Banks as Stewards *

Kristian Blickle[†] Adair Morse[‡] Parinitha Sastry[§]

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Abstract

Banks may play a more active role in corporate finance than previously documented. We document that banks hire industry experts and then steward firms to undertake investments in expansion (new to the firm) sectors. In supervisory data including detailed regulatory risk measures and granular loan-level industry attribution, expansion loans are double as likely to emerge in bank-firm potential pairs when the bank has precise industry specialization or higher degree experts. Results are robust to specifications that build off dynamic comparables strategies (Sun and Abraham (2021)), 'within-firm' (Khwaja and Mian (2008)) and 'within-bank' (Blickle et al. (2024)) analyses, and fully saturated bank-firm-time models (Paravisini et al. (2023)). Conceptualizing our setting, we frame that bank stewarding will be more prevalent where firms neglect expansion investment because of high discount rates. Empirically, the effect of bank expertise and specialization unlocking expansion loans is increasing in firms' short-termist discount rates. Finally, we document the mechanism through loan pricing: banks provide loans at 7-to-72 bps lower interest rates to induce loan volume, and thereby overcoming Kodak moments. Such expansion stewarding is likely most valuable in moments of transition for an industry. We corroborate our general expansion evidence in the context of firm expansion investments from the energy transition. Active bank stewarding moves the literature beyond the classic view of banks as mere credit providers.

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[†]Federal Reserve Bank of New Work. kristian.blickle@ny.frb.org

[‡]University of California, Berkeley and NBER. adair@berkeley.edu.

[§]Wharton, University of Pennsylvania. psastry@wharton.upenn.edu

1 Introduction

Economy-wide growth depends on, among other things, firms' ability to generate and undertake value-creating investment opportunities. What role might banks play in this process? One answer might be that banks have no role. The classic frictionless Modigliani-Miller benchmark suggests a limited scope for lenders other than mechanical providers of credit, since client firm investment is entirely driven by the fundamental characteristics of their investment opportunities. Even in the vast literature on banks' special role in screening, monitoring existing projects, and utilizing relationship information asymmetries, banks play little role in the firm decisions that lead to the generation and undertaking of new value-creating opportunities.[1]

Another answer, however, is that banks have a role as stewards, aiding firms in generating and undertaking value-creating projects. Three strands of literature head in this direction. First is the literature that studies banks as equity-holding insiders, affecting client firm decisions (Berlin et al. (1996); Stiglitz (1985), and Winton (2015)). Evidence in this line of research finds that firms with bank insiders have higher performance (Gorton and Schmid (2000)) and that banks act to gain board seats when client firms perform poorly (Kaplan and Schoar (2005)).[2] Yet, this active equity holder role for banks is only applicable and legal in specific contexts.

A second angle on banks as stewards might be found in the inference from the common banking work by Giacomini et al. (2024) and Frattaroli and Herpfer (2023). These papers find that firms who have a bank in common with their trade partners (or future partners) perform better in those trade relationships. The common banker literature suggests that banks bring an information channel as a benefit to client firms. The third angle on banks as stewards comes from the bank specialization literature (Blickle et al. (2024), Blickle et al. (2025), Paravisini et al. (2023), and Duquerroy et al. (2022)). These papers find that banks exhibit industry and geography expertise (usually from path histories with clients a la Lummer and McConnell (1989)) that leads to both more favorable loan outcomes for banks and lower interest rates for clients.

Yet this literature does not – thus far – consider the more active role of banks in helping firm clients to generate and undertake value-creating investment opportunities. Herein is the contribution of our paper. We bring together the bank equity ownership and common banker literature ideas that banks have an active role to play in firm operations with a new channel. Banks develop expertise not just in underwriting and monitoring existing firm projects, but also in impacting their clients' ability and willingness to generate and undertake new value-creating investment opportunities in the areas where banks have specialization. We call this bank stewardship.

[1] See, for example, Jaffee and Russell (1976); Stiglitz and Weiss (1981); Diamond (1984); Fama (1985); James (1987); Diamond (1991); Petersen and Rajan (1994); Puri et al. (2017); and Bharath et al. (2009a).

[2] See the survey of this literature in Drucker and Puri (2007).

Stewardship may throw long-standing views of the role of banks in corporate finance on its head, taking our thinking back to historical episodes of merchant banking roles, where lead bankers (e.g., Andrew Mellon) were also the industrial experts and visionaries. In current times, the financing tool of stewardship may differ from merchant banking, but the key to either story is bank's incentive to grow financing volume. This lending book growth view of banks goes well beyond the typical corporate finance models of bank lending that focus primarily on loan default and pricing profits per loan.

The 'why' of why stewardship might be emerging now is an interesting overlay. Stewarding language could easily characterize the role of merchant bankers in transportation transitions, electrification, agricultural automation, and factory lines commencements during the 19th and 20th centuries. These are moment of transition, periods when expertise in a bank might be most valuable to clients or potential clients facing Kodak moments, deciding whether to jump to a new technology. The Kodak settings of today are not the advent of the digital camera, but instead economy-wide transitions in technology, energy, labor, and supply chains.

To give some examples, consider the Applied Research division of JPMorgan Chase. Honing in on its research in quantum computing for in-house use and client growth advisory roles, JPMorgan states: "JPMorganChase is one of the first financial institutions worldwide to invest in quantum computing and to build an internal team of scientists to work on new quantum algorithms and applications."[3] Likewise, according to U.S. regional bank FifthThird about the technology, media, and telecommunications (TMT) sector: "In a sector with unlimited growth potential that's tempered with significant and evolving risk, your financial solutions team needs an eye on the horizon and feet on the ground. That's what we provide our more than 200 TMT clients: Deep industry knowledge. Decades of combined experience. Actionable insights."[4] U.K. bank Standard Chartered advocates its stewardship both in sectors such as: "Our global expertise enables us to support agri-traders, soft commodity and supply chain providers with the knowledge to navigate the complexities of global trade flows and support our clients' green business ambitions,"[5] and in geographies such as: "Having been on the ground in [emerging frontier markets across Asia, Africa and the Middle East] for decades, we can guide you through the local nuances. But beyond this, we can be your local advocate. By working with governments, regulators and clearing systems, we pioneer new opportunities for you."[6]

On the client side, bank stewardship depends on firms' having a need for stewardship. A

[3]We accessed the webpage https://www.jpmorganchase.com/about/technology/research/applied-research on October 18, 2025.

[4]https://www.53.com/content/fifth-third/en/commercial-banking/industries/TMT-solutions.html, referenced October 19, 2025.

[5]https://www.sc.com/en/corporate-investment-banking/industries/, accessed October 20, 2025

[6]https://www.sc.com/en/corporate-investment-banking/financial-markets/, accessed October 20, 2025.

long-standing corporate finance literature concludes that firms may pass-up profitable investment opportunities. A starting point might be that firms forego opportunities because of credit constraints (Fazzari et al. (1988); Kaplan and Zingales (1997)), but since banks can overcome credit constraints without stewardship, we look to other motivations. In particular, banks may have a stewardship incentive to foster investment because of other hindrances to firms' taking investment opportunities including short-termism (Amihud and Lev (1981); Narayanan (1985); Stein (1989); Bolton et al. (2006); Graham et al. (2005); Kumar and Purnanandam (2023)) and agency challenges such as empire entrenchment, enjoying the quiet life, and career concerns (Holmstrom and Costa (1986); Shleifer and Vishny (1989); Hirshleifer and Thakor (1992); Stein (2003); Bertrand and Mullainathan (2003)).

In this paper, we provide four contributions as evidence toward bank stewardship. The first contribution is direct evidence of what must be a necessary condition for stewardship – human expertise. We gather LinkedIn data via Revelio Labs datasets and document the prevalence of Ph.D.s and other deep industry expertise professionals within the banks. We carefully categorize all bank employees, identifying "subject matter" experts as those with a Masters or PhD degree and a job not related to financial intermediation, accounting, risk management, compliance, bank-IT, or sustainability. These experts are not bankers who work in aviation or chemistry, but rather aerospace engineers and materials scientists. We find that banks have been convexly increasing the in-house industry experts in their human capital resources, with the convexity having increasing kinked inflections starting in 2017 and then 2021.

Our other three contributions emerge as we structure bank-client loan evidence. To compel our empirical analysis, we begin with a model that envelopes bank stewardship into a firm's yes-or-no investment decision for a transition expansion opportunity. The firm faces a valuation tradeoff of using earnings for immediate dividends or for higher future growth from investing in a firm expansion in a transition opportunity. The tradeoff calculation affected by a firm-specific discount rate. Following the recent advances in the literature (Gormsen and Huber (2024); Lenzu et al. (2025)), we focus on the discount rate, and its importance acting as a hurdle rate or cost of capital. In this setup, high discount rates may induce firms to neglect investment opportunities.

The model then shows that bank financing unlocks neglected opportunities for some firms with valuable expansions hindered by high discount rates. By securing bank finance, firms can pay out all of current earnings as dividends, thus appeasing short-termist pressures, while financing the transition investment, the optimal long-term strategy. This seemingly straightforward punchline has not, to our knowledge, been emphasized in the literature. A bank's capacity to offer a transition loan is a function of expected loan performance, which is increasing in specialization and stewardship. Thus, a bank's specialization and stewardship capacity increases its role to unlock neglected investment for firms.

Our model delivers three testable predictions. Expansion loans will be more likely to be extended by specialized banks with the ability to steward projects. Bank stewarding of projects is particularly valuable for firms with high discounting of the future value from investment. Expansion loans from banks with higher stewardship will have a lower interest rate than other loans, ceteris paribus.

With access to Federal Reserve loan-level data collected as part of supervisory stress-testing efforts (Y-14-Q schedule H data), we have detailed information about a loan's riskiness – as measured using supervisory procedures that are standardized across banks, – the exact 6-digit industry of a loan, and a number of other important loan characteristics including purpose, duration, rate paid, collateral pledged, syndication status, etc. The data covers more than 70% of U.S. C&I lending.

Our key dependent variable for identifying stewardship is a binary variable indicating whether an expansion loan, defined as loans in sectors previously not a part of the firm's activities, emerges among the potential bank-client pairs of possible loans from historical relationships pre-dating specialization. Our key independent variables are *bank specialization* – the lagged proportion of the banks' lending book directed towards a very precise given industry and *bank experts* at the industry level. Our data allow rich fixed effects controls of loan type (credit line versus installment), the risk rating assessment of the Federal Reserve, a syndication dummy, the quarter-year time, and loan purpose categories. In addition, we step into deeply saturated models that incorporate advances (i) from the two-way fixed effects (TWFE) literature[7] by dynamically comparing potential pairs within industry crossed with time, (ii) from the 'within' banking literature (Khwaja and Mian (2008)) by including firm fixed effects, and from the (iii) bank specialization literature forcing within-bank identification (Blickle et al. (2024)) and within bank-firm-time fixed effects (Paravisini et al. (2023)), while keeping the TWFE dynamic within-industry comparison.

Our second main contribution is the finding that the likelihood that an expansion loan emerges from the bank-firm set of possibilities is at least double as likely when the bank specializes or has experts. More precisely, bank-firm pairs are 128 basis points more likely to commence expansion loans with bank stewarding attributes, compared off a baseline probability of 60 basis points. This assortative matching we document could be driven by a *credit demand* interpretation, where borrowers seek out stewarding banks for expansion because of their expertise and pricing or a *credit supply* channel, where specialized banks (likely with relationships) are able to steward borrowers towards expansion opportunities with their expertise. Either interpretation is consistent with our notion of bank stewardship, since in either case lenders offer an industry expertise, value-added benefit that goes beyond their role as mechanical providers of credit.

