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Reconfiguring the risk of financial organizations as a consequence of the green transition and a potential source of 'Green Swan events'

Abstract

The green transition may have a significant impact on the risk reconfiguration at financial institutions, resulting in a redefinition of their existing role in the economy. Thus, the aim of the article is to identify the determinants of risk in the activities of financial institutions, resulting from the green transition, and to diagnose to what extent the new conditions may exert a modifying effect on the existing constellation of traditional risks in banks. Cognitively interesting questions emerge when the issue of ESG risk and its transmission channels is juxtaposed with the concept of the Talebian 'Black Swan'. The question "To what extent is there a case to treat ESG risks as a potential source of so-called black swan events?" captures the point of the research problem. The results of the research carried out indicate that financial institutions are taking into account specific areas of risk as a result of the changing environment in which they operate. The constellation of traditional risks has changed. In addition, the 'Green Swan' metaphor may prove useful in explaining the mechanisms and repercussions associated with the green transition.

Keywords: Green Swan, risk, ESG, crisis
JEL Classification: G21, G32

Introduction

The results of literature studies indicate, on the one hand, a growing awareness of the inevitability and need for the so-called 'green transition', and on the other hand, the issue of identifying new risk areas as a consequence of the transition to a low-carbon economy [Semieniuk et al., 2020].

The implementation of ESG (Environmental, Social, Corporate Governance) concepts into the strategies and decision-making processes of contemporary organizations is the subject of much debate among academic, expert and government environments. At the same time, the observed global instability of the world economy makes it unclear what risks and threats will materialize along the green transition pathways. Both theory and practice point to the scale of uncertainty and challenges posed by the necessity of ongoing transformations [Klusak et al., 2021]. In particular, the complex and multifaceted role of financial institutions is highlighted in their co-creation [Barkawi, Monnin, 2015; Campiglio et al., 2017]. The significance of minimizing a bank's exposure to new risk areas is also pointed out [Instrat, 2022]. Researchers develop a dynamic macro-financial analysis [Dafermos, Nikolaidi, 2021].

The issues of risk categorization and management are an extremely broad subject. However, the reason for addressing these issues once again is the green transition.

Green transformation is defined as the process of creating an economic system that functions in an environmentally friendly manner, ensuring its sustainable development [Michalski, 2022, p. 8]. It is associated with the implementation of the so-called European Green Deal, i.e. a growth strategy aiming at a resource-efficient, carbon-free and competitive economy, in which economic growth will be decoupled from the use of natural resources [com/2019/640 final, p. 18], which the European Commission estimates will require more than € 260 million per year [com/2019/640 final, p. 18].

In 2021–2022, the European Commission adopted a new sustainable financing package, setting the directions for the flow of funding for a green transformation in the EU [com/2021/188]. The financial sector has been assigned a central role in this process. The majority of successive regulations in the area of sustainable finance are aimed at the financial sector [EU 2020/852], and the effects of their entry into force have a significant impact on the relationship of these institutions with their non-financial clients.

The activities of banks do not have a significant direct impact on the climate, as it is not a highly carbon-intensive sector. However, they may exert an important influence on the functioning of companies and the fight against climate change, as well as on creating climate-resilient organizations, through their lending policies, including above all their financing conditions [cf. EY, 2022, p. 18]. The green financing aims to increase the level of cash flow from the public, private or non-profit sectors towards sustainable development priorities [cf. Fu et al., 2023].

Undoubtedly, green financing is a permanent, irreversible trend in the global financial systems [Kotecki, 2020, p. 4]. This highlights the complex and multi-faceted role of banks

in co-creating the green transition. This role is not limited to providing capital as part of the offer of dedicated loans for green ventures, but also includes the market animation, the creation of mechanisms to generate demand for green products, the creation of financial incentives influencing customer choices, the provision of comprehensive advice, the promotion of environmental issues among customers and counterparties or, finally, the management of risks in hitherto unidentified areas.

The necessity to manage ESG risks related to environmental, social and governance factors, means that the existing constellation of traditional banking risks may have to be modified. There is an emerging need to manage ESG risks by incorporating mechanisms for their identification, measurement, assessment, mitigation, monitoring, and reporting into the standard credit, market, liquidity and so-called non-measurable risk management processes. Initiatives are being taken to integrate ESG risks into EU prudential regulations for banks.

