13

CIRCULAR ECONOMY AND FINANCE*

Either a straightforward relation or a virtuous loop?

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Introduction: The sustainable finance environment

A serious and effective transition toward a circular economy (CE) has become an urgent need to keep economic systems competitive, as well as to match the economic development with the needs of sustainability. This statement is matched by evidence in different geographies, such as in the EU (European Commission, 2018), North America (Enel North America, 2021), and China (Bleischwitz et al., 2022). Hence, policymakers are acting to set up and boost the rethinking of the current linear economic paradigm, like in Europe with the European Circular Economy Action Plan, issued by the European Commission (2020). This extensive change asks to mobilize significant amounts of financial capital to support the broad investments that the transition needs. As proof thereof, the EU's *Action Plan: Financing Sustainable Growth* (2018/097 final, 8.3.2018) includes – among its main actions – steering the flows of financial capital towards the investments needed for targeting the foreseen transformation, as well as necessary for reaching the political goals related to sustainability issues, such as climate change mitigation (Schröder & Raes, 2021).

In a widespread and commonly agreed view, finance is called to play a key role as a catalyst for supporting the circular transformation of the economy (Tellini et al., 2022). This is the position usually taken by policymakers: either regional, such as the EU with the previously cited *Action Plan: Financing Sustainable Growth*, or global, such as the *2030 Agenda* (United Nations, 2015), which pursues 17 Sustainable Development Goals (SDGs) needing huge capital flows to fund investments for them to be achieved (WBCSD, 2017). In accordance with this view, in the first decade of this century, the debate on the relationship between CE and finance was around the claim that the latter should promote and support the circular transition, asking why finance was not acting as expected (*inter alia*: European Investment Bank, 2015; European Commission, 2019; FinanCE Working Group, 2016; UN PRI, 2016). In the current decade, the focus has partially shifted from a 'must do' approach to discussing which are the obstacles that slow down the expected financial flows toward circular investments (e.g., NSW Circular, 2022; Sitra, 2016). Nevertheless, if we are willing to understand why finance has neither targeted nor scaled the CE as a major investment theme, it is of paramount importance to understand the conditions that may empower the relationship in the next years. Without a complete engagement of the financial

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services (FS) industry, the transition to a CE would be negatively affected by a lack of financial capital necessary to invest in it. Consequently, the transition would slow down its expected pace of development and adoption and, eventually, miss the goal of building a sustainable economic system that goes beyond the limits of the current linear economic paradigm and contributes to society's well-being.

In this chapter, we develop a theoretical framework aimed at understanding this relationship. We embrace the financial system's point of view, and observe that the existence of potential opportunities offered to financial players by a circular transition is a crucial trigger for steering the FS industry in supporting it, thereby acting as a powerful catalyst. Opportunities must be considered alongside the constraints introduced by policymakers and the compliance with the rules of sustainable finance, and enforced by financial authorities to implement policy orientations. We prove this relationship by focusing on a specific opportunity: that is, the de-risking of financial assets. There is a peculiar condition for finance to undergo a sustainable or circular transformation, yet relative to the role played by non-financial info disclosure. Evidence arises from the results spreading from an extensive programme of research on this topic, which we have been carrying out for the last five years.

The remainder of this chapter is structured as follows. In the second section, we focus on the main areas in the FS industry that are impacted by a transformation of finance in a sustainable way. In arguing it, we introduce a four-pillar theoretical framework that provides a comprehensive view of how finance is undergoing a transformation in a circular sense: that is, what we hereby label as 'circular finance'. Furthermore, we state that, among the four pillars, the one that refers to the opportunities flourishing from the adoption of a CE is the real driver of motivation that may attract the financial capital toward circular investments. We provide more details on such driver, developing the conceptual model of the 3Rs of opportunities – *Risk*, *Revenue* (or *Return*), and *Reputation*; these help in the understanding of why supporting the CE can be a good strategy for financial players. Among the three R's, there is a deeper digging on the first category, as risk is the readiest area of opportunities to catch for financial players such as banks. In the second part of this chapter, we provide some evidence in favour of the previous argumentation. More in detail, we follow on by describing the Circularity Score (CS) as an example of a measure of circularity at company level, matching the informative needs of investors to first acknowledge and then to assess the circular assets, aimed at supporting their investment decision process. In the next section, we justify the claim that a CE can be an effective de-risking strategy, considering either credit risk for the lender or equity risk for the investor in capital markets. A specific analysis, relative to the COVID-19 pandemic, is also presented as evidence in favour of circular assets' enhanced resilience in case of external shocks, reflected in a lower degree of risk. We then focus on the role that non-financial information disclosure plays as a vehicle for conveying information on the degree of circularity, as well as its contribution to establish a positive relationship between the CE itself, on the one hand, and financial performance, on the other. Finally, we review our arguments and draw our conclusions.

The interactions between finance and CE: A conceptual framework

The inclusion of sustainable and circular considerations in the framework of financial activity implies the need for the analysis to be focused on specific factors of consideration, highlighting the main areas of ongoing change. The first field refers to corporate information disclosure as a pre-requisite for having a clear view of the benefits that sustainable financial assets could

generate. For example, Healy and Palepu (2001) argue in favour of a negative association between the level of disclosure on non-financial information and cost of capital; Cheng et al. (2014) connect a stronger corporate disclosure on sustainability with lower capital constraints. A clear assessment of the positive relationship between transforming the economy in a circular way and overall financial performance might be limited by the availability of data on the circular operations of non-financial companies (e.g., Bernardini et al., 2021), as well as on the quality of the corporate disclosure, particularly in respect of its degree of financial materiality (Chong, 2015; Murninghan and Grant, 2013).

The need for having a clear view on what a CE is, and what the right metrics for measuring the degree of circularity at company level could be, is strongly backed by the EU's *Action Plan* (European Commission, 2020). In fact, the *Action Plan* includes a key recommendation when it relates to the need for developing a classification system for economic activities, to ensure a common understanding of what is sustainable and what is not.

When we refer to the CE specifically, another key topic is how to measure the degree of circularity at company level. In fact, several metrics have been developed for such purpose; however, as a general understanding, they never consider the informative needs of those financial players who wish to rely on entity-level data, embedding economic and material measures (Pauliuk, 2018).

The idea that finance should become increasingly oriented toward the inclusion of sustainability issues and support the adoption of a circular paradigm in the real economy can find a remarkable driver if a set of opportunities and benefits generated by this orientation can be put on the table. Financial players are very pragmatic and can rapidly steer their operations in a given direction if they foresee clear and firm advantages. When we refer to sustainability in a broad sense, a huge strand of literature argues in favour of sustainable asset classes exhibiting a higher financial performance (e.g., Eccles & Serafeim, 2013; Friede et al., 2015), yet the financial literature has never targeted the specific field of sustainability pertaining to a CE.

The opportunities offered by the CE adoption are not always 'ready to print': in fact, within the FS industry, catching them often requires changing the features of operations to a certain extent. The inclusion of sustainability risks within the assessment of a counterparty offers an interesting example. It implies to acknowledge that the underlying methodologies evolve, as well as include new and different sources of information (e.g., Vezér et al., 2017). Since circular practices are gradually adopted in the real economy, also, the FS industry must change its specific features and operations accordingly.

Figure 13.1 introduces a framework connecting all these arguments. It identifies the four pillars underpinning the main fields of consideration when we address the relationship between CE and finance.