[7] Athey and Imbens (2022); Imai and Kim (2021); Callaway and Sant'Anna (2021); Sun and Abraham (2021); Goin and Riddell (2023)

Our third contribution is demonstrating the role banks play in overcoming borrower short-termism to undertake neglected projects. This is a counterintuitive result, though consistent with the model, that a bank's stewardship may be most important for those firms with high hurdle rate constraints on investment, which may otherwise forego investing in expansion projects. Our results are consistent with evidence from other large industrial transitions: it may be the case that firms which choose to not undertake transition (i.e., the Kodaks when the economy transitioned to to digital cameras) put themselves at greater risk from remaining solely in the stationary economy.

Our fourth and final main contribution is to provide evidence as to the interest rate mechanism of stewardship overcoming neglected investments. Consistent with the literature on specialization (Paravisini et al. (2023), Blickle et al. (2024)), we find that banks with specialization or expertise offer lower interest rates, even conditioning on regulators' confidential risk assessments of borrowers. We re-emphasize that the default risk ratings we employ are those of the Federal Reserve, and are thus not endogenous to bank decision-making. In economic magnitude terms, our evidence suggest that expansion loans that are stewarded have lower rates ranging from 7 to 72 basis points, which translates in our sample to $5 billion - $48 billion in lower amortized payments as inducements for firms to overcome neglected investment.

This interest rate result provides two inferences relevant for stewardship. First, as we have phrased above, lower rates implies that stewardship changes firms' willingness to invest in expansion. Second, if we are to extrapolate the finding of Paravisini et al. (2023), which finds that specialized bank loans results in both lower rates to firms and higher bank profits from the loans, we can infer banks' may have both loan performance and lending book volume growth incentives to develop stewardship (advisory) groups.

In a final section of the paper, we seek corroborating evidence by homing in on a transition setting. We use the language of digital cameras and Kodak throughout the paper, but our analysis is thus far for expansions that are new to the firm. We would like to corroborate with evidence that corresponds to the transition economy of Andrew Mellon's day of industrialization and transport transitions. In our time, many of these transition are happening, but we focus on the energy transition for a reason of practicality – breadth and data. The Bureau of Labor Statistics has published a list of detailed industry codes for the green transition, which include a wide berth of industries in energy, mining, transport, and a host of other industries. Our last analysis repeats the predictions tests from before, focusing only on firm expansions into the green transition sector, with the word green being used loosely. We find evidence consistent with all of our main contributions.

2 Foundations

We begin by grounding our work in a few foundations. First, we demonstrate that banks are indeed gathering industry experts as stewards. To do so, we collect new data and present evidence on the existence of Ph.D.s and other industry experts inside a bank. Second, we summarize a theoretical framing, so that we can draw out empirical predictions, making the task of evidence grounded in mechanisms.

2.1 Ph.D.s and Experts

Our story is one of Ph.D.s and other non-banking deep technical industry experts working inside the bank to steward projects for clients with expansion desires. Thus, the starting point for any such analysis is documenting the existence and prevalence of such experts in the banking sector. We construct a bank-quarter measure of industry experts using LinkedIn workforce data from Revelio Labs. We then conduct a detailed match to attach this data to the Y14-Q schedule H1 data on banks. Specifically, we first assign a common commercial identifier, FactSet Entity ID, to the sample of banks.[8] We then merge the Y14-Q bank list with the Revelio Lab's company mapping, which assigns a unique Revelio company ID to each entity. The ID is at the ultimate parent level, allowing us to capture bank subsidiaries.[9] Next, we use the Revelio Company ID to subset the Revelio positions file to Y14 banks and subsidiaries.

The positions file provides detailed employment data for users, including the company name, role title and broader occupation category, as well as start and end dates. Finally, we merge on each individual their complete education history, including the degree obtained (Bachelors, Masters, PhD, etc.), the field, and university affiliation. We additionally use the publicly available O-NET Job Family Crosswalk to assign each position to a broader "job family."

The resulting data sample encompasses 7.8 million Linkedin users employed at 39 Y-14 banks and 3,103 bank subsidiaries. The reporting spans our full sample period, 2012:Q2-2023:Q2. With these job classifications in hand, we create industry expertise metrics, based on job family/occupation, education, and skills. We keep only people with Master's or PhD degrees (excluding MBAs). Importantly, we remove doctoral degrees and job family titles associated with banking, finance, managerial, or economic expertise. This filter includes any job titles associated with risk management, compliance, accounting, loan origination, loan assessment and monitoring, or even general management. We additionally exclude any natural scientists whose job description

[8] We make use of the CRSP-FRB link provided by the Federal Reserve Bank of New York to go from ID RSSD to permco, followed by CRSP's internal "Linking Factset with CRSP" tool provided by WRDS.

[9] For banks where we do not find a FactSet Entity ID in the CRSP crosswalk, we perform a string search of the Revelio company mapping by bank name (from the FFIEC National Information Center) to locate the Revelio company IDs.

involves the sustainability office of a bank. We exclude medical practitioners if they work in a medical office of the bank (such as onsite doctors). Finally, we exclude any computing specialists or scientists whose job description places them in the bank's own IT department. We assume an individual remains employed by the bank if no new employment is started and no end date for their employment at the bank is given.

We manually assign over 1000 ONET job descriptions to expertise categories. Our categories include computing/software, life science or pharmaceuticals, engineering or manufacturing, energy generation and energy resources, environmental science, agriculture or food science, mining or geological experts, and healthcare experts. These categories are broad but fit the data and people's job descriptions and educational details well.

Figure 1 plots the number of new expert hires per year at Y-14 banks over the period 2000-2024. In the initial decade through 2010, we see a steady growth in expert hires by banks. This growth itself is interesting, but is dwarfed byt the hiring that picks up in 2017 and is followed by a period of rapid hiring through 2024. We view this new data being brought to bear on the question of stewardship as a first finding of the paper. Namely, banks have hired experts aggressively in the last decade, building out advisory departments that sound a bit more like merchant banking times of industry expertise being housed inside financial institutions for lending book growth-oriented reasons.

We observe a similar trend when breaking hires into groups by occupation category (Figure 2). Aligned with the recent trend for technology hiring in banks, software is the most prevalent category of expert hiring in our data. The pattern of a massive recent growth in expert hires across the Y-14 banks is reflected in all job categories with over 100 new hires in a given year across the sample period.[10] Across software, life sciences / pharmaceuticals, and engineering roles, the trend mirrors the aggregate with a slow growth in the early period followed by a steep increase around 2017. The other sectors of energy, environment, and food / agriculture experience a slightly more more focused expansion, with a growth spike aligned potentially with the passage of the Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA), both of which stimulated policy-related job creation.

For the purposed of the rest of the paper's analyses, we assign experts to NAICS industries at the three digit level. This mapping is broad but enables the final Y14 lending analysis.

[10]We note that expert hires in the software field may include both experts by our definition and employees that are responsible for maintaining the bank's internal technology. We may not be fully able to extricate this from expert hiring if job descriptions or titles are unclear or vague.

2.2 A Theoretical Framing & Empirical Predictions

As our second foundation, we introduce a model to structure relationships that compel empirical tests. Because the model can be easily explained in prose, we relegate the full model formulation to Appendix B and summarize the setup and empirical predictions here.

Our interest is in firms that have access to expansion opportunities, especially at moments of transition akin to Kodak's moment with the digital camera. Kodak knew about opportunities and chose to stay in the traditional sector of the market rather than to expand into a new product line. It is well documented in corporate finance that firms regularly neglect investment opportunities that create value for the firm due to reasons of agency frictions (e.g., career motives such as entrenchment, risk avoidance, and enjoying the quiet life) and short-termism. Kodak may be name associated with such decisions, but it is by no means alone.

We model a firm with such an expansion investment opportunity that creates value by facilitating company growth into a new (similar risk) product line. Firms have idiosyncratic discount rates that reflects the degree of short-termism or agency preferences causing discounting above the market rate. The firm with an expansion opportunity faces a tradeoff of paying out dividends to its shareholders today or investing into the value-creating expansion opportunity created by the moment of transition. If the firm's discount rate is sufficiently high, the firm decision-makers will neglect expansion opportunities.

We then introduce a bank into the model. With an interest rate conditional on the expected performance of the loan, the bank offers the firm an expansion loan. In corporate finance, we typically assume that expected loan performance refers to default probabilities. Here, we broaden this lens also to include when a loan is expected to spawn new future loan volume. The key feature of the bank is in the delving into the causes of expected performance. Default and volume spawning have a number of causes – bank effects, firm risk and growth effects, macroeconomic time effects, and sector risk effects as well as pairs of these dimensions including relationship lending and bank sector specialization. We adopt the empirical regularities from the literature and sign some of the interest rate effects. Namely, banks with sector specialization are able to provide loans to firms that perform better for the bank (in default and lending book growth) and for the borrowing firm (in cheaper interest rates). Finally, we introduce stewarding as a form of, or action of, specialization. We define stewarding as the bank's bringing sector specialization to bear on a subsector in which the firm lacks any past activities. Stewardship can be bank initiated or firm initiated.

Returning to the firm, we see that firms with neglected expansion opportunities benefit from stewardship. Banks with specialization can offer low enough interest rates – due to specialization performance – to overcome expansion frictions for the firm. This leads directly to our first empirical

prediction.

> Prediction (I): Expansion loans will be more likely to be extended by specialized banks with the ability to steward projects.

Our second prediction builds off the possibility that firms may have more neglected opportunities when they are highly discounting the future. Hence, these same firms are more likely to have an opportunity that benefits from stewarding. The lower interest rate from stewardship-specialization helps the firm with the tradeoff of dividends versus long-term valuation.

> Prediction (II): Bank stewarding of projects is particularly valuable for firms with high discounting of the future value from investment.

These predictions rely on a mechanism assumption of how specialized lender price expansion loans with their stewardship.

> Prediction (III): Expansion loans from banks with higher stewardship will have a lower interest rate than other loans, ceteris paribus.

3 Data

Our empirical predictions focus our analysis on loan originations. A different approach might be to study firm investment with and without bank lending. Yet, as econometricians, we cannot see instances when the firm neglects investment or firm investment bring itemized as an expansion activity. Thus, we focus on bank lending as the base dataset. In the bank loan dataset, we see very precise loan-level industry subsectors to speak to whether a loan represents an expansion for a firm. We can determine bank-client relationships to consider loans that did and did not happen. In addition, we can relate loan originations to specialization in that bank, controlling for the bank, the firm, and relationships. Attached to that bank loan dataset, we will pull in human resources data on Ph.D.s and experts and short termist measures for the publicly-traded firms.

Y-14 Bank Loan Data Our sample is that of the Y14-Q, schedule H1 data from the Federal Reserve System. The dataset contains detailed quarterly information on the commercial and industrial (C&I) loans of reporting banks. Reporting institutions must file all loans they hold with a total balance-sheet commitment of more than 1 million USD in a given quarter. In the sample period between 2012:Q2 and 2023:Q2, we observe 40 banks that report several million loan observations. We keep observations for which we observe the amount, maturity, and interest rate. We remove observations with interest rates or maturities that are likely the result of coding errors

(i.e. negative or beyond reasonable coding ranges). In our cleaned sample, we thus focus on about 809,000 term loans and credit lines with a total of over 8,000,000 loan-quarter observations.

The data includes private as well as public borrowers – unlike many other data sets. Ultimately, our cleaned data contains loan-information for around 70% of C&I lending in the United States. Table 1 reports the key metrics for our sample. The average loan size is $16 million, reflective of lending at the large and small scale.

Banks report a large set of characteristics for each loan they hold that are useful for our analyses. Loan characteristics include the type of loan (credit line vs. term loan), total committed amount, total drawn amount, interest rate, the loan purpose (i.e. the project-type being financed) whether a loan is collateralized or unsecured, loan maturity, a loan's risk rating as rated by the bank and reported to Federal Reserve examiners, as well as whether a loan has become non-performing or is in arrears. Besides loan characteristics, the data contains additional information on borrower characteristics. These include borrower name, location, and – importantly–, the 6-digit NAICS of the industry to which the loan is directed.