The need to implement ESG regulation therefore creates a new dimension of business activity, creates new channels for risk transmission and involves a reformulation of the existing role of credit institutions, but importantly, may also contribute to a new breed of 'Black Swan', as shown in Figure 1.

Thus, the aim of the article is to identify the determinants of risk in the activities of financial institutions resulting from the green transition, and to diagnose the extent to which the new conditions may exert a modifying effect on the existing constellation of traditional risks in banks. Cognitively interesting questions emerge when the issue of ESG risk and its transmission channels is juxtaposed with the concept of the Talebian 'Black Swan'. The question "To what extent is there a case to treat ESG risks as a potential source of so-called black swan events?" captures the point of the research problem.

Figure 1. A potential source of a new breed of 'Black Swan'

On the one hand, regulatory organs, such as the Bank for International Settlements (BIS), the European Central Bank (ECB) or the European Banking Authority (EBA) are doing more and more to ensure that banks are aware of the risks associated with ESG factors and are correctly formulating their business strategies to adequately manage, mitigate and respond to new challenges in this area.	**BUT**	On the other hand, in today's uncertain times, it is an illusion that every risk can be considered, anticipated and managed [Bieder, Motet, 2017; Taleb et al. 2009].
The definition of risk as measurable uncertainty used in finance is the basis for risk management systems [fc. Tworek, 2023, p. 134].	**BUT**	it is rather impossible to disagree with the view that over-attachment to tried and tested methods of risk management completely fails in the case of unpredictable events [Szczepański, 2020, p. 10]. Given, for example, the complexity ofthe ESG risk transfer channels, it is also impossible to predict the impact of the green transition and initiatives in this area.
At the same time, the huge role of the financial sector in shaping the 'green' reality is recognized, the impact of new areas of risk on the design of modern banking products is visible and, importantly, the burden of transformation has been shifted towards the banks [Park, Kim, 2020; Pisano et al., 2012].	**BUT**	as Taleb [2013] points out, as a result of the introduction of multiple tools and methods of insuring against risk, and by shifting the burden of risk and responsibility to others, economies and societies are losing their natural resilience and the actions taken are proving to be contrary to the essence of anti-fragility [Taleb, 2013].

Source: based on Bieder, Motet, 2017; Park, Kim, 2020; Pisano et al., 2012; Szczepański, 2020, p. 10; Taleb et al. 2009; Tworek, 2023.

The essence of the 'Black Swan' and its variations: theoretical background and method

The term 'Black Swan' was first introduced by Taleb [2007]. The 'Black Swan' occurs when the gap between what we know and what we think we know becomes dangerously wide [Taleb, 2009]. This concept is closely related to uncertainty and learning [Hajikazemi et al., 2016]. Three characteristic features of this type of events can be identified [Taleb, 2009, p. XXII]. First, these events are unexpected, unusual, unpredictable, (outliers) and are outside the realm of regular expectations. Second, once they occur, they exert a huge impact on the economy and social life. Third, after they occur, many people claim that they could have been foreseen.

Over the years, researchers have questioned whether it is possible to tame the 'Black Swan' [Bingler, Colesanti, 2020; Chatzikonstanti, Karoglou, 2022] or to minimize its negative consequences. A bibliometric analysis [Donthu et al., 2021] and a systematic literature review are useful approaches to study the evolution of this issue.

The starting point for the considerations undertaken was the retrieval of studies related to the issue under investigation (articles with the search term – Black Swan – in their title, abstract or keywords) in the business management domain from the WoS databases (importantly, in the context of further considerations – only 3 records with the phrase 'Green Swan' were obtained). The search period was set to include articles published between January 2007, and February 2024. Only English language publications were considered. The search resulted in 391 items, and further narrowing the results to the area of business research yielded 70 articles.

The COVID-19 pandemic is a kind of magnifying glass, highlighting the lack of resilience of increasingly globalized and interconnected economies to crisis phenomena (Table 1). Interestingly, Taleb does not accept the view that a pandemic crisis can be treated in the 'Black Swan' (rather 'Grey Swan') category, as pandemics are predictable events [Mączyńska, 2020; Avishai, 2020] and statistically almost inevitable due to, for example, increasing social mobility [Mączyńska, 2020, p. 46].

