



Credit and demand for solar: Evidence from Ghana

Yunyu Shu and Jiayue Zhang

- This project studies how credit design shapes small firms' adoption of solar technologies in Ghana. Using an experiment that varies the timing of subsidies and the degree of protection against product-performance uncertainty, we examine how liquidity constraints and/or uncertainty about product usefulness affect small firms' solar adoption.
- Reducing upfront payments substantially increases small firms' adoption of solar technologies, by both alleviating liquidity constraints and reducing perceived cost in product usefulness uncertainty.
- However, repayment patterns suggest adverse selection when reducing upfront cost where adopters are more liquidity constrained and more likely to default as measured by repayment delays. We do not find increased payment delays when reducing product usefulness uncertainty.
- Small firm investment decisions are strongly influenced by household constraints. A larger share of purchases under down payment are for household usage only.

POLICY BRIEF GHA-24084

MARCH 2026

This project was
funded by the IGC

theigc.org

DIRECTED BY



FUNDED BY



Introduction

Unreliable electricity supply is a major constraint for small firms across many developing countries. Frequent blackouts disrupt production and operation hours, damage equipment, and reduce revenues for small businesses. Firms not constrained by energy can respond by relying on petrol or diesel generators as a backup option, which are costly to operate and contribute to air pollution and greenhouse gas emissions. Firms not constrained by labour can increase labour input after blackouts to catch up with the lost hours. However, many small firms in low- and middle-income countries are constrained by various factors.

Solar technologies provide a promising alternative source of backup power. Solar systems can allow firms to maintain operations flexibly without relying on grid electricity. However, despite these benefits, adoption of solar systems among small enterprises remains limited.

A key barrier to adoption is the financial cost, where various studies have shown effective upfront subsidies to incentivise adoption. However, it remains unclear whether the effect is dominated by adverse selection of liquidity-constrained borrowers or users concerned about the uncertainty around the usefulness of the product. This challenge is compounded by the fact that small businesses often rely on household resources to finance investments, meaning that liquidity constraints and information constraints at the household level can directly shape firm investment decisions for productive technologies.

To understand how financing structures affect solar adoption, we conducted a discrete choice experiment with small business owners in Ghana. The experiment was designed to identify whether adoption barriers stem primarily from liquidity constraints, uncertainty about product performance, or both.

Testing how financing structures affect solar adoption

Business owners participating in the study were presented with offers for a solar system under different financing arrangements. Participants were randomly assigned to one of four groups:

- Down-payment subsidy: the upfront payment required to obtain the solar system is reduced.
- Repayment subsidy: monthly or instalment payments are reduced over time.
- Repayment subsidy with refund option: firms receive a repayment subsidy, and they can return the product early and recover the unearned portion of the subsidy.
- Control group: no subsidy is provided.

This design allows us to distinguish between two key barriers to technology adoption. A down-payment subsidy directly relaxes liquidity constraints by lowering the initial cash requirement, whereas a repayment subsidy lowers the flow liquidity constraints in future. In contrast, the refund option primarily lowers the risk of investing in a new productive technology whose usefulness may be uncertain ex ante. That said, the refund option allows firms to reverse the investment if it turns out not to meet their needs.

Upfront subsidies strongly increase demand

Both down-payment subsidies and refund options significantly increase adoption within the experiment. Firms offered these contracts are much more likely to select the solar system compared to firms in the control group or those offered only a repayment subsidy.

