

# **Designing Self-Reporting Regimes to Encourage Truth Telling: An Experimental Study**

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## **Abstract**

We report results from an experiment that investigates truthfulness in self-reporting under different reporting regimes. The experiment involves a production task with self-reporting of accidents, with reporting compulsory for some participants, but only voluntary for others. We find that dishonesty is prevalent, but accident reporting is more frequent with compulsory reporting compared with voluntary. This suggests that lie aversion is a stronger force than the intrinsic motivation to voluntarily report, and that careful design of self-reporting regimes is necessary by enforcement agencies to achieve satisfactory compliance outcomes. Our results are relevant for several areas beyond regulatory compliance, including dishonesty in social security claims, insurance claims, workplace expense claims, income tax returns, and financial reporting.

**Keywords:** self-reporting, enforcement, dishonesty, experiment, individual decision making, theft, intrinsic motivation

**JEL Codes:** C91, K42

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## 1. Introduction

Honest communication is an important part of many economic transactions. Examples include claims about insurance, product quality and labelling, and workplace theft and shirking. Honesty is also an important part of the regulatory framework with self-reporting being the cornerstone of enforcement of environmental and occupational safety and health regulations, among others. Nevertheless Mazar and Ariely (2006) claim that dishonesty is rife in all levels of U.S. society, and they provide evidence of the high financial costs to society of this pervasive dishonesty. This is also true in other countries, for example, fraud has been identified as the “most expensive crime category in Australia” (Lindley and Smith, 2011, p.5).

Our aim is to investigate a specific type of dishonesty; the fraudulent provision of information by individuals, either via actual lying or through withholding of relevant information.<sup>1</sup> Although we focus on self-reporting in a regulatory context, our results are relevant for dishonesty in many areas such as social security claims, insurance claims, workplace expense claims, income tax returns, and financial reporting. We are particularly interested in how the design of self-reporting regimes evokes intrinsic motivations for honesty and the consequent effect on the efficacy of the regime.<sup>2</sup>

Self-reporting is a common feature of many enforcement regimes, particularly for regulatory compliance. Self-reporting of crimes and violations is encouraged by offering lower penalties for those who voluntarily report offenses. The U.S. Federal Sentencing

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<sup>1</sup> The Oxford English Dictionary defines dishonesty as a “disposition to deceive, defraud, or steal”. Dishonesty therefore encompasses a broad range of acts from providing false information to more direct forms of theft such as physically stealing money and equipment. Dishonesty can be perpetrated against individuals (e.g. phishing scams, credit card fraud), businesses (e.g. employee theft and misuse of leave entitlements, false insurance claims), and government organisations (e.g. fraudulent social security claims, misuse of corporate credit cards).

<sup>2</sup> Intrinsic motivations have also been referred to as internal rewards (Mazar and Ariely, 2006) or moral rules (Shavell, 2002). For a survey of the literature on the role of intrinsic motivation in contexts other than dishonesty, see Fehr and Falk (2002). Benabou and Tirole (2003, 2006) provide a theoretical analysis.

Guidelines Manual (USSC, 2010, §5K2.16), for example, allows penalty reductions in the case of voluntary disclosure of an offense that “was unlikely to have been discovered otherwise”, while the Department of Justice’s, Corporate Leniency Policy, reduces penalties for firms which voluntarily disclose antitrust violations. It is claimed that self-reporting will both improve compliance and reduce enforcement costs (EPA, 1999, 2000). These benefits depend, in part, upon truthful reporting.<sup>3</sup>

Not all reporting regimes are the same, however. Under many regulations, firms must submit regular compliance reports to the enforcement agency. For example, occupational safety and health regulation requires annual reporting of workplace injuries and illnesses, with more prompt reporting required in the case of serious events. Under the Clean Water Act’s National Pollutant Discharge Elimination System, major point sources must submit monthly reports of their compliance with permit limits. On the other hand, many regulations contain no such requirements; instead, firms may be offered incentives to voluntarily disclose any violations that do occur (e.g. the EPA’s audit policy).<sup>4</sup>

One way to think about this difference is as compulsory versus voluntary reporting. Reporting by firms’ on corporate social responsibility is another example. Although reporting of this kind is voluntary in most countries, some argue for it to be made compulsory (Overland, 2007). Theoretically, there should be no difference between compulsory and voluntary reporting, as long as the economic incentives coincide. Nevertheless, there seems a distinct difference between failing to voluntarily submit a report (an act of omission) and telling an outright lie (knowingly submitting a false report). We conjecture that this difference will matter, and that aversion to blatant lies could lead to greater reporting of

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<sup>3</sup> Self-reporting is an important feature in other settings too. For example, the Australian medical pay-for-performance scheme for General Practitioners, relies on self-reports of the number of patients seen and tests completed (Scott et al., 2009).

<sup>4</sup> Firms are only eligible for the EPA’s audit policy if they disclose violations that would not otherwise be uncovered via mandatory monitoring (EPA, 2000).

violations in the compulsory self-reporting treatment than in the voluntary one. On the other hand, being compelled to submit a report could lead to crowding out of the intrinsic motivation to voluntarily report and therefore we may observe less reporting in the compulsory case. While theoretical models tend to ignore such distinctions, behavioral influences may affect the success of enforcement regimes and therefore have significant policy implications.

The rational economic model (Becker, 1968) assumes that people are dishonest whenever it is financially advantageous to do so. To deter such acts therefore requires an increase in the financial disincentives such as the likelihood of detection and the amount of punishment when caught. At the other end of the spectrum to the rational economic actor, is someone who is always moral and never dishonest regardless of the financial incentive to do so.<sup>5</sup> Evidence suggests however that most people fall in-between these two extremes, being influenced by both economic incentives (e.g. Grogger, 1991) and intrinsic motivations which could include both moral and social considerations (e.g. Hurkens and Kartik, 2009). Indeed the behavioral approach to law and economics (Garoupa, 2003; McAdams and Ulen, 2008) has long challenged the standard neoclassical approach observing that “people exhibit bounded rationality, bounded self-interest, and bounded willpower” (Jolls et al., 1998, p.1471). Of particular relevance for our work are the role of bounded self-interest and the influence of social norms.

We use an economic experiment to investigate how the type of reporting affects incentives for dishonesty in self-reporting. Specifically, we design a production task with self-reporting of accidents where some participants faced compulsory reporting while for

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<sup>5</sup> Since our interest is in dishonesty associated with financial gain, this spectrum omits situations where it may be “moral” to lie (so-called “white lies”) to avoid hurting others. Additionally some people may get pleasure from lying (so-called “pathological liars”) but this should only be a small part of the population and not affect our results due to randomization of participants across treatments.

others it was voluntary. We seek to measure both the extent of dishonesty, along with which type of intrinsic motivation is strongest in our setting. We isolate the latter effect by keeping the monetary (extrinsic) incentives for dishonesty constant across the two types of reporting.

The paper closest to our research is Murphy and Stanlund (2008), in which the authors focus on the incentives for voluntary disclosure of violations when firms may be unaware of their compliance status. They find that voluntary policies can be effective for a certain range of penalties and in the presence of information about compliance status. In a paper on reporting in dynamic emission markets, Stranlund et al. (2011) examine enforcement and compliance when banking of permits is allowed. They find that imposing high permit violation penalties is not effective in these markets, and suggest that the main task of enforcement is to promote truthful self-reporting. In their experiment, reporting is compulsory.

We compare compulsory and voluntary self-reporting regimes within a single experiment. This paper is the first, to our knowledge, to focus on the behavioral aspects of self-reporting using experiments and provides insights on how individuals would make decisions when faced with different self-reporting regimes. In addition, we include controls for risk preference and inherent dishonesty; the latter measured via a task where subjects have the opportunity to steal real physical money, by taking more than they have actually earned in a mathematical game. This control task measures dishonest behavior at the individual level in situations where there is no formal probability of detection or punishment and when there are significant economic gains to being dishonest. Any abstention from dishonesty can therefore be interpreted as an attribute that some individuals have - an inherent characteristic or an influence of social norms. This task allows us to classify people into honest and dishonest categories and use it to understand behavior in different reporting regimes.

We use an individual task to examine self-reporting because it is closer to the types of “white collar” crimes we are interested in studying where the party being lied to or harmed by the dishonesty may be somewhat distant from, and possibly unknown to, the decision maker. In contrast, most of the existing experimental economics literature on dishonesty uses two-player communication games.<sup>6</sup>

We find that reporting of accidents was more frequent with compulsory reporting (20% of accidents) than with voluntary reporting (10% of accidents) suggesting that aversion to overt lying was stronger than feeling good about voluntarily cooperating. Nevertheless, dishonesty was rife with almost everyone dishonest in the reporting task, with only 4% of subjects always reporting an accident, and around half of the subjects never reporting. These results suggest that careful design of self-reporting regimes is necessary by enforcement agencies to achieve satisfactory compliance outcomes. Many self-reporting programs in the field use voluntary reporting rules. Direct empirical evidence on their performance is however difficult as critical variables such as frequency of accidents are not observed by researchers. Lab experiments such as the one reported in this paper can improve our understanding of the behavioral impacts of different self-reporting regimes.

