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Asset Overhang and the Green Transition*

INTRODUCTION

Policymakers worldwide have an important role to play in designing an adequate climate-finance framework (Borio, Claessens and Tarashev 2022; De Haas and Popov 2022; Giglio, Kelly and Stroebel 2021). In a recent report requested by the Presidency of the Climate Change Conference (COP27), the Independent High-Level Expert Group on Climate Finance stresses that transforming our economies to mitigate the ongoing climate crisis "[…] requires strong investment and innovation, and the right scale of finance of the right kind and at the right time" (Songwe, Stern and Bhattacharya 2022). In particular, the authors argue that "while there is broad private sector commitment to align with climate, there is now a need to develop approaches that can unlock institutional capital at scale. Asset owners and other stakeholders need to be incentivized to come up with more solutions."

In this article, however, we introduce one possible mechanism that may actually be preventing a rapid financing at scale of environmental technologies by the private sector. We provide empirical evidence for the case of bank loans to green projects. We further discuss how limited policy interventions would play an active part in reducing or eliminating such barriers by achieving an overall alignment of incentives between market participants and stakeholders.

An "asset overhang" arises when an investment related to a disruptive technology threatens the legacy investments of an external financier (Degryse, Roukny and Tielens 2022). The following scenario illustrates our theory: Assume a bank with a long-standing portfolio of investments in carbon-intensive industries. This bank now receives a request for a large loan by a firm seeking to implement a carbon-light business model using environmentally friendly technologies. One concern that may exist on the bank's side would be whether the commercial success of this green firm might result in a devaluation of some former investments: either because the green firm would steal away business from incumbent clients, or because the superior technology brought by the green firm would devalue some of the collateral posted by incumbents. As a result, the bank may demand compensation for these expected losses, eventually rationing the green firm. The existence of negative green spillovers therefore imposes an overhang on the bank, which in turn reduces its incentives to fund the green firm's profitable project.

Faced with this barrier, the green firm may simply decide to move to other banks in the economy and hope they do not face an asset overhang. To determine the extent of the aggregate funding supply fric-

KEY MESSAGES

- **Environmental technologies threaten dirty legacy portfolios of external financiers**
- **"Asset overhang" refers to an investor's incentive not to finance disruptive green firms in an attempt to protect exposed legacy positions**
- **Empirically, asset overhang renders green disruptors up to 4.4 percentage points less likely to receive external finance**
- **The presence of financiers with low asset overhang trigger systemwide incentives to fund green firms**
- **Limited policy interventions aimed at reducing such overhang can alleviate financial barriers to the green transition**

* The views expressed in this contribution are those of the authors and do not necessarily reflect the views of the National Bank of Belgium, the Eurosystem, or any other institutions to which the authors are affiliated. This contribution draws on earlier work of Degryse, Roukny and Tielens (2022).

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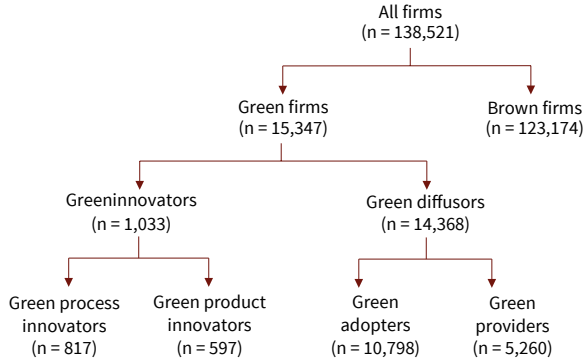
Figure 1

Incidence of Various Green Activities by Belgian Firms



Source: Degryse, Roukny and Tielens (2022). © ifo Institute

tion to the new disruptive technology, we therefore need to analyze the market structure of the banking system's asset overhang. In systems where all banks have a large legacy portfolio exposed to the disruptive technology, all banks have incentives not to support this technology's development or widespread uptake. Why? The strategy of deliberately not investing in a (standalone profitable) technology averts the adverse spillovers on their legacy investments. That is, the decision to not invest prevents their legacy investments to become stranded assets. However, the presence of investors with limited or no exposures to the negative impact triggers credit supply by the entire system (including from financiers heavily impacted by the new technology), as negative externalities on legacy investments, such as devaluations of pledged collateral or elevated default risk of incumbent borrowers, cannot be prevented in that case.

