Futureproofing companies & valuation ratios

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Abstract

Companies face serious transition risks and opportunities, which put their futureproofness to the test. Current valuation ratios are not well suited to value those transition risks and opportunities. We argue that the solution lies in expanding financial-based valuation ratios with externalities (external impacts), which are good proxies for transition risks and opportunities. Building on impact valuation methods, we calculate a company's integrated value, which combines financial, social and environmental value. This paper turns integrated value into a valuation ratio: the futureproofing ratio.

We provide an empirical analysis by calculating futureproofing ratios for the companies on the Amsterdam Stock Exchange. This analysis shows that the futureproofing ratio varies significantly across companies and sectors, and provides valuable insight in the transition risk of a company's business model. Company management and investors can use this ratio as a guide for investment decisions.

Key words: Valuation, transition, externalities, carbon emissions
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1. Introduction

Sustainability challenges put the economy in transition (Sachs, 2015). On the environmental side, climate change, biodiversity loss, freshwater shortages and depletion of nature resources are asking for new solutions. On the social front, social inequalities and poor labour practices in the supply chain are under pressure. Companies play an important role in the transition to a sustainable economy, because social and environmental externalities are generated primarily in the corporate sector (Hart and Zingales, 2017). But sustainability transitions are uncertain and happen shock-wise (Loorbach, Frantzeskaki and Avelino, 2017; Bolton et al., 2020).

Companies need to adapt to these transitions by changing their business model, which typically affects their cash flow profile (Walker, Holling, Carpenter, and Kinzig, 2004; Kurznack, Schoenmaker and Schramade, 2021). Sustainability transitions can thus have a major impact on company valuation. The traditional view holds that stock prices reflect rational expectations of future cash flows (Campbell and Shiller, 2005). But transitions are only partially priced in and therefore not very visible in market-based valuation ratios, as the number of analysts paying attention to sustainability factors is still limited and subject to learning (Lo, 2004). Current valuation methods struggle to deal with the effects of uncertain transitions (Graham and Harvey, 2001; Mukhlynina and Nyborg, 2020). Transitions and externalities are not quantified or captured in the structure of existing valuation ratios. The research question in this paper is how to assess the value and the risk of companies in an economy in transition. We argue that the answer lies in including externalities that are not (yet) priced in markets.

Resilience theory studies the capacity of a system to absorb shocks while maintaining its basic function and structure (Holling, 2001). Applying to business, the question is: if a company suffers a transition shock, will it recover or will it collapse? Companies that have positive social and environmental value are capable to absorb, and potentially even benefit from, transition shocks. By contrast, companies that have negative externalities are at risk when transition shocks hit.

Recent advances in impact accounting and valuation enable companies to measure social and environmental effects and to monetise these via cost-based prices techniques (Serafeim, Zochowski and Downing, 2019). In that way, social and environmental value (both positive and negative) can be estimated. Building on these impact valuation methods, Schoenmaker and Schramade (2023) develop the concept of integrated value, which combines financial, social and environmental value. This paper takes the next step and turns integrated value into a valuation ratio. The futureproofing ratio is defined as a company's integrated value divided by its financial value.

We argue that the futureproofing ratio is an indicator of the futureproofness of companies. The argument is that this ratio provides insights into the company's opportunities and risks in transitions. A futureproofing ratio larger than one means the company has net positive social and environmental value, indicating net transition opportunities. By contrast, a ratio below one indicates that a company faces net transition risks. Further down the range, a ratio below zero means the negative social and ecological value is larger than the company's financial value, indicating a highly unsustainable business model and a higher risk of failure when significant transition shocks occur. The value of these latter companies can decline rapidly, turning them into 'stranded assets' (Caldecott, Tilbury and Carey, 2014).

We explore the practical use of our futureproofing ratio for the companies listed on the Amsterdam Stock Exchange (AEX). The findings show that 15 of the 23 companies have a positive integrated value, expressed as a futureproofing ratio larger than one. Philips, Ahold Delhaize, and Randstad have very positive ratios. The main reasons for these scores are their positive contributions to health, food (distribution) and employment, respectively. The remaining 8 companies have a futureproofing ratio below one, which indicates that around one third of the AEX-listed companies carry heightened risk to succumb to transition shocks. This applies in particular to ArcelorMittal, Shell, and Heineken, companies that have a futureproofing ratio below zero. The main reasons for that are the high environmental costs of carbon emissions and air pollution, and for Heineken the social costs of alcohol. The weighted average futureproofing ratio of all AEX companies is 0.7, which means that 30% of the financial value of the AEX companies comes at the expense of society. This number is heavily skewed by a small number of companies with large negative externalities (and negative futureproofing ratios).

The single largest negative contributor to integrated value is carbon emissions. In our sample of Dutch AEX companies, the carbon burden amounts to 193% of companies' market capitalisation. In a study of US listed companies, Pastor, Stambaugh and Taylor (2024) find that the negative externality of carbon adds up to 131% of US companies' market capitalisation. This difference versus the Dutch index can probably be explained by the larger share of tech companies in the US, with a relatively low carbon burden.

The size and nature (positive or negative) of a company's externalities shows how much value a company creates and destroys for society, which makes it a useful indicator of the futureproofness of a company. The futureproofing ratio thus evaluates companies not only on their financial performance but also on their exposure to transition risks and their ability to generate positive societal and environmental impact. There is significant dispersion across companies and sectors. Leaders contribute to sustainable development goals (SDGs) like health, decent work, and food, while laggards transgress planetary boundaries like climate change and air pollution, the bulk of which is concentrated amongst a few bad actors. The futureproofing ratio does not only provide a mechanism with which to compare the long-term value potential of companies and sectors, but the ratio can also be used to compare sectors and economies in terms of their transition challenges. As such, it is an indicator of risk that is typically not well captured in asset prices.

The remainder of the paper is organised as follows. Section 2 starts with a review of current valuation ratios used in finance and accounting. Section 3 introduces the methodology for our new valuation ratio: the futureproofing ratio. Section 4 conducts an empirical study of the futureproofing ratio for the AEX companies. The findings and their implications are discussed in Section 5. Finally, Section 6 concludes.

2. Valuation ratios

2.1 The role of valuation and valuation ratios

The valuation of companies plays a key role in business, finance and accounting. It is the analytical basis for corporate investment decisions and informs the allocation of resources in the economy. Valuations are also widely used in mergers & acquisitions and investment banking. Valuation is an indication of a company's future earning capacity, which is in part derived from its past performance as summarised in its financial statements. Equity analysts scrutinise a company's business model to make future projections of revenue, margins and capital, culminating in a forecast of the company's stock price.

