

The Network Basket Loan: A Collective Lending Instrument to Correct Partial Selection Market Failure

Abstract: This paper introduces the Network Basket Loan, a collective lending mechanism enabling profit and non-profit organizations to jointly access concessional credit and public incentives within a network contract, conditional on a positive aggregate social impact and joint liability. The instrument addresses a distinct market failure, termed *partial selection*, which arises when projects are assessed individually rather than as components of a system, leading to the exclusion of combinations of agents that would increase aggregate welfare. A theoretical model shows that the NBL enhances welfare through three channels: (i) risk sharing from joint liability, which lowers borrowing costs; (ii) network synergies that raise returns through cooperation; and (iii) internal transfers that extend credit to economically weaker yet socially valuable members. The model defines the conditions under which Network Basket Loan increases welfare and demonstrates their superiority to existing instruments, such as Social Basket Loans, in overcoming partial selection market failure.

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Keywords: Network Basket Loan, Social Basket Bond, Market Failure, Adverse Social Selection, Partial Selection.

JEL codes: G12, I31, G18.

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1. INTRODUCTION

The global shift toward sustainable development is both urgent and highly complex (Bova, 2022; Costanza et al., 2016; Maggino & Alaimo, 2022; United Nations, 2015, 2025). Achieving it requires more than technological progress—it demands the creation of innovative financial tools. In recent years, instruments designed to incorporate and incentivize positive social and environmental outcomes—such as Social Impact Bonds (SIBs), Social Basket Bonds (SBBs), and Social Basket Loans (SBLs)—have proliferated, accompanied by a growing body of scholarly research (Alomoto et al., 2022; Bocchialini et al., 2024; Park, 2018; Sinfield et al., 2011; Trotta et al., 2020, 2021). Within this expanding field, the present study introduces a novel mechanism, the *Network Basket Loan (NBL)*, conceived to advance collective social welfare where other instruments may fail.

A Network Basket Loan is a collective lending scheme through which multiple organizations, both for-profit and non-profit, jointly access concessional credit and incentives under a network contract, provided that they generate a positive aggregate social impact and assume joint liability.

The paper argues that the NBL overcomes the *partial selection market failure*, a market failure that arises when credit is allocated on the basis of individual rather than aggregate social performance, and which cannot always be corrected through standard compensatory mechanisms, as discussed in the following section.

To demonstrate this, we develop a model showing that the fundamental mechanisms of the NBL resolve such a market failure when the following conditions hold:

- 1) *Group lending risk-sharing advantages*. Joint liability, which transfers part of the risk from the lender to the borrowers, reduces interest rates, while internal monitoring, social incentives and ties, and assortative matching lower the risks of failure, adverse selection, moral hazard, and free riding, making such risk transfer convenient (Ahlin, 2017; de Quidt et al., 2016; Ghatak, 1999; Guttman, 2008; Krause, 2025; Protter & Quintos, 2022; van Tassel, 1999),

- 2) *Positive network synergies.* Network cooperation generates synergies that raise both aggregate and individual economic and social returns, which in turn facilitate members' access to credit. This effect is particularly strong in network contracts where members' economic and social ties, typically, though not exclusively, within industrial districts, are complementary (Becattini, 2017; Becchetti et al., 2025; Cafaggi, 2011; Cisi et al., 2016; Pastore et al., 2020)
- 3) *Internal externality compensation.* Internal transfers among group members are convenient when and insofar advantages it creates a group whose actual value exceeds the transfer cost. When a positive aggregate performance is required to access credit, transfers can act as partial internal externalities compensation, rewarding and facilitating the access to credit of organizations having high social return unrewarded by market.
- 4) *Partial selection market failure avoidance.* When externalities are fully compensated at the individual level, the aggregate outcome may still be suboptimal. This occurs because some agents, unable to satisfy their budget constraints, may exit the market instead of transferring resources to those who generate positive externalities. In such cases, the market achieves fairness in compensation but fails to maximize collective welfare. This paper demonstrates that this type of inefficiency, referred to as the collectivistic or partial selection market failure, can be prevented through the NBL. By allowing internal compensation of externalities within the group, the NBL sustains participation of all agents whose joint activity produces a net positive social impact, thereby aligning aggregate outcomes with welfare maximization.

By analysing and integrating these aspects, the paper outlines the design of the NBL as a financial instrument aimed at fostering aggregate welfare and identifies the key elements for its evaluation and implementation.

The structure of the paper is as follows. *Section 2* reviews the literature on the distinction between individual and aggregate market failures and on group-lending theories that form the foundation of

the model. *Section 3* presents the model, which describes the dynamics of the NBL and the policy conditions required to prevent partial selection market failure. *Section 4* discusses the main results, and *Section 5* concludes.

2. LITERATURE REVIEW

2.1. Market failure in terms of fairness and aggregate welfare

Sustainable Development is in the agenda of most countries (United Nations, 2015), and finance play a pivotal role (Ellili, 2024; Kumar et al., 2025). The Sustainable Development Goals (SDGs) established by the United Nations, and more broadly the pursuit of development beyond GDP and the inclusion of non-economic dimensions of welfare, require substantial investment (Fioramonti, 2013; Stiglitz et al., 2009; United Nations, 2015, 2025). For this reason, new financial instruments are emerging (Dahbi et al., 2024; Gustafsson-Wright, E., Gardiner, S., & Putcha, V., 2015; Mudalige, 2023; Tortorice et al., 2020; Trotta et al., 2021).

Impact investing has emerged as a frontier of sustainable finance. Instruments such as green bonds, social bonds, and sustainability-linked bonds have gained prominence in this field. Social bonds, debt securities sold to investors whose proceeds are used to finance projects with a defined social benefit such as affordable housing, education, food security, and access to healthcare, and that can concur to promote human rights achievement (Park, 2018). Social impact bond or Payed-By-Results securities, ensure the provision of transparent goal-based financial resources oriented to social impact; These models have been piloted across Europe, particularly in employment, education, and healthcare, demonstrating potential for cost-effective service delivery and improved outcome measurement especially when the government is particularly risk adverse (Gustafsson-Wright, E., Gardiner, S., & Putcha, V., 2015; Tortorice et al., 2020; Trotta et al., 2020, 2021).

The transition toward a sustainable paradigm is nonetheless hindered by market failures, situations in which markets fail to reward externalities, particularly those related to non-economic dimensions (Coase, 1960; Pigou, 2013; Stiglitz, 1989). Insofar as the market fails to price appropriately these dimensions, the financial market may fail to properly allocate resources to achieve the SDGs (Berk & van Binsbergen, 2025; Pastor et al., 2021; Stiglitz, 2019).

