What Does Reputation Buy?
Differentiation in a Market for Third-party Auditors

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Reputation can be built and spent. A monopolist, for example, may provide a high-quality product to establish a reputation at first, only to cut costs later and draw a return on that investment (Tirole, 1994). Where information is scarce and legal penalties weak, building a reputation for reliability can help firms negotiate contracts under which they bear less risk for future cost overruns (Banerjee and Duflo 2000). The sources and uses of reputation may be particularly important for third-party information intermediaries like auditors, since clients cannot directly observe the quality of service they provide. By the definition of an intermediary—a party *between* the firm audited and the client consumer, regulator or firm—the client is a step removed from the information it needs, and so also in the dark about the quality of the information given.

We study differences in quality in one market for information intermediaries: the market for third-party environmental auditors in Gujarat, India. These auditors report on the pollution being emitted by industrial plants to the state environmental regulator. They also offer environmental consulting services, which plants use to meet requirements of the environmental regulator. We ask, do auditors differ in the quality of their reporting? Do the audit and consulting markets incentivize auditors to build a reputation for quality, or for leniency?

As part of a field experiment on the effects of regulatory changes in this market, we independently collected data on the same pollutants that auditors reported. We can then directly measure auditor quality as the difference between audit reports and our "backcheck" measure of pollution (Duflo et al., 2012). To our knowledge, no prior study in any context has had an independent measure of third-party auditor quality at the time of reporting. The overall quality of audits in this market is very low as auditors underreport pollution to avoid incriminating client plants. In the experiment, we showed that better incentives for auditors improved their reporting accuracy and, in turn, induced client plants to reduce pollution.

In this paper, we find that, despite the low overall quality, auditors are heterogeneous and some perform well. On a first pass, it is surprising that auditors who give accurate readings are able to survive in this competitive market with relatively low entry barriers. We posit that these high-quality auditors survive by using their good name to insulate select client plants from regulatory scrutiny. We find two pieces of evidence broadly consistent with this hypothesis: 1) higher-quality auditors are paid more both in their work as third-party auditors and in their complementary work as consultants; 2) plants with high-quality auditors incur fewer costly penalties from the regulator. It is important to underscore, however, that small sample sizes for comparisons across auditors mean that these findings lack some precision.

I. The Market for Third-Party Audits

We begin by giving a brief overview of the audit market under study, which Duflo et al. (2012) describe in more detail. Gujarat is one of India's fastest growing and most industrialized states. The state environmental regulator, the Gujarat Pollution Control Board or GPCB, is responsible for enforcing limits on pollution at over 20,000 plants. In order to reduce acute water pollution, the state mandated that industrial plants with the potential to produce high levels of pollution get an annual environmental audit by a third party. The GPCB accredits private firms as environmental auditors based on the qualifications of their staff and their capability to collect and analyze pollution samples.

Each plant is required to hire an auditor, who then visits three times over the year to take pollution samples and observe the plant's environmental management. The auditor summarizes findings on plant pollution emissions and offers abatement advice in a report that is sent both to the plant and to the GPCB. The contents of an audit report can incriminate a polluting plant and lead to costly sanctions.

According to both plants and the regulator, this system contributed to low quality reports, as plants shopped for auditors who would report them compliant. The head of GPCB noted that there were good auditors and bad and that the Board knew one from the other; presumably plants did too.

In collaboration with the GPCB, we evaluated a modified audit system to improve the accuracy of audits. The system was tested in a sample of all 473 audit-eligible industrial plants in Ahmedabad and Surat, the two largest cities in Gujarat, observed for two years, 2009 and 2010. This sample includes most of the audit-eligible plants in the state and 45 different audit firms that worked in them. About half of plants were assigned to the treatment group, in which auditors were randomly assigned to plants, paid from a central pool at a fixed rate and their reports were backchecked for accuracy.

Backchecks consist of revisiting the audited plant shortly after a randomly selected subset of audit visits to collect the same pollution samples as the auditor did. Backchecks were independent, conducted by teams from local engineering colleges, and the results could not be used by the regulator to punish plants. Further, all backchecks were unannounced, but the probability of backcheck in the treatment, 20 percent, was known. In the second of two years, auditors working in the treatment received bonuses for accuracy.

We regard the remaining half of plants, the control group, as the status quo audit market equilibrium. Control plants chose their own auditors and paid them an agreed, unregulated rate for the audit. While control audits were not generally backchecked, we did conduct readings in control plants at the end of the experiment to measure auditor accuracy, the key measure of quality in this market.