The paper proceeds as follows. Section 2 explains the experimental design and procedure. Section 3 presents the results, while Section 4 discusses explanations for our findings. Section 5 concludes by describing the broader policy implications and suggesting avenues for future research.

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<sup>6</sup> See Ellingsen and Johannesson (2004), Gneezy (2005), Charness and Dufwenberg (2006), Sánchez-Pagés and Vorsatz (2007, 2009), Dreber and Johannesson (2008), Hurkens and Kartik (2009), Lundquist et al. (2009), Innes and Mitra (2009) and Rode (2010). Fischbacher and Heusi (2008) study lying in an individual task but only observe the distribution of responses not individual lying behaviour.

## 2. Experimental Design

### 2.1 Overview

All subjects participated in a reporting task, which involved a production decision, where production had a potential to cause an “accident” for which they could be penalised. This was repeated for 30 rounds, where in the first 10 rounds they face a conventional enforcement regime, followed by 20 rounds where reporting was possible. Around half of the subjects experienced voluntary self-reporting, while the other half experienced compulsory self-reporting. That is, we use a between-subjects design for these treatments, with subjects randomly assigned to the treatments. Following completion of the reporting task, subjects answered some demographic questions, plus some questions about attitudes towards lying and their previous participation in dishonest behavior.<sup>7</sup> Before undertaking the reporting task, subjects participated in two short control tasks: a lottery task, designed to measure risk preferences and a theft task, designed to measure their underlying motivation for honesty.

The majority of the experiment was computerized using the software z-Tree (Fischbacher, 2007) except for the theft control task, which was conducted manually using pen and paper.<sup>8</sup> We discuss the reasons for these design choices in the following section. In addition to a \$5 show-up fee, subjects were paid their earnings from one round in the reporting task and for one decision in the lottery task. Subjects paid themselves in the theft task. The experiment lasted around 90 minutes, with average earnings being AU\$43 (approximately US \$40), of which \$7 on average came from the theft task.

The decision and round for payment in the reporting and lottery tasks respectively were selected at the end of the entire experiment, using physical randomization devices to

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<sup>7</sup> These additional questions were adapted from Lundquist et al. (2009) and Nagin and Pogarsky (2003).

<sup>8</sup> A copy of the experimental instructions is included in the appendix.

enhance credibility. Specifically, a ten-sided dice (rolled twice) was used for the lottery task, and a bingo cage, containing the balls 1 to 30, for the reporting task. The experiments were held at the University of Queensland. There were 115 participants, with 59 participants randomly allocated to the voluntary treatment and 56 to the compulsory treatment. The participants were predominantly undergraduate students (90%), with around 60% being business and economics students.

## 2.2 The Reporting Task

In this task, subjects made a “production decision” where production activities can potentially cause an “accident”, but the probability of an accident can be lowered for a cost. There are 30 rounds of such decisions. In the first ten rounds, all subjects face a conventional enforcement (CE) regime where there is some probability of being inspected ( $r$ ) and a fine ( $f$ ) for discovered accidents. These ten rounds allow subjects to learn about the task, and provide a baseline for comparison with their later decisions.<sup>9</sup>

In the following 20 rounds, subjects face one of two possible reporting regimes – either voluntary reporting or compulsory reporting. In voluntary, following an accident, subjects are given the binary choice: “Would you like to report the accident?” with response options of “Yes” or “No”. If they do report, then they pay a self-reporting fine ( $s$ ), otherwise they face CE. In contrast, with compulsory, subjects *must* fill out a report, and are asked “What would you like to say in the report?” The response options are “I had an accident” or

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<sup>9</sup> Prior to facing each regime subjects answered a series of quiz questions designed to assess their understanding of the instructions, and then participated in two practice rounds.

“I did not have an accident”. As with voluntary, a reported accident is assessed a fine of  $s$ , otherwise they face CE.<sup>10</sup>

The reporting task was framed using the language described here – i.e. we used the terminology of accident, inspection, and fine. While this is a deviation from the standard practice of using neutral language in economics experiments, since our aim was to understand attitudes towards dishonesty in a real-life situation of compliance with taxes, environmental, and health and safety programs, we used context specific language.

### 2.2.1 Theoretical Framework

The reporting task is inspired by the theoretical models of self-reporting developed by Malik (1993), Heyes (1996), and Innes (2001a), among others.<sup>11</sup> We follow here the model and notation of Innes (2001a). Risk neutral firms choose an accident prevention effort or level of care ( $x$ ), which determines the probability of an accident occurring:  $p(x)$ , where  $p'(x) < 0$  and  $p''(x) > 0$ . Let  $F$  be the *expected* penalty if an accident occurs, which takes on the value  $s$  if the firm self-reports and  $rf$  if not. The firm’s problem is to choose  $x$  to minimize its expected costs,  $x + p(x)F \Rightarrow x^*(F)$ . Assuming that in the case of indifference, firms will self-report, self-reporting occurs when  $s \leq rf$ . The enforcement agency will set  $s = rf$  to economise on enforcement costs, without any loss of deterrence (because  $x^*(s) = x^*(rf)$ ). A major advantage of self-reporting is the reduction in enforcement expenditures that arises because the agency need no longer inspect firms that

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<sup>10</sup> With compulsory reporting, subjects must file a report even if they do *not* have an accident however we did not permit them to file a false report in this case (i.e. reporting an accident when one did not occur). In the voluntary case, it did not make sense to ask the reporting question if no accident occurred.

<sup>11</sup> These models contrast with the more general crime model of Kaplow and Shavell (1994), who assume that potential offenders are heterogeneous in terms of their gains from crime and have a binary choice to commit a harmful act or not.

self-report accidents. Instead, only non-reporters have to be inspected with probability  $r$ .<sup>12</sup> This advantage however relies on truthful reporting of accidents.

A practical implementation of self-reporting however requires a strict incentive for self-reporting (i.e.  $s < rf$ ), leading to a weakening of deterrence, and hence more accidents. As a result, while self-reporting may generate enforcement economies, this may come at the expense of environmental protection, a concern expressed in the self-reporting literature (e.g. Innes, 2001a; Murphy and Stranlund, 2008).

Note that this model does not distinguish between compulsory and voluntary self-reporting, because theoretically there is no difference between the two (provided the monetary incentives are identical).<sup>13</sup> Nevertheless, there are a number of behavioral reasons why we may observe a difference. For example, compulsory reporting may crowd out any intrinsic motivation to voluntarily report, leading to less reporting in the compulsory treatment. However an opposing force like aversion to lying can arise in this treatment as subjects who chose not to report have to explicitly send a false report (i.e. lie) and we may find this aversion increases reporting in the compulsory treatment. Thus, whether we observe higher levels of reporting in the compulsory treatment or in the voluntary treatment depends on the relative magnitude of these effects and cannot be stated a priori.

### 2.2.2 Lab Implementation

To implement this in the lab we made several adjustments to simplify the cognitive burden on subjects. The first was to have subjects directly choose the probability of an

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<sup>12</sup> Additional potential benefits of self-reporting are earlier clean-up in the case of persistent pollutants (Heyes 1996), guaranteed remediation of damages (Innes 1999), and reduced firm expenditures on avoiding apprehension (Innes 2001b).

<sup>13</sup> Few theoretical models make any distinction between voluntary and compulsory self-reporting, with most implicitly assuming the voluntary case, although this is rarely made explicit. An exception is Malik (1993) who models compulsory self-reporting, in which case a failure to report is interpreted as a violation.

accident ( $p$ ), rather than effort ( $x$ ) itself. The second was to limit the number of choices available to subjects. The latter also enhanced salience, as it increased the difference between two options, and was acceptable because our main interest was in the reporting stage. We translated the problem into an equivalent maximization problem by including a fixed amount of revenue ( $R$ ) each period. Then the problem becomes to choose  $p$  to *maximize*  $R - x(p) - pF$ .<sup>14</sup> Subjects were told  $R - x(p)$  which is described as their “trading profit”. The five options available to the subjects are shown in Table 1.

The production and enforcement parameters were held fixed across all rounds of both treatments. Random draws were conducted each round to determine whether an accident or inspection occurred.<sup>15</sup> Subjects received their earnings from one randomly selected round from the 30 rounds.

Given our interest in studying the incentive (aversion) to lie we chose the enforcement parameters such that  $s > rf$ . In this case, all except the very risk averse will have a monetary incentive to lie therefore creating a potential conflict with one’s “moral incentive”. Alternatively, if we had set  $s < rf$  then there would be no monetary gain from lying and all but the most risk loving would self-report.<sup>16</sup> Hence in this case it would be difficult to isolate the impact of the monetary incentive from the moral incentive on dishonest behavior as both these effects would lead to less lying. A further constraint on our choices was the need to avoid bankruptcy in the experiment, which limits the upside for our fines and hence potential loss from being caught out.

