Fear of Rejection?
Tiered Certification and Transparency

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Abstract

The literature on intermediaries has carefully analyzed their incentives to collect information and disclose it truthfully, but we know little about the broader strategic dimensions of this market. The paper explores three related strategic dimensions of the certification market: the publicity given to applications, the coarseness of rating patterns and the sellers' dynamic certification strategies.

In the model, certifiers respond to the sellers' desire to be highly rated and to limit the stigma from rejection. We find conditions under which sellers opt for an ambitious certification strategy, in which they apply to a demanding, but non-transparent certifier and lower their ambitions when rejected. We derive the comparative statics with respect to the sellers' initial reputation, the probability of fortuitous disclosure, the sellers' self-knowledge and impatience, and the concentration of the certification industry. We also analyze the possibility that certifiers opt for a quick turnaround time at the expense of a lower accuracy. Finally, we investigate the opportunity of regulating transparency.

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1   Introduction

As most markets are characterized by imperfect knowledge, informational intermediaries have become central to their working. From underwriters to rating agencies,

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from scientific journals to entry-level examinations, from standard-setting organizations to system integrators, intermediaries serve sellers and buyers by providing product-quality information to the latter.

The literature on intermediaries has carefully analyzed their incentives to collect product-quality information and disclose it truthfully. By contrast, we know little about three related aspects of the certification market: the publicity given to applications, the coarseness of rating patterns, and the sellers' dynamic certification strategies. Policies in these matters exhibit substantial heterogeneity.

Regarding the transparency of the application process, scientific journals, certified bond rating agencies, lenders, underwriters, employers, universities, and organic food certifiers usually do not reveal rejected applications. By contrast, some entry-level examinations (SAT, GMAT,...) have historically disclosed previous, and presumably unsuccessful attempts by the student. In 2009, though, the College Board began allowing students to only report certain SAT test scores to colleges, rather than all results as previously.[1] Critics questioned whether this program was a competitive response to the competing ACT test, which has long had a similar policy. For instance, Stanford's admissions head asked "Was this a student-centered decision? Or was this business-centered because they're worried about losing market share?"[2]

Regarding the *coarseness of grading*, many institutions, such as most scientific journals, adopt a "minimum standard" or "pass-fail" strategy, while others, such as entry-level examination firms, report an exact grade. While a fine partition in the grading space presumably requires more resources than a pass-fail approach, what drives the choice of coarseness is unclear.

Table 1 reports the strategies of some certifiers regarding publicity and grading. *Application opacity* refers to the certifier's policy of not disclosing rejected applications, not necessarily to the outcome.[3]

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[1] Colleges can opt out of the "Score Choice" program, but most —including Harvard— have not.

[2] See Rimer (2008).

[3] For example, one may fortuitously learn that a paper was submitted to and rejected by a journal; furthermore, a delayed publication may create some stigma as the profession is unsure as to whether the delay is due to the author, slow editing or a rejection. Similarly, while academic departments, corporations and partnerships warn in advance assistant professors and junior members that they are unlikely to receive tenure or keep their job, thereby allowing them to attempt to disguise a layoff as a quit, information leakages and the inference drawn from the very act of quitting provide some limit to this strategy. Relatedly, faculty members who want

		Application process is (intentionally)	
		opaque	transparent
Grading strategy	minimum standard	• (most) scientific journals • job market • underwriting • university admissions	• (many) state medical licensing exams • (some) entry-level examinations (bar exam, series 7)
	fine	• BePress • rating agencies	• (some) entry-level examinations (SAT, ...)

Table 1

While we will consider a variety of examples, the example that we will return to repeatedly is the certification of papers by academic journals.[4] The publication process is opaque as almost all journals refrain from publishing the list of submitted or rejected papers; they also by and large follow a minimum standard approach, even though a lead article carries some added prestige. But our analysis applies to a number of other industries. Consider for example the recent efforts in the United States to ensure transparency of the securities rating process, particularly in the area of structured finance. Issuers have historically been able to get rating agencies not to disclose ratings that displease them in a number of ways. First, the U.S. Securities and Exchange Commission (2008) notes that even if a firm appeals a rating that displeases it and the appeal is rejected, the proposed rating may not be published. Instead, a "break-up fee" is paid by the issuer to the rating agency to compensate it for its efforts. Alternatively, as Partnoy (2006) and Coffee (2008) note, consulting services offered in recent years by rating agencies to issuers could make an apparently transparent process opaque.[5]

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to quit but expect to be successful at a particular promotion or reappointment will often delay their resignation until after their review process is completed, as they want to avoid the negative inference associated with an early resignation.

[4]We here envision journals as certifiers more than as distributors. While the two functions have historically been bundled, they need not be. The relative importance of certification has increased with easy access to alternative distribution modes.

As we will see, our key insights hold whether the certifier charges buyers or sellers, and whether they maximize profit or a non-profit goal such as market share.

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As for dynamic certification strategies, sellers often adopt an *ambitious or top-down submission strategy*, in which they apply first to the best certifiers and then, after rejections, move down the pecking order. Why do we observe this pattern, and what determines the rejection rate, or equivalently whether submissions tend to be ambitious or realistic?

This paper develops a framework in which the descriptive and public policy aspects of transparency and grading strategies can start being analyzed. Needless to say, our model does not capture all elements of each of the many relevant situations, but only some key trade-offs that they share. It builds on the idea that certifiers' policies must reflect the demands of the two sides of the market, as well as who has "gatekeeping power" over the certification process. In the majority of applications, on which we will be focusing, the seller chooses the certifier.[6] While they need to be credible vis-à-vis the buyers, the certifiers must first cater to the sellers' desires.

At an abstract level, a certifier's policy maps the information it acquires about the quality of the product into a public signal; if desired, the certifier can choose not to provide a signal, thereby concealing the existence of an application in order not to convey bad news about quality. We also allow for fortuitous disclosure, as buyers may hear about the application "through the grapevine" even though the certifier does not disclose it.

We find conditions under which sellers opt for an "ambitious strategy", in which they apply to a demanding, but non-transparent certifier and lower their ambitions when rejected. We derive the comparative statics with respect to the sellers' initial reputation, the probability of fortuitous disclosure, the sellers' self-knowledge and impatience, and the concentration of the certification industry. We also analyze the possibility that certifiers opt for a quick turn-around strategy

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"*The inherent conflict facing the credit rating agency has been aggravated by their recent marketing of advisory and consulting services to their clients. Today, the rating agencies receives one fee to consult with a client, explain its model, and indicate the likely outcome of the rating process; then, it receives a second fee to actually deliver the rating (if the client wishes to go forward once it has learned the likely outcome). The result is that the client can decide not to seek the rating if it learns that it would be less favorable than it desires; the result is a loss of transparency to the market.*" (Coffee 2008)

[6]Interestingly in view of the pattern exhibited in Table 1, the seller does not choose the certifier in the case of state licensing and professional exams.

at the expense of a lower accuracy.[7] Finally, we investigate the implications of regulating transparency.

The paper's key insights are summarized in the conclusion, where we also revisit the patterns in Table 1. A key theme of the paper is that sellers have a clear individual preference for non-transparency as they do not want buyers to know about their rejections. A second broad theme is that certification strategies exhibit strategic complementarities through the stigma associated with second-tier certification: When certification by second-tier institutions carries a big stigma, sellers are tempted to first try high, thereby confirming the buyers' distrust of certification by second-tier certifiers. Another side of the same coin is that non-transparency collectively always hurts sellers (while its impact on buyers is ambiguous).

The paper is organized as follows. Sections 2 and 3 lay down the basic model, in which only minimum-standard certification is offered. It solves for a competitive or concentrated certification industry equilibrium and conducts the welfare analysis of transparency regulation. Section 4 analyzes the impact of the sellers' accuracy of information about the quality of their offering. Section 5 generalizes the basic model by endogeneizing the sellers' quality choice. Section 6 examines the effect of entry by certifiers who trade off accuracy and turn-around time. Section 7 allows for multi-tier grading. Section 8 summarizes our insights and discusses a number of open questions.

Relationship to the literature

There is a large literature on certification in corporate finance, industrial organization and labor markets. Much of this literature focuses on the trade-off for parties seeking certification between the cost of certification and its benefits in terms of signaling, reduced agency costs or assortative matching. Much less has been written on the industrial organization of the certifying industry.

A series of papers have studied the coarseness issue, without linking to opaqueness. Lizzeri's (1999) classic paper analyses the choice of coarseness in an environment in which the seller perfectly knows the quality of her product and applications to a certifier are (endogenously) public. Lizzeri shows that a monopoly certifier may either disclose nothing at all or go for a minimal standard, while a competitive certifying industry can lead to full disclosure of quality. Faure-Grimaud et

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[7]Of course quick turn-around need not be associated with lower quality and may just result from superior effort or norms. But choices become meaningful when within a given category of certifiers, turn-around-time and accuracy covary negatively.

al (2009), in a model in which sellers are imperfectly informed about the quality of their product, allow sellers to "own ratings," in the sense that they can hide the rating from the buyers if they choose to. They show that the imprecision of the rating technology per se does not lead to certifiers offering the concealment option to sellers. Rating ownership arises only if sellers are very unsure about their product's quality. In Lerner–Tirole (2006), certifiers differentiate through their composition and decision processes, making them more or less friendly to sponsors' interests. The current paper investigates certifiers' positioning with respect to transparency; it further analyzes sequential rejections, an issue that does not arise when the technology sponsor's objective is simply to have the technology adopted, as in Lerner-Tirole.

In environments such as those considered in Lizzeri and Lerner-Tirole, in which either the seller has a single chance to be certified or the seller's application is public, the certifier cannot or does not want to conceal applications. Faure-Grimaud et al do allow for the possibility of hiding the rating, but do not consider the possibility of a second chance, perhaps by going to a less demanding certifier.