Market failures at individual level occur when private incentives diverge from social welfare, that is, when individual costs and benefits differ from their social counterparts (Bator, 1958; Hardin, 1968). These divergences generate *externalities*, defined as the uncompensated effects of one agent's actions on others. The process through which such divergences are corrected—by aligning private and social incentives—is known as *internalization* of externalities.

The internalization and alignment of individual and social incentives, while providing a criterion of fairness, do not necessarily maximize *aggregate welfare*. When the latter prevails, it may dominate the alignment of individual incentives, so that externalities are only partially or not at all compensated, and fairness may be set aside in pursuit of the greater good. From this perspective, a *collectivistic view of the economy* would define market failure as any allocation that fails to maximize aggregate welfare.

The *individualistic* and *collectivistic views can be mutually reinforcing or in conflict*. For instance, internalization, although aimed at maximizing welfare, can become a matter of justice when it is proceduralized, that is, when specific rules are established to achieve aggregate welfare even if they are suboptimal in certain cases (Sandel, 2010). The polluter pays principle, for example, is primarily a principle of fairness, categorical in nature, though derived from welfare considerations (Glazyrina et al., 2006; Khan, 2015). . Similarly, Pigouvian taxes may be replaced by standards or quotas when this proves more efficient (Weitzman, 1974), and emission trading systems may be chosen for their cost-effectiveness even when they raise concerns about the fairness of pollution permit allocation

(Fowlie & Perloff, 2013; Hahn & Stavins, 2011). Economic thought on these issues continues to evolve and is less unified than it might appear at first glance (Zylicz, 2010).

2.2. Individualistic and collectivistic credit market failures

In financial markets, and specifically in credit markets, the preceding concepts require a brief recodification to be applied. We propose two ways of defining *market failure* according to two distinct perspectives: the *compensatory and individualistic* view, and the *collectivistic and welfarist* one. The latter will hereafter be referred to as *Partial Selection Failure (PSF)*.

1. *Compensatory and individualistic market failure*: this occurs when credit is provided (or denied) even though the *actual social value* generated is lower (or higher) than the cost of capital. It is a direct consequence of a lack of internalization of externalities.
2. *Collectivistic and welfarist market failure – or partial selection failure*: this occurs when access to credit depends solely on the impact of individual projects, without accounting for their aggregate interaction with others, thereby excluding combinations of projects that, taken together, would generate a net benefit for society.

At the end of the next section, we provide an analytical definition of both forms of market failure.

The relevance of this distinction lies in the following: (i) *aggregate welfare* may be maximized without full compensation, thereby avoiding the individual market failure but not necessarily the collectivistic one; and (ii) the *NBL* is structured as a group of borrowers whose performance is assessed on an aggregate basis. If, and insofar as, the collectivistic view prevails, and insofar as the *NBL* prevents the collectivistic market failure (as demonstrated in the next section), then the *NBL* can be regarded as a financial instrument that promotes welfare and sustainable development.

In what follows, we proceed under the assumption that the collectivistic perspective prevails, leaving its broader theoretical debate to future research, as it falls beyond the scope of this paper.

Our research hypothesis is “*The Network Basket Loan (NBL) prevents collective market failure even when it does not fully compensate for externalities, whereas loans granted to agents solely according to their individual economic and social performances (i.e., compensatory approaches) may not*”

PSF may reflect an accounting distortion. An organization can be viewed as an artificial construct used for administrative and reporting purposes. Whether its activities are evaluated as a whole or separated into distinct components, for example, one economically efficient but polluting, and another socially valuable but financially weak, can lead to different outcomes in terms of welfare and credit eligibility (e.g., accepting the whole but rejecting its subparts). This difference, however, results purely from the accounting structure rather than from any substantive change in real impact. Moreover, it is not necessary for an organization to be perfectly compensatory across its internal components. PSF arises precisely from this failure to consider the aggregate effects of a system while focusing on its isolated parts. The *Network Basket Loan* introduces mechanisms that address this issue by internalizing externalities within the group.

The second contribution of this paper is to provide insights into the *optimization of the NBL* from a public policy perspective. To achieve this, we review the literature on *group lending* and develop a model that highlights the dominant dynamics and the conditions under which optimization can occur, offering practical guidance for policymakers.

2.3. Assumption and review

The Network Basket Loan is a collective loan granted to a group of borrowers within a network contract. The network contract has previously been recognized as an economic policy instrument capable of promoting economic and sustainable development by transforming individual competition into collective success and resolving suboptimal equilibria (Becchetti et al., 2025). To test our hypothesis, we examine whether these effects can be extended to *group lending* and identify the conditions under which this occurs. Accordingly, in setting up the model, we build upon the

framework proposed by Krause (2025) and consider related contributions (Ahlin, 2017; Protter & Quintos, 2022). We extend this line of research by endogenizing the *group size*—that is, by determining the optimal number of members rather than assuming it exogenous—and by maintaining the simplifying assumptions used by these authors, such as the exclusion of borrower preference heterogeneity when it does not affect aggregate outcomes.

The model considers four main components: the *interest rate*, the *joint risk*, the *cost of setting up and monitoring the group*, and the *economic rate of return* and their relationship with the groups of members (n) to test whether it is convenient to borrow alone ($n=1$) or in group ($n>1$).

Interest rate (i)

In group lending with joint liability, the interest rate is lower than in individual lending because part of the credit risk is transferred from the lender to the group members (Krause, 2025). Consequently, we assume that the interest rate decreases with the number of members in the group. The lender, in turn, obtains funds from risk-free deposits at a given rate i_d ; therefore, the rate charged to borrowers must be equal to or higher than this risk-free rate. Formally, we assume:

$$\frac{di}{dn} < 0, \frac{d^2i}{dn^2} > 0, \lim_{n \rightarrow \infty} i = i_d \in \mathbb{R}$$

Joint risk (R)

The risk shared through joint liability within a group is initially lower for its members, insofar as and to the extent that one or more of these conditions are true: (1) The assortative matching reduces adverse selection and ex-ante and ex-post moral hazard (Ghatak, 1999; Guttman, 2008; van Tassel, 1999); (2) The group of borrowers diversifies risk to the extent that its members are heterogeneous, which we assume to be the case; (3) Group lending can enhance repayment and reduce overall risk, although the magnitude of this effect depends on the strength of social ties and the structure of liability (Breza, 2012; de Quidt et al., 2016). Group lending, whether under full or partial liability, functions

as a form of *self-insurance* against default risk, thereby reducing the lender's exposure and, consequently, the cost of credit (Krause, 2025).