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<sup>14</sup> An interior solution requires that  $x'(p) < 0$ , while the second order condition for a maximum requires that  $x''(p) > 0$ . This is equivalent to an increasing (i.e. convex) cost of reducing accidents. The actual functions used were  $R = 33.21$  and  $x(p) = \frac{2}{0.05+0.3p}$ .

<sup>15</sup> To increasing comparability across sessions, we made the random draw prior to any sessions, and used the same random numbers in each session.

<sup>16</sup> Note that an optimal self-reporting regime (from the theoretical literature) would set  $s \leq rf$ . Arguably however, the case of  $s > rf$  is more realistic as we do not observe full (voluntary) self-reporting.

The probability of inspection ( $r$ ) was set at  $\frac{1}{2}$  and the fine for a violation discovered via conventional enforcement ( $f$ ) was set at \$15. The fine for a self-reported violation ( $s$ ) was set at \$12. The expected fine under conventional enforcement is then \$7.50, so self-reporting yields a fine that is higher by \$4.50, which should provide a sufficient monetary incentive to lie. Note further that the optimal risk neutral accident probability choice was 80% with conventional enforcement or if they intend to not report (lie or withhold); compared with 60% if they plan to self-report. Risk aversion should lead to greater care being taken reducing the probability of having an accident.

The *ex post* incentive to lie is smaller than \$4.50 for the risk averse, and larger for risk lovers. Specifically for the risk averse, the gain from lying will decrease with the degree of risk preference and with the trading profit (lower accident probability). Using the constant relative risk aversion utility function with a coefficient of 0.5, we can compute the following *ex post gain from lying = certainty equivalent of lying – certain payoff if self-report*. This gain ranges from \$3.77 when  $p=100\%$ , to \$3.41 when  $p=40\%$ , and \$1.06 when  $p=20\%$  (the latter is rarely chosen).

## 2.3 Control Tasks

While the theoretical model assumes risk neutrality, we expect that risk preferences will play a role in the lab. We employ a lottery task similar to the one described in Brown and Stewart (1999) to control for this. Prior to undertaking the main reporting task, all subjects made a series of ten lottery choices between a risky option and a certain amount.<sup>17</sup> The point of switching from the certain option to the risky option provides a measure of risk

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<sup>17</sup> The lottery choices are in the experimental instructions in the Appendix.

preference. Specifically, switching after Game 5 indicates risk aversion, switching before Game 5 indicates risk loving, and switching exactly at Game 5 implies risk neutrality.

To control for the inherent tendency to be dishonest we used the matrix task devised by Mazar et al. (2008) however, in contrast to their experiment, we collect individual level data.<sup>18</sup> Subjects were given a sheet of 20 matrices, where each matrix contains 12 three-digit numbers (e.g. 5.34). The task was to find a pair of numbers in each matrix that add up exactly to 10.00. A sample matrix is shown in Figure 1. The task is made more difficult because not all of the matrices have solutions, of which subjects were made aware. Subjects were given five minutes to solve as many matrices as possible and were told that they would earn \$1 for each correctly solved matrix.

After the five minutes was over, subjects were instructed to count the number of correctly solved matrices and record this number on their collection slip.<sup>19</sup> We then collected the folded matrix sheets and placed them in a sealed envelope, emphasizing that we would not open the envelope until everyone had left the lab. On each desk, we had already placed a small envelope containing 20 \$1 coins, and subjects were instructed to pay themselves using this money. Afterwards they were told to put their completed collection slip with any remaining money in the small envelope, seal the envelope, and leave it on their desk.<sup>20</sup> Again, we emphasized that the envelope would not be collected until after everyone had left the lab.

We chose to do this part of the experiment manually to enhance credibility – specifically to convince subjects that their decisions were anonymous. We wanted to assure the subjects that we would not be deceiving them and checking up on them while they were

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<sup>18</sup> Mazar et al. (2008) only measure dishonesty at the group (or session) level as they do not collect subjects' matrix sheets.

<sup>19</sup> The collection slip read "I got \_\_\_\_\_ Boxes, which translates to \$ \_\_\_\_\_ (=\$1.00 per Box)".

<sup>20</sup> Both the collection slip and the matrix sheet had an ID number on it which allowed us to match their answers and the amount they paid themselves.

still in the lab. We thought this would be more believable to subjects than if the task was computerised and the data immediately accessible to us.<sup>21</sup> We hoped to measure a baseline level of the dishonesty for each individual from this task, where the probability of detection was effectively zero.

From previous results in the literature, we believed that \$1 per matrix would be sufficient (i.e. salient) to encourage cheating. In addition, as not all of the matrices had solutions, there was considerable scope for cheating even for top performers. The total incentive to cheat ranged from \$10, for anyone who solved all ten matrices that had solutions, to \$20 for someone who solved none.

Mazar et al. (2008) note several advantages of using this task to measure dishonesty. First, subjects consider that the outcome is predominantly effort related rather than IQ related. Second, subjects can readily evaluate their own performance – they know if they have the correct answer or not. This means that any dishonest gain can be reasonably interpreted as cheating, rather than as a genuine mistake. This control task therefore allows us to measure the degree and existence of dishonesty at an individual level, in a situation where there is no plausible way of being detected or punished. Subjects undertake a real effort task and they deal with real cash, improving the external validity of our design. While theory predicts that reporting behavior is invariant to our treatments, this measure may help us understand any differences we observe by identifying the types of people most affected.

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<sup>21</sup> This is also the reason why we did this task before the main reporting task as the participants may have been less likely to believe that they would not be checked up on if the control had followed the reporting task. In addition, we believed that experimenter demand effects could be stronger.

### 3. Results

Using the experimental design described in Section 2 we aim to consider the strength of different types of intrinsic motivations within the reporting task. Across the voluntary and compulsory treatments, the economic incentive to report is held constant, but differences in reporting could occur due to the explicit lie required with compulsory reporting or the crowding out of voluntary motivations to report.

We present our results in the next three subsections, beginning by describing the degree of dishonesty in the main reporting task and the control task. We then compare voluntary and compulsory reporting. Finally, we describe how accident prevention choices vary across enforcement regimes and treatments. Summary statistics for the variables discussed below are provided in Table 2a.

#### 3.1 Are individuals dishonest?

In the reporting task, we observe whether subjects reported an accident. Hence dishonesty in this task can be defined as the proportion of times an accident was not reported over 20 periods.<sup>22</sup> Only 15% of the accidents that occurred were reported, with 47% of the subjects never reporting an accident and only 4% of the subjects always reporting accidents.

In the control task, subjects are asked to pay themselves depending on how many of the 20 matrices they solved and leave the rest of the money in an envelope on the table. Given that subjects can readily determine their performance in this matrix task, we can interpret dishonesty as a situation in which subjects take more money than they are entitled to. On average subjects correctly solved 4.5 matrices during the five minutes, with only two

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<sup>22</sup> With voluntary reporting, failing to report an accident involves withholding of information, while with compulsory reporting an outright lie is required; hence, we can measure two different types of dishonesty.

able to solve all ten, and six solving none. The average dishonest gain was \$2.43, far below the maximum possible gain, which was \$15.48 on average and ranged from \$10 to \$20.<sup>23</sup>

We construct three related but distinct measures of dishonesty using the above interpretation. Our first measure is a binary indicator of dishonesty – i.e. do they take more money than they are entitled to? Using this variable, we find that 33% of the subjects were dishonest in the control task. That is, two-thirds of the subjects were willing to give up a gain of \$10 or more to be honest. The second measure is the magnitude of dishonesty, which is illustrated in Figure 2 where the size of the circles reflects the number of observations at each point. The larger circles along the diagonal show that most people are honest, with points above the diagonal representing subjects who took more than they had earned. Of the 33% who lie (38 subjects), 37% keep one dollar more than they should, 42% keep ten dollars or more than they should, and 18% of the subjects keep fifteen dollars or more. The figure also suggests that the dishonest were not just those who did poorly in the matrix task. The third measure is the percentage of maximum dishonest gain that is possible for each subject, given how many answers they get right in the task. We find that of those who are dishonest, 26% take the maximum amount possible.<sup>24</sup>

To measure the effectiveness of our control measure, we compared dishonesty in the control task with the frequency of self-reporting, finding that those who were dishonest in the control task reported less often in the reporting task (pairwise correlation;  $p$  value = 0.06). Investigating the correlation separately for the two types of reporting, we find that this

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<sup>23</sup> The maximum possible dishonest gain equals \$20 minus the number of correctly solved matrices.