II. Heterogeneity in Auditor Quality and Payments to Auditors

A. Heterogeneity in Auditor Quality

Figure 1 plots our measure of auditor quality, which is the mean standardized difference between measures of pollution taken in audits and backchecks.[1] The sample is audit firms that were hired by control plants in 2010 and were backchecked, or 17 out of the total 45. As the difference is the audit reading less the backcheck reading, a negative value indicates that audit report gave a reading under the true pollution level. The point estimates for 15 out of 17 auditors are negative, with 7 of these 15 significantly less than zero—i.e., underreporting pollution—and neither of the remaining two auditors' readings were significantly different than zero. The average audit report across all auditors is 0.3 standard deviations *below* the average backcheck. This difference is economically significant, in that it represents enough underreporting to shift many plants from non-compliant to compliant.

[1] The mean is across all plants audited and all pollutants observed, where the pollutants measured typically are NH_3-N, BOD, COD, TDS, and TSS for water pollution and SO_2, NO_x, SPM for air pollution.

[2] Bootstrapped standard errors are bootstrapped by drawing

[Insert Figure 1 Here]

Despite widespread underreporting, auditors are not homogeneous. A test for the joint equality of all auditor means in a regression of the audit less backcheck difference on dummy variables for each auditor rejects the equality of auditor means (F-statistic 17.56, p-value < 0.000). Auditors range in quality from being unbiased to underreporting by a full 1.5 standard deviations. The tail of auditor quality seems especially poor, as three auditors underreport actual pollution levels by at least half a standard deviation.

B. Payments to Auditors

The market for third-party environmental audits appeared to be very competitive. We judge the state of the market from the 240 sample plants in the control group, which operated in the status quo system under which plants directly hired and paid auditors. We surveyed both auditors and plants on audit, and consulting prices for the years 2009 and 2010. Control plants report paying an average of INR 23,049 for an audit, and auditors report that plants have a mean minimum willingness-to-pay for an audit of INR 28,000 and a mean maximum of INR 37,500. (The auditor survey was not blind, and we expect the minimum may be more accurate if auditors thought they would be judged on their prices.) The standard deviations of these payments range from INR 14,000 to 19,000, a large share of the average payment.

While the average figures for the price of an audit reported by both plants and auditors roughly agree, both are below the cost of conducting an audit. Based on the costs of taking pollution samples and analyzing them, an audit for a plant in the textile sector, the industry that comprises 80% of our sample, should run roughly INR 40,000. The simplest way for auditors to offer prices below cost is to skip the required collection or analysis of some pollution samples.

Aside from the audit market, there is also significant variation in the payments auditors earn acting as environmental consultants. While plants in the sample are required to have an environmental audit as discussed above, they may also need to hire environmental consultants from time to time, typically under some kind of regulatory pressure. For example, over 40% of plants in the treatment and control groups were mandated to install some abatement equipment in the year prior to the beginning of the experiment (Duflo et al., 2012, Table 2). Such equipment would often be procured and installed with help from an environmental consultant. A full 44% of control plants hired an environmental consultant in 2010 and, conditional on hiring, paid these consultants a mean of INR 33,999 (standard deviation INR 70,144). The mean payment to consultants was thus higher than the mean payment to environmental auditors; for some plants payments to consultants were far larger.

III. Origins of Demand for Quality

Given the competitive nature of the audit market, it is surprising to observe heterogeneity in auditor quality. From the perspective of a plant hiring an auditor, lower reports are better, and we would expect it to be difficult for more accurate auditors to survive. To gain some insight into how they do so, we will unpack the demand for quality by looking at what high-quality auditors are paid and how their client plants fare in interactions with the regulator.

A. Relationship of Auditor Quality to Payments to Auditors

We first relate our measure of audit quality to payments to auditors from our plant survey. High-quality auditors may earn more if their reputation is valuable to client plants, either in auditing or in consulting. Conversely, low-quality auditors may earn more if they are paid a risk premium for reporting inaccurately on behalf of clients, which could get them disaccredited.