Morrison and White (2005) and Gill and Sgroi (2003) allow for a second chance, but do not focus on the opacity issue. In particular, banks in Morrison-White apply to regulators with different perceived abilities. A successful application to a tough regulator allows banks to raise more deposits. As regulators make mistakes, banks may get a second chance. On the other hand, the Morrison-White paper focuses on rather different issues than our paper; for instance, it assumes that applications are transparent. By contrast, applications are non-transparent in Skreta-Veldkamp 's (2009) work on rating ownership; in that paper, sellers shop for ratings and disclose them selectively. Each rating agency issues an unbiased forecast of the product quality (there is no coarseness choice). Buyers are naïve. The selective disclosure of ratings by sellers matters more, the more mistakes certifiers make; Skreta and Veldkamp thereby provide a narrative on the recent treatment of complex assets by financial rating agencies. In a related vein, Sangiorgi et al (2009) analyze the winner's curse problem associated with more sophisticated buyers and the selective disclosure of ratings.

Like these papers, we assume that certifiers have sufficient governance or reputation to abide by the reporting rule that they announce.[8] Certifiers' reputation

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[8]Of course, this assumption does not always hold in the real world. For instance, some critics

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building is analyzed in Bolton et al (2009), Bouvard-Levy (2008) and Mathis et al (2008).

Finally, our focus on coarseness relates to the very extensive literature on cheap talk. But unlike in the cheap talk literature, there is here no issue of credibility of the reporting strategy, as certifiers are as truthful as their reporting rule allows them to be. Coarseness thus stems from the sellers' request, not from moral hazard and misalignment between certifier and buyers.

2 The model

2.1 Description

Time is discrete and runs from $-\infty$ to $+\infty$. There is a mass 1 and a steady inflow of sellers, each with one product of unknown single-dimensional[9] quality. For simplicity, the representative seller's quality i, which is initially unknown to both sides of the market, can take one of three values: high (H), low (L) or "abysmal" ($-\infty$), with respective benefits for the buyers $b_i \in \{b_H, b_L, -\infty\}$ with $b_H > b_L > -\infty$. Conditional on not being abysmal, quality is high with prior probability ρ and low with prior probability $1 - \rho$. Buyers prefer quality H to quality L, and do not consider the product unless its quality has been certified to be at least L. A seller whose quality has not been certified to be at least L does not bring the product to the market and obtains zero profits.

Assuming that this certification has taken place, let $\hat{\rho}$ denote the buyers' posterior belief at the time at which the product is brought to the market (more on this shortly). Let $S_i(\hat{\rho})$ denote the seller's expected gain from putting a product of quality i on the market when beliefs are $\hat{\rho}$. We will assume that S_i is always positive and is increasing in $\hat{\rho}$.

We will say that the seller is *information loving* (respectively, *averse*) if in a situation in which she could not get a second chance, she would prefer full

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have accused rating agencies of initially being excessively generous when rating new offerings, then revising the rating months later. They suggest that the natural organizations to question this behavior, the investment banks, have little incentive to do so, because they have typically 'laid off' any exposure to the securities through refinancings (U.S. Securities and Exchange Commission, 2003).

[9]This is unlinke Ellison (2002), whose main focus is on the implications of multitasking in the presence of multiple quality dimensions.

revelation (respectively, a coarse disclosure specifying that quality is at least L).[10]

Certifiers. Profit-maximizing certifiers audit quality. Throughout the paper, we will assume that, through reputation or a credible internal-audit mechanism, certifiers are able to commit to a disclosure policy, that is to a mapping from what they learn to what they disclose to buyers. This ability to commit to a disclosure policy makes the question of choice of their incentive scheme moot,[11] and so we can assume without loss of generality that they demand a fixed fee for the certification service. To sum up, a certifier's strategy is thus the combination of a fixed fee and a disclosure policy. In some instances, we will alternatively assume that certifiers do not charge fixed fees and that their objective is to maximize market share. When certifiers are atomistic and competition is perfect, the outcome will be exactly the same. Differences will potentially materialize when we consider monopolistic competition.

Because certifiers are useless unless they rule out the abysmal quality, we can consider three types of certifiers, two "minimum standard" certifiers and one "full grade" certifier:

A *tier-1* certifier ascertains that $b = b_H$ or $b \in \{b_L, -\infty\}$. Tier-1 certifiers furthermore do not disclose applications for which they find that $b \in \{b_L, -\infty\}$, as such disclosure of bad news (a "rejection") is unappealing to sellers and reduces the demand for such certifiers' services.

A *tier-2* certifier certifies that $b \in \{b_H, b_L\}$ or $b = -\infty$.[12]

A *multi-tier* certifier discloses the true quality: $b = b_H, b_L$ or $-\infty$.

We will normalize the audit cost incurred by a minimum standard certifier to be 0. By contrast, the cost of a finer grading may be positive (see Section

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[10]Sellers are *information loving* if $\rho S_H(1) + (1-\rho)S_L(0) > \rho S_H(\rho) + (1-\rho)S_L(\rho)$; *information averse* if $\rho S_H(1) + (1-\rho)S_L(0) < \rho S_H(\rho) + (1-\rho)S_L(\rho)$; *information neutral* if $\rho S_H(1) + (1-\rho)S_L(0) = \rho S_H(\rho) + (1-\rho)S_L(\rho)$.

Note that when $S_i(\rho) = S(\rho)$ is independent of i, sellers are information loving if and only if $S(\rho)$ is strictly convex, information averse if and only if $S(\rho)$ is strictly concave, and information neutral if and only if $S(\rho)$ is affine.

[11]An arbitrary incentive scheme can be duplicated through a fixed payment (equal to the expected payment under the incentive scheme) and the same commitment to a disclosure policy.

[12]Obviously, the certifier's reporting strategy for $b = -\infty$ is irrelevant, as the seller then always makes no profit. If by contrast we assumed that sellers have other products, the production of an "abysmal quality" could be a bad signal for other offerings. One would then expect that the information that $b = -\infty$ would not be disclosed either.

7). Certifiers compete for the sellers' business. The certification market, unless otherwise stated, is perfectly competitive. Equilibrium fees are then equal to 0.

Consider a seller who arrives at date t and chooses a certifier. She can contract with a single certifier in each period. Contingent on the outcome of certification(s), the seller chooses the date, $t + \tau$ ($\tau \geq 0$), at which she brings the product to the market. If the buyers' beliefs at that date are $\widehat{\rho} = \widehat{\rho}_{t+\tau}$, then the seller's utility is

$$\delta^\tau S_i(\widehat{\rho}_{t+\tau})$$

where $\delta < 1$ is the discount factor. Thus the seller maximizes

$$E[\delta^\tau S_i(\widehat{\rho}_{t+\tau})].$$

In our model, there are only two (relevant) levels of quality and audits of a given kind always deliver the same outcome.[13] And so a date-t product will actually be brought to the market either at t or at $t + 1$.

There can be *fortuitous disclosure*: When a seller arrives at date t and does not bring her product to the market until date $t + 1$, with probability $d \geq 0$, buyers exogenously discover that the date-$(t + 1)$ introduction corresponds to a date-t arrival. With probability $1 - d$, buyers receive no such information.[14]

Equilibrium: We will analyze perfect Bayesian equilibria. If multiple equilibria coexist, which can be Pareto ranked for the sellers, we will select the Pareto dominant one.

2.2 Examples

Let us provide a few examples to illustrate the notion of information loving and aversion. We will return to these examples later in the paper:

Example 1 (sale). Suppose that production is costless and that the seller sells the product to homogenous, price-taking consumers. Then, under such first-degree price discrimination

$$S_i(\widehat{\rho}) = \max\{E_{\widehat{\rho}}[b], 0\}$$

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[13]There is no certifier-idiosyncratic noise, unlike in Morrison-White (2005) or Skreta-Veldkamp (2009).

[14]Fortuitous disclosures will in equilibrium increase the cost of being rejected. Note that learning that the seller arrived at date t is here equivalent to learning that her application was rejected at date t. We could easily enrich the model by adding "slow sellers," who arrive at date t, but apply only at date $t + 1$. Such sellers would suffer an unfair stigma if the date of their arrival is made public, as do papers in academia that authors are slow at submitting to a journal.

is independent of i, where $E_{\widehat{\rho}}[b] \equiv \widehat{\rho} b_H + (1-\widehat{\rho}) b_L$ denotes the consumers' posterior assessment of quality.

Example 2 (sale with imperfect price discrimination). Following up on Example 1, assume now that there are two types of consumers, indexed by $a = a_H$ (proportion μ) or a_L (proportion $1-\mu$) with $a_H > a_L$. If $\widehat{b} = E_{\widehat{\rho}}[b]$, the gross surplus of a user of type $j \in \{H, L\}$ is $a_j + \widehat{b}$. "Belief-sensitive pricing" (which would be the "generic case" with a continuum of types) arises when user surplus depends on posterior beliefs $\widehat{\rho}$,[15] i.e., when

$$a_L + b_H > \mu(a_H + b_H) \text{ and } a_L + b_L < \mu(a_H + b_L).$$

Then, $S_i(\widehat{\rho})$ (which again is independent of i) is given by

$$S_i(\widehat{\rho}) = \begin{cases} a_L + \widehat{b} & \text{for } \widehat{\rho} \geq \rho_0 \\ \mu(a_H + \widehat{b}) & \text{for } \widehat{\rho} < \rho_0 \end{cases}$$

where

$$a_L + [\rho_0 b_H + (1-\rho_0) b_L] = \mu[a_H + \rho_0 b_H + (1-\rho_0) b_L].$$

Buyers then have (average) utility

$$B(\widehat{\rho}) = \begin{cases} \mu(a_H - a_L) & \text{for } \widehat{\rho} \geq \rho_0 \\ 0 & \text{for } \widehat{\rho} < \rho_0 \end{cases}.$$

Example 3 (clientele effects / assortative matching). Some buyers may have a strong preference for high-quality offerings due to prudential regulation. For example, many public pension funds are allowed to hold only investment-grade securities. Full grading allows the seller to better segment the market. Suppose that a fraction of buyers buy only high-quality products, at price Kb_H where $K > 1$. Other buyers are less discriminating and are as depicted in Example 1. Then

$$S_i(\widehat{\rho}) = Kb_H \mathbb{1}_{\{\widehat{\rho}=1\}} + \max\{E_{\widehat{\rho}}[b], 0\} \mathbb{1}_{\{\widehat{\rho}<1\}},$$

is again independent of i.