<sup>24</sup> We also constructed a measure of false reporting by comparing the number of matrices each subject reported solving with the actual number correctly solved. Honest subjects always correctly reported. Of the 38 dishonest subjects, six correctly reported the number of matrices they solved (but still took more money) while the other 32 overstated this. Interestingly of these 32, 27 filed a report to match what they took. It is also interesting to note that the majority of the dishonest (74%) also falsified their matrix sheet by ticking extra “Got It” boxes to match what they reported. Note however, there were no consequences to false reporting in this task as the probability of detection was implied to be zero.

correlation is only significant in the voluntary treatment ( $p$  value = 0.02) but not in the compulsory treatment ( $p$  value = 0.65), providing some early indicators of treatment differences.

Responses to our survey questionnaire give an alternative measure of participation in dishonest behavior and attitudes to lying. As reported in Table 2b, around one-third of respondents indicated they have lied in an application at least once, and a similar number have lied when selling something. About one-quarter of respondents reported having driven with an excess blood alcohol level, while only 8% have knowingly lied on their income-tax return. With regards to attitudes to lying, about half of the subjects agreed (either slightly or strongly) that “there are no degrees of lying”, and about three-quarters indicated responsiveness to the monetary incentives associated with lying.<sup>25</sup> Correlations between these survey responses and the measures of dishonesty in the reporting and control tasks are reported in the final two columns of Table 2b. Attitudes towards lying show a significant correlation with behavior in the reporting task.

### **3.2 Does the proportion of reports submitted vary by treatment?**

Figure 3a shows that the proportion of individuals who report accidents over the 20 periods is higher in the compulsory treatment as compared to the voluntary treatment. This difference is highest in the middle periods: periods 16-25 (9% in voluntary and 20% in compulsory). Figure 3b shows the distribution of the proportion of reports by treatment. The graph shows the mass shifts to the right (i.e. more reporting) when reporting is compulsory. It is also worth noting that all of the five subjects who always reported were in the compulsory treatment. The average proportion of accidents reported (averaged across

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<sup>25</sup> In contrast, only around 20% of the subjects in Lundquist et al. (2009) believed there are no degrees of lying, and only 4% of these strongly agreed.

periods and individuals) in the compulsory treatment is double that for the voluntary treatment (20% versus 10%,  $p$  value: 0.09, using a non-parametric ranksum test). This difference is also higher for subjects who were dishonest in the theft task (5% versus 18%,  $p$  value = 0.005). For subjects who were not dishonest, there is no statistical difference in the proportion of reports across treatments though reporting is higher as a proportion of accidents in the compulsory treatment (13% versus 21%). By classifying subjects as honest and dishonest, the control task helps identify how each of these types would behave in different self-reporting regimes.

Table 3 reports estimates from a probit regression, which models the decision of the subject to report an accident. It accounts for individual specific heterogeneity by clustering standard errors at the subject level.<sup>26</sup> We present different specifications to examine if reporting of an accident can be explained by the treatment subjects are in, the period in which they make their decision, demographic characteristics, and control measures of risk preference and dishonesty in the theft task.<sup>27</sup> The coefficient for the treatment variable is always statistically significant, with subjects in the compulsory treatment having about a 10% higher probability of reporting accidents in all specifications.

In terms of demographics, older subjects have a higher probability of reporting, while those who answered more quiz questions correctly reported less often.<sup>28</sup> To control for the monetary incentive to report, across subjects, we include measures of the accident probability chosen, a measure of risk aversion, and the interaction between the two. Recall that the experimental parameters were set so that it was financially advantageous to *not* report, with the expected gain from *not* reporting equal to \$4.50. For risk averse subjects, the certainty

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<sup>26</sup> We also estimated random effects probit models for these specifications and the results are practically identical to the ones reported.

<sup>27</sup> Results from the lottery choice control task indicated that 77% of participants were risk averse, 9% risk neutral, and the remaining 15% risk lovers.

<sup>28</sup> As noted earlier, quiz questions were used to assess subjects' understanding of the experimental instructions.

equivalent of this gain from dishonesty decreases with their choice of accident probability and the degree of risk aversion. Nevertheless, as discussed in Section 2.2.2, this gain from dishonesty remains positive for all except the extremely risk averse who choose a low accident probability. Since the monetary incentive is for everyone to be dishonest, there should be no relationship between these variables and the probability of reporting, and the results in Table 5 are consistent with this.<sup>29</sup> Subjects who cheated by a larger magnitude in the control task, have a lower probability of reporting accidents, consistent with the correlations reported earlier.<sup>30</sup> Controlling for inherent dishonesty while significant, does not alter the main conclusion.

Overall, our results show that behavior is significantly different in the two treatments, with the propensity to report more in compulsory than in the voluntary treatment. We find this difference despite identical monetary incentives in the two treatments, indicating the important role of intrinsic incentives. We find that the lie aversion effect seems to be stronger than the crowding out of intrinsic motivation effect.

### 3.3 Additional Results

In this section, we examine whether individuals take less care to avoid an accident in the self-reporting regulatory regime than with conventional enforcement, and whether this differs by treatment. Recall that a common concern expressed over self-reporting regimes is the potential weakening of deterrence that results from lowering the penalty associated with an accident (i.e. because  $s < rf$ ). As explained above, in our experiment we set  $s > rf$  to

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<sup>29</sup> Using a continuous measure of risk preference yields similar results. Including separate dummy variables for each level of ProbChoice and interacting these with Risk Averse showed that those choosing an accident probability of 40% (i.e. ProbChoice=4) had a 9% lower probability of reporting an accident, but other results remain unchanged. It is likely that subjects who have already paid a moderate amount to avoid an accident may feel that having an accident was unfair and may feel entitled to not report it. Note that the lowest accident probability (20%) was only rarely chosen.

<sup>30</sup> Alternative definitions of dishonesty, for example, the percentage of maximum dishonest gain or a binary measure of dishonesty, give similar results.

introduce a conflict between the monetary and moral incentives for self-reporting. Therefore, deterrence should not be weakened, but may instead be strengthened if subjects opt for self-reporting.<sup>31</sup>

To examine this issue we explore subjects' choice of probability of accident in the reporting task, i.e., do they pay less to avoid an accident in a self-reporting regime than in the conventional enforcement regime. In each session, in the first 10 periods, subjects make decisions under the conventional enforcement rules. We find that the average choice of accident probability is lower in the conventional enforcement periods than in the self-reporting periods (p value = 0.07, using a sign rank test). A closer inspection of the five options reveals that option 1, which is associated with a 100% accident probability, was chosen significantly more often in the self-reporting periods (33% versus 23%, significant using a ranksum test, p value: 0.000). The option with the highest care and hence the lowest accident probability (option 5) was chosen significantly less often in the self-reporting treatment (0.78% versus 2.43%, p value: 0.000). The options in the middle were not statistically different across the self-reporting and the conventional enforcement regimes. These results suggest that, contrary to the economic incentives, introducing self-reporting actually weakened deterrence.<sup>32</sup> This somewhat puzzling finding could have significant implications for regulators, as it suggests that self-reporting may affect behaviour in a way that goes beyond changes in the economic incentives.<sup>33</sup>

It is interesting to examine if individuals choose different levels of care (i.e., do they pay less to avoid an accident) across the voluntary and compulsory reporting treatments.

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<sup>31</sup> As noted in Section 2.2.2, the optimal risk neutral accident probability choice was 80% with conventional enforcement or if they intend to not report (lie or withhold); compared with 60% if they plan to self-report.

<sup>32</sup> An ordered probit regression on the probability of accident chosen by individuals over time corroborates the findings above with the coefficient on the dummy for the Conventional Enforcement regime positive and statistically significant. These results are not reported in the paper to save space.

<sup>33</sup> The self-reporting periods always followed the conventional enforcement periods, hence order effects may explain the lower deterrence in the self-reporting periods. This is a worthy topic for further study.

Since compulsory reporting leads to greater reporting of accidents, it should also lead to greater care being taken. Figure 4 presents the five options individuals choose from in the two treatments, averaged over periods. We observe that in the compulsory treatment, options 2 (accident probability=80%) and 3 (accident probability =60%) were chosen more often than in the voluntary treatment, while options 1 (accident probability=100%) and 4 (accident probability =40%) were selected less often. Except for the change in option 3, these all reflect significant changes ( $p$  values  $< 0.02$ , rank sum test). Overall, these suggest a tendency away from the extreme left of the distribution when we shift from voluntary to compulsory reporting. When we average across all five of the options, we find that the average level of care chosen in the compulsory treatment is marginally higher than the average level chosen in the voluntary treatment (2.32 versus 2.27).<sup>34</sup>

Our results provide evidence that self-reporting schemes can lead individuals to choose higher accident probabilities and within self-reporting, voluntary reporting can create incentives for individuals to exert less care. These need to be considered in field implementations of these regulatory policies.