An asset overhang friction in the financing of disruptive technologies may generalize beyond green technologies to multiple settings where the entire pool of investors is exposed to large enough technological disruption. However, the case of climate change and the financing of green technological transitions by banks is particularly relevant. First, there is ample evidence that banks are highly exposed to assets and industries subject to strong disruptions due to climate change (ECB 2019). Second, a large share of economies worldwide continue to rely on bank financing, in particular in developing economies. Developing economies have recently become a main focus on climate finance due to their limited market capacities: Songwe, Stern, and Bhattacharya (2022) estimate that "The world needs a breakthrough and a new roadmap on climate finance that can mobilize the $1 trillion in external finance that will be needed by 2030 for emerging markets and developing countries." Third, while alternative financing opportunities may exist for technological innovation, the process of technological diffusion – which is equally important when it comes to achieving technological change – is largely supported by bank-financed firms even in economies with developed capital markets. For instance, the recent energy package passed by the U.S. Senate under the Inflation Reduction Act includes $27 billion of funding directed to green banking in order to support the adoption of greenhouse gas reduction technologies in parts of the economy underserved by the private sector. Finally, note that even in countries with credible alternative financing sources, such as in Europe, innovation in green technology has been underperforming (Aghion et al. 2022). Below, we provide evidence of an asset overhang mechanism at play in reducing the development and dissemination of green technologies.

EMPIRICAL APPLICATION

Our empirical application studies whether green technologies suffer from an asset overhang problem in the market for corporate bank credit, leveraging data from a heavily bank–based economy (Belgium).

Our application first pins down the externalities to which firms are exposed to when other firms unfold their environmental activities. The linchpin of our identification strategy has two main features: First, in the spirit of Hall and Helmers (2013), we take a two-tiered view on environmental activities. Green activities either take the form of green innovations (i.e., development of new environmentally friendly products and production processes) or green diffusion (i.e., adoption or selling of environmental products and services that embody an incumbent green technology). Drawing on various unique large-scale datasets, we directly observe both components of technological change at the firm level (Figure 1). This bifurcated view is warranted as the two activities differ in their financing and disruptive capacity (Utterback, 1974) – and therefore might trigger different levels of overhang problems – while both are instrumental in the net-zero transition (Aghion, Veugelers and Serre 2009). Second, following Bloom, Schankerman, and Van Reenen (2013), we empirically distinguish each firm's position in the technology space and product market using granular information on the distribution of firms' input and output markets (inferred from detailed B2B transactions). This allows us to construct distinct measures of economic distance between "firms with environmental activities" and "other (dirty) firms" in the technology (input) and product (output) market dimensions. We leverage both ingredients to trace out adverse spillovers of green activities on neighboring dirty firms.

We focus on two types of externalities that were previously documented to weigh heavily on banks' lending decisions: firm performance (as proxied by firm household sales, corporate sales, market shares, etc.) and pledgeable asset values (measured by losses incurred on secondary markets upon liquidation of tangible assets, etc.). The former are taken from granular VAT declarations. The latter are taken from a widespread business survey. We apply this framework to a panel of Belgian firms over the period 2008–

2018 and document that firms with green innovation and/or green diffusion generate negative spillovers on brown firms through deteriorated firm performance and asset devaluations.

We provide further corroborating evidence that these induced firm-level externalities stemming from green technology effectively feed into the banks' assessments of their incumbent borrowers. First, we find that green innovation and diffusion is associated with elevated probabilities of default and additional provisioning reported by banks on their incumbent dirty borrowers. Second, we observe adjustments in market values of firms' pledged collateral in the face of (particular types of) environmental innovation & adoption by technology peers.

Armed with the established externalities, the second step in our analysis proceeds to quantify the share of individual bank's legacy positions threatened by each individual firm's green activities using bank-firm credit exposures as reported in the corporate credit registry. This allows us to study the impact of the magnitude and structure of the banks' legacy portfolio at risk on credit allocation to environmental firms. A priori, banks are expected to take on board these exposures in their lending decisions as Figure 2 reveals a significant amount of the corporate credit portfolio at risk to the population of innovators and diffusors of environmental technology.

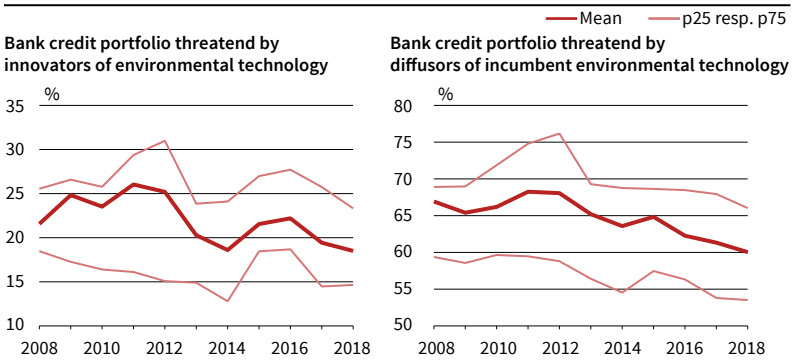
EMPIRICAL FINDINGS

We estimate that,

1. Being a large threat to the legacy portfolios of all banks (i.e. a one standard deviation negative impact on each bank in the credit market) makes a green innovator (diffusor) around 4.4 p.p. (1.0 p.p.) less likely to receive bank credit compared to an otherwise equal innovator (diffusor) that does not have an impact on banks' legacy positions.
2. The rationing effect is largely muted by the presence of intermediaries with low asset overhang.
3. We further study, conditional on lending, which bank in the asset overhang spectrum matches up with the green firm. We find that the bank with the smallest asset overhang is 8.4 p.p. more likely to grant a loan to the green firm relative to any other bank in the system. That is, investors with less asset overhang are more likely to "break the barrier" to technological disruptions.
4. In the context of an existing relationship between a bank and firm, we document that changes in the asset overhang of the incumbent lender do not play a role in credit supply to the environmental firm. Instead, a 1 s.d. decrease in the lowest asset overhang position (potentially, but not necessarily, that of the incumbent lender) drives up credit supply by the incumbent lender to the disruptive innovator (diffusor) by 0.11 s.d. (0.05 s.d.).