Example 4 (spillovers from adoption). A researcher whose paper is read and used by the profession, or a technology sponsor whose intellectual property becomes

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[15]The other two cases are isomorphic to Example 1, as the volume of sales is not affected by beliefs.

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part of a royalty-free standard benefit only indirectly from adoption (prestige, referencing, diffusion of ideas for a researcher, network effects or spillovers to complementary products for a technology sponsor). Letting s_i denote the seller's gross benefit from adoption. The seller's surplus is then:[16]

$$S_i(\widehat{\rho}) = s_i \, \mathbb{1}_{\left\{E_{\widehat{\rho}}[b] \geq 0\right\}}.$$

Note that in this case the seller's surplus in general depends directly on quality i.

The seller is information-loving in Example 2. If $b_L \geq 0$, the seller is information neutral in Examples 1 and 4, and information loving in Example 3. If $b_L < 0$, she is information loving when she fully appropriates the consumer surplus through a price (Examples 1 and 3).

By contrast, the seller is information averse if $E_\rho[b] > 0$ and if she is unable to charge the buyer and therefore has buyer adoption as her primary objective. The seller always benefits from a no grading, simple-acceptance policy (see Lerner-Tirole 2006), weakly so in the two-type case when $b_L \geq 0$ (as in Example 4) and strictly so with two types and $b_L < 0$ or with a continuum of types, some of them negative. That way, she is able to "pool" negative-buyer-surplus states with positive-buyer-surplus ones.[17]

3 Minimum standard certifiers

3.1 Determinants of tiered certification

3.1.1 Equilibrium behavior

Note that there is no point applying to a tier-2 certifier unless one goes to the market following an endorsement. Similarly, after an application to a tier-1 certifier, the seller brings the product to the market if the latter is a high-quality one and applies to a tier-2 certifier in case of rejection. The equilibrium thus ex-

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[16] Where $\mathbb{1}_{\{\cdot\}}$ is the indicator function.

[17] To illustrate information aversion, consider the following two examples from the Harvard campus. Harvard College has seen such rampant grade inflation that grades provided little information: in recent years, the median grade has been an A-, and over 80% of the students graduated with honors (Rosovsky and Hartley, 2002). At Harvard Business School, the School until recently had a formal policy that prohibited students from disclosing their grade point average to prospective recruiters (Schuker, 2005). Such "pooling" of certified students is much less common at second-tier institutions.

hibits the familiar pattern of moving down the pecking order, with diminishing expectations.[18]

Let x denote the fraction of sellers who choose an *ambitious strategy* (start with a tier-1 certifier, and apply to a tier-2 certifier in case of rejection). Fraction $1 - x$ select the *safe strategy* (go directly to a tier-2 certifier).

When faced with a product certified by a tier-2 certifier, buyers form beliefs:

$$\begin{cases} \widehat{\rho} = 0 \text{ if they know the product introduction is delayed (as they infer} \\ \qquad \text{a rejection in the previous period), and} \\ \\ \widehat{\rho} = \widehat{\rho}(x) \equiv (1 - x)\rho / [1 - x + x(1 - \rho)(1 - d)] \text{ otherwise.} \end{cases}$$

Note that $\widehat{\rho}(x)$ decreases from ρ to 0 as x increases from 0 to 1.

Let

$$W^1(\widehat{\rho}) \equiv \rho S_H(1) + (1 - \rho)\delta[d S_L(0) + (1 - d)S_L(\widehat{\rho})]$$

and

$$W^2(\widehat{\rho}) \equiv \rho S_H(\widehat{\rho}) + (1 - \rho)S_L(\widehat{\rho})$$

denote the expected payoffs[19] when applying to a tier-1 or tier-2 certifier, when certification by a tier-2 certifier delivers reputation $\widehat{\rho}$. Note that $\frac{\partial W^2}{\partial \widehat{\rho}} > \frac{\partial W^1}{\partial \widehat{\rho}} \geq 0$.

- *Safe-strategy equilibrium.* It is an equilibrium for sellers to all adopt a safe strategy $(x = 0)$ if $W^2(\rho) \geq W^1(\rho)$:

$$\rho S_H(\rho) + (1 - \rho)S_L(\rho) \geq \rho S_H(1) + \delta(1 - \rho)[(1 - d)S_L(\rho) + d S_L(0)],$$

or

$$(1 - \rho)[(1 - \delta)S_L(\rho) + \delta d[S_L(\rho) - S_L(0)]] \geq \rho[S_H(1) - S_H(\rho)]. \qquad (1)$$

Condition (1) captures the costs and benefits of a safe strategy. A safe strategy avoids delaying introduction when quality is low, thereby economizing $(1-\delta)S_L(\rho)$. It also prevents the stigma associated with fortuitous disclosure, and thereby provides gain $\delta d[S_L(\rho) - S_L(0)]$. The cost of a safe strategy is of course the lack of recognition of a high quality $S_H(1) - S_H(\rho)$.

Unsurprisingly, a safe-strategy equilibrium is more likely to emerge, the lower the discount factor (e.g., the longer the certification length), and the higher the

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[18]An exception to this widespread pattern is provided by publications in law journals, where authors build on acceptance to move up the quality ladder.

[19]Conditional on $b \in \{b_L, b_H\}$.

rate of fortuitous disclosure. Indeed, when $\delta = 1$, the safe-strategy equilibrium never exists (i.e., even for $d = 1$) if the seller is information-loving.

- *Ambitious-strategy equilibrium.* Next, consider an equilibrium in which all sellers adopt an ambitious strategy. Certification by a second-tier certifier is then very bad news. Thus $x = 1$ is an equilibrium if and only if $W^1(0) \geq W^2(0)$:

$$\rho S_H(1) + \delta(1 - \rho)S_L(0) \geq \rho S_H(0) + (1 - \rho)S_L(0) \tag{2}$$

- *Mixed-strategy equilibrium.* Finally, consider a mixed equilibrium in which $x > 0$ (some sellers adopt an ambitious strategy), that is $W^1(\widehat{\rho}(x)) = W^2(\widehat{\rho}(x))$:

$$\rho S_H(1) + \delta(1 - \rho)[(1 - d)]S_L(\widehat{\rho}(x)) + dS_L(0)] = \rho S_H(\widehat{\rho}(x)) + (1 - \rho)S_L(\widehat{\rho}(x)). \tag{3}$$

Condition (3) has a unique solution x, if it exists. Note also that whenever a mixed equilibrium exists, the safe-strategy equilibrium also exists, and it dominates the mixed equilibrium from the point of view of the sellers.

Interestingly, there may exist multiple pure equilibria. For example for $d = 0$, the conditions for the safe-strategy and the ambitious-strategy equilibria can be written:

$$\rho S_H(1) \leq \rho S_H(\rho) + (1 - \rho)(1 - \delta)S_L(\rho) \tag{4}$$

and

$$\rho S_H(1) \geq \rho S_H(0) + (1 - \rho)(1 - \delta)S_L(0). \tag{5}$$

Indeed, the sellers' certification strategies are *strategic complements*: Ambitious certification strategies depreciate tier-2 certification. A low payoff from being certified by a tier-2 certifier in turn encourages ambitious applications. Focusing on seller welfare W^1 and W^2, Figure 1 depicts the possible equilibrium configurations (the dotted line refers to the outcome under mandated transparency, to be analyzed shortly, and should be ignored for the moment). Eligible beliefs following tier-2 certification range from $\widehat{\rho} = 0$ (all sellers first try a tier-1 certifier, and go to a tier-2 certifier only when rejected) to $\widehat{\rho} = \rho$ (no stigma from tier-2 certification). Under configurations (i) and (ii), one of the strategies (safe and ambitious strategy, respectively) dominates the other regardless of the stigma attached to tier-2 certification. The equilibrium is then unique. In the third configuration, strategic complementarities lead to three equilibria, two of them stable: all sellers

adopt an ambitious strategy ($\widehat{\rho} = 0$ and $W^1(0) > W^2(0)$) or all go for the safe strategy ($\widehat{\rho} = \rho$ and $W^2(\rho) > W^1(\rho)$). The Pareto-dominant equilibrium (yielding the highest welfare among equilibrium outcomes) corresponds to $\widehat{\rho} = \rho$.
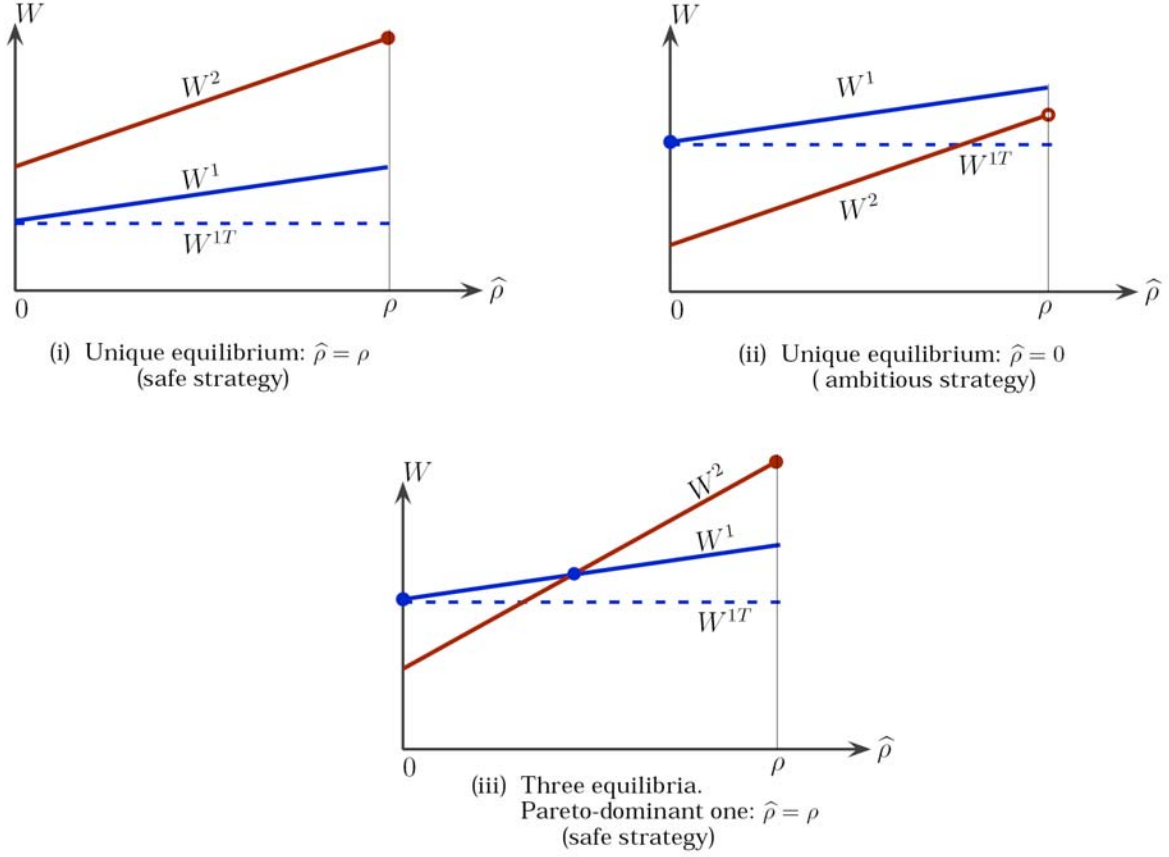

