. While the dataset contains both reported and modelled emissions, only the reported emissions are used. Missing emission data is supplemented with carbon emission imputations following work done in the ECB's Expert Group on Climate Change Statistics (EG CCS) (see (ECB Statistics Paper, 2024a) and (ECB Technical Annex, 2024b)). The company-level data from ISS Climate Core data is merged with the granular data on stock holdings using the ISIN codes and year. Although the ISS Climate Core provides information about Scope 3 emissions, these are not included in the analysis due to concerns over the quality of the data.

Calculation of carbon indicators

For the calculation of the two carbon indicators, Financed Emissions and Weighted Average Carbon Intensity, described in detail in the main text, we follow the methodology as presented in the ECB statistical paper on carbon indicators (ECB Technical Annex, 2024b). This calculation includes inflation and exchange rate corrections on the WACI, a balancing approach and outlier detection. Both carbon emission and financial data (revenue and EVIC) imputation performed by the EG CCS is used.