The first pillar – namely, non-financial information disclosure on CE (and, broadly speaking, on sustainability) – is not directly influenced by the FS industry, and it refers to data and information on circularity that should be provided by security issuers. This pillar involves mainly non-financial companies as outside capital raisers and regulators as standard-setters on information transparency. In financial markets, information plays a key role in supporting the transfer of funds from investors to fund raisers. When circular, companies engaged in fundraising must endow investors with a specific information flow on their degree of circularity for letting them carry out proper screening, valuation, and monitoring of investments. In this area, regulators can play a pivotal role in fixing the rules of the game, like in the European Economic Area (EEA) with the Non-Financial Reporting Directive (NFRD, No. 2014/95/EU) and the Corporate Sustainability Reporting Directive (CSRD, No. 2022/2464/EU), which is set to apply starting from 2024. Information disclosure on circularity becomes even more relevant with regard to the

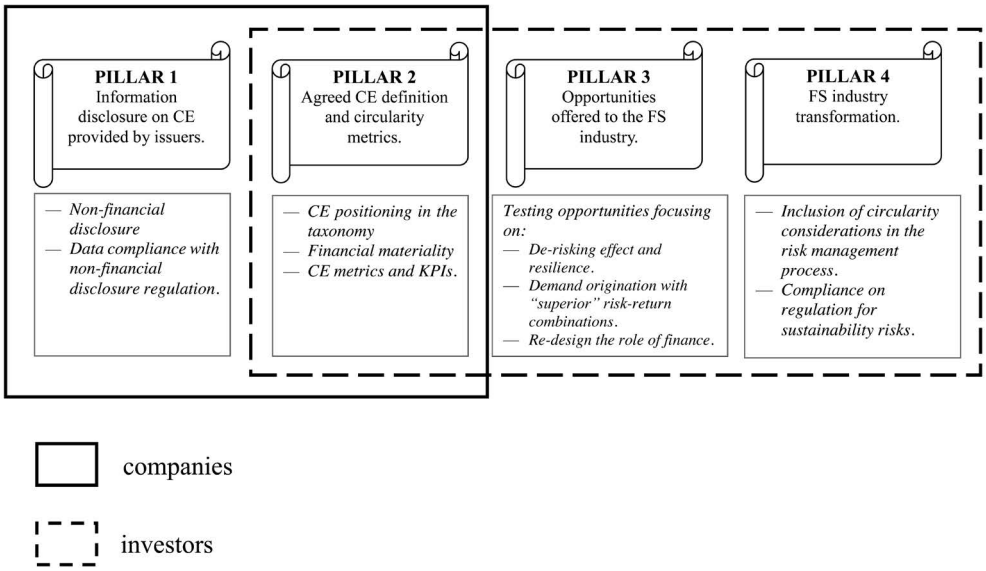


Figure 13.1 The four pillars of the circular finance chain.

content of innovation, both technological and managerial, which often characterizes the transition to a CE. For instance, in 2020, upon launching a 'call for evidence' on that topic, the Italian financial markets authority (CONSOB) highlighted the need for improving 'non-financial information' disclosure and reorient regulatory practices to include this topic into both the micro- and the macro-prudential discipline (Linciano, 2020).

Directly connected to the first one is the second pillar: namely, the agreed CE definition and circularity metrics, which could not be properly addressed without an effective non-financial info-disclosure. It implies a direct involvement of both issuers, according to the previous pillar, and financial players, which develop and adopt suitable metrics and measures. First, financial institutions need a clear and shared definition of CE in order to distinguish what is circular and what is not, as well as to recognize circularity from other sustainability-related frameworks, like CSR and ESG. The development of an EU Taxonomy on Sustainability (Regulation No. 2020/852) is the first key action among those identified by the European Commission (2020).

Second, in order to adequately screen and assess circular assets, financial players need a framework for measuring the companies' degree of circularity in a way that must be financially material, with the ultimate purpose of being able to recognize them among investment opportunities. In respect of non-financial information, 'materiality' carries a twofold connotation: *financial*, as companies are required to disclose information on those aspects that affect corporate financial performance and, thus, further strengthen the predictive capacity of metrics for financial value (Barman, 2018); or *environmental and social*, which requires companies to disclose information on the impact of their activities on the environment and society-at-large. Finally, a definition of suitable key performance indicators (KPIs) that allow to measure the results achieved by becoming circular is essential to link financial contracts, such as their covenants, with the targeted capital allocation and the needed monitoring.

Provided that the two previous pillars are properly addressed, the third pillar – namely, opportunities that the transition to a CE offers to the FS industry – points out how a transformation

of the economy in a circular way can yield positive effects for financial market players. Advantages can be foreseen across three main dimensions of financial business, which pertain to the 3R Model (Zara, 2018, 2020, see par. 2) and refer to the following:

- *Risk*, due to a comprehensive de-risking effect for financial assets.
- *Revenues* (or *Return*), which consists in the origination of non-speculative business opportunities with, possibly, superior risk-return combinations.
- *Reputation,* which entails the redesign of the role of finance within society.

This array of opportunities is not always a ready-to-print option; in fact, the transformation of the current economic model into a circular way can imply a transformation of operations and techniques in the FS industry. This leads to formulating the fourth pillar, namely the transformation of specific features in the FS industry, which results from the need for setting new processes or redesigning already existing ones within the industry's value chain, as well as products offered to the market. Drivers of change can be either external to the industry – such as regulators, who are increasing compliance on sustainability for financial institutions as well as a growing demand for sustainable and circular financial products – or internal, such as the need to include new and different sources of linear risks affecting the redesign of the credit risk assessment process. Other examples can refer to adopting new and unexplored criteria to properly handle circularity in the investment selection process, as well as actively managing the existing portfolios of linear assets that are expected to become more and more stranded in the medium term.

Some notable examples have arisen over the last few years. In 2018, Intesa Sanpaolo (ISP) – i.e., the largest Italian banking group in terms of both market capitalization and total assets – launched a five-billion-euro 'CE plafond', subsequently increased to six billion, which aims to construct a portfolio of circular private loans. The access of credit proposals to the plafond rests on a 'circularity screening' process – based on six main criteria – to assess whether a customer's project is either eligible for getting the circular label, or not. In the new 2022–2025 business plan, ISP has re-financed the plafond with an additional eight billion euros. In September 2019, ING – a large Dutch banking group – presented its *Terra* methodology, which steers and monitors its strategy of loan portfolio decarbonization through an asset reallocation that aims to be consistent with relevant 2030 climate change goals. A similar initiative, though a broader one, is the Net-Zero Banking Alliance, launched in 2021 by more than 90 financial institutions that cumulatively hold about 40% of global banking assets at end-2022 (according to UNEP-FI).

When considered on a standalone basis, laws and regulations – which are external to the business realm – might have a limited effect on the behaviour of financial players. For instance, financial institutions could manage regulatory changes from the narrow spot of just being formally compliant with the rules, thereby ringfencing the effect on their business activities. A major role could be played by changes in demand, such as large institutional investors that are attracted by investment opportunities that properly include sustainability themes in their features, or consumers who ask for green-labelled products because they wish to positively contribute to environmental targets with their consumption choices. Even in this case, financial institutions could adopt opportunistic positions to catch the rising demand with a limited change in their operations.

So, even if outside the industry there is a request, or a constrain, for finance to act as a catalyst, this condition does not imply that finance – that is, as a pool of economic players with their own goals, such as pursuing the financial interest of shareholders – will agree to take on this role and act accordingly. In a step-by-step process of transformation of finance in a circular and

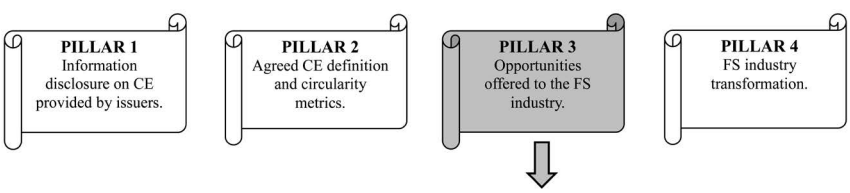
sustainable way, the third pillar (opportunities), plays the role of the major trigger of the process inside the industry. Only when financial players foresee real business opportunities in going circular and sustainable, thereby improving their own performance, they start to regard the CE and sustainability as strategic topics, rather than ringfenced to the compliance and risk management fields; hence, they become interested in adopting and scaling them. So, embracing the financial system's point of view entails shifting the standpoint from the usual 'what finance can do for CE' to the new 'what CE can do for finance', which implies a clear focus on the opportunities that can be generated when supporting the transformation of the economy in a circular way, what is their extent in terms of results, and what is the evidence in support. The 3R Model of business opportunities for the FS industry (Zara, 2018, 2020) answers these questions and focuses on the triggers for the CE adoption in financial markets. The ultimate interest is to explore the CE as a catalyst for the FS industry, not just the reverse.

The 3R Model of opportunities driven when supporting the transition

As previously highlighted, the third pillar of opportunities can be seen through the lens offered by the 3R Model, which considers three key dimensions: risk, revenue (or return), and reputation. The 3R Model is summarized in Figure 13.2.

