Ethics, Capital and Talent Competition in Banking*

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Forthcoming, ***Journal of Financial Intermediation***

Abstract

We model optimal ethical standards, capital requirements and talent allocation in banking. Banks with varying safety-net protections, including depositories and shadow banks, innovate products and compete for talent. Managers dislike unethical behavior, but banks heed it only because detection imposes costs. We find: (i) higher capital induces higher ethical standards, but socially optimal capital requirements may tolerate some unethical behavior; (ii) managerial ethics *fails* to raise banks' ethical standards; (iii) banks with lower ethical standards attract better talent and innovate more; and (iv) it is socially optimal to allocate better talent to shadow banks instead of depositories, and this allocation results in higher capital requirements and ethical standards for depositories. Consequently, with capital capacity constraints, the shadow banking sector is larger than the depository sector; talent competition induces a race to the bottom in ethical standards, and the regulator responds by setting capital requirements to *magnify* this size difference.

Keywords: Ethics, Bank capital, Talent, Financial innovation

JEL: D18, G20, G28

*For their helpful comments, we thank Jason Donaldson, Paolo Fulghieri (discussant), Stuart Greenbaum, Jennifer Huang, Doron Levit (discussant), Alan Morrison (discussant), Zhen Zhou, Stuart Zimmerman, participants in seminars at Washington University in St. Louis, Wharton-University of Pennsylvania Law School, the Central Bank of Portugal, Goethe University, BI Oslo, University of Illinois, CKGSB, PBCSF, the 2019 RFS-Bocconi-Sapienza Conference on New Frontiers in Banking in Milan, the 2019 RCFS Conference in Hong Kong, the 2019 Stony Brook International Conference on Game Theory, and the 2019 Oxford Financial Intermediation Theory Conference (OxFIT), and especially an anonymous referee and editor of this journal. We alone are responsible for any remaining errors.

1 Introduction

Motivation: Since the 2007-09 financial crisis, the spotlight has been turned ever more intensely by many on the role of ethics in banking. Ethical violations have been blamed for numerous failures in banking. There is also growing concern among bankers about talent migration out of depository banking. We develop a model showing that these two phenomena are related. At the heart of the model is the insight that regulation can affect both ethical standards in banks and the allocation of talent across deposit-insured banks and uninsured non-depository financial institutions, with important connotations for the exposure of the safety net. It thus provides a novel perspective on the role of prudential regulation in banking, beyond its previously examined necessity with deposit insurance (Merton (1977)).

Ethical violations in banking are spectacular, with shocking headlines like "3 Former ICAP Brokers Appear in British Court in Libor Manipulation Case" (*New York Times*, April 15, 2014), and "The Big Banks are Corrupt – and Getting Worse" (*Huffington Post*, May 22, 2016). Unethical behavior has also been empirically documented. Piskorski, Seru, and Witkin (2015) provide evidence that mortgage buyers received false information about asset quality in contractual disclosures from selling intermediaries in the non-agency market, and even reputable intermediaries were involved. European banking too has been noted for its lax ethical standards (Carboni (2011)). Since the crisis, global banks have paid $321 billion in fines between 2008 and 2017 for legal and ethical transgressions (Finch (2017)). This raises interesting questions about the tradeoffs faced by banks in setting their ethical standards and how they set these standards.

Some have suggested that banking tends to attract those who do not put much stock in ethics (Cohn, Fehr, and Maréchal (2014) and Deloitte (2013)),[1] so hiring more ethical people might help. Others say that more intense competition has contributed to institutions cutting ethical corners to compete more aggressively (Norman (2012)). Others have suggested that government safety nets may make a contribution (Kane (2016)). These have led many to emphasize the importance of culture and ethics in banking, an issue made especially prominent due to the enormous size and influence of the industry.[2]

While regulators have focused on ethical violations, bankers have fretted about talent migration from depository banking, in part due to increasingly burdensome regulation. The media has reported on the

[1] Deloitte (2013) reports the results of a Deloitte survey which found that banking-oriented students ranked culture and ethics 32nd and 33rd, respectively, out of a list of 40 desirable job attributes.

[2] Bergman (2015) reports that both Thomas Baxter, general counsel at the Federal Reserve Bank of New York, and Federal Reserve governor Jerome Powell gave speeches on the same day about the importance of ethics, with Baxter stating: "At the New York Fed, we have made ethical culture a priority for financial services."

post-crisis departure of talent from various bank holding companies.[3] And regulators have taken note too. The 2016 Fed Conference of State Bank Supervisors noted that a survey of community banks revealed: "A 'brain drain' has been blamed for problems in attracting sufficient talent for future leadership of the bank. This is a particular problem because of impending retirements of older management in many community banks." This has potential consequences for how well banks are managed.[4]

Questions: These twin developments of ethical lapses and talent migration raise three questions:

1. If unethical behavior is so corrosive, why don't regulators use regulatory instruments, like capital requirements, to quell it?
2. How do banks choose their own ethical standards, and how are socially optimal and privately optimal ethical standards determined when banks hire managers who innately value ethics?
3. How do safety nets and interbank competition for managerial talent affect the setting of privately optimal and socially optimal ethical standards?

Setup: Banks, with varying safety-net protections, engage in innovation. Each bank hires a manager who is incentivized to innovate and then, conditional on successful innovation, decides whether to sell the new product to a customer. Mis-selling an unsuitable product harms the customer, and also entails a loss for the bank upon detection. The manager, with an innate dislike for mis-selling, is responsible for both product innovation and sale. While this multi-tasking matters for our results, it is worth noting that simply separating the two tasks and entrusting them to different people is not a solution – we can view the manager as the CEO or a sufficiently senior executive with overarching responsibility for overseeing multiple tasks. That is, multi-tasking is essential at the *bank* level. Each bank takes this multi-tasking into account in designing its wage contract to incentivize the manager to adopt its desired ethical standard; the bank's capital level influences its desired standard. A regulator provides safety-net protection and also sets capital requirements for banks. Banks face capital capacity constraints, which affect the setting of regulatory capital requirements and, consequently, ethical standards in banking.

Our focus on mis-selling as a specific form of (potentially) unethical behavior is motivated by abundant examples of mis-selling of financial products such as selling adjustable-rate mortgages (ARMs) with low

[3]See, for example, Bowley and Story (2009) who state: "There is an air of exodus on Wall Street – and not just among those being fired. As Washington cracks down on compensation and tightens regulation of banks, a brain drain is occurring at some of the biggest ones." Parker and Gupta (2015) write: "Tighter regulation is designed to improve standards, but one unintended consequence is the disincentivising of talented bankers."

[4]For example, Bowley and Story (2009) note: "For the chiefs of Citigroup, JPMorgan Chase and other United States banks that have received government money, the implications are worrisome... Vikram S. Pandit of Citigroup and Jamie Dimon of JPMorgan, for example, say it will be harder to break away from taxpayer support if the workers most capable of steering their banks toward recovery walk away."

"teaser rates" to borrowers who cannot afford them once rates go up, pressuring borrowers to buy payment protection insurance (PPI) without explaining the "fine print" such as rules about pre-existing medical conditions and the borrower's option to refuse PPI, making a secured loan to a borrower who should get a cheaper unsecured loan, selling an investment product whose risk-return profile is unsuitable for the customer, and mis-selling complex interest rate swaps to small businesses.[5]

In our model, banks are monopolists in the product market, but they compete for talent in the labor market. The analysis solves endogenously for managerial wage contracts, each bank's privately optimal capital level, regulatory capital requirements, ethical standards, and managerial talent distribution.

Results: Our results, corresponding to the three questions raised earlier, are as follows.

1. Unethical behavior is not fully expunged by regulators due to a tradeoff relevant for both bank profits and social welfare. While raising ethical standards reduces unethical behavior and associated welfare losses, there are costs for banks adopting higher standards: less innovation and talent migration to banks with lower standards. Regulators can influence ethical standards with capital requirements, but when banks face capital capacity constraints, the socially optimal capital requirement is set to induce banks to adopt ethical standards that permit some unethical behavior.
2. Absent talent competition, banks determine their privately optimal ethical standards by trading off the benefit of smaller financial losses (due to detection of mis-selling) from higher standards against the consequent reduction in innovation, and they implement these standards through the design of managerial wage contracts. A lower pay-for-performance sensitivity implements a higher standard, but it reduces innovation. A higher level of managerial ethics does *not* increase a bank's (privately optimal) ethical standard because the bank can strategically design the wage contract to fully exploit managerial ethics without increasing its own ethical standard.
3. With talent competition, banks with lower ethical standards attract better talent. Thus, the regulatory concern with ethical behavior in banking and bankers' concern about talent migration are two sides of the same coin. This talent migration affects privately optimal standards of banks and socially optimal standards, which diverge nonetheless. Safety-net provision raises socially optimal standards for depositories, so it is socially efficient to allocate better talent to shadow banks without safety nets. Implementing this talent allocation requires higher capital requirements for depositories, resulting in a larger shadow banking sector than the depository sector when intermediary capital is scarce. Talent competition may induce a "race to the bottom" between the two sectors in ethical

[5] British regulators charged major British banks with mis-selling 40,000 interest rate swaps; see Inman (2013).

standards, and the regulator's attempt to prevent this race further magnifies these sector differences in capital requirements, ethical standards, and sector sizes.

In extensions of the model, we discuss that banks with stronger organizational innovation capabilities (e.g., culture) can innovate with flatter incentive contracts and higher ethics. Moreover, banks that innovate more are likely to have lower capital ratios and higher idiosyncratic risk (but possibly less systematic risk). In a dynamic setting, it is the more reputable banks that are more likely to lower their ethical standards. We also examine a variety of robustness issues, including the effects of uncertainty about managerial ethics, managerial risk aversion and the possibility of bailout protection for non-depositories.

Implications: Financial innovation drives economic growth (Laeven, Levine, and Michalopoulos (2015)). We show that although both innovation and ethics are desirable in a first best sense, stimulating innovation with informational constraints (second best) may require tolerating lower ethical standards. This is missed in popular arguments for improving ethics via stringent regulations. The regulator strikes the second-best tradeoff between the desire for ethics on the one hand and the need for innovation on the other by having lower ethical standards in shadow banking, while tightening standards in depositories.

Our analysis revolves around the interaction between innovation, ethics and talent. From a regulatory policy standpoint, it sheds new light on how bank capital requirements can not only serve their usual prudential role, but also influence the setting of ethical standards, the labor market competition between banks, and the amount of financial innovation. In sharp contrast to the standard argument for imposing capital requirements on shadow banks,[6] which is to reduce the attractiveness of regulatory arbitrage by closing the capital ratio gap between depositories and shadow banks, we find that talent competition increases the difference between socially optimal capital requirements on depositories and shadow banks.

Moreover, as we discuss in Section 5.3, the rich interaction between capital requirements, talent allocation in the managerial labor market, competition between depositories and shadow banks, and financial stability in our model implies that coordination is needed between the penalties consumer protection regulators impose on banks and the capital requirements set by prudential regulators.

Literature: Our paper is related to the small but growing theoretical literature on ethics and culture in financial services. Morrison and Thanassoulis (2017) analyze the relationship between ethics, culture, and compensation in financial services. Thanassoulis (2020) examines how product market competition

[6]Shadow banks include a wide variety of non-depository financial institutions – investment banks, hedge funds, insurance companies, etc. Some are subject to explicit regulatory capital requirements, some are not. Our analysis should be viewed as being normative on the issue of capital requirements on depositories *vis-à-vis* shadow banks.

affects corporate misconduct. Song and Thakor (2019) develop a model of bank culture, and show that the optimal (second-best) compensation contract induces the manager to invest excessively in growth relative to what the bank wants. Investment by the bank in its culture can attenuate this distortion. Daley and Gervais (2018) develop a model of employee ethics with "ethical" employees and "strategic" employees.

A contrast between these papers and ours is that managerial behavior in our model is driven both by a desire for ethics at the preference level and endogenous compensation. This highlights the ability of banks to influence their employees' ethical standards through incentive contracts.[7] This feature of our analysis is important because it shows that the conventional wisdom that hiring more ethical managers will lead to more ethical behavior may be wrong. We show that when compensation is a choice variable, the bank can strategically use it to exploit managerial ethics without raising its own ethical standard.[8]

Maintaining high ethical standards and gaining the trust of counterparties is important for relationship banking. Thakor and Merton (2019) develop a theory of trust in lending, where the trust investors have that lenders will make good loans affects the cost and availability of financing to lenders. They show that banks have stronger incentives to maintain trust than non-depository (fintech/shadow banks) lenders. Banerjee, Gambacorta, and Sette (2021) provide evidence that during times of financial stress, banks offer their relationship borrowers more favorable continuation financing terms, indicating that banks invest in developing trust with their borrowers. Our paper is closest to Inderst and Ottaviani (2009) in the modeling approach; they model agents who may mis-sell products, and their propensity to do so depends on their (endogenous) wage contracts. Our paper differs in that we focus on ethics in *banks* that create and sell innovative (loan) products. Most significantly, our novel contribution is that we examine how endogenous ethical standards and compensation contracts respond to managerial ethics, safety nets and *capital requirements*, as well as implications of labor market competition for the migration of talent from regulated depositories to shadow banks based on their endogenous differences in ethical standards.

The vast capital adequacy regulation literature is also related; see Greenwood, Stein, Hanson, and Sunderam (2017) and Thakor (2014) for reviews. In Allen, Carletti, and Marquez (2015), banks hold

[7]Ultimately, it is a philosophical issue whether people are born with a particular ethical orientation or whether this orientation emerges in response to environmental stimuli. Our approach is consistent with the much publicized discussion of the role of compensation in potentially driving unethical behavior. For example, a former NatWest banker reveals how the bank used compensation to induce employees to mis-sell PPI: "I recall that hitting 120% of [sales] target meant our bonus would be in a higher paying threshold. Working in a branch didn't pay very well, so the bonus really helped." (*The Guardian*, November 8, 2012).

[8]Our assumption is that managerial distaste for unethical behavior is uncorrelated with managerial talent. Alternatively, one may specify that more talented managers also have a stronger preference for ethics. We do not deny that this may be true for some managers, but then there is no tradeoff. Every bank would prefer to hire such managers. If they were available in unlimited supply, then unethical behavior would vanish. This is clearly counterfactual.

capital to reduce bankruptcy costs but capital regulation may be necessary with insured deposits. Allen, Carletti, and Marquez (2011) and Mehran and Thakor (2011) emphasize the role of capital in committing banks to monitor borrowers, whereas in Thakor (2021) it induces more prudent lending behavior by the bank. In Carletti, Marquez, and Petriconi (2019), capital regulation resolves fire sales externalities and benefits bank shareholders. Ahnert, Chapman, and Wilkins (2021) present a model in which risk-sensitive capital requirements act as a screening mechanism. Mayordomo, Moreno, Ongena, and Rodríguez-Moreno (2021) document that capital requirements affect personal guarantees and collateral usage in loan contracts. Our paper is most closely related to the literature dealing with the design of capital regulation for both depositories and shadow banks (Adrian and Ashcraft (2012)), with the incremental contribution being the insight that capital requirements are needed for both depositories and shadow banks even absent regulatory arbitrage, and that capital requirements for depositories should be higher to implement the socially optimal talent allocation between depositories and shadow banks.

Finally, our paper relates to studies of the labor market in financial services (e.g., Bolton, Santos, and Scheinkman (2016), and Bond and Glode (2014)). Murphy, Shleifer, and Vishny (1991) study the economic growth implications of talent allocation across industries. Philippon (2010) analyzes welfare implications of human capital allocation in an economy with production externalities and financial constraints. In contrast, we focus on the interaction between endogenous ethical standards in depository and shadow banking, with the mediating role of bank capital, and explore how these standards affect talent allocation across depository and shadow banking.

Structure: Section 2 develops the model. Section 3 analyzes the model. Section 4 examines talent competition between depositories and shadow banks. Section 5 discusses model robustness, policy implications, extensions and empirical predictions. Section 6 concludes. Proofs are in Appendix A.

2 Model

The economy has four major players: banks, savers who provide financing for banks, managers who develop financial products for banks,[9] and customers who purchase bank products. There is universal risk neutrality and the riskless rate is zero.

Banks, Managers and Customers: Banks are institutions whose owners have provided L in equity;

[9]The term "financial products" in our model should be interpreted broadly – consumer loans, mortgages, insurance, wealth management products, payment protection insurance on loans, and so on.

we will endogenize L. Banks maximize their owners' wealth. Each bank asks its manager ("she") to design a new product (henceforth, "product"). The manager privately chooses effort $e \in \{0, 1\}$ with a cost ce, where $c > 0$. The product is developed with probability (w.p.) μe, where $\mu \in (0, 1)$. Managers differ in talent, where "talent" is the probability of successful innovation conditional on working ($e = 1$), so μ represents managerial talent. Once the manager develops the product, she decides whether to sell it to the customer ("he"). The manager is thus multi-tasking: working to innovate and then deciding whether to sell the product (if available). Selling the product requires the bank to raise deposits R from savers to finance the sale.[10]

The manager's sales decision depends on her assessment of the product's potential match with the customer's needs; we represent this match with a parameter $\theta \in \{h, l\}$, which is a priori unknown to all.[11] The product is suitable for the customer when $\theta = h$ but unsuitable when $\theta = l$. The customer's utility from the product depends on whether the product is suitable: the utility is u_θ, with $u_h > 0 > u_l$. The product's price p will be endogenized. When the product is not sold, only the manager knows whether it is because no product was developed or the product was deemed unsuitable for the customer.

Unethical Selling and Mis-selling: No one, including the manager, knows for sure whether a product is suitable for a particular customer ex ante. However, upon interacting with the customer, the manager *privately* observes a signal, $s \in [0, 1]$, that probabilistically indicates whether the product is suitable for that customer (i.e., $\theta = h$), with $\Pr(\theta = h) = s$. We refer to s as product suitability, randomly drawn from a commonly known distribution F with a continuous density $f(s)$. A bigger s indicates higher suitability.

The manager observes only s, and not θ, when making her sales decision. At a future date, the realization of θ is publicly observed, so it becomes known ex post whether a sold product was suitable for the customer. Nonetheless, s is never publicly revealed, so it cannot be ascertained ex post whether there was unethical selling ex ante (a concept introduced below).