#### 4. Discussion

We can draw four results from our experiment. First, regarding the incidence of dishonesty in self-reporting, we found that nearly everyone was dishonest at some point during the reporting task. This is most striking in the compulsory treatment, where not reporting an accident required an outright lie. Only five subjects (4%) always reported an accident in this treatment. Second, we found that reporting occurred significantly more often

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<sup>34</sup> To examine this further, we estimate ordered probit models, where the dependent variable is the probability of choosing options 1 to 5. The estimates are consistent with the non-parametric results such that in the compulsory treatment, subjects choose higher levels of care, but this is not statistically significant. These results are not reported in the paper to save space.

in the compulsory reporting regime than with voluntary reporting, a result that is contrary to theoretical predictions. This implies that the aversion to lying effect dominates the crowding out of intrinsic motivation to voluntarily report. Third, the control task results suggest that those who were most affected by the compulsory treatment were those with low inherent motivations for honesty where the aversion to telling an outright lie caused a number of those who were dishonest in the theft task to report accidents. The behavior of those who were honest in the theft task is invariant to self-reporting regimes. Fourth, the introduction of self-reporting, and in particular voluntary self-reporting, appears to lessen the incentive for accident prevention.

We conjectured two intrinsic factors that might lead to a difference between reporting of accidents between the voluntary and compulsory regimes. First, we conjectured that compulsory reporting might create a crowding out effect: i.e., crowd out the intrinsic incentive to report that may exist in the voluntary reporting case, resulting in fewer reports of violations in the compulsory case than in the voluntary case. Second, we conjectured that the aversion to lying would work in the opposite direction, with subjects being less willing to tell overt lies, and so reporting would be more frequent in the compulsory case. For example, Hurkens and Kartik (2009) found that people were less willing to tell “big” and “solemn” lies. Our results found that the aversion to lying effect was stronger than the crowding out effect.

An explanation for the aversion to lying effect can be found in the model of Mazar and Ariely (2006), who propose a non-monotonic relationship between economic incentives and dishonesty, resulting from an individuals’ need to maintain their self-concept as an honest person. They argue that small acts of dishonesty are easier to justify to oneself, generating an “activation threshold” level of dishonesty, below which the intrinsic rewards for honesty are not triggered and where dishonesty increases with economic incentives.

However, once the threshold level is reached, dishonesty becomes unresponsive to changes in economic rewards, until these rewards become sufficiently large to overwhelm intrinsic rewards, and once again, dishonesty increases with economic rewards. Mazar and Ariely (2006) argue that drawing attention to moral standards may lower the “activation threshold” for intrinsic rewards, making it harder to justify dishonesty to oneself. Applying this to our results might explain why dishonesty is prevalent in the reporting task because it seems easier to justify to oneself a reporting mistake than outright stealing of money. Further, compulsory reporting makes lying harder to justify because, like a moral code, it draws attention to what you are doing.

A final explanation is related to status quo bias and the use of default options (Thaler and Sunstein, 2009). In both treatments, following an accident subjects had to select one of two options. However, with voluntary reporting subjects may interpret “not reporting” as the implicit default option and this potential inertia could lead to less reports being filed in the case of voluntary reporting.

## **5. Conclusion**

Self-reporting initiatives are often promoted as the way forward for cash strapped enforcement agencies. Our results however suggest they are not a panacea and that careful design is required to achieve satisfactory regulatory outcomes. This design should pay attention to not only the financial incentives for disclosure but also details of the reporting regime. Our findings imply that given the right circumstances, almost everyone is prone to dishonesty and regulators should design enforcement regimes with this in mind. In our experiment, participants were willing to be dishonest, which in the case of compulsory reporting required an outright lie, for a relatively small monetary gain. In the experiment, dishonesty was at “arm’s length” from the money being exchanged. Nevertheless, this is the

case for most “white collar” crimes, including regulatory compliance and filing false insurance claims. Recent moves to increased computerization of reporting systems (e.g. the EPA’s electronic reporting initiatives) only heighten these concerns.

As dishonesty is influenced by both the context and incentives in place, it suggests ways forward for enforcement agencies beyond simply increasing enforcement efforts. In particular, regulators should be cautious in using voluntary reporting instead of compulsory reporting, and this is even more so because those whose behavior changed the most with compulsory reporting were those who had been dishonest in the theft task, i.e. the compulsory regime led dishonest people to be more truthful and report accidents more often. Anecdotally, the observation that compliance rates are considerably higher for major water dischargers than for toxic and hazardous waste regulation (Magat and Viscusi, 1990) is consistent with our conjecture, with the latter involving only voluntary reporting. More recently, Pfaff and Sanchiriro (2004) found that only relatively inconsequential violations are reported under the EPA’s audit policy (which uses voluntary reporting), compared with those uncovered with traditional enforcement procedures, and suggest that these could be “red herrings” to distract the agency from more substantial undisclosed violations.

The effect of self-reporting on preventative actions is unclear but of primary importance given the prevalence of self-reporting initiatives. Our results suggest that the use of self-reporting can have unexpected effects, and points to future work in this area.

**Table 1: Production Task Choices**

| Probability of Accident | Trading Profit |
|-------------------------|----------------|
| 100%                    | 27.50          |
| 80%                     | 26.31          |
| 60%                     | 24.51          |
| 40%                     | 21.45          |
| 20%                     | 15.03          |

**Table 2a: Summary Statistics**

| <b>Variable</b>                          | <b>Task</b> | <b>Description</b>                                             | <b>Mean</b> | <b>Std Dev</b> | <b>Min</b> | <b>Max</b> |
|------------------------------------------|-------------|----------------------------------------------------------------|-------------|----------------|------------|------------|
| <i>Risk Averse</i>                       | Lottery     | Switch to risky lottery after decision 5                       | 0.77        | 0.42           | 0          | 1          |
| <i>Correct Matrices</i>                  | Theft       | Number of correctly solved matrices                            | 4.52        | 2.56           | 0          | 10         |
| <i>Dishonest</i>                         | Theft       | Was subject dishonest or not                                   | 0.33        | 0.47           | 0          | 1          |
| <i>Magnitude Theft Dishonesty</i>        | Theft       | Amount of extra money subjects keep                            | 2.43        | 5.10           | 0          | 19         |
| <i>Maximum Possible Theft Dishonesty</i> | Theft       | Maximum dishonest gain possible                                | 15.48       | 2.56           | 10         | 20         |
| <i>% Max Dishonest</i>                   | Theft       | Actual dishonest gain as % of maximum possible                 | 0.15        | 0.32           | 0          | 1          |
| <i>Period</i>                            | Reporting   | Period of the reporting task                                   | 15.5        | 8.66           | 1          | 30         |
| <i>Compulsory</i>                        | Reporting   | Whether subject was in compulsory treatment                    | 0.49        | 0.50           | 0          | 1          |
| <i>Accident</i>                          | Reporting   | Whether or not an accident occurred in a particular period     | 0.74        | 0.44           | 0          | 1          |
| <i>Report</i>                            | Reporting   | Whether an accident was reported or not in a particular period | 0.15        | 0.36           | 0          | 1          |
| <i>Proportion of accidents reported</i>  | Reporting   | Proportion of accidents that were reported                     | 0.15        | 0.24           | 0          | 1          |
| <i>ProbChoice</i>                        | Reporting   | Accident probability option chosen (over 30 periods)           | 2.35        | 1.10           | 1          | 5          |
| <i>ProbChoice100</i>                     | Reporting   | Chose 100% accident probability (over 30 periods)              | 0.30        | 0.46           | 0          | 1          |
| <i>ProbChoice80</i>                      | Reporting   | Chose 80% accident probability (over 30 periods)               | 0.22        | 0.41           | 0          | 1          |
| <i>ProbChoice60</i>                      | Reporting   | Chose 60% accident probability (over 30 periods)               | 0.31        | 0.46           | 0          | 1          |
| <i>ProbChoice40</i>                      | Reporting   | Chose 40% accident probability (over 30 periods)               | 0.15        | 0.36           | 0          | 1          |
| <i>ProbChoice20</i>                      | Reporting   | Chose 20% accident probability (over 30 periods)               | 0.01        | 0.12           | 0          | 1          |
| <i>Number correct quiz answers</i>       | Reporting   |                                                                | 7.17        | 1.09           | 2          | 8          |
| <i>Total earnings</i>                    | n/a         | Over all tasks                                                 | 42.87       | 6.71           | 26.30      | 59.50      |
| <i>Male</i>                              | n/a         |                                                                | 0.61        | 0.49           | 0          | 1          |
| <i>Business or Economics Major</i>       | n/a         |                                                                | 0.60        | 0.49           | 0          | 1          |
| <i>Age</i>                               | n/a         |                                                                | 19.45       | 2.35           | 17         | 33         |
| <i>Born in Australia or NZ</i>           | n/a         |                                                                | 0.50        | 0.50           | 0          | 1          |