The two major types of valuation models are absolute multiperiod valuation models (such as the discounted cash flow and the dividend discount model) and relative valuation models ("multiples"). Finance textbooks stress the use of absolute methods to calculate value by discounting cash flows (DCF) from business activities (e.g., Berk and DeMarzo, 2024). The multiperiod discounted cash flow model is also most suited to integrate sustainability into valuation (see Section 3). By contrast, relative valuation models derive the value of a company from the observed market value of other companies with similar characteristics. Valuation ratios are essentially short-cuts to a full-fledged DCF analysis. Their ease of use makes them attractive to practitioners, and they can be useful sanity checks to DCFs (Kaplan and Ruback, 1995; Mukhlynina and Nyborg, 2020). Market valuation ratios come in many types: they can be asset-based (such as price-to-book), earnings-based (price-earnings) or cash flow-based (price-to-cash flow); and historical (price-reported earnings) or forward looking (price-estimated earnings). Liu, Nissim and Thomas (2002) find that ratios based on forward earnings tend to have higher valuation accuracy than those based on historical ratios. Gao et al. (2019) develop a hybrid model that combines multiples and absolute valuation. They show that the hybrid model gives superior valuation accuracy.

Like all short-cuts, valuation ratios come with limitations that are well documented. Most valuation ratios assume constant growth, which implies extrapolating growing cash flows into eternity. This is not realistic in a competitive environment of creative destruction, and even less so given the digital and sustainability transitions. Another problem with relative valuation is that it relies on fair valuation of the comparable assets, which in practice may not hold. In fact, entire industries can be overvalued. An example is the boom in Internet stocks in the late 1990s and early 2000s, before the Internet bubble burst. While multiples could justify the value of these companies in relation to each other, it was more difficult to justify the stock prices of these companies jointly (Berk and DeMarzo, 2020). Moreover, the outcomes of multiples can vary a lot depending on the type of multiples chosen (see discussion above) and on the choice of comparable companies to be included in the peer group. This gives practitioners a lot of leeway in selecting multiples that are favourable for their purpose. For example, the findings of Eaton et al. (2022) suggest that investment bankers select peers with high valuation multiple to negotiate higher takeover prices.

We add a limitation of valuation ratios that is not well-documented: their disregard for externalities and transitions. By nature, valuation ratios are purely financially focused. At first sight, that makes sense, since their aim is to assess financial value. However, that is problematic from a stakeholder perspective, as they overlook essential types of value (both positive and negative) that are not currently priced in markets but which do generate significant costs or benefits (Schoenmaker and Schramade, 2023). It is also problematic from a shareholder perspective, since those other types of value are important drivers of financial value.

2.2 Market-based valuation ratios and externalities

Financial reporting is focused on manufactured (i.e. physical) and financial assets. The book value of equity thus reflects the value of these manufactured and financial assets. But it misses out on most intangibles, like brand name, human capital, intellectual property and more recently data (Veldkamp, 2023).[1] A typical approach to valuing intangible assets is to use the difference between the market value and the book value of a company.

The price-to-book ratio, also known as Tobin's Q, is defined as the market value of equity divided by the book value of equity (Brainard and Tobin, 1968). Back in 1968, the authors already argued that “the market valuation of equities, relative to the replacement cost of the physical assets they represent, is the major determinant of new investment” (Brainard and Tobin, 1968, p.103-4). This fits in the rise of modern finance from the 1970s built on market-based concepts. The leading market paradigm is consistent with the argument of Friedman (1970) that ‘*the business of business is business*’. Friedman (1970) proposes a classical division of labour, whereby the government takes care of companies’ externalities and companies focus on production.

But Zingales (2020) shows that two conditions are needed for the Friedman doctrine to hold. The first is that companies do not have market power or political power. The second is that companies do not generate externalities or alternatively that the government could perfectly address these externalities through regulation. Both conditions are violated in practice. Large corporations are too big to regulate (Zingales, 2020). Moreover, corporate concentration leads to oligopoly powers to the detriment of consumers (Philippon, 2019). On the second condition, governments cannot effectively regulate all companies’ externalities due to

[1] Intangibles do not appear on a company’s balance sheet, unless they are purchased from another company. If a company acquires a target company, the company may report items, like acquired goodwill, in its balance sheet.

asymmetric information between governments and companies (Zingales, 2020). The result is that social and environmental externalities - caused by companies - remain largely unchecked.

This is not a tenable situation. In a large survey among more than 75,000 people in 28 countries, Bershoff, Sucher and Tufano (2024) find that the vast majority (85%) acknowledges that the main job of business is to produce safe and reliable products and create jobs. But they find that its second job is nearly as important: their societal duties (including tackling climate change, addressing discrimination, and supporting local communities) are also deemed central by 75% of respondents. The authors conclude that societal expectations haven't superseded traditional economic expectations but are just being added to business' duties.[2]

Hence, the challenge for companies is to incorporate social and environmental factors alongside traditional financial factors in accounting and valuation. Hitherto, this is typically done with all kinds of ESG metrics, but that approach suffers from a lack of comparability (Berg, Kölbel and Rigobon, 2022). A better route is to express social and environmental factors in the externalities that are generated by companies. Unlike ESG issues, externalities have a size in units, and by multiplying them with a shadow price, they can be expressed in monetary terms (see Section 3). The monetisation allows for direct comparability both with financial value and among externalities. Like cash flows in a DCF, the value flows of externalities can be discounted to arrive at value estimates (Schoenmaker and Schramade, 2023).

The question arises to what extent such externalities are valued by markets. Or more precisely, to what extent do markets price the likelihood of internalisation and the resulting competitive effects of those externalities being internalised (Kurznack et al., 2021)? This touches on the efficient markets hypothesis, which assumes that markets are information efficient (i.e., share prices reflect all available information). By contrast, Lo (2004) introduces the adaptive markets hypothesis, which states that the incorporation of specific types of information (such as sustainability-related information) in stock prices depends on the number and quality of analysts studying such information, consistent with an evolutionary model of individuals adapting to a changing environment. This view is confirmed by recent articles on investor attention to sustainability issues. Carbon risk, for example, has started to be priced since the 2015 Paris Climate Agreement (e.g. Bolton and Kacperczyk, 2023), as has biodiversity risk since the 2022 Kunming-Montreal Global Biodiversity Framework. Benlemlih, Ge and Zhao (2021) provide evidence that the stock market reacts positively to sustainability news released by undervalued firms and more so for undervalued firms with high information asymmetry. The next section develops a methodology for integrated value to systemically account for social and environmental factors in valuation.

[2] In a similar way, Chiu and Lin (2024) document that companies with gross-profit rates above the market median are in the best position to undertake CSR activities.

3. Modelling the futureproofing ratio

This section provides the methodology for deriving the futureproofing ratio. The first step is to broaden financial value to integrated value, which also includes social and environmental value (subsection 3.1). The second step is to calculate the futureproofing ratio, which is defined as integrated value divided by financial value (subsection 3.2). The futureproofing ratio is an indicator of the futureproofness of a company's business model. Companies have both positive and negative externalities, which allows us to disentangle the futureproofing ratio into a transition opportunity ratio and a transition risk ratio. These ratios measure a company's exposure to transition shocks to the upside and to the downside, respectively.