Table 1. Selected papers of 'Black Swan'

Author	Title / Research perspective
Hysa, E., et al. [2022]	COVID-19-A Black Swan for Foreign Direct Investment: Evidence from European Countries
Weber, A.N., [2021]	Responding to supply chain disruptions caused by the COVID-19 pandemic: A Black Swan event for omnichannel retailers
Blasco, G.P. [2021]	The coronavirus: Black Swan and endowment shock

Source: own elaboration.

In order to achieve the above stated objective, a systematic literature review, content analysis of academic studies and secondary source data (integrated reports, bank board reports, secondary research findings) were used (Table 2).

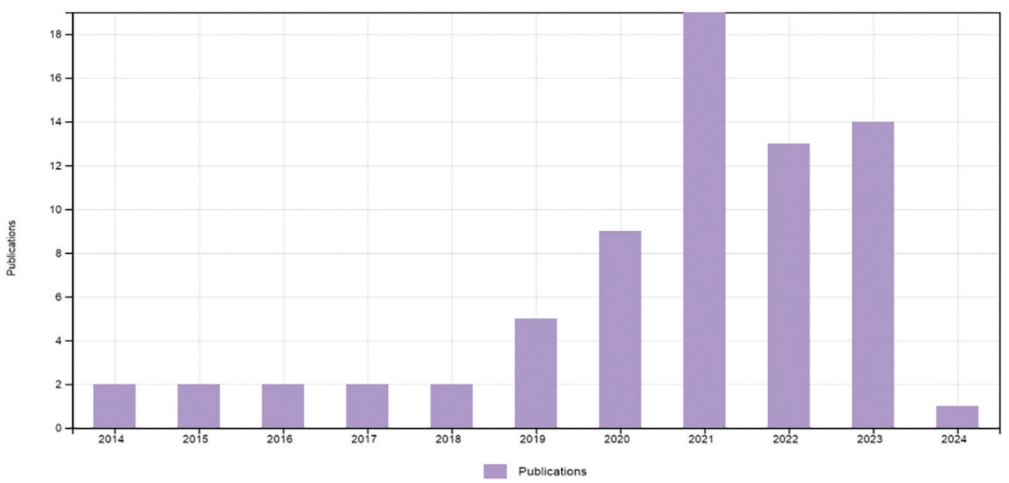
Table 2. Research process steps

1. Identify the problem Identify the determinants of risk in the activities of financial institutions resulting from the green transition, and to diagnose the extent to which the new conditions may exert a modifying effect on the existing constellation of traditional risks in banks (context: Black Swan).		
2. The systematic literature review		
Web of Science – Results for "black swan" (years 2007–2024) • narrowing to English language • narrowing to "Business" and "Management" • abstract verification		Number of results: 391 70 70
3. The content analysis of:		
academic studies (Impact of ESG factors on individual risk areas in banks),	secondary source data: • The Global Risk Report 2023 (The Evolving Risks Landscape in selected years) • Reports of individual bank – ING Bank, bank board reports, secondary research findings. (Categories of risks in ING's reports in years 2020–2022)	
4. Conclusion From physical and transition risks to the financial stability risks (context: Black Swan).		

Source: own elaboration.

The results of the bibliometric analysis and the content analysis of scientific papers indicate that researchers analyze Taleb's concept in the context of decision-making under uncertainty. In particular, the COVID-19 pandemic has been labelled as a black swan event that caused a ripple effect on every aspect of human life [Verma, Gustafsson, 2020]. The timing of the pandemic undoubtedly contributed to an increase in the number of studies addressing this topic, as shown in Figure 2. However, a number of other Black Swan-like events in history are also pointed out, for example: the stock market crash after the 9/11 terrorist attacks, the global financial crisis in 2008, the Brexit in 2016, and the reaction of G20 stock markets to the Russia-Ukraine conflict [Yousaf et al., 2022].

Figure 2. The number of publications addressing the 'Black Swan' issue between 2014 and 2024



Source: the Web of Science report.

Researchers agree that a 'Black Swan' is an event that does not fit into a normal probability distribution (Gaussian distribution) [BIS, 2020]. Interestingly, research reports indicate that the 'Black Swan' mutates and appears in new varieties [Mączyńska, 2020; Taleb, 2009], the typology of which is shown in Table 3. The BIS has also published a study, on contemporary climate challenges, entitled "The green swan. Central banking and financial stability in the age of climate change" [2020].