Risk

Some of the features that characterize the circular transition act in support of an internal hedge against several new sources of risks related to the limits affecting the linear economic model. Moreover, the adoption of circular business models, and the subsequent diversification with respect to the linear business as usual, drives a growing reduction of systematic risk, which affects the current and linear economic system. Such de-risking effect can be linked to four circular key levers (Zara, 2018, 2020).



	Risk	Revenue	Reputation
Main claim	A comprehensive ***de-risking effect*** on the financial business.	Origination of non-speculative business opportunities with ***superior risk-return combinations***.	Redesign the ***role of finance*** in the society.
CE drivers	— **Decoupling** economic growth from finite resources. — Right **natural capital** management. — Economic **resilience**. — **Policy action**: internalization of negative externalities.	Demand for: — New investments in **innovation**. — Supporting **circular BMs** adoption. — **Impact trends** in end-user markets. — Sustainable investments in **policy plans for growth**.	— Back to basic: supporting **real economy development**. — **Social impact** and shared value strategies. — **Compliance** with regulation on sustainability and stability.

Figure 13.2 The 3R Model of opportunities: Main claims and drivers.

From a more overarching standpoint, the first positive effect on risk reduction to be associated with the CE paradigm is the decoupling of economic growth from the exploitation of finite resources (Lacy and Rutqvist, 2015). In a linear production system, the dependency of transformative economies on sources that supply finite virgin materials is a factor of intrinsic volatility, for these materials are becoming even more intensely consumed and, thus, scarce. Moreover, they are often subject to extremely competitive commercial conditions, and/or located in politically unstable areas. By fostering decoupling, the CE reduces the exposure of resource-intensive businesses to volatility in prices and procurement, as well as other possible sources such as operational and legal risks. The disconnection from finite virgin resources enables the reaping of benefits in terms of lower amount of the systematic component of risk, and potentially the idiosyncratic one. In a CE environment, finite resources and materials are replaced with renewable, regenerative or, at least, secondary ones; therefore, the stocks of finite resources are managed in a way that accounts for the limits associated with their exhaustion.

A second lever of risk reduction is constituted by the (effective) management of natural capital: that is, not only regenerating natural systems (*ex-post*) or replacing finite resources with regenerative ones (*ex-ante*) but, to a much larger extent, optimizing the use of products and materials to reduce the consumption of natural resources, such as water and land (e.g., Stahel, 2016). Jointly taken, these avenues enable the circular transition to exert a fundamental impact on the protection of natural capital and the environment at-large, something that the linear paradigm does neither consider nor ensure. Generally speaking, this is the way we can address the problem of preserving the natural habitats of our planet, withstanding the threats generated by demographic trends, increase in consumption, and growing pollution.

In the microeconomic realm, the two above-mentioned levers can contribute to strengthen the resilience of products over time, thus abiding by or, at least, contributing to uphold the most basic principle of the economic science itself: the pursuit of an efficient allocation of resources. The transition toward a CE is strongly connected to the redesign of products and their life cycles; this results in goods that are manufactured with better input requirements and used longer and more often, even after their first life; also, this highlights the intrinsically higher efficiency of the circular design. When products and services are redesigned in accordance with the circular principles, companies can develop and adopt different business and revenue models – vis-à-vis 'business as usual'– that diversify their operations and increase their efficiency inside the economy (Lacy and Rutqvist, 2015). Companies that diversify business operations through the adoption of circular practices will be less exposed to the volatility of the economic cycle, embedded in the global economy, which is still mostly linear. For example, in the automotive industry, original equipment manufacturers (OEMs), like BMW and Daimler-Benz, to enter the car-sharing business, add a new revenue model characterized by a continuous stream of revenues in comparison with the 'business as usual' car sale, which generates mainly upfront revenues from selling the ownership of cars. Knowing that demand for new cars might be highly affected by the economic cycle in one case, or by a supply chain disruption on the other, having a different revenue model – that is, the car-sharing business line – allows to de-correlate part of the revenues from the main model (that is, the car-sale business line). Moreover, the direct relationship between the car's life and the amount of revenues generated by driving prompts OEMs to design and manufacture cars that are more durable and efficient, in order to keep them longer in the loop and exploit better their economic value. (Circle Economy, 2022).

Companies that realize a revenue/business model diversification through the adoption of circular principles are usually less linked to the economic mainstream, more stable against the economic cycle, and become more resilient and persistent in their operations; these effects result in an expected risk mitigation.

However, companies are not islands; that is, they cannot act in full autonomy but have to abide by some constraints that regulatory authorities create and enforce. Therefore, another important lever is constituted by the ability to reduce negative externalities and system leakages to better match the effects of policy action. In this respect, going circular allows to become less impacted by the forthcoming policymakers' action. Regulators are orienting the costs generated by negative externalities from the whole society to originators, thus exposing the latter to emerging legal risks and related additional costs, such as new tax burdens for offsetting externalities and leakages (EMF, 2019). In light of this, the transition to a CE offers solutions to decrease companies' negative externalities, such as reducing pollution and minimizing or eliminating waste to landfills, which accelerate an internal hedging against the rising legal risks to curb their level of idiosyncratic risk.

Revenue (or return)

In the FS industry, 'revenue' refers to financial intermediation businesses, such as lending and other retail services (e.g., payments); conversely, 'return' pertains to investment activity in capital markets, such as asset management. Regardless of the adoption of this double level of turnover definition, the arguments reported in this paragraph can be extended to both revenue and return (Zara et al., 2022a).

A CE can generate new and additional streams of revenue spreading from four different areas of demand for outside capital, which refer to: investment and financing of innovation that involves both technology and managerial practice; supporting the adoption of new circular business models in companies; matching new trends in impact demand for financial products; sustainable investments that are compliant with policies related to economic growth and economic competitiveness. The first channel whereby profitable opportunities may arise stems from investments in innovation. A radical change in the economic paradigm opens up to a period of relevant investments to manage the transition and achieve the transformation from linear to circular. The adoption of circular business and revenue models, like the development of new activities in circular value chains, is prompted by managerial innovation. The magnitude of such trend is even higher if tied to the development of new technologies (for instance, digitalization, connectivity, biomaterials, etc.). Each of the former requires significant investments in innovation within companies. Therefore, demand for outside capital will increase to support the investment stage. A CE could represent a great driver of recovery in the corporate and investment banking area. Even if sustainable issuances are still a small amount of the market, they have been growing at a very fast pace; for example, in 2021, according to Bloomberg, sustainable debt market amounted to $1.644 bn (that is, a similar size to the annual GDP of Canada), and with a 116% growth rate year-on-year. In particular, the demand side included not only already established companies undergoing transformation but, also, new innovative enterprises devoted to the transition.

Eliciting a relevant transformation of the invested capital of the companies, the adoption of circular business models and practices originates new sustainable/circular asset classes that are particularly attractive to institutional investors. This occurs thanks to three major features: the ability of generating stable returns in the medium-to-long run, a risk-return profile allowing the construction of more efficient and diversified portfolios, and the internal hedging against operating risks, which support the stability of performance. In asset management, the CE may become a powerful theme for putting in action an investment strategy crossing some relevant megatrends, such as demography, resource scarcity, and climate change, and allow the achievement of clear goals in the sustainability area, alongside financial returns.

Nevertheless, the CE is important not only for investors and not merely in terms of the classical ways to assess an investment's profitability. Another very promising area is impact demand, as the CE can play a significant role also in retail banking. Consumers show a growing preference for responsible purchases. The introduction of new products and services, also fostered by regulatory action, drives and targets the demand for consumption-specific financial instruments linked to sustainability-related topics. In this way, financial institutions might be able to exploit the case where clients could be willing to pay a premium on the price of products and services that generate a positive impact on society (Pavoni, 2019).

Finally, non-negligible opportunities lie in the activities deployed by the public sector; that is, the involvement of the CE in policy plans for growth. In areas like Europe, there is a common view on sustainability as a key element for keeping the competitiveness of the economic system in the global arena (European Commission, 2020). In their decisions, policymakers are increasingly relying on the CE as a key factor for a sustainable transition (Sitra, 2016). They link the access to public funds to projects that embody the principles pertaining to the circular paradigm; also, the access to public funds is a catalyst for financing projects, such as the case of sustainable infrastructures, and a requirement to boost the supply of private capital, too.