The customer's expected utility from a product with suitability s is $u(s) = su_h + (1 - s)u_l$. There is a unique cutoff $s^{\text{FB}} \in (0, 1)$, with $u(s^{\text{FB}}) = 0$. If s were public information, then the first best would be for the manager to sell the product only to customers with $s \in (s^{\text{FB}}, 1]$.

[10] For example, if the product is a new type of loan, then R includes the loan amount and expenses incurred in loan extension and servicing. Our assumption is that, unlike R&D in the real sector, coming up with a new financial product does not require a huge capital investment, but setting up business operations to actually market the product to customers is an expansion of scale/scope that is more resource intensive and, hence, requires the bank to invest R.

[11] A few examples illustrate what we mean by customer-product match. One example is a variable-rate mortgage with a low teaser rate that a borrower can afford initially but not when the rate increases. Another example may be an expensive term life insurance policy that the customer does not really need but naively purchases. On the other hand, a customized investment portfolio tailored to the customer's time-varying needs may be a good match for that customer.

Suppose the manager sells the product whenever $s \geq s^*$, with $s^* < s^{\mathrm{FB}}$, then customers with $s \in [s^*, s^{\mathrm{FB}}]$ are sold the product that would not have been sold to them if s were public information. They are thus exploited, and the manager knows *ex ante* (before θ is realized) that she is exploiting those customers by selling them the wrong product. We call this "*unethical selling.*"

While customers for whom $s \in (s^{\mathrm{FB}}, 1]$ is observed by the manager should all be sold the product and they should purchase it, the fact that s is privately observed by the manager means that some customers overpay and others underpay. That is, there is also a cutoff $s^{\mathrm{P}} \in (s^{\mathrm{FB}}, 1)$, with $u(s^{\mathrm{P}}) = p$, such that customers with $s \in (s^{\mathrm{FB}}, s^{\mathrm{P}})$ overpay for the product,[12] while those with $s \in (s^{\mathrm{P}}, 1]$ underpay.

If the product yields a low utility u_l to the customer (i.e., $\theta = l$), we say the product is mis-sold ("*mis-selling*"). Note the difference between "unethical selling" and "mis-selling" in the model. Unethical selling means that the manager knowingly sells a wrong product *ex ante*, while mis-selling refers to all *ex post* bad outcomes, including instances in which the manager sells the right product ex ante (i.e., ethical selling) but it turns out to be unsuitable ex post (i.e., honest mistake).

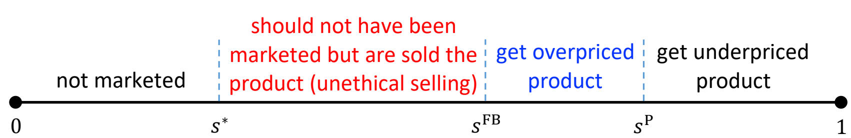

Figure 1: Unethical selling under an ethical standard s^*

Figure 1 summarizes the above discussion. We call s^* the bank's "*ethical standard*;" this will be endogenized. Since the manager observes s privately, the bank cannot directly dictate the standard. Rather, it can only influence the manager to set a particular ethical standard by designing her wage contract to incentivize a choice of that standard: s^* is a cutoff such that the manager will sell the product only if she observes a realization of suitability $s \geq s^*$. A higher s^* corresponds to a higher standard because it shrinks the region of unethical selling, $[s^*, s^{\mathrm{FB}}]$. Some customers are hurt in two ways in the model: (i) customers with $s \in [s^*, s^{\mathrm{FB}}]$ are knowingly sold unsuitable products due to unethical selling; and (ii) although customers with $s \in (s^{\mathrm{FB}}, s^{\mathrm{P}})$ are sold ex ante suitable products, they pay too much.

To make the analysis succinct, we have modeled the manager's choice between selling and not selling the new product. We could also model her decision as selling the new product or an old (traditional) product with a deterministic utility to the customer; if we normalize the old product's utility as zero (its

[12] Overpayment in the model means the price paid by the customer for the product exceeds his expected utility from the product, i.e., $p > u(s)$. In that sense, customers with $s \in [s^*, s^{\mathrm{FB}}]$, who are sold the wrong product ($u(s) \leq 0$), also overpay (and overpay more than those with $s \in (s^{\mathrm{FB}}, s^{\mathrm{P}})$, as $p - u(s)$ decreases with s for a given p).

price is thus also zero), then the analysis would be identical. Moreover, while the financial product in the model is abstract, we illustrate the model by examining the specific example of secured and unsecured bank lending in Appendix B. That is a model in which there are high-risk and low-risk borrowers and the incumbent bank has private information about borrower riskiness that the rest of the credit market does not have. Absent collateral, high-risk borrowers would be unable to get credit because the bank will only make them secured loans. However, secured loans generate rents for the bank and lower utility for low-risk borrowers because they are more expensive. We interpret secured loans (with the attached security design accoutrements) as an innovative product and the more plain vanilla unsecured loan as a traditional product. In this case, unethical lending by the bank is exploiting its private information about borrower riskiness to make unsecured loans to low-risk borrowers. That is, the bank may engage in "predatory lending" by making secured loans to borrowers who should get cheaper unsecured loans.

Bank's Loss from Mis-selling: Since the manager's sales decision is based on s, and not θ, it is possible that even an ex ante ethical sale may result in the customer experiencing a low utility u_l ex post (i.e., $\theta = l$ is realized). If all agents in society were fully rational, then it would be recognized that ex post discovery of unsuitable sales is not indisputable proof of ex ante unethical selling. However, we assume that the realization of $\theta = l$ will always lead to the imposition of a penalty on the bank, a penalty that causes a cash loss κ. This loss captures many possible costs: loss of business, reputation-related damage, legal and/or regulatory fines, etc. As mentioned in the Introduction, large fines on banks were quite commonplace in the aftermath of the 2007-09 financial crisis.

A simple way to microfound this societal response to ex post detection of unsuitable sales is to assume that there is a small fraction of banks that are pathologically unethical in the sense that their managers always sell the product, regardless of s. Then, there will be a positive probability that an ex post unsuitable sale was in fact due to an ex ante unethical sale. In the interest of not complicating the analysis, we do not formally model that. In any case, we can think of the ex post punishment as a friction in the interaction of society with banks that may behave unethically.

Managerial Ethics: The manager is innately ethical: she suffers a utility loss, $\delta \geq 0$, if the product is mis-sold by her (i.e., yielding u_l to the customer). A larger δ means the manager "cares" more about customer welfare (i.e., more innately ethical). We assume that δ is common knowledge.

Safety Net: If a bank suffers the loss κ from unsuitable sales, it becomes insolvent (κ is sufficiently large), and the regulator covers a fraction $\gamma \in [0, 1]$ of the bank's unpaid deposits using public funds as part of the safety net. Using each unit of public funds entails a shadow cost λ. The safety net is extended at no cost to banks. We let γ vary in the cross-section of banks, with a bigger γ meaning higher protection, to reflect the reality that different types of banks have different levels of safety-net coverage. For example, U.S. banks with federal deposit insurance coverage have their deposits insured up to $250,000 per account owner, and sufficiently large and systemically important banks have even greater protection. In contrast, non-depositories like shadow banks have no *de jure* safety-net protection.

Wage Contract: The manager's reservation utility is zero and is protected by limited liability (wage cannot be negative). The wage contract, denoted by (w, b), is based on ex post discernible states: (i) without a sale, the manager is paid w (base salary); (ii) if a product is sold and it yields u_h to the customer, the manager receives $w + b$, where b can be viewed as a bonus; and (iii) if a product is sold but it yields u_l to the customer, the manager gets 0 (as part of optimal contracting).[13] Customers do not observe (w, b). The wage contract determines the ethical standard, s^*, that the manager will choose.

Bank's Capital Capacity: We assume that banks face capacity constraints on how much capital they can provide, and these constraints vary in the cross-section. This reflects capital scarcity at the bank level (see, for example, Holmstrom and Tirole (1997) for an analysis with scarce bank capital).[14] We model the cross-sectional capital capacity heterogeneity as follows. For banks with a given safety-net subsidy γ, capacities follow an exponential distribution with support $[0, \infty)$ and a rate parameter $\alpha > 0$. That is, for any γ, the mass of banks with available capital no less than L is $e^{-\alpha L}$ (the density is $\alpha e^{-\alpha L}$). With a bigger α, the distribution has a thinner tail (i.e., less banks with large capital capacities). As $\alpha \to 0$, capital capacity becomes unconstrained. Thus, α measures the capital capacity constraint.

Time Line: The sequence of events is as follows:

1. The regulator sets a publicly observed capital requirement L, taking into account banks' capital capacity constraints. Banks that do not satisfy the capital requirement are not allowed to operate.
2. The bank sets the price p for its (potential) new product, which hinges on the ethical standard s^* that it believes will be adopted by its manager.
3. The bank determines the managerial wage contract (w, b) to induce its desired ethical standard s^*.
4. The manager chooses effort $e \in \{0, 1\}$ to develop a product.
5. If a product is developed, the manager privately observes its suitability s, and decides whether to sell

[13]The proof of Lemma 1 shows that specifying a zero wage in this state allows the bank to implement a given ethical standard at the minimal compensation cost.

[14]Absent bank capital capacity constraints, most prudential regulation challenges faced by regulators would be trivialized.

the product. Deposit R is raised in case with product sale.

6. If the product is sold, it is eventually discovered (with certainty) whether it suits the customer.
7. If the product fails to suit the customer ($\theta = l$), the bank suffers a cash loss κ, the manager incurs a disutility δ, and the regulator covers a fraction γ of the bank's unpaid deposits.
8. The manager is paid according to (w, b). The bank pays off financiers (possibly with the safety-net subsidy) and bank owners keep the rest, subject to limited liability.

3 Analysis

The model is solved backwards. Since all the decisions about endogenous variables are made in steps 1 – 5 in the time line, we work from step 5 to step 1.[15] For now, we assume that the bank is a monopolist in its product and labor markets; Section 4 examines bank competition for managerial talent.

STEP 5 (Product Sale): Given a contract (w, b), the manager's expected payoff from selling the product (if available) after observing s is $s(w + b) - (1 - s)\delta$;[16] she gets w if she does not sell. Thus, the manager sells if and only if $s \geq s^*$, where $s^*(w + b) - (1 - s^*)\delta = w$. We have

$$s^* = \left(1 + \frac{b}{w + \delta}\right)^{-1}. \tag{1}$$

Given a contract (w, b), a more ethical manager (bigger δ) adopts a higher standard (higher s^*). By contrast, a steeper contract (higher $\frac{b}{w}$) leads to a lower s^*. The bank implements s^* by choosing (w, b).

STEP 4 (Managerial Effort): The manager needs to be incentivized to exert effort to innovate:

$$w + \mu \int_{s^*}^{1} [sb - (1 - s)(w + \delta)] f(s) ds - c \geq w. \tag{2}$$

The manager gets w even if she shirks (hence, no product sale), the right-hand side (RHS) of the incentive-compatibility (IC) constraint (2). The left-hand side (LHS) is her net payoff if she works; the integral computes her extra pay from working instead of shirking. With a cost c, the product is developed w.p. μ, which is then sold and, hence, the extra pay above the base, $s(w+b)-(1-s)\delta-w = sb-(1-s)(w+\delta) \geq 0$, is obtained when $s \in [s^*, 1]$.

STEP 3 (Wage Contract): Given its monopoly power over managerial hiring, the bank's optimal

[15] The analysis through Lemma 2 follows the setup in Inderst and Ottaviani (2009), and diverges after that.

[16] Mis-selling occurs w.p. $1 - s$, in which case the manager receives a zero wage and suffers a disutility δ.

wage contract minimizes its pay to the manager, so (2) is binding. Jointly solving (1) and (2) yields the contract for the bank to implement a given ethical standard s^*:

$$w = \max\left(\frac{(c/\mu)s^*}{\int_{s^*}^{1}(s-s^*)f(s)ds} - \delta, 0\right) \tag{3}$$

$$b = \frac{(c/\mu)(1-s^*)}{\int_{s^*}^{1}(s-s^*)f(s)ds}. \tag{4}$$

We assume that δ is not too big to focus on the practically relevant case in which $w > 0$. In other words, the manager's preference for ethics is not so strong that she would pay the bank to work ethically. The binding constraint (2) shows that the manager's expected utility is $c + w$, higher than her cost of effort c. The manager enjoys a rent w because she can secure the base w even by shirking. Note

$$\frac{dw}{ds^*} = \frac{(c/\mu)\int_{s^*}^{1} sf(s)ds}{\left[\int_{s^*}^{1}(s-s^*)f(s)ds\right]^2}. \tag{5}$$

Lemma 1. *A higher ethical standard s^* increases both the manager's base salary w and bonus b ($\frac{dw}{ds^*} > 0, \frac{db}{ds^*} > 0$), while it decreases $\frac{b}{w}$. An increase in managerial talent μ lowers both w and $\frac{dw}{ds^*}$. Given s^*, a stronger managerial preference for ethics (bigger δ) lowers w but does not affect b and $\frac{dw}{ds^*}$.*

This lemma highlights numerous properties of the wage contract. First, a higher ethical standard s^* leads to a bigger managerial rent w. This rent arises because the bank cannot tell whether the absence of a product sale means the manager did not innovate or decided to not sell an innovation due to the chosen ethical standard; the latter is more likely with a higher s^*, so $\frac{dw}{ds^*} > 0$. Second, $\frac{dw}{ds^*}$ is decreasing in μ, so it is marginally less costly for the bank to adopt a higher ethical standard with a more talented manager. The intuition is that a higher μ reduces the manager's rent because the absence of product sale is *ceteris paribus* more indicative of shirking when μ is higher. Third, for the same reason, $\frac{dw}{d\mu} < 0$.[17]

The bonus-to-base ratio, $\frac{b}{w}$, plays key roles. It affects (i) managerial effort (innovation), (ii) the bank's ethical standard, and (iii) managerial talent attraction. While a higher $\frac{b}{w}$ results in stronger effort incentives and better talent, it leads to a lower ethical standard. The analysis in this section reflects only (i) and (ii), whereas (iii) plays a role in Section 4 where we model talent competition.

One might think that the manager's personal preference for ethics (δ) would impact her bonus (b) and the sensitivity of her base wage (i.e., rent) to the bank's ethical standard ($\frac{dw}{ds^*}$). However, this is not the

[17]This result is an artifact of the assumption here that there is no competition for talent. With talent competition being introduced in Section 4, more talented managers earn higher rents (Proposition 3).

case. The reason is that the manager's utility loss δ upon mis-selling effectively relaxes her limited liability constraint from zero to $-\delta < 0$, which reduces w by exactly δ for a given s^* (see (1)). The IC constraint (2) further shows that any increase in δ is exactly offset by a commensurate decrease in w to leave the manager's effort incentive unchanged.

STEP 2 (Ethical Standard): We now analyze the bank's ethical standard. The equilibrium concept is Perfect Bayesian Equilibrium (PBE). Not observing the contract (w, b), customers cannot directly infer the standard s^* (using (1)). Customers form beliefs about s^*, and decide how much they are willing to pay for the product. The bank takes the customers' willingness to pay as given, and decides on its desired ethical standard by selecting (w, b), which pins down the *de facto* standard based on (1). We use "ˆ" to denote a party's best response given her/his belief about the other party's action. In equilibrium, the bank's choice of its ethical standard maximizes its expected profit, and is consistent with customers' beliefs.

Customers believe that the product is sold only when $s \geq s^*$, so their valuation of it is

$$\hat{p} = \mathbb{E}[u(s)|s \geq s^*] = \int_{s^*}^{1} u(s)\frac{f(s)}{1 - F(s^*)}ds. \tag{6}$$

Recall $u(s) = su_h + (1-s)u_l$ is the customer's expected utility from a product with suitability s. Customers are willing to pay more if they believe the bank has a higher ethical standard.

The bank believes customers are willing to pay p for its product. If a product with suitability s is sold, the bank owners' profit, net of their equity input L, is $\pi(s) \equiv s(p - \tilde{R}) - (1 - s)L$, where $\tilde{R}$ is the bank's repayment obligation to depositors who provided R to finance product sale. Without mis-selling (w.p. s), the net profit after repaying depositors is $(p + L - \tilde{R}) - L = p - \tilde{R}$. But w.p. $1 - s$ mis-selling occurs, and the bank suffers a loss κ. To have the bank be insolvent in this state, we assume its available cash, $p + L - \kappa$, is insufficient to repay R, the amount raised from depositors.[18] The regulator provides

$$\tau \equiv \gamma[R - (p + L - \kappa)] \tag{7}$$

to cover a fraction γ of the bank's unpaid deposits, and bank owners lose equity L. These explain $\pi(s)$.

[18]That is, the loss κ (partly due to penalties) is substantial enough to cause a bank financial distress. This is in line with the magnitude of fines on financial institutions, especially since the 2007-09 crisis. See bills at www.goodjobsfirst.org.

The depositors' breakeven pricing constraint yields $\tilde{R}$ as[19]

$$\int_{s^*}^{1} \left\{ s\tilde{R} + (1-s)[\gamma R + (1-\gamma)(\hat{p} + L - \kappa)] \right\} \frac{f(s)}{1-F(s^*)} ds = R. \tag{8}$$

The LHS of (8) computes the bank's expected deposit repayment from product sale. For a given $s \in [s^*, 1]$, w.p. s the product suits the customer (no mis-selling) and depositors are fully repaid $\tilde{R}$ (note that $\hat{p}+L > \tilde{R}$ must hold in equilibrium to satisfy the bank's participation constraint), but w.p. $1-s$ mis-selling occurs and the bank's available cash, $\hat{p}+L-\kappa$, is insufficient to cover R. With the regulatory subsidy τ (see (7)), depositors receive $(\hat{p}+L-\kappa)+\tau = \gamma R + (1-\gamma)(\hat{p}+L-\kappa)$.

The bank chooses its ethical standard s^* to maximize the ex ante (prior to the manager observing s) net value to its owners:

$$\max_{s^*} \ \mu \int_{s^*}^{1} \pi(s) f(s) ds - (c+w). \tag{9}$$

The product is available w.p. μ, and is then sold when $s \in [s^*, 1]$, generating a profit $\pi(s)$. As explained in step 3, $c+w$ is the bank's compensation cost (which it incurs regardless of the manager's innovation outcome and sales decision), where the managerial rent w is a function of s^* (see (5)).