We end our analysis looking for corroborating evidence from a transition setting, akin to the Kodak moment of digital cameras. We focus on green economy transition opportunities for firms for which the Bureau of Labor Statistics (BLS) provides a list of affected industry codes.[11] Around 3% of all outstanding or new loan observations are considered transition under the BLS coding.

Data on Short-Termism As our view of the extent to which firms may have a a higher likelihood of having neglected expansion opportunities, we seek a measure of the heightened discount rates caused by agency or short-termism. We focus on short-termism, which we can measure using shareholder rather than firm activities. We measure short-termism for each firm with the share of the company's shareholders are short-termist, utilize 13F filings data. Large institutional investors with more than $100 million in assets under management are required to report (every quarter) their holdings of U.S. stocks and other related securities to the Securities and Exchange Commission.[12] To identify which institutional investors can be classified as "short-termist',' we follow the literature following (Bushee, 2001) and consider two measures of short-termism: the share of their investor's portfolio held for less than 2 years, and the share of the investor's portfolio that is turned over in each period. We classify an investor as "short-termist" if it is in the top quartile of short-termism using either measure, or whether that investor is classified as short-termist in the

[11] The full list can be found at , or available from the authors. We refine the list somewhat to remove borderline green industries such as aluminum smelting and tar production. The list includes a wide range of industries associated with green energy generation, bio-fuels, certain agricultural sectors or agricultural improvements, certain mining, and more.

[12] We access 13F filings through WRDS for the post-2013 period, and from Backus et al. (2020) for for the period prior to 2011.

Bushee (2001) classification.[13] We then calculate for each firm what fraction of their outstanding shares are held by "short-termist" investors.

We merge Y-14 data with our firm level 13F and Compustat data using a multi-step process. [14] Our final matched sample covers 56% of all firms listed in Compustat by count but just over 90% by size. As can be seen from Table 1, around 62% of our loan-quarter observations are directed towards firms with short-termist investors. Naturally, compared to the Y-14 data with both public and private firms, the merged sample of firms for which we have short termist data is reduced.

4 Empirical Methodology

We take three lenses to the bank data to test for evidence identifying stewardship. First, we create a database of possible loans – those that did and those that could have occurred. This enables us to focus on the likely mechanisms through which stewardship might happen. To build a database of potential bank-firm pairs, we consider the likely mechanisms by which stewardship might happen. Imagine that a bank has gained specialization expertise in a sector, working with clients in the recent past. Now, this bank, working with a different client, may suggest an expansion-oriented project by leveraging this prior knowledge via its advisory department. Indeed, this is how the bank advisory divisions are defined. In this story, expansion loans might happen within existing bank-borrower relationships. Thus, our first test to identify stewardship takes the set complete set of historical bank-client relationships and asks whether expansion lending happens if a bank has gained expertise in an industry. Methodologically, we create a fictive database that supposes that a borrower might reasonably borrow from any of its prior relationship banks for a specific project. Naturally, we define bank-borrower relationship pairs at the start of our sample – usually before a bank has gained significant expertise in the relevant field – and avoid capturing cases whereby a borrower has sought out a bank because of its specialization.

Our second lens looks only at loan originations that have happened and thus speak to lending terms, especially the interest rate pricing. Because we use the Y-14 data, we have the risk profile of each loan that is part of the Federal Reserve System stress testing efforts. It provides a risk gauge

[13] We thank Brian Bushee for making this data publicly available on his website. Bushee (2001) classifies institutional investors into "dedicated" (DED), "quasi-indexer" (QIX), and "transient" (TRA) types based on their portfolio characteristics. The "TRA" types are short-termist.

[14] In some cases, public-firm loans are listed with the company's ticker or tax ID (tin). This allows us to match publicly traded or other large firms to Compustat data directly. In the majority of cases, however, we merge by name and headquarter zip code.Our algorithm first removes common article words and other non-identifying additions to names. This includes words associated with a firms corporate structure such as LLC, Holding, Corporation, and abbreviations of these and similar words. We subsequently match firms with one another if they operate in the same four digit zip code and have names with a high similarity score. In a final step we hand check the largest 2500 firms based on their total asset size.

based on observable information rather than proprietary information of the specific bank providing the loan. This, and the detailed industry code, allows us to make apple-to-apple comparisons.[15]

The final lens is one used as corroborating evidence for a transition happening during our period of time. Our arguments about Kodak's potential expansion into digital cameras were set in a moment of the digitization of imagery. At this moment, green technologies end energy usage offer investment opportunities for firms in transition spaces. Thus, as corroborating evidence, we consider a deep dive into expansion in action by studying green transition loans.

Potential Pairs: Main Specification The main estimation lens is that of potential bank-client pairs. The raw Y-14 data contains only bank–firm pairs that exist because a loan was actually originated. To use an identification strategy that identifies the increased likelihood with which specialized banks lend to firms and especially to which specialized banks help firms enter a new industry, it is necessary to expand the sample to include potential lending relationships—that is, bank-firm pairs that could have resulted in a loan during the sample period. Moreover, as discussed above, we want to limit firm-bank combinations to ones that existed in the early portion of our sample. As such, we can exclude new bank-firm relationships that formed later (after the lender became specialized in the field). This serves to limit the possible size of our constructed data set and makes a strong case for active bank stewardship.

To construct this expanded panel, we proceed in three steps. First, we collapse our data to the firm-bank-industry-quarter level (combining instances in which a firm had multiple loans from the same bank in the same field originated in the same quarter). Next, we identify active firm-bank combinations from the first two years of our sample. Third, we extend this data to include all possible combinations of bank-firm interactions that could have followed. Naturally, we limit our "potential" data to only those industries in which a bank is active and to only those firm-times in which a firm actually borrows. Truly originated loans can take a value of 1 and bank-firm-industry combinations that did not result in a loan take the value of 0.

We begin with a specification of a two-way fixed effects (TWFE) model or, more accurately, multi-way fixed effects (MWFE) of the form:

$$y_{jsbt} = \beta \, Specialized_{bt} + \delta_j + \delta_b + \delta_s + \delta_t + \gamma' X_{jbt} + \epsilon_{jsbt}, \tag{1}$$

where y is an indicator for an expansion loan realized among the bank-historical client potential pairs. Included are fixed effects for firm (δ_j), bank (δ_b), sector (δ_s), and time (δ_t). Vector X_{bjt} includes controls to adjust for the size of a firm's use of bank debt and for loan use fixed effects –

[15] We follow the revealed preference choice argument of Jiménez et al. (2020) that the firm-bank pairs observed are all comparably at an optimal matching, even though one cannot see loan offers turned down.

loan purpose, loan type, and syndication – following Paravisini et al. (2023). The firm and bank fixed effects δ_j and δ_b level each observation to be compared against the average likelihood for the firm and the bank. The coefficient of interest β indicates whether bank specialization impacts the probability of an expansion loan, where Prediction I implies $\beta > 0$.

Identification of the model depends on the absence of unobserved dynamic confounders related to the bank offering of a expansion loan or to the firm having expansion opportunities, either of which could be spuriously correlated with bank specialization. In the context of the model, the firm endogeneity concern would be represented as some firms not having access to expansion technologies, while others do, with this propensity changing over time and being correlated with the likelihood of relying on specialized banks. A bank endogeneity concern would be a bank facing a liquidity shock that affects its loan performance for a sector-firm-year that is related, but not causally so, to the timing of the bank's specialization portfolio.

We draw insights on addressing such confounding effects from the TWFE literature (Athey and Imbens (2022); Imai and Kim (2021); Callaway and Sant'Anna (2021); Sun and Abraham (2021); Goin and Riddell (2023)). In particular, Sun and Abraham (2021) that the key to identification in the presence of potential dynamic confounders lies in isolating the appropriate control group, dynamically. Our study is not a "treatment" per se; yet, the principal is the same. We need to ensure that each observation (firm-bank pair at a point in time) has a dynamic comparables group against which it is compared. Thus, our first step is already done in the creation of pairs. We do not want to force our dependent variable to be within relationship or not, but we need to level observations to being all possible within the historical relationship, a leveling in the spirit of Callaway and Sant'Anna (2021).

Second, we level the analysis within a panel cohort to allow for dynamic treatment effects and dynamic control comparisons. Our parallel is a 'control' comparison cohort of all firm-bank potential pairs operating in the same (precise) industry sector at the same month-year. Thus, critical to our analysis will be a industry*time fixed effects. We isolate these dynamic industry effects at the highest number of digit level as our data permit.

Third, we tackle the possibility of dynamics confounders due to the risk prospects of the sector loan for that particular firm-sector setting at a point of time. We include an external-to-the-bank risk measure, so that we are not picking up the benefits of relationship or specialization lending and a lagged bank average interest rate. The external to the bank risk rating – for the purpose of stress testing efforts – is comparable across different banks and reflects non-public information about the quality of a borrower's project and help us make sure our loans are comparable.

Finally, we implement a saturated firm*bank*time fixed effect model, building off Khwaja and Mian (2008) and Jiménez et al. (2020), and more specifically of the bank interactions included in Paravisini et al. (2023), Banerjee et al. (2021), or Blickle et al. (2024). Such a setup in our

application may mask identification of banks with stable specialization across time and variation among firm or bank comparables, but does allow robustness checks as to whether specialization matters for within-firm-bank-time pairs in seeing potential pairs realize into a loan.

Our final (robustness) estimating specification is thus:

$$y_{jsbt} = \beta\, Specialized_{bt} + \alpha_2 Risk_{jbst} + \delta_{jbt} + \delta_{st} + \gamma' X_{jbt} + \epsilon_{jsbt}. \tag{2}$$

5 Main Results

We organize our results around the three predictions for evidence of bank stewardship.

5.1 Prediction I: Expansion Loan Realizations with Stewardship

Prediction I implies that expansion loans are more likely among potential bank-client pairs when the bank has a prior specialization in the industry or industry experts in advisory roles. Table 2 and Table 3 present the potential pair results with bank specialization and experts being the key independent variable, respectively, in each table.

The columns step into different degrees of fixed effects saturation, appealing to different models. All columns include loan type (credit line versus installment), the risk rating assessment of the Federal Reserve, a syndication dummy, the quarter-year time effects, and loan purpose categories. In column (2), we borrow from the advances in the TWFE, comparing potential pairs within industry crossed with time. We also include firm fixed effects to level analysis to the firm's average probability of a loan pairing with banks following Khwaja and Mian (2008). Columns (3) forces within-bank identification from Blickle et al. (2024), also keeping the TWFE dynamic within-industry comparison. Finally, column (5) implements bank-firm-time fixed effects akin to Paravisini et al. (2023), again keeping the TWFE dynamic within-industry comparison.

In Panel A, the sample is the full set of potential bank-client historical pairs. The dependent variable is whether a loan is originated – for the moment zooming out and not considering whether the loan is an expansion loan. We find, not surprisingly given the past literature on specialization, that loans are more likely to originate in bank-historical client pairs when the bank has developed specialization in that 6-digit NAICS code sector Table 2. New are the parallel results in Panel A of Table 3; bank-historical client potential pairs are more likely to result in originated loans when the bank has experts in the industry sector for which the firm will be using the loan. The magnitude of this new result is instructive. The average potential pair likelihood of a loan originating is almost two percentage points higher if a bank is one standard deviation more specialized in an industry. Given that the unconditional probability of a loan occurring in our expanded sample is

slightly over 2 percent, the effect size is economically meaningful. This result is robust to including bank*year*firm fixed effects, implying that a bank is more likely to extend a loan to an existing borrower-relationship in a given year only in an industry in which it is specialized.