3.1 Integrated value

When taking a long-term view of corporate value, social and environmental externalities are likely to be internalised through different channels, such as regulation and taxation, technological advancement, and customer preferences (Kurznack et al., 2021). To capture these effects, company valuation can be broadened from narrow financial valuation to broad integrated valuation. Following Schoenmaker and Schramade (2023), the integrated value IV_i of company i combines financial value FV, social value SV, and environmental value EV:

$$IV_i = FV_i + SV_i + EV_i \quad (1)$$

Many financial valuation ratios, such as the price-to-book ratio, aim to value a company from a shareholder perspective (see Section 2). Both equity value and enterprise value are then a relevant proxy for FV. By contrast, integrated value aims to measure a company's contribution from a holistic perspective. That requires adding the value of externalities and taking an enterprise perspective rather than an equity only perspective. Hence, FV is here defined as the company's enterprise value, i.e. the sum of the market values of its equity (its market capitalisation) and its debt. Enterprise value provides a comprehensive overview of the company's business activities.

The other components of IV are SV and EV. Recent advances in impact accounting and valuation enable companies to measure social and environmental effects and monetise these via cost-based pricing techniques (Serafeim, Zochowski, and Downing, 2019). Impact accounting starts with expressing social and environmental impacts j of company i in their own units $Q_{i,j}$. For example, carbon emissions can be expressed in tonnes of CO_2. The next step is to monetise each factor with its shadow price SP_j, which reflect the social cost (Pastor, Stambaugh, and Taylor, 2024; Schoenmaker and Schramade, 2024b). As we deal with social and environmental externalities, market prices tend to underestimate the social and environmental value from a welfare perspective. The principle of remediation can be used to derive the remediation costs of social and environmental impacts (Harclerode, Lal and Miller, 2016). While the market price of carbon emissions fluctuated around €70 per ton of CO_2 in the EU Emissions Trading System in 2024, the shadow carbon price to restore the original situation is computed at €214 per ton of CO_2 (IEF, 2024).

Social components can also be expressed in their own units, such as quality adjusted life years added by a medical technology company. The number of quality adjusted life years added is calculated as the change in utility value induced by the medical treatment, multiplied by the duration of the treatment effect (Räsänen et al., 2006). According to IEF (2024), the shadow price for a quality adjusted life year is €107,700. IEF (2024) also provides shadow prices SP_j for social and environmental impacts j. Value flows VF are calculated as follows:

$$VF_i = Q_{i,j} \cdot SP_j \tag{2}$$

Using the standard discounted cash flow model, social value flows SVF and environmental value flows EVF can be discounted to obtain SV and EV:

$$SV_{i,t} = \sum_t \frac{SVF_{i,t}}{(1+r)^t} \tag{3}$$

$$EV_{i,t} = \sum_t \frac{EVF_{i,t}}{(1+r)^t} \tag{4}$$

Whereby r reflects the social discount rate and t the number of periods over which the impacts are discounted. Social and environmental impacts are discounted at the social discount rate (Pastor, Stambaugh, and Taylor, 2024; Schoenmaker and Schramade, 2024a). The social discount rate is applied for impacts on society and is a single rate for all impact factors j. Pastor, Stambaugh and Taylor (2024) and Schoenmaker and Schramade (2024a) find a consensus among experts on a social discount rate of 2.2%. The time horizon for calculating impacts is infinite. The size of EV depends critically on the pathway for reducing negative externalities (in particular of carbon emissions). The leading scenario of net zero by 2050 can be taken as starting point, which can be further investigated with scenario analysis.

There are also limitations. Calculating integrated value is "work in progress" due to missing data, but integrated reporting is improving with the advance of sustainability reporting standards under the International Sustainability Standards Board (ISSB) and the EU Corporate Sustainability Reporting Directive (CSRD). Moreover, at its current stage of development, integrated value calculations demand detailed guidelines. In an online appendix 'Notes on integrated value methodology', we provide accounting policies to ensure consistent and reliable calculations of integrated value.

3.2 Futureproofing ratio

The Integrated value approach that we outlined above is a valuation model of the first type, namely an absolute multiperiod valuation model. The innovation of this paper is that we take integrated value as the basis for a new relative valuation model, which we call the futureproofing ratio. We define the futureproofing ratio as the ratio of integrated value IV to financial value FV:

$$Futureproofing\ ratio = IV/FV \tag{5}$$

The futureproofing ratio measures the net social and environmental externalities in relation to financial value. To understand the working of the futureproofing ratio, we disentangle the net externalities in positive social and environmental value (SV^+, EV^+) and negative social and environmental value (SV^-, EV^-). In option terms, the monetised positive social and environmental externalities represent transition opportunities for the company, which come into the money when transition shocks happen that cause the externalities to be internalised. Kurznack et al. (2021) show how positive social and environmental value can be a source of long-term value creation. We can thus define the transition opportunity ratio as positive social and environmental value (SV^+, EV^+) divided by financial value FV:

$$Transition\ oppurtunity\ ratio = (SV^+ + EV^+)/FV \quad (6)$$

Next, we can switch risk from a backward-looking perspective based on historical stock data to a forward-looking transition risk perspective. Transition risk assesses a company's vulnerability to transition shocks. The monetised negative social and environmental externalities are an indicator for transition risk, as the company faces high costs when these externalities are internalised. Wetzer, Stuart-Smith and Dibley (2024) report, for example, that climate-related financial risk exposures are increasing. More than 100 climate lawsuits have been filed per year globally since 2015. We define the transition risk ratio as negative social and environmental value (SV^-, EV^-) divided by financial value FV:

$$Transition\ risk\ ratio = (|SV^- + EV^-|)/FV \quad (7)$$

To cast the transition risk ratio as a positive quotient, we take the absolute value of SV^- and EV^- in equation (7). Using equation (1), we can link the three ratios as follows:

$$Futureproofing\ ratio = 1 + transition\ opportunity\ ratio - transition\ risk\ ratio \quad (8)$$

The futureproofing ratio measures the extent to which a company is prepared for future internalisation shocks. A ratio larger than one indicates that a company is relatively well prepared for future internalisation shocks, while a ratio below one suggests that a company is less prepared. The interpretation is akin to the price-to-book ratio, where a ratio over one indicates that the market assigns a higher value to the company than its replacement value. Similarly, a futureproofing ratio over one implies that the company's future value or long-term value potential (as expressed in integrated value) is higher than its market-based financial value.