Denote the solution to (9) as $\hat{s}^*$, determined by the first-order condition (FOC):[20]

$$-\mu\pi(\hat{s}^*) f(\hat{s}^*) = \frac{dw}{d\hat{s}^*}, \tag{10}$$

where $\frac{dw}{d\hat{s}^*} > 0$ is given by (5) (replacing s^* there with $\hat{s}^*$). Inspecting (10) shows $\pi(\hat{s}^*) < 0$: the bank loses at the margin (with $s = \hat{s}^*$). This is because the managerial rent w increases with $\hat{s}^*$. So while the bank can reduce its loss at the margin by raising $\hat{s}^*$, it will relinquish higher rents to the manager for *all inframarginal* sales (with $s \in (\hat{s}^*, 1]$).

In equilibrium, the customer's belief about the bank's ethical standard coincides with the bank's privately optimal choice of the standard ($s^* = \hat{s}^*$) and the product's price is correct ($p = \hat{p}$). The PBE is determined jointly by (6), (8) and (10); the proof of Lemma 2 shows that the PBE exists and is unique.

Lemma 2. *The bank's ethical standard s^* is increasing in its equity capital L and managerial talent μ, while decreasing in the regulatory subsidy γ ($\frac{ds^*}{dL} > 0$, $\frac{ds^*}{d\mu} > 0$, $\frac{ds^*}{d\gamma} < 0$). The marginal effect of equity capital*

[19]When $\gamma = 1$, we have $\tilde{R} = R$, in which case the depositors' claim is riskless due to full deposit insurance.

[20]The proof of Lemma 2 shows that the second-order condition (SOC) to ensure the problem in (9) is quasi-concave is satisfied for most distributions. To satisfy the bank's participation constraint, (9) should be non-negative at the optimum.

on the bank's ethical standard is stronger with a more talented manager ($\frac{ds^*}{dL}$ is increasing in μ).

Higher capital leads to a higher ethical standard ($\frac{ds^*}{dL} > 0$) because it makes mis-selling more costly for bank owners, a variant of the "skin in the game" effect. The ethical standard the bank chooses to incentivize its manager to choose is more responsive to its capital with a more talented manager ($\frac{ds^*}{dL}$ increases with μ), since a smaller increase in managerial rent is needed to induce a higher standard ($\frac{dw}{ds^*}$ decreases with μ; see (5)). Thus, capital and talent are *complements* in affecting bank ethical standard: higher talent makes capital more effective in raising the standard. For the same reason, the bank chooses a higher standard when managerial talent is higher ($\frac{ds^*}{d\mu} > 0$). The safety-net subsidy lowers the bank's deposit repayment obligation $\tilde{R}$ upon a product sale, which increases its profit, *ceteris paribus*. This encourages selling, thereby lowering the bank's ethical standard for a given amount of capital ($\frac{ds^*}{d\gamma} < 0$).

Lemma 3. *Hiring an innately ethical manager who suffers a disutility δ upon mis-selling, ceteris paribus, does not alter the bank's ethical standard s^*, except lowering the managerial rent by δ.*

The intuition for this surprising result that the strength of managerial preference for ethics (δ) does not affect the bank's ethical standard (s^*) is as follows. We know from (10) that s^* is determined by the bank's tradeoff between reducing its loss at the margin and saving managerial rents for inframarginal sales; the latter is captured by $\frac{dw}{ds^*}$. Since δ has no effect on $\frac{dw}{ds^*}$ (Lemma 1), it does not alter the tradeoff in (10) and, hence, does not affect s^*.

The result has several implications. First, hiring more ethical managers may not be effective in raising a bank's ethical standard. Nonetheless, there could be a private benefit to the bank's shareholders from recruiting more ethical managers: it lowers the managerial rent and thus increases the bank's profit. Banks may strategically respond to managerial ethics by designing wage contracts to fully exploit this managerial ethics preference without raising their own ethical standards. Besides a higher profit, there may also be (unmodeled) "virtue signaling" benefits to the bank from hiring more ethical managers.

Second, the fact that the ethical standard s^* the bank induces the manager to choose is independent of δ suggests that the effective ways to improve s^*, as shown by Lemma 2, are to (i) increase managerial talent μ, and (ii) increase bank capital L or reduce the regulatory subsidy γ. This suggests that regulators interested in raising ethical standards in banking may find it more effective to focus on increasing capital requirements or reducing safety-net subsidies than jawboning banks to hire more ethical managers.

Third, notwithstanding the greater efficacy of targeting managerial talent instead of ethics in raising a bank's ethical standard, when the bank faces a choice between a more ethical (higher δ) manager and a more talented (higher μ) manager, with both δ and μ being observable, it may prefer the former. This is because each unit increase in δ leads to a unit decrease in managerial rent and, hence, a unit increase in bank profit, whereas the effect of managerial talent μ in reducing managerial rent depends on $\frac{dw}{ds^*}$, which is low when the effort cost c is low (see (5)). Thus, for c low enough, the more ethical manager is preferred, even though hiring such a manager does not affect the bank's ethical standard or product innovation.[21] In doing so, the bank forgoes the opportunity to hire a more talented manager with whom *both the ethical standard and innovation probability would be higher.*

STEP 1 (Bank Capital): Before analyzing the regulator's socially optimal capital requirement, we examine the bank's privately optimal choice of capital L, which maximizes its net profit in (9).

Private optimum. Given L, the bank's ethical standard s^* is determined by (6), (8) and (10) (let $\hat{s}^* = s^*$ and $\hat{p} = p$). A higher L elevates s^* (Lemma 2), which increases the product price p, but also raises the managerial rent w as $\frac{dw}{ds^*} > 0$ (Lemma 1). A higher L also lowers the bank's debt repayment obligation $\tilde{R}$: $\frac{\partial \tilde{R}}{\partial L} = -\frac{(1-\gamma)\int_{s^*}^1 (1-s)f(s)ds}{\int_{s^*}^1 sf(s)ds} \leq 0$ (from (8)). A lower $\tilde{R}$ and a higher p both increase the bank's profit. To examine the net effect of L, we apply the Envelope Theorem to (9): the value function is invariant to changes in L when $\gamma = 0$, but is decreasing in L when $\gamma \in (0, 1]$.[22]

Thus, when a subsidy is provided ($\gamma > 0$), the bank sets $L = 0$. This is because the marginal benefit of a higher p is exactly offset by the increased w in the subgame when the bank optimally chooses s^* for a given L. That (even partially) safety-net-protected banks prefer zero capital is a familiar result. What is new here is that this occurs despite the benefit of equity in reducing mis-selling a product and increasing its price. This benefit is not traded off against the safety-net advantage of debt (which exists whenever $\gamma > 0$) as usual for an interior optimum; instead, this benefit of equity is passed along entirely to the manager through the equilibrium managerial rent.

Without a subsidy ($\gamma = 0$), the bank is indifferent to the level of L. An unprotected bank faces the same tradeoffs as a protected bank, with one exception: without the subsidy, debt is fairly priced, so the consequent reduction in debt repayment and the associated increase in bank profit when there is no mis-selling *exactly* offsets the loss of the extra capital upon mis-selling, leaving the bank's expected profit unaffected. Thus, we have capital structure irrelevance for an unprotected bank.

[21] Paine (1994) provides examples of how compensation used by firms encouraged unethical behavior and advocates emphasizing ethics more in hiring employees. We show that such blind emphasis on employee ethics may not be effective.

[22] The partial derivative of the value function with respect to L is

$$-\mu \int_{s^*}^1 \left[s\frac{\partial \tilde{R}}{\partial L} + (1-s) \right] f(s)ds = -\mu \int_{s^*}^1 \left[-s\frac{(1-\gamma)\int_{s^*}^1 (1-s)f(s)ds}{\int_{s^*}^1 sf(s)ds} + (1-s) \right] f(s)ds = -\mu\gamma \int_{s^*}^1 (1-s)f(s)ds.$$

Relation to Modigliani-Miller. Such capital structure irrelevance is reminiscent of the Modigliani-Miller (MM) theorem. But it is surprising in this context because the standard frictions invalidating MM are present here: managerial moral hazard (affected by compensation and bank leverage), and a bank cash loss (due to mis-selling) that leads to bankruptcy. The reason why capital structure irrelevance obtains here is thus more complicated than in MM. Specifically, there is an Envelope Theorem argument operating here. Given *any* capital structure, the unprotected bank endogenously chooses its ethical standard to exactly balance the benefits of a higher standard – higher product price and lower cash loss – against the costs of a higher managerial rent and a lower probability of product sale. Thus, the bank's overall profit is unaffected by the capital level at the endogenously chosen ethical standard, even though debt and equity are fundamentally different here (unlike in MM without taxes).

Social optimum. We now examine the socially optimal capital. Given a capital requirement L, a bank will hold capital exactly equal to L. This is because, as just shown, banks with $\gamma > 0$ privately prefer zero capital (so will not hold more capital than required), and banks with $\gamma = 0$ are indifferent to the capital level (as will be clear below, it is socially optimal for those banks to not keep more capital than required when capital is scarce).

We expect the social and private optima in bank capital to diverge because transfers among agents – managerial rent, deposit repayment, and product price – matter for bank profit but not for social welfare, while the social cost associated with safety-net provision and managerial disutility from mis-selling affect social welfare but banks do not care. Moreover, the regulator has to take into account capital capacity constraints faced in the aggregate by banks that individual banks do not internalize.

Given L, the bank chooses its ethical standard s^*, according to the subgame equilibrium conditions (6), (8) and (10) (which uniquely pin down the bank's choice of ethical standard for a given capital level; Lemma 2). The consequent social welfare generated by a bank with a safety-net subsidy γ is

$$V(L,\gamma) \equiv \mu \int_{s^*}^{1} v(s)f(s)ds - c. \tag{11}$$

The product is developed w.p. μ, which is then sold when $s \geq s^*$, generating an expected social surplus $\mu \int_{s^*}^{1} v(s)f(s)ds$, where $v(s) \equiv u(s) - R - (1-s)(\kappa + \delta + \lambda\tau)$ is the surplus from selling a product with suitability s. To understand $v(s)$, recall $u(s) = su_h + (1-s)u_l$ is the customer's expected utility from the product, R is the cost for sale, and $(1-s)(k + \delta + \lambda\tau)$ is the expected deadweight loss due to possible mis-selling of the product: the regulatory subsidy τ is given by (7), with a per unit social cost λ; κ and δ

are losses incurred by the bank and the manager, respectively. Finally, c is managerial effort cost, incurred regardless of the manager's innovation outcome and sales decision.

For banks with a given safety-net subsidy γ, the regulator's problem is[23]

$$\max_{L} \; e^{-\alpha L} V(L, \gamma) \tag{12}$$
$$\text{s.t. } (6), (8), (10).$$

Banks that cannot satisfy the capital requirement L are not allowed to operate. The regulator faces the following tradeoff. While a higher L increases $V(L, \gamma)$ by inducing higher ethical standards for all banks with capital capacity high enough to satisfy the capital requirement, it also reduces the mass of banks, $e^{-\alpha L}$, that can meet the requirement. That is, capital requirements have effects on social welfare at both the intensive and extensive margins, and these effects are in tension: a more stringent requirement reduces the mass of operating banks, but it enhances the welfare generated by each operating bank.

Denote the solution to (12) as L^{reg}, and the resulting bank ethical standard as s^{reg}, according to the subgame equilibrium conditions (6), (8) and (10) (which are stated explicitly in terms of L^{reg} and s^{reg} in (A6), (A7) and (A8) in Appendix A; L^{reg} and s^{reg} are jointly determined by (A5) – (A8)).

Proposition 1. *For banks with a given safety-net subsidy γ, a tighter capital capacity constraint (bigger α) lowers the socially optimal capital requirement L^{reg} and, consequently, bank ethical standard s^{reg}. There is a cutoff, α^{FB}, such that when $\alpha > \alpha^{FB}$, $s^{reg} < s^{FB}$, so unethical selling is permitted under the social optimum. Moreover, L^{reg} and s^{reg} are increasing in γ, while decreasing in managerial talent μ.*

When bank capital becomes more scarce (bigger α), the regulator sets a lower capital requirement to increase the mass of operating banks while tolerating a lower ethical standard from each operating bank to strike a (correct) balance between the effects of the capital requirement at the extensive and intensive margins. With capital being sufficiently scarce ($\alpha > \alpha^{\text{FB}}$), the capital requirement is (optimally) set so low that the prevailing ethical standard s^{reg} falls below the first-best sales cutoff s^{FB} (see Figure 1), implying that ex ante unethical selling exists even under the social optimum. The regulator can stamp out unethical selling if capital is so plentiful that capacity constraints are inconsequential for the regulator's optimization problem in (12), but we believe this is an unrealistic case.

The socially optimal capital requirement achieves a balance between the mass of banks allowed to

[23]Banks with different γ do not interact in this base setting, so their problems can be treated in isolation.

operate and the ethical standard chosen by each operating bank, whereas the chosen ethical standard achieves a balance between the amount of innovation (developing and selling new products) and the social cost of the safety-net subsidy (related to γ) when there is mis-selling of new products. When γ increases, given $\frac{ds^*}{d\gamma} < 0$ (Lemma 2), the regulator finds it optimal to elevate the ethical standard of operating banks with a higher capital requirement to protect the safety net (strengthening the intensive margin effect of capital), even after accounting for the consequence of this in reducing the mass of operating banks (sacrificing the extensive margin effect). That is, the social optimum is recalculated with a new tradeoff between the extensive and intensive margin effects of capital. This is why L^{reg} increases with γ.

The argument for why s^{reg} also increases with γ is a bit more subtle than simply noting that s^{reg} and L^{reg} are positively related. Although γ positively affects L^{reg}, it also negatively impacts s^{reg}, so the net effect is not obvious. To see the net effect, note that as L^{reg} increases, its marginal impact in reducing the mass of operating banks declines (as the density of the capacity distribution, $\alpha e^{-\alpha L}$, decreases with L), while its marginal effect on increasing s^{reg} (hence, the welfare contribution of each operating bank) remains unaffected by the mass of operating banks. That is, as L^{reg} increases, the adverse extensive margin impact of a higher capital requirement falls faster than its intensive margin effect, so the regulator prefers to increase L^{reg} sufficiently to induce a higher s^{reg} in the new equilibrium.

The opposite is true when managerial talent μ increases. Lemma 2 shows that a bank's ethical standard is more responsive to its capital with a more talented manager ($\frac{ds^*}{dL}$ increases with μ). Thus, for a given capital level, each operating bank's ethical standard is higher when μ is higher; consequently, the regulator finds it optimal to lower the capital requirement to allow more banks to operate. This explains why L^{reg} decreases with μ. The reason why s^{reg} also decreases with μ is related to the earlier argument that as L^{reg} decreases, its marginal impact in increasing the mass of operating banks gets bigger, while its marginal effect in reducing s^{reg} (hence, the welfare created by each operating bank) remains unaffected by the mass of operating banks. The net effect is that in the new equilibrium, the regulator decreases L^{reg} sufficiently to lower s^{reg} to outweigh the positive impact of a higher μ on s^{reg}.

The proposition has three implications for capital regulation. First, we need capital requirements for banks with deposit insurance or other safety nets as well as those without. That is, both depositories and shadow banks should have capital requirements. The reason, however, is completely different from the standard regulatory arbitrage minimization argument (e.g., Acharya, Schnabl, and Suarez (2013), and Adrian and Ashcraft (2012)). Here capital requirements generate the socially desirable balance between the mass of operating banks and the ethical standard adopted by each operating bank, with each bank's ethical standard achieving the desired balance between the degree of innovation (higher with a lower standard) and safety-net losses due to mis-selling of innovative products (bigger with a lower standard).

Second, banks with larger safety-net protections should face higher capital requirements. The reason for this is more familiar – protecting the safety net.

Third, managerial talent can partially mitigate the capital capacity constraint problem. With higher managerial talent, a lower capital requirement will be imposed, relaxing the capacity constraint and allowing more banks to operate. This could be especially valuable when banks face aggregate capital scarcity. This arises from the complementarity between talent and capital in sustaining banks' ethical standards, as pointed out in Lemma 2. The implication is that a banking sector with access to better talent will face lower capital requirements, and consequently be larger.

4 Talent Competition

This section introduces talent competition among banks seeking to hire the most talented managers. Our focus is on competition among heterogeneous banks, and the fundamental heterogeneity in our model is the safety-net subsidy γ. To bring out the effect of this heterogeneity on talent competition sharply, we assume there are only two types of banks: one with $\gamma = 0$ (shadow bank, labeled as N bank) and the other with $\gamma = 1$ (depository, labeled as D bank). There are two types of managers: m_1 with talent $\mu = \mu_1$, and m_2 with talent $\mu = \mu_2$, where $\mu_1 > \mu_2$, so m_1 is more talented (more likely to innovate). Each manager privately knows her own μ, and the two banks compete for talent. Managers are equally ethical, with the same ethics parameter δ. We examine how endogenously determined ethical standards and capital requirements in these two banks both affect and are influenced by talent competition.

4.1 Talent Migration

Banks compete for talent by designing contracts to attract the desired type of manager. Section 4.1 solves for optimal contracts offered by D and N, taking ethical standards in the two banks as given. We show that the bank with the lower standard attracts the more talented manager, given optimal contracts (Proposition 2). To make this point, the analysis here assumes N has a lower standard, but the point can also be made if we start out assuming D has a lower standard. Next, Section 4.2 shows that N should indeed have a lower ethical standard and hence, attract better talent from a social welfare perspective

(Proposition 4). Finally, Section 4.3 solves for ethical standards for both banks and shows how capital requirements for them may be set to implement this talent allocation (Proposition 5).

Overarching Intuition: Banks strictly prefer to hire m_1 *ceteris paribus*,[24] and wish to design contracts accordingly. The more talented m_1 prefers a higher bonus while the less talented m_2 prefers a higher base pay, since m_1 is more likely to innovate and get the bonus. In competing for m_1, N has an advantage over D in using a higher bonus-to-base ratio as a talent-attraction device because N's ethical standard is lower,[25] which means the product is sold in more states with N. Consequently, N can lower its base pay enough to dissuade m_2 from applying, ensuring that m_1 joins N while m_2 joins D.