Figure 2

Share of Banks' Corporate Credit Portfolio Negatively Exposed to Environmental Innovators/Diffusors



Source: Degryse, Roukny and Tielens (2022). © ifo Institute

Taken together, these results highlight that the distribution of asset overhang across investors determine credit supply to disruptive firms both at the extensive margin (i.e., whether a firm receives any credit from a bank) and – once the rationing barrier is broken – at the intensive margin (i.e., how much credit is received by the firm in the context of an existing relationship with a bank).

POLICY IMPLICATIONS

Our framework suggests that economies may suffer from technological conservatism when new technologies threaten the legacy position of investors through changes in performance and asset devaluation. Empirical evidence from the Belgian economy reveals that bank lending policies effectively aim to protect business models that do not fit into global commitments to transition into a green economy. Various policy measures can help to breach the source of this barrier at the investor level.

The first measure could be promoting financial institutions that do not hold legacy positions exposed to the negative spillovers originating from disruptive technologies. This outcome can be achieved by several initiatives.

First, it can be by design: promoting financial institutions with explicit intentions of supporting the production and diffusion of specific green technologies. This case commands particular business models and expertise to be sustainable. Large-scale demand such as the fight against climate change can promote such conditions. Relevant examples include the UK Green Investment Bank, or the Green Credit department of ICBC China. Moreover, to the extent that these initiatives are public (or quasi-public), their mandate potentially does not require them to factor in the impact of the disruption (i.e., their behavior is not governed by our framework) should these externalities appear later on in the financiers' life cycle. In a more general setting, where the demand and need for technology transitions are not specifically formulated upfront, a generic policy of promoting entry of

new – hence legacy-free – financial institutions would achieve a similar result from the perspective of our theoretical and empirical analysis.

Perhaps more important to note is that the presence of at least one legacy-free financier has the capacity to produce larger scale effects: the presence of investors with less or no exposures to asset devaluations promotes credit provisioning by the entire system. By virtue of this result, the entry of a single sizeable investor with no legacy exposures would effectively mute overhang issues and break rationing barriers. In other words, the existence of spillovers may positively amplify the effectiveness of limited interventions (i.e., entry of a single legacy-free agent). In fact, the devaluation of legacy assets materializes irrespective of the loan originator. Therefore, once the entry of a disruptive technology is certain, losses will materialize irrespective of the loan originator. Accordingly, all investors in the system become theoretically likely to extend credit to disruptive technologies. This is confirmed in our empirical analysis where a reduction in the lowest asset overhang engages incumbent banks to increase credit supply at the intensive margin.

Focusing on incumbent institutions, policymakers have voiced the possibility of leveraging macro prudential policies to address the green transition (European Central Bank 2019; European Union 2018). Such policies work by introducing an additional implicit/explicit cost which either (i) increases if the investor (e.g., bank) persists in lending to laggard firms, or (ii) drops when it lends to innovative firms. The investor's behavior can then be steered by driving the sign of the difference between this cost and the cost of technological disruption on the legacy assets. In the case of climate change, banks would therefore prefer to lend to green firms if this difference is negative. Examples include (i) a risk-weight reduction (addition) in the prudential framework for banks' exposures to green (brown) assets, (ii) lower (higher) required reserve rates for portfolios skewed toward greener, less carbon-intensive assets (brown, carbon-intensive assets), (iii) dedicated disclosure requirements, and (iv) climate-related stress testing, etc. Evidently, the feasibility of such measures hinges on a proper taxonomy (a classification of economic activities and the conditions under which economic activities can be considered sustainable) to sort between green and brown firms. Such work is underway at the European Commission.

Our theory suggests that an asset overhang materializes when new technologies have a large potential for adverse spillovers to which the full pool of eligible investors is exposed. While the climate-banking application satisfies these criteria, there are other applications which meet similar conditions, thereby warranting an overhang analysis as well. For instance, the pool of candidate investors in advanced niche technologies (e.g., AI, cloud computing, biotech etc.) is typically restricted due to the intimate knowledge required to screen candidate projects. This screening ability is typically acquired through experience in funding projects embodying similar or adjacent technologies which may potentially suffer from the entry of disruptive rivaling projects. If the latter legacy projects still feature on the investors' balance sheet, they have incentives to ringfence their legacy from competing novel technologies.

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