However, the shared risk increases as the number of members rises, because: (1) A larger group reduces members' ability to select and monitor one another effectively; (2) *Contagion effects* may emerge due to joint liability, as the default of one member increases the burden on others (Ma et al., 2021; Sui et al., 2020). Social contagion may also occur when some members fail to meet social objectives when linked to the credit, reducing the expected benefits of network participation.

Formally, we assume:

$$\frac{dR}{dn} > 0, \frac{d^2R}{dn^2} > 0$$

where R can be derived following Krause (2025)⁵, who assumes homogeneous returns and risks across borrowers and no moral hazard or adverse selection. In contrast, we relax these assumptions, allowing for heterogeneous probabilities and increasing R with n , that is, assuming that each additional member added to the group is, on average, riskier than the previous one.

Group cost (C_g)

The cost of establishing and managing the network contract includes training, coordination, and monitoring expenses, as well as costs arising from information asymmetries and behavioural risks such as adverse selection, moral hazard, and free riding. These factors increase transaction costs and may undermine cooperation within the group (Cafaggi, 2011; Nicolau & Mas, 2014; Scott & Triantis, 2005). Such risks tend to rise with the number of members, as larger groups experience weaker reciprocal control due to reduced mutual knowledge and weaker social ties. In turn, this amplifies the

⁵ $R = \sum_{m=0}^n \binom{n}{m} \pi_m^{n-m} (1 - \pi_m)^m m$. Where n is the number of group's member, m the number of agents failing to pay back, and π_m the m -th agent probability not to pay.

potential for moral hazard and adverse selection. This assumption is equivalent to stating that social ties mitigate risk, but as the group expands, these ties weaken, thereby increasing the likelihood of opportunistic behaviour, especially in local projects involving geographically or socially proximate actors (Bourjade & Schindele, 2012; Stiglitz, 1990; Van Tassel, 1999)). Formally we assume:

$$\frac{dC_g}{dn} > 0, \frac{d^2C_g}{dn^2} > 0$$

Economic rate of returns (r)

We assume that the group increases its members' revenues as the number of members grows, due to *economies of scale*, *network effects*, and *knowledge sharing* typical of network contract (Becattini, 2017; Becchetti et al., 2025; Cafaggi, 2011; Cisi et al., 2016; Pastore et al., 2020). These effects lead us to an increasing but increasing always less effect of the number of members. Formally we assume:

$$\frac{dr_g}{dn} > 0, \frac{d^2r_g}{dn^2} < 0, \quad r_g(n = 1) = r_a = \text{constant} \geq 0$$

Where r_a represents the return rate when an agent borrows individually, and r_g denotes the return rate obtained within the group lending with network contract.

Simplifications

We review here the rationale behind the other minor assumptions adopted in the model. The purpose of the following assumptions is to delimit the analytical framework and achieve an adequate balance between approximation and representativeness.

Temporal dimension: the loan is repaid in a single period. Although in reality repayment typically occurs through instalments, this simplification allows us to focus on the core mechanisms

Borrowers' probability of success (π) and risk ($1-\pi$): the probability of project success and the associated risk are assumed to be independent across borrowers, following Krause (following (Krause, 2025)).

Financing options: borrowers can finance their projects either individually or as part of a group; no alternative funding sources (e.g., savings, other credit instruments) are considered.

Repayment rule: borrowers can repay the loan only from project revenues. Consequently, there exists a risk that the lender may not be repaid. Under joint liability, if one member defaults, the others cover the shortfall up to the limit of their own project returns (as in (Krause, 2025)).

Rational behaviour: borrowers are profit maximizers and choose to borrow only when the *actual value* is positive. In particular, each agent selects the option with the highest actual value among: not borrowing, borrowing individually, or borrowing in a group.

Moral hazard: ex-post moral hazard is ruled out, as group members are bound by a contractual agreement and heterogeneity among agents makes collusion unlikely.

Government objective: the government is assumed to maximize aggregate welfare, prioritizing the *collectivistic* welfare criterion over fairness considerations.

Functional properties: all functions are assumed to be continuous and twice differentiable in the number of members, n , even though n is discrete, to facilitate the analysis.

Parameter domains: the interest rate (i), the deposit rate (i_d), the economic rate of return (r), the social rate of return (s), and the probability of success (π) are all positive real numbers between 0 and 1 (inclusive). The loan amount (L) is also a positive real number.

3. MODEL

This section develops a model, grounded in the literature and the assumptions outlined above, to describe the conditions under which *group lending* may be preferred to *individual loans*, how it can generate internal transfers among members, and how it may maximize welfare by addressing the *collective market failure*. The model's dynamics are subsequently used to identify the policy measures that enable and optimize the *Network Basket Loan (NBL)*.

3.1. Borrowers' decisions

Alone

An agent borrows individually if doing so yields a positive actual value ($AV_a > 0$).

$$AV_a = \pi(1 + r_a)L - (1 + i_a)L$$

where π is the probability of project success in the next period, L is the gross loan amount, r_a is the economic rate of return, and i_a is the interest rate. The subscript a denotes the case of an agent borrowing alone, distinguishing it from the group case (g).

Group

The actual value of *group lending* (AV_g) equals the individual case, adjusted for the expected loss due to the default of other members (R) and the transaction cost of establishing and managing the network:

$$AV_g = \pi(1 + r_g)L - (1 + i_g)L - C_g - R(1 + i_g)L$$

Decision to join

An agent finds it convenient to join the group if its actual value within the group is higher and positive:

$$AV_g > AV_a \geq 0$$

For simplicity, we assume $AV_a \geq 0$ and omit it in the comparison. Hence, the joining condition becomes:

$$\pi(1 + r_g)L - (1 + i_g)L - C_g - R(1 + i_g)L > \pi(1 + r_a)L - (1 + i_a)L$$

Rearranging the terms:

$$\pi(1 + r_g)L + (i_a - i_g - (1 + i_g)R)L - C_g - \pi(1 + r_a)L > 0$$

Optimal number of members

The optimal number of members, n^* , that maximizes the actual value obtained within the group, can be derived from the first-order condition of AV_g

$$\frac{d[\pi(1+r_g)L + (i_a - i_g - (1+i_g)R)L - C_g]}{dn} = 0$$

which yields the condition:

$$\pi \frac{dr_g}{dn}(L) - \frac{di_g}{dn}(1+R)L = \frac{dC_g}{dn} + (1+i_g) \frac{dR}{dn}L$$

The optimum is achieved where the *marginal benefits*, represented by the higher economic returns $\pi \frac{dr_g}{dn}L$ and the lower interest rate $-\frac{di_g}{dn}(1+R)L$, equal the *marginal costs*, given by the higher transaction costs $\frac{dC_g}{dn}$ and the increasing shared risk $(1+i_g) \frac{dR}{dn}L$.