Reputation

Since the 2007–2009 Global Financial Crisis (GFC), there has been a wide debate on the role played by finance in society, given a growing feeling that it was somehow 'disconnected' from the real economy or even operating against it (e.g., Schoen, 2017). Although a CE is focused on the change of the economic paradigm and constitutes the economic engine of sustainability, going circular may also help the financial system regain a better positioning within society and contribute to the development of its well-being. Advantages in terms of reputational capital increase may be obtained in respect of three main areas of action, related to: 1) the support to the real economy and its growth, 2) investments in shared value projects, which combine impact and financial results, and 3) a contribution to fostering the stability of the financial system.

As for the reconnection with the economy, the transition to a CE offers the opportunity for a repositioning of the financial system's role in society, after the negative consequences in terms of reputation due to the GFC. Finance has the chance to reconnect with the real economy by supporting the transition and contributing to social well-being. Offering products and services aligned with sustainability allows financial institutions to enlarge their intangible capital of trust and reputation, which is critical for players like commercial banks. Becoming a 'circular bank' promises to be a winning position for a credit institution (Bocconi University et al., 2021).

A natural consequence of such commitment is the implementation of strategies aimed at creating shared value (Porter and Kramer, 2011), which implies the ability to generate business opportunities from tackling social issues such as reducing poverty, providing equal opportunities to minorities, closing the gender gap, etc.; the extant literature has already investigated its connections with the banking industry (Akpinar et al., 2022; Bockstette et al., 2015). Supporting the adoption of a circular paradigm allows creating the conditions for regaining an economic role in communities, such as cities, internal geographical areas, and social clusters. For instance, the ability to reduce and eliminate negative externalities, as well as either replacing virgin materials with secondary ones that are mined in urban areas, or swapping physical products for virtual ones, enables the cities to bring back some economic activities that had been outplaced over the last decades, due to their environmental and social costs. When cities regain an economic role, they can also offer income opportunities to their inhabitants, particularly young people, and

let them avoid leaving their community due to unemployment. Financing projects and ventures that lie on the principles of the shared value theory, which has significant overlaps with the CE paradigm, allows banks and other financial actors to play a part in supporting the recovery of the economic role of communities, as well as to finance people for exploiting new business opportunities that also generate a positive social impact.

The system-wide outcome is an increased stability. If banks are more circular, they will also reduce their asset-side risk, becoming more stable and ultimately matching the banking stability goal pursued by regulators and authorities. Hence, this convergence highlights an alignment of goals between regulators and financial players. As pioneers in supporting the CE adoption, financial players could be also in a position to advice authorities and regulators on the benefits for the financial ecosystem entailed by the CE, in order to accelerate the acceptance of possible incentive factors that could support early adopters.

Digging deeper on risk

Among the three R's, risk is currently gaining a momentum as the area of opportunity that could be caught faster and with significant advantages, from a regulatory standpoint as well. Opportunities around risk are important for financial institutions, particularly banks, not only because they allow pursuing a generalized de-risking of their asset side, mainly relative to corporate lending and specialized lending: also, this area entails a strategy to manage the prospective divestiture from linear assets' portfolios. Moreover, the opportunity to increase the stability and persistence of asset-side performance is another strong argument in favour; additionally, it is particularly relevant to some categories of players, such as institutional and value investors. Figure 13.3 shows the relationship between CE de-risking drivers and financial players' interests, showing how they can transfer the effect on operations (distinguished between 'strategic' versus 'tactical').

When a financial institution, like a bank, targets a direct strategy of CE investment, its main rationale is to build a portfolio of fresh circular assets that can perform well and grow in value over the medium term. This could happen by exploiting the four CE drivers that should enable to hedge against the rising sustainability-related risks, as well as a lower connection with the risk implied

Risk	
CE drivers	— **Decoupling** economic growth from finite resources. — Right **natural capital** management. — Economic **resilience**. — **Policy action**: internalization of negative externalities.
Reasons for the FS industry to transition	— De-risking of financial assets through all the drivers — Active management of linear risks & stranded (linear) assets. — Stability and persistence of performance.
Opportunities: —**tactic** —***strategic***	— Predictive management of actual loan portfolios before being stranded. — *New circular loan portfolios to pursue de-risking benefits.*

Figure 13.3 Risk breakdown in the 3R Model of circular finance.

in the economic cycle. The assumption of a lower level of risk for a circular portfolio, alongside a linear comparable, is the baseline of the investment decision alongside the possibility to generate a superior risk-adjusted performance (refer to the 'Revenue/Return' in the 3R Model) and, perhaps even more importantly, a performance that will be persistent and stable over the forthcoming years. Very often, this strategy must be put in relation with the need to actively manage the existing portfolios of assets, for instance private loans. According to the sectoral composition, parts of existing portfolios, or even a portfolio as a whole, could have their value impaired by the weaknesses on sustainability topics, such as the level of CO_2-equivalent emissions, the dependence from scarce resources, or even the change in the technological paradigm and demand trends. An example of a sector that is heavily affected by sustainability issues and the changing energy model is the oil and gas industry, due to its extraction and refining operations that are currently stranded by both legal limitations to research and drilling on one side and negative externalities, such as greenhouse gas (GHG) emissions, on the other one (Zara et al., 2023). In cases like this one, a bank needs to manage the risk that loans in the portfolio become progressively stranded and finally turn from performing to nonperforming. As a first level of action, a bank could use circular metrics and key risk indicators (KRIs) for monitoring the level of exposure to linear risks and steer the divestment from the stranded positions before they turn into a nonperforming condition. That corresponds to a tactical orientation towards the opportunity. When the bank decides to catch the opportunity with a strategic approach, it will move to an active management for building new portfolios, searching for companies that are investing in the circular transformation (or are circular by origin), and steering and supporting the transition for those counterparties that are already existing clients. With a strategic approach, a bank can obtain a twofold result, as actively supporting the transition also becomes a way to find a solution for the problem of linear stranded assets.

The trigger for financial players to actively seize an opportunity is also dependent on clear and consistent evidence in favour of the assumptions, here viewed as a de-risking effect. For this reason, independent academic research plays an important role in testing the hypothesis, finding possible evidence in its favour through the analysis of empirical fields, and spreading the knowledge among industry players, both financial companies and regulators. In this chapter, we present some findings in favour of the de-risking hypothesis, spreading from our research in empirical finance pertaining to the field of opportunities (3R Model) and provide results regarding the role played by non-financial information disclosure, as an example of transformative topics that affect areas corresponding to the first and the second pillar of the framework presented in the section titled 'The interactions between finance and the CE: A conceptual framework.' Conversely, in this chapter we avoid discussing evidence pertaining to the fourth pillar, which is only indirectly affected by the circular transition.

The Circularity Score

The Circularity Score (CS) is a quantitative and concise metric proposed by Zara and Ramkumar (2022) to measure the degree of circularity at company level, that is, the extent to which companies engage in circular business strategies and operations. By constructing the score, we highlight the relevance of pillar 2 – 'Agreed CE definition and circularity metrics' – in the framework reported in Fig. 13.1. In this regard, the extant literature (e.g., Harris et al., 2021) has seemingly reached a rough agreement on the levels at which circularity may be assessed, which are (a) micro-levels revolving around enterprises and consumers, (b) meso-levels entailing the integration between different economic agents, such as within an industry, and (c) macro-levels centred on cities, regions, and governments. Outside the economic and financial literature, metrics at the

Table 13.1 Components of the Circularity Score

Pillar	*Category*	*Number of Indicators*
Circular Inputs	Emissions	65
	Resource Use	39
	Total Circular Inputs Pillar	**104**
Product Usage	Innovation	27
	Agenda 2030	8
	Community	7
	Total Product Usage Pillar	**42**
End of Life	Product Responsibility	9
	Total End-of-Life Pillar	**9**
Disclosure and Signalling	Disclosure and Signalling	9
	Total Disclosure and Signalling Pillar	**9**
Total Indicators		**164**

product level have also been developed (e.g., Linder et al., 2017). However, lenders and investors in general need to assess their counterparty's standing; hence, they could not rely on anything but company-level indicators. This is why the FS industry needs measures of circularity at the micro-level (company), like the CS, grounded on how an entity performs during the transition of its business model toward a circular one.