The results are similar if we look at experts instead of industry specialization. We exclude all industries to which we cannot match experts. Given that our matching is fuzzy (see above) this adjustment ensures we are being conservative. We find that a one standard deviation increase in experts is associated with an around 50 basis point increase in the chance that a loan is originated. Our baseline chance of a loan being originated is slightly lower, at 1.5 percent, meaning our result is highly similar, from an economic magnitude perspective, to the one we estimate above.

Panel B changes the dependent variable to being only expansion loans, defined as the loan being a new subsector (i.e. new 3-digit NAICS industry) of investment for the firm. In Table 2, we find the coefficient on bank specialization to be not only significant for all of the models but also fairly stable across the columns. This specification is our most natural for assessing the economic magnitude. In the most stringent saturation of fixed effects in columns (5) of Panel B, we find that a one standard deviation increase in bank specialization increases the likelihood of an expansion loan by 128 basis points. Given that the unconditional mean is only slightly larger than 60 basis points, the effect is a doubling. Expansion loans are double as likely with a specialized bank compared to relationship potential pairs. We view this as our second main finding.

The result holds when we instead look to experts as the key independent variable, in Table 3. We find a consistently statistically positive and stable coefficient on the relationship between experts and the bank-client pair originating an expansion loan.

One might make an argument that our data is picking up experts useful for banking operations, not in stewardship. For example, a bank having an employee with a Ph.D. in quantum engineering might reflect bank hiring of expertise for bank technology applications. Hence in Table A.2, we re-estimate the specification of Panel A column (1) of Table 3 on an industry-by industry basis. The specification in Table A.2 is run on the sample of all observed loans, rather than all potential bank-client relationships.[16] While we might expect the quantum argument could hold in our software and technology industry, it should not be so in food and agriculture. Table A.2 shows that our results are robust to the concern that in-house banking experts are driving the results, with positive stewarding results holding in all of the industries except manufacturing.

For robustness, we include a more limited sample in the Panel C specifications of both Table 2 and Table 3. We drop all bank-firm pairs that do not reflect a potential pair in an expansion industry – i.e. an industry that represents a new 3-digit NAICS code for the borrower. This is a much restricted sample with a different interpretation. It follows the implicit logic embedded in

[16]We plan to run an additional version of Table A.2 on the panel of all potential bank-client relationships.

some high dimensionality non-linear models of removing observation-pairs without relevant variance. If specialization and the presence of experts are most valuable for stewarding to expansion, we would expect the magnitudes of the coefficients to be larger in Panel C compared to Panel B. That is what we find.

5.2 Prediction II: Stewardship More Prevalent when Short-termism Causes Neglected Investment

The model predicts that bank specialization and expertise for stewardship is particularly valuable for firms with overcome short-termism issues, as well as similar constraints that might otherwise limit their ability to invest. Table 5 and Table 6 follow the same specification as Panel A of the prior two tables, but also include an interaction of short-termism with bank specialization (in Table 5) or with experts (in Table 6). The sample size is much smaller, because our measure of short-termism relies on shareholder data in public firms. Moreover, we include some firm-level controls, which are available for only a subset of our data.

We find that bank specialization (or experts) interacted with short-termism is statistically significant and positively economically related to a bank-firm potential pair realizing a loan. This result might be surprising except for the founding in our theory that short-termism provides a setting where bank stewardship might help the firm overcome neglected investment opportunities. Looking across the columns in both Table 5 and Table 6, we now see that the added stringency of the bank and bank-firm fixed effects somewhat diminishes the economic magnitude of our coefficients. However, in almost every case the importance of specialization or experts are most evident for short-termist firms.

Furthermore, the magnitude is meaningful. For the average short-termist firm, a one standard deviation increase in bank specialization implies a between 50 basis point and 1.3% (depending on specification) increase in the likelihood that a loan is originated. This represents up to 50% of the unconditional mean of our dependent variable and is thus economically meaningful. Interpreting the most stringent result as our third main finding contributes to understanding how bank specialization overcomes high discounting by firms and thus neglected investment opportunities – the Kodak moments.

5.3 Prediction III: Lower Pricing with Stewarding Banks

The final prediction comes from the mechanism of loan pricing. In Table 7, we consider whether pricing of loans made by banks stewarding with specialization or by banks with experts is different compared to loans ceteris paribus on a host of characteristics. These characteristics include fixed

effects of industry-time and bank, and importantly also control for the levels of the risk rating of the loan made by the Federal Reserve System. In these specifications, we change the scope of the data to looking only a loans originated, not at the potential pair setup. One can only observe rates for loans that exist.

In Table 7, columns (1) and (2), we consider the effect of bank specialization on interest rates. In Columns (3) and (4), our independent variable of interest is experts. Columns (2) and (4) differ from (1) and (3) in including bank fixed effects. It is unclear which is the better column – with or without bank fixed effects – in that bank specialization in a sector is not especially dynamic. A bank may become specialized but does not become un-specialized in our dataset. Likewise for experts in that the rise of experts is generally late in the sample. Hence, the even numbered columns are identifying off the time dimension of how long the firm has had specialization or experts. This duration will affect the average specification for the bank fixed effect "coefficient". Because of this discussion, we take the average of the two column's (significant) coefficients for the purpose of economic magnitude.

Across all columns, we find that specialization or experts commands a negative effect on interest rate pricing. In understanding the economic magnitude, two approaches might be valid for columns (1) and (2). First, one might make the argument that the average of columns (1) and (2) coefficients imply that comparing projects with and without specialization (multiplying the coefficient by 1) results in an implication that specialization implies lower rates of 72 basis points (bps). A 72 bps change in the rate implies an overall amoritization payment savings of $151,375 on an average sample loan of $16.3 million. Across our sample of 317,799 unique loans, this aggregates to $48 billion. A much more conservative approach would be to take the standard deviation of specialization (0.04) as the economic magnitude change framing. In this metric, columns (1) and (2) averaged, imply that a loan ceteris paribus on a host of characteristics including risk is 3 basis points cheaper. This calculation is not a realistic depiction of a possibility, however.

For the expert columns, the economic magnitude interpretation is simpler. Firms have an average of 19.5 experts and a standard deviation of 25.4 people. The independent variable experts in these columns are divided by 100 to make the table read more easily. Thus, with a one standard deviation increase in experts (25.4 / 100), a given bank is likely to charge 7 basis points less (taking the average of the effects across columns (3) and (4). Doing the same aggregate calculation, we arrive at a lower bound impact of just shy of $5 billion in lower payment costs from the pricing differential of stewarded loans, leaving us with a range of $5 billion - $48 billion in inducements for neglected investment.

These results are based on the bank-firm pairs that existed at the start of our data. We can expand our analysis by looking at all loans, which we do in Panel B. Here, we see that the results are sample independent. As such, the new relationships, which come about due to a bank's

specialization or expert hires, are priced in the same way.

6 Green Expansion: Corroborating Evidence

The final lens we take to the data is a test case of studying the energy transition, looking for corroborating evidence in a "Kodak" transition of our time in the green transition. Specifically, we are looking for firms expanding with the green economy opportunities do so with the aid of bank stewardship. This choice is partially motivated because the green transition offers opportunities to both firms and banks (Morse and Sastry (2024)), but primarily motivated by our ability to build off the Bureau of Labor Statistics lists to isolate very detailed sector codes for clean energy and other green technologies. The green transition is, in the definition of the BLS, much larger than the (politicized) debates on climate, as the BLS categories include industry codes such as mining, semiconductors, and industrial battery storage as well as the typically green labeled categories of electric vehicles and new energy.

In Tables 8, 9 and 10, we follow the same sequence as before in studying (i) the realization of an expansion loan as a function of bank specialization, (ii) the interaction of specialization with short-termism in predicting the realization of an expansion loans, and (iii) the interest rate of an expansion loan as a function of specialization. In this draft, we focus on realized loans only rather than potential bank-firm pairs. We also focus on bank specialization in expansion areas for the firm as our evidence for stewardship, with the evidence on experts being a work-in-progress.

Stewarding of Green Expansion: Results Table 8 presents evidence as to whether stewardship via bank specialization is more likely to empirically predict expansion borrowing by firms. All columns include loan type (credit line versus installment), a syndication dummy, year time effects, industry code at the NAICS 6-digit level, loan purpose categories, and bank fixed effects. Thus, all columns force within-bank identification as in Blickle et al. (2024). In column (3), we include firm fixed effects to level analysis to the firm's average probability of a loan pairing with banks following Khwaja and Mian (2008) and implement the TWFE dynamic within-industry comparison (Sun and Abraham (2021)). Our identification in this column thus seeks to compare Kodak at the moment of transition investment opportunities to potential pairs for digital cameras with a Fuji Corporation, lined up in risk and other characteristics. Finally, column (4) adds in the important Federal Reserve System risk rating fixed effects.

Across all of these specifications, we find a positive, significant coefficient on specialization. Importantly, the coefficient of interest does not vary greatly as we add more controls and fixed effects, honing in on a precision comparison group. Interpreting the significant, positive coefficient on specialization in column (4), a 1 standard deviation increase in lender specialization is associated

with a 3.3 basis point increase in the probability that a new loan origination is a transition expansion loan, a large effect given that on average only 1.2% of all loans are expansion loans. More directly, a firm is slightly more than two times (137%) as likely to do green expansion with a specialized bank.

Short-termism and the Stewarding of Green Expansion: Results Table 9 reports the green expansion findings as they relate to the preponderance of neglected opportunities captured in our measure of high discount rates via short-termism. The table shows that these patterns hold when looking at transition expansion loans. Short-termist firms are in general less likely to undertake expansion loans in transition industries, and the effect of lender specialization is particularly pronounced for short-termist firms. We also note that these results are robust across our controls and fixed effects. These results are strongly consistent with Prediction II of the model, showing that if a firm with a high discount rate invests in a transition or expansion projects, empirically it is more likely it is that the lender is a specialized bank.

An interesting second finding comes out of this focus on a transition sector. For short-termist firms that are not undertaking a loan with a specialized lender, we see that they are less likely to undertake transition expansion projects. All else equal, a firm with high short-termism is *unlikely* to undertake a transition project, consistent with the notion that these pay off over the longer-term and may be less attractive for high discount rate firms. However, we find that specialized lenders make it *more likely* for a short-termist firm to pursue a transition project. This helps support the idea that the effect of lender specialization is *most* pronounced for firms that are otherwise constrained by short-termism, firms that would not have done these projects in the absence of lender specialization. These findings are robust to a range of controls and fixed effects across the columns. These results also help to shed light on the credit supply and credit demand dynamics from earlier. Since, all else equal, short-termist firms are less likely to undertake transition projects, these results help support a view that lenders may play a particularly important role in unlocking transition investments. We argue this holds because short-termist firms would not necessarily be the ones to approach the bank seeking to undertake these investments.

Pricing of Loans with Stewardship of Green Expansion: Results Finally, we consider interest rate pricing for green expansion investment in Table 10. In all columns, we include stringent and saturating fixed effects of loan type, risk rating, syndication, loan purpose, industry times year, bank, and firm fixed effects. In columns (1) and (2), we use lagged bank specialization. We use current green specialization in columns (3) and (4). Columns (1) and (3) include all loans – outstanding and new, – to follow the practice of treating outstanding loans on the banks' lending book as an important weighting of the rates. Columns (2) and (4) consider only new originations,

and thus are implemented with lower statistical power.

We find that green expansion loans carry lower interest rates with specialized banks. The magnitudes are highly similar in the sample of new loan originations only, although we lose power because the sample size significantly shrinks. Interpreting column (3), the effect is double the magnitude – a 6.7 basis point effect for a 1 standard deviation higher specialization – of the interest rates result we found in expansion without the green lens, likely because we are honing in on a transition sector where specialization is even more valuable. Again, our results offer affirmation of Prediction III, that specialized banks with more stewarding capacity will offer a lower interest rate than other bank-firm matches.