Figure 1: **Equilibrium configurations**

Proposition 1 *With minimum standard certifiers, certification choices are strategic complements: a seller's choice of an ambitious strategy encourages other sellers to turn to a tier-1 certifier. Furthermore,*

(i) the (Pareto-dominant) equilibrium exhibits

• the ambitious strategy of applying to a non-transparent tier-1 certifier, and then, in case of rejection, to a tier-2 certifier (tiered certification) iff

$$(1 - \rho)[(1 - \delta)S_L(\rho) + \delta d[S_L(\rho) - S_L(0)]] < \rho[S_H(1) - S_H(\rho)], \qquad (6)$$

• the safe strategy of applying directly to a tier-2 certifier otherwise.

(ii) ambitious strategies are more likely, the lower the probability of fortuitous

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disclosure (the lower d *is), and the more patient the seller (the higher* δ *is); when* δ = 1 *and* d = 1 *ambitious strategies are adopted if and only if the seller is information loving.*

3.1.2 Discussion

Let us first comment on the interpretation of an equilibrium in which sellers do not apply for tier-1 certification, given that observed certifier rankings always start with "tier-1", almost by definition. One interpretation is that this particular class of sellers (products) is an identifiable subgroup of sellers (products), who in equilibrium apply to tier-2 certifiers (on this, see also Section 4 below). Another interpretation speaks to the very definition of "tier-1", "tier-2", etc. What we here call "tier-2" could in practice be called "tier-1" if no seller applied to what we define as "tier-1" certifiers. For example, no "super tier-1" journal has been created that would be more demanding than the top-5 economics journals and only take, say, the ten best papers of the year.

An example of impatient sellers in many American universities is junior faculty members, who are about to come up for tenure. For instance, an assistant professor in the strategy group at a business school may submit a promising empirical analysis to Management Science, rather than submitting it to the American Economic Review. In part, this choice is driven by the different time frames that the two journals typically have for reviewing papers (on this, see Section 6). But in many cases, the junior faculty member senses that a rejection by a tier-1 certifier would make the track record at the tenure review too thin.[20]

Is lack of transparency linked to market structure?

Market structures in certifying industries change over time (academic journals), sometimes under the influence of regulation or deregulation (rating agencies). Whether transparency is socially desirable or not (see next section), one would like to know whether it is impacted by the intensity of competition. To answer this question, assume by contrast that the market for tier-1 certification is monopolized, while tier-2 certifiers are still competitive. Under non-transparency

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[20]The junior faculty's impatience can reasonably be assumed to be common knowledge, and so we are performing comparative statics with respect to the discount factor (part (ii) of Proposition 1).

(NT), the tier-1 monopolist can demand fee

$$F^{NT} = W^1(\rho) - W^2(\rho)$$

whenever (6) is satisfied (i.e., whenever the sellers use the services of the tier-1 certifier). In cases (i) and (iii) of Figure 1, the sellers Pareto coordinate on the safe strategy for all $F^{NT} \geq 0$. Thus, under non-transparency, the outcome is the same as with a competitive tier-1 industry, except for the monopolist lump-sum payment F^{NT} in case (ii) of Figure 1.

Suppose that instead the monopolist opts for transparency (T). He can then charge fee
$$F^T = W^1(0) - W^2(\rho) < F^{NT}$$

(assuming $F^T \geq 0$. If $F^T < 0$, then the monopolist faces no demand at any non-negative fee.) We conclude that the absence of transparency is not driven by market structure.

Proposition 2 *Suppose that tier-2 certification is competitive. A monopoly tier-1 certifier opts for non-transparency so as to maximize the sellers' incentive to apply for tier-1 certification. Up to a lump-sum transfer, the outcome is exactly the same as for a competitive tier-1 industry.*

Thus, unlike in Lizzeri's (1999) work, disclosure does not hinge on market structure. Note also that this result would hold as well if certifiers did not charge fees and cared only about market share: Regardless of the number of tier-1 certifiers, transparency is a dominated strategy.

Is lack of transparency robust to the buyer-pay paradigm?

The key feature underlying lack of transparency under perfect competition in the certification industry is that the sellers choose their certifiers, not that they pay them. We could alternatively assume that certifiers can monitor that buyers do not communicate the ratings among each other, and so that they can charge buyers rather than sellers (how much they can charge depends on the context, as the buyers' willingness to pay depends on the anticipated pricing strategy of the sellers).

Imagine now that certifiers are perfectly competitive profit maximizers and can charge buyers but not sellers. Suppose further that when deciding whether

to buy the rating, buyers do not yet know their type. Then the payment to the certifier is a lump-sum payment, equal to the buyers' expected net surplus, and has no influence on seller payoffs $S_i(\widehat{\rho})$. Consider for example Example 2 (the logic extends more generally). When condition (6) is satisfied, and letting as earlier $B(\widehat{\rho}) = \mu(a_H - a_L)$ if $\widehat{\rho} \geq \rho_0$, $B(\widehat{\rho}) = 0$ if $\widehat{\rho} < \rho_0$, tier-1 certifiers can charge fee $F_B = B(1)$ for the disclosure of a successful tier-1 application. Tier-2 certifiers can charge a fee $F_B = B(0) = 0$ for the disclosure of a successful tier-2 application. In this ambitious-strategy equilibrium, buyers already know that a tier-2 application means that the seller was previously rejected by a tier-1 certifier, and thus neither tier-1 nor tier-2 certifiers are able to charge anything for the disclosure of a failed tier-1 application. In this case, disclosing this information for free to buyers is indifferent to sellers. Suppose instead that condition (6) is violated. Then tier-2 certifiers can charge $F_B = B(\rho)$ for the disclosure of a successful tier-2 application. There is then no way for a tier-1 certifier to make a profit and attract sellers, whether or not they disclose failed applications and charge for it or not. The analysis of the equilibrium is therefore completely identical to the case where certifiers charge sellers and not buyers. The only difference is that certifiers appropriate the buyer's surplus that is not appropriated by sellers.

For example, academic journals have traditionally charged the buying side. They bundled, however, the certification and distribution function. The distribution function nowadays can be performed through web sites and web repositories (although journals try to keep the two activities bundled through requirements not to keep papers posted once they are accepted). The recent advocacy in favor of open access publishing (charging authors through submission and/or publication fees, rather than readers) may accelerate this unbundling. An interesting literature (e.g., McCabe-Snyder 2005, 2007a,b and Jeon-Rochet 2009) analyzes certification from the point of view of two-sided markets theory. In particular, it looks at when academic journals should charge readers or authors, and how the quality of certification is affected by this choice. By way of contrast, the issues of transparency and sequential certification remain to be investigated in full generality in this context.

To sum up, because the analysis rests entirely on the seller's surplus $S_i(\widehat{\rho})$, nothing is altered by introducing a buyer fee,[21] in the same way the analysis was

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[21]The certifier then obtains a rent. This rent can be dissipated either through free entry when there is a fixed entry cost into the certification industry (monopolistic competition) or through a subsidy to sellers for an exclusive certification (as emphasized by two-sided markets theory).

shown to carry over to the case of a monopolistic certifier charging a seller fee. The non-transparency result is thus very robust.

3.2 Regulation of transparency

In reaction to the subprime crisis the US Treasury chose to require structured investment vehicles to disclose ratings (even unfavorable ones). This section studies whether regulation of disclosure increases welfare in industries in which sellers shop around for certification.[22]

Suppose that a regulator can require transparency of applications (this amounts to setting $d = 1$) and that this regulation cannot be evaded. Application to a tier-2 certifier yields ("T" refers to "transparency") $W^{2T}(\widehat{\rho}) = W^2(\widehat{\rho})$.

By contrast, application to a tier-1 certifier yields a lower payoff than in the absence of transparency:

$$W^{1T} = W^1(0) < W^1(\widehat{\rho}) \text{ whenever } \widehat{\rho} > 0,$$

Application to a transparent tier-1 certifier (with payoffs as depicted by the dashed horizontal line in Figure 1) is an equilibrium behavior if and only if

$$W^1(0) \geq W^2(\rho).$$

And so if $W^1(0) < W^2(\rho) < W^1(\rho)$, or

$$\rho S_H(1) + \delta(1-\rho)S_L(0) < \rho S_H(\rho) + (1-\rho)S_L(\rho) < \rho S_H(1) + \delta(1-\rho)[(1-d)S_L(\rho) + dS_L(0)],$$

the transparency requirement increases the sellers' welfare: see case (ii) in Figure 1, where $\widehat{\rho} = \rho$ was not an equilibrium under opaque applications and becomes (a Pareto dominant) one under transparency. In the other parameter configurations (cases (i) and (iii) in Figure 1), transparency has no impact on equilibrium outcome and welfare.