The CS results from an algorithm built upon 164 indicators, retrieved from the ESG section of the Refinitiv database (formerly Thomson Reuters – Datastream, ASSET4 module) and selected based on their relevance to measuring a company's degree of circularity. Data were originally downloaded in September 2020. Also, they are classified in seven categories (namely: Emissions, Resource Use, Innovation, Agenda 2030, Community, Product Responsibility, and Disclosure and Signalling), which are organized into four pillars, namely circular inputs, product usage, end of life, and disclosure and signalling. Table 13.1 shows the breakdown into indicators, categories, and pillars (Zara et al., 2023).

The first three pillars reflect those of the CE framework: namely, the introduction of renewable and regenerative resources, the circulation of products and materials in the economy, and the design of products that can be easily separated in their materials and components at the end of their life cycle. The fourth pillar is intended to measure the level of sustainability-related information disclosure with the aim to provide outside data to assess the commitment to the transition toward a CE.

The measurement process follows different steps, based on a bottom-up approach:

1 A score is assigned to each company-indicator combination. In order to account for the inherent barriers that companies operating in certain industries face when transitioning from a linear to a CE (thus, to ensure a level playing field), the score assigned is adjusted for the performance of all the companies operating in the same industry. The indicator score is computed as the ratio between the number of companies performing worse or equal with regard to that indicator (numerator) and the total number of companies having an available value for that indicator on the Refinitiv platform (denominator).
2 Then, a company-category score is computed as the arithmetic mean of the scores of the indicators comprised within that category.
3 The pillar score is computed as the weighted average of category scores. The weight of each category is defined as the ratio between the number of indicators belonging to that category (numerator) and the overall number of indicators encompassed by the pillar to which it belongs (denominator).

4 The 'plain' version of the CS is computed as the weighted average of the pillar score. The weight of each pillar is defined as the ratio between the number of indicators encompassed by the pillar (numerator) and the overall number of indicators (denominator).
5 Finally, the plain CS is adjusted to account for the different levels of financial materiality that a given category of indicators takes for different industries. Financial materiality is measured based on the Materiality Map developed by the Sustainability Accounting Standards Board, which identifies the most financially material topics of sustainability issues relative to each industry, as identified pursuant to its proprietary Sustainable Industry Classification System (SICS). Then, after being attached a score for financial materiality that varies across industries, topics are reconciled with circular categories, so that within a given industry, each category is associated with a comprehensive materiality factor, given by the ratio between the materiality score of that category in that industry (numerator) and the materiality score of the industry as a whole (denominator); that is, the category's relative weight on the industry's materiality score. Finally, for a company, each category's (partial) circularity score is adjusted for materiality by multiplying the plain version thereof by the industry-specific factor, yielded by adding 1 to the ratio described previously. Re-performing steps 3 and 4 ultimately yields the materiality-adjusted measure of circularity.

This process results in a materiality-adjusted CS whose value ranges between 0 and 1, growing along with the degree of circularity.

Figure 13.4 presents summary statistics relative to the CS, with respect to SASB SICS industries. Note that direct comparisons between companies, regarding their circularity, may be

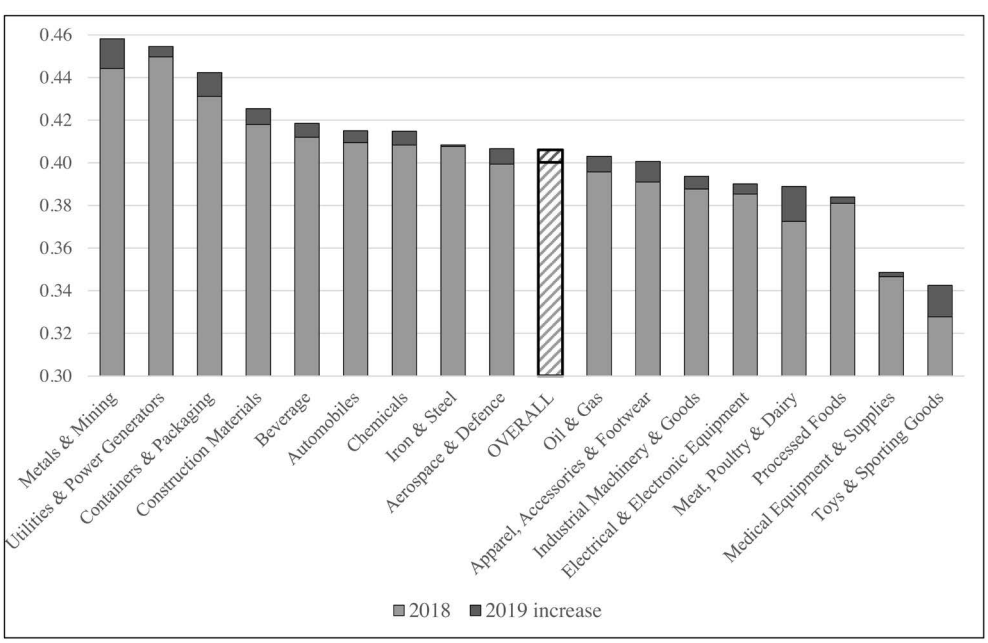


Figure 13.4 Average Circularity score by industry.

Note: These figures should not be used to establish cross-industry comparisons; hence, the above does *not* represent a circularity-based ranking. In fact, the CS may be used to compare only companies pertaining to the same industry.

established only within the same industry but not across industries; hence, we are not allowed to compare industry averages either. Looking at 2019 figures, we can observe that metals and mining exhibits the highest average CS (~0.46), toys and sporting goods the lowest (~0.34), whereas aerospace and defence is the closest to the sample mean (~0.40). In all industries, the CS was higher in 2019 compared to 2018, albeit to a varying extent. However, we should be careful not to read that chart as a 'circularity ranking'.

The circular economy as a de-risking strategy

The findings that we present in this section are a selection of the current research activity on the topic of the relationship between the CE and financial performance. This research has been carried out at the GREEN Research Centre of Bocconi University and has benefited from with Intesa Sanpaolo Innovation Center, ISP Banking Group.

By empirically testing whether there is a greater commitment towards the CE is actually associated with de-risking at a company level, we dig deeper into pillar 3 – 'Opportunities that the transition to a CE offers to the FS industry' – in our framework; hence, we apply and test the 3R Model, with a specific focus on the first R: risk. The selected evidence presented in this section lends support to the thesis designed in the 3R Model, which considers the CE as an effective de-risking strategy.

At an early stage, we collected a sample of European circular and listed entities over a 2013–2018 timeline to investigate the relationship between their degree of circularity – measured by the CS – on the one hand, and equity risk and risk-adjusted returns (Zara et al., 2022a), as well as their default risk (Zara and Ramkumar, 2022), on the other. At a later stage, we enlarged our sample and circumscribed the horizon to the 2018–2020 time span. The following paragraphs refer to the second step of the research programme.

Sample construction

Our sample consists of 644 companies – retrieved from the Orbis database – that match the following criteria, set forth by Zara et al. (2022a):

a Operating in the manufacturing, construction, metal mining, oil and gas extraction, and utilities sectors, pursuant to the Standard Industry Classification (US SIC) system. It is a system that assigns companies a four-digit numerical identifier on the basis of their primary line of business. Thus, each sector has a unique identifier. The SIC system arrays the economy into 11 divisions, divided into 83 two-digit major groups that are further subdivided into 416 three-digit industry groups, and finally disaggregated into 1,005 four-digit industries. Our choice of industries must be traced back to the exposure of these sectors to the promotion and adoption of circular business models, as they are resource-intensive and instrumental to contrasting the climate change.

b Being listed in EU-15 markets (that is, countries that were EU Member States between 1 January 1995 and 30 April 2004) or Switzerland. Such geographical focus acknowledges the pioneering role played by the European economic system in respect of the transition from linear to circular business models, driven by both private and public initiatives. In the public realm, it is worth mentioning the *Circular Economy Action Plan* (European Commission, 2020), which sets forth provisions in respect of products' design, production processes, and sustainable

consumption, aiming to improve waste prevention and increasing resources' usage (European Commission, 2020).

c Having non-financial information and data available during 2018–2019; that is, allowing computing their measure of circularity for at least one of the two years.