**Table 2b: Responses to the Survey Questions**

| Question                                                                                                                                        | Response Scale    |                   |                    |                   | Correlation with Extra Money Taken | Correlation with Prop. of Accidents Reported |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|-------------------|------------------------------------|----------------------------------------------|
|                                                                                                                                                 | Strongly Disagree | Slightly Disagree | Slightly Agree     | Strongly Agree    |                                    |                                              |
| I am more inclined to lie, the more I have to gain from the lie.                                                                                | 18%               | 20%               | 39%                | 23%               | 0.30***                            | -0.38***                                     |
| I am less inclined to lie, the greater the risk of discovery                                                                                    | 10                | 12                | 37                 | 40                | 0.11                               | -0.19**                                      |
| You either lie or you don't, there are no degrees of lying                                                                                      | 23                | 23                | 23                 | 30                | -0.04                              | 0.19**                                       |
|                                                                                                                                                 | <b>Never</b>      | <b>Once</b>       | <b>A Few Times</b> | <b>Many Times</b> |                                    |                                              |
| Have you ever lied in an application – in writing or in an interview – for example when applying for work, membership, school, or scholarships? | 67%               | 14%               | 17%                | 2%                | -0.01                              | -0.15                                        |
| Have you ever lied when selling something?                                                                                                      | 66%               | 7%                | 21%                | 6%                | 0.04                               | -0.14                                        |
| Have you ever consciously reported false information in your income-tax return?                                                                 | 93%               | 3%                | 3%                 | 2%                | 0.10                               | -0.11                                        |
| How many times have you received a speeding ticket?                                                                                             | 85%               | 11%               | 2%                 | 2%                | 0.07                               | 0.04                                         |
| How many times have you driven when you believe your blood alcohol content exceeded the legal limit?                                            | 75%               | 14%               | 10%                | 1%                | 0.13                               | 0.04                                         |

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 3: Probit Model of Reporting an Accident**

|                                              | (1)           | (2)           | (3)           |
|----------------------------------------------|---------------|---------------|---------------|
|                                              | <i>Report</i> | <i>Report</i> | <i>Report</i> |
| <i>Period</i>                                | -0.003**      | -0.004***     | -0.004***     |
|                                              | (0.001)       | (0.001)       | (0.001)       |
|                                              |               |               |               |
| <i>Compulsory treatment</i>                  | 0.096**       | 0.089**       | 0.081**       |
|                                              | (0.045)       | (0.043)       | (0.037)       |
|                                              |               |               |               |
| <i>(Accident) Probability Choice</i>         |               | -0.016        | -0.019        |
|                                              |               | (0.024)       | (0.028)       |
|                                              |               |               |               |
| <i>Risk averse</i>                           |               | 0.027         | 0.026         |
|                                              |               | (0.069)       | (0.071)       |
|                                              |               |               |               |
| <i>Prob Choice * Risk averse</i>             |               | -0.014        | -0.007        |
|                                              |               | (0.030)       | (0.032)       |
|                                              |               |               |               |
| <i>Magnitude of dishonesty in theft task</i> |               | -0.010*       | -0.010*       |
|                                              |               | (0.005)       | (0.005)       |
|                                              |               |               |               |
| <i>Male</i>                                  |               |               | 0.018         |
|                                              |               |               | (0.038)       |
|                                              |               |               |               |
| <i>Age</i>                                   |               |               | 0.025***      |
|                                              |               |               | (0.008)       |
|                                              |               |               |               |
| <i>Business or Economics Major</i>           |               |               | 0.042         |
|                                              |               |               | (0.035)       |
|                                              |               |               |               |
| <i>Born in Australia or NZ</i>               |               |               | 0.070         |
|                                              |               |               | (0.047)       |
|                                              |               |               |               |
| <i>Number correct quiz answers</i>           |               |               | -0.060***     |
|                                              |               |               | (0.015)       |
|                                              |               |               |               |
| <i>N</i>                                     | 1915          | 1915          | 1915          |
| <i>Prob &gt; Chi-squared<sup>a</sup></i>     | 0.0103        | 0.0007        | 0.0000        |

Marginal effects reported in the table; robust (clustered) standard errors in parentheses.

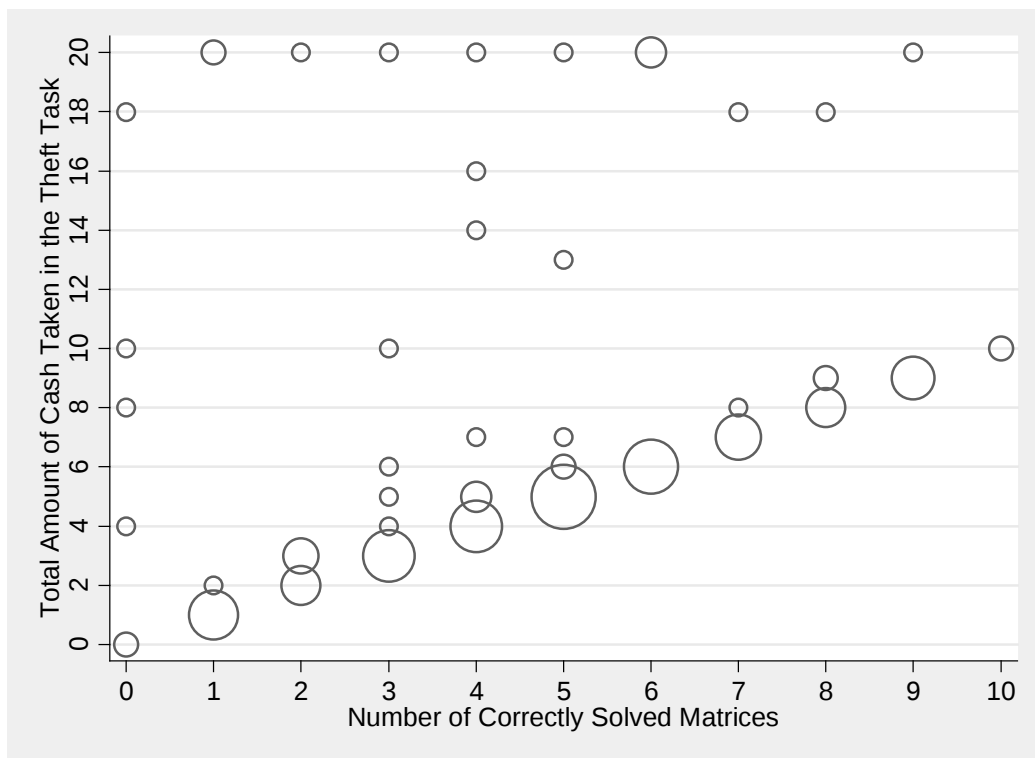
\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

<sup>a</sup> Result of Wald test of model significance.

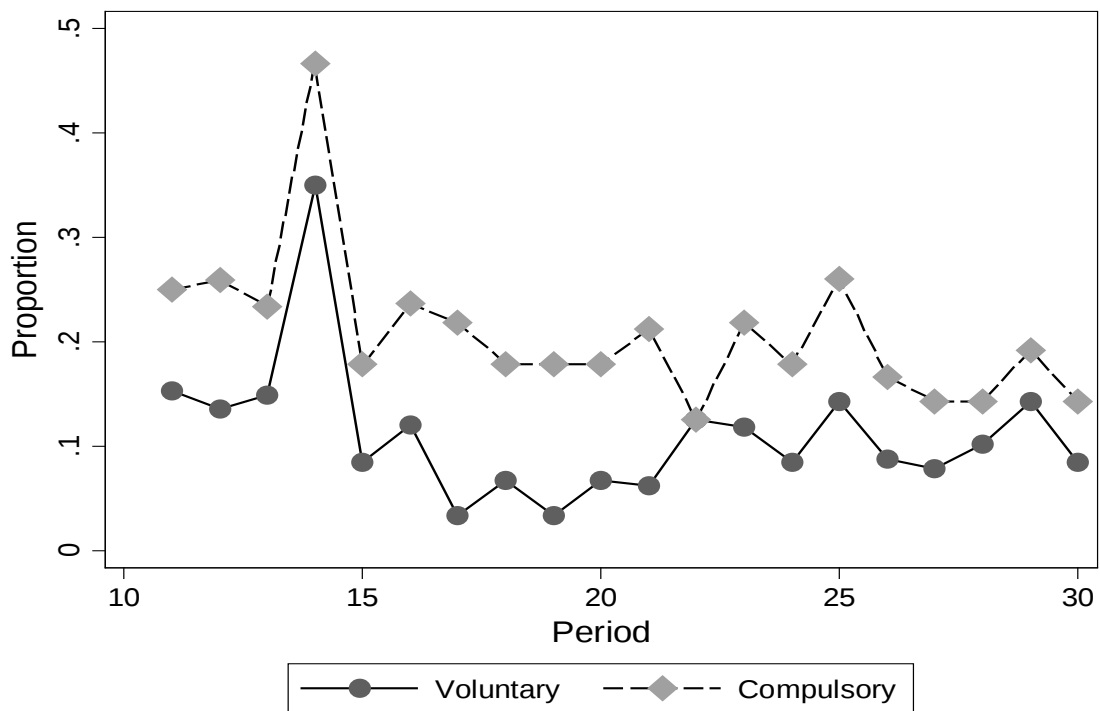
**Figure 1: Sample Matrix**

|      |      |      |
|------|------|------|
| 3.91 | 0.82 | 3.75 |
| 1.11 | 1.69 | 7.94 |
| 3.28 | 2.52 | 6.25 |
| 9.81 | 6.09 | 2.46 |