The futureproofing ratio can also be interpreted in terms of resilience. A futureproofing ratio larger than one means that the company is more resilient and thus better capable to absorb transition shocks. By contrast, a ratio below one indicates that a company is less able to absorb transition shocks. Further down the range, a ratio below zero means the negative social and ecological value is larger than the company's financial value, indicating a highly unsustainable business model and a potential inability to withstand significant transition shocks. The value of these latter companies can decline rapidly, turning them into 'stranded assets' (Caldecott, Tilbury and Carey, 2014).

This means that the futureproofness of a company's business model is based on a weighted mix of transition opportunities and risks. A futureproofing ratio larger than one implies that a company is resilient on a net basis. The futureproofing ratio is a summary ratio providing an overall view of a company's long-term value potential. It is also useful to further analyse a company's opportunities and vulnerabilities on a gross basis, as sustainability transitions are uncertain and happen shock-wise (Loorbach, Frantzeskaki and Avelino, 2017).

A common limitation of ratios is the stability of the denominator. Price-earnings ratios can, for example, be distorted by current earnings. A way to address this is by using forward earnings, which are estimated earnings over the next period. Another method is using historical earnings, for example, over the last one or two years. The financial value denominator of the futureproofing ratio is determined by the current stock price, which can be distorted by investor sentiment. In a similar way to adjusted price-earnings ratios, the financial value can be calculated with a DCF model based on expected cash flows. Alternatively, the financial value can be calculated using a rolling window of stock prices over the last few years; or one could apply historical through the cycle earnings and multiples, such as Shiller's CAPE (cyclically adjusted price-earnings) ratio, which takes ten-year average earnings as a basis (Siegel, 2016).[3]

4. Empirical study

We provide an empirical investigation by calculating futureproofing ratios for the companies listed on the Amsterdam Stock Exchange (AEX). We collect data on the financial, social and environmental factors (subsection 4.1) as input for the computation of each company's integrated value (subsection 4.2). This allows us to calculate the transition and futureproofing ratios and analyse their properties (subsection 4.3). We also conduct scenario analysis, whereby companies can follow different pathways for reducing their negative environmental impacts (subsection 4.4).

4.1 Sample and data

Our sample consists of the companies listed on the Dutch AEX. The large cap segment of the AEX contains the largest 25 companies. Integrated value aims to assess the real-world impacts of companies on a consolidated basis. This assessment is more difficult, both in calculating

[3] Another possibility for financial value is to use a company's book value, which is typically more stable than its market value. But book value underestimates a company's financial value as intangibles are not included (see Section 2.2). That would introduce a new distortion.

and interpreting, for companies with a layered structure. Hence, the holding companies Exor and Prosus are excluded from the list of AEX companies.[4]

For the remaining 23 companies in our sample, we collect financial, social and environmental data from publicly available sources for the fiscal year 2023. The vast majority of our data is taken from company annual reports, company sustainability reports and company fact sheets. Only when information is not available from these sources, non-financial qualitative data such as Glassdoor reviews on employment satisfaction and IBM reports on cybersecurity are consulted. The data sources are provided in the online appendix 'Individual company results'.

Table 1 reports the summary statistics. In Panel A, we provide the financial variables. The structural features of the mean company include a market capitalisation of €46.1 billion, a net debt of €88.3 billion and a financial or enterprise value of €134.4 billion. In Panel B, we report the monetised social variables related to a company's production process (internal effects) and its products and services (external effects). We measure 15 different social factors, which can be positive or negative. Consumer wellbeing, measured as the consumer surplus, is a large and positive contribution. By contrast, health effects on consumers, measured in life years extended or lost, can be positive (e.g. due to medical equipment or pharmaceutical drugs) or negative (e.g. due to alcohol or tobacco). The largest mean contributions on the social side comprise consumer wellbeing (€53.9 billion), employment wellbeing (€21.3 billion), health effects on consumers (-€7.84 billion) and corporate taxes (€5.9 billion). The mean company has a social value of €65.1 billion.

In Panel C, we report summary statistics for the eight environmental variables. These are largely negative contributions. The largest mean environmental contributions are due to greenhouse gas (GHG) emissions (-€89.1 billion), waste (-€6.6 billion), biodiversity loss (-€4.7 billion) and air pollution (-€3.9 billion). The mean company poses an environmental externality of -€105.6 billion.

Summing up, there is a wide range of social and environmental factors that affect company stakeholders. The major impacts are for future generations (carbon emissions), consumers (consumer wellbeing) and employees (employment wellbeing). Other impact factors can be material or relevant for some companies, but not for other companies.[5] For these factors the median is zero in Table 1. Looking at the full sample of companies, all three values (financial, social and environmental) are sizeable with mean financial value at €134.4 billion, mean social value at €65.1 billion and mean environmental value at -€105.6 billion.

[4] Exor is an investment vehicle containing large stakes in multiple companies. Prosus is a combination of the various operating companies that it owns and of Tencent, the Chinese social media company in which Prosus has a 25% stake.

[5] Material social and environmental factors reflect issues that are sufficiently crucial regarding to the business model or size of impact (Schoenmaker and Schramade, 2023). Health and safety of employees is, for example, material for industrial companies, but less relevant for services companies.

Table 1. Summary statistics

Summary statistics for the main variables in our sample of 23 companies from the AEX. Panel A. contains the financial variables; Panel B. contains the social variables; Panel C. contains the environmental variables. The variables are reported in EUR billions. The sample period is fiscal year 2023.

Panel A. Financial variables (EUR billion)					
Variable	Mean	Median	Std. dev.	Min	Max
Market capitalisation	46.06	23.12	64.00	8.95	268.22
Net debt	88.35	5.78	206.96	-8.10	923.40
Financial value	**134.40**	**42.98**	**210.47**	**10.22**	**968.64**
Panel B. Social variables (EUR billion)					
Variable	Mean	Median	Std. dev.	Min	Max
Consumer wellbeing	53.94	23.39	86.04	1.07	410.56
Employment wellbeing	21.27	12.33	24.07	0.60	95.34
Training	1.42	0.63	1.92	0.00	7.42
Discrimination and inclusion	0.17	0.00	0.82	0.00	3.93
Health and safety employees	-2.06	0.00	7.20	-33.91	0.00
Underpayment in value chain	-1.78	0.00	5.96	-27.57	0.00
Human rights breaches	-0.01	0.00	0.05	-0.26	0.00
Corporate taxes	5.94	0.00	29.21	-20.65	136.90
Products enabling low-income people	1.11	0.00	5.34	0.00	25.62
Health effects on consumers	-7.84	0.00	48.64	-228.13	32.68
Impact on local communities	0.13	0.00	3.90	-14.60	9.99
Information dissemination	1.16	0.00	3.96	0.00	16.43
Cyber security breaches and data privacy	-1.92	-0.02	5.55	-23.28	0.00
Product responsibility and safety	-1.34	0.00	6.44	-30.91	0.00
Business ethics	-5.10	0.00	18.35	-82.35	0.00
Social value	**65.10**	**26.51**	**131.26**	**-103.33**	**595.76**
Panel C. Environmental variables (EUR billion)					
Variable	Mean	Median	Std. dev.	Min	Max
GHG emissions	-89.11	-8.04	277.52	-1310.34	-0.03
Air pollution	-3.89	0.00	15.74	-75.44	0.00
Water pollution	-1.63	0.00	6.27	-30.15	0.00
Waste	-6.62	0.00	16.78	-75.69	0.00
Land use/biodiversity loss	-4.71	0.00	14.64	-62.75	0.00
Water usage	-0.31	0.00	1.13	-5.45	0.00
GHG emissions reduction	0.03	0.00	0.16	0.00	0.77
Land restoration / protection	0.67	0.00	3.18	0.00	15.27
Environmental value	**-105.56**	**-9.24**	**287.53**	**-1327.18**	**-0.14**

4.2 Integrated value

We calculate the financial, social and environmental value components to arrive at a company's integrated value. Table 2 presents the results for our sample of 23 companies.

