CLEAN ENERGY INVESTMENT AND CREDIT RATIONING

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Overview

The main market failure that is typically used to justify the promotion of clean energy investments is the negative externality caused by greenhouse gas emissions. Market failures of capital markets, however, are typically not taken into consideration in analyses of instruments for environmental policy. Most of the latter market failures are due to information asymmetries between the borrower (agent) and the lender (principal). We argue that these market failures, although they are not exclusive for clean energy projects, are particularly relevant for these investments. Firstly, clean energy investments highly depend on services provided by capital markets. The cost structure of clean energy investments is dominated by capital costs, as these investments have high up-front investment and low operating costs (Evans et al., 2009; Wiser et al., 1997). Secondly, the information asymmetries between potential borrowers and the lender are particularly high for clean-tech investments, because (i) rather new technologies are used, where the lender has reduced information on the return-risk profile (Carpenter and Petersen, 2002) and (ii) young and small clean-tech firms do not have a relationship with a bank, which further fosters credit rationing (Berger and Udell, 2002).

Some previous papers addressed the role of financial market failures for clean energy (see, e.g., Kempa and Moslener, 2017; Stern and Rydge, 2012). To our knowledge, there is no systematic theoretical analysis of the role of information asymmetries and potential credit rationing in the context of clean energy investments. Our theoretical approach builds on previous studies that analysed whether public intervention on financial markets can correct market imperfections (see, e.g., Arping et al., 2010; Gale, 1990; Philippon and Skreta, 2012). In this paper, we extend the credit rationing model of Janda (2011) by introducing emission externalities. Investors can choose between two types of projects: a dirty investment without risk (e.g. a fossil fuel plant), which causes emissions, and a clean investment (e.g. renewable energy), which is risky and requires a bank loan. There are two types of agents in the dirty sector differing in the amount of emissions associated with production (high and low). In the clean sector, there are two types of potential borrowers that differ in their probability to successfully finish a clean energy project. As there is an information asymmetry between the potential borrowers and the lender (bank), the latter cannot distinguish between both types of potential borrowers.

Our theoretical analysis is structured as follows. We first analyse the model without policy intervention and then introduce an emissions tax to address the negative emission externality. As a next step, we introduce interventions on the credit markets, i.e. interest rate subsidies and loan guarantees, in order to address the remaining capital market failure related to clean-energy investments. We then assume a situation, where an emission tax is (politically) not feasible and analyse, whether investment support instruments alone might lead to a similar outcome compared to the case with emission tax. Finally, we provide comparative welfare analysis of the scenarios and a discussion of dynamic effects.

Methods

We use a theoretical principal-agent model with information asymmetries between potential borrowers (clean energy sector) and lenders.

Results

First, we find that without any policy intervention all agents choose the dirty (fossil fuel) project. When introducing an emissions tax, those agents with high emission levels switch to the clean sector and thus apply for a loan to undertake the clean energy project. Due to information asymmetries, however, there is credit rationing. Some of the potential borrowers, namely those with lower probability of successfully finishing the project, do not receive financing although those projects would be socially beneficial.

Second, an additional intervention of the government on the capital market by introducing an interest subsidy or a loan guarantee successfully eliminates credit rationing and hence improves the outcome.

Third, we find that, in the absence of an emission tax, the interest rate subsidy is also capable to induce a switch of some agents from the dirty to the clean sector. Compared to the emission tax, however, this policy intervention induces inefficiency as there is no efficient self-selection of agents that choose to switch to the clean sector.

Fourth, a comparison of the scenarios with and without emission tax shows that the former, where each of the two externalities is addressed with an appropriate instrument, yields socially better results than latter, where the government only intervenes on capital markets.

Fifth, we show that any intervention on capital markets is finite, as credit rationing vanishes due to increasing success probabilities of high-risk borrowers in the clean energy sector. Even when the government does not intervene to address the credit rationing, it will disappear at some point. There are, however, costs of delay if the government only addresses the emission externality, but does not deal with credit market failure.

Conclusions

We offer a novel theoretical approach to jointly analyse emission externalities and capital market failures related to clean energy investments. Overall, we find that these externalities can be best eliminated by addressing both with respective instruments, i.e. a tax on emissions and interest rate subsidies or loan guarantees. We find that, in a world without a CO_2 price, investment subsidies and these financial instruments are also capable to induce a switch to clean energy. This case is, however, more costly to society. These results have high policy relevance as climate policy is increasingly using investment support / financial instruments, such as grants, concessional loans, and guarantees, while a CO_2 price seems to loose relevance. Our findings stress the importance of a CO_2 price and indicate that a shift towards relying too much on investment support instruments bear the danger of substantially increasing the costs of the transition to a clean economy.

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