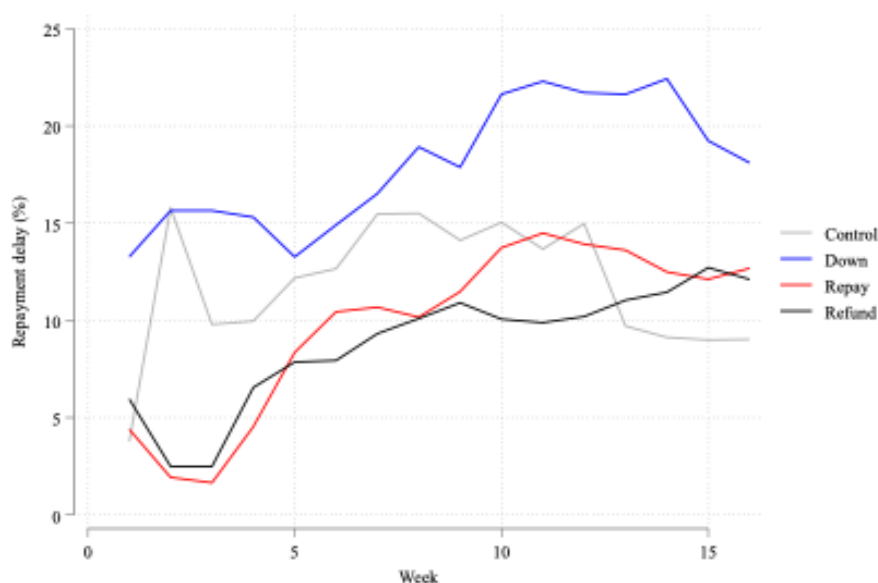
This pattern suggests that both liquidity constraints and uncertainty about product performance influence firms' stated demand for solar technologies. Reducing upfront payments lowers the cost of experimenting with a new technology, while refund options reduce the downside risk of adoption.

When we examine actual purchasing behaviour after the experiment, a different pattern emerges. Down-payment subsidies are the most effective in generating real purchases of solar systems. Firms offered lower upfront payments are significantly more likely to follow through with a real purchase. By contrast, repayment subsidies and refund options have much smaller effects on actual adoption. In other words, reducing the immediate cash burden appears more effective than lowering the cost gradually over time.

These results suggest that liquidity constraints play a central role in small-firm real investment decisions. While uncertainty-reducing mechanisms can encourage interest in solar systems, they do not appear sufficient, on their own, to generate comparable increases in real purchases. Lowering the upfront payment appears to be the most effective way to convert interest into actual purchases.

We also find suggestive evidence that contracts relaxing upfront constraints may influence repayment behaviour and usage patterns due to adverse selection. Firms receiving down-payment subsidies experience more and longer repayment delays. In addition, these firms are somewhat more likely to use the solar systems at home rather than exclusively for business purposes. Although these patterns are imprecisely estimated, they point to the importance of household-business financial linkages in shaping both technology use and repayment performance. It is important to take household–business financial linkages in to account when designing financing programs.

FIGURE 1: Repayment delay by treatment groups



Note: This figure shows the repayment delay by treatment arms, measured by the number of days behind repayment schedule as a percentage of the due day after contracting. It shows that, within the first four weeks, when the repayment subsidy group (red) and the refund group (black) experience cheaper repayment, repayment delay remains very low; the delay rate catches up to the level of the control group gradually. Down payment subsidy group shows a significantly higher rate of delay throughout the repayment period.

Household liquidity constraints matter for business investment

The results point to an important insight: small firms' investment decisions are closely tied to household financial constraints. Unlike large firms, small enterprises often lack access to formal credit markets. Business owners frequently rely on personal savings or household funds to finance productive investments. As a result, decisions about adopting productive practices are shaped by the household's ability to mobilise cash. A technology that is profitable in principle may remain out of reach if the upfront payments are too high at the moment of initial purchase.

Our findings suggest that policies focusing solely on reducing the total cost of technologies may be less effective than those that reduce the immediate liquidity burden faced by firms. Even when repayment subsidies lower the long-run cost of solar systems, they may not overcome the upfront liquidity constraints that prevent firms from adopting the technology in the first place.

Policy implications

These findings have several implications for policymakers and organisations promoting renewable energy adoption among small firms.

First, reducing upfront costs is critical. Policies that lower down payments—such as upfront subsidies or financing models with small initial payments—may be significantly more effective than those that only reduce repayments over time.

Second, financing programs should account for household liquidity constraints. Because small firms often rely on household resources to finance investments, enterprise-support programs should consider how household financial conditions affect business decisions.

Third, contract design should balance adoption with repayment incentives and intended use. While reducing upfront costs can increase adoption, programme designers should also consider complementary mechanisms that support repayment performance and ensure that technologies are used for productive purposes.

Expanding access to reliable, clean electricity for small firms can improve productivity, resilience and environmental performance. By addressing liquidity

constraints faced by small enterprises, policymakers can accelerate the diffusion of distributed solar systems and reduce reliance on polluting backup generators.