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# Financing the transformation: A proposal for a credit scheme to finance the Paris Agreement

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## Abstract

To achieve the goals of the Paris Agreement, massive investments in the real economy are needed. We propose providing long-term interest subsidized loans to companies investing in sustainable projects with the primary goal of greenhouse gas neutrality. In detail, we propose linking loan interest rates to the EU Taxonomy and to future CO<sub>2</sub> prices. These links incentivize companies to decarbonize. Furthermore, this link can hedge companies against volatile CO<sub>2</sub> prices and incentivizes companies to make their business models more sustainable. Both elements support the transformation process of the economy.

### *Key policy insights*

- By linking an interest rate discount to the investment's alignment with the EU Taxonomy, companies are incentivized to invest climate-friendly even at low CO<sub>2</sub> prices.
- By coupling the interest rates to future CO<sub>2</sub> prices, the loans act as a hedge, which helps emission reducing activities when they need it the most.
- Additionally, these loans set incentives for companies to disclose their alignment with the EU Taxonomy and signal their exposure to CO<sub>2</sub> price risk, while helping governments to commit to their policy goals.

*Keywords:* Carbon pricing, policy failure, financial incentives, interest rate subsidy, EU Taxonomy

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## 1 Introduction

Compliance with the Paris Agreement requires a profound transformation (transition) of the economies of the signatories. Large-scale investments are necessary to reduce emissions to achieve an ambitious temperature target while adapting to unavoidable climate change impacts due to global warming of 1.5°C to 2°C. Avoiding the otherwise severe economic damages makes economic sense (Hsiang et al., 2017), however, the required investments are immense (European Commission 2018, Table 10). For the

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European Union alone, annual investments (the average investment from 2016 to 2050) are estimated to be as high as 263 (302) billion US dollars for the 2°C (1.5°C) limit (McCollum et al., 2018).

Mobilizing private investments along this long-term transformation path requires financial incentives for companies. A sustainable economic stimulus programme could support and guide companies during this transformation. In the following sections, we introduce a specific design for a stimulus that couples financial incentives to the goal of greenhouse gas neutrality.

The core ideas are, first, to make companies eligible for preferential loans at discounted lending rates to the extent that the financed activities support greenhouse gas neutrality. This creates an incentive for decarbonization. And second, to link the lending rate to future CO<sub>2</sub> prices such that it reduces financial risks for companies.

Our suggestion builds on the availability of a classification system to identify eligible activities. For this purpose, we use the EU Taxonomy (TEG 2020) as a prime example, which is by now very well developed and destined to be the central benchmark for the necessary transformation process.<sup>1</sup> Of course, alternative indicators that capture the alignment of companies or investment with the goals of the Paris Agreement could be used. Shortcomings of climate policy are reflected by the difference between the actual CO<sub>2</sub> price compared to a climate-economically optimal CO<sub>2</sub> price.

Our initial presentation focuses on the debt financing of companies, but the idea is easily transferred to project finance as well as to equity financing and hybrid finance.

## **2 Related approaches in literature and practice**

The concept of strengthening climate finance by creating a link between financing conditions and climate policy is not new. This concept includes suggestions to provide a hedge against climate policy risk, to subsidize debt financing, or to aim to do both. For example, index-linked carbon bonds offer a hedging function that is similar to our proposal but without providing a subsidy, since these bonds are meant to create revenues for the government rather than finance projects (Mainelli and Onstwedder, 2009).

While Mainelli and Onstwedder list several alternative metrics that could serve as indices of climate policy ambition, Dasgupta et al. (2019) specifically propose the social cost of carbon as a reference price, because their intention is to capture what efficient climate policy ought to achieve. Their support scheme focuses on minimizing risk by providing government guarantees.

Carbon contracts set a fixed price that governments pay for future emissions reductions, replacing CO<sub>2</sub> price uncertainty with a long-term positive cash flow (Helm and Hepburn 2005). As with reference CO<sub>2</sub> prices in our proposal, the contractually agreed CO<sub>2</sub> price can create an implicit subsidy.

A carbon contract for difference builds on this idea but remunerates emissions reductions by the difference of the contracted and the actual price of carbon (Richstein, 2018; Richstein and Neuhoff, 2019). Rather than eliminating price uncertainty, contracts for difference more broadly provide a hedge against transition risks.