Analysis: Each bank offers two contracts, one for each managerial type. Bank D offers (w_D^1, b_D^1) and (w_D^2, b_D^2), and N offers (w_N^1, b_N^1) and (w_N^2, b_N^2), where the superscript $j \in \{1, 2\}$ indicates the managerial type m_j the contract is designed for. The contract for m_j satisfies m_j's participation constraint and induces effort. Each manager selects one contract from the four offered, thereby deciding which bank to join. The analysis proceeds in six steps, in which we show:

1. m_2's problem comes down to choosing between (w_D^2, b_D^2) and (w_N^1, b_N^1).
2. m_1's choice also boils down to (w_N^1, b_N^1) or (w_D^2, b_D^2).
3. Derive the relevant IC constraints to ensure that N attracts m_1 and m_1 exerts effort.
4. The optimal contract design boils down to satisfying two constraints: N offers a low enough base pay to dissuade m_2 and a high enough bonus to attract m_1.
5. Contracts are characterized.
6. m_1's higher talent generates a higher rent for her due to competition for talent.

(1) m_2***'s choice comes down to*** (w_D^2, b_D^2) ***or*** (w_N^1, b_N^1)***.*** Banks do not compete for m_2, so each bank designs its contract for m_2 only to incentivize m_2 to work and hold the bank's desired ethical standard if she joins. Such contracts make m_2's IC constraint for effort exertion bind, and are given by (3) and (4) by replacing μ and s^* there with μ_2 and the standard s_i^* in bank $i \in \{D, N\}$, respectively:

$$w_i^2 = \frac{(c/\mu_2)s_i^*}{\int_{s_i^*}^1 (s - s_i^*)f(s)ds} - \delta \tag{13}$$

$$b_i^2 = \frac{(c/\mu_2)(1 - s_i^*)}{\int_{s_i^*}^1 (s - s_i^*)f(s)ds}. \tag{14}$$

[24] We verify this statement later in Proposition 3.

[25] The use of a higher bonus-to-base ratio leads to a lower ethical standard being set by the manager; see (1).

Since D is assumed to have a higher ethical standard ($s_D^* > s_N^*$), we have $w_D^2 > w_N^2$ and $b_D^2 > b_N^2$ (a higher standard requires a higher base pay and a higher bonus for given managerial talent; Lemma 1). For m_2, (w_D^2, b_D^2) is thus more attractive than (w_N^2, b_N^2), since she gets a higher rent w_D^2 by selecting the former contract (the rent is w_N^2, less than w_D^2, if she opts for the latter contract).

Bank D's contract for m_1, (w_D^1, b_D^1), will not offer m_2 a rent higher than w_D^2. Were it not the case, (w_D^1, b_D^1) designed to attract m_1 would also attract m_2, so it is not worth it. Since $\frac{b_D^1}{w_D^1+\delta} = \frac{b_D^2}{w_D^2+\delta} = \frac{1-s_D^*}{s_D^*}$ to maintain the ethical standard s_D^* in D (see (1)), we must have $w_D^2 > w_D^1$ and $b_D^2 > b_D^1$.[26]

Therefore, m_2's choice can be narrowed down to deciding between (w_D^2, b_D^2) and (w_N^1, b_N^1), since (w_N^2, b_N^2) and (w_D^1, b_D^1) are strictly dominated by (w_D^2, b_D^2). We show below that N will design (w_N^1, b_N^1) so that m_2 does not select that contract. We will also show that N has an advantage over D in attracting m_1.

(2) ***m_1's choice boils down to (w_N^1, b_N^1) or (w_D^2, b_D^2).*** For N to attract m_1, its contract for m_1, (w_N^1, b_N^1), must satisfy two conditions: (i) dissuade m_2 from selecting that contract, and (ii) offer m_1 a payoff no lower than what m_1 could get by selecting (w_D^2, b_D^2) offered by D.

We eliminate (w_N^2, b_N^2) and (w_D^1, b_D^1) from m_1's outside options when stating condition (ii), since we have shown in step 1 that these two contracts are strictly dominated by (w_D^2, b_D^2). That is, N only needs to ensure that m_1 prefers (w_N^1, b_N^1) over (w_D^2, b_D^2), her only relevant outside option.

(3) ***IC constraints to ensure N attracts m_1 and m_1 expends effort.*** The IC constraint for condition (i) in step 2 (i.e., dissuade m_2 from selecting (w_N^1, b_N^1)) is

$$\max\left(w_N^1 + \mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds - c, w_N^1\right) \leq w_D^2. \tag{15}$$

The LHS is m_2's rent if she selects (w_N^1, b_N^1). As explained for (2), this involves a choice between working with a rent $w_N^1 + \mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds - c$ and shirking with a rent w_N^1, depending on which is bigger. We show later that the former rent is bigger with optimal contracting (see (21)), so m_2 strictly prefers to work if she selects (w_N^1, b_N^1). The RHS, w_D^2, is m_2's rent if she selects (w_D^2, b_D^2). As shown in step 1, m_2 strictly prefers (w_D^2, b_D^2) to (w_D^1, b_D^1) or (w_N^2, b_N^2), so we only consider w_D^2 in (15).

It follows from (15) that $w_D^2 \geq w_N^1$, i.e., the base pay offered by D to m_2 cannot be lower than the base pay offered by N to m_1. If $w_D^2 < w_N^1$, then m_2 simply takes (w_N^1, b_N^1) and shirks, collecting a rent w_N^1, higher than the rent w_D^2 she collects from selecting (w_D^2, b_D^2).

[26] If $w_D^2 < w_D^1$, then $b_D^2 < b_D^1$, and m_2 would strictly prefer (w_D^1, b_D^1) over (w_D^2, b_D^2).

The IC constraint for condition (ii) in step 2 (i.e., ensure m_1 to choose (w_N^1, b_N^1) over (w_D^2, b_D^2)) is

$$w_N^1 + \mu_1 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)] f(s) ds - c \geq w_D^2 + \mu_1 \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2 + \delta)] f(s) ds - c. \quad (16)$$

The LHS is m_1's rent if she chooses (w_N^1, b_N^1) and works. The RHS is her rent if she chooses (w_D^2, b_D^2), and with this contract she will strictly prefer to work.[27]

Finally, (w_N^1, b_N^1) must also incentivize m_1 to expend effort:

$$w_N^1 + \mu_1 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)] f(s) ds - c \geq w_N^1. \quad (17)$$

Lemma 4. *m_1's IC constraint for effort exertion (17) is slack in equilibrium.*

Since (17) is slack, contracts are determined by (13) – (16). We only need to derive (w_N^1, b_N^1): (w_N^2, b_N^2) and (w_D^1, b_D^1) are irrelevant along the path of play (i.e., not selected by either manager in equilibrium, as shown earlier), and (w_D^2, b_D^2) has been determined by (13) and (14).

The slackness of (17) implies that m_1 enjoys a rent higher than the base w_N^1 from selecting (w_N^1, b_N^1). This result differs from that with one monopoly bank (Section 3), where the manager's IC constraint for effort exertion is binding, so the manager's rent equals her base salary. Here, competition for m_1 increases her rent; we explicitly compute m_1's rent below in (22). By contrast, no bank competes for the less talented m_2, so her rent from selecting (w_D^2, b_D^2) equals the base w_D^2, as in the one-bank case.

(4) ***Contract design boils down to two IC constraints ensuring m_1 joins N and m_2 joins D.*** We can rewrite conditions (15) and (16), and simplify the contract design problem as follows:

Lemma 5. *The optimal contract design satisfies the following two IC constraints:*

$$w_D^2 - w_N^1 \leq \frac{\mu_1}{\mu_2} \left(\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)] f(s) ds - c \right) \quad (18)$$

$$w_D^2 - w_N^1 \geq \mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)] f(s) ds - c. \quad (19)$$

Optimal contracts ensure that for m_1 the expected increase in bonus from working for N instead of D exceeds the loss of a higher base from choosing D ((18)), whereas for m_2 this expected bonus increase from

[27] Note that (w_D^2, b_D^2) as in (13) and (14) is such that $w_D^2 + \mu_2 \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2 + \delta)] f(s) ds - c = w_D^2$ (IC constraint is binding for m_2), so $w_D^2 + \mu_1 \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2 + \delta)] f(s) ds - c > w_D^2$ (IC constraint is slack for m_1), given $\mu_1 > \mu_2$. Thus, m_1 strictly prefers to work if she chooses (w_D^2, b_D^2), earning a rent captured by the RHS of (16).

choosing N over D is less than the associated loss in base pay ((19)).[28] Bank N offers a higher expected bonus (for either managerial type) because it has a higher probability of a product sale due to its lower ethical standard. However, m_2 has a lower ability than m_1 in designing a new product in the first place. So while both m_1 and m_2 can work for N, m_1 is more likely to earn the bonus.

(5) ***Optimal contracts.*** We examine (18) and (19). The term, $\int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds$, pulls the two constraints in opposite directions. To minimize its wage cost, N wants to lower w_N^1 as much as possible. But when w_N^1 falls, b_N^1 also falls to maintain $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*}$, sustaining the ethical standard s_N^*. It can be shown that as w_N^1 falls, the RHSs of (18) and (19) both decrease,[29] so (19) becomes more slack while (18) becomes tighter. Thus, (18) must be binding:

$$w_D^2 - w_N^1 = \frac{\mu_1}{\mu_2}\left(\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds - c\right). \tag{20}$$

If it were not, then N could lower w_N^1 and b_N^1 to reduce its wage cost, which further strengthens (19).

Given (20), (19) automatically holds (and is slack) as long as

$$\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds - c > 0, \tag{21}$$

since $\mu_1 > \mu_2$. (21) says that m_2 strictly prefers to work if she joins N.[30] It also ensures an increase in expected bonus for a manager (either type) in going from D to N (see footnote 28).

Proposition 2. *Take ethical standards s_D^* and s_N^* as given, with $s_D^* > s_N^*$. The less talented manager, m_2, selects (w_D^2, b_D^2) offered by D and given by (13) and (14) with $i = D$, and the more talented manager, m_1, selects (w_N^1, b_N^1) offered by N, where w_N^1 and b_N^1 are jointly given by (20) and $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*}$, which always satisfy (21).*

Proposition 2 characterizes optimal contracts that perform two functions: (a) implement the given

[28] More clearly, $\int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds$ is a managers's (either type) expected bonus from working for N *for each product she designs*, so for m_2 her expected bonus from joining N is $\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds$; m_2's bonus from working for D is $\mu_2 \int_{s_D^*}^1 [sb_N^1 - (1-s)(w_N^1 + \delta)]f(s)ds$, which equals c due to m_2's binding IC constraint for effort exertion from selecting (w_D^2, b_D^2) (as shown in step 1). So, m_2's expected bonus increase from joining N rather than D is captured by the RHS of (19). Since m_1 develops a new product with a higher probability μ_1, her expected bonus increase from joining N instead of D is captured by the RHS of (18).

[29] When w_N^1 falls, the integrand $sb_N^1 - (1-s)(w_N^1 + \delta)$, also falls. To see this, suppose w_N^1 decreases by ϵ, and b_N^1 decreases by ξ, so $\frac{b_N^1 - \xi}{w_N^1 - \epsilon + \delta} = \frac{b_N^1}{w_N^1+\delta}$, i.e., $\xi = \frac{b_N^1}{w_N^1+\delta}\epsilon$. The integrand becomes $s(b_N^1 - \xi) - (1-s)(w_N^1 - \epsilon + \delta) = sb_N^1 - (1-s)(w_N^1 + \delta) - [s\xi - (1-s)\epsilon] = sb_N^1 - (1-s)(w_N^1 + \delta) - \left[s\frac{b_N^1}{w_N^1+\delta} - (1-s)\right]\epsilon < sb_N^1 - (1-s)(w_N^1 + \delta)$; the last inequality follows from $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*} > \frac{1-s}{s}\ \forall s > s_N^*$.

[30] Recall, we used this condition to simplify (15) in step 3 to derive (19).

ethical standard, and (b) attract talent. Performance on (a) affects the contract's efficacy in achieving (b). The key insight is that, because of its (assumed) lower ethical standard, N can load up more on variable pay and less on base pay relative to D. This higher pay-for-performance sensitivity allows the IC constraint to be such that m_1 will take the contract offered by N, whereas the less talented m_2 opts for the higher-base-pay contract offered by D. That is, $\frac{\text{variable pay}}{\text{base pay}}$, which is negatively related to the ethical standard, is also the positive *sorting device* for talent. Bank N's lower ethical standard gives it an edge in attracting m_1 by designing its contract with a lower base but a higher bonus (hence, higher $\frac{\text{variable pay}}{\text{base pay}}$), thereby deterring m_2 from taking it.

(6) m_1 ***earns a higher rent than*** m_2. The rent (i.e., expected pay above the effort cost c) enjoyed by m_1 from working for N is

$$\begin{aligned} w_N^1 + \mu_1 \int_{s_N^*}^{1} [s b_N^1 - (1-s)(w_N^1 + \delta)] f(s) ds - c &= w_N^1 + (w_D^2 - w_N^1) + c\left(\frac{\mu_1}{\mu_2} - 1\right) \\ &= w_D^2 + c\left(\frac{\mu_1}{\mu_2} - 1\right), \end{aligned} \tag{22}$$

which is bigger than m_2's rent, w_D^2, from working for D. The first equality in (22) follows from (20). The nice intuition here is that m_1's ability to earn a higher rent comes precisely from her talent advantage $\frac{\mu_1}{\mu_2} > 1$. This advantage generates competition for m_1, enabling m_1 to earn $c\big(\frac{\mu_1}{\mu_2} - 1\big)$ more than m_2.

Note from (22) that each dollar increase in m_2's rent, w_D^2, is matched by a dollar increase in m_1's rent, a direct consequence of talent competition. Managerial rents are thus "contagious" – higher rents in depositories (D) lead to higher rents in shadow banks (N) due to the latter's incentive to retain talent.

We have assumed so far that banks prefer to hire m_1 rather than m_2, despite the higher rent captured by m_1. We show below that this is because the higher innovation benefit of hiring m_1 exceeds the cost of the extra rent.

Proposition 3. *Competition for talent allows m_1 to earn $c\big(\frac{\mu_1}{\mu_2} - 1\big)$ more than m_2. Despite this higher rent, each bank, holding its ethical standard fixed, still prefers to hire m_1 instead of m_2.*

Banks find it worthwhile hiring m_1 or m_2 because their expected profits net of wages are positive with either manager. For m_2, this means the bank's expected profit, $\mu_2 \times$ {profit from product sale}, exceeds the managerial effort cost c, so {profit from product sale} $> \frac{c}{\mu_2}$. Hiring m_1 rather than m_2 improves the probability of product development by $\mu_1 - \mu_2$, thereby increasing the profit by $(\mu_1 - \mu_2) \times$ {profit from product sale}. The extra rent to m_1 is $c\big(\frac{\mu_1}{\mu_2} - 1\big) = (\mu_1 - \mu_2)\frac{c}{\mu_2}$. Since {profit from product sale} $>$

$\frac{c}{\mu_2}$, we have $(\mu_1 - \mu_2) \times \{\text{profit from product sale}\} > (\mu_1 - \mu_2)\frac{c}{\mu_2}$, making it beneficial to hire m_1 instead of m_2. In other words, since m_1 generates higher surplus and captures only a portion of it, the bank prefers m_1 despite her higher rent.

4.2 Socially Optimal Talent Allocation

The analysis in Section 4.1 implies that for any two given ethical standards, say $s_1^* < s_2^*$, there are two possible standard-talent pairs: (s_1^*, μ_1) and (s_2^*, μ_2), i.e., low (resp., high) standard is paired with high (resp., low) talent. *A bank cannot have a higher ethical standard than its competitor and also attract better talent through contract design.* We show below that the regulator, who maximizes aggregate welfare from the two banks but otherwise has no preference over which bank innovates more, prefers to let N have the former allocation (denoted by $(s_1^*, \mu_1) \to N$) and D have the latter (denoted by $(s_2^*, \mu_2) \to D$). The idea is that the socially optimal talent allocation, attaching no weight to which sector engages in more innovation and sales, minimizes the exposure of the public safety net for depositories by inducing them to adopt higher ethical standards and inevitably, therefore, hire less talented managers.

Proposition 4. *The socially optimal talent allocation is to let bank N have a relatively low ethical standard and hire the more talented manager, and induce bank D to have a relatively high ethical standard and hire the less talented manager.*

The regulator cannot dictate talent allocation but has to accept how the labor market allocates talent across D and N through contracting once ethical standards in the two sectors are fixed. What the regulator can do, as we show in Section 4.3 below, is to influence ethical standards, hence wage contracts, by choosing capital requirements in the two sectors, thereby indirectly implementing the desired (constrained efficient) talent allocation.

4.3 Implementation of Talent Allocation through Capital Requirements

This section examines how regulatory capital requirements can be used as an indirect tool to implement the desired talent allocation across shadow banks (N) and depositories (D). To make the analysis here comparable with that in Section 3 without talent heterogeneity, suppose $\mu = \mu_2$ there (i.e., only less talented managers are available). Denote the corresponding socially optimal ethical standards for N and D as $s^{\text{reg}}_{\mu_2,N}$ and $s^{\text{reg}}_{\mu_2,D}$, respectively. The corresponding capital requirements to implement $s^{\text{reg}}_{\mu_2,N}$ and $s^{\text{reg}}_{\mu_2,D}$ are $L^{\text{reg}}_{\mu_2,N}$ and $L^{\text{reg}}_{\mu_2,D}$, respectively. Note that subscripts for variables here indicate both types of manager and bank. Recall that, in the absence of talent heterogeneity, (A5) – (A8) in Appendix A are equilibrium conditions that pin down the socially optimal capital requirement and the consequent ethical standard for an arbitrary bank (with any values of γ and μ). We can thus obtain $s^{\text{reg}}_{\mu_2,N}$ and $L^{\text{reg}}_{\mu_2,N}$ by letting $\gamma = 0$ and $\mu = \mu_2$, and $s^{\text{reg}}_{\mu_2,D}$ and $L^{\text{reg}}_{\mu_2,D}$ by letting $\gamma = 1$ and $\mu = \mu_2$, in (A5) – (A8). The comparative statics results on γ in Proposition 1 show that $s^{\text{reg}}_{\mu_2,D} > s^{\text{reg}}_{\mu_2,N}$ and $L^{\text{reg}}_{\mu_2,D} > L^{\text{reg}}_{\mu_2,N}$.