Table 1 reports the results of regressions of audit and consulting payments, at the plant level, on auditor quality, as measured by average accuracy described above. As auditors generally underreport, a higher fixed effect means a more accurate, higher-quality auditor. We focus on results from the control plants, which hire and pay their own auditors. However, we also show consulting payments for the full sample together, as both treatment and control plants decided themselves whether to hire a consultant and at what rate. Standard errors are clustered at the auditor level at which quality is measured, meaning that we effectively have 17 observations in each regression, for the 17 auditors for whom we can measure quality. We report both analytic clustered standard errors, in brackets, and bootstrapped standard errors, which are preferred, since they account for the fact that auditor quality is itself estimated.[2]

[Insert Table 1 Here]

Table 1, despite a lack of statistical power, suggests that higher-quality auditors are paid

[2] Bootstrapped standard errors are bootstrapped by drawing observations at the plant level stratified by auditor within the control group, so that quality is observed for each auditor in each replication, with 200 bootstrap replications.

more both as auditors and as consultants. On average, as shown in column (1), an increase of one standard deviation in auditor quality raises auditor pay by INR 8,853 in the control group of plants. Moving from the 25th to the 75th percentile of auditor quality (0.32 standard deviations) therefore is associated with an INR 2,833 increase in pay, or 12% of the average payment to auditors in the control group. This is a large increase but is not statistically significantly different from zero when using the appropriate, bootstrapped standard errors.

Higher auditor quality is also associated with higher consulting payments, in column (2), on average for each firm where an auditor served as a consultant: moving from the 25th to the 75th percentile of quality implies an INR 9,206 increase in the average consulting payment. This increase is economically large but not statistically significant due to the small sample of auditors. The increase in consulting payments in the full treatment and control sample, in column (3), is somewhat larger and more precise (p-value < 0.10).

On balance, high-quality auditors appear to be paid more for audits and consulting. This relationship may be surprising since quality is measured as accuracy and, in this context where pollution is high, client plants generally demand low accuracy in order to insulate themselves against the threat of regulatory action. In the next subsection we investigate how differentiation in the demand of client plants for quality may explain why more accurate auditors are in fact paid more.

B. The Demand for Reputation from Client Firms

The GPCB conducts its own inspections of plants and, using these inspections or audit reports, may impose penalties up to the disconnection of utilities and closure of the plant. According to regulatory records, about 80 percent of sample plants are inspected in a given year and 10 percent have their utilities cut off. In practice, the most costly sanctions are used only for those plants with the highest pollution readings, five or ten times greater than the regulatory standard. With such top-heavy sanctions, plants may want to acquire a clean reputation, via hiring a high-quality auditor, to reduce the likelihood and cost of costly regulatory actions against them.

To test this hypothesis we bring in an additional data source. We use GPCB's records of interactions with sample plants to measure whether each plant had a costly action taken against them during a particular year. Costly actions are the following: orders to close, disconnection of a plant's utilities, the mandated installation of equipment, and the posting of a performance bond. Table 2 then regresses whether a plant *i* experienced such an action in year *t* on whether a plant was in the audit treatment group (T_i = 1), where auditors reported more accurately, on the quality Q_{jt} of one's auditor *j*, measured in the control group for all plants it audited, and on the interaction of treatment and auditor accuracy.

$$(1) \quad CostlyAction_{it} = \alpha_r + \beta_0 T_i + \beta_1 Q_j + \beta_2 Q_{jt} \times T_i + \varepsilon_{ijt}$$

We find suggestive evidence that higher-quality auditors cause plants to have fewer costly sanctions levied against them. As shown by the mean dependent variable, about a quarter of sample plants experience some costly action each year. Table 2, column (1) includes no controls for plant characteristics. A plant randomly assigned to the treatment group is an insignificant 6 percentage points more likely to have a costly action. Consistent with these treatment plants indeed being under greater scrutiny, we observe that they did reduce pollution output (Duflo et al., 2012).

The next row shows that higher auditor quality is associated with significantly fewer costly actions. Because an interaction term with treatment is also included, the second row estimates of β_1 give the relationship between quality and costly actions in the control group, where plants hire their own auditors. The coefficient of -0.158 says that a plant hiring an auditor at the 75^{th} as opposed to the 25^{th} percentile of accuracy is associated with 0.05 fewer costly actions, a 22% reduction. The interaction of auditor quality and treatment is small and insignificant. Apparently the value of a high-quality auditor does not depend on whether that auditor was chosen (as in the control) or randomly assigned (as in the treatment).

[Insert Table 2 Here]

This reduction in costly actions may be caused either by cleaner plants hiring higher-quality auditors or by higher-quality auditors insulating all plants, regardless of their existing reputation with the regulator, against costly actions. We now try to separate these explanations, though we note that either one suggests that higher-quality auditors have some value in audit-market equilibrium due to plants signaling, or actually achieving, low pollution for the regulator via those auditors.