Regarding the object of a company's business, pursuant to US SIC, we selected 15 two-digit industries from Division D (manufacturing), 2 industries from Division B (mining), 3 from Division C (construction, fully covered), and 1 from Division E (transportation, communications, electric, gas, and sanitary services), for a total of 21 two-digit industries.

By jointly applying (a) and (b), we get an investable universe made of 2,028 entities; then, following the application of (c), we end up with 644 companies in 17 industries pursuant to the SASB SICS classification, as two of them – namely, agricultural products and building and furnishing products – are not populated by any firms. More in detail, we computed the measure of circularity for 622 companies relative to 2018 and 638 companies relative to 2019, whereas 616 exhibit that measure for both years. For a reconciliation between the SIC and the SASB SICS classifications, see Table A1 in the Appendix in Zara et al. (2023).

A description of the sample by country is reported in Table 13.2, where 2018 and 2019 observations on total assets are pooled together and ordered by the number of companies. As for the latter, the four most represented countries, the United Kingdom, Germany, Switzerland, and France jointly constitute an outright majority of the sample: more in detail, Germany slightly exceeds France, whereas the United Kingdom comes up third and, jointly taken with the previous two, sum up to an outright majority of the sample. Such a configuration is quite representative of the reference population of undertakings; the Herfindahl-Hirschman index – which measures how concentrated a population is, on a 0–10,000 scale – denotes an appreciable degree of dispersion (about 1,129 in terms of observations, 1,521 in terms of total assets). The average entity in our sample is worth 13.88 billion euros in total assets, yet there are wide cross-country differences; while Spain's undertakings exhibit an average size (€13.53 bn), French and German entities are by far the largest ones (€31.05 bn and €24.79 bn, respectively), whereas Greek firms lie at the very bottom (€1.63 bn).

Default risk

Default risk expresses the likelihood that a company may fail to fulfil its financial obligations, whether on publicly exchanged securities with an active market (e.g., corporate bonds) or with regard to private transactions (e.g., commercial debt towards suppliers). We express default risk via three alternative dependent variables, all of which are log-transformed (that is, we take the natural logarithm of each figure). They reflect the traditional distinction between short-term measures and medium-to-long term ones, which describe the likelihood of a company defaulting over a 1-year and 5-year horizon, respectively.

- *Probability of default (PD), 1-year;*
- *Probability of default (PD), 5-year*; and
- *Credit default swap (CDS) spread, 5-year.*

More in detail, the PDs are grounded on the ratings externally attributed by large and experienced agencies (e.g., Standard & Poor's, Moody's, and Fitch, the so-called 'Big Three'), given

Table 13.2 Description of the sample

	Numerosity			*Size*	
Country	*Number of companies*	*Observations (% of observations in the whole sample)*	*Cumulative share (% obs)*	*Total assets (% of Total Assets of the whole sample)*	*Average total assets per company (EUR bn)*
United Kingdom	150	23.52%	*23.52%*	18.82%	11.10
Germany	79	12.43%	*35.96%*	22.21%	24.79
Switzerland	67	10.54%	*46.50%*	7.61%	10.02
France	63	9.91%	*56.41%*	22.18%	31.05
Sweden	52	8.18%	*64.59%*	2.44%	4.14
Italy	38	5.98%	*70.57%*	5.40%	12.54
Netherlands	34	5.35%	*75.92%*	6.60%	17.12
Spain	31	4.88%	*80.80%*	4.76%	13.53
Belgium	23	3.62%	*84.42%*	3.42%	13.10
Ireland	23	3.62%	*88.04%*	2.58%	9.87
Finland	22	3.46%	*91.50%*	1.63%	6.55
Denmark	21	3.30%	*94.81%*	0.73%	3.05
Austria	14	2.20%	*97.01%*	0.81%	5.10
Luxembourg	7	1.10%	*98.11%*	0.30%	3.74
Portugal	6	0.94%	*99.06%*	0.42%	6.17
Greece	6	0.94%	*100.00%*	0.11%	1.63
Overall	**636**	**HHI ≅ 1,129.46**		**HHI ≅ 1,520.63**	**13.88**

Notes
Countries are ordered by the number of companies in the sample. *Number of companies* counts the entities for which there is at least one non-missing observation on total assets (i.e., relative to 2018, 2019, or both). The other figures are computed by pooling years 2018 and 2019 together.
HHI = Herfindahl-Hirschman Index

that basically any listed undertaking – hence, every company in our sample – is attached a rating by at least one Big Three agency. The CDS spread rests on the marked-to-market spreads on publicly traded securities of the same kind, relative to a basket of comparable entities, for there might be no active market for a company's CDS, given that this security is usually exchanged only in respect of large entities with significant debt issuances outstanding. Five years is the usual maturity for this kind of securities.

The CDS spread is the risk premium (i.e., additional costs) charged on credit default swaps, which are derivative contracts enabling the holder to be financially immunised against the event of a company defaulting on its debt: if this occurs, the CDS holder receives a payment, just like a policyholder gets liquidated by an insurance company. The 'spread' refers to the difference – conventionally measured in basis points, that is to say units worth 0.01% of the nominal value – vis-à-vis a risk-free contract of the same type, taken as a benchmark.

All these measures are computed and released by Bloomberg and are based on proprietary algorithms. Among the independent, explanatory variables that we include in our models to explain the dependent ones, the CS is the central one we are the most interested in. Also, we include an array of other variables that the literature has often regarded as potentially contributing to explaining the variability of default risk as controls. They express a company's size (i.e., the natural logarithm of total assets), leverage (i.e., the debt-to-equity ratio), debt servicing capability (i.e., the interest

coverage ratio), profitability (i.e., the profit-on-sales ratio), and the presence of a capital impairment (i.e.. whether total equity is negative or not). Our models consider two periods of time; dealing with yearly figures, default risk measures are retrieved at the end of 2019 and 2020. Figure 13.5 shows results in the first column of the default risk section at the bottom part of the table.

We found that more circular companies faced a lower likelihood of defaulting on their debt. In the short run, defined as one year, the beneficial effect associated with a higher CS was much stronger compared to the medium-to-long timeframe of five years. The estimate was different from zero at 95% confidence level in both cases. An X% confidence level – where X is usually set at 90, 95, or 99 – means that, in X% of cases in a high number of trials, the outcome lies in an 'interval' centred on the punctual estimate; conversely, in 1 – X% of cases (i.e., the frequency of errors), it would lie outside. A smaller de-risking effect, which in statistical terms is zero, is associated with the CDS spread. Such difference may be explained by noting that PD estimates reflect the outcome of a fundamental analysis performed by rating agencies and reported by Bloomberg, which is able to catch the de-risking embedded in circularity; conversely, the CDS spread is a market-based measure and reflects that investors are less efficient to account for the risk associated with an entity's business model when they have to judge the credit standing of a security issuer.

Equity risk

Unlike the previous paragraph, focused on debt issuances, this field of research features risk in respect of a company's publicly traded equity instruments. In line with Zara et al. (2022a), equity risk is expressed by the following variables:

- *Standard deviation of stock returns, annualized*,
  - it represents the total risk – expressed in volatility terms – that is borne by an investor who held a given stock.
- *Beta against the STOXX Europe 600 index,*
  - it represents the systematic component of the above: that is, the portion that depends on a given stock being exposed to fluctuations in a Europe-wide fully diversified market portfolio and, thus, cannot be erased through diversification.
- *Beta against the MSCI World index*,
  - an alternative measure of systematic risk as benchmarked to a global market portfolio, rather than just a Europe-based one.

The explanatory variables are the same as those described in the 'Default risk' paragraph. However, the perspective is a short-term one and aims to investigate the extent to which more circular companies are also more resilient to a severe shock, exogenous to the financial system: specifically, events such as the outbreak and initial spread of the COVID-19 pandemic. For this purpose, dependent variables were computed not only over the whole 2019–2020 horizon but four shorter ones, too: namely, 2020 and three subperiods thereof, as we identify a pre-shock, a shock, and a post-shock phase. By mirroring Ramelli and Wagner (2020), with a slight adjustment to ensure that the pre- and post-shock phases have the same length, we computed dependent variables out of the following time windows:

1 between Monday, 2 January 2020, and Friday, 21 February 2020 (*pre-shock*);
2 between Monday, 24 February 2020, and Friday, 20 March 2020 (*shock*); and
3 between Monday, 23 March 2020, and Friday, 8 May 2020 (*post-shock*).