7 Conclusion

We argue that banks are not merely fungible, mechanical providers of credit, but rather integral guides who enable firms to undertake long-term, value-creating investments. We synthesize work in banking and corporate finance into a novel new characterization of bank activity that we label bank stewardship. Banks expertise in certain types of investment projects impact their clients' ability (and willingness) to undertake such projects. This expertise is valuable in general for firm expansions, but is particularly valuable we show in moments of transition.

Throughout the paper, we have used the language of a transition moment in time generally to refer to transitions in digitization of cameras, technology, energy, AI, etc. The same language could easily characterize the role of merchant bankers in transportation, electrification, agricultural automation, and factory lines from the 19th and 20th centuries. Likewise, the application of our paper – and our anecdotes of stewardship in the introduction – concerned the different technologies from quantum to agriculture and communications.

Building on the literature around bank specialization (Paravisini et al., 2023; Blickle et al., 2024, 2025) we develop a model, which showcases that banks with more expertise in certain types of projects can help firms make such investments. Specialized banks familiar with financing transition opportunities would charge lower rates to their clients. We show that particularly firms with high short-termism (or similar constraints) may find bank expertise necessary to engage in value-creating investments.

We corroborate our theory empirically using supervisory – and highly detailed – stress-testing data. For these empirical tests, we use investments into greener technologies, which were relevant to the growth of some sectors during our sample period, as transition opportunities. We find that our empirical predictions map onto the data well. Borrowers associated with lenders that are specialized in transition lending are themselves more likely to take transition loans and enter

in new transition industries for the first time. These findings are highly robust across a range of specifications. Moreover, we can also leverage the passage of the IRA – which created a shock to transition opportunities – and show that this also favored more transition projects with specialized lenders.

Consistent with the model, we find empirically that it is high discount-rate firms–those with high short-termist shareholders– that seem to benefit the most from bank specialization. Their propensity to undertake transition investments is significantly higher if it involves a specialized bank. We also show that without a specialized bank, short-termist firms are less likely to undertake such projects on their own. That is, specialized lenders are indeed most critical in the case of larger short-termist borrowers. Lastly, We find that transition lenders charge less for transition loans. These results hold even in the face of restrictive risk-controls and borrower as well as lender fixed effects.

A Tables and Figures

A.1 Figures

Figure 1: Expert Hires by Y-14 Banks



Figure 2: Expert Hires by Occupation Category (Aggregated from O-NET Code)

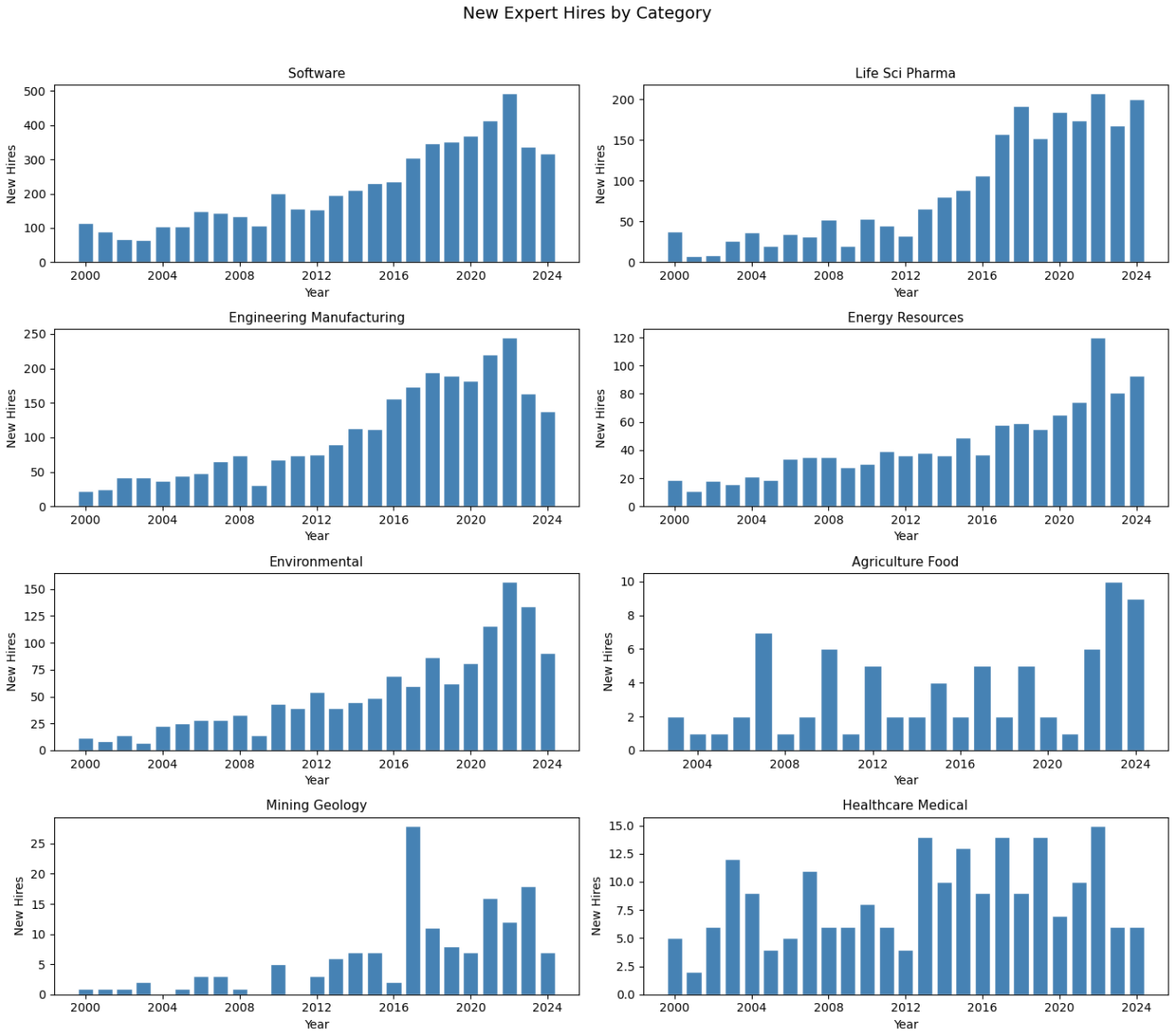


Figure 3: Model relationship between the discount rate and the probability of a firm investing

Note: This figure plots the model-implied relationship between the firm's discount rate and the probability of a firm undertaking the transition investment under the parameters discussed in the text.

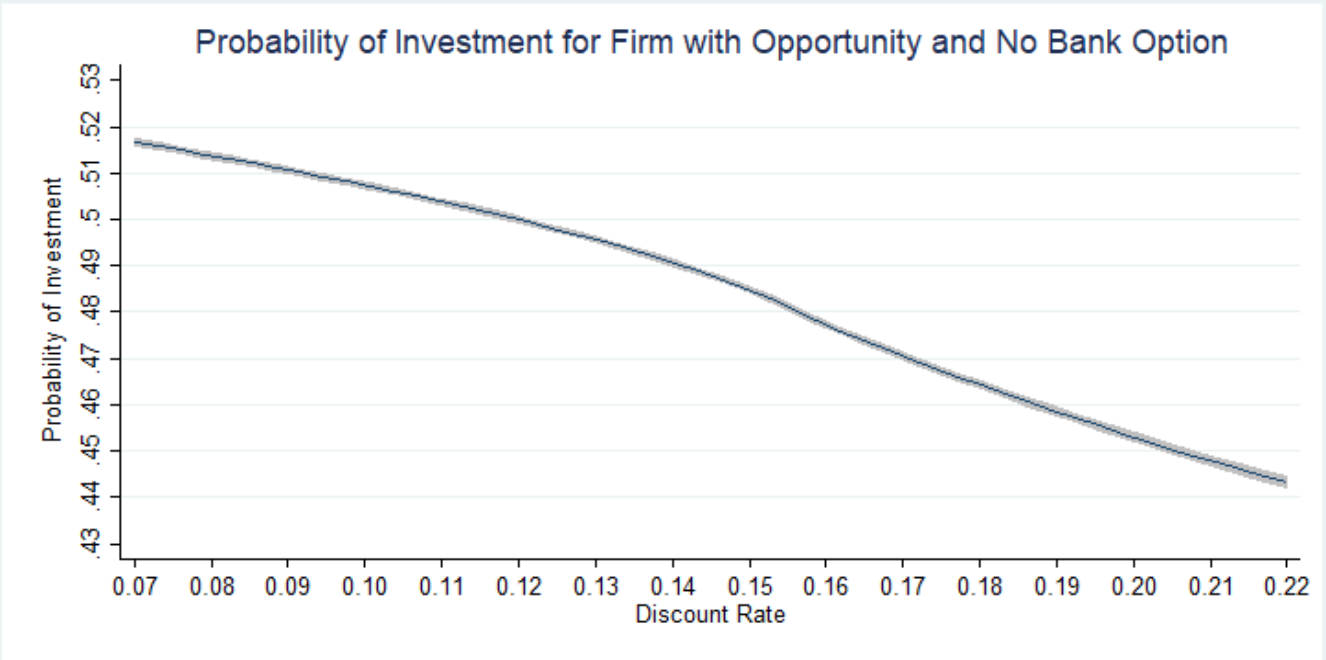


Figure 4: The model-implied relationship between investor short-termism and bank specialization for neglected opportunity firms

Note: This figure plots the model-implied relationship between the firm's likelihood of undertaking the transition investment with bank financing and the firm's discount rate after conditioning on neglected opportunity firms – the ones who would not undertake the transition investment without banking finance. This figure uses the parameter assumptions discussed in the text.