Integrated value starts with the financial value, which is measured as enterprise value. Next, material social and environmental factors are measured in their own units and subsequently multiplied by the relevant shadow price. An intermediate step of attribution is needed to arrive at value flows. The impact can be directly or indirectly attributed to companies (IEF, 2014). Internal effects (that is, effects happening in or at the company) are directly attributed for the full 100% to the company. External effects happen elsewhere in the supply chain: upstream at suppliers or downstream at consumers or local communities. These external effects are attributed pro rata over the value chain (see note 1 of the online appendix 'Notes on the integrated value methodology'). The value flow $VF_{i,j}$ in equation (2) is adjusted for the attribution factor $AF_{i,j}$ and becomes: $VF_{i,j} = Q_{i,j} * SP_j * AF_{i,j}$.

To calculate the present value of the value flows, we need to make assumptions for the future growth of value flows. To avoid overstating externalities, we are cautious in our assumptions about the development of externalities. Over time, these assumptions can be replaced and updated with actual developments in future impacts when companies report their material impacts (performance and targets) under the Corporate Sustainability Reporting Directive (CSRD). A neutral position is taken on the social side by assuming that social externalities remain constant. On the environmental side, it is assumed that companies want to reduce their negative environmental externalities. The most important environmental factor is carbon emissions. Companies are given the benefit of the doubt in that they are assumed to follow a net zero strategy, whereby carbon emissions are reduced in equal steps towards 2050. Companies are further assumed to reduce their other negative environmental externalities by 2% per year. In Section 4.4, we analyse different scenarios for reducing environmental externalities. We also conduct a sensitivity analysis for the applied social discount rate.

Positive and negative social and environmental values are reported separately for each company in Table 2 to avoid substitution between positive and negative impacts. It also allows us to distinguish between transition opportunities (proxied by positive externalities) and transition risks (proxied by negative externalities). Figure 1 provides a graphical overview of our results. On the social side, we find that positive externalities amount to €90 billion on average (67% of financial value), while negative externalities are -€25 billion (-19% of financial value). These numbers add up to the average net effect of €65 billion (48% of financial value) reported in Table 1. Environmental externalities are predominantly negative at -€106 billion (-79% of financial value). We thus arrive at an average integrated value of €94 billion (70% of financial value). This means that 30% of the financial value of the AEX companies comes at the expense of society. This number is heavily skewed by a small number of companies with large negative externalities. These companies comprise ArcelorMittal and Shell with high environmental costs of carbon emissions and air pollution and Heineken with high social costs of alcohol use.[6]

[6] The social costs of alcohol use include healthcare costs, productivity losses, a rise in accidents, and increased rates of crime (Congressional Report by National Institute on Alcohol Effects and Alcohol Associated Disorders, National Institutes of Health, Washington D.C., 2023).

Table 1 shows that carbon emissions are the largest negative contributor to integrated value. In our sample of Dutch AEX companies, the carbon burden (the present value of the social costs of future carbon emissions) amounts to 193% of companies' market capitalisation. In a study of US listed companies, Pastor, Stambaugh and Taylor (2024) find that the negative externality of carbon adds up to 131% of US companies' market capitalisation. This difference versus the Dutch index can be explained by the larger share of tech companies in the US, with a relatively low carbon burden.

In Section 4.3, we further discuss the results for companies. The detailed calculation and aggregation of social and environmental factors for each company are provided in an online appendix 'Individual company results'.

Table 2. Integrated value

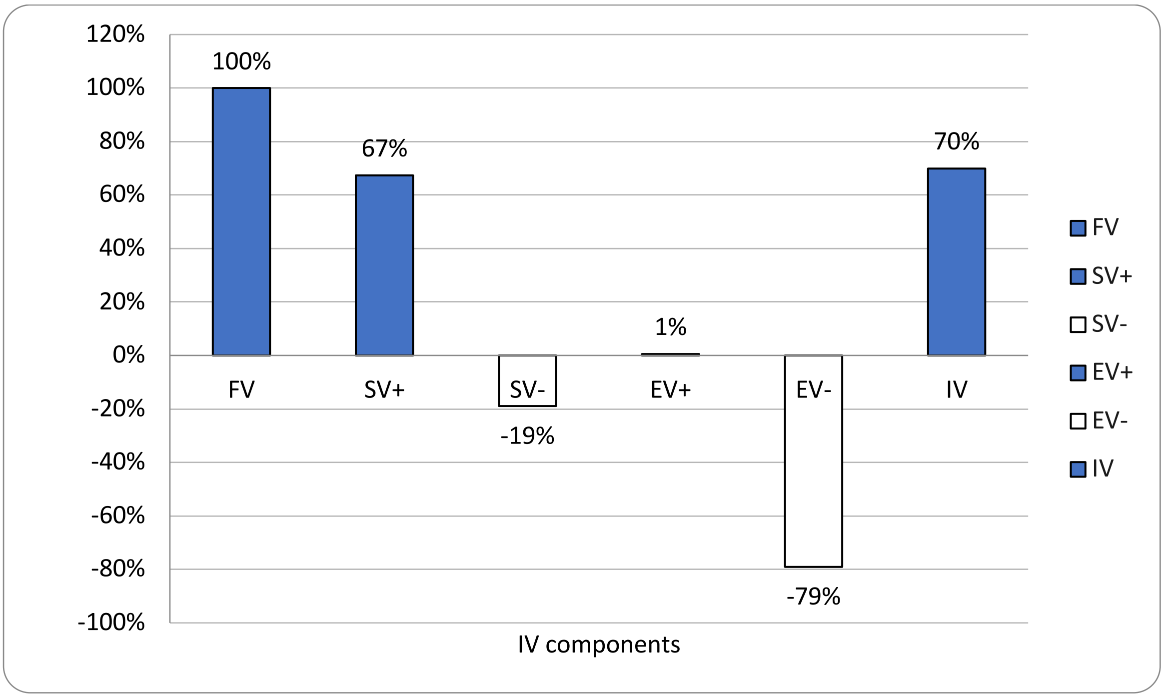
Integrated value is calculated for our sample of 23 AEX companies. The first column with numbers contains the financial or enterprise value; the next two columns the positive and negative social value; the penultimate two columns the positive and negative environmental value; and the final column the integrated value, which is the sum of financial, social and environmental value. The weighted average is weighted by financial value. Values are reported in EUR billions and as a percentage of financial value in brackets. The sample period is fiscal year 2023.