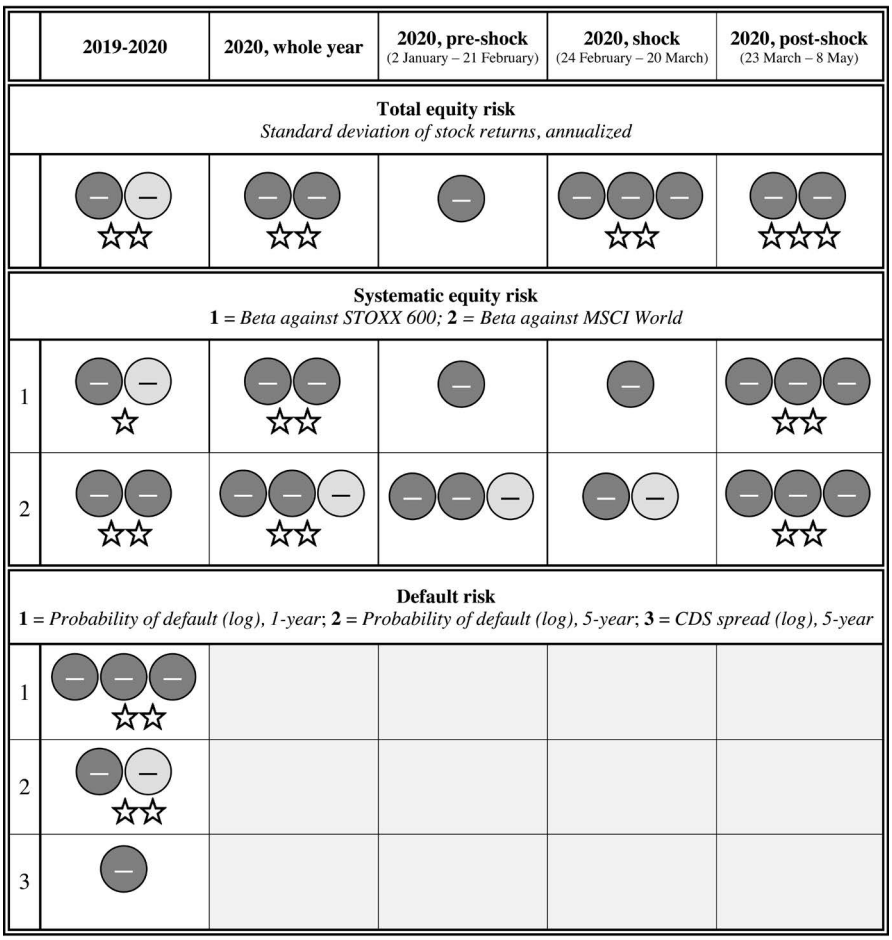


Figure 13.5 The effect of circularity on risk; the magnitude of estimated coefficients and statistical significance.

Note: Circles express the relative magnitude of the effect generated by a 0.05 increase in *Circularity Score* (focus explanatory variable) on the following:

- total equity risk (*Standard deviation of stock returns, annualised*). The effect is expressed in absolute terms; results do not change if we consider a different size of the Circularity Score increase;
- systematic equity risk (*Beta against the STOXX Europe 600 index and Beta against the MSCI World index*). The effect is expressed in absolute terms; results do not change if we consider a different size of the Circularity Score increase;
- default risk, measured as the likelihood of a company defaulting on its debt in the short run (*Probability of default, 1-year*) or the medium-to-long run (*Probability of default, 5-year*), or the risk premium charged by those investors that buy insurance against that event (*CDS spread, implied, 5-year*). The effect is expressed in percentage terms; results are sensitive to the size of the Circularity Score increase that we consider.

The relative magnitude of coefficients can be compared only within models having the same dependent variable or groups of dependent variables, not between them.

For each variable or group of variables, we order all the estimated coefficients from the smallest to the largest; hence, we obtain a scale ranging between 1 (smallest) and 3 (largest), with 0.5 steps. Dark circles count as 1, light circles as 0.5: for instance, one dark circle and one light one denotes a 1.5 score. Approximations are used: for instance, an estimated coefficient comprised between 2 and 2.5, but closer to the former (the latter), is represented as 2 (2.5).

Stars express the statistical significance of coefficients by reporting the confidence level of estimates: i.e., 99% (3 stars), 95% (2 stars), 90% (1 star, which is never the case), or less than 90% (no stars).

Figure 13.5 reports the results. The analysis shows that the de-risking effect played by the degree of circularity did soar along with the COVID-19 virus spreading, peaking in the post-shock phase. In fact, the coefficient associated with CS is never statistically different from zero in the pre-shock phase. During the very outbreak of the pandemic (the shock phase), the estimated effects of a company's degree of circularity on systematic risk remain nonsignificant, whereas the standard deviation of stock returns significantly decreases as the CS increases, the coefficient being statistically different from zero at 95% confidence level. Conversely, after the shock, the negative association between the CS and equity risk measures gets clearly displayed, in respect of any dependent variable, and is consistent across models. The relative magnitude of estimated coefficients is very large, the confidence level being 95% or 99% (relative to systematic and total risk, respectively).

Together, these results potentially suggest that, upon the occurrence of a massive exogenous shock, more circular companies were not only more resilient in terms of equity risk vis-à-vis less circular ones; also, they performed notably better in the post-shock phase, exhibiting a swifter and more effective recovery. This is consistent with the analysis on risk developed in the 3R Model, where enhanced resilience to negative scenarios is presented because of the diversification of business models enacted by the adoption of circular ones.

Bridging the CE with finance: Focus on disclosure

In our CE-finance framework, non-financial disclosure is particularly relevant to carefully investigate the role played by the undertakings' non-financial information disclosure; that is, relative to their sustainability practices and achievements, particularly in its association with the company-level degree of circularity and financial performance.

First, we should consider that the extent whereby an entity releases sustainability-related information does affect the measurement of its circularity, based on the CS methodology; hence, companies that are more prone to make a bountiful disclosure are more likely to get a high CS, also because a Disclosure and Signalling pillar is included within that metric. Therefore, we need to clear the overall circularity from the contribution of disclosure itself, yielding a core CS (CCS) that may provide a more faithful representation of the company's actual transition to CE by structurally changing its business model rather than just conveying information to its stakeholders.

By testing how much of the CS does reflect the contribution of explanatory variables, we ended up discovering that about 80% of the variability of the CS is explained by that of disclosure-related variables. Hence, we could compute the CCS as the nondisclosure component of circularity; reiterating, the nondisclosure component is a measure of circularity once cleared of the influence exerted by disclosure practices. In further steps, we considered the CCS either alone, to compare the effects associated with the full measure of circularity to those associated with the core component thereof, or alongside sustainability disclosure variables. In practice, this provided a decomposition of the 'full' CS. Disclosure-related characteristics are condensed in two variables: namely, *information content*, which expresses both the quantity and the quality of circularity-related non-financial disclosure, and *information integration*, which expresses whether the sustainability reporting is integrated within the financial one and the extent a company is subjected to an Anglo-Saxon, investor-protective legal framework. The two disclosure-related variables have been constructed by applying the Principal Component Analysis (PCA) technique to other variables, used as inputs. Details are available in Zara et al. (2022b). We show the essential results with a focus on equity risk in Figure 13.6.

	Full Circularity Score	Core Circularity Score	Information content	Information integration
Standard deviation of stock returns, annualized				
Model: Full Circularity only	⊖⊖ ☆☆			
Model: Core Circularity only		⊖⊖⊖ ☆☆		
Model: Core Circularity & Disclosure		⊖⊖ ☆☆☆	⊖ ☆☆☆	⊖
Model: Disclosure only			⊖ ☆☆	⊖ ☆☆☆
Beta against the STOXX Europe 600 index				
Model: Full Circularity only	⊖⊖ ☆☆			
Model: Core Circularity only		⊖⊖⊖ ☆☆		
Model: Core Circularity & Disclosure		⊖⊖⊖ ☆☆	⊖	⊖

Figure 13.6 The effect of circularity and disclosure on equity risk as magnitude of estimated coefficients and statistical significance.