Inspired by Taleb's Black Swans, Elkington [2020] proposed the concept of Green Swans as an alternative means to transform capitalism. Green Swans are profound shifts that are generally catalyzed by some other disruption such as Black Swans. The 'Green Swan' has different characteristics from the black swan, not least that its impact is significantly more serious and comprehensive [BIS, 2020].

Table 3. A typology of Swan: similarities and differences

White Swan	Black Swan	Green Swan	Blue Swan
Predictability through	Gaussian, normal distribution	Tail risk, perhaps non-Gaussian. Ex-post rational explanation after occurrence	Highly likely or certain occurrence but uncertain timing of occurrence and materialization. Too complex to fully understand
Main explanation by	Statisticians, economists	Economists, financial analysts and risk managers with some disagreement	Scientists, disagreement with economists and financial analysts
Impacts	Low or moderate	Massive and direct impact mostly material. Possible correction of damages after event (crisis).	Massive and direct impact mostly to human lives (or even civilizational). Irreversibility of damages in most cases.
Policy recommendations	Risk models are fine (can be marginally improved).	Reconceptualist approach to risk. Learn from event to design anti-fragile strategies.	Given severity of effects, even without full understanding, need for immediate action and coordination under radical uncertainty.

Source: BIS, 2020, p. 6.

Other authors point out that catastrophic climate change and weather phenomena could become a 'Green Swan', which has the same DNA as its black cousin [Ballentine, 2020].

Some also distinguish its blue variant, which deals with contingencies generated by digital technologies and involves the development of artificial intelligence [BIS, 2020]. Kisielnicki [2021] posits that Information Communication Technology is not only a perpetrator of crises and disasters, but can also be instrumental in building an effective and efficient threat monitoring tool. Similarly, Taleb's metaphor may be useful in the context of considering the unpredictability of the future trajectory of climate change and the complexity of transition risk, resulting from a 'green transition'.

The few studies addressing the 'Green Swan' mainly emphasize the unpredictability of changes resulting from environmental disasters. BIS [2020] points out that traditional risk management approaches, based on extrapolation of historical events and assumptions about normal distributions, are largely inaccurate when it comes to assessing future climate risks.

Undoubtedly, since the transition to a greener economy, the economy itself has been fraught with risk, characterized by profound uncertainty and non-linearity, but the nature of the 'Green Swan' can be far more complex and multidimensional, as it also concerns consequences beyond the environmental aspect. This is because physical risks relate to climate-related hazards and include financial impacts and material losses. In contrast, the transition risk (presented later in this paper), which involves the unpredictable consequences of actions taken by credit institutions, is much more complex.

Banks are part of a complex system of interconnected vessels, within which quick and disorderly initiatives can ultimately lead to far-reaching and complicated consequences and trigger for a crisis of an already financial nature. The ESG activities of financial sector institutions, although subject to prudential regulations [Smoleńska, 2023], go far beyond the past experience and the ability to average past data.

Due to the complexity and interdisciplinary nature of the topic, studies analyzing the financial dimension of ESG risks and explaining the interaction between climate risk and the financial stability of the banking sector are rather rare.

Complicated nature of transition risk

The Global Risk Report [2022], produced on behalf of the World Economic Forum in collaboration with renowned experts, provides insights into the main risk factors and the biggest threats of today's world. Environmental risks, which were overlooked in 2010, dominate the ranking in the latest report (Table 4).

Table 4. The Evolving Risks Landscape in selected years

Top Global Risks in Term of Impact			
2010	2014	2018	2023
Asset price collapse	Fiscal crises	Weapons of mass destruction	Failure to mitigate climate change
Deglobalization (developed)	Climate action failure	Extreme weather	Failure of climate change adaption
Oil prices spikes	Water crises	Natural disasters	Natural disasters and extreme weather events

Source: The Global Risk Report 2023, https://www.weforum.org/publications/global-risks-report-2023/in-full/
The Global Risk Report 2020 https://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf

In general, risk is embedded in every area of human functioning and has become a key decision-making criterion [cf. Jajuga, 2019, p. 17].