Company name	Financial value	Positive social value	Negative social value	Positive environmental value	Negative environmental value	Integrated value
ABN AMRO BANK	365.5 (100%)	48.9 (13%)	-35.8 (-10%)	0 (0%)	-9.2 (-3%)	369.3 (101%)
ADYEN	28.1 (100%)	6.1 (22%)	-0.2 (-1%)	0.0 (0%)	-0.1 (0%)	33.8 (120%)
AEGON	301.7 (100%)	23.9 (8%)	-0.7 (0%)	0.0 (0%)	-9.9 (-3%)	315.0 (104%)
AHOLD DELHAIZE	40.4 (100%)	230.7 (571%)	-43.1 (-107%)	0.0 (0%)	-122.3 (-303%)	105.6 (261%)
AKZO NOBEL	16.8 (100%)	40.1 (239%)	0.0 (0%)	0.0 (0%)	-40.5 (-241%)	16.4 (98%)
ARCELORMITTAL	25.9 (100%)	152.4 (589%)	-25.8 (-100%)	0.0 (0%)	-463.2 (-1791%)	-310.7 (-1201%)
ASM INTERNATIONAL	22.6 (100%)	6.5 (29%)	-0.8 (-4%)	0.0 (0%)	-7.5 (-33%)	20.7 (92%)
ASML HOLDING	266.66 (100%)	74.5 (28%)	-21.3 (-8%)	0.0 (0%)	-53.0 (-20%)	266.88 (100%)
ASR NEDERLAND	150.5 (100%)	13.9 (9%)	-0.3 (-0.2%)	0.2 (0.1%)	-1.7 (-1%)	162.5 (108%)
BE SEMICONDUCTOR	10.6 (100%)	1.7 (16%)	-0.6 (-6%)	0.0 (0%)	-1.6 (-15%)	10.1 (95%)
DSM FIRMENICH	26.9 (100%)	67.9 (253%)	-40.8 (-152%)	0.8 (3%)	-31.2 (-116%)	23.5 (88%)
HEINEKEN	68.5 (100%)	125.4 (183%)	-228.7 (-334%)	0.0 (0%)	-29.2 (-43%)	-64.0 (-94%)
IMCD	10.2 (100%)	6.9 (68%)	0.0 (0%)	0.0 (0%)	-1.0 (-10%)	16.1 (158%)
ING GROEP	968.6 (100%)	143.3 (15%)	-84.5 (-9%)	0.0 (0%)	-35.9 (-4%)	991.6 (102%)

KPN	18.4 (100%)	16.7 (91%)	0.0 (0%)	0.0 (0%)	-1.6 (-9%)	33.4 (182%)
NN GROUP	197.6 (100%)	27.0 (14%)	-0.4 (-0.2%)	0.0 (0%)	-4.2 (-2%)	219.9 (111%)
PHILIPS	24.9 (100%)	136.2 (547%)	-33.0 (-133%)	0.0 (0%)	-11.6 (-47%)	116.5 (468%)
RANDSTAD	14.3 (100%)	48.8 (342%)	-29.3 (-205%)	0.0 (0%)	-0.3 (-2%)	33.4 (182%)
RELX	68.7 (100%)	58.2 (85%)	-23.3 (-34%)	0.0 (0%)	-0.1 (-0.2%)	103.5 (151%)
SHELL	238.1 (100%)	597.9 (251%)	-2.2 (-1%)	0.0 (0%)	-1327.2 (-557%)	-493.3 (-207%)
UNIVERSAL MUSIC GROUP	49.2 (100%)	45.1 (92%)	-8.4 (17%)	0.0 (0%)	-0.7 (-2%)	85.1 (173%)
UNILEVER	134.3 (100%)	192.8 (144%)	-5.3 (-4%)	15.3 (11%)	-291.4 (-217%)	45.8 (34%)
WOLTERS KLUWER	43.0 (100%)	31.4 (73%)	-14.6 (-34%)	0.0 (0%)	-0.5 (-1%)	59.4 (138%)
WEIGHTED AVERAGE	**134.4 (100%)**	**90.5 (67%)**	**-25.4 (-19%)**	**0.7 (1%)**	**-106.3 (-79%)**	**93.9 (70%)**

Figure 1. Integrated value components

This graph plots the individual components of the integrated value calculation. These numbers reflect the mean value components for the AEX companies and are expressed as percentage of financial value. The first five components add up to the final IV component.



4.3 Futureproofing ratio

We are now able to compute the valuation ratios for the AEX companies. Tables 3 and 4 contain the empirical results of the transition opportunity, transition risk and futureproofing ratio. Whereas Table 3 presents the results at the company level, Table 4 provides the results at the sector level. A transition opportunity ratio or a transition risk ratio close to one, or higher, implies a major sensitivity to transition shocks. Unless transition opportunities and risks are more or less balanced, this also leads to larger deviations from one for the futureproofing ratio. The futureproofing ratio measures the net exposure of a company's business model to transition shocks.

As companies in the same sector often face similar challenges, we might expect more dispersion between sectors than within sectors. Table 4 confirms this, with ratios differing greatly across sectors. It reports high transition ratios for the fast-moving consumer goods (FMCG) sector and the resources sector, resulting in futureproofing ratios well below one. The food (distribution) companies in the FMCG sector (Ahold Delhaize, DSM and Unilever) have a large environmental footprint in the form of carbon emissions, water usage and biodiversity loss. The drinks company (Heineken) faces a large social cost of alcohol consumption, as discussed in Section 4.2. These companies in the FMCG sector also have sizeable opportunities, in particular visible in their consumer surplus. The net result is a futureproofing ratio of 0.41.

The resources sector contains oil & gas (Shell), steel (ArcelorMittal) and chemicals (AkzoNobel and IMCD). The value-weighted results are dominated and skewed by Shell and ArcelorMittal. Because of its carbon footprint, Shell has a high transition risk ratio of 5.6. The toxic combination of carbon emissions and air pollution from the coal furnaces of ArcelorMittal leads to a transition risk ratio of 18.9, by far the highest in our sample. The resulting negative futureproofing ratios indicate a highly problematic business model for these companies.