The EU Green Deal has already created a rapidly increasing demand for green debt products, as reported by the European Investment Bank (EIB 2021). In response to the EU Green Deal, the European Investment Bank (EIB), which is one of the largest financers of climate action projects in the world, is working to expand its range of green debt instruments (EIB 2020), which provide finance at preferential interest rates to eligible investors. The EU Taxonomy and the EU Green Bond Standards will be central tools to determine eligibility. These initiatives in principle address the same demand as the proposed

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<sup>1</sup> Although the EU Taxonomy is destined to become a widely used standard, it has been subject of some debate. In particular, the decision in early 2022 to label natural gas fired power plants (although only if they replace “dirtier” alternatives and can burn clean fuels such as hydrogen in the future) and nuclear power plants (also under specific conditions) as “green” has been criticized by politicians, environmental NGOs as well as large investors.

lending rate discounts in this study. Indeed, state investment banks, such as the EIB or sovereign funds, are fitting institutions to implement the proposed discounts.

Our proposal goes beyond existing green debt products and contributes to the literature in four ways. First, in contrast to an either-or test for eligibility (e.g. the activity sector of the beneficiary as an eligibility criterion), linking interest rate discounts to the degree of Taxonomy alignment creates a more nuanced incentive to decarbonize and, second, sets incentives for further improvements over the entire loan term. In contrast, while the EIB bases lending decisions for some of its programmes on the EU Taxonomy, after a loan has been awarded there is no ongoing incentive to further improve the Taxonomy ratio. Our proposal provides such an incentive. Third, our idea of providing loans to companies rather than grants for specific projects allows companies to identify projects over time that increase their Taxonomy compliance. Thus, our proposal provides greater flexibility for businesses. Finally, linking lending rates to CO<sub>2</sub> prices reduces risks for companies and creates incentives for both companies and policy to realize the transformation.

### 3 Proposal for a lending rate linked to the EU Taxonomy and CO<sub>2</sub> prices

When companies use loans to finance investments, the market lending rates  $r^M$  charged by banks or the capital market are mainly determined by the company's creditworthiness. Since lower lending rates make investments more profitable, preferential financing conditions can create a steering effect for investment decisions. This section introduces two modifications to market lending rates to make sustainable investments more attractive to companies.

The first modification is a discount to reward the Taxonomy alignment of companies ( $d_t^{align}$ ): Companies with a higher share of activities that contribute to emissions abatement according to the classification of the EU Taxonomy are eligible to borrow at lending rates below market lending rates. The closer the alignment to the Taxonomy, the higher the discount to the market lending rates. In 3.1 we discuss operational details and further implications.

Our second modification is a component that adjusts lending rates based on future CO<sub>2</sub> prices ( $d_t^{adj}$ ): In general, uncertainty about future CO<sub>2</sub> prices creates risks for the profitability of emissions reductions and lowers the attractiveness of such investments. Activities that reduce emissions will in general be less profitable if CO<sub>2</sub> prices remain low, especially below expected CO<sub>2</sub> prices. On the other hand, higher CO<sub>2</sub> prices make such activities more profitable. This component can hedge companies' business risks due to volatile CO<sub>2</sub> prices as a result of, e.g. policy shortfalls in carbon pricing. Therefore, this component can be positive or negative, depending on future CO<sub>2</sub> prices. In section 3.2 we introduce and discuss the coupling of lending rates to future CO<sub>2</sub> prices and how this can contribute to the low-carbon transformation.

Formally, the company-specific lending rate  $r_t$  for further periods  $t$  is calculated as:<sup>2</sup>

$$r_t = r^M - d_t^{align} - d_t^{adj} \quad (1)$$

The resulting lending rates are not constant during the loan term, but dynamically adjusted to the future Taxonomy alignment of the company and future CO<sub>2</sub> prices. Therefore, a company is continuously rewarded for further efforts to drive decarbonization and vice versa. At the same time, a company's risk is reduced since the success of a company's decarbonization activities is made less dependent on future CO<sub>2</sub> prices.