In column (2) we add controls, again from regulatory records, for the mean pollution that the GPCB observed at a given plant in its own inspections prior to the study. These *ex ante* pollution controls consist of dummies for a plant belonging to one of four quartile bins, from least to most polluting, and are a very good summary measure of a plant's reputation for cleanliness with the regulator.

Conditional on past observed pollution, it remains that high-quality auditors are associated with fewer costly actions. It is striking that the size of the reduction in costly actions from hiring a high-quality auditor is not reduced by including controls for plant pollution, which may be noisy measures of actual pollution but are exactly the right controls here, as they are the very readings the regulator observed itself. If high-quality auditors helped plants avoid costly actions by actually reducing pollution, we may expect that controlling for plant pollution, even from before the experiment started, would remove this effect and so reduce the estimated coefficient on auditor quality.

Lastly, in column (3), we test for heterogeneity in the effect of quality on costly actions by initial plant pollution. We keep controls for pollution quartiles and add interactions of a dummy for *ex ante* plant pollution being below the median with auditor quality and treatment. Auditor quality is estimated to reduce costly actions more, with a coefficient of -0.225 (standard error 0.135), for those plants with low initial pollution.

The best single explanation for these findings seems to be plants using auditor quality as a signal to the regulator. Higher-quality auditors are paid more because they allow less-polluting plants to signal to the regulator that they will comply. Such clean plants thus separate themselves from their dirtier peers, who generally pool on low-quality audits, and benefit by being penalized less. Auditors maintain a reputation for high quality by reporting accurately in audits, in part so that they can gain business providing these signals.

IV. Conclusion

We measure the quality of third-party information intermediaries, namely environmental auditors in the Indian state of Gujarat, using the difference between their reports on the air and water pollution emitted by client industrial plants and independent backchecks. We find that there is a substantial range of auditor quality, that higher-quality auditors receive more in payments for audits and consulting, and that higher-quality auditors are associated in market equilibrium with fewer costly actions against client plants. Even in a market with very low quality overall a niche appeared for auditors to build a reputation and serve clients with a demand for quality. We suggest that plants demand reputable auditors as a signal to insulate themselves against regulatory action.

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FIGURES:

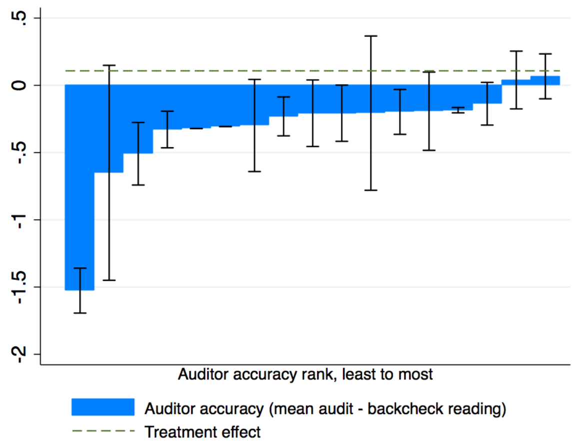

FIGURE 1. AUDITOR ACCURACY BY AUDITOR, IN CONTROL PLANTS

Note: Plotted is the mean, across all plants audited and pollutants, of the difference between audit reports and backcheck readings for the same pollutants. The dashed line represents the treatment effect (increase in accuracy) observed in Duflo et al. (2012).

TABLES:

Table 1: Payments to Auditors on Auditor Quality

	Control Group Only		Treatment and Control
	Audit Payment	Consulting Payment	Consulting Payment
	(1)	(2)	(3)
Auditor quality as measured in control	8,853	28,771	34,140*
	(8,826)	(33,555)	(20,740)
	[4,515]	[21,834]	[16,824]
Observations	113 plants	52 plants	165 plants

Table 2: Costly GPCB Actions on Auditor Quality in Treatment and Control

	(1)	(2)	(3)
Audit treatment assignment (=1)	0.0641	0.0594	0.0159
	(0.0630)	(0.0630)	(0.0825)
Auditor quality as measured in control	-0.158***	-0.173***	-0.0790
	(0.0368)	(0.0297)	(0.0922)
Auditor quality as measured in control X Treatment	-0.0232	-0.0177	-0.119

	(0.0566)	(0.0551)	(0.141)
Auditor quality X Pollution below median			-0.225
			(0.135)
Pollution below median X Treatment			0.102
			(0.0738)
Quality X Pollution below median X Treatment			0.245
			(0.209)
Mean pollution controls included?	No	Yes	Yes
Mean of the dependent variable	0.23	0.23	0.23
Observations	458	458	458
Number of auditors	17	17	17