

## Allegato 1

### Descrizione dello Spoke 4 “Sustainable finance”

#### Abstract

Mobilize sustainable investments for the green transition of the economic system. Define sustainable financial instruments and offer sustainable funding access to firms, especially SME. Define ESG scores targeted for SMEs and improving firms and financial institutions' alignment to EU Green Taxonomy.

Improve financial inclusion and funding to individuals, families and SME leveraging the complementarity among different funding and lending channels (digital and traditional).

Make public debt and financial system resilient in the face of economic, social and climate shocks.

#### Work Packages

**WP1. ESG risk dimensions and their impact on investors and SMEs.** Assess and measure the relevant risks and impact of sustainable investing as to mainstream sustainability considerations in investors' risk management (both retail, company and system levels) and in the use of new sustainable finance instruments.

*Referente Monica Billio*

**WP2. Digital finance, inclusion and green/young entrepreneurship.** Improve financial inclusion and funding to individuals and SMEs, measuring risks and leveraging the inclusionary nature of digital finance, as well as the complementarity among different funding and lending channels (digital and traditional). Improve participation to capital markets in line with the EU Capital Markets Union with attention to new green/young enterprises.

*Referenti Silvio Vismara e Massimo Colombo*

**WP3. Assessment of climate change impact, physical and transition risks.** Innovate financial and quantitative approaches to climate change impact by coherently including complexity, uncertainty, and ambiguity dimensions to properly deal with financial and sustainability risks. Deal with physical and transition risks both for investors, firms and the whole system.

*Referenti Stefano Battiston e Monica Billio*

**WP4. Public debt and the financial system under Compounding Risks.** Public debt management and sustainability monitoring. Assess long-term debt vulnerability under stress scenarios: from pandemic to climate-related events also under compound risk. Evaluate the effects of fiscal rules and unconventional monetary policies in crisis times.

*Referenti Massimiliano Marcellino e Andrea Consiglio*

## Data

*Firms' balance sheets; Firms level funding data; Administrative data; Surveys (for ESG scores); ESG ratings and their determinants; Macroeconomic data; Climate change scenarios; Environmental data; Text and Social media data*

## Deliverables

New datasets (firms ESG scores); New sustainability indicators at macro-financial level, also accounting for compound risks; Physical and transition risks mapping at geographical and sector level; Capacity building programs for firms, financial institutions and households; Capacity building labs for ESG disclosure and sustainable finance access devoted to SME; New competencies for financial consultancy to support financial choices in the medium/long run combining sustainable finance and hedging instruments; Three practice oriented research observatories.

## Work Packages details

### WP1. ESG risk dimensions and their impact on investors and SMEs.

WP objectives are: Assess and measure the relevant risks and impact of sustainable investing; Mainstream sustainability considerations in investors' risk management (both retail, firm and system levels); Mainstream the use of new sustainable finance instruments.

The lack of standardized ESG risk disclosure represents a barrier to financial institutions, firms and regulators to include ESG considerations into their risk management tools, potentially leading to mispricing of financial risks, greenwashing and thus potentially reducing the investment opportunities in the low-carbon transition.

Contributions and expected results are manifold and can be grouped in four thematic areas.

#### a) Asses ESGness:

- Investigate and define the determinants of ESG risk reporting of firms, including SMEs by understanding how double-materiality is implemented by firms.
- New measures for the ESG dimensions. To improve the understanding of the quality of the ESG disclosures, new measures will be developed:
  - at a micro level, measures of 'greenness', exposure to 'climate shocks', and 'ESG awareness' through novel indicators of 'ESGness', of materiality in sustainability, and of a circularity measure distilled at the company level (also based on balance sheet data);
  - at a macro level, to define a 'sustainability' factor, novel in the literature and computed as the difference between the average returns on low-carbon and high-carbon portfolios defined according to the Green Taxonomy.
- Creation of a comprehensive ESG and climate risks database, both considering available data from public and proprietary sources and constructing ESG scores through surveys and information available in Non Financial Statements, useful for ESG/Sustainability Ratings.