#### 3.1 Rewarding alignment with the policy objectives of the EU Green Deal

The first element of our proposal is to grant companies a discount  $d_t^{align}$  to the market lending rate depending on the degree to which their activities are aligned with the EU Taxonomy. The EU Taxonomy is a classification system designed to help investors to identify investment opportunities with positive climate and environmental impacts. Hence, the EU Taxonomy can also be used to allocate government

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<sup>2</sup> Market lending rates  $r^M$  are determined at the beginning of the credit period and are assumed to be fixed interest rates. However, allowing for variable market lending rates would be unproblematic.

subsidies, aiming to mobilize low-carbon investments. If companies are to receive state subsidized financing, the Taxonomy alignment of the (entire) company is a suitable measure for the eligibility of the company. Our focus is on limiting global warming and therefore on economic activities that are Taxonomy aligned regarding the goal of emission mitigation. However, our insights can be carried over to other environmental goals once the complete EU Taxonomy has been developed.

According to the EU Taxonomy, a company's economic activities are *Taxonomy aligned* if they positively contribute to climate change mitigation or adaptation. Larger companies are already required to report the relevant information about their Taxonomy alignment. Therefore, this information will be readily available for such companies. The degree of a company's Taxonomy alignment (between 0 and 100%)  $a_t$  is obtained by assessing the level of revenues from the Taxonomy aligned economic activities  $y_t^{align}$  of the company.<sup>3</sup> Based on the company's total revenue  $y_t$ , the share of Taxonomy aligned revenue  $a_t$  can be calculated as

$$a_t = y_t^{align} / y_t \quad (2)$$

A dynamic incentive for companies is generated by linking the lending rate discount  $d_t^{align}$  in (1) to  $a_t$ .

$$d_t^{align} = b^{align} a_t \quad (3)$$

The factor  $b^{align}$  denotes the maximum possible discount that a company could receive if all its economic activities are sustainable according to the EU Taxonomy. Companies are, therefore, rewarded for sustainable economic activities. The incentive effects are obvious: companies will have an incentive to make their economic activities sustainable. We suggest linking the discount to the company's current degree of Taxonomy alignment, which would be updated over the financing period (i.e. the future values of  $a_t$  of the company).

For the assessment of real investments, the EU Taxonomy is applied to companies' capital expenditures and operational expenditures, i.e. their longer-term fixed assets, such as machinery or buildings, and their current expenditures, such as raw materials, supplies, personnel, leasing contracts, and energy consumption. Such real investments are Taxonomy aligned if the related economic activities are Taxonomy aligned (TEG 2020, Section 3.3.13).

As a positive side effect, Taxonomy aligned financing forces financed companies to calculate and report their  $a_t$  on the basis of the EU Taxonomy to the government (e.g. via institutions like the EIB). This requirement is very conducive to both the implementation of the EU Taxonomy and to potential further EU Taxonomy applications (e.g. private financing).<sup>4</sup>

In principle, the same logic can be applied to the financing of individual projects instead of entire companies. The EU Green Bond Standards (EU GBS) define green projects as projects that comply with the requirements of the EU Taxonomy and thus offer a suitable framework to determine if projects are Taxonomy aligned. Analogous to (2), the Taxonomy alignment of a project could be measured as the part of investment aligned with the Taxonomy as a share of the total investment volume of the project. For reporting related to the project, it would be possible to follow the EU GBS here as well but would require detailed and transparent reporting on the progress and success of the project ("Allocation Reporting" and "Impact Reporting") after the awarding of the project. The impact reporting should contain information on the green projects and report on the environmental impact using metrics and thresholds.

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<sup>3</sup> Instead of an allocation via the pertinent revenue, an allocation can also be made via related earnings. For details concerning this type of allocation, see the EU Taxonomy.

<sup>4</sup> The EU Taxonomy Regulation requires capital market-oriented companies with more than 500 employees to report information on their Taxonomy compliance. However, smaller companies are exempt from this requirement.