It is impossible to list all risk management researchers here. However, it should be noted that uncertainty and risk are two distinct scientific and research categories, which were separated by Knight [1921, pp. 19–29]. He defines risk as a measurable category, whereas uncertainty is not quantifiable [Knight, 1921]. Depending on the specifics of a given organization, risk has a unique profile.

However, it should be noted that this article is not a comprehensive treatment of the issue of risk. This issue has been widely addressed in the literature, starting with Knight [1921] or Drucer [2006]. Instead, the remainder of the paper focuses on theoretical and conceptual considerations regarding the risk of transposition and its transmission channels as a potential source of risks of unprecedented magnitude.

It can be assumed that, in the most general sense, the emergence of threats (the essence of risk) is due to the lack of complete information about the individual components of the cause and effect relationship [Kaczmarek, 2006, p. 53]. Thus, the risk arises because the decision maker's knowledge of the future is not, and cannot be, complete because many of the parameters affecting the effects of a decision are subject to variability, and not all attributes of that variability are known [Galitz, 1996, p. 5]. In the case of banks, the so-called systemic risk, which is compounded by globalization, and can significantly disrupt the financial system and the economy as a whole, is also of key importance. Bandt and Hartman [2000] describe systemic risk in the context of the probability of systemic events, when the (indirectly) affected institutions fail as a result of an initial shock – even though they were ex-ante solvent. Therefore, appropriate regulations are put in place to reduce risks in the financial sector and make it more resilient to potential shocks. However, the reduction of unmeasurable risks is extremely difficult. Banks' pro-social and pro-environmental initiatives and activities entail the identification and monitoring of ESG risks. An ESG risk affects all other financial and non-financial risks in the bank to varying degrees, mainly: credit, market, operational, liquidity, compliance, reputational [KPMG, 2021].

The definition of the ESG risk, in contrast to the traditional financial risk, is not neutral, but focuses on the negative aspects [cf. Marcinkowska, 2022 p. 37], resulting from the current or prospective impact of ESG factors on the financial performance or solvency of entities [EBA 2021; EC 2021]. Examples of ESG factors are presented in Table 5.

Table 5. Examples of ESG factors

Environmental factors	Social factors	Corporate governance factors
climate change, greenhouse gas emissions, resource depletion, waste and pollution, biodiversity loss, deforestation, energy and resource consumption, waste generation, extreme weather conditions, natural disasters	human rights, slavery, forced labor, conditions of employment, employee relations, discrimination, diversity and equal opportunities, training and development, customer privacy, financial inclusion, social destabilization, infectious diseases and pandemics	Ownership structure, owners' rights, diversity of board members, executive compensation, bribery and corruption, political lobbying and donations, tax strategies, stakeholder engagement, transparency, business ethics, competitive practices, regulatory compliance and internal audit

Source: Coleton et al., 2020; EC 2021; EBA 2021.

Banks are exposed to risks related to ESG factors directly and indirectly through the materialization of these risks in their customers or counterparties, including suppliers, correspondent banks or financial transaction partners [BIS, 2021].

Bearing in mind that the characteristics of ESG factors include intangibility, uncertainty about the timing of the effects, negative economic externalities, patterns emerging along the value

chain, increased sensitivity to changes in public policies [EBA 2021], and that their specificity directly affects the operations of not only the credit institution, but also its customers (individuals, households, businesses) and counterparties, the issue is characterized by a considerable degree of complexity. In particular, it emphasizes the need to manage climate risk in order to mitigate the effects of climate change and climate policy, taking the stability of the financial system as a whole into account [BIS, 2021]. Huge losses may be incurred not only by companies, insurers and pension funds, but also by banks themselves as a result of climate change.

It is generally accepted that the risk management process starts with risk identification [cf. Mentel, 2017, p. 60]. Due to the knowledge associated with ESG risk management, this article is limited to its selected environmental components. In the second decade of the 21st century, climate risk is identified as one of the most significant risks in terms of impact and the probability of occurrence [Global Risk Report, 2022, p. 14]. The links between climate change and its impact on the economy were already observed in the 1970 s of the 20th century, becoming the subject of considerations by Nordhaus [1977]. As shown in Table 6, the impact of the climate risk on financial markets manifests itself in two aspects: the so-called physical risk and the transition risk [Batten et al., 2020].