- b) Exploit ESGness
  - Impact analysis on performances and optimal portfolio allocation, also developing axiomatic definitions of ESG-based risk and reward measures to help investors to evaluate and optimize their positions.
  - Supporting companies in the definition of the better combination of financial instruments (in the medium and long term) to finance sustainable investments.
- c) Improve ESGness:
  - Construction of augmented credit ratings including ESG factors: complexity and scenario analyses. One of the most important challenges for credit practitioners is to transform several of the qualitative aspects of ESG into quantitative measures and modelling non-financial ESG risks might be burdensome. The increasing awareness of ESG criteria on investors' choice explains the need to analyze how ESG factors contribute to the firms' creditworthiness.
  - Analysis and signaling of greenwashing, also considering a law perspective input, through testable implications in terms of time-varying shares of brown, green and green-washed activities and agents (firms) will be derived and confronted with available data.
- d) Stimulate ESGness and policy implication
  - Assessment and policy implications of the integration of sustainability criteria into the compensation contracts of executives (CEOs, senior managers, etc.). These contracts link executive compensation to social and environmental performance targets by using non-financial key performance indicators, such as ESG dimensions. There is a need to scan the main effects of ESG risk reporting on managerial incentives and firm risk-taking.
  - Scenario analysis to assess the ability to inform decision makers on the expected impact of extreme events or scenarios (e.g., climate scenarios). The analysis provides a forward-looking perspective by stressing the ESG and climate change factors to evaluate their effect on alternative (and compound) defined scenarios, helping the analysis of policy implications.

*List of activities: i) Investigate and define the determinants of ESG risk reporting of firms - including SMEs – to improve the quality of the ESG disclosures. ii) Contribute to the creation of a comprehensive ESG and climate risks database, and construction of ESG scores through dedicated surveys and public information. iii) Impact analysis on portfolio allocation, performances and stress resilience to support investors to evaluate and optimize their positions. iv) Definition of optimal combinations of financial and hedging instruments (in the medium and long term) to finance sustainable investments. v) Construction of augmented credit ratings including ESG factors. vi) Analysis and signaling of greenwashing phenomena. vii) Design of ESG executive incentive policies.*

## **WP2. Digital finance, inclusion and green/young entrepreneurship.**

*WP objectives are: Improve financial inclusion and funding to individuals and SMEs, by leveraging the complementarity among digital and traditional funding and lending channels. Take advantage of digital technologies to improve measures of the risks of entrepreneurial finance transactions. Improve participation to capital markets in line with the EU Capital Markets Union with specific attention to new green/young enterprises.*

- how to foster the inclusiveness of capital markets on both the supply and the demand sides:

- favor the access to capital markets and sustainable finance by companies (with particular attention to SME and startups)
- develop the inclusionary nature of digital finance, by providing financing opportunities to small investors, while controlling risks

Digitization, i.e., the increasing use of digital technologies in the production and sale of products and services, is ubiquitous and is rapidly transforming the global economy, including the demand for and supply of entrepreneurial finance. The far-reaching impact of digitalization on finance markets generates new business opportunities for young innovative firms (e.g., in blockchain technologies) and, at the same time, creates new financial channels (e.g. crowdfunding, initial coin offerings (ICO), peer-to-peer lending). While early-stage finance is traditionally limited to sophisticated investors, such as venture capitalists and business angels, digital finance platforms are associated with a large pool of small investors. The disintermediation provided by these platforms enables individuals to directly invest in promising entrepreneurial ventures or seek capital to finance their businesses. Thus, they are expected to (1) reduce adverse selection and moral hazard problems in capital markets, (2) to democratize and improve their efficiency. For instance, as homophily facilitates matching between entrepreneurs and professional investors, male and white dominance among professional investors creates a disadvantage for minority entrepreneurs.

Through disintermediation, digital finance platforms encourage direct valuation and investment, thereby delivering unprecedented investment opportunities to small investors. While the role as gatekeepers of crowdfunding platforms is certainly relevant, the final decision on which venture to finance is left to the investors. Nevertheless, small investors are likely to have neither the ability nor the incentives to research and evaluate entrepreneurial ventures extensively. Coherently, there are concerns about the potential risks for small investors in digital finance. The lack of financial literacy on the supply side (i.e., investors seeking investment opportunities) might pair with adverse selection problems on the demand side (i.e., entrepreneurs seeking finance). One of the major concerns for the development of the market is that low-quality entrepreneurs seek financing through crowdfunding to take advantage of unsophisticated small investors. Digital finance platforms might thus deliver opportunities to exploit inexperienced and uncoordinated investors with behavioral and herding biases.