Now, introduce the more talented manager, m_1, into the labor pool. We know that the bank hiring m_1 has a lower ethical standard (Proposition 2), and it should be N (Proposition 4). With talent heterogeneity and competition, what is the socially optimal ethical standard, $s^{\text{reg}}_{\mu_1,N}$, and what is the corresponding capital requirement, $L^{\text{reg}}_{\mu_1,N}$, to induce that standard for N? Here, consistent with the socially efficient talent allocation, we suppose N hires m_1 (instead of m_2 in the base case without talent competition). Proposition 1 shows that the socially optimal ethical standard and the capital requirement to induce that standard are both decreasing in managerial talent, so $s^{\text{reg}}_{\mu_1,N} < s^{\text{reg}}_{\mu_2,N}$ and $L^{\text{reg}}_{\mu_1,N} < L^{\text{reg}}_{\mu_2,N}$. We can obtain $s^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_1,N}$ by letting $\gamma = 0$ and $\mu = \mu_1$ in (A5) – (A8).

Bank D hires m_2, according to the socially efficient talent allocation. Since D hires the same type of manager as it does in the case without talent competition, its socially optimal ethical standard and the capital requirement to implement that standard remain unchanged: they are still $s^{\text{reg}}_{\mu_2,D}$ and $L^{\text{reg}}_{\mu_2,D}$.

The following analysis is centered around variables $s^{\text{reg}}_{\mu_1,N}$, $L^{\text{reg}}_{\mu_1,N}$, $s^{\text{reg}}_{\mu_2,D}$, and $L^{\text{reg}}_{\mu_2,D}$. So, for ease of reference, we explicitly write down the system of equations that determine those variables: $s^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_1,N}$ are pinned down by (A13) – (A16), and $s^{\text{reg}}_{\mu_2,D}$ and $L^{\text{reg}}_{\mu_2,D}$ are pinned down by (A17) – (A19) in Appendix A. Clearly, $s^{\text{reg}}_{\mu_1,N} < s^{\text{reg}}_{\mu_2,D}$ and $L^{\text{reg}}_{\mu_1,N} < L^{\text{reg}}_{\mu_2,D}$, following the discussion above.

Are capital requirements $L^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_2,D}$ sufficient to implement the socially efficient talent allocation? The answer is: they may not be. The reason is competition for talent. Absent this competition, $L^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_2,D}$ would induce N and D to adopt the desired ethical standards, taking the talent allocation ($m_1 \to N$, $m_2 \to D$) as given. However, both banks prefer m_1 to m_2 and recognize that lowering the ethical standard improves the odds of hiring m_1. Thus, if talent competition is sufficiently strong, D may prefer an ethical standard lower than what it would set without this competition, in order to "beat" the standard of N (to poach m_1). Of course, were this to happen, N would react by further lowering its own ethical standard (to retain m_1). This sets in motion a "race to the bottom" in ethical standards.

Preventing this race requires the regulator to *widen* the gap between capital requirements for D and N. The proof of Proposition 5 shows that this is achieved by simultaneously lowering the capital requirement for N below $L^{\text{reg}}_{\mu_1,N}$ and raising the capital requirement for D above $L^{\text{reg}}_{\mu_2,D}$. In doing so, the regulator (deliberately) puts depositories at a competitive disadvantage relative to shadow banks in terms of capital requirements. Since $L^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_2,D}$ maximize social surplus in the depository and shadow banking sectors, respectively, when there is no talent competition, deviating from these capital requirements lowers social surplus in both sectors.

Proposition 5. *Compared to the case without talent competition, talent competition induces the regulator to impose an even higher capital requirement on D relative to N (capital requirement higher than $L^{reg}_{\mu_2,D}$ for D, and lower than $L^{reg}_{\mu_1,N}$ for N), and consequently D adopts an even higher ethical standard relative to N (standard higher than $s^{reg}_{\mu_2,D}$ for D, and lower than $s^{reg}_{\mu_1,N}$ for N). In the presence of capital capacity constraints, the increased capital requirement gap between D and N increases the mass of operating shadow banks relative to the mass of operating depositories.*

The existing literature suggests that higher capital requirements for depositories will lead to regulatory arbitrage, causing banking activities to migrate to shadow banks. In our model, we have shut down this activity migration channel by assuming that the same financial innovation can be performed in both sectors. What we show is that this capital requirement gap may nonetheless be needed for the regulator to (indirectly) implement the (constrained) socially optimal talent allocation. When financial intermediary capital is scarce, one consequence of this is that talent competition further increases the size of shadow banking relative to the depository sector.

5 Model Robustness, Extensions, Implications and Predictions

5.1 Robustness

Uncertain Managerial Ethics: In our analysis, the managerial ethics parameter δ is a constant. In practice, firms face uncertainty in determining personal ethical standards of the people they hire. How would such uncertainty affect the analysis? To examine this, we consider a setting with $\delta \in \{\delta_{\text{hm}}, \delta_{\text{lm}}\}$, where $\delta_{\text{hm}} > \delta_{\text{lm}}$, i.e., managers with $\delta = \delta_{\text{hm}}$ are innately more ethical. The exact value of δ is *a priori* unknown to all, including the manager. Denote the common prior belief $\Pr(\delta = \delta_\iota) = \beta_\iota$, $\iota \in \{\text{hm}, \text{lm}\}$, with $\beta_{\text{hm}} + \beta_{\text{lm}} = 1$. Although the manager does not know δ at the contracting stage, she privately learns her δ after the product is developed, but it remains unknown to others.[31]

[31] The manager may not know precisely how harmful a mis-sold product could be to customers (hence, her exact disutility δ from mis-selling) until the actual product is developed. The idea is that ethics has a *situational* aspect. An agent may be

We first analyze the bank's contract (w, b) without talent competition. Following (1), the manager chooses her ethical standard s_ι^* based on (w, b) signed (which cannot be altered) and her realized δ_ι:

$$s_\iota^* = \left(1 + \frac{b}{w + \delta_\iota}\right)^{-1} \quad \Rightarrow \quad s_{\text{hm}}^* > s_{\text{lm}}^*. \tag{23}$$

Following (2), the manager's IC constraint for effort exertion is

$$w + \mu \int_{s_\iota^*}^{1} [sb - (1-s)(w + \delta_\iota)] f(s) ds - c \geq w. \tag{24}$$

The low-ethics manager sells in more states ($s_{\text{lm}}^* < s_{\text{hm}}^*$) and loses less upon mis-selling ($\delta_{\text{lm}} < \delta_{\text{hm}}$). Both give her a stronger incentive to develop the product: (24) is more binding when $\delta = \delta_{\text{hm}}$. There are thus two possible cases: (i) (24) is binding for $\delta = \delta_{\text{hm}}$, and slack for $\delta = \delta_{\text{lm}}$; and (ii) (24) is binding for $\delta = \delta_{\text{lm}}$, but fails to hold for $\delta = \delta_{\text{hm}}$.[32]

In (i), the manager works regardless of her ethics. A high-ethics manager, with a binding IC constraint, earns a rent equal to w (so her ethical preference δ_{hm} is fully exploited by the bank, as in Section 3), while a low-ethics manager, with a slack IC constraint, enjoys a rent bigger than w. The bank's uncertainty about δ at the contracting stage prevents it from fully exploiting the low-ethics manager's ethical preference δ_{lm}. The bank may thus consider (ii) by designing (w, b) to incentivize only the low-ethics manager when the probability of facing such a manager (β_{lm}) is high enough. The benefit of this is that the bank then knows its manager's ethical preference relevant for the contract design, $\delta = \delta_{\text{lm}}$, with certainty, so (w, b) can be chosen to fully exploit δ_{lm}. But such a contract fails to incentivize the high-ethics manager. Therefore, the bank faces a tradeoff between extracting rents (by exploiting managerial ethics) and incentivizing innovation. If the bank wants to induce both types of managers to innovate, then it cannot extract maximum rents by fully exploiting managerial ethics from both types. Appendix C examines how this tradeoff shapes the bank's contract (w, b) and the resulting ethical standard, for a given capital level.

We show that the chosen (w, b) determines whether case (i) or case (ii) obtains, and the bank's contract design maximizes its expected profit. The complexity of the problem permits only a numerical analysis. The results are plotted in Figure 2. When the probability of hiring a high-ethics manager is not too low ($\beta_{\text{hm}} \geq 0.28$, $\beta_{\text{lm}} \leq 0.72$), the bank induces both types of managers to work (case (i), left part). The

more ethical than another in one situation while less so in a different circumstance. Personal ethics can be product-dependent, and a rank-ordering of employees based on ethics may not be possible *a priori*.

[32]If (24) fails to hold for both $\delta = \delta_{\text{hm}}$ and $\delta = \delta_{\text{lm}}$, then it is worthless hiring the (always shirking) manager.

high-ethics manager's standard, s^*_{hm}, is increasing in the presence of the low-ethics manager, $\frac{ds^*_{\text{hm}}}{d\beta_{\text{lm}}} > 0$. The possibility of facing a low-ethics manager causes the bank to be cautious – too steep a contract (high $\frac{b}{w}$) would result in a very low standard, s^*_{lm}, if the low-ethics manager is hired. As β_{lm} rises, the bank flattens the contract ($\frac{b}{w}$ falls) further to raise s^*_{lm}, which in turn raises s^*_{hm}, since s^*_{hm} and s^*_{lm} are both determined by (w, b); see (23). The low-ethics manager essentially exerts a "disciplinary effect" on the bank, and this effect becomes stronger with more uncertainty about managerial ethics. In this example, ethical standards are highest when $\beta_{\text{lm}} = 0.72$.

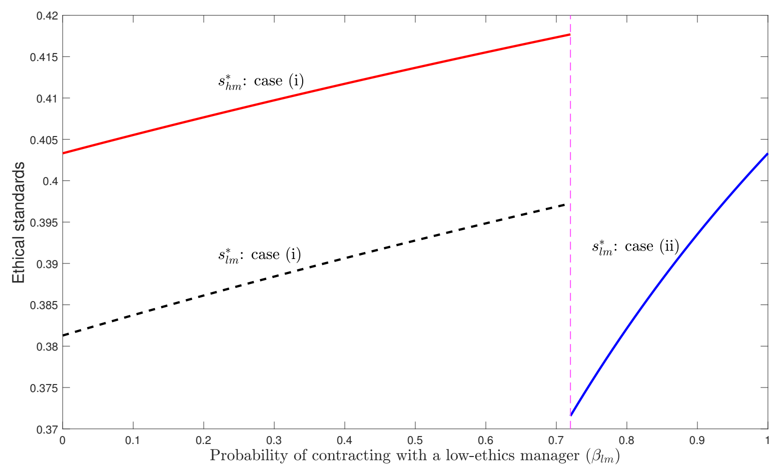

Figure 2: Effect of uncertain managerial ethics on bank ethical standard. Parameter values: $s \sim U[0, 1]$, $u_l = -1$, $u_h = 2.5$, $\mu = 0.8$, $c = 0.02$, $\delta_{\text{hm}} = 0.015$, $\delta_{\text{lm}} = 0.01$, $L = 1$, $R = 1$, $k = 1.5$, and $\gamma = 1$ (i.e., deposits are fully insured; qualitatively similar results obtain $\forall \gamma \in [0, 1)$).

When the probability of facing a low-ethics manager is sufficiently high ($\beta_{\text{lm}} > 0.72$), it becomes too costly for the bank to incentivize the high-ethics manager and simultaneously maintain a very high standard s^*_{hm} (recall that the managerial rent rises with the standard; Lemma 1). Consequently, the bank incentivizes only the low-ethics manager (case (ii), right part), and its standard drops significantly around $\beta_{\text{lm}} = 0.72$.

When $\beta_{\text{lm}} = 0$ ($\delta = \delta_{\text{hm}}$ for sure) or $\beta_{\text{lm}} = 1$ ($\delta = \delta_{\text{lm}}$ for sure), there is no uncertainty about managerial ethics – we are back to the setting in Section 3. In these two polar cases, as shown in Figure 2, the bank adopts the same standard, regardless whether the high-ethics or low-ethics manager is hired. This follows from Lemma 3 – with a constant known δ, managerial ethics does not affect the bank's ethical standard.

The analysis with talent competition is much more complicated, and we can only provide intuition. We assume there is no correlation between managerial talent and ethics – the distribution $\delta \in \{\delta_{\text{hm}}, \delta_{\text{lm}}\}$ is identical for both m_1 (more talented) and m_2 (less talented). This specification ensures that banks compete for talent, not managerial ethics. This provides consistency with the main focus in Section 4.1.

If β_{lm} is very high, both banks D and N design contracts to incentivize only low-ethics managers, so the analysis in Section 4.1 holds (let $\delta = \delta_{\text{lm}}$). If β_{lm} is not very high, each bank wants to incentivize both the high-ethics and low-ethics managers. The key is that N can still design its contract to attract only m_1, regardless of the realization of δ. To see this, suppose D and N design contracts as in Section 4.1, setting $\delta = \delta_{\text{hm}}$. If managers expect $\delta = \delta_{\text{hm}}$ to be realized, m_1 will select N's contract and m_2 will choose D's contract. And if they expect $\delta = \delta_{\text{lm}}$ to be realized, the attractiveness of N's contract for m_1 relative to its attractiveness for m_2 becomes even greater. With a lower δ the manager loses even less upon mis-selling, and since m_1 innovates more than m_2, N's bonus-heavy contract becomes even more attractive to m_1. So, contracts based on $\delta = \delta_{\text{hm}}$ enable N to attract only m_1 even more effectively than those based on $\delta = \delta_{\text{lm}}$. Optimal contracts, designed before δ is realized, should lie between these two sets of contracts. But the formal analysis to pin down optimal contracts is daunting and complicated. Nonetheless, our discussions above imply that the main intuition underlying the analysis in Section 4.1 will hold qualitatively.

Risk Aversion and Talent Competition: The result in Section 4.1 that bank N can use a higher $\frac{\text{bonus}}{\text{base}}$ as a talent sorting device to attract the more talented manager hinges on the idea that the more talented manager prefers a higher bonus while the less talented manager prefers a higher base. All our agents are risk neutral. If managers are risk averse, they will find bonus-heavy wage contracts less attractive. However, as long as managerial talent and the degree of risk aversion are uncorrelated, our results will be qualitatively unaffected. The results will change if the more talented manager is sufficiently more risk averse than the less talented, in which case the flatter contract offered by bank D may attract better talent.

We are not aware of systematic empirical evidence that more talented managers are more risk averse. There are theories, however, that imply those who display less risk-averse behavior are perceived as being more talented. For example, Goel and Thakor (2008) model an intrafirm tournament for promotion to CEO among risk-averse managers. They show that the manager who underestimates risk chooses riskier projects, has a higher chance of achieving extreme investment payoffs, and is thus more likely to win. Cucculelli and Ermini (2013) examine Italian manufacturing firms and provide evidence that firms run by risk-loving entrepreneurs perform better than those run by risk-averse entrepreneurs, in a setting in which some firms are introducing new products.

Bailing Out Shadow Banks: We have assumed that only depositories are protected by safety nets, and this induces the regulator to impose higher capital requirements on depositories. But we saw during the 2007-09 financial crisis that even shadow banks were bailed out. The reason was the perceived negative externality – a higher probability of financial instability – from the failure of systemically important shadow banks. How would bailout protection for shadow banks affect our analysis?

This question raises the broader issue of what distinguishes depositories from shadow banks. In our model, it is that depositories are safety-net protected, whereas shadow banks are not. Merton and Thakor (2019) provide a microfoundation for this based on the efficiency of insulating depositors against the bank's idiosyncratic risk (but not doing so for other investors). Nonetheless, our results hold qualitatively as long as the probability of depositories being bailed out is higher than that for shadow banks. This is true for most shadow banks – the (implicit) regulatory "promise" to bail out shadow banks is much weaker than its statutory obligation to rescue safety-net protected depositories, as illustrated by the Lehman failure.

Of course, the crisis also revealed that most shadow banks that were considered to be systemically important (e.g., AIG) were not allowed to fail. To the extent that it is recognized *ex ante* that such shadow banks – for example, institutions like the identified GSIBs in the post-crisis period[33] – have the same *de facto* protection as depositories, regulators should impose the same capital requirements on them, consistent with Merton (1993)'s "functional regulation" approach. These institutions will attract less talented managers and operate with higher ethical standards than other shadow banks without such implicit guarantees. Thus, there will be heterogeneity among shadow banks in their capital requirements.

5.2 Extensions

Our analysis can be extended in many respects, and we discuss below how they would affect our results.

Bank Fixed Effects in Innovation Capability: In our model, all banks have the same innovation capabilities. But as noted in the innovation literature, there is a great deal of cross-sectional heterogeneity in the innovation capabilities of firms, based on their corporate culture, human capital, strategy and so on (e.g., Cameron, Quinn, DeGraff, and Thakor (2014), and Graham, Harvey, Popadak, and Rajgopal (2017)). In the context of our model, it would be easier for a manager to innovate if she were working in a bank with better innovation capabilities – her effort cost c would be lower in such a bank. Of course, acquiring a superior innovation capability is not costless for the bank. So we can think of the bank incurring a fixed cost, which may itself vary in the cross-section, to acquire a better innovation capability, and then the manager incurring a lower variable cost c to innovate. Then, we can let c vary in the cross-section and derive predictions based on comparative statics results on c. Specifically, from (5) we know that $\frac{dw}{ds^*}$ decreases when c decreases: it is less costly at the margin (i.e., a lower managerial rent) for a

[33] GSIBs are "global systemically important banks."

bank with better organizational innovation capability to induce a higher ethical standard. As a result, following from the FOC in (10), the bank adopts a higher ethical standard s^* in equilibrium. Moreover, a flatter contract is needed to implement a higher s^* (Lemma 1). Together, these comparative statistics results show that banks with better organizational innovation capabilities and culture in place rely less on steep compensation contracts to incentivize managerial innovation and, hence, can maintain higher ethical standards. This suggests a link between organizational culture, managerial compensation, and financial stability.