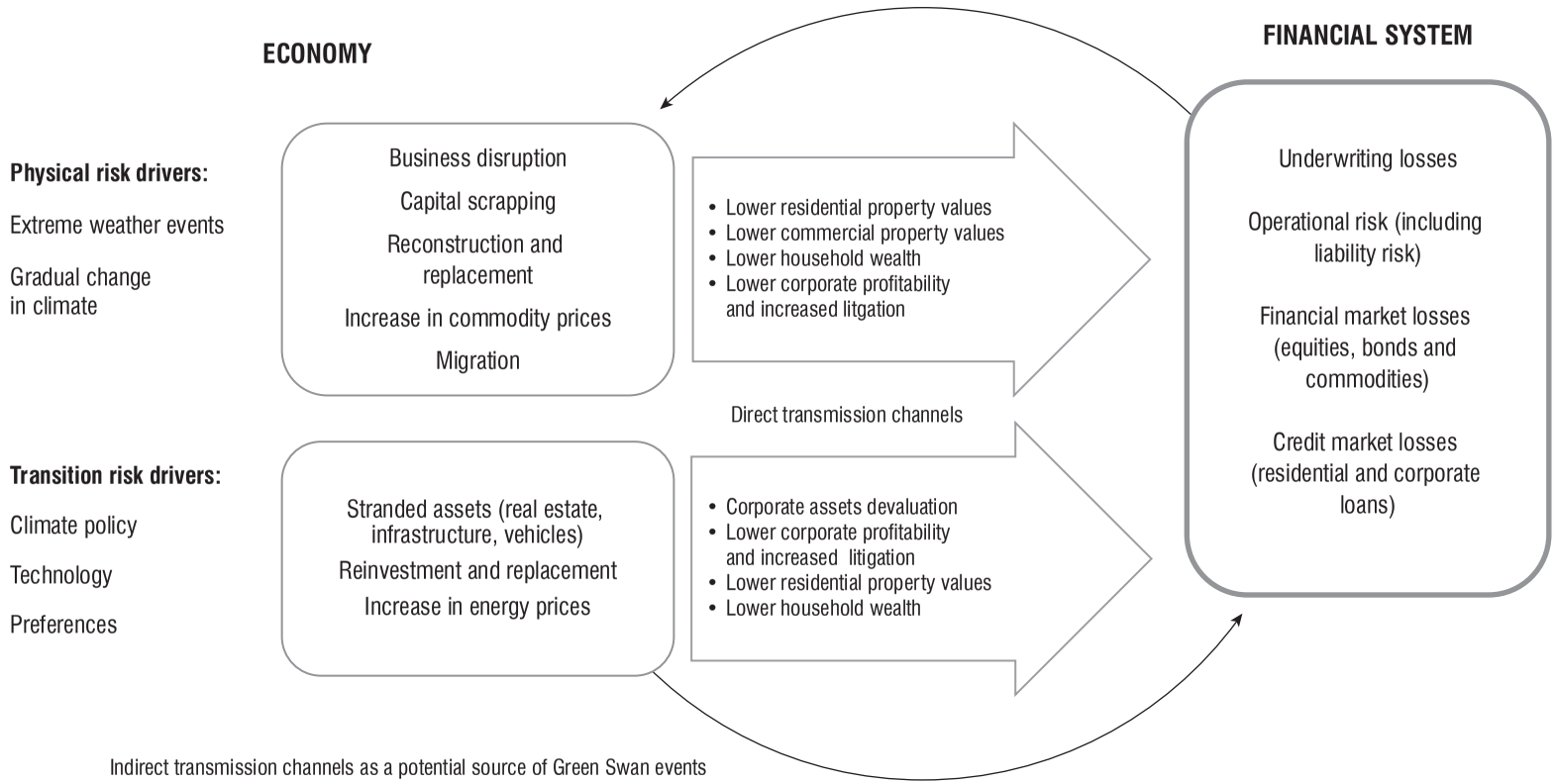
Table 6. Types of environmental risks under ESG