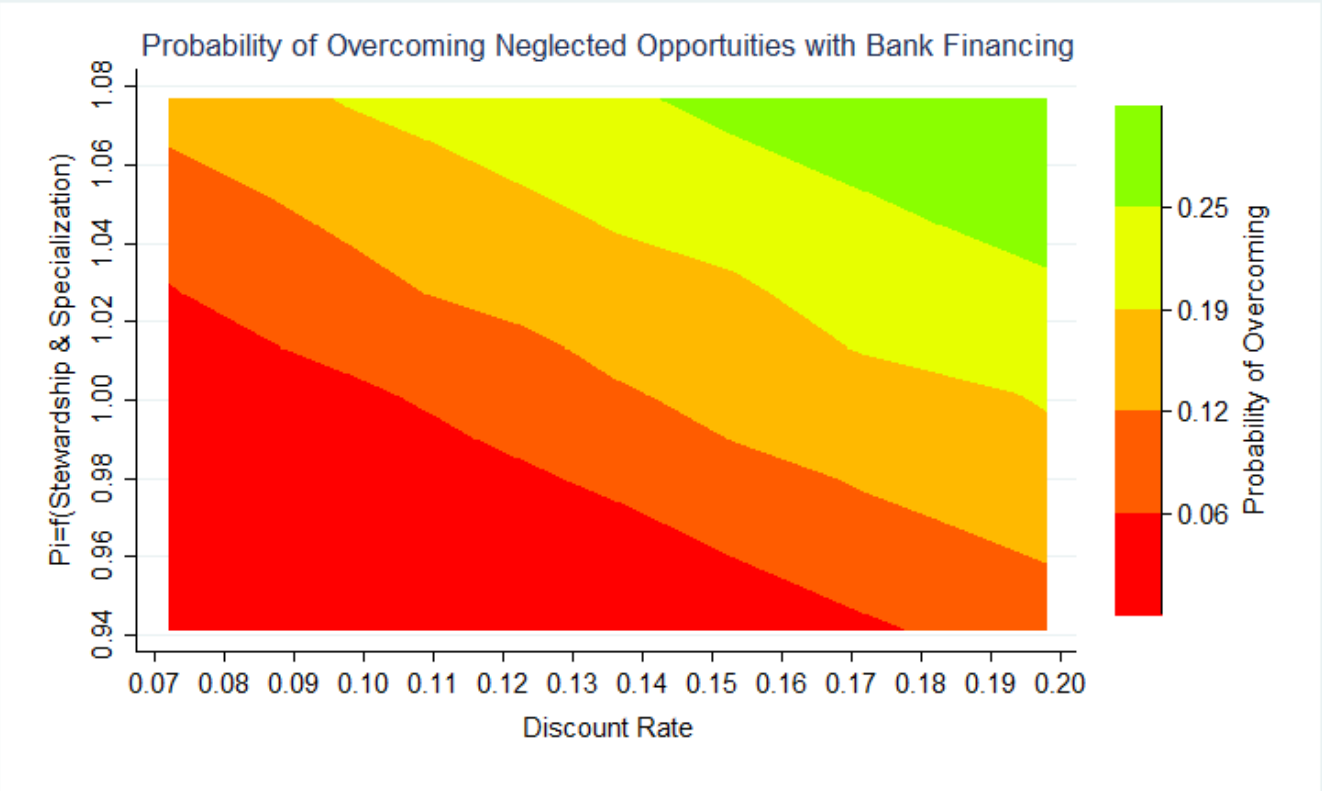
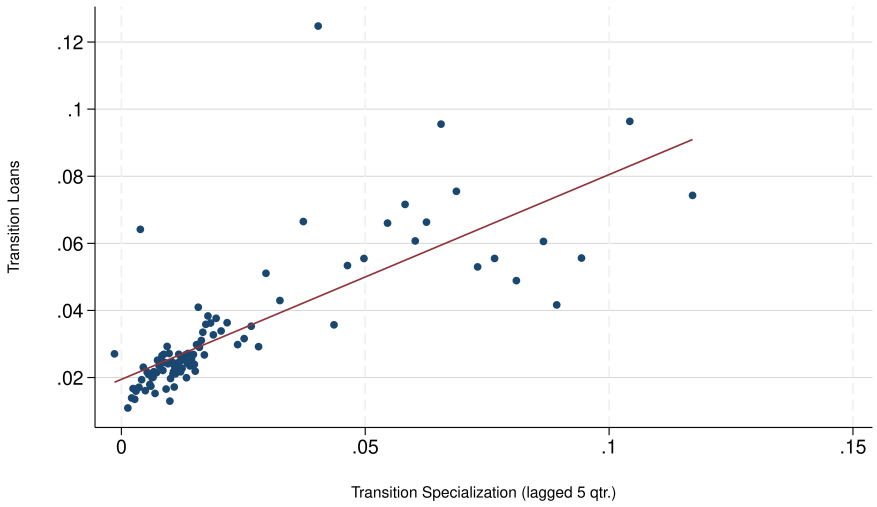


Figure 5: Correlations of Transition Loans to Bank Transition Specialization

Notes: We relate the share of transition loans (relative to all loans) made to a borrower to the average transition specialization of their lenders. We lag lender specialization by 5 quarters and absorb time fixed effects.



A.2 Tables

Table 1: Summary Statistics for All Loans

Note: This table produces summary statistics for the variables used in the paper. Panel A shows the origination rate of loans in a constructed "possible loan" universe of bank-firm relationships. We focus on the years 2014-2024 and limit to bank-firm pairs that interacted in the first two years of our sample (2012-2013). Panels B-C make use of all loan observations that can be observed in the actual Y14 data. We include new origination and renegotiation.

	N	Mean	SD	p25	p75
Panel A: Potential Bank-Firm Pairs					
Loan actually originated	9,758,914	0.025	0.10	0	0
Loan to new Industry Originated (3 digit)	9,758,914	0.006	0.064	0	0
Loan to new Industry Originated (5 digit)	9,758,914	0.010	0.09	0	0
Industry Specialization	9,758,914	0.01	0.02	-0.01	0.02
Experts	2,030,896	12.1	15.7	1	19
Panel B: Loan Variables					
Committed exposure (loan size)	5,648,974	16,344	49,270	17,112	13,375
Log committed exposure	5,648,974	8.57	1.35	7.44	9.50
Interest rate	5,648,974	3.77	3.06	2.43	4.65
Maturity	5,648,974	16.56	18.41	4	20
Internal risk rating	5,648,974	4.69	1.17	4	5
Syndicated loan flag	5,648,974	0.12	0.33	0	0
Short-Termist Firm	1,087,579	0.62	0.07	0.59	0.67
Panel C: Bank Specialization					
Industry Specialization	5,648,974	0.03	0.04	0.01	0.02
Experts	1,664,863	19.5	25.4	1	28
Green Specialization	5,648,974	0.015	0.02	0.01	0.02
Panel D: Industry and Loan Purpose					
Expansion Loan	5,648,974	0.012	0.11	0	0
Transition loan	5,648,974	0.03	0.16	0	0
Working Capital	5,648,974	0.54	0.49	0	1
Real Estate	5,648,974	0.19	0.39	0	0
Capex	5,648,974	0.07	0.26	0	0
Trade Finance	5,648,974	0.03	0.16	0	0
Project Finance	5,648,974	0.01	0.05	0	0
Leasing	5,648,974	0.03	0.18	0	0
Agriculture	5,648,974	0.01	0.08	0	0
Other	5,648,974	0.12	0.33	0	0

Table 2: Loan origination and bank specialization

Note: We regress loan origination on bank specialization. In Panel A, we regress a binary variable, which takes the value of 1 for originated loans, on bank specialization for the sample of all potential bank-client pairs constructed from historical relationships. In Panel B, we limit the dependent variable to expansion loans, where a firm takes a loan in a new industry (6-digit NAICS sector) for the first time. Panel C uses the expansion loan dependent variable from Panel B but limits the sample to bank-client pairs in new industries for the firm. We include fixed effects as indicated. T-statistics are shown in brackets; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

			Panel A		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Expansion Loan **Sample:** All Potential Bank-Client Pairs from Historical Relationships				
Bank Specialization	0.683***	0.679***	0.681***	0.677***	0.675***
	(220.61)	(220.45)	(216.13)	(216.94)	(216.31)
N	9,758,914	9,758,914	9,758,914	9,758,914	9,758,914
			Panel B		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Expansion Loan **Sample:** All Potential Bank-Client Pairs from Historical Relationships				
Bank Specialization	0.346***	0.344***	0.339***	0.339***	0.321***
	(183.17)	(181.69)	(175.97)	(175.64)	(175.64)
N	9,758,914	9,758,914	9,758,914	9,758,914	9,758,914
			Panel C		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Expansion Loan **Sample:** Expansion Loan Potential Bank-Client Pairs from Historical Relationships				
Bank Specialization	0.785***	0.480***	0.706***	0.427***	0.499***
	[28.04]	[7.84]	[18.72]	[7.82]	[8.76]
N	184,101	151,350	184,065	149,031	110,315
Baseline FE	Loan Type, Rating, Syndicated Loan, Time, Purpose				
Firm	-	Y	-	-	-
Industry*Time	-	Y	Y	Y	Y
Bank	-	-	Y	-	-
Bank*Firm	-	-	-	Y	-
Bank*Firm*Time	-	-	-	-	Y

Table 3: Loan origination and bank experts

Note: We regress loan origination on experts, the number of PhD or Master level employees hired by a bank in roles not related to financial intermediation, risk management, or internal technical support. In Panel A, we regress a binary variable for new loans originated on bank specialization for the sample of all potential bank-client pairs constructed from historical relationships. In Panel B, we limit the dependent variable to expansion loans, where a firm takes a loan in new industry (6-digit NAICS sector) for the first time. Panel C uses the expansion loan dependent variable from Panel B but limits the sample to bank-client pairs in new industries for the firm. We include fixed effects as indicated. Standard errors are shown in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

			Panel A		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Loan Originated				
	Sample: All Potential Bank-Client Pairs from Historical Relationships				
Experts	0.0201***	0.0217***	0.0152***	0.0165***	0.0174***
	[34.19]	[35.31]	[15.35]	[16.18]	[16.37]
N	2,065,957	2,065,957	2,065,957	2,065,957	2,065,957
			Panel B		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Expansion Loan				
	Sample: All Potential Bank-Client Pairs from Historical Relationships				
Experts	0.00260***	0.00316***	0.00271***	0.00297***	0.00319***
	[7.59]	[8.72]	[4.68]	[4.90]	[5.10]
N	2,065,957	2,065,957	2,065,957	2,065,957	2,065,957
			Panel C		
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Expansion Loan				
	Sample: Expansion Loan Potential Bank-Client Pairs from Historical Relationships				
Experts	0.497***	0.149	0.810***	0.624***	0.659***
	[3.29]	[0.82]	[4.91]	[2.59]	[2.65]
N	46,358	36,618	46,358	34,804	17,921
Baseline FE	Loan Type, Rating, Syndicated Loan, Time, Purpose				
Firm	-	Y	-	-	-
Industry*Time	-	Y	Y	Y	Y
Bank	-	-	Y	-	-
Bank*Firm	-	-	-	Y	-
Bank*Firm*Time	-	-	-	-	Y

Table 4: Loan origination and experts counts

Note: We regress loan origination on experts, the number of PhD or Master level employees hired by a bank in roles not related to financial intermediation, risk management, or internal technical support. We aggregate from ONET-Code to divide experts into the following categories: "Agriculture Food Experts," "Energy Resource Experts," "Engineering or Manufacturing Experts," "Environmental Experts," "Life-Sciences of Pharmaceutical Experts" and "Healthcare Experts." We include controls and fixed effects as indicated. T-statistics are shown in brackets; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: Loan Originated						
Agriculture Food Experts	0.0177***						
	[5.53]						
Energy Resources Experts		0.0115***					
		[11.55]					
Engineering or Manufacturing Experts			-0.00209***				
			[-6.08]				
Environmental Experts				0.00619***			
				[7.29]			
Life-Sciences or Pharmaceutical Experts					0.00544***		
					[7.61]		
Healthcare Experts						0.0293***	
						[9.77]	
Software Experts							0.00513***
							[7.10]
N	406,284	520,545	520,794	201,444	104,230	312,660	208,487
R^2	0.040	0.007	0.004	0.001	0.020	0.006	0.001
adj. R^2	0.040	0.007	0.004	0.001	0.019	0.006	0.001
Baseline FE	Loan Type, Rating, Syndicated Loan, Time, Purpose, Industry, Bank						
Controls	Bank Size						

Table 5: Loan origination and bank specialization – new origination short-termist interaction

Note: We regress loan origination on bank specialization. We also interact specialization with a continuous variable, "Short-Termist," measuring the firm's short-termism, defined as the share of a company's shareholders that can be classified as short-termist. This variable is only available for publicly traded companies. We include fixed effects as indicated. T-statistics are shown in brackets; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Loan Originated				
Bank Specialization	0.302	0.236	0.347	0.406*	0.460*
	[1.13]	[0.94]	[1.32]	[1.70]	[1.96]
Bank Specialization * Short-Termist	1.317***	1.396***	1.185***	1.027***	0.917**
	[2.99]	[3.38]	[2.74]	[2.62]	[2.37]
Short-Termist	-0.0229***	-0.0660***	-0.0257***	-0.0650***	0
	[-2.86]	[-3.67]	[-3.30]	[-3.50]	[.]
N	241,023	241,023	241,019	241,019	241,019
Baseline FE	Loan Type, Rating, Syndicated Loan, Time, Purpose				
Firm	-	Y	-	-	-
Industry*Time	-	Y	Y	Y	Y
Bank	-	-	Y	-	-
Bank*Firm	-	-	-	Y	-
Bank*Firm*Time	-	-	-	-	Y