Note that, although the functions are assumed to be continuous, *group lending* is meaningful only for $n \geq 2$. In particular, when $n = 1$ (an agent borrowing alone), both R and C_g are zero. Hence, the agent's decision, whether to abstain from borrowing, to borrow individually, or to join a group, must be based on a comparison of the corresponding actual values.

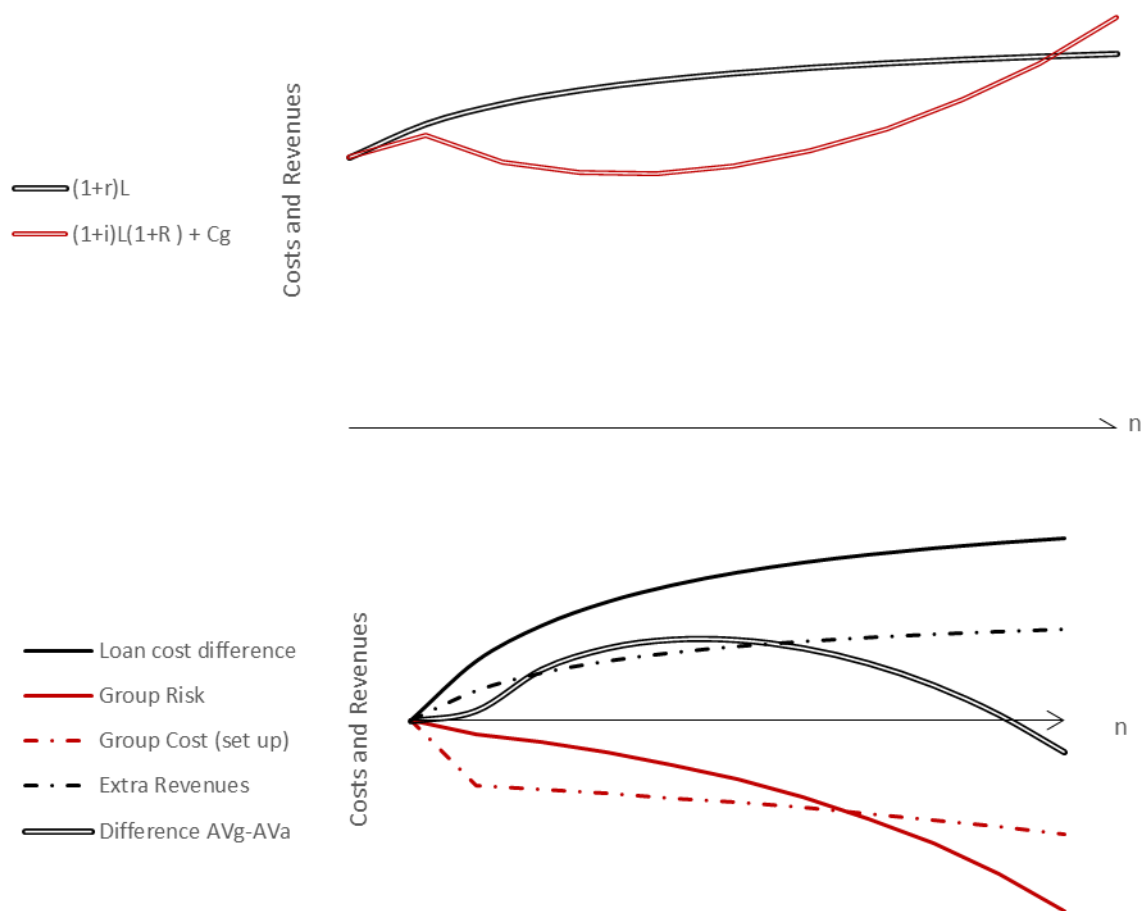


Figure 1 illustrates an example with the difference between the actual value obtained within the network and that obtained individually.

Preliminary results

That the actual value at the optimal group size ($n \geq 2$) being higher than the individual value, or even positive, is not necessarily guaranteed. This occurs particularly when the increase in economic returns is too weak, the reduction in the interest rate is limited, or these advantages are offset by high network and shared-risk costs. Such situations arise, for instance, when there are no significant economic synergies among members, when their risks are homogeneous and correlated, or when weak social ties, limited trust, and scarce mutual knowledge hinder cooperation. These conditions explain why

group lending tends to be especially suitable for development projects involving local or closely connected agents.

When group lending has a higher actual value, allowing its implementation increases aggregate welfare, since the welfare of the parts is higher. Moreover, every time an agent alone has an actual value that is negative but a positive actual value within the group, group lending provides both financial inclusion and welfare growth. Territories where synergies and trust among agents are stronger obtain greater benefits from this type of policy, which explains why, among countries, Italy and its district tradition were the first to implement NBL (see Appendix).

3.2. Transfers and Policies

Transfers

When the group has a higher actual value (see Figure 1), the surplus obtained by joining the group can be partially transferred to another member, provided that it remains advantageous to participate. Formally, the transfer that makes an agent indifferent between joining the group and borrowing individually is defined as

$$t^*: AV_g - AV_a + t = 0$$

Whenever the inclusion of a member who does not individually satisfy the joining condition generates a *maximum transfer differential* greater than the amount required to make participation beneficial, group lending provides an incentive for a *spontaneous internal transfer* to that economically weaker agent. This mechanism extends credit access to otherwise excluded members and, in turn, reduces financial inequality within the network.

Formally, let one agent, A , have a maximum transferable surplus $t_A^* > 0$, and another agent, B , have $t_B^* < 0$. If $t_A^* - t_B^* > 0$, then there exists a feasible transfer t_{AB}^* such that $t_A^* > t_{AB}^* > t_B^*$. Under this condition, both agents find it convenient to join the network, as their actual value from participating

in the group exceeds their respective actual values from borrowing individually and, consequently, a lending group can be formed.