Note: Circles express the relative magnitude of the effect generated by a unit increase in the focus explanatory variable(s) on each model's dependent variable. Focus explanatory variables are reported in the first row; namely:

- *Full Circularity Score*; i.e., the degree of circularity gross of the effect of disclosure;
- *Core Circularity Score*; i.e., the degree of circularity net of the effect of disclosure;
- *Information content*; i.e., a variable expressing both the quantity and the quality of non-financial disclosure;
- *Information integration*; i.e., a variable expressing whether the sustainability reporting is integrated within the financial one and the extent a company is subjected to an Anglo-Saxon, investor-protective legal framework.

For details on these variables, see Zara et al. (2022b) presented at the 2022 GRETA conference held at Ca' Foscari University, Venice, Italy.

The first column denotes which model the estimations are taken from, based on the focus explanatory variables included.

The relative magnitude of coefficients can be compared only within models having the same dependent variable or groups of dependent variables, not between them.

As for the meaning of dependent variables, as well as the meaning of circles and stars, see the note to Figure 13.5.

In general, sustainability disclosure turns out to be necessary but there are not enough tools for de-risking purposes; in fact, disclosure-related variables alone exert relatively weak and inconsistent effects on equity risk. Moreover, we found no statistically significant effect on credit risk. In this sense, sustainability reporting is a powerful mediator as it can trigger de-risking by helping the relatively more circular companies to make investors aware of the lower risk they embed. Conversely, CCS exhibits a de-risking effect on both realms of risk measures, which is even stronger in magnitude through full circularity, whose benefits for a company's creditworthiness are in line with previous studies (Zara and Ramkumar, 2022).

Jointly taken, these results (Zara et al., 2022b) suggest that the most direct driver of de-risking, for an undertaking, is not its endeavour as of the information given to investors, but the practical actions it takes to move from a linear to a circular way of conducting its operations. Therefore, transparency in financial markets remains an essential tool but cannot achieve, alone, the same benefits as those that a circular transition brings to a company's financial soundness, in terms of lower volatility of its publicly listed equity or increased distance to default.

Furthermore, we investigated the effects played on credit risk by specific disclosure-related behaviours, such as having the non-financial reporting assured by a certified external agency and integrated into traditional financial statements (Zara and Bellardini, 2022). These results suggest that at least rating agencies, as a proxy of private markets, dislike excesses: in their judgment, those companies that engage in overwhelming disclosure (that is, with both integration and external assurance) are regarded as relatively riskier. Conversely, public markets are more appreciative of the information conveyed to the exterior, as non-financial disclosure helps them refine the valuation of potential investment targets. We found that market-based risk measures actually exhibited de-risking in case debt issuers integrated their non-financial disclosure into financial statements and received an external certification relative to the former.

Akin to the divergence in the empirical association between circularity and default versus equity risk, such divergence may be easily explained by noting that public markets essentially rely on widely available information, including on sustainability, for their smooth functioning. Conversely, private markets are longer-term oriented, prefer looking at business fundamentals rather than a company's informational behaviour, and can use more private information vis-à-vis the generality of investors.

Conclusions

This chapter shows the existence of a double-sided association between the CE and finance: not only is the latter a 'catalyst' of the former, but it constitutes an irreplaceable tool to support and accelerate the circular transition. Additionally, the CE is a realm wherein highly valuable financial opportunities may be found. To paraphrase US President J. F. Kennedy in his inaugural address, we should ask not only what finance can do for the CE but what the CE can do for finance. When finance moves towards CE and sustainability in a broader sense, some key areas embedded in our four-pillar framework (see the section 'The interactions between finance and the CE: A conceptual framework') are affected. The pillars are crucial for the management of the transition chain of finance. Pillar 3, which refers to opportunities offered by a circular transition, is the trigger of the process embedded in the chain and influences the speed of the change in the other three pillars. Opportunities arising for the FS industry are developed and explained in detail through the 3R Model.

In this chapter, the first R, risk, is adopted as an archetype of the potential lien in the relationship. As we argued from an empirical standpoint, there can be an economically significant

association between the degree of circularity of a non-financial company and its risk, relative to both its publicly traded securities (equity risk) and the likelihood to go bankrupt (default risk). In general, by investing in entities that are committed to changing their businesses and operations in a circular direction, financial institutions may enjoy lower risk, catch superior risk-adjusted returns, and nurture their reputation.

The contribution we offer to the literature can be placed in the fields of both sustainable finance and the relationship between the CE and finance. With regard to the former, our contribution is innovative: by considering the CE as measured through the CS and as a content of sustainability different from the usual ESG framework. Its advancement stands on the fact that circularity is a more 'material' content vis-à-vis ESG. The latter includes sustainability concerns in a business-as-usual model that remains linear, whereas the first involves rethinking the economic paradigm by origin, generating ESG impact as a consequence of the circular transition. Moreover, the evidence reported in the discussion of the de-risking effect is in line with most of the literature on sustainable finance, which is also in favour of an association between the degree of sustainability and financial performance (Friede et al., 2015). Referring to the second field, research on circular finance is a new strand of literature and we contribute to its theoretical design and empirical evidence. The four-pillar framework states which main topics should be taken into consideration when the transition chain toward a circular finance is developed. Moreover, the 3R Model of opportunities provides a comprehensive theory of the drivers that generate benefits for financial players – that is, mainly credit institutions and asset managers – who decide to embrace and actively support a circular transition of the economy. Empirical research shows support for the proposed theory; this chapter is focused on the first array of opportunities, namely risk.

When we refer to our empirical results, it is necessary to observe that the field we hereby present has a limited geographic scope, for we focused only on EU-15 countries, plus Switzerland, and considered only industries that are resource intensive and clustered in the manufacturing, energy, construction, and mining sectors. Nevertheless, our results point toward the circular transformation representing a powerful opportunity for the financial industry, which, concurrently, is a strong enabler of the circular transition. By choosing assets that are more circular, investors would be able to better withstand exogenous shocks, secure their returns over time, and minimize the losses on the capital they disbursed. In other terms, circular assets can be more appealing than linear ones. Theoretically, this should trigger a substitution effect within portfolios, ultimately resulting in the gradual exclusion of linear assets from the market by a free choice of agents, not solely due to regulatory constraints. This substitution effect would affect those assets that are not in line with the ongoing transition, for they are expected to become more and more stranded as time passes.

Symmetrically, this is likely to shed a positive light on more circular companies and business operations. In their financial dimension, it means being able to pursue advantages in terms of a more stable capital structure, thanks to the ability to attract long-term investors, such as institutional ones, which follow a buy-and-hold investment strategy, a lower cost of capital, as these securities have (1) a more prudent risk profile and (2) a broader, better diversified basis of funders. The combination of (1) and (2) should raise the interest of both policymakers and the authorities that oversee the financial system, persuading them that a support to the development of circular and sustainable finance is not only positive for the growth of the economic system but also a relevant element to increase stability. The latter is a fundamental element for the acknowledgement of the lower level of risk, incorporated by the portfolios of circular assets, which should orient and drive regulators to distinguish between linear and circular assets and look at the latter as a positive supporting factor.

For instance, the reduction of capital requirements could represent a tangible reward for that portion of the FS industry that has decided to play the role of catalyst in the circular transformation.

Educational content

1 Reflect on the double-sided relationship between the CE and finance. In your opinion, which of the two aspects prevails? Is finance a catalyst of the CE, or the CE as a source of valuable opportunities for finance?
2 Regarding financial institutions, how could you link the theoretical framework of the four pillars with the 3R Model of opportunities?
3 In your opinion, which are the most prominent features of the CE paradigm that contribute to significantly reducing both default and equity risk?
4 According to the theory and evidence presented in the chapter, is the role played by non-financial information disclosure determinant for fostering the role of finance as a catalyst for the CE adoption? How?

Note

* For those readers who are unfamiliar with the financial nomenclature we use in this chapter, we suggest you familiarize by using the most up-to-date edition of the *Investments* handbook by Bodie et al. (1999).

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