### 3.2 Reducing risks by including CO<sub>2</sub> prices in financial contracts

The second lending rate component links the lending rates to the future CO<sub>2</sub> prices  $\tau_t$ . We propose the following operationalization, in which the lending rate adjustments  $d_t^{adj}$  depend on the differences of future CO<sub>2</sub> prices  $\tau_t$  and “intended CO<sub>2</sub> prices”  $\tau_t^*$ . The intended CO<sub>2</sub> prices are fixed when the loan is contracted.

$$d_t^{adj} = b^{adj}(\tau_t^* - \tau_t) \quad (4)$$

The loan-specific fixed factor  $b^{adj}$  determines how strong  $d_t^{adj}$  is linked to  $(\tau_t^* - \tau_t)$ . Thus, the lending rate will be more strongly reduced the further the future CO<sub>2</sub> prices  $\tau_t$  are below the intended prices  $\tau_t^*$  and the larger  $b^{adj}$  is. Taxonomy aligned activities, which may be less competitive at this CO<sub>2</sub> price, thus receive a compensation via better financing conditions and vice versa. In principle, this design corresponds to the concept where bond interest rates are linked to inflation rates or GDP.

References for the intended CO<sub>2</sub> prices are given by forward prices from CO<sub>2</sub> derivatives, if available, but can also reflect political intentions or ambitions concerning future CO<sub>2</sub> prices. In general, political intentions or ambitions are reflected by the allocation of emission permits in the European Union Emissions Trading System (EU ETS) (e.g. the EU ETS for energy, industry, and aviation emissions, and the envisioned ETS for buildings and transport emissions). Capital markets, more specifically commodity markets, translate these ambitions into spot prices for CO<sub>2</sub> and forward prices for CO<sub>2</sub> derivatives. The latter kind of prices can serve as reference prices for  $\tau_t^*$ . However, the lender (here the state) is free to fix more ambitious (that is higher) intended CO<sub>2</sub> prices. In doing so, the state creates a “focal point” for the European economy and thus supports the EU’s voluntary commitment to achieve greenhouse gas neutrality by 2050.

When  $\tau_t^*$  are equivalent to forward prices from CO<sub>2</sub> derivatives, the differences  $(\tau_t^* - \tau_t)$  provide a hedge for companies with no additional financial value or subsidy for the companies when the loan is contracted, since companies could have contracted those hedges for the same price at derivatives markets. Setting the reference price  $\tau_t^*$  above the forward prices of CO<sub>2</sub> derivatives adds an implicit subsidy to the loans.

The CO<sub>2</sub> prices necessary to achieve policy targets can be estimated based on climate-economy models,<sup>5</sup> which, however, are subject to large uncertainties and change over time with updates to the models. Therefore, the intended CO<sub>2</sub> prices for new financing will need to be iteratively adjusted as new or cheaper technologies become available or consumer behaviour changes (Edenhofer et al., 2019). It is important that these adjustments are not made ad hoc but rather according to transparent rules so as to stabilize expectations (Edenhofer et al., 2019). Of course, these adjustments only apply to new financing. Recent information on the implications of different CO<sub>2</sub> prices in terms of global warming is found, for example, in the assessment reports of the Intergovernmental Panel on Climate Change (IPCC, 2018).

The factor  $b^{adj}$  in (4) controls how sensitively the interest rate adjustment responds to future CO<sub>2</sub> prices. For a higher  $b^{adj}$ , companies receive a steeper discount if the actual CO<sub>2</sub> price  $\tau_t$  is lower than the intended CO<sub>2</sub> price  $\tau_t^*$  and vice versa. Companies are free to choose  $b^{adj}$  within a range which has to be designed to yield an appropriate interest rate adjustment when multiplied by  $(\tau_t^* - \tau_t)$ .

The company’s risk due to the uncertainty of future CO<sub>2</sub> prices is reduced by the dependency of financing payments on the actual CO<sub>2</sub> price. After all, green businesses need financial compensation in general when future CO<sub>2</sub> prices do not rise as much as is necessary to achieve the goals of the Paris Agreement. In this case, green business models would be less successful. However, this is not the result of bad business decisions, but (among other things) the consequence of an inadequate implementation of the Paris Agreement. Conversely, if the actual CO<sub>2</sub> price rises above the intended CO<sub>2</sub> price, the green companies are not (any longer) dependent on support and can afford higher interest payments. Consequently, these time-variable payments, due to their link to future CO<sub>2</sub> prices, protect companies (i.e. hedging) against non-intended changes in the CO<sub>2</sub> price – and ultimately against the difficult-to-predict

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<sup>5</sup> How to best implement CO<sub>2</sub> prices is widely discussed in the literature (e.g. Hepburn et al., 2020).

speed of the transformation process of the economy towards a green economy. Moreover, since companies are effectively reimbursed for the difference between the intended and actual CO<sub>2</sub> price, they potentially have an incentive to invest according to the intended CO<sub>2</sub> price-path.