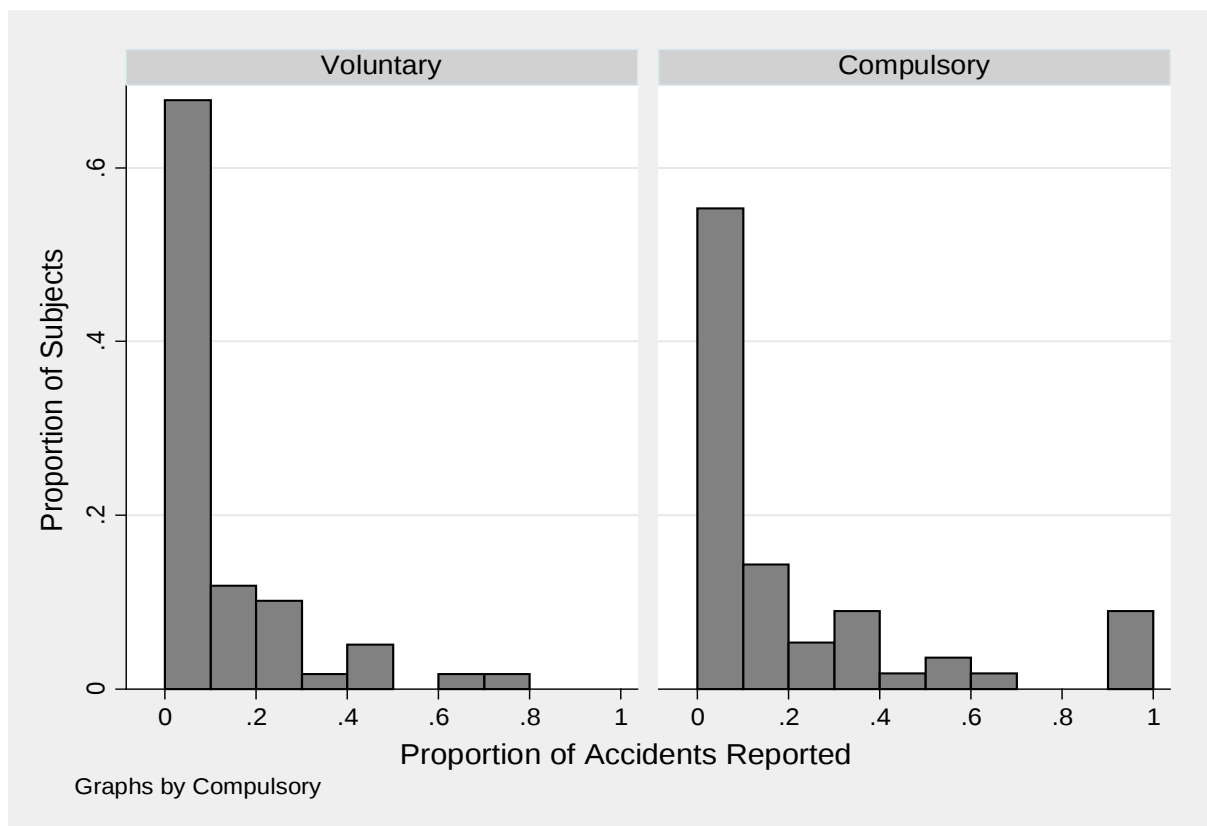
**Figure 2: Distribution of Magnitude of Dishonesty in the Theft Task**



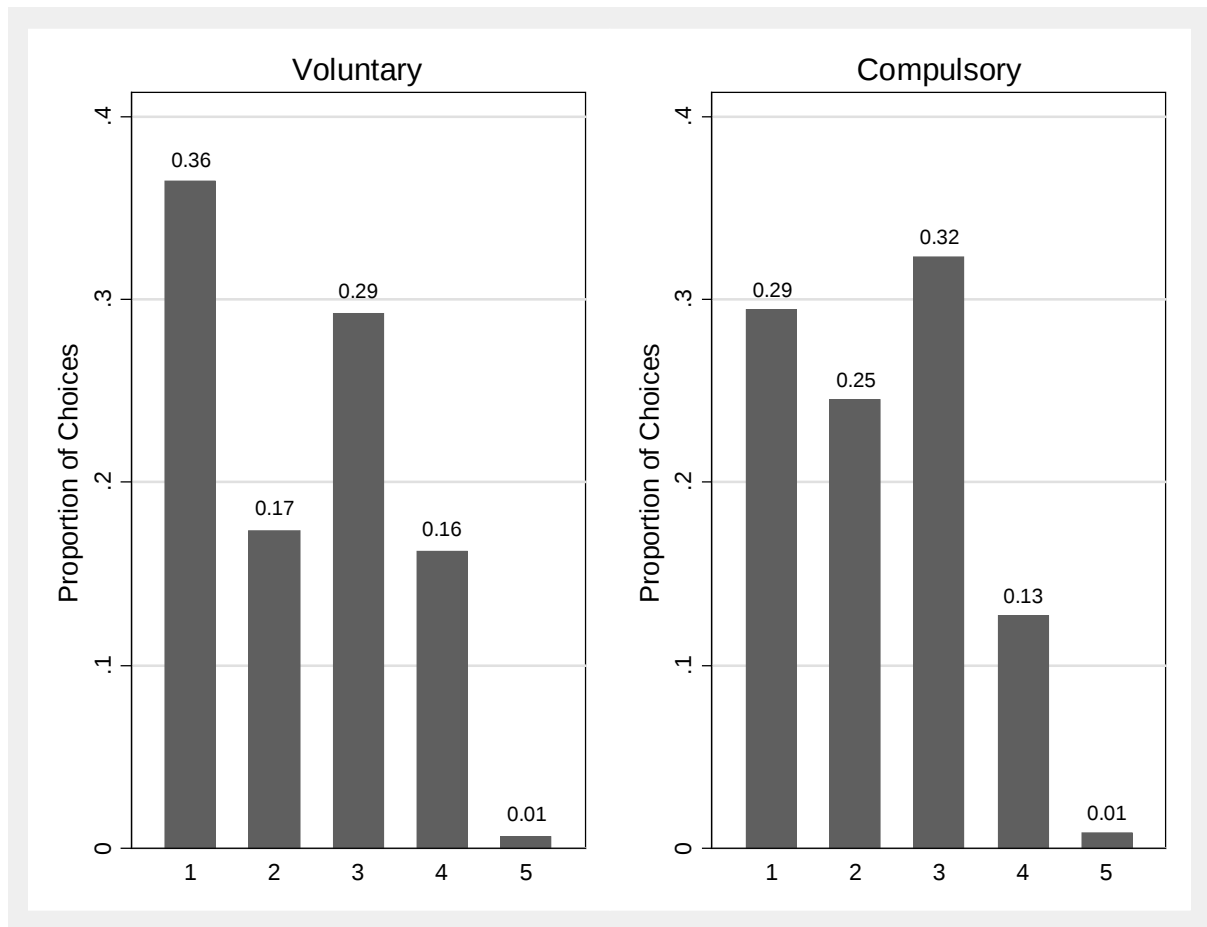
**Figure 3a: Proportion of Individuals who Reported Accidents across Treatments**



**Figure 3b: Distribution of the Proportion of Accidents Reported by Treatment**



**Figure 4: Choice of Probability of Accidents across Treatments**



1: Accident probability = 100%; 2: Accident probability = 80%; 3: Accident probability = 60%; 4: Accident probability = 40%; 5: Accident probability = 20%

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## Appendix: Experimental Instructions

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Thank you for agreeing to take part in this study. Please read the following instructions carefully. A clear understanding of the instructions will help you make better decisions and increase your earnings.

The instructions which we have distributed to you are for your private information. Please do not communicate with the other participants during the experiment. Should you have any questions please ask us. Although there are many people participating in today's experiment, everyone is working independently. This means that your earnings are based entirely on your decisions and what others do has no effect on you.

At the end of the experiment we will give every participant 5 Australian Dollars in addition to the money that you will make in the experiment. You will participate in a number of tasks in this experiment and you will get information about each of these tasks one by one. Each task is independent and the decisions that you make in one task have no impact on your earnings in the other tasks.