NBL threshold

In the *Network Basket Loan (NBL)*, access to credit requires that the group as a whole generates a *positive social actual value*. The individual social actual value, AV_g^s , can be obtained by substituting the *economic rate of return* with the *social rate of return* (s), assuming—as we do—that all other costs already reflect social costs:⁶

$$AV_g^s = \pi(1 + s_g)L - (1 + i_g)L - C_g - R(1 + i_g)L$$

The *aggregate social actual value* of the group is given by the sum of the members' individual values. Imposing a threshold on a positive aggregate social actual value for a group of n agents is therefore equivalent to stating that the loan is granted if $\sum_{j=1}^{j=n} AV_g^s > 0$.

Because of transfers, and under the conditions discussed earlier, the *aggregate economic actual value* of a group is always positive, since each member has a positive individual economic value (after transfers). However, it is possible for the aggregate *economic* actual value to be positive while the aggregate *social* actual value remains negative. For this reason, group lending alone may not ensure social sustainability, and the imposition of a threshold on social value becomes necessary.

What follows demonstrates that, by imposing this threshold—even without full compensation and, in particular, when compensation (i.e., internal transfers partially covering externalities) is only partial—the aggregate welfare achieved under the NBL is higher than that obtained through individual lending alone.

⁶ Perhaps it is less obvious that the risk should be considered a social cost. Nevertheless, insofar as it reduces the expected actual social value, and insofar as risk itself, if not well managed, can generate contagious effects and externalities, it is a legitimate social cost (Bocola & Lorenzoni, 2020; Farhi & Werning, 2016; Jeanne & Korinek, 2010; Lorenzoni, 2008).

Policies

Government, in case of group lending, may alter the actual value of the group by means of a transfer, reduction in the deposit rate i passed through to i_g , a public guarantee that lowers the default risk borne within the group (R), and a subsidy to cover group formation and monitoring costs C_g . However, these policies affect the optimal group size and, by this way, transfer costs to the government such as collective risks. While these costs are not different in nature from a direct transfer, their inference with the group size make it complex or costly to quantify and, as such, their benefits risk to be offset by cost.

A *lump-sum* transfer does not depend on n and enters AV_g additively, therefore it does not distort the optimal group size n^* . A *Deposit rate reduction*, lower i_d that in turn decreases i_g and $\frac{di_g}{dn}$, which in turn increases n^* , enlarging the group and potentially pushing it beyond the efficient size by making credit too much accessible. A *Guarantee on others' default* reduces the level R and its slope dR/dn , accordingly, increases n^* and distorts the optimal size by altering the group risk faced by the group. *Covering group costs* reduces the *marginal* cost of adding members, that is, lowers dC_g/dn , which rises n^* . Only a *pure fixed set-up subsidy*, that is the lump-sum transfer, would be neutral with respect to n^* .

Only a lump-sum transfer does not affect the optimal group size. However, since the implementable group size is an integer, small policy-induced shifts may leave n^* unchanged; when this occurs, we say that the instrument is acceptable in *quantic* terms. In general, assigning a transfer to the group is justified insofar as it increases aggregate welfare net of the social cost of the transfer. Other policies, instead, imply transfers on less observable dimensions—such as group risk—which would require additional evaluation efforts whose cost generally outweighs their benefit.

3.3. The collectivistic solution of NBL

In this section, we compare *compensatory instruments*—such as impact bonds or other mechanisms that reward (or penalize) agents for their externalities—with *collectivistic instruments* such as the *Network Basket Loan (NBL)*. Building on the theoretical debate outlined in the literature review, we formalize the two types of market failure—*individualistic* and *collectivistic*—and demonstrate that the NBL resolves the latter, thereby achieving a higher aggregate welfare. For simplicity, we set $\pi = 1$, which simplifies the algebra without altering the underlying logic.

Individualistic market failure

An *individualistic market failure* occurs whenever credit is granted but the social actual value is lower than the cost of credit, or when credit is denied even though the social value is higher than the credit cost. Formally:

$$\textit{financed and } AV_a^S < 0, \quad \textit{not financed and } AV_a^S > 0$$

In actual markets, *financed* is the condition $AV_a > 0$. because lending decisions are based on the borrower's ability to repay. Accordingly, the individualistic market failure can be rewritten as:

$$AV_a > 0 \textit{ and } AV_a^S < 0, \quad AV_a > 0 \textit{ and } AV_a^S < 0$$

Internalization through a tax or subsidy t would entail $AV_a^S = AV_a + t$. When this occurs, there is no individualistic market failure , since the condition become $AV_a^S = AV_a + t > 0 \textit{ and } AV_a^S = AV_a + t < 0, AV_a^S = AV_a + t > 0 \textit{ and } AV_a^S = AV_a + t < 0$ that has contradictions on both sides (i.e., is false).

Collective market failure

A *collectivistic market failure* arises when a set of n projects, which together could increase social welfare, are not financed—fully or in part—when evaluated individually. Formally, such a failure exists when

$$\exists j \in [1, n]: AV_{a_j} < 0 \wedge \sum_{j=1}^{j=n} AV_{a_j}^s > 0$$

Where j represents the project(s) having not sufficient returns to get credit. In other words, the market fails to finance combinations of projects that collectively generate a positive net social value but individually do not satisfy their budget constraints.

The aggregate budget constraint

The aggregate welfare condition $\sum_{j=1}^{j=n} AV_{a_j}^s > 0$ is not necessarily satisfied through full internalization. Full internalization presumes that transfers t_j can be implemented wherever needed, yet this is possible only if sufficient resources exist for such transfers. The *aggregate budget constraint* requires that the actual economic value generated be non-negative, both individually (first row) and collectively (second row):

$$\text{Aggregate budget constraint: } \left\{ \begin{array}{l} \forall j \in [1, n]: AV_{a_j} + t_j \geq 0 \\ \sum_{j=1}^{j=n} [AV_{a_j} + t_j] \geq 0 \\ \sum_{j=1}^{j=n} AV_{a_j}^s > 0 \end{array} \right.$$

Consider the case where it exists a vector of transfers $T^* = [t_1^*, t_2^*, \dots, t_n^*]$ such that the constraints are all satisfied. Let the vector of full compensatory transfers be $T = [t_1, t_2, \dots, t_n]: \forall j \in [1, n]: AV_{a_j}^s + t_j = 0$. If the resulting allocation violates any budget constraint (i.e., $\exists j \in [1, n]: AV_{a_j} + t_j < 0$) then the number of viable projects decline from n to m . Consequently, the total resources available for redistribution change ($\sum_{j=1}^{j=m} [AV_{a_j} + t_j]$) and so does the aggregate welfare ($\sum_{j=1}^{j=m} AV_{a_j}^s$).