physical risk	transition risk
concerns economic losses caused by deteriorating weather conditions and the occurrence of natural disasters.	• is linked to rising costs and falling profitability of individual investments as a result of increasingly ambitious national climate policies [Coeuré, 2018; Batten et al., 2020], • also includes changes in market sentiment and investor preferences, and reputational risks associated with less favorable attitudes of regulators and markets towards 'dirty' assets [CISL, 2015].
Extremely difficult to forecast.	Relatively easier to forecast (than the physical risk)
difficult to measure but poses an existential threat to financial systems and cannot be ignored	
Materialization of this risk may affect the overall level of prices, their volatility as a result of supply shocks. These shocks may also negatively affect demand in the economy through a reduction in household wealth and, consequently, a lower propensity to consume [Batten et. al. 2020]. An example: The growing incidence of floods and weather anomalies will have an impact on the value of the properties that secure transactions.	A manifestation of this risk is found in stranded assets – the assets that have suffered from unexpected or premature write-downs, devaluations or conversions to liabilities [Caldecott, 2013]. An example of a stranded asset due to transformational risk could be a coal-fired power plant where it is not profitable to produce energy due to the high price of emission allowances. For banks, stranded assets, which secure loans, will create a need for borrowers to provide additional collateral, or increase the risk weighting of their loans, resulting in higher capital requirements for their lending. This may cause a reduction in lending, thereby reducing productivity and slowing economic growth. This, in turn, may have implications for the long-term real interest rates and monetary policy [Brainard, 2019].

Source: Batten et al. 2020; Brainard, 2019; Caldecott, 2013; CISL, 2015; Coeuré, 2018.

Physical and transition risks are relevant to bank operations. From the viewpoint of the considerations undertaken, special attention should also be paid to ESG transmission channels, the specifics of which are shown in Figure 3. Their existence amplifies threats that may prove impossible to neutralize. Risk transmission channels lead to the uncontrolled transmission of volatility. This is known as financial contagion [Zieliński, 2013].

Figure 3. From physical and transition risks to the financial stability risks



Source: based on NGFS, 2020, p. 13.

Physical and transition risks can materialize in terms of financial risk in five main ways [NGFS, 2020]: credit risk, market risk, liquidity risk, operational risk and insurance risk.

Banks vis-à-vis ESG risks

The results of the survey conducted in 14 banks [whose assets account for approximately 66% of the total balance sheet of the Polish banking sector), indicate that [PwC, 2021]:

- almost 80% of the banks surveyed have introduced elements of sustainable financing in their business strategies and product offerings,
- currently, 12 of the 14 banks surveyed, include climate and environmental risks in their lending processes, mainly for selected industries and sectors,
- the biggest challenges arising from the requirements to implement the risk framework associated with ESG factors include the lack or limited availability of counterparty data on ESG (according to 86% of respondents), the poor quality of counterparty disclosure and awareness of ESG factors (according to 79% of respondents) and the lack of final, transparent regulations (according to 71% of banks),
- two of the institutions surveyed plan to increase costs for customers at this stage for financing so-called 'dirty' investments or activities. However, no bank considered that last year,
- the greatest impact of ESG factors is observed in credit risk (86%) as well as operational and reputational risk (71%) – Table 7.

Table 7. Impact of ESG factors on individual risk areas in banks

The risk in credit and in credit process	86%
Operational and reputational risks	71%
Financing and liquidity risks	36%
Market risk	14%
The ESG risks are identified and managed as a separate category	7%

Source: based on PwC, 2021.

Table 8. Categories of risks in ING's reports in years 2020–2022

Year	2020	2021	2022
Type of risk	credit risk market risk liquidity risk models risk business risk cybersecurity	credit risk market risk liquidity risk model risk business risk cybersecurity	credit risk market risk liquidity risk model risk business risk cybersecurity **compliance** **security of personal data** **security of transactions and stability of IT systems** **ESG risk**

Source: based on ING's reports, 2020, 2021, 2022.

The new conditions modify the existing constellation of traditional risk and its transmission (Figure 3) in particular banks. This is clearly evident in the reports of individual banks, e.g. ING Bank (Table 8). Banks recognize the importance of channels for transferring ESG factors to other risk categories. ESG issues are increasingly placed at the center of every aspect of bank operations.

Discussion

Taking into account the results of the literature review, secondary research findings and the results of the content analysis of a bank's integrated reports, there are several important indications that ESG risks should be considered as a potential source of so-called black (optionally green) swan events.