Proposition 3 *Transparency weakly improves sellers' welfare.*

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[22]We focus on governmental regulations. An interesting and related subject of inquiry could be concerned with social regulation (social norms). For example, a social group may disagree when one of its members reveals a rejection incurred by another member (in professional or personal matters); society then "regulates" against transparency.

Intuitively, transparency makes ambitious strategies less appealing to individual sellers. It thereby may eliminate the basic externality associated with ambitious strategies: They depreciate tier-2 certification. Proposition 3 therefore has a natural feel.

Self-Regulation. Relatedly, would tier-1 certifiers agree among each other not to compete on the transparency dimension and to disclose applications? The answer is no, as they would thereby diminish their collective attractiveness. Put differently, a self-regulated disclosure requirement would either have no impact or drive tier-1 certifiers out of business.[23]

Buyer welfare. How does transparency impact buyers' welfare? As we have seen, transparency regulation makes a difference only in case (ii) of Figure 1, by killing the ambitious-strategy equilibrium. The issue is thus whether buyers benefit from more or less information. The answer to this question is case-specific. In the first-degree price discrimination illustrations of Examples 1 and 3, buyers have no surplus and so we can confine welfare analysis to that of sellers. In Example 4, either $\rho b_H + (1-\rho)b_L \geq 0$ and then the equilibrium is always a safe-strategy one, or $\rho b_H + (1-\rho)b_L < 0$ and the equilibrium is always the ambitious-strategy one: In either case transparency is irrelevant.

The analysis is more interesting for Example 2 (imperfect price discrimination). In the belief-sensitive-pricing case in Example 2,[24] buyer net surplus in the

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[23]To prove these assertions, one must assume that certifiers are slightly differentiated (and thus can demand a positive fixed fee): As in Hotelling's model, the total cost for a buyer of using a certifier is the fixed fee charged by the certifier plus a function of the "distance" between the certifier and the buyer. For example, one can imagine that tier-k certifiers ($k = 1, 2$) are on an Hotelling-Lerner-Salop circle and that sellers are distributed randomly along the circle, incurring a transportation cost of "traveling" to a specific seller. One can then take the limit as the differentiation vanishes. In the absence of differentiation, profits are always equal to 0, and regulatory choices are a matter of indifference to the certification industry.

[24]I.e., when $a_L + b_H > \mu(a_H + b_H)$ and $a_L + b_L < \mu(a_H + b_H)$. The sellers' payoffs in the two potential equilibrium configurations are:

$$W^1 = \rho(a_L + b_H) + \delta(1-\rho)\mu(a_H + b_L)$$

$$W^2 = \begin{cases} a_L + [\rho b_H + (1-\rho)b_L] & \text{for } \rho \geq \rho_0 \\ \mu[a_H + [\rho b_H + (1-\rho)b_L]] & \text{for } \rho < \rho_0. \end{cases}$$

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ambitious-strategy and safe-strategy equilibria are:

$$B^1 = \rho\mu(a_H - a_L)$$

$$B^2 = \begin{cases} \mu(a_H - a_L) \text{ for } \rho \geq \rho_0 \\ 0 \text{ for } \rho < \rho_0 \end{cases}$$

respectively. Thus a transparency regulation that moves the equilibrium from ambitious to safe strategies increases (decreases) buyer welfare if $\rho \geq \rho_0$ (if $\rho < \rho_0$). We thus see that while mandated transparency always benefits sellers, it need not benefit buyers. This is a noteworthy observation, in view of the fact that transparency regulation is often heralded as protecting buyers; needless to say, with naive buyers, the case for transparency regulation would be stronger.

4 Seller self-knowledge

For expositional simplicity, we have assumed that the seller is a poor judge of the quality of her product for the buyers. In some cases, sellers are likely to have some information about the quality of their product. Suppose that a fraction α of sellers know their "type" (a fraction $1-\alpha$ have no clue, as earlier). Then, maintaining the assumption that only minimum-standard certification is available, knowledgeable H sellers apply to a tier-1 certifier, and knowledgeable L sellers apply to a tier-2 certifier.

As earlier, let us look for the condition under which direct tier-2 applications by unknowledgeable sellers is an equilibrium. Let

$$\widehat{\rho} = \frac{(1 - \alpha)\rho}{(1 - \alpha)\rho + (1 - \rho)}$$

denote the probability of high quality following certification by a tier-2 certifier. Condition (6) is replaced by

$$(1 - \rho)[(1 - \delta)S_L(\widehat{\rho}) + \delta d[S_L(\widehat{\rho}) - S_L(0)]] < \rho[S_H(1) - S_H(\widehat{\rho})].$$

Because $\widehat{\rho} < \rho$, this condition has become harder to satisfy.

Proposition 4 *An increase in the fraction of sellers who are able to assess the quality of their product (an increase in α) makes tiered certification by the uninformed more likely.*

An improvement in the quality of self-assessment may therefore have an ambiguous impact on the probability of rejection: The direct and obvious effect is to reduce rejections by matching applications to the true quality. However, it increases the stigma attached to second-tier submissions (low-ambition applications are more likely to be low-caliber products): The choice of certifier then becomes a stronger signal of quality.

5   Endogenous quality

This section shows that our analysis is unchanged when the choice of quality depends on the equilibrium of the certification process. Suppose that quality depends on the seller's investment effort $e \in [\underline{e}, \overline{e}]$. We are interested in modeling a dimension of effort that affects the likelihood of a high quality outcome but does not change the probability of an abysmal outcome. It is reasonable to think that those margins respond to different forms of investment, and that for some of the examples that we have in mind, the latter margin would be quite inelastic.[25] Hence our focus on the former.

Let q be the probability that a product is not abysmal. A higher effort increases the probability of the high quality $\rho(e)$ outcome conditional on a non-abysmal outcome. Let $\psi(e)$ denote the disutility of effort. We assume that $\rho(e)$ is increasing and concave in e and that $\psi(e)$ is increasing and convex in e with $\rho'(\underline{e}) = +\infty$ and $\psi'(\underline{e}) = 0$. To simplify the analysis, we also assume that $S_L(.) = S_H(.)$ (as in Examples 1 through 3), and that $d = 0$.

We define two ex-ante payoff functions $\mathcal{W}^1$ and $\mathcal{W}^2$ as follows:

$$\mathcal{W}^1(\hat{\rho}) \equiv \max_e \{q[\rho(e)S(1) + \delta(1 - \rho(e))S(\hat{\rho})] - \psi(e)\}$$

and

$$\mathcal{W}^2(\hat{\rho}) \equiv \max_e \{qS(\hat{\rho}) - \psi(e)\}.$$

Let $e^1(\hat{\rho})$ and $e^2(\hat{\rho})$ be the solutions of the maximization problems underlying $\mathcal{W}^1$ and $\mathcal{W}^2$. Clearly, $e^2(\hat{\rho}) = \underline{e}$.

Lemma 5 *We have $\frac{d\mathcal{W}^2(\hat{\rho})}{d\hat{\rho}} > \frac{d\mathcal{W}^1(\hat{\rho})}{d\hat{\rho}}$ for all $\hat{\rho}$.*

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[25] More generally, the analysis extends straightforwardly to a small elasticity of abysmal quality to effort.

Proof. By the envelope theorem,

$$\frac{d\mathcal{W}^1(\hat{\rho})}{d\hat{\rho}} = q\delta\left(1 - \rho\left(e^1(\hat{\rho})\right)\right)\frac{d\mathcal{S}(\hat{\rho})}{d\hat{\rho}}$$

$$\frac{d\mathcal{W}^2(\hat{\rho})}{d\hat{\rho}} = q\frac{d\mathcal{S}(\hat{\rho})}{d\hat{\rho}}$$

The result follows immediately. ■

There are two potential equilibria. The ambitious strategy equilibrium effort level e^{1*} and the safe-strategy equilibrium effort level e^{2*} are determined by the following equations:

$$e^{1*} = e^1(0) > \underline{e} = e^{2*}.$$

The safe strategy is an equilibrium if and only if

$$\mathcal{W}^2(\rho(\underline{e})) \geq \mathcal{W}^1(\rho(\underline{e}))$$

while the ambitious strategy equilibrium is an equilibrium if and only if

$$\mathcal{W}^1(0) \geq \mathcal{W}^2(0).$$

From Lemma 1, an equilibrium always exists. The safe and risky strategy equilibria coexist over a range of parameters. When there are multiple equilibria, we select the ex-ante Pareto dominant equilibrium. Let $\mathcal{W}^{1T} \equiv \mathcal{W}^1(0)$ denote the sellers' welfare under mandated transparency. The analysis is then identical to the case where effort is exogenous, with ρ replaced by $\rho(\underline{e})$ and W^1, W^{1T}, and W^2 replaced by $\mathcal{W}^1$, $\mathcal{W}^{1T}$, and $\mathcal{W}^2$. In particular, transparency weakly improves sellers' welfare. When it does so strictly, a safe-strategy equilibrium with low-quality investment replaces an ambitious-strategy equilibrium with high-quality investment.

Proposition 6 *When quality is endogenous,*
(i) quality is always higher in an ambitious-strategy equilibrium than in a safe-strategy one;
(ii) transparency weakly improves sellers' welfare and weakly reduces quality.

6 Quick turn-around

We now assume that tier-1 certifiers choose their certification delays so as to attract sellers. Shorter lags may increase the certification cost (here normalized at 0) or (as modelled here) result in reduced accuracy. We assume that quick turn-around certifiers make type-I and type-II errors. They receive a high signal H with probability $1 - z_H$ if the actual quality is high, and z_L if it is low, where $1 - z_H > z_L$. Thus, they act as tier-1 certifiers with noisy signals. To capture the idea that short turn-around times benefit the sellers, we assume that a quick turn-around certification takes less time (and therefore is subject to discount factor $\hat{\delta} > \delta$), while both tier-1 and tier-2 certification take a full period.[26] To ensure that these quick turn-around certifiers are not able to supersede the tier-2 certifiers in ensuring that quality is not abysmal, we assume that they look for an H type (only H and L types can get the H signal) but in the absence of an H signal, cannot rule out the abysmal quality.