This leads to three possible cases:

1. When such internalisation is not financially sustainable ($\sum_{j=1}^{j=m<n} [AV_{a_j} + t_j] < 0$), full compensation becomes impossible because there are not enough resources. In this case, enforcing full compensation instead of a feasible, non-full compensatory set of transfers leads to collective market failure. Conversely, imposing a non-full compensatory set of transfers generates individual market failure. The two objectives, therefore, are in conflict.
2. When such internalisation is financially sustainable ($\sum_{j=1}^{j=m<n} [AV_{a_j} + t_j] \geq 0$) and
 - a. the aggregate welfare does not decline ($\sum_{j=1}^{j=m<n} AV_{a_j}^s \geq \sum_{j=1}^{j=n} AV_{a_j}^s$), then full compensation is feasible and aligned with collective welfare.
 - b. the aggregate welfare declines ($\sum_{j=1}^{j=m<n} AV_{a_j}^s < \sum_{j=1}^{j=n} AV_{a_j}^s$), then full compensation remains feasible but is not aligned with collective welfare.

The two objectives, individual fairness and collective welfare, can therefore conflict. In this sense, whenever financial instruments adopt a compensatory logic, that is, when each project or organization is evaluated and rewarded solely according to its own social return, without accounting for aggregate interactions, there is a risk of generating a collective market failure.

This occurs, for instance, in Social Impact Bonds, Pay-for-Results schemes, or other outcome-based impact finance instruments (Gustafsson-Wright, E., Gardiner, S., & Putcha, V., 2015; Tortorice et al., 2020; Trotta et al., 2021), which link remuneration or access to funding to the individual agent's measured impact performance. By design, these mechanisms ensure fairness—each actor is compensated in proportion to their contribution—but they may fail to finance combinations of agents whose joint action would generate a higher aggregate welfare. Similarly, Social Basket Bonds or other portfolio-based structures that evaluate projects independently within the same vehicle remain compensatory when they lack joint performance thresholds or internal redistribution mechanisms.

Conversely, instruments such as the Network Basket Loan replace this compensatory approach with a collectivistic one, assessing creditworthiness at the group level and enabling internal transfers

among members. NBL can *endogenously resolve collectivistic market failure* by allowing internal adjustment among participants, provided that the aggregate social net value remains positive.

4. DISCUSSION

4.1. Interpretation of the results

The model developed demonstrates that the *Network Basket Loan* transforms traditional group lending into a welfare-maximizing, impact-aligned mechanism by combining *joint liability*, *network synergies*, and *internal transfers* under a collective social constraint. Its distinct contribution lies in endogenizing *group composition and transfers*: the number of members and the internal redistribution are jointly determined by the equilibrium between (i) increasing economic and social returns from cooperation and risk-sharing, and (ii) the rising coordination and shared-risk costs as the network expands.

Unlike standard group-lending models, where the benefits of risk pooling are purely financial, the NBL introduces a welfare criterion that governs credit eligibility: the group gains access to credit only when its *aggregate social actual value* is positive.

The model shows that *partial compensation* within the group can achieve the same or higher aggregate welfare outcome that full compensation would, because the latter imposes a rigid burden that is more likely to violate some of the agents' budget constraints. Internal transfers redistribute part of the surplus from stronger to weaker members, enabling participation of otherwise non-bankable but socially valuable agents. This endogenous adjustment substitutes for exogenous subsidies and prevents the *collective insolvency* that full Pigouvian internalization might induce.

The comparative-statics analysis highlights that public instruments can either support or distort this equilibrium. *Lump-sum transfers* to the group enhance welfare without affecting the optimal group size, while *guarantees*, *interest-rate reductions*, or *cost subsidies* shift the marginal conditions that

determine optimal group size. When these shifts are small, they remain acceptable; when large, they undermine efficiency by over-expanding the network or externalizing risk. Thus, policy effectiveness depends on *neutrality*—interventions that correct unpriced social value without altering the group’s endogenous structure.

Taken together, these results position the NBL as a *collectivistic alternative to compensatory instruments* such as Social Impact Bonds or Pay-for-Results schemes, which reward agents individually and therefore risk under-funding welfare-maximizing combinations. By internalizing cooperation and linking credit access to aggregate social value, the NBL operationalizes the *collective version of Coasean efficiency*: it corrects market failures that arise not from missing prices and property rights, but from missing groups synergies and aggregate budget constraint.

4.2. Critical aspects

There are a few aspects that deserves attention when implementing NBL. Here we debate the role of ESG certification on firms’ return, the ESG evaluation limitations, the local synergies and the genius loci, the risk connected with public guarantee on loan and the state aid and market neutrality potential limit.

ESG evaluation impact on economic returns

ESG evaluation and disclosure provide benefits to the agents and the group, especially when it was not already accessible to the agent alone or when it would have not a positive evaluation. A positive ESG evaluation increases the organization’s demand, which pays a premium to sustainable products, and by this way the economic returns (Becchetti, 2011; Becchetti & Salustri, 2019). Demand sensibilization has been proved effective into reward ESG investments also because these often perform better than non-ESG investments (Bocchialini et al., 2024). Disclosure frameworks, such as the EU Sustainable Finance Disclosure Regulation and the Task Force on Climate-related Financial

Disclosures, by enhancing transparency, comparability, and accountability across markets reduce information asymmetries and enable investors to integrate ESG risks and impacts into their decision-making processes (Hummel & Jobst, 2024; Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector, 2019; Schoenmaker & Schramade, 2019). Adherence to ESG guidelines, such as the Social Bond Principles and the Green Bond Principles (ICMA, 2021), even if voluntary, increase the investors trust and demand (Bolton & Kacperczyk, 2021).

ESG evaluation limits

ESG evaluation and risk assessment are inherently subject to substantial measurement and methodological uncertainty. Divergence across ESG rating providers is often large, driven by differing definitions, weighting schemes, missing data, and imputation choices (Jagrič et al., 2025). Moreover, empirical work shows that rating uncertainty meaningfully affects portfolio optimization: when analysts account for rating dispersion or disagreement, the efficient frontier shifts (Avramov et al., 2022).

On the data side, ESG datasets frequently contain gaps and missing observations, forcing the use of imputation techniques whose assumptions introduce additional uncertainty. Caprioli et al. (2025) quantify this uncertainty via prediction intervals, showing that small changes in imputation methods can lead to materially different ESG scores. Similarly, frameworks such as the “Missing pillar” approach argue that unreported information should be treated explicitly as a latent uncertainty dimension (Sahin et al., 2022).