Depending on the sensitivity between company profits and the CO<sub>2</sub> price development, it is possible to optimize  $b^{adj}$  individually for each company, thereby producing an optimal hedge by each company. Companies whose profits are very dependent on future CO<sub>2</sub> prices would choose a higher value for  $b^{adj}$  than companies whose profits are less or even independent of future CO<sub>2</sub> prices. Alternatively, companies could be offered a choice of pre-specified levels.

Another benefit from this incentive scheme is that companies “signal” their willingness to transform by setting  $b^{adj}$ . A company reveals that its business model is particularly exposed to CO<sub>2</sub> price risk by choosing a high  $b^{adj}$ , e.g. when its business model largely relies on the success of the transformation. However, it is also advantageous for companies with very CO<sub>2</sub>-intensive business models (e.g. steel) to choose a high value for the  $b^{adj}$  if they are serious about using the subsidy to adapt their business model to a climate-neutral future. Ultimately, specifying  $b^{adj}$  allows such companies to mitigate the risk of being at a competitive disadvantage to their less sustainable competitors if CO<sub>2</sub> prices remain low. In this respect, the  $b^{adj}$  chosen by the company would reveal its commitment to the low-carbon transition.

However, if the intended prices are (much) higher than the forward prices from CO<sub>2</sub> derivatives, companies would choose the maximum  $b^{adj}$ , since this provides an additional financial benefit. In this case, upper limits for  $b^{adj}$  or other restrictions become necessary.

Variable payments encourage future policymakers to not fall short of their own ambitions. There is, after all, a cost to the policy depending on how far it falls short of its own targets, because the closer the announced and intended CO<sub>2</sub> price gets to the actual CO<sub>2</sub> price, the higher the (interest) revenues and vice versa. The proposed lending rate model, therefore, counteracts the expectation that policymakers will not implement their self-imposed targets. To strengthen this expectation, it makes sense to increase the credibility of the measure by removing the payments to companies from the control of politicians, for example, by outsourcing the financing to an independent institution (such as a fund or a development bank), for whose financing, however, politicians remain responsible.

In essence, the CO<sub>2</sub>-price-related component in (4) combines two effects: a hedging instrument for corporate CO<sub>2</sub> price risk which simultaneously becomes a commitment device for the companies and the government.<sup>6</sup>

### 3.4 Example

Table 1 illustrates the benefits of the suggested approach. In this simplified example, we assume a loan-financed green investment in  $t=0$  with an initial payment of 40 and a maturity of five years.

The cash flows from sales depend on the state of the transformation process. If an orderly transition is assumed, the cash flows from sales are assumed to be 15 during all years. In the case of a disorderly transition, these cash flows are lower for two years, because the transformation is not on path. The cash flows are higher for the next two years, since the transformation is assumed to be drastic to catch up with the climate targets. The speed of the transformation can then be reduced in the last period. In the case of a hothouse scenario, the cash flows from sales are much lower because the transformation fails to meet the targets.

At the market interest rate  $r^M$ , the interest payments are 5 in all scenarios and years.

As the earnings after interest in Table 1 show, the investment is very risky. Furthermore, the average earnings are not sufficient for all scenarios. Hence, the investment might not be attractive to the company.