Exogenous Risk: In our model, the risk that banks face is that of selling an unsuitable innovative product to a customer. So if the innovative product is not sold, there is no risk. In practice, banks face additional exogenous risks, which can stem from both the innovative product being exogenously risky – it can fail even if it is suitable for the customer – and the bank's alternative to the innovative product, which may be a conventional but risky investment. How would the analysis be affected with such exogenous risk? Note first that there is empirical evidence that R&D risk is largely idiosyncratic. For example, Jørring, Lo, Philipson, Singh, and Thakor (2020) use project-level biotech data to provide such evidence, and it had also been posited in some earlier papers (e.g., Fernandez, Stein, and Lo (2012), and Pástor and Veronesi (2009)). Assuming that similar logic applies to financial products, we could surmise that banks with a larger fraction of their product portfolio consisting of innovative products would exhibit less systematic risk than banks with a larger fraction of the portfolio devoted to conventional products, assuming that conventional products have less idiosyncratic but more systematic risk.[34]

Capital Structure Heterogeneity within Depository Sector: In our model, while depositories and shadow banks have different equilibrium capital structures, within each sector banks have identical capital ratios. In reality, cross-sectional variation in capital structure occurs also within each sector. For example, Berger and Bouwman (2013) document that higher-capital depositories benefit at the expense of their lower-capital counterparts during financial crises. Mehran and Thakor (2011) develop a theory and provide evidence that cross-sectional differences in bank capital ratios have value implications. Capital ratios also vary intertemporally, often due to changes in capital requirements, with attendant real effects (e.g., Benetton, Eckley, Garbarino, Kirwin, and Latsi (2021) who document the impact of lower capital requirements on mortgage interest rates). What implications can be drawn from our analysis if depositories displayed capital structure heterogeneity?

[34]For example, these conventional products may be standard home mortgages and loans to firms in traditional industries with high betas. Another reason for the higher systematic risk in conventional financial products relative to innovative products is that lending across banks is more likely to be correlated with such products than with innovative products (Thakor (2012)).

An immediate implication is that more innovative banks would be associated with lower capital ratios. This is consistent with the theory of financial innovation developed by Thakor (2012) which shows that lower capital ratios encourage banks to innovate more. Moreover, in that model banks that innovate more are also more likely to fail and cause a financial crisis,[35] which neatly connects our insight here to the Berger and Bouwman (2013) evidence. Note, however, that the mechanism by which capital affects innovation in Thakor (2012) is entirely different from the mechanism in our model.

Dynamics: Our model is static. But it does raise the interesting question of how the endogenous choice variables might evolve in a dynamic version of the model.[36] For dynamic considerations to be interesting in our setting, we would need to add at least one ingredient to the model, namely some bank-specific attribute that is *a priori* imperfectly known to the market (but may be privately known to the bank) and affects the bank's ethical standard. This may be the attribute the bank is developing a reputation for. An example of such an attribute could be an "innate" disutility, δ_{b}^{t} in period t, that the bank associates with mis-selling a product; δ_{b}^{t} can be high or low, and a bank with a high δ_{b}^{t} is *ceteris paribus* more likely to adopt a higher ethical standard. At the start of each period t, δ_{b}^{t} is unknown to all, but there is a probability ζ_t it will be high (and a probability $1-\zeta_t$ it will be low). In period t, the bank designs the managerial wage contract for that period as in our model, and does so before observing the realization of δ_{b}^{t}. After the contract is given to the manager and innovation effort is undertaken, the bank observes δ_{b}^{t}. The bank can overrule the manager when the sale of an innovative product is proposed, but cannot force the manager to sell a product she does not want to. Beliefs about ζ_t evolve over time based on what is observed. A higher ζ_t is synonymous with a better reputation for ethics, which allows a higher price to be charged for the product.

In such a model, one possible result is that banks may choose fairly high ethical standards initially, thereby rejecting innovative product sales proposed by their managers with a high probability. When they have built up strong reputations (i.e., high posterior beliefs of the market about ζ_t), they may choose to lower their ethical standards (for any given realization of δ_{b}^{t}), thereby "liquifying" their reputation, as in the theory developed by Boot, Greenbaum, and Thakor (1993). The intuition is that when reputation is high, the price at which an innovative product can be sold is also high (as argued above), so the bank faces a relatively high (opportunity) cost of forgoing a sale. This yields the somewhat striking implication that it is the highly reputable banks that are more likely to engage in unethical behavior. While we are not aware of direct evidence on this, anecdotes like the Wells Fargo scandal are consistent with this implication.[37]

[35]Others arguing that financial innovation can lead to crises include Biais, Rochet, and Woolley (2009) and Rajan (2006).

[36]We are grateful to the editor for pushing us to think about this issue.

[37]Yang (2021) documents that the Wells Fargo scandal reduced trust in banks and pushed consumers to fintech lenders,

5.3 Policy Implications

First, regulators need to be thoughtful about how to use regulatory instruments to encourage higher ethical standards in banking. Even though a higher standard leads to fewer ethical transgressions, it is not a "free lunch." The costs are twofold: less innovation and migration of talent to an affiliated but distinct sector where ethical transgressions may be socially less costly or simply harder to detect.

Second, field experiments like Cohn, Fehr, and Maréchal (2014) suggest that enhancing bankers' personal ethical standards may elevate ethics in banking. However, our analysis indicates that, even apart from the practical challenge in doing so, this bottom-up approach may not produce the desired outcome. Top-down approaches that directly attack the problem at the bank level, like using tools of prudential regulation, may work better.

Third, regulators need to explicitly consider the role of capital requirements in influencing ethical standards in banking. In our model, capital requirements play not only the usual role of diminishing the risk appetite of banks, but also lead to higher ethical standards.

Fourth, since the 2007-09 financial crisis, there has been considerable attention on regulating executive compensation in banking to change managerial behavior for the better. This has obvious challenges because it often requires regulators to "micromanage" compensation design, with all of the attendant information impediments. Our analysis shows that a potentially better alternative for regulators to influence managerial behavior may be more oblique than direct regulation of compensation. Specifically, capital requirements will induce a voluntary change in compensation practices that will improve ethical standards in banking without requiring regulators to have all the information needed for efficient compensation design.

Fifth, regulators should realize that it may be socially optimal to impose higher capital requirements on depositories than on shadow banks, even though the consequently higher ethical standards will cause talent to migrate to shadow banks. In other words, prudential regulation of depositories as well as shadow banks will have unavoidable labor market consequences in financial services.

Sixth, the rich interaction among capital requirements, ethical standards, and talent competition and allocation highlighted by our analysis suggests that policy coordination is needed between consumer protection regulators and prudential regulators. If a consumer protection agency like CFPB in the U.S. pursues a

thereby highlighting the spillover effects of ethical transgressions that we have not considered. Another complication not considered here is that the regulator may use time-varying capital requirements to influence the dynamics of ethical standards. In this case, there will be an interaction between a reputational ratchet effect and careen concerns (Meyer and Vickers (1997)).

policy of penalizing mis-selling of financial products, these penalties will deter innovation beyond the dampening effect of capital requirements. For any given capital requirement imposed by prudential regulators, CFPB penalties will cause depositories to innovate less and attract less talent than intended by prudential regulators, without coordination between the two types of regulators. With coordination, CFPB penalties may enable prudential regulators to achieve the targeted ethical standard in depositories (and hence the desired financial stability) with *lower* capital requirements. Given the capital capacity constraints in our model, this means a bigger depository sector. Of course, none of this is meant to suggest that penalties by consumer protection legislators are welfare enhancing, as they make banks financially more fragile and further expose the safety net.

Finally, our analysis is partial equilibrium in that we do not solve the social planner's problem of how large to permit the depository and shadow banking sectors to be. In practice, the regulator's chartering policy determines the relative sizes of these two sectors. Our analysis suggests that regulatory capital requirements can also determine sector sizes. If the social planner puts a great weight on safety and not much on innovation, then the capital requirement on shadow banks can be raised so much that the sector shrinks. This is likely to be preferable to raising the capital requirement on depositories, which are already subject to high capital requirements in our model. Once shadow banks' capital requirements are raised, those on depositories can be adjusted to achieve the desired sector size, given the distribution of capital capacity constraints.[38] That way, social planners in different countries can achieve different safety-innovation outcomes by influencing depositories and shadow banks through capital requirements.

5.4 Empirical Predictions

First, ethical violations in banking will be lower with higher bank capital ratios. Second, managerial talent will be higher in non-depositories (not protected by the government safety net) than in safety-net protected depositories. Third, when executive compensation in banking is more performance sensitive, there will be more ethical violations. While not specific to banking and product mis-selling, evidence consistent with this prediction appears in the corporate fraud literature, manifested in financial mis-reporting (Bergstresser and Philippon (2006) and Burns and Kedia (2006)). Fourth, when labor market competition in financial services increases, so will ethical violations. Finally, when depositories and shadow banks compete for talent in the same labor market, an increase in this competition will lead to a growth in the size of

[38] For example, Calomiris and Haber (2014) provide a contrast between Canada, which has been crisis-free, and the U.S., which has experienced many crises. The arguments above suggest a smaller shadow banking sector in Canada than in the U.S.

shadow banking relative to the depository sector. However, in countries where regulators emphasize safety more than innovation, the shadow banking sector will be smaller relative to the depository sector.

6 Conclusion

Regulators have been concerned with ethical lapses by banks, whereas bankers are worried about talent migration out of depositories. We show that these are two sides of the same coin: higher ethical standards lead to talent migration. This highlights a new tradeoff in raising ethical standards. In a nutshell, our paper has three main results. First, higher ethical standards in banking can be achieved with higher capital requirements. However, elevating ethical standards may lower innovation and also shrink the size of the banking industry when banks face capital capacity constraints. Thus, the socially optimal capital requirements may be set in a way to tolerate some unethical behavior in equilibrium.

Second, absent talent competition, this tradeoff between more innovation and bigger losses from mis-selling with lower ethical standards determines a bank's privately optimal standard, and it implements this standard through wage contracting with managers. Hiring innately more ethical managers does not influence this standard, since banks can strategically design wage contracts to fully exploit managerial ethics without raising their own ethical standards.

Third, when banks compete for talent, those with lower ethical standards attract better talent. This affects both the socially optimal and privately optimal ethical standards of banks, which diverge nonetheless. The regulator implements socially optimal standards by imposing capital requirements on both safety-net protected depositories and unprotected shadow banks. Safety-net provision raises the socially optimal standard, so capital requirements on depositories are higher than those on shadow banks. When bank capital is scarce, this capital requirements gap results in the shadow banking sector being larger than the depository sector. These differences between depositories and shadow banks (in terms of ethical standards, capital requirements, and sector sizes) become greater when the regulator accounts for talent competition between the two sectors. The analysis thus provides novel insights into how capital requirements, besides their prudential regulation role, can influence the setting of ethical standards, the nature of labor market competition in financial services, and the extent of financial innovation.

Appendix A: Proofs of Results in Sections 3 and 4

Proof of Lemma 1. We first show that specifying a zero wage upon mis-selling is part of optimal contracting (see footnote 13 in Section 2). Suppose the manager gets $z > 0$ upon mis-selling; correspondingly, the base becomes w'. Then, $s^*(w' + b) + (1 - s^*)(z - \delta) = w'$, so $s^* = \left(1 + \frac{b}{w' - z + \delta}\right)^{-1}$. Compared to the original contract (w, b), this means that implementing the same s^* requires $w' = w + z$ (holding b fixed), which also leaves the IC constraint $w' + \mu \int_{s^*}^{1} [sb - (1 - s)(w' - z + \delta)] f(s) ds - c \geq w'$ same as that in (2). Clearly, the increase in the base salary causes (w', b) to be strictly dominated by (w, b).

We now prove the rest of the lemma. It is clear from (5) that $\frac{dw}{ds^*} > 0$. It is also straightforward to show that $\frac{db}{ds^*} = \frac{(c/\mu) \int_{s^*}^{1} (1-s) f(s) ds}{[\int_{s^*}^{1} (s - s^*) f(s) ds]^2} > 0$. Increasing s^* requires to increase $\frac{w+\delta}{b}$; given $\frac{db}{ds^*} > 0$, this means $\frac{b}{w}$ must decrease. Results on μ and δ follow directly from (3) – (5). □

Proof of Lemma 2. To ensure that the problem in (9) is quasi-concave, it is sufficient to have $\frac{dw}{ds^*}$ (given by (5)) be non-decreasing in s^*. A necessary and sufficient condition for this is $\frac{s^* f(s^*) \int_{s^*}^{1} (s - s^*) f(s) ds}{\int_{s^*}^{1} f(s) ds \int_{s^*}^{1} s f(s) ds} \leq 2$, which holds with many distribution specifications for $f(s)$, including uniform distribution and most Beta distributions with the shape parameter $\beta > 1$.[39]

Since $\hat{p}$ is increasing in s^* (see (6)), while $\hat{s}^*$ is decreasing in p (apply the Implicit Function Theorem to (10), $\frac{d\hat{s}^*}{dp} = -\frac{-\mu \hat{s}^* f(\hat{s}^*)}{\text{SOC}} < 0$, where $\text{SOC} \equiv -\mu(p + L - \tilde{R}) - \frac{d^2 w}{d\hat{s}^{*2}} < 0$), the PBE exists and is uniquely determined by the intersection of the two best-response curves: $\hat{p}$ responding to s^* as defined by (6), and $\hat{s}^*$ responding to p as defined by (10).

We now prove comparative statics results of the PBE. Note that: (i) μ, L and γ do not affect $\hat{p}$ in (6) for a given belief s^*; (ii) $\tilde{R}$ in (8) is affected by L and γ, but not μ (since $\hat{p}$ in (8) is not a function of μ); and (iii) for a given belief p in (10), μ affects $\hat{s}^*$ directly, L affects $\hat{s}^*$ both directly and indirectly (through its effect on $\tilde{R}$), and γ affects $\hat{s}^*$ indirectly (through its effect on $\tilde{R}$).

Apply the Implicit Function Theorem to (10), $\frac{d\hat{s}^*}{d\mu} = -\frac{-\pi(\hat{s}^*) f(\hat{s}^*) - \frac{d^2 w}{d\hat{s}^* d\mu}}{\text{SOC}} > 0$, since $\pi(\hat{s}^*) < 0$ (from (10)) and $\frac{d^2 w}{d\hat{s}^* d\mu} < 0$ (from (5)). The result $\frac{ds^*}{d\mu} > 0$ then follows directly, given $\hat{s}^* = s^*$ and $\hat{p} = p$ in equilibrium.

Apply the Implicit Function Theorem to (10) and (8): $\frac{d\hat{s}^*}{dL} = -\frac{\mu(1 - \hat{s}^* + \hat{s}^* \frac{\partial \tilde{R}}{\partial L}) f(\hat{s}^*)}{\text{SOC}}$ and $\frac{\partial \tilde{R}}{\partial L} = -\frac{(1-\gamma) \int_{\hat{s}^*}^{1} (1-s) f(s) ds}{\int_{\hat{s}^*}^{1} s f(s) ds}$. We argue that $(1 - \hat{s}^*) + \hat{s}^* \frac{\partial \tilde{R}}{\partial L} > 0$, so $\frac{d\hat{s}^*}{dL} > 0$. A sufficient condition for this is $\frac{1 - \hat{s}^*}{\hat{s}^*} > \frac{\int_{\hat{s}^*}^{1} (1-s) f(s) ds}{\int_{\hat{s}^*}^{1} s f(s) ds}$, which clearly holds. The result $\frac{ds^*}{dL} > 0$ then follows directly, given $\hat{s}^* = s^*$ and $\hat{p} = p$ in equilibrium. Moreover, since $\frac{d\hat{s}^*}{dL}$ increases with μ (i.e., $\hat{s}^*$ becomes more responsive to L with a larger μ), $\frac{ds^*}{dL}$ is increasing in μ in equilibrium.

Apply the Implicit Function Theorem to (8) and (10): $\frac{\partial \tilde{R}}{\partial \gamma} = -\frac{\int_{\hat{s}^*}^{1} (1-s)[R - (\hat{p} + L - \kappa)] f(s) ds}{\int_{\hat{s}^*}^{1} s f(s) ds} < 0$ and $\frac{d\hat{s}^*}{d\gamma} = -\frac{\mu \hat{s}^* \frac{\partial \tilde{R}}{\partial \gamma} f(\hat{s}^*)}{\text{SOC}} < 0$. The result $\frac{ds^*}{d\gamma} < 0$ then follows directly, given $\hat{s}^* = s^*$ and $\hat{p} = p$ in equilibrium. □

[39] Rewrite the condition as $\frac{s^* f(s^*)}{1 - F(s^*)} \frac{\mathbb{E}[s|s \geq s^*] - s^*}{\mathbb{E}[s|s \geq s^*]} \leq 2$: $f(s)$ does not have "big spikes" for large values of s.