Finally, policy and regulatory uncertainty further compound the problem: shifting climate, social, and governance regulations create ex-ante ambiguity about how firms’ ESG efforts will be judged, complicating both credit risk and impact forecasts (Ge & Zhang, 2025).

For NBLs, this implies a double burden: uncertainty permeates both the credit risk assessment and the social impact evaluation of networked portfolios.

Genius loci and local development

The network emergence passes across the development of trust relationships among its members, which in turn concurs to develop the local social capital, generating a positive externality. The network contract embodies a shared objective and fosters a sense of common identity and culture; when the objective aligns with local, multidimensional, and sustainable progress, as in the NBL case, it is embedded in the region's identity and culture. This common culture and identity is a fertile ground for the emergence of territorial districts and the associated high specialization, productivity, social and human capitals (Becattini, 2017; Cafaggi, 2011; Pastore et al., 2020). The NBL could be an effective tool to nourish the genius loci—the spirit of place—, a cultural heritage transforming static identity into dynamic identitarian processes, a fruitful cultural, social and productive (in multidimensional terms) ecosystem leveraging both instrumental and intrinsic values (Girard & Vecco, 2019).

Partial guarantee

In the previous section we demonstrated that public guarantee on loan transfer the risk from the lending group to the government and by this way they reduce the welfare. Here we stress this argument by highlighting that such a risk transfer is in fact a negative externality and that risk decreases welfare. Individual or group decisions of excessive private risk-taking and debt exposure, which occur when interest rates fail to adequately reflect underlying risks, thereby generating negative spillovers and aggregate effects among agents interconnected within the financial system (Bocola & Lorenzoni, 2020; Farhi & Werning, 2016; Jeanne & Korinek, 2010; Lorenzoni, 2008). High financial risk, as captured by the variance or volatility of returns or the probability of project failure, can depress social welfare because it raises the cost of capital and suppresses investment in projects with positive but uncertain payoffs. In a stochastic endogenous growth framework, Xu (2017) demonstrates that increased volatility slows capital accumulation and diminishes long-run consumption growth, generating welfare losses for risk-averse agents. Complementing this

theoretical perspective, recent cross-country evidence shows that macroeconomic uncertainty imposes significant welfare costs, with losses often comparable to substantial fractions of the gains from growth (Aurland-Bredesen, 2021). Hence, public guarantee on the one hand increases the risk exposure decreasing welfare, on the other it may avoid contagious effects due to a chain of failures (Ma et al., 2021; Sui et al., 2020). This aspect demands further research.

State aid and market neutrality

Public support measures associated with the NBL, such as subsidies or guarantees, must also be assessed in light of State aid and market neutrality principles. Under Article 107(1) of the Treaty on the Functioning of the European Union, any measure that confers a selective economic advantage and has the potential to distort competition constitutes State aid unless justified by overriding public interest. In the case of loan guarantees or subsidized credit, the advantage arises when risk or cost is transferred to the State without an equivalent market-based fee, as clarified in the European Commission's *Notice on State Aid in the Form of Guarantees* (Rubini, 2009). Consistency with market economy operator principles therefore requires that guarantees be risk-priced and that subsidies remain proportionate, transparent, and non-discriminatory. From this perspective, the lump-sum transfer identified by the model as welfare-neutral also satisfies competition neutrality, while recurrent or selective aids, such as guarantees or cost coverage, may create unintended advantages and distort market incentives (Altavilla et al., 2025).

4.3. Difference with other social impact instruments

The Network Basket Loan differs from existing social finance instruments in both structure and purpose.

Unlike Social Impact Bonds, which rely on external outcome payers and contractual chains to enforce impact, the NBL internalizes coordination and incentives within the borrower network itself, reducing transaction costs, promoting synergies, and concurring to avoid collective market failures.

Traditional Social Basket Loans and Social Basket Bonds pursue efficiency mainly through aggregation—pooling multiple borrowers or projects to reduce administrative costs or diversify risk—but they continue to evaluate each component individually. The NBL instead evaluates and rewards the *group as a whole*, conditioning access to credit on the group’s aggregate social performance and introducing joint liability among members.

Compared with Social Basket Bonds, which operate through capital markets and thus require high fixed costs for structuring, certification, and external verification, the NBL operates within a network contract among borrowers. This framework drastically reduces transaction and certification costs while maintaining low interest rates, thanks to the dual effect of risk sharing and network synergies such as cooperation, information exchange, and trust.

Relative to Social Basket Loans, the NBL goes beyond simple loan aggregation. It transforms the financial relationship into a mutual responsibility mechanism: members are jointly liable, and public support (interest-rate reductions, guarantees, or subsidies) depends on the collective social outcome. This creates internal incentives for coordination and solidarity that are absent in standard lending instruments.

In summary, while SIBs, SBBs, and SBLs remain compensatory instruments, assessing performance project by project, the NBL is collectivistic and relational, aligning credit access with aggregate welfare rather than individual performance. It is therefore most suitable in contexts with fragmented but interdependent actors, such as local ecosystems of SMEs, nonprofit organizations, and social enterprises, where cooperation itself becomes a productive asset.

4.4. Further insights and research trajectory

Final remarks

The first Network Basket Loan pilot has been launched in *Friuli Venezia Giulia*, Italy. Its operational features are presented in the Appendix. This paper aimed to provide the economic rationale behind

the instrument and to model the fundamental dynamics that explain its effects on credit access, welfare, and social cohesion. While the original goal was to integrate actors with limited economic solidity and restricted access to credit, the outcomes have exceeded expectations, demonstrating that the NBL can evolve into a replicable and structured financial mechanism for sustainable development, an instrument different from others because it fosters local synergies and is capable to avoid the collective market failure.

Nevertheless, significant challenges remain. Transforming a simple “basket” of loans into a synergic network capable of generating collective benefits requires specific enabling conditions: a shared objective, complementary capabilities, trust, and cognitive proximity among participants (Arrow, 1974; Becattini, 2017; Boschma, 2005; Cafaggi & Iamiceli, 2010, p. 4; Gorga & Halberstam, 2007; Oxley, 1997). A further challenge lies in the measurement and verification of social impact, which, as discussed in Section 4.2, remains subject to substantial uncertainty in ESG evaluation and reporting. Moreover, the policy environment must ensure that public support—through subsidies, guarantees, or concessional rates—does not distort competition or create selective advantages, as warned by the literature on State aid and market neutrality (Altavilla et al., 2025; Rubini, 2009). Designing support schemes that are impact-based yet competition-safe remains a crucial research and policy frontier.

