

# An elementary model of green bonds

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# Introduction

The nascent empirical literature on green bonds (e.g. Bachelet et. al. (2019)), document two key stylized facts:

- (a) Green bonds typically tend to impose extra costs on borrowers linked to monitoring, information sharing and reporting issues, required to establish their green credentials;
- (b) When borrowers are able to credibly establish their green credentials, in well-functioning green bond markets (e.g. those in high income countries), there is a “greenium” associated with green bonds that is statistically significant in many empirical studies.

This paper will develop an elementary model that accounts for these empirical findings.

In doing so, it will provide an account of the mechanisms that lead to a well-functioning market for green bonds and their welfare implications.

It will quantify the additional welfare gain that it can be achieved by public monitoring and information sharing to establish the green credentials of potential borrowers, in determining the issuance, uptake and pricing of green bonds aimed at LMIC borrowers.

# The Framework

- A borrower needs to raise funds to finance a lumpy unit investment to switch to a green project from a business-as-usual project whose payoff is normalised to zero.
- Adoption of the green technology leads to an additional GGE cut with a social benefit of  $G$  which cannot be directly appropriated by either the borrower or the creditor.
- To focus on the specificity of green bonds (establishing the green credentials of the borrower), we abstract from the issue of limited commitment and risk that are common to all bond-financed investment whether green or not, namely default.
- The green intention of the borrower is  $g \in \{\underline{g}, \bar{g}\}$ .
- The borrower can choose an action  $\sigma \in \{\underline{\sigma}, \bar{\sigma}\}$  to signal its green intentions at a cost  $c \in \{\underline{c}, \bar{c}\}$ ,  $0 < \underline{c} < \bar{c}$ .
- The monetary value to the borrower of setting up the green technology is  $v$ .

# Information

- For  $g \in \{\underline{g}, \bar{g}\}$ , the cost of  $\sigma = \underline{\sigma}$  is  $c = \underline{c}$ . For  $g = \underline{g}$ , the cost of  $\sigma = \bar{\sigma}$  is  $c = \bar{c}$  with probability one.
- For  $g = \bar{g}$ , the cost of  $\sigma = \bar{\sigma}$  is  $c = \underline{c}$  with probability  $q$  and  $c = \bar{c}$  with probability  $1 - q$ ,  $0 < q < 1$ .
- A strategy for the borrower is  $s: \{\underline{g}, \bar{g}\} \rightarrow \{\underline{\sigma}, \bar{\sigma}\}$ .
- The creditor does not observe either  $g$  or  $c$ . It observes  $\sigma$ .

# Green Bonds

- Conditional on observing  $\sigma$ , it can offer a green bond or a standard bond. The return on a green bond is denoted by  $r'$  and the return on a standard bond is denoted by  $r$ .
- In addition to caring about monetary payoffs, assume that the creditors get a non-contractible benefit  $f(G)$ , strictly increasing in  $G$ , from investing in the green project.
- In a well functioning market for green bonds, only borrowers with green intentions should be able to credibly signal their green credentials by being able to finance their investment in a green project using green bonds.

# Signalling green intentions and the market for green bonds

- Suppose  $v - \underline{c} - r < 0$ . Then, a green project is adopted if and only if it can be financed using a green bond. Conditional on observing  $\sigma = \bar{\sigma}$  (a) creditors offer a green bond to finance the green project and only borrowers for whom the cost of choosing  $\sigma = \bar{\sigma}$  is  $c = \underline{c}$  choose  $\bar{\sigma}$ . The return on a green bond  $r' < r$  by a factor that reflects  $f(G)$ .
- The above equilibrium is socially inefficient for two reasons: (a) Information asymmetry between borrowers and creditors and potentially high signalling costs for green borrowers, (b) The inability of borrowers and creditors to appropriate  $G$ .