**All decisions that you make today are recorded only by an anonymous subject number and will only be used for research purposes. Your decisions will remain completely anonymous.**

## Task 1: Lottery Game

In this task, you will be asked to make a choice between two options - Option A or Option B – 10 times. The options differ in the following way:

OPTION A: pays \$7 in cash always.

OPTION B: has two possible payoffs, HIGH payoff = \$12 or LOW payoff = \$2

Whether Option B pays the HIGH or LOW payoff will be randomly determined in the following way:

At the end of the entire experiment, the experimenter will throw a ten-sided dice in front of you. The sides are numbered from 1 to 10 (the “0” face of the dice will serve as 10). If the number on the dice is associated with a HIGH payoff, then the payoff is \$12. If it is associated with the LOW payoff, then the payoff is \$2.

For example, you might be shown the following two options:

|                                                         |                                                                                       |
|---------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>OPTION A</p> <p>\$7</p> <p>If the dice is 1 - 10</p> | <p>OPTION B</p> <p>\$2 - if the dice is 1 - 7</p> <p>\$12 - if the dice is 8 - 10</p> |
|---------------------------------------------------------|---------------------------------------------------------------------------------------|

In the above example, choosing OPTION A pays you \$7.00 no matter what the dice roll is. Choosing OPTION B will pay \$2.00 if the number rolled is 1, 2, 3, 4, 5, 6 or 7, and \$12.00 if the number rolled is 8, 9, or 10.

### Actual Earnings in Task 1

This experiment will begin with your making choices between Option A and Option B on 10 different games (numbered Game 1 to Game 10, see the figure on the following page). Even though you will be asked to make a choice between Option A and Option B for 10 different games, your actual earnings in Task 1 will depend on your choice in only ONE of those games. At the end of the entire experiment the actual game that is played will be determined by rolling a ten-sided dice. The number rolled will be announced and then the dice will be rolled a second time to determine whether the payoff from Option B is HIGH or LOW.

For instance suppose the first time the experimenter rolls a dice, the number 5 comes up. This means that Game 5 will be used to determine your earnings for Task 1.

Next the experimenter will roll the dice again. If you chose Option A you will get \$7. If you chose Option B and the dice roll turns out to be 1,2,3,4 or 5 then you earn \$2 while if the dice roll turns out to be 6,7,8,9 or 10 then you get \$12.

Are there any questions?

Please proceed to Task 1.

In each of the 10 games below, please choose either Option A or Option B

|         |                                                   |                                                                                 |                                                                  |
|---------|---------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------|
| Game 1  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 9<br/>\$12 - if the dice is 10</p>     | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 2  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 8<br/>\$12 - if the dice is 9 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 3  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 7<br/>\$12 - if the dice is 8 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 4  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 6<br/>\$12 - if the dice is 7 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 5  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 5<br/>\$12 - if the dice is 6 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 6  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 4<br/>\$12 - if the dice is 5 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 7  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 3<br/>\$12 - if the dice is 4 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 8  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1 - 2<br/>\$12 - if the dice is 3 - 10</p> | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 9  | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 - if the dice is 1<br/>\$12 - if the dice is 2 - 10</p>     | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |
| Game 10 | <p>OPTION A<br/>\$7<br/>If the dice is 1 - 10</p> | <p>OPTION B<br/>\$2 -<br/>\$12 - if the dice is 1 - 10</p>                      | <input type="radio"/> OPTION A<br><input type="radio"/> OPTION B |

Full-screen Snip

Once you have made all 10 choices please click on the OK button

OK

## Task 2: Instructions

**Please do not open the envelope. Wait for experimenter instructions!**

In the large envelope on your desk you will find a sheet with 20 matrices like the one below:

| Example |      |      |
|---------|------|------|
| 3.91    | 0.82 | 3.75 |
| 1.11    | 1.69 | 7.94 |
| 3.28    | 2.52 | 6.25 |
| 9.81    | 6.09 | 2.46 |

In each matrix you should look for a unique set of numbers that **sum up exactly to 10**. In some matrices you may not have a solution.

When you find a set, circle the numbers, and mark the corresponding 'Got It' Box below, as in the example below:

| Example                                    |      |      |
|--------------------------------------------|------|------|
| 3.91                                       | 0.82 | 3.75 |
| 1.11                                       | 1.69 | 7.94 |
| 3.28                                       | 2.52 | 6.25 |
| 9.81                                       | 6.09 | 2.46 |
| Got it <input checked="" type="checkbox"/> |      |      |

For each matrix you solve, you will receive **\$1.00**. You have **5 minutes** for this task.

Once 5 minutes are up you have to do the following:

1. Count the number of correctly solved matrices and write down the number of correctly solved matrices on the green collection slip.
2. Fold your matrix sheet and place it in the envelope that we are going to bring to you. This envelope will remain sealed until after all participants have left the lab.
3. On your desk you will find a small envelope containing 20 \$1 coins. Now pay yourself with the money provided in the small envelope on your desk.
4. Fold the collection slip and put it into the envelope with the leftover money, seal the envelope, and leave it on the table. This will only be collected at the end of the experiment after all the subjects have left the lab.

**All decisions that you make today are recorded only by an anonymous subject number and will only be used for research purposes. Your decisions will remain completely anonymous.**

## Task 3: Production Decision

In Task 3, you will make production decisions in 30 periods. This task has 2 parts and part 1 has 10 periods and part 2 has 20 periods. At the end of today's experiment we will randomly choose one of these periods using a bingo cage which contains balls numbered 1 to 30. You will receive your earnings from that chosen period.

### Instructions for Part 1:

In this task you are responsible for making a production decision. When you produce, there is a chance that an accident will occur. Your production decision directly affects the probability of an accident. Reducing the probability of an accident is costly and will reduce your production earnings. Similarly increasing the probability of an accident will increase your production earnings.

You will receive your production earnings regardless of whether an accident occurs. However there is a chance that you will be inspected. If you are inspected and if an accident occurred, then you will incur a fine. The probability that you will be inspected is 50% and if an accident has occurred then you have to pay a fine of \$15.

The table below shows you the relationship between the probability of an accident and your production earnings. For example if you choose the probability of an accident to be 40%, then your production earnings are equal to \$21.45. If an accident occurs and you are inspected, you would have to pay a fine of \$15. Your earnings in this case would be  $\$21.45 - \$15.00 = \$6.45$ . This occurs 20% of the time ( $0.4 \times 0.5 = 20\%$ ). In the remaining 80% of the cases you would earn \$21.45.

**Production decision**

Please choose one of the following options:

- ☐ 100% accident probability and production earnings of \$27.50
- ☐ 80% accident probability and production earnings of \$26.30
- ☐ 60% accident probability and production earnings of \$24.50
- ☐ 40% accident probability and production earnings of \$21.45
- ☐ 20% accident probability and production earnings of \$15.05

You will pay a fine of \$15 if an accident occurs and if you are inspected. Otherwise you will not pay a fine and you will earn \$21.45.

Whether or not you have an accident will be determined by the computer in accordance with your chosen accident probability and is independent across periods. This means that whether or not you have an accident this period is not affected by what happened last period. Similarly whether you are inspected or not is also determined by the computer and is not affected by previous inspection outcomes.

You will participate in 2 practise periods before the actual task begins. The earnings that you obtain in the practice periods will not count towards your final earnings. The practice periods are intended to help you understand how to make your decisions in this task. We will also ask you to answer some questions to check your understanding of the instructions.

### Instructions for Part 2: [voluntary treatment]

In this part 2, you will make the same production decision as in Part 1. In addition, you have an option to report whether an accident has occurred or not (see an example below). If you report that you had an accident, you will pay a self reporting fine of \$12. If you do not submit a report, you will be inspected with 50% probability and fined \$15 if an accident did occur.

You chose: 100% accident probability, which gives you \$27.50 in production earnings.

You DID have an accident.

Would you like to report the accident? ☐ Yes  
☐ No

You will participate in 2 practise periods before the actual task begins. The earnings that you obtain in the practice periods will not count towards your final earnings. The practice periods are intended to help you understand how to make your decisions in this task. We will also ask you to answer some questions to check your understanding of the instructions.

### Instructions for Part 2: [compulsory treatment]

In this part 2 you will make the same production decision as in Part 1. In addition, you will be asked to fill in a report about whether an accident has occurred or not (see an example below). If you report that you had an accident, you will pay a self reporting fine of \$12. If you report that you have not had an accident, you will be inspected with 50% probability and fined \$15 if an accident did occur.

You chose: 100% accident probability, which gives you \$27.50 in production earnings.

You DID have an accident.

You will need to fill out a report. What would you like to say in the report? ☐ I HAD an accident  
☐ I DID NOT have an accident

You will participate in 2 practise periods before the actual task begins. The earnings that you obtain in the practice periods will not count towards your final earnings. The practice periods are intended to help you understand how to make your decisions in this task. We will also ask you to answer some questions to check your understanding of the instructions.