A seller who is rejected by a quick turn-around certifier can apply to a tier-2 certifier without losing as much time as if he had been rejected by a tier-1 certifier. We will make assumptions so that it is never optimal to turn directly to a tier-2 certifier, and that it is never optimal to turn to a quick turn-around certifier after a rejection either by a tier-1 certifier or by a quick turn-around certifier. We further assume that $d = 0$, and that $S_H(\hat{\rho}) = S_L(\hat{\rho}) \equiv S(\hat{\rho})$ for all $\hat{\rho}$, so as to simplify the analysis.

Let

$$\rho^+ \equiv \frac{\rho(1 - z_H)}{\rho(1 - z_H) + (1 - \rho)z_L}$$

denote the posterior belief following an H signal by a quick turn-around certifier. Such a signal is good news for the quality of the product, i.e. $\rho^+ > \rho$, since $1 > z_H + z_L$.

Our first assumption adapts condition (6) to the less general setup of this section. It ensures that no safe-strategy equilibrium exists, as sellers would then

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[26]In order to avoid integer problems (and the concomitant possibility that the date of product introduction reveal the strategy), one must assume in this section that sellers arrive in continuous time (but the certification length is still discrete).

Alternatively, we could assume that quick turn-around results in a random certification length of either 0 or 1, while regular certification always takes 1 period.

rather choose to try a tier-1 certifier first:

$$\rho S(1) + (1 - \rho)\delta S(\rho) > S(\rho). \tag{7}$$

Our second assumption is sufficient to ensure that after a rejection by a tier-1 certifier, a seller prefers to apply to a tier-2 certifier than to try a quick turn-around certifier (and then a tier-2 certifier in case of rejection by the quick turn-around certifier):

$$\delta S(0) \geq \hat{\delta}(z_L S(1) + (1 - z_L)\delta S(0)). \tag{8}$$

Our third assumption is sufficient to ensure that after a rejection by a quick turn-around certifier, a seller prefers to apply to a tier-2 certifier than to a tier-1 certifier (and then a tier-2 certifier in case of rejection by the tier-1 certifier):

$$\delta S(0) \geq \delta[\widehat{\rho}_2(1)S(1) + \delta[1 - \widehat{\rho}_2(1)]S(0)],$$

where $\widehat{\rho}_2(1)$, the posterior beliefs following a rejection by a quick-turn-around certifier, is defined below.

Last, we ensure that a seller does not want to turn to another quick turn-around certifier after being rejected by one. A sufficient condition for the absence of such repeated attempts is that false positives be perfectly correlated among quick turn-around certifiers, and so a failed attempt to be certified by such a certifier does not lead to other attempts.

Given these assumptions, the only relevant strategic consideration is whether to apply to a quick turn-around certifier or to a tier-1 certifier. Denote by y the fraction of applicants who opt for a quick turn-around certification rather than tier-1 certifiers.

Let $\widehat{\rho}_2 = \widehat{\rho}_2(y)$ denote the posterior beliefs following tier-2 certification:

$$\widehat{\rho}_2(y) = \frac{y\rho z_H}{y\rho z_H + y(1 - \rho)(1 - z_L) + (1 - y)(1 - \rho)}.$$

We necessarily have $\rho^+ > \rho > \widehat{\rho}_2(y)$. Both false positives and false negatives improve the pool of applications to tier-2 certifiers and decrease the stigma associated with tier-2 certification. As long as $z_H > 0$, $\widehat{\rho}_2(y)$ increases with y as the stigma associated with tier 2 certification decreases.

For a given probability y, sellers turn to a certifier with low turn-around time rather than to a tier-1 certifier if and only if $\Psi(y) \geq 0$ where:

$$\Psi(y) = \hat{\delta}[\rho(1-z_H) + (1-\rho)z_L]S(\rho^+) + [\rho z_H + (1-\rho)(1-z_L)]\hat{\delta}\delta S(\hat{\rho}_2(y))$$

$$-\delta[\rho S(1) + \delta(1-\rho)S(\hat{\rho}_2(y))].$$

The sign of $\Psi'(y)$ determines whether the choices between tier-1 certification and quick turn-around certification are strategic complements (positive sign) or substitutes (negative sign). Decisions are strategic complements if and only if

$$\rho z_H + (1-\rho)(1-z_L) \geq \frac{\delta}{\hat{\delta}}(1-\rho). \tag{9}$$

The left-hand side of (9) is the probability of being rejected when applying to a quick turn-around certifier. The right-hand side of (9) is the discounted probability of being rejected by a tier-1 certifier. Increasing y reduces the stigma of applying to a tier-2 certifier, which impacts the payoff of both the tier-1 certification strategy and the quick turn-around application strategy in proportion to these probabilities. The higher z_H, the lower z_L and the lower δ, the more likely is (9) to be verified.

When (9) holds, then there can be multiple equilibria. This occurs when the following additional conditions hold:

$$\Psi(0) < 0 < \Psi(1). \tag{10}$$

If there are multiple equilibria, the equilibrium where all sellers first turn to quick turn-around certifiers has higher seller welfare. Indeed, combining a revealed preference argument ($\Psi(1) > 0$) and the fact that $\rho S(1) + \delta(1-\rho)S(\hat{\rho}_2(1)) > \rho S(1) + \delta(1-\rho)S(0)$ yields the result. We maintain the maximization of seller welfare as our selection criterion, and so the economy will find itself in the quick turn-around equilibrium as long as $\Psi(1) > 0$. Again, if multiple equilibria coexist, sellers are better off in the one with the least stigma attached to tier-2 certification.

When (9) is violated, the equilibrium is unique, and may entail mixed strategies. If $\Psi(1) \geq 0$ (and hence $\Psi(0) > 0$), then the equilibrium involves quick turn-around certification. When $\Psi(0) \leq 0$ (and hence $\Psi(1) < 0$), then the equilibrium involves tier-1 certification. When $\Psi(1) < 0 < \Psi(0)$, then the equilibrium involves mixed strategies.

Proposition 7 *Suppose that $0 < z_H < 1 - z_L$ and that (7) and (8) hold. If (9) holds, then the equilibrium involves quick turn-around certification if $\Psi(1) \geq 0$ and tier-1 certification otherwise. If (9) is violated, then the equilibrium involves quick turn-around certification when $\Psi(1) \geq 0$, tier-1 certification when $\Psi(0) \leq 0$, and mixed strategies otherwise.*

Market structure and quick turn-around

Appendix 1 analyzes how market structure affects the emergence of quick turn-around certification versus tiered certification. More specifically, it maintains the assumption that the market for tier-2 certifiers is perfectly competitive, and analyzes the impact of the degree of competition among tier-1 certifiers.

We show that the effect of competition depends on its nature, namely whether certifiers choose prices to maximize profit or else do not set prices and maximize market shares. We find conditions under which competition enhances quick turn-around certification when certifiers compete in market shares and not in prices.

This prediction is largely consistent with the historical experience among the leading academic journals in finance.[27] While highly influential finance papers were also published in more general economics journals such as the *Journal of Political Economy* and the *Bell Journal of Economics*, for many years there was a single dominant finance journal, the *Journal of Finance* (*JF*). In 1973, Michael C. Jensen and his colleagues at the University of Rochester spearheaded the formation of a new journal, the *Journal of Financial Economics* (*JFE*).

One of the defining aspects of the *JFE* from its initial conception by its editors was its emphasis on rapid turn-around time for paper submissions. In its first two years, the median turn-around time for a submission was only three weeks. Due to stringent pressure from the editors, as well as the then-novel feature of paying referees for timely reviews (though the sums were rather nominal), review times remained under five weeks for a dozen more years. The speed of review was in dramatic contrast at the time to the other outlets where major finance publications appeared.

The emphasis on quick turn-around at a time when long publication lags and multiple rounds were becoming more common (Ellison 2002) —in addition to the

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[27]This and the following two paragraphs are based on conversations with several current and former editors of finance journals. We are particularly grateful to Cam Harvey and Bill Schwert for sharing historical data with us.

well-cited nature of many of the initial papers published in the *JFE*— proved to be extremely attractive to would-be authors. Consequently, the number of submissions to the journal soared: the acceptance rate fell from 41% in 1972 to 20.5% in 1978 to 13.5% in 1984. The gap between the acceptance rates of the *JF* and *JFE* in those years also narrowed, from 24% to 9% to 4%. During the 1980s, and particularly after the ascension of Rene Stulz to its editorship, the *JF* shortened the average time in which its papers were reviewed.

7 Multi-tier certification

Let us return to error-free certification, but assume now that certifiers can, at cost $c \geq 0$, provide a fine grade if they choose so (which, in a competitive certifying environment, is equivalent to the sellers wanting a fine grade). We maintain the assumption that $d = 0$ for expositional simplicity. In the same way they do not want to disclose unsuccessful applications, tier-1 certifiers do not gain by transforming themselves into multi-tier certifiers. The question is then whether tier-2 certifiers disappear and how this affects the sellers' incentive to apply to tier-1 certifiers.

The broad intuition, which we develop in more detail below, goes as follows: Sellers who would otherwise have applied directly to a tier-2 certifier can avoid the adverse-selection stigma by turning to a multi-tier certifier. This stigma avoidance however comes at a cost if sellers are information averse. If they are information loving or neutral, and the cost of fine grading is small, multi-tier certification drives out tier-2 certifiers; it also drives out tier-1 certifiers as resubmission after a rejection by a tier-1 certifier involves a delay and cannot prevent the buyers from knowing that quality is not high. Thus, if fine grading is costless, minimum-standard certification can survive only if sellers are information averse.