Proof of Lemma 3. The result that, all else equal, δ has no effect on s^* follows from the facts that $\frac{dw}{ds^*}$ does not depend on δ (see (5)) and $\pi(s^*)$ is not a function of δ either, so the FOC (10) determining s^* is independent of δ. The result that the managerial rent w is reduced by δ is evident from (3), with s^* being unaffected by δ. □

Proof of Proposition 1. Differentiating the objective function in (12) with respect to L:

$$\frac{d}{dL}e^{-\alpha L}V(L,\gamma) = e^{-\alpha L}\left[\frac{\partial V(L,\gamma)}{\partial L} + \frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL} - \alpha V(L,\gamma)\right], \tag{A1}$$

where

$$\frac{\partial V(L,\gamma)}{\partial L} = \mu\lambda\gamma\int_{s^*}^{1}(1-s)f(s)ds \tag{A2}$$

$$\frac{\partial V(L,\gamma)}{\partial s^*} = -\mu v(s^*)f(s^*) + \mu\lambda\gamma\frac{dp}{ds^*}\int_{s^*}^{1}(1-s)f(s)ds \tag{A3}$$

$$\frac{ds^*}{dL} = -\frac{\mu(1-s^*+s^*\frac{\partial\tilde{R}}{\partial L})f(s^*)}{\text{SOC}}. \tag{A4}$$

We derived $\frac{ds^*}{dL}$ in the proof of Lemma 2, with $\frac{\partial\tilde{R}}{\partial L} = -\frac{(1-\gamma)\int_{s^*}^{1}(1-s)f(s)ds}{\int_{s^*}^{1}sf(s)ds}$ and SOC $\equiv -\mu(p+L-\tilde{R}) - \frac{d^2w}{ds^{*2}}$. The following proof uses sufficient conditions that $\frac{dp}{ds^*}$ and $\frac{ds^*}{dL}$ are non-increasing in s^*, which mean diminishing effects of s^* in enhancing p and L in improving s^*; these ensure that $\frac{\partial V(L,\gamma)}{\partial s^*}$ is decreasing in s^*, so $V(L,\gamma)$ is concave in s^*. These realistic specifications can be ensured by the initial sufficient condition in the proof of Lemma 2, $\frac{s^*f(s^*)\int_{s^*}^{1}(s-s^*)f(s)ds}{\int_{s^*}^{1}f(s)ds\int_{s^*}^{1}sf(s)ds} \le 2$, which guarantees that the bank's problem in (9) is quasi-concave in the first place. Uniform distribution and most Beta distributions (with the shape parameter $\beta > 1$) for $f(s)$, which satisfy $\frac{s^*f(s^*)\int_{s^*}^{1}(s-s^*)f(s)ds}{\int_{s^*}^{1}f(s)ds\int_{s^*}^{1}sf(s)ds} \le 2$, are sufficient to ensure that $\frac{dp}{ds^*}$ and $\frac{ds^*}{dL}$ are non-increasing in s^*.[40]

We argue that $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}$ is monotonically decreasing in L. When L increases, the denominator $V(L,\gamma)$ increases; otherwise, $e^{-\alpha L}V(L,\gamma)$ could be increased by lowering L. Moreover, s^* is positively related to L, so the three terms in the numerator, which are all decreasing in s^*, decrease with L. A bigger L also directly increases $v(s^*)$, which directly lowers $\frac{\partial V(L,\gamma)}{\partial s^*}$ in the numerator. Thus, L^{reg} and s^{reg} are jointly determined by the FOC

$$\left.\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}\right|_{L=L^{\text{reg}},s^*=s^{\text{reg}}} = \alpha \tag{A5}$$

and the subgame equilibrium conditions governing the relation between s^{reg} and L^{reg}, (6), (8) and (10), which can

[40]For example, with $f(s)$ being uniform, we have $\frac{dp}{ds^*} = \frac{u_h-u_l}{2}$ (constant) and $\frac{ds^*}{dL} = \frac{(1-s^*)[1-(1-\gamma)\frac{s^*}{1+s^*}]}{p+L-\tilde{R}+\frac{4c}{\mu^2}\frac{2+s^*}{(1-s^*)^4}}$ (decreasing in s^*), both are sufficient for the rest of the proof.

be explicitly written as

$$u_l + (u_h - u_l)\int_{s^{\text{reg}}}^{1} \frac{sf(s)}{1-F(s^{\text{reg}})}ds = p \tag{A6}$$

$$\int_{s^{\text{reg}}}^{1} \left\{s\tilde{R} + (1-s)[\gamma R + (1-\gamma)(p + L^{\text{reg}} - \kappa)]\right\}\frac{f(s)}{1-F(s^{\text{reg}})}ds = R \tag{A7}$$

$$-\mu\big[s^{\text{reg}}(p-\tilde{R}) - (1-s^{\text{reg}})L^{\text{reg}}\big]f(s^{\text{reg}}) = \frac{(c/\mu)\int_{s^{\text{reg}}}^{1} sf(s)ds}{\big[\int_{s^{\text{reg}}}^{1}(s-s^{\text{reg}})f(s)ds\big]^2}. \tag{A8}$$

We now examine comparative statics. When α increases, L^{reg} decreases (following (A5)), as $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}$ is monotonically decreasing in L; consequently, s^{reg} decreases as well (due to its positive relation with L^{reg} given by (A6) – (A8); note these three conditions are not affected by α). Thus, the cutoff, α^{FB}, is uniquely defined by $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}\Big|_{L=L^{\text{FB}},s^*=s^{\text{FB}}} = \alpha^{\text{FB}}$ and replacing L^{reg} and s^{reg} in (A6) – (A8) with L^{FB} and s^{FB}, respectively. Recall, s^{FB} is defined by $u(s^{\text{FB}}) = 0$.

When γ increases, denote the solutions in the new equilibrium as $\breve{L}^{\text{reg}}$ and $\breve{s}^{\text{reg}}$. We want to show $\breve{L}^{\text{reg}} > L^{\text{reg}}$ and $\breve{s}^{\text{reg}} > s^{\text{reg}}$. We prove by contradiction. Suppose $\breve{L}^{\text{reg}} = L^{\text{reg}}$, then we must have $\breve{s}^{\text{reg}} < s^{\text{reg}}$ because $\frac{ds^*}{d\gamma} < 0$ in (A6) – (A8) (Lemma 2). Consequently, $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}$ increases: a bigger γ directly decreases the denominator while increases all three terms in the numerator; moreover, since all three terms in the numerator decrease with s^*, the consequence of $\breve{s}^{\text{reg}} < s^{\text{reg}}$ indirectly increases these three terms. Therefore, $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}\Big|_{L=\breve{L}^{\text{reg}},s^*=\breve{s}^{\text{reg}}} > \alpha$, which cannot be true in equilibrium. Given that $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}$ is monotonically decreasing in L, we must have $\breve{L}^{\text{reg}} > L^{\text{reg}}$ to restore the FOC.

To show $\breve{s}^{\text{reg}} > s^{\text{reg}}$, we again prove by contradiction. Suppose $\breve{s}^{\text{reg}} = s^{\text{reg}}$, then given $\frac{ds^*}{d\gamma} < 0$, we must have $\breve{L}^{\text{reg}} > L^{\text{reg}}$ to sustain the ethical standard; denote the corresponding capital requirement for that purpose as $\check{L}^{\text{reg}}$. We show $\breve{L}^{\text{reg}}$ should be even higher than the level needed to sustain $\breve{s}^{\text{reg}} = s^{\text{reg}}$, i.e., $\breve{L}^{\text{reg}} > \check{L}^{\text{reg}}$, which leads to $\breve{s}^{\text{reg}} > s^{\text{reg}}$. For this, we need to show $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}\Big|_{L=\check{L}^{\text{reg}},s^*=\breve{s}^{\text{reg}}} > \alpha$. Since the three terms in the numerator increase with γ, they all become larger with $\breve{s}^{\text{reg}} = s^{\text{reg}}$ and a bigger γ. Therefore, it is sufficient to show that $V(L,\gamma)$ and $v(\breve{s}^{\text{reg}})$ decrease, which boils down to showing that, with a bigger γ, the subsidy $\gamma[R-(p+L-\kappa)]$ increases in the new equilibrium. We now prove that. Suppose γ increases by $\Delta\gamma$. From (A8), we know that $\tilde{R}$ must fall to balance the increase in capital $\Delta L \equiv \check{L}^{\text{reg}} - L^{\text{reg}}$ (to sustain $\breve{s}^{\text{reg}} = s^{\text{reg}}$); suppose $\tilde{R}$ falls by $\Delta\tilde{R}$, so $\breve{s}^{\text{reg}}\Delta\tilde{R} = (1-\breve{s}^{\text{reg}})\Delta L$. Next, we know from (A7) that $-s\Delta\tilde{R}+(1-s)[\Delta\gamma R+(1-\gamma-\Delta\gamma)(p+L+\Delta L-\kappa)-(1-\gamma)(p+L-\kappa)] = 0$; note p does not change because $\breve{s}^{\text{reg}} = s^{\text{reg}}$. Simplifying it: $\Delta\gamma[R-(p+L-\kappa)]-\gamma\Delta L-\Delta\gamma\Delta L = \frac{s}{1-s}\Delta\tilde{R}-\Delta L = \frac{s}{1-s}\Delta\tilde{R}-\frac{\breve{s}^{\text{reg}}}{1-\breve{s}^{\text{reg}}}\Delta\tilde{R} > 0$, where the last equality uses $\breve{s}^{\text{reg}}\Delta\tilde{R} = (1-\breve{s}^{\text{reg}})\Delta L$, and the last inequality uses $s > \breve{s}^{\text{reg}}$ in (A7). Our objective to prove $(\gamma+\Delta\gamma)[R-(p+L+\Delta L-\kappa)] > \gamma[R-(p+L-\kappa)]$, i.e., $\Delta\gamma[R-(p+L-\kappa)]-\gamma\Delta L-\Delta\gamma\Delta L > 0$, then follows immediately. This implies that $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}\Big|_{L=\check{L}^{\text{reg}},s^*=\breve{s}^{\text{reg}}} > \alpha$, so given that $\frac{\frac{\partial V(L,\gamma)}{\partial L}+\frac{\partial V(L,\gamma)}{\partial s^*}\frac{ds^*}{dL}}{V(L,\gamma)}$ is monotonically decreasing in L, we must have $\breve{L}^{\text{reg}} > \check{L}^{\text{reg}}$ to restore the FOC; consequently, $\breve{s}^{\text{reg}} > s^{\text{reg}}$.

Results on μ can be proved by contradiction in a similar way (expect all of the comparative statics go in the opposite direction), so we do not repeat here. □

Proof of Lemma 4. Prove by contradiction. Suppose (17) is binding. Then, the LHS of (16) equals w_N^1, and the RHS is strictly bigger than w_D^2 (this is due to m_1 strictly preferring to work if she selects (w_D^2, b_D^2); see footnote 27), so $w_N^1 > w_D^2$. However, (15) shows $w_N^1 \leq w_D^2$, a contradiction. □

Proof of Lemma 5. We can rewrite (16) as

$$\begin{aligned} w_D^2 - w_N^1 &\leq \mu_1 \left(\int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds - \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2+\delta)]f(s)ds \right) \\ &= \mu_1 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds - \frac{c\mu_1}{\mu_2}, \end{aligned} \tag{A9}$$

where the equality follows from $\mu_2 \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2+\delta)]f(s)ds = c$; this is because (w_D^2, b_D^2), given by (13) and (14), makes m_2's IC constraint for effort exertion binding. We know from (15) that $w_D^2 - w_N^1 \geq 0$, so the RHS of (A9) is non-negative, i.e., $\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds \geq c$.[41] Thus, we can rewrite (15) as (19). □

Proof of Proposition 2. Much of the proof has been provided in the text. To complete the proof, we only need to show that w_N^1 and b_N^1, jointly given by (20) and $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*}$, ensure (21). Prove by construction. Start with some $w_N^1 = w_D^2$ and $b_N^1 > b_D^2$ with $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*} > \frac{b_D^2}{w_D^2+\delta} = \frac{1-s_D^*}{s_D^*}$ (so $s_N^* < s_D^*$). This obviously guarantees (21), since $\mu_2 \int_{s_D^*}^1 [sb_D^2 - (1-s)(w_D^2+\delta)]f(s)ds - c = 0$ (recall, for w_D^2 and b_D^2 given by (13) and (14), m_2's IC constraint for effort exertion is binding), which ensures $\mu_2 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds - c > 0$ given $w_N^1 = w_D^2$ and $b_N^1 > b_D^2$ with $s_N^* < s_D^*$. But this contract (w_N^1, b_N^1) is not optimal: the LHS of (20) equals zero, while its RHS is positive. We can improve it by lowering w_N^1 (below w_D^2) and, correspondingly, b_N^1, while leaving $\frac{b_N^1}{w_N^1+\delta}$ unaltered, until (20) becomes binding. This will be the optimal contract, jointly given by (20) and $\frac{b_N^1}{w_N^1+\delta} = \frac{1-s_N^*}{s_N^*}$. Clearly, under this optimal contract, both the LHS and RHS of (20) are positive, implying that (21) holds. □

Proof of Proposition 3. Hiring m_1 instead of m_2 increases bank i's profit by $(\mu_1 - \mu_2)\int_{s_i^*}^1 \pi_i(s)f(s)ds$, $i \in \{D, N\}$, where $\pi_i(s)$ is bank i's profit from each product sold. The extra cost of hiring m_1 rather than m_2 is the increased managerial rent, $c\left(\frac{\mu_1}{\mu_2} - 1\right) = (\mu_1 - \mu_2)\frac{c}{\mu_2}$. The result follows by noting that $(\mu_1 - \mu_2)\int_{s_i^*}^1 \pi_i(s)f(s)ds > (\mu_1 - \mu_2)\frac{c}{\mu_2} \Leftrightarrow \mu_2 \int_{s_i^*}^1 \pi_i(s)f(s)ds - c > 0$, which is exactly bank i's positive expected net profit from hiring m_2. □

Proof of Proposition 4. If $(s_1^*, \mu_1) \to N$ and $(s_2^*, \mu_2) \to D$, then aggregate welfare is

$$\underbrace{\left[\mu_1 \int_{s_1^*}^1 [u(s) - R - (1-s)(\kappa+\delta)]f(s)ds - c\right]}_{\text{welfare obtained with bank } N} + \underbrace{\left[\mu_2 \int_{s_2^*}^1 [u(s) - R - (1-s)(\kappa+\delta+\lambda\tau_{D\{2\}})]f(s)ds - c\right]}_{\text{welfare obtained with bank } D}, \tag{A10}$$

where $\tau_{D\{2\}}$ denotes the public fund injection to D given its standard being s_2^*.

[41] This ensures $\mu_1 \int_{s_N^*}^1 [sb_N^1 - (1-s)(w_N^1+\delta)]f(s)ds > c$, so (17) is slack (a result proved in Lemma 4).

If $(s_1^*, \mu_1) \to D$ and $(s_2^*, \mu_2) \to N$, then aggregate welfare is

$$\underbrace{\left[\mu_2 \int_{s_2^*}^1 [u(s) - R - (1-s)(\kappa+\delta)]f(s)ds - c\right]}_{\text{welfare obtained with bank } N} + \underbrace{\left[\mu_1 \int_{s_1^*}^1 [u(s) - R - (1-s)(\kappa+\delta+\lambda\tau_{D\{1\}})]f(s)ds - c\right]}_{\text{welfare obtained with bank } D}, \quad \text{(A11)}$$

where $\tau_{D\{1\}}$ denotes the public fund injection to D given its standard being s_1^*. Note that $\tau_{D\{1\}} > \tau_{D\{2\}}$: with the lower standard s_1^*, D's product price is lower and, hence, requires more public fund injection upon mis-selling. The welfare in (A10) is bigger than that in (A11) if

$$\mu_1 \int_{s_1^*}^1 (1-s)\tau_{D\{1\}} f(s)ds > \mu_2 \int_{s_2^*}^1 (1-s)\tau_{D\{2\}} f(s)ds, \quad \text{(A12)}$$

which clearly holds given $\mu_1 > \mu_2$, $s_1^* < s_2^*$, and $\tau_{D\{1\}} > \tau_{D\{2\}}$. If $(s_1^*, \mu_1) \to D$, then: (a) more subsidy to D upon mis-selling ($\tau_{D\{1\}} > \tau_{D\{2\}}$) (for a given s, mis-selling occurs w.p. $1-s$); (b) more sales conditional on innovation ($s_1^* < s_2^*$); and (c) more innovation ($\mu_1 > \mu_2$). So, (b) and (c) lead to more mis-selling, and (a) results in more public assistance upon mis-selling. All three cause $(s_1^*, \mu_1) \to D$ to be less efficient relative to $(s_1^*, \mu_1) \to N$. □

Proof of Proposition 5. The system of equations pinning down $s^{\text{reg}}_{\mu_1,N}$ and $L^{\text{reg}}_{\mu_1,N}$ (setting $\gamma = 0$ and $\mu = \mu_1$ in (A5) – (A8); here, SOC $= -\mu_1(p + L^{\text{reg}}_{\mu_1,N} - \tilde{R}) - \left[(c/\mu_1)\int_{s^{\text{reg}}_{\mu_1,N}}^1 sf(s)ds\right]^2 \left[\int_{s^{\text{reg}}_{\mu_1,N}}^1 (s - s^{\text{reg}}_{\mu_1,N})f(s)ds\right]^{-4}$, and $v(s) = u(s) - R - (1-s)(\kappa+\delta)$):

$$\frac{\mu_1^2 f(s^{\text{reg}}_{\mu_1,N})^2 v(s^{\text{reg}}_{\mu_1,N}) \dfrac{1 - s^{\text{reg}}_{\mu_1,N} + s^{\text{reg}}_{\mu_1,N} \frac{\int_{s^{\text{reg}}_{\mu_1,N}}^1 (1-s)f(s)ds}{\int_{s^{\text{reg}}_{\mu_1,N}}^1 sf(s)ds}}{\text{SOC}}}{\mu_1 \int_{s^{\text{reg}}_{\mu_1,N}}^1 v(s)f(s)ds - c} = \alpha \quad \text{(A13)}$$

$$u_l + (u_h - u_l)\int_{s^{\text{reg}}_{\mu_1,N}}^1 \frac{sf(s)}{1 - F(s^{\text{reg}}_{\mu_1,N})} ds = p \quad \text{(A14)}$$

$$\int_{s^{\text{reg}}_{\mu_1,N}}^1 \left[s\tilde{R} + (1-s)(p + L^{\text{reg}}_{\mu_1,N} - \kappa)\right] \frac{f(s)}{1 - F(s^{\text{reg}}_{\mu_1,N})} ds = R \quad \text{(A15)}$$

$$-\mu_1\left[s^{\text{reg}}_{\mu_1,N}(p - \tilde{R}) - (1 - s^{\text{reg}}_{\mu_1,N})L^{\text{reg}}_{\mu_1,N}\right] f(s^{\text{reg}}_{\mu_1,N}) = \frac{(c/\mu_1)\int_{s^{\text{reg}}_{\mu_1,N}}^1 sf(s)ds}{\left[\int_{s^{\text{reg}}_{\mu_1,N}}^1 (s - s^{\text{reg}}_{\mu_1,N})f(s)ds\right]^2}. \quad \text{(A16)}$$

The system of equations pinning down $s^{\text{reg}}_{\mu_2,D}$ and $L^{\text{reg}}_{\mu_2,D}$ (setting $\gamma = 1$ and $\mu = \mu_2$ in (A5) – (A8); here, SOC $= -\mu_2(p + L^{\text{reg}}_{\mu_2,D} - R) - \left[(c/\mu_2)\int_{s^{\text{reg}}_{\mu_2,D}}^1 sf(s)ds\right]^2 \left[\int_{s^{\text{reg}}_{\mu_2,D}}^1 (s - s^{\text{reg}}_{\mu_2,D})f(s)ds\right]^{-4}$, and $v(s) = u(s) - R - (1-s)[\kappa +$