First, by analyzing ESG risks and modeling climate change, using statistical methods, it can be observed that the probability of marginal events is increasing and phenomena that were once considered extreme, are becoming commonplace [EY, 2020]. These events are outside the realm of regular expectations, are non-linear in nature and tend to cause domino effects. These are also attributes of the Talebian Swan.

Second, shifting the responsibility and burden of ESG risk mainly to the banks, may prove to be (as Taleb points out) "contrary to the essence of antifragility" [Taleb, 2013] and contribute to events of enormous impact and extreme consequences, i.e. the occurrence of the 'Black/Green Swan' symptom.

Thirdly, ESG risk transmission channels lead to the uncontrolled transmission of volatility, fostering the formation of economic shocks [fc. Zieliński, 2013], the source of which also lies in the implementation of climate neutrality and the financial decisions made in this respect mainly by banks. Negative feedback may lead to the destabilization of the whole system. The financing of green transition tasks by banks is associated with transposition risk implications that are "beyond the realm of normal predictions" [Taleb, 2009, p. 10].

Furthermore, despite the significant impact of ESG risks, the timing of their materialization far exceeds the business cycle outlook. This lack of a sense of immediate threat can make procrastination tragic in its results [Carney, 2015]. Meanwhile, in November 2020, the ECB published a "Guide on climate and environmental risks", which sets out its expectations for the banking sector's approach to ESG risk management. On this basis, a review of 186 European banks was carried out in 2022 to assess the degree of work completed. More than 85% of institutions now apply at least basic environmental and climate risk management practices in the areas identified by the ECB. However, deficiencies related to methodology, the use of detailed risk information and/or active management of the portfolio and risk profile are still evident. In addition, around 10% of institutions are lagging behind and did not make any significant progress in environmental risk management in the previous year.

The banking sector is subject to an ever-increasing regulatory tightening to create conditions for the stable functioning of the banking system. In line with the Corporate Sustainability Reporting Directive and the requirements of the Taxonomy, banks are required to report non-financially and analyze the impact of their activities on the achievement of ESG goals. Paradoxically, however, as Zielinski [2013] points out, every change in regulation produces undesirable phenomena in addition to the expected effects. The green transition and the associated regulatory and market pressures also create both opportunities and risks [Michalski, 2022].

At the same time, it should be noted that the 'Green Swan' can also provide exponential progress in the form of economic, social and environmental wealth creation [Elkington, 2020]. This positive aspect can spur the development of competitive advantages in the future, also taking the ESG factors into account.

Summary

A review of the source literature on the subject leads to the conclusion that the 'Green Swan' metaphor may prove useful in explaining the mechanisms and effects associated with the green transition already underway. The reference to Taleb's theory illustrates the possibility of unpredictable phenomena that may be an indirect, unintended result of the transformations taking place.

The effects, associated with the existence of transformation risks, undoubtedly reveal a potential to significantly disrupt the normal functioning of the financial sector. This problem requires both empirical and theoretical attention.

Predicting the nature of critical events that may become an indirect, unintended outcome of systemic transformation, their magnitude and the exact timing of their occurrence is extremely difficult and often impossible at the level of a single institution [Sahebjaminia et al, 2015, pp. 261–273]. In response to the complexity of the already identified transition risks, efforts are made to strengthen organizational resilience, manifested by the obligation of non-financial disclosures imposed, among others, by Taxonomy. In order to better prepare for future crises, it is necessary to go beyond current scenarios based on frequentist statistical evidence [Haas, 2020], risk management across all facets of a financial institution and a multi-scenario approach [Mączyńska, 2020].

The results of the research carried out indicate that financial institutions take specific areas of risk into account as a result of the changing environment in which they operate. Their description (of these risks) is a component of the integrated reports and management accounts, as required by the Accounting Act (AAR, Article 49, paragraph 2) and EU regulations. However, an analysis of the integrated reports shows that risks are not treated as a separate component of the banking risk (the integrated reports – ING, Santander). It has become a driver for the bank's other typical risk categories, i.e. credit, operational or reputational.

The traditional risks have changed. In addition, ESG risk transmission channels lead to the uncontrolled transmission of volatility, fostering the formation of economic shocks. The 'Green Swan' symptom may be useful to describe repercussions in this field. The nature of the 'Green Swan' can be far more complex and multidimensional, as it also concerns consequences beyond the environmental aspect.

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