Table 6: Loan origination and experts – new origination short-termist interaction

Note: We regress loan origination on experts, the number of PhD or Master level employees hired by a bank in roles not related to financial intermediation, risk management, or internal technical support. We also interact the stock of experts with a continuous variable, "Short-Termist," measuring the firm's short-termism, defined as the share of a company's shareholders that can be classified as short-termist. This variable is only available for publicly traded companies. We include fixed effects as indicated. T-statistics are shown in brackets; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Loan Originated				
Experts	0.0133***	0.0172***	-0.00141	0.00109	-0.000319
	[7.65]	[10.15]	[-0.33]	[0.26]	[-0.08]
Experts * Short-Termist	2.026***	2.097***	1.404***	1.419***	1.447***
	[32.33]	[34.30]	[18.78]	[20.02]	[20.30]
Short-Termist	0.00513**	0.00127	0.00249	0.00364	0
	[2.37]	[0.38]	[1.16]	[1.04]	[.]
N	252,159	252,159	252,159	252,159	252,159
Baseline FE	Loan Type, Rating, Synd. Loan, Time, Purpose				
Firm	-	Y	-	-	-
Industry*Time	-	Y	Y	Y	Y
Bank	-	-	Y	-	-
Bank*Firm	-	-	-	Y	-
Bank*Firm*Time	-	-	-	-	Y

Table 7: Loan Terms on Bank Specialization: Baseline Sample

We regress loan interest rates on bank specialization and the stock of experts employed at banks over the sample of all loans in the Y-14. Experts are defined as the number of PhD or Master level employees hired by a bank in roles not related to financial intermediation, risk management, or internal technical support. Columns 1 and 2 focus on bank specialization, while Columns 3 and 4 count the number of industry experts employed at banks in our sample. We scale these by 100 for ease of viewing. The sample in Columns 3 and 4 is limited to 3-digit NAICS code subsectors where banks employ experts in our data. We include controls and fixed effects as indicated. T-statistics are shown in brackets; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Bank Specialization		Lender Experts	
	(1)	(2)	(3)	(4)
	Dependent Variable: Loan Interest Rates			
	Panel A: Existing Bank-Lender Pairs			
Bank Specialization	-0.980***	-0.463***		
	[-9.42]	[-4.01]		
Experts (/100)			-0.1510*	-0.383***
			[1.75]	[-11.74]
N	2,839,284	2,839,284	633,716	633,716
	Panel B: All Loans			
Bank Specialization	-0.519***	-0.410***		
	[-7.91]	[-5.25]		
Experts (/100)			-0.00254	-0.365***
			[-0.17]	[-20.21]
N	5,383,988	5,383,988	778,771	778,771
Baseline FE and cont.	Time, Industry, Purpose, Loan Type, Rating, Syndicated Loan, Bank size			
Controls	-	Loan Size, Maturity	-	Loan Size, Maturity
Bank FE	-	Y	-	Y

Table 8: Effect of Bank Green Specialization on Green Expansion Loans: All Loans

Note: We regress whether a loan is considered a green expansion loan, which is a binary variable that takes the value of 1 if the firm does a loan in a green industry for the first time, on the degree to which the associated lender is specialized in transition lending. We lag the specialization of the lending institution by 5 quarters. We run this regression on the sample of all outstanding loans. We include controls and fixed effects as indicated. Standard errors are shown in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Dependent Variable: Green Expansion Loan			
Lagged Green Specialization	0.0176***	0.0182***	0.0165***	0.0165***
	(0.000760)	(0.000886)	(0.000895)	(0.000896)
Log Relationship Lending	-0.0000549***	-0.0000404**	-0.0000429***	-0.0000423***
	(0.00000660)	(0.0000161)	(0.0000163)	(0.0000163)
Log Total Bank Lending	0.0000532***	-0.0000168	-0.0000244*	-0.0000251*
	(0.00000760)	(0.0000133)	(0.0000133)	(0.0000133)
Lagged Average Interest Rate				0.000000773
				(0.00000259)
N	5,383,988	5,347,369	5,347,349	5,339,431
adj. R^2	0.004	0.031	0.043	0.043
Baseline FE	Loan Type, Syndicated Loan, Time, Purpose, Industry, Bank			
Firm	-	Y	Y	Y
Industry*Time	-	-	Y	Y
Rating	-	-	-	Y

Table 9: Effect of Bank Green Specialization on Green Expansion Projects by Borrower Short-Termism: All Loans

Note: We regress whether a loan is considered an green expansion loan, which is a binary variable that takes the value of 1 if the firm does a loan in a green industry for the first time, on the degree to which the associated lender is specialized in transition lending. We lag the specialization of the lending institution by 5 quarters. We lag the specialization of the lending institution by 5 quarters. We also interact specialization with a continuous variable ("Short-Termism") measuring the firm's short-termism, defined as the share of a company's shareholders that can be classified as short-termist. This variable is only available for publicly traded companies. We run this regression on the sample of all outstanding loans. We include controls and fixed effects as indicated. Standard errors are shown in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Dependent Variable: Green Expansion Loan			
Lagged Green Specialization	-0.0281***	-0.0262***	-0.0227***	-0.0210**
	(0.00656)	(0.00842)	(0.00834)	(0.00835)
Lagged Green Specialization x Short-Termist	0.0670***	0.0562***	0.0484***	0.0456***
	(0.0103)	(0.0131)	(0.0130)	(0.0130)
Short-Termist	-0.000870***	-0.000634	-0.00118**	-0.00113**
	(0.000286)	(0.000465)	(0.000472)	(0.000473)
Log Relationship Lending	-0.0000452***	-0.000102***	-0.000151***	-0.000148***
	(0.0000116)	(0.0000287)	(0.0000291)	(0.0000293)
Log Total Bank Lending	0.0000511***	-0.0000355	-0.0000404*	-0.0000433**
	(0.0000131)	(0.0000220)	(0.0000218)	(0.0000219)
Lagged Average Interest Rate				0.00000380
				(0.00000790)
N	1,054,339	1,036,189	1,035,894	1,033,314
adj. R^2	0.008	0.035	0.090	0.091
Baseline FE	Loan Type, Syndicated Loan, Time, Purpose, Industry, Bank			
Firm	-	Y	Y	Y
Industry*Time	-	-	Y	Y
Rating	-	-	-	Y

Table 10: Effect of Bank Green Specialization on Interest Rates for Transition Loans

We limit the sample to green expansion loans only, and regress the interest rate of the loan on the degree to which the associated lender is specialized in green lending. We consider both current lender specialization as well as the lender's lagged specialization. We include controls and fixed effects as indicated. Columns 1 and 3 consider the sample of all outstanding loans, and Columns 2 and 4 consider the sample of new loan originations. Standard errors are shown in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Dependent variable: Loan Interest Rates			
	All Loans	New Loans	All Loans	New Loans
Lagged Green Specialization	-1.914***	-1.657		
	(0.370)	(3.203)		
Current Green Specialization			-1.675***	-1.884
			(0.388)	(2.985)
Log Relationship Lending	0.0274**	-0.00233	0.0155	0.0440
	(0.0107)	(0.0781)	(0.00965)	(0.0660)
Log Total Bank Lending	-0.0431***	0.0410	-0.0418***	0.00582
	(0.00930)	(0.0635)	(0.00839)	(0.0538)
Lagged Average Interest Rate	0.0477***	-0.0500	0.0139***	0.00286
	(0.00136)	(0.0428)	(0.000663)	(0.00461)
N	140,940	4,608	162,821	5,516
adj. R^2	0.738	0.640	0.729	0.641
Baseline FE	Loan Type, Rating, Syndicated Loan, Time, Purpose, Industry, Bank, Firm, Industry*Time			

B Appendix: Model

B.1 The Bank

We start with the bank and its incentive to make a loan. Bank b is willing to offer a loan to firm j, operating in industry sector s, if the following inequality holds:

$$-L + \frac{1}{(1+r)} L(1+i)\overline{\pi}_{jsb} \geq 0. \tag{3}$$

The bank provides principal value L today and gets back this principal, grown with interest $(1+i)$. This future cash flow is discounted at the long-run market discount rate r.[17]

The final term, $\overline{\pi}_{jsb}$, is the bank b-client j specific expected performance of the loan in industry sector s, where performance varies in expected default and the spawning of future lending business. Empirically, realizations of π_{jsb} are positive and likely to be close to one, but not constrained to be less than or greater than one. If a loan has high default risk because of the firm or sector, the expected performance will be less than one. On the other hand, if a loan is likely to spawn new lending or other financial services in the future, the expectation of $\overline{\pi}_{jsb}$ could be greater than one.

To further understand the dimensions of $\overline{\pi}_{jsb}$, we write out its decomposed expectation as follows:[18]

$$\begin{aligned}\overline{\pi}_{jsb} = & \underbrace{\pi_{...}}_{\text{Overall Mean}} + \underbrace{\pi_{j..}}_{\text{Firm Effect}} + \underbrace{\pi_{.s.}}_{\text{Sector Effect}} + \underbrace{\pi_{..b}}_{\text{Bank Effect}} \\ & + \underbrace{\pi_{j.b}}_{\text{Relationship Lending}} + \underbrace{\pi_{.sb}}_{\text{Return to Specialization}} + \underbrace{\pi^{stew}}_{\text{Return to Stewardship}},\end{aligned} \tag{4}$$

where, denoting prior time with superscript *prior* and all other firms except j as $-j$:

$$\pi^{stew} = \pi^{prior}_{[-j]sb} \times I^{NoExperience}_{js}.$$

If firm j has no experience in sector k, $\{I^{NoExperience}_{js} = 1\}$, the bank has an expected return to harnessing its stewardship capacity to induce investment opportunities for firm j in line with the bank's lagged specialization in that sector. Note that we define the banks lagged specialization as

[17] The market discount rate is generally higher than the cost of capital for a bank, but we assume this rate also captures a Jorgensenian user cost of capital including the mean rate of lending provision costs.

[18] We use the ANOVA notation of a subscripted dot to denote a mean taken over the omitted subscript letter, such as $\pi_{j\cdot b} = \frac{1}{K}\sum_{k=1...,K} \pi_{jsb}$.

sector expertise working with any of the $[-j]$ firms except j.

In this formulation, the performance of a loan can be considered to result from banks, sector, and firm expected deviations from an overall mean performance,[19] as well as returns to relationship lending ($\pi_{j \cdot b}$), industry specialization ($\pi_{\cdot sb}$), and stewardship (π^{stew}). Hereafter, we add superscripts $relat$, $spec$, and $stew$, to these respective parameters for clarity . Following the literature, we assume that expected loan performance is increasing in relationship, specialization, and stewardship: $\frac{\partial \overline{\pi}_{jsb}}{\partial \pi^m} > 0$ for $m \in [relat, spec, stew]$.[20]

A bank will lend as long as the interest rate is sufficiently high to satisfy the inequality of wanting to lend; i.e.:

$$hurdle\ rate:\ i \geq \frac{(1+r)}{\overline{\pi}_{jsb}} - 1. \tag{5}$$

If we assume that banks operate in an quasi-competitive environment, where they price loans at the hurdle rate equality condition of equation (5), $i = (1+r)/\overline{\pi}_{jsb} - 1$, then the break-even interest rate is (concavely) decreasing in relationship lending, specialization, and stewardship, $\frac{\partial i}{\partial \pi^m} < 0$ for $m \in [relat, spec, stew]$, consistent with Blickle et al. (2024), Paravisini et al. (2023), and Degryse and Ongena (2005).