More generally, assume that $c \geq 0$, and consider first an ambitious-submission equilibrium ($x = 1$) under minimum-standard certification (Section 3). Sellers obtain $\rho S_H(1) + \delta(1-\rho)S_L(0)$. But they can avoid discounting and obtain $\rho S_H(1) + (1-\rho)S_L(0) - c$ by turning to a multi-tier certifier directly. The tiered-certification equilibrium therefore requires, besides condition (6), that

$$\rho S_H(1) + \delta(1-\rho)S_L(0) \geq \rho S_H(1) + (1-\rho)S_L(0) - c$$

$$\Longleftrightarrow c \geq \underline{c} \equiv (1-\delta)(1-\rho)S_L(0).$$

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Second, consider a safe-strategy equilibrium ($x = 0$), and so condition (1) obtains. This equilibrium is robust to the introduction of full-grading if and only if furthermore

$$\rho S_H(\rho) + (1 - \rho)S_L(\rho) \geq \rho S_H(1) + (1 - \rho)S_L(0) - c$$

$$\Longleftrightarrow c \geq \overline{c} \equiv \overline{c} \equiv \rho[S_H(1) - S_H(\rho)] - (1 - \rho)[S_L(\rho) - S_L(0)].$$

Note that when $c = 0$, this condition holds if and only if the sellers are information averse.[28]

To sum up, sellers resort to multi-tier grading when its cost c is low, when sellers are impatient (δ is low), and when sellers are information neutral or loving.

Conversion to multi-tier grading is a potential defense strategy by tier-2 certifiers against the adverse-selection stigma. There is a sense in which tier-1 certifiers face less pressure to convert to multi-tier grading. Namely there exist $\overline{c}$ and $\underline{c}$, with $\overline{c} > \underline{c} > 0$ such that (i) for $c \geq \overline{c}$, the equilibrium is as in Proposition 1 (i.e., a minimum-standard certification) and (ii) for $\underline{c} \leq c \leq \overline{c}$, the equilibrium remains a tier-1 equilibrium if this is what Proposition 1 predicts, but switches from a tier-2 equilibrium to a multi-tier equilibrium otherwise.[29]

Multi-tier grading as a defensive strategy by tier-2 certifiers seems to resonate with our academic experience. Illustrations include fine grading by BePress and the proliferation of prizes offered by tier-2 journals (and not by tier-1 journals[30]).

Our assumption that certifiers can commit to a policy may be a bit stretched in the case of multi-tier grading. Suppose that such a commitment is enforced by reputational concerns, and consider a tier-2 certifier trying to break a tiered-certification equilibrium by converting into a multi-tier grade certifier. If sellers do not believe in this strategy, the certifier is deprived of high types and cannot

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[28] For the sake of completeness, we can consider a mixed equilibrium ($0 < x < 1$). A necessary and sufficient condition for this equilibrium to be robust to the introduction of fine grading is that the sellers who apply directly to a tier-2 certifier do not find it advantageous to go for a full grade:
$$\rho S_H(\widehat{\rho}(x)) + (1 - \rho)S_L(\widehat{\rho}(x)) \geq \rho S_H(1) + (1 - \rho)S_L(0) - c.$$

[29] Indeed, at $c = \overline{c}$, the safe strategy equilibrium starts being replaced by a multi-tier equilibrium. Similarly, at $c = \underline{c}$, the ambitious strategy equilibrium starts being replaced by a multi-tier equilibrium. That $\underline{c} \leq \overline{c}$ follows from the following manipulation:
$$\underline{c} = (1 - \delta)(1 - \rho)S_L(0) = \overline{c} - \delta[S_L(\rho) - S_L(0)] < \overline{c}.$$

[30] An apparent exception is provided by top finance journals. In their case, prizes may stem from a desire to provide an attractive alternative to top-5 economics journals for authors valuing publications in general economics outlets.

(and has no incentive to) develop a reputation for accurate, fine grading. As we earlier indicated, we leave foundations of commitment for future research, but we note that our commitment assumption may be more problematic for some forms of certification than for others.[31]

Proposition 8 *Multi-tier grading is more likely, the lower its cost, and the more impatient and the less information-averse the sellers are.*

Proposition 8 focuses on a competitive certifying industry. Appendix 2 by contrast considers a monopoly certifier who can costlessly engage in fine grading; it performs a mechanism design exercise and shows how efficient disclosure relates to the sellers' information aversion.

Proposition 8 may shed some light on rating agencies' practice of fine grading. As we observed in Example 3 (Section 2), bond ratings not only certify the quality of an issue but also allow matching between securities and buyers. This matching dimension became more important in the mid 1970s, when broker-dealers' regulatory assessment of solvency (and then insurers', pension funds', and, with Basel II, banks') started to make use of ratings, creating a strong demand for high-quality liquid claims. The matching dimension is captured here by sellers becoming more information loving. The mid-1970s coincidentally were a turning point in the business model of rating agencies, which switched to the issuer-pays mode.

8 Summary and conclusion

Certifiers such as journals, rating agencies, standard setting bodies and providers of standardized tests play an increasingly important role in our disintermediated market economies. This paper makes an initial attempt at understanding how the certification industry caters to the sellers' demand through strategies such as the non-disclosure of rejections, and analyzes the welfare implications of such policies.

The first insight is that, in the absence of regulation, certifiers have a strong incentive not to publicize rejected applications.

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[31]We can however capture this idea through the following reduced form: Suppose that each certifier secretly chooses between spending 0 and spending c per review (say, by recruiting talented employees), and announces publicly its certification strategy (tier-1, tier-2, multi-tier); and that it incurs a finite penalty for incorrect rankings. No certifier has an incentive to invest in the cost c per review if sellers choose an ambitious strategy and believe that certifiers do not invest in the extra cost.

On the normative side, sellers' gaming of the certification process involves costs: delay (or, in a variant of our model, duplication of certification costs) and possibly excessive information exposure; these costs were shown to provide a role for transparency regulation. We showed that transparency regulation always benefits sellers, but need not benefit buyers.

On the positive side, we examined when sellers are willing to take the risk of applying to a tier-1 certifier. This willingness hinges on the behavior of other sellers (which affects the stigma associated with a tier-2 acceptance, leading to strategic complementarities), the discount factor (which impacts the cost of an ambitious submission strategy), the accuracy of the sellers' self-assessment (more realistic self-estimates favor tiered certification), and sellers' information aversion (which determines the reputation-risk tolerance). We further showed that multitier grading may be a rational response by tier-2 certifiers to the stigma carried by their endorsement.

We also analyzed the impact of entry by certifiers who offer a quick turnaround time and a lower accuracy. Such certifiers, if they appeal to sellers, create less stigma for tier-2 certification than tier-1 certifiers do. We characterized the conditions under which sellers will indeed turn to such "quick turn-around" certification. We further showed that the more competitive the industry, the more likely it is that certifiers offer a quick (slower) turn-around time if certifiers maximize market share (profits).

Finally, we examined when certifiers might adopt more complex rating schemes, rather than a simple pass-fail scheme. We highlighted that such nuanced schemes are more likely when the costs of such ratings are lower. In addition, these schemes are more common when sellers are less averse to the revelation of information about their quality and more impatient.

Turning back to Table 1, it is not surprising in light of our theoretical predictions that the bulk of the entries are under the opaque heading. State licensing examinations may be fundamentally different due to the presence of regulatory dicta; accordingly, "sellers" cannot choose their certifier. Entry-level examinations exhibit transparency, but may or may not exhibit fine grading. These features may reflect the power imbalance between the buyers (say, colleges) and sellers (would-be students). In this instance, it is the buyers rather than the sellers who choose

certifiers, which probably explains the unusual entry in Table 1.[32] Finally, and also consistent with our theory, it is not surprising that in situations where we would anticipate that risk aversion would be greatest (e.g., an undergraduate or MBA student going on the job market, an entrepreneurial firm going public), we see minimum standard certification rather than a fine-grained scheme.

This paper leaves open a number of interesting questions. We conclude by discussing a few of these.

- *Horizontal aspects.*

Certifiers differentiate not only through their standards (the vertical dimension), but also with respect to the audience they target on the buyer side. For instance, an interesting question in academic certification is the relative role of generalist and field journals. In economics, for instance, the most valued publications are the top-5 generalist journals, but top field journals do extremely well and seem to dominate second-tier generalist journals.

Papers may be classified through their vertical component (quality) as well as the scope of their potential readership (a "generalist" paper is more appropriate for a broader audience than a "specialist" paper). A possibility is that being accepted at a good specialist journal carries less stigma than being accepted at a second-tier generalist one: the paper may have been rejected because it is too specialized, but still have very high quality.

The same patterns are seen in other contexts as well. For instance, from the 1960s through the 1990s, four investment banks specializing in technology firms—Hambrecht & Quist, Alex. Brown, Robertson Stephens and Unterberg Towbin (later supplanted by Montgomery Securities)—had an influence that belied their modest sizes. They frequently participated in the underwriting of the largest technology offerings, often in partnership with the most prestigious "bulge bracket" investment banks (Brandt-Weisel 2003). Similarly, a strategy adopted by many of the successful new entrants into the venture capital industry has been to adopt a well-defined specialization, and then seek to co-invest with prestigious groups which might not otherwise have considered working with a new organization.[33]

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[32]Top schools want to be matched with top students. They therefore have an incentive to demand tier-1 certification or a fine grading.

[33]Another case in point is the credit ratings industry. The U.S. Congress recently changed the framework for an "NRSRO" designation, leading to substantial entry of specialized rating agencies.

- *Other second-tier certifier strategies to deal with adverse selection.*

Grading is a potential response by certifiers to adverse selection problems. We may think about other strategies. For example, second-tier journals sometimes organize successful special issues, which by building "network effects," may carry less stigma. It would be interesting to understand whether special issues have more appeal to second-tier journals, and, if so, whether this is due to a visibility effect (tier-1 journals having less need for visibility) or to a quality effect (special issues in tier-2 journals carrying less of stigma). In a similar vein, less established certifiers have attempted to distinguish themselves through innovation (for instance, Drexel Burnham Lambert's development of the junk bond market). These issues would deserve further exploration.

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Appendix 1 (quick turn-around equilibrium and market structure)

As stated in the text, we analyze the demand for quick-turn-around certification when competition among tier-1 certifiers is imperfect.

We maintain throughout the assumptions that $0 < z_H < 1 - z_L$, that (7) and (8) hold, and that $\Psi(1) > 0$.