The services and tech sectors are at the opposite end of the spectrum, with medium transition risk ratios at 0.4. The services sector is a large and still growing part of the Dutch economy. The sector's high transition opportunity ratio of 1.0 leads to a futureproofing ratio of 1.6. Randstad is a staffing and temp agency that connects companies and employees. By doing so, it creates a lot of social value. RELX and WolterKluwer, other companies in the services sector, provide data analytics and decision tools for business. Their information dissemination also creates social value.

The tech sector is an important driver of local industrial activity and innovation. This is most visible in Brainport Eindhoven, which is one of Europe's most innovative technology regions and where ASML leads a vibrant ecosystem. ASML, ASM International and BE Semiconductor are active in the semiconductor industry producing chips, which is in much demand. But water pollution, a significant part of semiconductor production, is one of the more costly aspects of this technology. The medtech company Philips leads the company ranking with a futureproofing ratio of 4.7. Philips' high score is driven by its health solutions and access to health (bringing health technology to low-income communities).

Table 3. Valuation ratios companies

The valuation ratios are computed for our sample of 23 AEX companies. The first column with numbers contains the transition opportunity ratio, which measures the positive social and environmental values; the second column refers to the transition risk ratio, which measures the negative social and environmental values; and the final column shows the futureproofing ratio, which is computed as 1 + transition opportunity ratio – transition risk ratio. The weighted average is weighted by financial value. Ratios are expressed as quotient of 1. The sample period is fiscal year 2023. The bottom row shows the results of the chi-square goodness of fit test; the *p*-value is reported between brackets.

Company name	Transition opportunity ratio	Transition risk ratio	Futureproofing ratio
ABN AMRO BANK	0.13	0.12	1.01
ADYEN	0.22	0.01	1.20
AEGON	0.08	0.04	1.04
AHOLD DELHAIZE	5.71	4.10	2.61
AKZO NOBEL	2.39	2.41	0.98
ARCELORMITTAL	5.89	18.90	-12.01
ASM INTERNATIONAL	0.29	0.37	0.92
ASML HOLDING	0.28	0.28	1.00
ASR NEDERLAND	0.09	0.01	1.08
BE SEMICONDUCTOR	0.16	0.21	0.95
DSM FIRMENICH	2.55	2.68	0.88
HEINEKEN	1.83	3.77	-0.94
IMCD	0.68	0.10	1.58
ING GROEP	0.15	0.12	1.02
KPN	0.91	0.09	1.82
NN GROUP	0.14	0.02	1.11
PHILIPS	5.47	1.79	4.68
RANDSTAD	3.42	2.08	2.34
RELX	0.85	0.34	1.51
SHELL	2.51	5.58	-2.07
UNIVERSAL MUSIC GROUP	0.92	0.19	1.73
UNILEVER	1.55	2.21	0.34
WOLTERS KLUWER	0.73	0.35	1.38
WEIGHTED AVERAGE	**0.68**	**0.98**	**0.70**
χ^2	143.04 $(p = 0.01)$	385.45 $(p = 0.01)$	202.84 $(p = 0.01)$

The financials – two banks and three insurers - have relatively low transition ratios and thereby a futureproofing ratio close to one. There are two factors behind their low transition scores. First, the main social and environmental effects are indirect, occurring at their clients. While client carbon emissions are starting to be measured; this is more difficult for other social and environmental factors. Moreover, indirect effects are only partly attributed to the financing institution, as explained in Section 4.1. Second, the denominator of the ratios is financial value; see equations (5) to (7). As financials are highly leveraged, the financial value (reflecting the nominal value of stocks, bonds and loans on their balance sheet) is very large relative to other sectors (see Table 2). So, these ratios are less well-suited for the financial sector.

Table 4. Sector analysis

This table reports the sector results. The first column with numbers contains the transition opportunity ratio, which measures the positive social and environmental values; the second column refers to the transition risk ratio, which measures the negative social and environmental values; and the final column shows the futureproofing ratio, which is computed as 1 + transition opportunity ratio – transition risk ratio. The weighted average is weighted by financial value. Ratios are expressed as quotient of 1. The sample period is fiscal year 2023. The bottom row shows the results of the chi-square goodness of fit test; the *p*-value is reported between brackets.

Sector	Transition opportunity ratio	Transition risk ratio	Futureproofing ratio
Technology	0.69	0.38	1.30
Fast-moving consumer goods	2.34	2.93	0.41
Services	0.93	0.38	1.55
Financials	0.13	0.09	1.04
Resources	2.74	6.39	-2.65
WEIGHTED AVERAGE	**0.68**	**0.98**	**0.70**
χ^2	10.83 $(p = 0.05)$	35.29 $(p = 0.01)$	14.06 $(p = 0.01)$

The chi-square goodness of fit tests in Tables 3 and 4 reject the null hypothesis that the ratios do not contain information, mostly at the 1% significance level ($p = 0.01$) and only for the transition opportunity ratio in the sector analysis at the 5% significance level ($p = 0.05$). We can thus accept the alternative hypothesis that the ratios contain information on the transition opportunity, transition risk and futureproofness of companies. The variation is, in particular, large for the transition risk ratio, which shows a company's vulnerability to transition shocks.

4.4 Scenario analysis

To test the robustness of our results, we conduct a sensitivity analysis on the key variables in our integrated value calculation: the carbon pathway and the social discount rate. The assumption on the carbon pathway to net zero is a major driver of the environmental value. The baseline scenario in our calculations is net zero by 2050. Other externalities are assumed to decline by 2% per year. To perform a scenario analysis, we formulate both an ambitious and a business-as-usual scenario: plus and minus 10 years on the net zero target; and plus and minus 100 basis points on the annual reduction of other environmental externalities. In the ambitious scenario, companies are speeding up their environmental efforts with net zero by

2040 and a reduction of other externalities by 3% per year. By contrast, in the business-as-usual scenario, companies slow down their environmental endeavours to net zero by 2060 and a reduction of other externalities by 1% per year.

Table 5 shows that the results are very sensitive to a company's environmental strategy. The deviations from the baseline scenario are about 30% for the transition risk ratio and over 40% for the futureproofing ratio. This clearly shows that strategy matters. Companies have the power to improve their futureproofness by accelerating their investment in environmental improvements. As companies have to report their environmental metrics and targets from fiscal year 2024 onwards under the Corporate Sustainability Reporting Directive, future research could incorporate company specific net zero targets.

Table 5. Scenario analysis

This table shows three scenarios. The baseline scenario is net zero by 2050 for GHG emissions and 2% reduction of other environmental externalities per year. The ambitious scenario is net zero by 2040 for GHG emissions and 3% reduction of other environmental externalities per year. The business as usual (BAU) scenario is net zero by 2060 for GHG emissions and 1% reduction of other environmental externalities per year. The first column with numbers contains the transition opportunity ratio, which measures the positive social and environmental values; the second column refers to the transition risk ratio, which measures the negative social and environmental values; and the final column shows the futureproofing ratio, which is computed as 1 + transition opportunity ratio – transition risk ratio. Ratios are expressed as quotient of 1.