Inclusion – in the form, for instance, of access of SMEs and individuals to credit - can be fostered also by revisiting traditional risk assessments in terms of methods and metrics. To this end, we aim at using new Artificial Intelligence methods and metrics that, on one hand, measure their trustworthiness (in terms of accuracy, explainability, fairness and robustness) and, on the other hand, can capture the greenness of loan recipients and their exposure to risks that are as new as pervasive such as supply chain disruptions and catastrophes on the other.

Most ESG activities are long-term, so that it is difficult to determine the time horizon ESG activities should be measured. For instance, environmental activities reduce the risks of costly future environmental incidents, such as hazardous chemical, substantial emissions, and climate change

concerns. Considering the novelty of digital finance and how recently ESG has become “mainstream”, what we currently observe might be transitory and the market may be transitioning to a new equilibrium, with new risk/return perspectives on ESG assets.

*List of activities: i) Define measures to foster the inclusiveness of capital markets on both the supply and the demand sides. ii) Favor the access to capital markets and sustainable finance by companies (with particular attention to SME and new green/young enterprises). iii) Develop the inclusiveness of digital finance, by providing financing opportunities to small investors. iv) Measure and control of the risks of digital finance also by using artificial intelligence.*

### **WP3. Assessment of climate change impact, physical and transition risks.**

*WP objectives are: Innovate financial and quantitative approaches to climate change impact by coherently including complexity, uncertainty, and ambiguity dimensions to properly deal with financial and sustainability risks; Deal with physical and transition risks both for investors, firms and the whole system.*

Climate change has been recognized as a new, and material, type of risk for the financial sector. The Climate stress test of the financial system has shown that investors are largely exposed to losses driven by carbon stranded assets, i.e., assets of firms that directly or indirectly use fossil fuels for their business. These assets are expected to lose value as a result of a disorderly transition, i.e., a transition to a low-carbon economy characterised by a late introduction of climate policies whose impact cannot be fully anticipated by the investors. This risk has also been recognized by financial regulators who included it in the category of ‘climate transition risk’, to distinguish it from the financial risk induced by more extreme natural hazards impacting the productive assets of firms, i.e., climate physical risk.

Expected results are at micro and macro/policy levels.

TASK 1- Analysis at micro level of the complexity and granularity of the climate transition risk. Results will contribute to inform the regulatory design of climate stress test exercises building on ongoing engagement with the NGFS, as well as to guide the integration of firms’ climate risk considerations into the risk management implemented by investors and regulators. We will also assess the impact of climate transition risks on bank-firm credit relationships and default rates due to financial interconnections between firms and financial institutions, helping in defining the better way to integrate transition risk in the creditworthiness evaluation.

TASK 3- Climate-related uncertainty and policy implications. At the macroeconomic level, new measures of climate-related uncertainty will be introduced and evaluated their impact on financial markets and the economy. The aim is to identify climate uncertainty shocks and to trace their dynamic effects on economic and financial variables.

TASK 2- Modeling the interdependence among real, financial and climate cycles and the various dimensions of financial-climate instability co-evolution. The analysis will be micro-founded using a

network of balance-sheet interlinkages among borrowers and lenders operating in financial and real markets where brown, green and green-washed assets/investments are available. New models will be proposed to identify and measure climate risk drivers and firm specific impacts with attention on financial stability and to identify non-conventional policies able to mitigate the systemic risk emerging from agents' interaction.

TASK 3- New econometric models will be introduced to evaluate how climate uncertainty shocks and other climate-related shocks propagate across economic sectors and geographical regions, also to assess the extent to which climate related contagion may amplify the impact of shocks on financial markets and institutions. In fact, within country variation in climate-related shocks and changes may alter not only the intertemporal variability of economic growth, but also the cross sectional volatility of growth across territories and related risks. This, in its turn, may have sizeable impacts on the primary sector's output and productivity with cascade effects on commodity prices and workers' living standards.