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<sup>6</sup> For a fundamental discussion of different approaches that address the credibility problem, see Brunner et al. (2012).

t	Cash flows from sales			Interest payments loan			Earnings			Earnings	
	Orderly Transition	Disorderly Transition	Hothouse Scenario	Orderly Transition	Disorderly Transition	Hothouse Scenario	Orderly Transition	Disorderly Transition	Hothouse Scenario	Mean	Standard-deviation
1	15	10	10	-5	-5	-5	10	5	5	6.7	2.4
2	15	10	10	-5	-5	-5	10	5	5	6.7	2.4
3	15	20	10	-5	-5	-5	10	15	5	10.0	4.1
4	15	18	10	-5	-5	-5	10	13	5	9.3	3.3
5	15	12	10	-5	-5	-5	10	7	5	7.3	2.1
Mean	15	14	10	-5	-5	-5	10	9	5	8.0	2.8

Table 1: Investment financed with a standard loan at the market interest rate  $r^M$

t	Cash flows from sales			Interest payments loan			Earnings			Earnings	
	Orderly Transition	Disorderly Transition	Hothouse Scenario	Orderly Transition	Disorderly Transition	Hothouse Scenario	Orderly Transition	Disorderly Transition	Hothouse Scenario	Mean	Standard Deviation
1	15	10	10	-4	-1	-1	11	9	9	9.7	0.9
2	15	10	10	-4	-1	-1	11	9	9	9.7	0.9
3	15	20	10	-4	-8	-1	11	12	9	10.7	1.2
4	15	18	10	-4	-7	-1	11	11	9	10.3	0.9
5	15	12	10	-4	-3	-1	11	9	9	9.7	0.9
Mean	15	14	10	-4	-4	-1	11	10	9	10.0	1.0

Table 2: Investment financed with a loan as suggested



In Table 2, we assume that the green investment is subsidized, and the lending rates are linked to CO<sub>2</sub> prices. The future CO<sub>2</sub> prices are assumed to be different according to the three scenarios. This simplified example shows that the suggested loan leads to higher and relatively stable earnings after interest, which makes the investment attractive to companies.

## **Conclusion and outlook**

This paper discusses a financial instrument that supports companies in making climate-neutral investments. The proposed discount to lending rates specifically for investments aligned with the EU Taxonomy supports private sector emissions reduction. Linking the interest rate to future CO<sub>2</sub> prices reduces companies' CO<sub>2</sub> price risk. Furthermore, the link creates an incentive for governments to live up to their climate policy agendas and minimize the difference of actual and planned CO<sub>2</sub> prices, which can keep the costs of the proposed subsidy programme to a minimum.

Our proposal breaks a vicious cycle in stimulus spending, where a lack of carbon pricing begets further investment in status quo industries, which consequently creates greater political resistance to higher CO<sub>2</sub> prices. Conversely, by mobilizing investment beyond the levels incentivized by the lackluster CO<sub>2</sub> price, progress and innovation in clean technologies become more likely, which will in turn make it politically easier to raise the CO<sub>2</sub> price.

A more comprehensive reform with credible carbon pricing will still take time. Our proposal could steer investments in the right direction in the short-term, given insufficient policy action to effectively impose a price on CO<sub>2</sub> emissions. A policy offering discounted loans for investments aligned with low-carbon objectives offers an intermediate option. Such an intermediate option may be valuable since stimulus spending is urgently needed. Moreover, it can address the risk that financial markets find, that announced carbon pricing reforms are too weak to clearly signal the government's commitment to the Paris Agreement's goals.

A strength of our proposal is that the future interest payments depend on the future sustainability performance of the company. The company thus has a continuous incentive to implement projects that are conducive to achieving the goals of the Paris Agreement.

However, our proposal has some limitations. One possible limitation is data availability. Even though many companies will already have to disclose the shares of economic activities that are considered "Taxonomy-aligned" or "non-Taxonomy-aligned" under the Taxonomy Regulation in their 2021 non-financial reporting, this reporting is only mandatory for larger capital market-oriented companies with more than 500 employees. All other companies are not required to collect this data for the time being. For these companies, collecting this data presents an additional cost, which limits the attractiveness of the proposed financing model.

Furthermore, we see a potential limitation in terms of the intended CO<sub>2</sub> price if policymakers are tempted to set the CO<sub>2</sub> price path incorrectly, especially too low. It is crucial that this pricing is based on scientific evidence.

Missing additionality might be another limitation of our approach; subsidizing interest rates for loans is not necessary if firms would have realized the underlying real investments anyway, because the investment was considered profitable without subsidies. However, this "lack of additionality problem" can arise with virtually all comparable government subsidies. Typical countermeasures, which can also be considered here, can restrict lending to certain real investments in order to increase the probability of additionality through subsidized lending.

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