Future research will build on the results of the pilot’s implementation to evaluate its long-term sustainability, the behavioral dynamics of network participants, and the macro-level welfare effects of collective lending. Empirical analysis of these dimensions will be essential to refine the theoretical model and guide the scaling-up of NBLs in other regions and contexts.

5. CONCLUSIONS

By analysing the budget constraint in credit markets, the distinction between *individualistic–compensatory* and *collectivistic–welfarist* instruments becomes evident. In compensatory systems,

each project must independently internalize its externalities and satisfy its own financial balance. While this condition ensures fairness, full compensation at the individual level may violate the aggregate budget constraint, as projects required to offset their negative externalities completely may no longer be financially viable. When such projects would otherwise generate the resources or complementarities needed to sustain others with positive externalities, the aggregate welfare outcome becomes suboptimal (*Partial Selection Market Failure*). The *Network Basket Loan* addresses this limitation by allowing *partial internal compensation* among members of the network. Through transfers within the group that enable the collective to reach a positive social actual value without requiring full individual compensation, the NBL helps satisfy the overall budget constraint and finance the aggregate project—an outcome that full individual internalization alone may fail to achieve.

The analysis provides several key insights that extend both theory and policy in sustainable finance. First, it formalizes a new type of market failure—Partial Selection Market Failure—arising when projects are evaluated individually rather than collectively, leading to the exclusion of welfare-maximizing combinations. Second, the Network Basket Loan offers a structural correction to this failure through three integrated mechanisms: joint liability, which lowers borrowing costs; network synergies, which enhance economic and social returns; and internal transfers, which enable inclusion of socially valuable but financially constrained agents. Third, the model identifies policy neutrality as essential for welfare maximization: while lump-sum transfers align with market-neutrality and State-Aid principles, guarantees, subsidies, or interest-rate reductions may distort competition and alter optimal network size. Fourth, persistent uncertainty in ESG evaluation continues to affect both credit and impact assessment, highlighting the need for robust disclosure and verification systems. Finally, the Friuli Venezia Giulia pilot demonstrates the instrument’s practical feasibility thus suggesting the NBL’s potential as a replicable, scalable model for sustainable regional finance.

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Appendix. Pilot project in Friuli Venezia Giulia

This case study explores the implementation and operational framework of the NBL pilot in Friuli Venezia Giulia, a region in Northern Italy. The project was designed⁷ to support a network of socially and environmentally sustainable small and medium enterprises (SMEs) and non-profit organizations through a collective financial instrument based on mutual solidarity, performance-based incentives, and public guarantees.

The social objective was defined in consultation with local stakeholders and concerns the rehabilitation of abandoned houses to improve their energy efficiency and habitability, enabling them to accommodate migrants and thereby address the region's labor-supply shortage. The project also includes activities for migrant inclusion and vocational training.

Participants include construction and renovation firms, companies specialized in building energy efficiency, and non-profit organizations dedicated to migrant integration and skills development. The loan has a six-year maturity, with intermediate instalments determined according to the project's implementation schedule and financial needs.

⁷ The project has not been approved in all its parts and, as such, the result may be slightly different from what presented foregoing.

Institutional Framework and Guarantee Mechanism

The regional government of Friuli Venezia Giulia provides the institutional backbone for the NBL scheme. It defines the access rules and outlines the impact evaluation framework, including the identification of responsible parties for implementation and assessment. The government with the FVG⁸ guarantees up to €30 million in loans, subject to compliance with predefined impact criteria and performance indicators. These guarantees allow participating entities to benefit from lower interest rates and potential access to other fiscal or regulatory advantages.

Role of the Financial Intermediary

The designated financial intermediary is responsible for issuing loans to both SMEs and non-profit organizations within the NBL. Each participating entity signs a mutual solidarity contract, under which the loan amounts and repayment schedules are allocated. The intermediary not only manages disbursements and repayments but also enforces collective responsibility: if a borrower defaults and fails to resolve the issue within four months, the intermediary redistributes the unpaid obligations proportionally among the remaining members. Each member's joint liability is limited to an additional 25% of their individual payment obligation. The government guarantee covers 25% of the portion of the loan that may remain unpaid.

Impact Monitoring and Evaluation

Each loan within the NBL is tied to specific ESG (Environmental, Social, Governance) performance goals. NEXT, an independent third-party evaluator, assesses both individual and aggregate ESG outcomes of the network. Evaluations are conducted periodically, and results are communicated to both the intermediary and the regional authority. If the network as a whole meets its impact targets, it continues to benefit from the initial conditions of the loan, including the reduced interest rate and access to the regional guarantee. However, penalties apply in case of underperformance: a 10%

⁸ Fondo Centrale di Garanzia per le PMI, a guarantee fund for SMEs made by the Italian Ministry of Made in Italy.

reduction in benefits after one year of failure, 30% after two years, and 100% after three years. In such cases, the intermediary increases loan repayments accordingly to recover the cost of lost benefits. Should the network realign with its targets, benefits may be reinstated and the additional repayments adjusted.

Internal Governance: The Role of the Network Manager

Upon formation, the NBL network designates a manager. This figure is responsible for internal coordination, communication of ESG performance to members, and facilitation of corrective actions in case of difficulties. Any member anticipating difficulty in repayment or target achievement must notify the manager, who seeks solutions through intra-network cooperation. The manager may also propose simplified internal transfer mechanisms, such as intra-network transfers between members, to maintain the financial and impact equilibrium. This flexibility is designed to enhance collective resilience and preserve the integrity of the NBL structure. Its cost is one of the most important, and will be subsidised by the government.

Final Safeguard: The Public Guarantee

If the network fails to recover and defaults persist, the financial intermediary may activate the public guarantee for the unpaid portion of the loans. This mechanism ensures systemic risk containment and preserves confidence in the NBL framework.

Final remarks

In our case study analysis, a public guarantee of €30 million enabled a total leverage of €120 million in Network Basket Loans. While the market interest rate is 3%, the effective rate has been reduced to 1.5% thanks to the lower aggregate risk of the basket and related governmental incentives and guarantee. The portion of the saved interest cost, €6'532,56, could be redirected to finance positive externalities and amounts to 21.6% of the guaranteed amount. Overall, the Network Basket Loans model implemented in Friuli Venezia Giulia represents an innovative financial infrastructure. By

integrating ESG metrics, mutual solidarity, and impact-based conditionality, it offers a scalable model for sustainable regional development.