TASK 4- Scenario analysis to assess the ability to inform decision makers on the expected impact of extreme events or scenarios (e.g., climate scenarios). The analysis provides a forward-looking perspective by stressing the ESG and climate change factors to evaluate their effect on alternative defined scenarios, helping the analysis of policy implications.

*List of activities: i) Understanding of the complexity and granularity of the climate transition risk to inform the regulatory design of climate stress test exercises and to guide the integration of firms' climate risk considerations into the risk management by investors and regulators. ii) Definition of new measures of climate-related uncertainty and their policy implications. iii) Modeling the interdependence among real, financial and climate cycles and the various dimensions of financial-climate instability co-evolution. iv) Scenario analysis to inform decision makers on the expected impact of extreme events and to provide a forward-looking perspective by stressing the ESG and climate change factors.*

#### **WP4. Public debt and the financial system under Compounding Risks.**

*WP objectives are: Public debt management and sustainability monitoring. Assess long-term debt vulnerability under stress scenarios: from pandemic to climate-related events also under compound risk. Evaluate the effects of fiscal rules and unconventional monetary policies in crisis times.*

Public debt sustainability is a major issue for Italy, given its high level of debt to GDP ratio, which recently further increased substantially to finance public policies aimed at counteracting the effects of the Covid-19 pandemic. The war in Ukraine is another unexpected event that will have an impact on debt vulnerability, increasing the fiscal deficit and lowering GDP growth. And climate change, now recognized as the main source of risk for socio-economic and financial stability, can also take its toll. Moreover, climate change does not happen in isolation, but it compounds with other sources of risk and existing socio-economic weaknesses. An ongoing example is the compounding of pandemics with natural hazards, such as floods, hurricanes, droughts, that are accrued by climate

change. Recently, also cyber security risks have emerged– e.g., cyber attacks on critical infrastructure in the financial, energy, healthcare and transportation sectors - ranked as the second risk of greatest concern for business globally over the next 10 years and included in the World Economic Forum list of global risks.

The drivers of compound risk thus include:

- financial/systemic risk, essentially endogenous;
- climate change risk, also endogenous due to circularity issues deriving from political choices;
- cyber risk, generated endogenously (as a consequence of climate and other exogenous sources of risk) due to the increased usage of technologies;
- disaster risk (which includes also the pandemic one), exogenous but with some potential endogeneity due to a mitigation dimension and thus impact.

The implications of compounding pandemic and climate risk on public debt sustainability and fiscal policy responses and effectiveness, as well as on crisis preparedness and fiscal risk management, have still to be understood. Indeed, compounding can give rise to non-linear dynamics that amplify losses and delay economic recovery, leading to hysteresis effects. This requires the development of proper econometric methods and models that permit the quantification of the effects of single and compound risks on debt sustainability and the effectiveness of fiscal policies.

*List of activities: i) Proper understanding of the key vulnerability factors for public debt dynamics. ii) Scenario analysis to assess long-term debt vulnerability and the related financial system stability. iii) Understanding of compounding risks on public debt sustainability and fiscal policy responses and effectiveness. iv) Development of proper economic and econometric models and methods.*

Spoke n 4	Spoke title: Sustainable finance	Spoke Leader Monica Billio
<p><b>Spoke description and objectives:</b> Spoke’s activities deal with all financial aspects at micro and macro level of the project.</p> <p>Main objectives are: Mobilize sustainable investments for the green transition of the economic system. Define sustainable financial instruments and offer sustainable funding access to firms, especially SME. Define ESG scores targeted for SMEs and improving firms and financial institutions’ alignment to EU Green Taxonomy. Improve financial inclusion and funding to individuals, families and SME measuring risks and leveraging the complementarity among different funding and lending channels (digital and traditional). Make public debt and financial system resilient in the face of economic, social and climate shocks.</p>		
<p><b>WP 4.1 ESG risk dimensions and their impact on investors and SMEs</b></p> <p><i>WP objectives are: Assess and measure the relevant risks and impact of sustainable investing; Mainstream sustainability considerations in investors’ risk management (both retail, firm and system levels); Mainstream the use of new sustainable finance instruments.</i></p>		