The results turn out to depend on the nature of this competition. We analyze two cases. In case (a), tier-1 certifiers charge a fixed fee and maximize profits. In case (b), tier-1 certifiers do no compete in prices. Rather, they care about market share but have to incur a per-submission cost, which depends on whether they opt for tier-1 or quick turn-around certification. Case (a) might be a better description of rating agencies while case (b) might be a better model of scientific journals.

(a) *Certifiers compete in prices*

Assume that there is a single, monopolistic tier-1 certifier. This tier-1 certifier can choose between two strategies: tier-1 certification and quick turn-around certification. In each case, the monopolist extracts all the sellers' surplus over and above the sellers' welfare if the sellers were to go directly to a tier-2 certifier. Therefore, the tier-1 certification strategy yields monopoly profit[34]

$$\delta \left[\rho S(1) + \delta(1 - \rho)S(\rho) \right] - \delta S(\rho)$$

while the quick turn-around certification strategy yields monopoly profit

$$[\rho(1 - z_H) + (1 - \rho)z_L]\hat{\delta}S(\rho^+) + [\rho z_H + (1 - \rho)(1 - z_L)]\,\hat{\delta}\delta S(\rho) - \delta S(\rho)$$

The monopoly certifier will therefore opt for a quick turn-around certification strategy if and only if the monopoly profit is higher under the latter strategy than

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[34]Let F be the fee charged by the monopoly tier-1 certifier. If

$$\delta S(\rho) \geq \delta \left[\rho S(1) + \delta (1 - \rho) S(\rho) \right] - F$$

then the tier-2 equilibrium exists and Pareto dominates any other equilibrium. If this inequality is violated, then there is no tier-2 equilibrium and furthermore the tier-1 equilibrium exists as

$$\delta S(0) < \delta \left[\rho S(1) + \delta (1 - \rho) S(0) \right] - F.$$

A similar reasoning applies to the computation of the monopoly profit under quick turn-around certification.

under the former. This can be expressed as $\Psi^M \geq 0$ where

$$\Psi^M \equiv \Psi(1) + \left[[\rho z_H + (1 - \rho)(1 - z_L)] - \frac{\delta}{\hat{\delta}}(1 - \rho) \right] \hat{\delta} \delta \left[S(\rho) - S(\hat{\rho}_2(1)) \right].$$

Hence $\Psi^M > \Psi(1)$ if and only if (9) holds. Therefore, with a monopolist tier-1 certifier which charges a fixed fee and maximizes profits, quick turn-around certification is more (less) likely than under competitive markets if (9) holds (doesn't hold). Similarly, one can look at an oligopolistic tier-1 structure with two (or more) tier-1 certifiers competing in prices à la Bertrand: The outcome in the limit of small differentiation is the same as when tier-1 certifiers are perfectly competitive. If there is enough differentiation, on the other hand, then it can be the case in a Hotelling duopoly where (9) holds, that quick turn-around certification is less likely than under perfect competition

Consider a Hotelling duopoly game between two tier-1 certifiers where the differentiation parameter t is large enough so that both firms have positive market share. In a symmetric, pure-strategy equilibrium, then each firm charges fee $F = t/2$. Let

$$W^1(\hat{\rho}_2) \equiv \rho S(1) + \delta(1 - \rho) S(\hat{\rho}_2),$$

$$W^3(\hat{\rho}_2) \equiv \frac{\hat{\delta}}{\delta} [[\rho(1 - z_H) + (1 - \rho) z_L] S(\rho^+) + \delta[\rho z_H + (1 - \rho)(1 - z_L)] S(\hat{\rho}_2)]$$

and let

$$\rho^- \equiv \hat{\rho}_2(1).$$

Hence,

$$\Psi^M = \delta \left[W^3(\rho) - W^1(\rho) \right]$$

and

$$\Psi(1) = \delta \left[W^3(\rho^-) - W^1(\rho^-) \right].$$

Consider a quick turn-around equilibrium. If one of the two certifiers deviates to become tier-1 and charges F (in general, $F \neq t/2$), then the market share of the other certifier is

$$y \equiv \frac{t + (t/2 - F) + \delta \left[W^3(\hat{\rho}_2(y)) - W^1(\hat{\rho}_2(y)) \right]}{2t}. \tag{11}$$

It is easy to show that, for the optimal F associated with the deviation,

$$W^1(\hat{\rho}_2(y)) > W^3(\hat{\rho}_2(y))$$

is the condition for the deviation to be profitable. In particular, the deviator can charge $F = t/2$ (not optimal). If

$$W^1\left(\rho^-\right) \geq W^3\left(\rho^-\right)$$

then for y given by (11), $\hat{\rho}_2\left(y\right) < \rho^-$ and

$$W^1\left(\hat{\rho}_2\left(y\right)\right) > W^3\left(\hat{\rho}_2\left(y\right)\right)$$

if (9) holds. And so, the quick turn-around equilibrium exists for a smaller set of parameters than for a perfectly competitive industry.

(b) *No price competition*

We now assume that the tier-1 certifiers' objective function is given by

$$[\text{market share}] * [1 - c]$$

where $c = c_L$ for tier-1 certification and $c = c_H$ for quick turn-around certification. We assume that $c_L < c_H$. In the case of peer-reviewed scientific journals, for example, this might capture the cost for editors of pressing the referees to return their reports quickly.

A monopolist tier-1 certifier would choose tier-1 certification with a payoff of $1 - c_L$ over quick turn-around certification which yields only $1 - c_H$. By contrast, in an oligopoly with two (or more) tier-1 certifiers where

$$(1 - c_L)/2 < 1 - c_H \tag{12}$$

then they will all choose quick turn-around certification.[35] Hence in this case, the oligopolistic game features a form of prisoner's dilemma and competition increases quick turn-around certification.

Proposition 9 *Suppose that (7) and (8) hold, and that $\Psi(1) > 0$. The effect of competition on quick turn-around certification depends on the nature of competition. Competition decreases quick turn-around certification if certifiers charge a fixed fee and compete in prices so as to maximize profits if and only if (9) holds. By contrast, competition increases quick turn-around certification if tier-1 certifiers do not compete in prices but rather in market shares as long as (12) holds.*

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[35] If there are n tier-1 certifiers, then the condition for the equilibrium to feature quick turn-around certification is

$$(1 - c_L)/n < 1 - c_H$$

which is weaker, the higher n.

Appendix 2 (mechanism design for a monopoly certifier under costless fine grading)

For expositional simplicity, we assume that the certifier does not discount the future (maximizes steady-state profits) and can perform fine grading at no cost ($c = 0$). Adopting a mechanism design approach, let $F_H(\widehat{\rho})$ and $F_L(\widehat{\rho})$ denote the c.d.fs of posterior beliefs when the seller comes to the market for types H and L, respectively.

The certifier solves:

$$\mathcal{S} \equiv \max_{\{F_H(\cdot), F_L(\cdot)\}} \{\rho \int S_H(\widehat{\rho}) dF_H(\widehat{\rho}) + (1-\rho) \int S_L(\widehat{\rho}) dF_L(\widehat{\rho})\}$$

s.t.

$$\rho\widehat{\rho}_H + (1-\rho)\widehat{\rho}_L = \rho \tag{13}$$

where

$$\widehat{\rho}_i \equiv \int \widehat{\rho} dF_i(\widehat{\rho}) \quad \text{for} \quad i \in \{H, L\}$$

$$\widehat{\rho}_H \geq \rho \quad \text{and} \quad \widehat{\rho}_L \leq 1 - \rho.$$

In words, $\widehat{\rho}_i$ is the average ex post reputation of type i. Condition (13) just expresses the martingale property of beliefs.

Rather than solving this program in full generality, we study several cases of interest.

(a) *Sellers are strongly information loving.*

In this case, the convexity of S_i implies that

$$\mathcal{S} \leq \mathcal{T} \equiv \rho[\widehat{\rho}_H S_H(1) + (1-\widehat{\rho}_H)S_H(0)] + (1-\rho)[\widehat{\rho}_L S_L(1) + (1-\widehat{\rho}_L)S_L(0)].$$

Maximizing $\mathcal{T}$ with respect to constraint (13) (with multiplier μ) yields first-order conditions:

$$\frac{\partial \mathcal{L}}{\partial \widehat{\rho}_H} = \rho[S_H(1) - S_H(0) - \mu] \leq 0, \quad \text{with equality if} \quad \widehat{\rho}_H > 0$$

$$\frac{\partial \mathcal{L}}{\partial \widehat{\rho}_L} = (1-\rho)[S_L(1) - S_L(0) - \mu] \leq 0, \quad \text{with equality if} \quad \widehat{\rho}_L > 0.$$

Because $S_H(1) - S_H(0) \geq S_L(1) - S_L(0)$, the program admits $\widehat{\rho}_H = 1$ and $\widehat{\rho}_L = 0$ as a solution: Fine grading is optimal, and

$$\mathcal{S} = \rho S_H(1) + (1-\rho)S_L(0).$$

(b) *Sellers are strongly information averse.*

A symmetric proof shows that it is then optimal to have tier-2 certification. And so:

$$\mathcal{S} = \rho S_H(\rho) + (1 - \rho)S_L(\rho).$$

(c) *Spillovers from adoption (example 2).*

Suppose (as in Lerner-Tirole 2006) that

$$S_i(\widehat{\rho}) = s_i \, \mathbb{1}_{\{E_{\widehat{\rho}}[b] \geq 0\}}.$$

Clearly if $E_\rho[b] = \rho b_H + (1 - \rho)b_L \geq 0$, the optimum is a pooling one (tier-2 certification). So let us assume that

$$\rho b_H + (1 - \rho)b_L < 0.$$

Let $\rho^* > \rho$ be defined by

$$\rho^* b_H + (1 - \rho^*)b_L = 0.$$

One has:

$$\mathcal{S} = \rho s_H + \frac{\rho(1 - \rho^*)}{\rho^*} s_L.$$

Put differently, the certifier "accepts" all high types and a fraction u of low types, such that

$$\rho^* = \frac{\rho}{\rho + (1 - \rho)u}.$$

Optimal certification is then intermediate between a tier-1 and a tier-2 certifier: less stringent than the former, but more demanding than the latter.