Scenario	Transition opportunity ratio	Transition risk ratio	Futureproofing ratio
Baseline scenario: net zero 2050	0.68	0.98	0.70
Ambitious scenario: net zero 2040	0.68	0.69	1.00
Business as usual scenario: net zero 2060	0.68	1.32	0.36

The social discount rate is an important variable in the DCF model for calculating the social and environmental value. We conduct a sensitivity analysis for the social discount rate: plus and minus 50 basis points. When added to the 2.2% baseline rate, we obtain alternative discount rates of $r = 2.7\%$ and $r = 1.7\%$. Table 6 reports that the results are not very sensitive to changes in the discount rate. As a changing discount rate affects both the positive side (transition opportunity ratio) and the negative side (transition risk ratio), the net effect on the futureproofing ratio is limited.

Table 6. Varying discount rates

This table reports a sensitivity analysis of the social discount rate. The variation is plus and minus 50 basis points for the social discount rate of 2.2%. The first column with numbers contains the transition opportunity ratio, which measures the positive social and environmental values; the second column refers to the transition risk ratio, which measures the negative social and environmental values; and the final column shows the futureproofing ratio, which is computed as 1 + transition opportunity ratio – transition risk ratio. Ratios are expressed as quotient of 1.

Discount rate	Transition opportunity ratio	Transition risk ratio	Futureproofing ratio
Baseline social discount rate: 2.2%	0.68	0.98	0.70
Low social discount rate: 1.7%	0.88	1.08	0.80
High social discount rate: 2.7%	0.56	0.91	0.65

5. Discussion and implications

The results of our empirical investigation indicate that the new valuation ratios provide insight in companies' exposure to transition shocks. The transition opportunity ratio indicates a company's exposure to transition shocks to the upside, while the transition risk ratio shows a company's vulnerability to transition shocks to the downside. As discussed, Section 4 shows a wide variation of the transition risk ratio among companies. So, companies differ in their vulnerability. The futureproofing ratio measures the net exposure to shocks and differs within and across sectors.

The study of AEX companies is a first empirical investigation of the new valuation ratios. Further research could be done for a sample of European companies, US companies and/or Asia-Pacific companies. These larger samples allow a more in-depth sector analysis. Best-in-class leaders as well as laggards within sectors can then be identified. That allows us to answer the question which business models are futureproof and which business models are at risk and may turn the company in a stranded asset (Caldecott, Tilbury and Carey, 2014).

Valuation ratios can influence the way companies think about creating value for the long-term and use this methodology to make better investment decisions. Company management can analyse its own company and its competitors in a similar way, but with much better information than we currently have. For example, they can determine the futureproof ratios of individual business units and even individual products. This can help them make better-informed investment and M&A decisions. At the strategic level, companies can develop pathways to improve on their social and environmental impacts and thereby advance the futureproofness of their business model.

We also see a promising field of application among institutional investors, notably long-term investors like pension funds and insurers, to assess the futureproofing ratios of their investment portfolios. The monetisation of social and environmental factors with shadow prices enables comparison across factors (financial, social and environmental) and companies.

Unlike the flawed ESG ratings (Berg, Kölbel and Rigobon, 2022), futureproofing ratios give investors an evidence-based overview of the societal value created and destroyed in the long term, which can inform their investment decisions and corporate engagement.

Futureproofing ratios also provide an interesting starting point for analysis and dialogue for policymakers and regulators. They enable policymakers to assess the extent to which companies are prepared for the upcoming transitions. Futureproofing ratios could, among other things, inform industry policy or M&A approval processes. In this way, policymakers can futureproof the economy by stimulating sectors that create long-term value and abandoning sectors that have no value-potential. It also informs policymaking itself. Acemoglu et al. (2012) propose a mixed policy of taxes and subsidies that redirect innovation toward clean inputs. The transition and futureproofness ratios provide information for an evidence-based implementation of these policies. Next, Rabarison, Siraj and Wang (2024) find that companies in countries with more stringent environmental policies are better and more innovative at managing environmental risk. These companies thus face lower transition risk.

6. Conclusions

In the 1970s, the market value relative to the book value, as measured by the price-to-book ratio, became the major determinant of new investment. This paper argues to expand our central valuation ratio again, from financial value to integrated value. Integrated value combines financial, social and environmental value, providing a holistic valuation of companies. As economies are in transition, positive social and environmental value proxy companies' preparedness for transition (called transition opportunities in this paper). By contrast, negative social and environmental value indicate companies' vulnerability to transition shocks (called transition risks).

The net sum of transition opportunities and risks shows the futureproofness of a company's business model. Does the company provide solutions for the coming sustainability transitions? Or will the company be hurt when transition shocks occur? As the timing of transitions is difficult to predict and transitions happen shock-wise, the transition and futureproof ratios are indicators to assess company value in the long-term, beyond current market valuations.

Our empirical findings suggest that the new valuation ratios provide information on a company's transition preparedness. The results are in particular insightful at sector level, as ratios differ greatly across sectors. Leaders and laggards within sectors can be identified. The interpretation of the futureproofing ratio is similar to that of the price-to-book ratio: a ratio of one is neutral; larger than one indicates good performance and below one weak performance. We find that the resources sector is in particular vulnerable to transition shocks with a negative futureproof ratio of -2.7 due to their carbon emissions and air pollution. This puts a premium on companies that invest in solutions, like steel companies moving to green steel and oil & gas companies switching their energy mix to renewables. The FMCG sector is also below one at 0.4, due to the environmental footprint of food production. The tech and services sectors have positive futureproofing ratios of 1.3 and 1.6 respectively. These sectors provide positive impact for consumers, employment and society, with more limited environmental impact. A medtech company leads the company ranking with a futureproofing ratio of 4.7, due to the provision of health solutions and access to health.

These new valuation ratios provide guidance for investment, both for company management and institutional investors. These groups are direct users of the ratios. An interesting extension is to apply our methodology to futureproof economies. Policymakers are investigating the future earnings potential of their industrial sectors. Futureproofing ratios could guide their search. By contrast, the current earnings potential – measured by market-based valuation ratios – would often be a bad proxy for futureproofing economies in a dynamic world. A case in point is Germany, which for too long relied on the 'market' success of its traditional industry and has discovered belatedly that its main industries are not prepared for the future.

A major limitation of the calculation and use of futureproof ratios is the lack of data on social and environmental factors. We are able to estimate the most important social impacts for consumers and employees as well as the carbon footprint. But data on social impact in the value chain (e.g. human right breaches) and other environmental impacts like biodiversity loss are still largely missing. Nevertheless, the transition and futureproof ratios provide a new perspective on company valuation.

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Online appendix: **Notes on the integrated value methodology**

Online appendix: **Individual company results**