*List of activities: i) Investigate and define the determinants of ESG risk reporting of firms - including SMEs – to improve the quality of the ESG disclosures. ii) Contribute to the creation of a comprehensive ESG and climate risks database, and construction of ESG scores through dedicated surveys and public information. iii) Impact analysis on portfolio allocation, performances and stress resilience to support investors to evaluate and optimize their positions. iv) Definition of optimal combinations of financial and hedging instruments (in the medium and long term) to finance sustainable investments. v) Construction of augmented credit ratings including ESG factors. vi) Analysis and signaling of greenwashing phenomena. vii) Design of ESG executive incentive policies.*

*D4.1.1 – Definition of ESG scores for SMEs through dedicated surveys and public information and their mapping, M12*

*D4.1.2 - Practice oriented research observatory on Sustainable Finance, M18*

*D4.1.3– Augmented credit ratings including ESG factors, M24*

*D4.1.4 - Optimal combinations of financial and hedging instruments (in the medium and long term) to finance sustainable investments, M36*

*D4.1.5 - Policy briefs and best practices for SME's access to sustainable finance instruments, M36*

#### **WP 4.2 Digital finance, inclusion and green/young entrepreneurship**

*WP objectives are: Improve financial inclusion and funding to individuals and SMEs, by leveraging the complementarity among digital and traditional funding and lending channels. Take advantage of digital technologies to improve measures of the risks of entrepreneurial finance transactions. Improve participation to capital markets in line with the EU Capital Markets Union with specific attention to new green/young enterprises.*

*List of activities: i) Define measures to foster the inclusiveness of capital markets on both the supply and the demand sides. ii) Favor the access to capital markets and sustainable finance by companies (with particular attention to SME and new green/young enterprises). iii) Develop the inclusiveness of digital finance, by providing financing opportunities to small investors. iv) Measure and control of the risks of digital finance also by using artificial intelligence.*

*D4.2.1 – Practice oriented research observatory on Digital Finance and Entrepreneurship, M18*

*D4.2.2 - Definition of risk measures of digital finance and credit ratings of SMEs and new green/young enterprises based on artificial intelligence M24*

*D4.2.3– Policy briefs and best practices for financial inclusion and participation to EU Capital Markets, M36*

#### **WP 4.3 Assessment of climate change impact, physical and transition risks**

*WP objectives are: Innovate financial and quantitative approaches to climate change impact by coherently including complexity, uncertainty, and ambiguity dimensions to properly deal with financial and sustainability risks; Deal with physical and transition risks both for investors, firms and the whole system.*

*List of activities: i) Understanding of the complexity and granularity of the climate transition risk to inform the regulatory design of climate stress test exercises and to guide the integration of firms' climate risk considerations into the risk management by investors and regulators. ii) Definition of new measures of climate-related uncertainty and their policy implications. iii) Modeling the interdependence among real, financial and climate cycles and the various dimensions of financial-climate instability co-evolution. iv) Scenario analysis to inform decision makers on the expected impact of extreme events and to provide a forward-looking perspective by stressing the ESG and climate change factors.*

*D4.3.1 – Practice oriented research observatory on Climate Finance, M18*

*D4.3.2 – Scenario analysis, M24*

*D4.3.3– Policy briefs on climate-related uncertainty measures and policy implications, M24*





#### **WP 4.4 Public debt and the financial system under Compounding Risks**

*WP objectives are: Public debt management and sustainability monitoring. Assess long-term debt vulnerability under stress scenarios: from pandemic to climate-related events also under compound risk. Evaluate the effects of fiscal rules and unconventional monetary policies in crisis times.*

*List of activities: i) Proper understanding of the key vulnerability factors for public debt dynamics. ii) Scenario analysis to assess long-term debt vulnerability and the related financial system stability. iii) Understanding of compounding risks on public debt sustainability and fiscal policy responses and effectiveness. iv) Development of proper economic and econometric models and methods.*

*D4.4.1 – Real time monitoring and forecasting of key macro economic and financial indicators, including probabilistic vulnerability indicators, M18*

*D4.4.2 – Scenario analysis, M24*

*D4.4.3 – Policy briefs on debt sustainability and financial stability also under compound risk, M24*