B.2 The Firm

We model the firms as a risk neutral and having reached its stationary growth rate, g, with a valuation governed by the Gordon growth model and a long-run market discount rate, r. For simplicity, we assume that if the firm wants to continue operations in its stationary focus, it maintains investment in line with depreciation. As such, the firm's earnings will grow at g, and it will pay out all earnings as dividends. We denote a baseline earnings at period $t = 0$ as E_0 and dividends at time t by d_t.

Rather than applying the Gordon growth valuation for the long term valuation today, at $t = 0$, we introduce a medium term period as $t = 1$. We apply the long-run perpetuity at period $t = 1$.

[19] Firm and sector effects might reflect risk, and a bank shifter might reflect market power.

[20] Blickle, Parlatore, and Saunders (2024); Blickle, He, Huang, and Parlatore (2025) find that banks with specializations in industries are able to offer lower interest rates to clients while yet lending more profitably. Likewise, Paravisini, Rappaport, and Schnabl (2023) find that banks with specialty knowledge about geography within sectors of export expertise provide lower interest, more profitable loans. Duquerroy et al. (2022) find that banks have industry specialization that further determines the equilibrium amount of lending into the future, and Frattaroli and Herpfer (2023) find that bank interconnected firms find value-enhancements for both the firm and the bank. Finally, a longstanding literature documents the lending relationship implications for loan contracts as value enhancement for firms and banks. See, for example, Bharath et al. (2007), and Bharath et al. (2009b) and the survey Elyasiani and Goldberg (2004).

In this setup, the stationary valuation at time $t = 0$, $V_0^{stationary}$ can be written as:

$$V_0^{stationary} = d_0 + \frac{1}{(1+\zeta_j)} V_1 \tag{6}$$

$$= d_0 + \frac{1}{(1+\zeta_j)} \frac{d_2}{(r-g)}$$

$$= E_0 + \frac{1}{(1+\zeta_j)} E_0(1+g) \frac{1+g}{r-g}$$

A key attribute of the firm is the discount rate ζ_j, which we assume has the property $\zeta_j \geq r$. We subscript ζ with j, indicative of a particular firm, to emphasize that this is an attribute whose variation in the cross section is a focus of the model. In particular, we built off the large literature showing that firms may pass-up profitable longer-term investment opportunities because of high discount rates, either caused by short-termism in the investor pool (Amihud and Lev (1981); Narayanan (1985); Stein (1989); Bolton et al. (2006); Graham et al. (2005); Kumar and Purnanandam (2023)) and agency challenges (Holmstrom and Costa (1986); Shleifer and Vishny (1989); Hirshleifer and Thakor (1992); Stein (2003); Bertrand and Mullainathan (2003)) hinder investment. Managers who themselves prefer the quiet life or those who face a short-termist board (and its punishment mechanisms) are loathe to cultivate longer-term opportunities, thus have a higher discount rate.

Decisions: We consider two decisions for this firm at a time $t = 0$. The first decision is whether or not the firm should make an investment today toward a transition economy expansion into new technologies or processes. The second decision is whether or not the firm prefers to use bank financing, rather than retained earnings, for this expansion investment. The second decision may affect the initial choice to invest.

B.3 Transition Investment

Some firms have a transition investment opportunity at $t = 0$. We refer to these firms as opportunity firms. To take advantage of the transition opportunity, the firm invests kE_0 out of current earnings, holding back on dividends. k is the capital intensity, which we consider to be industry determined, not a decision parameter. We assume that the market can see when a firm makes a transition investment. With our empirical focus on energy, mining, and materials, we have large, visible projects in mind. For example, in energy, a transition investment might be a hydrogen infrastructure project. In mining, a firm might greenfield a new emissions-light mine for transition

need critical minerals. Both of these investments are large and visible.

In return for the investment, the transition opportunity increases the firm's long-run growth rate at $t = 2$ from g to g^*, a fixed incremental difference for the long-run. We have in mind a firm grabbing new market share as transitioning existing processes or in an expansion division in the long-term growing segment of the economy.

Note that our simple formulation abstracts from the possibility that the company risk profile changes when a firm invests in transition opportunities. From a practical sense, we keep the model simple intentionally as a way to fix thoughts. The intuition of our model predictions hold when considering extensions that add in transition investment shifting the overall riskiness of the firm (embedded in the risk as to the success of reaching g^*), a point to which we return later. Our rationale, however, is more fundamental: in settings where firms face industry transitions, it may be that firms not undertaking transition (the Kodaks of the digital camera transition era) put themselves at greater risk from remaining solely in the stationary economy.

B.4 Firm Investment Choice without Bank Financing

If an opportunity firm chooses to make the transition investment, it pays out $(1-k)E_0$ as dividends, rather than E_0 in the no investment scenario. From period 1 to period 2, the transition investing firm grows at the baseline growth rate of g. Thus, the dividend at $t = 1$ is $E_0(1 + g)$, as in the no investment scenario. But over the longer-term the firm grows at an opportunity growth rate of g^*, where $g^* > g$. In this scenario, the valuation today can be expressed as:

$$V_0^{Invest|NoBankDebt} = d_0 + \frac{1}{(1+\zeta_j)} d_1 \frac{1+g^*}{(r-g^*)} \tag{7}$$

$$= E_0(1-k) + \frac{1}{(1+\zeta_j)} E_0(1+g) \frac{1+g^*}{r-g^*}$$

The transition opportunity firm will choose to invest if $V_0^{Stationary} < V_0^{Invest|NoBankDebt}$. This simplifies to the inequality:

$$\underbrace{\frac{1+g^*}{r-g^*}}_{\text{Expansion perpetuity factor}} - \underbrace{\frac{1+g}{r-g}}_{\text{Stationary perpetuity factor}} > \underbrace{k\frac{(1+\zeta_j)}{(1+g)}}_{\text{Capital intensity wedge valued at discount rate relative to growth}} \tag{8}$$

Equation 8 has a natural interpretation; the firm will make the transition investment if the excess

growth from transition or expansion over the stationary growth outweighs the investment capital intensity k times the cost in the short-termism augmented discount rate relative to stationary growth.[21]

We are particularly interested in when a high discount rate hinders otherwise value-creating investment. We flip equation 8 to isolate this effect:

$$Neglected := \ 1+\zeta > \frac{(1+g)}{k}\Delta^{perpetuities} \tag{9}$$
$$\text{where } \Delta^{pertpetuities} = \frac{1+g^*}{r-g^*} - \frac{1+g}{r-g}$$

To provide more intuition, we provide a graphical representation. Figure 3 depicts the relationship between the discount rate and the probability of a firm investing, conditional on that firm having an expansion opportunity. We parameterize as follows. We set the market rate as r =0.07, and the stationary growth as g =0.02. We draw g^* as uniform distributed between [0.0205, 0.0215] and capital intensity k as normally distributed with mean 0.4 and standard deviation of 0.05. Finally, we draw ζ as the market r of 0.07 plus a (0.75,1.5) beta distribution draw with upper bound of 0.22 to simulate short-termism along a bounded right tail.

Because we focus on opportunity firms, the question is what hinders a firm from wanting to invest in expansion. At the lowest discount rate – that of no short-termism, – 48 percent of firms do not choose to invest. Either the g^* is too low, or the k is too large to warrant investment. As the discount rate increases along the horizontal axis, the investment probability declines – and neglected opportunities rise – as short-termism hinders investment.

B.5 Firm Investment Choice with Bank Debt

We have just plotted how some firms with a transition opportunity might neglect the opportunity because of their high discount rate. Now imagine that the firm has the option to borrow kE_0 from a bank to finance the transition investment, allowing it to maintain its short-term shareholder payouts. Our question is whether this bank access implies that some neglected opportunities become investable.

In this case, the firm can pay shareholders the full dividend equal to earnings E_0 in the base period, invest kE_0 into the transition investment, and repay the loan at $t = 1$ at the interest rate

[21] Firms know whether they have a transition expansion opportunity; thus, it is straightforward that firms without a transition opportunity will never invest since the left hand side of 8 will be zero.

i. The value of the firm is given by:

$$V_0^{Invest|BankDebt} = E_0 + \frac{1}{1+\zeta_j}\left[\frac{E_0(1+g)(1+g^*)}{(r-g^*)} - kE_0(1+i)\right]. \tag{10}$$

Comparing this valuation to $V_0^{stationary}$ leads to the decision relationship that the firm will now choose to make the transition investment with bank debt when:

$$\Delta^{perpetuity} > \frac{k(1+i)}{(1+g)} \tag{11}$$

Our interest is in when the bank option overcomes neglected opportunities. Applying the neglected inequality in equation 9, bank lending overcomes neglected opportunities when:

$$1+i \leq \frac{(1+g)}{k}\Delta^{perpetuities} \leq 1+\zeta_j,$$

or, replacing the endogenous interest rate at the hurdle condition and dividing the system by $(1+r)$:

$$\frac{1}{\overline{\pi}_{jsb}} \leq \frac{(1+g)}{k(1+r)}\Delta^{perpetuities} \leq \frac{1+\zeta_j}{1+r}. \tag{12}$$

The left hand side is the inverse of the expected performance of the loan, including the role of stewardship and specialization. The right hand side is the gross percentage change of the short termist discount rate over the market rate. Scenarios in which bank lending can overcome neglected opportunities are increasing both in $\overline{\pi}_{jkb}$, making the left hand side of the inequality smaller, and in ζ_j, making the right hand side larger.

In other words, banks' ability to overcome neglected opportunities relies on settings in which the expected loan performance (because of specialization and stewardship as well as firm and bank effects) is high. This allows for a project affordable interest rate offer. At the same time, how extreme the firm's short-termism in discounting matters too. The discount rate cannot be so high to overly discount future benefits from added future growth.

Figure 4 plots this relationship, conditioning the sample to neglected opportunity firms.[22] As the contour legend conveys, when $\overline{\pi}_{jkb}$ (the y-axis) and ζ_j (the x-axis) are both high, which is captured in the yellow and green (lighter) regions, the probability of bank financing overcoming neglected opportunities rises to over 25%. This leads to a prediction, perhaps surprising, that

[22] We draw $\overline{\pi}_{jkb}$ from a beta(2,4) distribution, then centered at mean 1, with a standard deviation of 0.04, resulting in a range of [0.94,1.14].

a bank's role in financing transition is most expected in firms with high agency entrenchment frictions and investor short-termism. In such settings, stewardship advantages are most valuable.

B.6 Testable Predictions

The model provides a number of empirical predictions for firms. Observationally, the econometrician cannot distinguish firms with no opportunities from those with neglected opportunities . Thus, we focus our testable predictions on the empirical content found within the dataset of bank loans, avoiding the question of what a lack of borrowing means for the firm.

In this dataset, we can see three primary outcomes:

- Whether or not a bank loan is a loan for a transition project (denoted *Transition Loan*),
- Whether or not a bank loan is a loan for an expansion projecting, meaning a project in a new sector for the firm (denoted *Expansion Loan*), and
- The interest rate on the loan.

We focus on the model's predictions within the bank loan data as follows:

> Prediction (I): Expansion loans will be more likely to be extended by specialized banks with the ability to steward projects.

The model highlights that bank specialization and stewardship are particularly important for firms neglecting investing in transition opportunities with retained earnings. When firms do not have access to bank credit or are not engaging with banks able to offer stewardship-induced attractive interest rates, firms will invest less in transition projects when they are short-termist in their discount rates . Thus, empirically, Prediction I should hold with a greater strength in the subsample of firms that are short-termist. That is, bank financing will be more important for inducing transition investment for firms that would not have done it in the absence of bank financing. This intuition leads to the second empirical prediction:

> Prediction (II) Bank stewarding of projects is particularly valuable for firms with high discounting of the future value from investment.

These predictions rely on a mechanism assumption of how specialized lender price transition loans, influencing the cost of credit for such project. This leads to our final prediction:

> Prediction (III): Expansion loans from banks with higher stewardship will have a lower interest rate than other loans, ceteris paribus.

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