$\delta + \lambda\gamma(R + \kappa - p - L^{\text{reg}}_{\mu_2,D})]$):

$$\frac{\mu_2\lambda\int_{s^{\text{reg}}_{\mu_2,D}}^1(1-s)f(s)ds + \mu_2^2\big[v(s^{\text{reg}}_{\mu_2,D})f(s^{\text{reg}}_{\mu_2,D}) - \lambda\frac{dp}{ds^{\text{reg}}_{\mu_2,D}}\int_{s^{\text{reg}}_{\mu_2,D}}^1(1-s)f(s)ds\big]\frac{(1-s^{\text{reg}}_{\mu_2,D})f(s^{\text{reg}}_{\mu_2,D})}{\text{SOC}}}{\mu_2\int_{s^{\text{reg}}_{\mu_2,D}}^1 v(s)f(s)ds - c} = \alpha \tag{A17}$$

$$u_l + (u_h - u_l)\int_{s^{\text{reg}}_{\mu_2,D}}^1 \frac{sf(s)}{1-F(s^{\text{reg}}_{\mu_2,D})}ds = p \tag{A18}$$

$$-\mu_2\big[s^{\text{reg}}_{\mu_2,D}(p-R) - (1-s^{\text{reg}}_{\mu_2,D})L^{\text{reg}}_{\mu_2,D}\big]f(s^{\text{reg}}_{\mu_2,D}) = \frac{(c/\mu_2)\int_{s^{\text{reg}}_{\mu_2,D}}^1 sf(s)ds}{\big[\int_{s^{\text{reg}}_{\mu_2,D}}^1(s-s^{\text{reg}}_{\mu_2,D})f(s)ds\big]^2}. \tag{A19}$$

With the capital requirement $L^{\text{reg}}_{\mu_2,D}$, if D chooses the ethical standard $s^{\text{reg}}_{\mu_2,D}$ (as supposed), its hires m_2 and earns a net profit:

$$\Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D}) = \mu_2\int_{s^{\text{reg}}_{\mu_2,D}}^1[s(p-R) - (1-s)L^{\text{reg}}_{\mu_2,D}]f(s)ds - c, \tag{A20}$$

with p being given by (A18). If D deviates and chooses an ethical standard a bit below $s^{\text{reg}}_{\mu_1,N}$, then it hires away m_1 from N, with a net profit:

$$\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) = \mu_1\int_{s^{\text{reg}}_{\mu_1,N}}^1[s(p-R) - (1-s)L^{\text{reg}}_{\mu_2,D}]f(s)ds - c\frac{\mu_1}{\mu_2}, \tag{A21}$$

with p being given by (A14). The change of profit from deviation is

$$\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D}) = \big[\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_1,N})\big] + \big[\Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D})\big] - c\left(\frac{\mu_1}{\mu_2} - 1\right), \tag{A22}$$

where (i) $\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_1,N}) > 0$ is the gain from hiring m_1, instead of m_2, with the standard $s^{\text{reg}}_{\mu_1,N}$; (ii) $\Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D}) < 0$ is the loss from reducing the standard from $s^{\text{reg}}_{\mu_2,D}$ to $s^{\text{reg}}_{\mu_1,N}$ (in order to poach m_1); and (iii) $c\left(\frac{\mu_1}{\mu_2} - 1\right)$ is the extra rent to m_1. If $\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D}) \leq 0$, then D will not start the race with N, so capital requirements $L^{\text{reg}}_{\mu_2,D}$ for D and $L^{\text{reg}}_{\mu_1,N}$ for N will implement the efficient talent allocation.

Consider the more interesting case, $\Pi_{\mu_1,D}(s^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(s^{\text{reg}}_{\mu_2,D}) > 0$, so the regulator needs to prevent the race. Suppose the regulator increases D's capital requirement from $L^{\text{reg}}_{\mu_2,D}$ to $\tilde{L}^{\text{reg}}_{\mu_2,D}$, and decreases N's capital requirement from $L^{\text{reg}}_{\mu_1,N}$ to $\tilde{L}^{\text{reg}}_{\mu_1,N}$. Recall from the regulator's problem in (12) that surpluses generated by D and N are $e^{-\alpha L}V(L,1)$ and $e^{-\alpha L}V(L,0)$, respectively. That the problem in (12) is quasi-concave (shown in the proof of Proposition 1) implies that $\frac{\partial e^{-\alpha L}V(L,1)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_2,D}} < 0$ for D, while $\frac{\partial e^{-\alpha L}V(L,0)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_1,N}} > 0$ for N.

To minimize the adverse impact of the capital requirements deviation to the aggregate welfare, the regulator will set $\tilde{L}^{\text{reg}}_{\mu_2,D}$ and $\tilde{L}^{\text{reg}}_{\mu_1,N}$ such that $\left|\frac{\partial e^{-\alpha L}V(L,1)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_2,D}}\right| = \left|\frac{\partial e^{-\alpha L}V(L,0)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_1,N}}\right|$ to equate the impacts at the margin across D and N. If $\left|\frac{\partial e^{-\alpha L}V(L,1)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_2,D}}\right| > \left|\frac{\partial e^{-\alpha L}V(L,0)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_1,N}}\right|$, then the capital requirement increase for D is too big while the capital requirement decrease for N is too small, so the aggregate welfare can be increased by reducing both $\tilde{L}^{\text{reg}}_{\mu_2,D}$ and $\tilde{L}^{\text{reg}}_{\mu_1,N}$. Conversely, if $\left|\frac{\partial e^{-\alpha L}V(L,1)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_2,D}}\right| < \left|\frac{\partial e^{-\alpha L}V(L,0)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_1,N}}\right|$, then the aggregate welfare can be increased by increasing both $\tilde{L}^{\text{reg}}_{\mu_2,D}$ and $\tilde{L}^{\text{reg}}_{\mu_1,N}$.

With $\tilde{L}^{\text{reg}}_{\mu_2,D}$ and $\tilde{L}^{\text{reg}}_{\mu_1,N}$, denote the consequent ethical standards of D and N by $\tilde{s}^{\text{reg}}_{\mu_2,D}$ and $\tilde{s}^{\text{reg}}_{\mu_1,N}$, respectively. Clearly, $\tilde{s}^{\text{reg}}_{\mu_2,D} > s^{\text{reg}}_{\mu_2,D}$ and $\tilde{s}^{\text{reg}}_{\mu_1,N} < s^{\text{reg}}_{\mu_1,N}$. In the new equilibrium, $\tilde{L}^{\text{reg}}_{\mu_2,D}$ and $\tilde{L}^{\text{reg}}_{\mu_1,N}$ are jointly determined by $\left|\frac{\partial e^{-\alpha L}V(L,1)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_2,D}}\right| = \left|\frac{\partial e^{-\alpha L}V(L,0)}{\partial L}|_{L=\tilde{L}^{\text{reg}}_{\mu_1,N}}\right|$ as shown above, and the indifference condition that deters the race under the new capital requirements, $\Pi_{\mu_1,D}(\tilde{s}^{\text{reg}}_{\mu_1,N}) - \Pi_{\mu_2,D}(\tilde{s}^{\text{reg}}_{\mu_2,D}) = 0$.

Results on sizes are straightforward: increasing (resp. decreasing) capital requirements reduces (resp. elevates) the mass of operating banks. □

Appendix B: An Example of a Specific Banking Product – Collateral-Based Lending

The innovative product we have modeled is somewhat abstract. To fix ideas, we illustrate the model with a specific banking product: a loan that can be either secured or unsecured. A secured loan can be thought of as the innovative product for which the manager must expend effort to design an appropriately structured collateral requirement and repayment obligation.

Setting: Bank customers are borrowers who need loans to fund projects, each of which requires R in investment; the bank raises R via deposits, as in Section 3. Each project pays off X w.p. q, and 0 w.p. $1-q$. The success probability drops by Δq if the borrower ("he") shirks; shirking provides the borrower a private benefit ϕ. To induce the borrower to work with an unsecured loan, he needs to receive at least $X_b = \frac{\phi}{\Delta q}$ upon success:

$$qX_b \geq (q-\Delta q)X_b + \phi \quad \Rightarrow \quad X_b \geq \frac{\phi}{\Delta q}. \tag{B1}$$

If funded, the social welfare obtained is $qX - R$, which is assumed to be positive, so the project should always be funded. The borrower gets $qX_b = q\frac{\phi}{\Delta q}$, and the bank receives $q\left(X - \frac{\phi}{\Delta q}\right) - R$.

Now suppose the borrower posts collateral worth A to himself, but only ηA to the bank, with $\eta \in (0,1)$.[42] Then, the IC constraint for the borrower to work becomes

$$qX_b - (1-q)A \geq (q-\Delta q)X_b - (1-q+\Delta q)A + \phi \quad \Rightarrow \quad X_b \geq \frac{\phi}{\Delta q} - A. \tag{B2}$$

Since failure causes the borrower to lose the collateral, a secured loan relaxes his limited liability constraint upon failure from zero (with unsecured lending) to $-A$. This allows the bank to lower the borrower's repayment in the success state by exactly A while maintaining his effort incentive.

The bank's payoff from secured lending exceeds that from unsecured lending, while the borrower receives less

[42]This is a standard assumption. See, for example, Besanko and Thakor (1987a,b).

with a secured loan.[43] Thus, the bank always prefers secured loans. However, secured loans generate a welfare loss due to the deadweight loss associated with collateral transfer upon failure.[44] Secured lending exists despite this loss because, as shown below, it provides funding access to borrowers with low pledgeable income who cannot obtain unsecured loans.

Suppose there are two types of borrowers, $\phi \in \{\phi_l, \phi_h\}$, where $\phi_h > \phi_l$. Assume

$$q\left(X - \frac{\phi_l}{\Delta q}\right) > R > q\left(X - \frac{\phi_h}{\Delta q}\right) \quad \text{and} \quad q\left(X - \frac{\phi_h}{\Delta q} + A\right) + (1-q)\eta A > R. \tag{B3}$$

If types are public information, then only the l type can obtain unsecured loans. Absent collateral, the h type cannot obtain funding. Secured lending resolves this problem, although it permits the bank to extract a rent from the borrower. It does not benefit the l type who should get unsecured loans. We show below that if the bank knows more about the borrower's type than what is known publicly, then it can engage in unethical "predatory lending" by making excessive use of collateral.

Predatory Lending: The borrower's type ϕ is a priori unknown to all (including the borrower). The probability $\Pr(\phi = \phi_h) = s$ is a random variable drawn from a commonly known distribution F with a continuous density $f(s)$, as in Section 3.

As a benchmark against which to define predatory lending, suppose s is public information. Knowing his own s, a borrower's expected private benefit from shirking is $\phi(s) \equiv s\phi_h + (1-s)\phi_l$, strictly increasing in s. The borrower cannot get an unsecured loan if $s > s^{\text{FB}}$, where

$$q\left(X - \frac{\phi(s^{\text{FB}})}{\Delta q}\right) = R. \tag{B4}$$

So, without information asymmetry it is socially efficient for borrowers with $s \in [0, s^{\text{FB}}]$ to get unsecured loans, and those with $s \in (s^{\text{FB}}, 1]$ to obtain secured loans.

Assume now that bank manager privately observes s, and she offers secured loans if and only if $s \geq s^*$. The borrower's expectation of his ϕ, if offered a secured loan, is $\mathbb{E}[\phi(s)|s \geq s^*] \equiv \Phi(s^*)$, which is increasing in s^*. In order for the bank to make a secured loan, we need $q\left(X - \frac{\Phi(s^*)}{\Delta q}\right) < R$; otherwise, the borrower knows an unsecured loan is available. So, the lowest possible bank ethical standard (i.e., lowest s^*), call it s^{sell}, is given by

$$q\left(X - \frac{\Phi(s^{\text{sell}})}{\Delta q}\right) = R. \tag{B5}$$

[43] The bank gets $q\left(X - \frac{\phi}{\Delta q} + A\right) + (1-q)\eta A - R = q\left(X - \frac{\phi}{\Delta q}\right) - R + [1-(1-q)(1-\eta)]A$; the borrower receives $q\left(\frac{\phi}{\Delta q} - A\right) - (1-q)A = q\frac{\phi}{\Delta q} - A$. For each dollar of collateral posted, the borrower loses exactly a dollar from an ex ante standpoint, while the bank only captures a fraction $1-(1-q)(1-\eta)$ of it.

[44] Welfare with secured lending is $qX - R - (1-q)(1-\eta)A$, lower than that from unsecured lending by $(1-q)(1-\eta)A$.

Clearly, $s^* > s^{\text{sell}}$. Comparing (B4) with (B5), we have

$$\phi(s^{\text{FB}}) = \Phi(s^{\text{sell}}) = \mathbb{E}[\phi(s)|s \geq s^{\text{sell}}] \quad \Rightarrow \quad s^{\text{sell}} < s^{\text{FB}}. \tag{B6}$$

Therefore, there is a non-empty region $[s^{\text{sell}}, s^{\text{FB}}]$, such that if s^* falls within this region, then borrowers with $s \in [s^*, s^{\text{FB}}]$ get secured loans although they would obtain unsecured loans if s were public.

Summary: Assuming the ethical standard $s^* \in [s^{\text{sell}}, s^{\text{FB}}]$, we can partition $s \in [0, 1]$ into three regions:

- $s \in [0, s^*)$: Those borrowers get unsecured loans, the same outcome as in the benchmark.
- $s \in [s^*, s^{\text{FB}}]$: Those borrowers would get unsecured loans if s were public information, but they get suboptimal secured loans instead. They are exploited, and the bank knows *ex ante* that it is exploiting those borrowers. There is a social welfare loss from extending secured loans to those borrowers because collateral is dissipatively costly.
- $s \in (s^{\text{FB}}, 1]$: Those borrowers cannot get unsecured loans even if s were public information, but now they obtain secured loans. This is a social gain despite the dissipative cost of collateral.

This example shows a specific way in which banks may engage in unethical behavior: making expensive secured loans to borrowers who should receive cheaper unsecured loans. Given the extensive literature on how the availability of collateral to borrowers affects both the availability and price of credit, this highlights the potential impact of bank ethics on real outcomes via the collateral channel.

Appendix C: Technical Details of Section 5.1 on Uncertain Managerial Ethics

We examine the bank's contract design (w, b) with no talent competition, for a given capital level. Consider case (ii) first. Since (24) is binding for $\delta = \delta_{\text{lm}}$, we can express (w, b) as functions of s^*_{lm} as in (3) and (4), by replacing s^* and δ there with s^*_{lm} and δ_{lm}, respectively. The bank's problem is

$$\max_{s^*_{\text{lm}}} \; \beta_{\text{lm}} \left[\mu \int_{s^*_{\text{lm}}}^1 \pi(s) f(s) ds - (c + w) \right] + \beta_{\text{hm}}(-w). \tag{C1}$$

The problem mirrors (9), except the contract here incentivizes only the low-ethics manager (w.p. β_{lm}) with a standard s^*_{lm} (w.p. β_{hm} a high-ethics manager is hired who shirks and simply collects w). The equilibrium is jointly determined by the FOC (mirroring (10))

$$-\mu \beta_{\text{lm}} \pi(s^*_{\text{lm}}) f(s^*_{\text{lm}}) = \frac{dw}{ds^*_{\text{lm}}} \tag{C2}$$

and other two conditions (6) (product pricing) and (8) (deposit pricing), replacing s^* in both with s^*_{lm}.

Consider case (i). Since (24) is now binding for $\delta = \delta_{\text{hm}}$, we express (w, b) as functions of s^*_{hm} as in (3) and (4), by replacing s^* and δ there with s^*_{hm} and δ_{hm}, respectively. We also express s^*_{lm} as a function of s^*_{hm} by replacing w and b in $s^*_{\text{lm}} = \left(1 + \frac{b}{w+\delta_{\text{lm}}}\right)^{-1}$ with their functional forms of s^*_{hm}. It can be shown that s^*_{lm} increases with s^*_{hm}. The bank's ex ante expected profit ($c + w$ is the expected pay to the high-ethics manager with $\delta = \delta_{\text{hm}}$) is

$$\beta_{\text{hm}} \left[\mu \int_{s^*_{\text{hm}}}^{1} \pi(s) f(s) ds - (c + w)\right] + \beta_{\text{lm}} \left[\mu \int_{s^*_{\text{lm}}}^{1} \pi(s) f(s) ds - \underbrace{\left(w + \mu \int_{s^*_{\text{lm}}}^{1} [sb - (1-s)(w + \delta_{\text{lm}})] f(s) ds\right)}_{\text{pay to the low-ethics manager } > c+w}\right]$$

$$= \mu \left[\beta_{\text{hm}} \int_{s^*_{\text{hm}}}^{1} \pi(s) f(s) ds + \beta_{\text{lm}} \int_{s^*_{\text{lm}}}^{1} \pi(s) f(s) ds - \beta_{\text{lm}} \int_{s^*_{\text{lm}}}^{1} [sb - (1-s)(w + \delta_{\text{lm}})] f(s) ds\right] - (\beta_{\text{hm}} c + w). \quad \text{(C3)}$$

This expression is a function of s^*_{hm}, as w, b and s^*_{lm} can all be expressed in s^*_{hm} (as described above). So, the bank's problem comes down to choosing s^*_{hm} to maximize the profit. The equilibrium is jointly determined by the FOC

$$-\mu \left(\beta_{\text{hm}} \pi(s^*_{\text{hm}}) f(s^*_{\text{hm}}) + \beta_{\text{lm}} \pi(s^*_{\text{lm}}) f(s^*_{\text{lm}}) \frac{ds^*_{\text{lm}}}{ds^*_{\text{hm}}} + \beta_{\text{lm}} \int_{s^*_{\text{lm}}}^{1} \left[s \frac{db}{ds^*_{\text{hm}}} - (1-s) \frac{dw}{ds^*_{\text{hm}}}\right] f(s) ds\right) = \frac{dw}{ds^*_{\text{hm}}}, \quad \text{(C4)}$$

the product pricing condition (customers are unsure about the bank's eventual ethical standard)

$$\hat{p} = \sum_{\iota \in \{\text{hm}, \text{lm}\}} \beta_\iota \mathbb{E}[u(s) | s \geq s^*_\iota], \quad \text{(C5)}$$

and the deposit pricing condition (depositors are also unsure about the bank's eventual ethical standard)

$$\sum_{\iota \in \{\text{hm}, \text{lm}\}} \beta_\iota \mathbb{E}\big[s\tilde{R} + (1-s)[\gamma R + (1-\gamma)(\hat{p} + L - \kappa)] \big| s \geq s^*_\iota\big] = R. \quad \text{(C6)}$$

Between cases (i) and (ii), the bank chooses the one (via its design of (w, b)) with a higher profit. While it seems difficult to obtain an analytical solution, we conduct a numerical analysis that generates Figure 2 in Section 5.1.

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