Taxpayers' behavioural responses to changes in audits and penalties: The case of South Africa

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Abstract

Tax revenue is a major source of public revenue in South Africa, and it plays an integral role in creating the fiscal space to provide public services and infrastructural development. Tax collection is however impeded by evasion. In its 2014 interim report, the Davis Tax Committee suggested that South Africa loses a substantial amount of revenue through evasion. To enhance compliance, the government has made several changes to existing tax penalty structures, and introduced new ones as well. The question arises whether these deterrence measures effectively reduce evasion. International empirical evidence on the efficacy of such policies are mixed, and are mainly drawn from developed country applications. Hence, evidence from developing countries are limited, particularly also for South Africa.

This study employs a conventional laboratory experiment to examine taxpayers' behavioural responses to changes in audits and penalties as deterrent measures to non-compliance. Our results indicate that the effect of high penalty rates is not significantly different from the effect of low penalty rates. We also find that threats for higher audit rates increase compliance, and the impact is higher on non-salaried income. A taxpayer complies even more when he/ she was audited in the preceding tax year. These results suggest that the effectiveness of the deterrence policy is highly dependent on the frequency of audits and the tax authority's ability to detect underreporting.

Keywords: deterrence, experiments, penalties, compliance, evasion

JEL Codes: C91, H26

1. Introduction

Tax evasion is practised in a number of ways, and taxpayers are always finding new ways to reduce their tax liabilities (Tanzi & Shome, 1993: 809). Nevertheless, opportunities for evasion vary. For instance, direct taxes are associated with higher evasion than with indirect taxes (see Whicker & White, 2015). Evasion also varies with the mode of reporting or the type of income. It is generally easier to evade on self-reported income than on income that is withheld at the source. In South Africa for instance, the largest share (about 99%) of the Personal Income Tax (PIT) gap comes from self-reporting taxpayers.

Tax evasion has a number of effects. Evasion may distort the equity structure (both horizontal and vertical) of the tax system as taxpayers. It also deprives governments of their potential revenue, and hence crippling efforts to fulfil fiscal obligations. Government's failure to meet its fiscal commitments cause citizens to develop some discontentment with the public sector, which may create anarchy. At times governments increase tax rates or introduce more taxes to fill-in the revenue gap arising from evasion. Such a move may create some inefficiencies in the tax system as it increases the tax burden on honest taxpayers, which may incentivise or force them to evade too (Tanzi & Shome, 1993: 810). Further, tax evasion has an impact on the market framework. More precisely, it would be impossible to have a pure market economy when other economic agents (e.g. sellers) are dodging taxes. Sellers who do not pay outcompete those who do. Concisely, tax evasion has serious implications for economic performance.

In an endeavour to dissuade taxpayers from evading, governments use a number of measures. These measures are broadly categorised into two, the deterrence (audits, financial penalties and incarceration) and non-deterrence. Nevertheless, most governments are biased towards the former. The deterrence approach (commonly referred to as the traditional approach) requires the tax authority to be able to detect evasion, and severely punish those detected. More precisely, this approach is anchored on the notion that stringent enforcement measures produce high compliance levels.

The aggressiveness of enforcement mechanism varies across countries; and South Africa is one of the countries with a strict penalty regime (Cummings, Martinez-Vazquez, McKee & Torgler, 2009: 449). To enhance compliance, the government has made several changes to existing tax penalty structures, and introduced new ones as well. The question arises whether these deterrence measures effectively reduce evasion. International empirical evidence on the efficacy of such policies are mixed, and are also mainly drawn from developed country

applications. Hence, evidence from developing countries are limited, particularly also for South Africa. Furthermore, considering that self-reporting and third-party reporting exhibit different compliance rates, it is essential to understand how deterrence measures influence compliance in respect of these reporting mechanisms; more particularly from a developing country perspective.

In light of the foregoing discussion, this study employs a laboratory experiment to examine taxpayers' behavioural responses to changes in audits and penalties as deterrent measures to non-compliance, taking into account both aspects of personal income tax reporting (i.e. self and third-party reporting). An experimental setting provides flexibility to vary variables individually while allowing for replication, thereby generating data that are more reliable. Importantly, unlike previous studies, this study disaggregates the effects of deterrent factors on voluntary and enforced compliance, and by type of income (salaried and non-salaried income). This empirical exercise can contribute to tax policy design on the use of audits and penalties to increase tax compliance.

2. PIT enforcement mechanism in South Africa

2.1 PIT reporting mechanisms

South Africa, like many other countries, has a dual tax reporting system; self-assessment and withholding tax system. Salaried income tax is withheld at the source, i.e. it is paid to the tax authority by the employer. After the tax on remuneration income is paid, the employer issues the employee with the tax certificate, which is a summary of earnings and deductions (or payable income) reported to a tax authority. The tax certificate serves as proof to the employee that his/ her tax due has been paid. If the employee is not in agreement with the contents of the tax certificate, or if there are refunds to be claimed, he/ she directly engages the tax authority by submitting a tax return (SARS, 2016: 7). Thus, an employee will be able to 'assess' declarations made on his/ her behalf by the employer; making it difficult to evade. To evade, employees and employers would need to connive. However, due to red tape, connivance is generally not easy, more especially in formal and/ or large enterprises (Alm & Soled, 2016: 22). Further, due to the presence of paper trail, under- or non-declaration of salaried income is easily detectable through an audit by the tax authority (see Paulus, 2015). Concisely, it is not easy to evade on income that is declared through third-party reporting.

Unlike salaried income, non-salaried income (e.g. self-employed income, rental income, etc.) is reported through self-assessment, a mechanism whereby a taxpayer is tasked to make an own assessment of the tax liability and submit the same to the tax authority. This tax reporting approach provides the taxpayer with more control and responsibility over his/ her tax affairs. However, considering that a taxpayer determines his/ her tax liability, and that he/ she has some 'significant control' over his/ her financial records it is relatively easy to reduce one's tax liability through manipulating figures. In some instance, taxpayers may avoid formal business channels, or may 'destroy' any paper trail to conceal their economic activities; making it difficult for tax authorities to trace any non- or under-reporting (see Schneider, 2005; Paulus, 2015). Actually, it is difficult and administratively costly to detect misreporting of self-reported income. This implies that non-salaried income bears a lower detection rate compared to salaried income.

2.2 Penalty structure

Tax evasion is treated as a serious offence in South Africa. Depending on the nature and extent of the offence, tax evaders are made to pay financial penalties and/ or serve a jail sentence. There are basically three forms of financial penalties in South Africa, namely administrative penalties, understatement penalties and non-compliant interests (SARS, 2016: 10). Administrative penalties are intended mainly to promote compliance with the administrative provisions of the tax legislation. There are two categories of administrative penalties; and these are fixed amount and percentage-based penalties. Fixed amount penalties are levied to individual taxpayers who fail to submit a tax return within the stipulated timeframe. They are applied to taxpayers with outstanding tax returns for at least two years of assessment. Fixed amount penalties are payable per month, at a fixed rate. Depending on the amount received by the taxpayer in the preceding year of assessment, the amount of the penalty ranges between R250 and R16 000 (see Table 1 below). The penalty payable increases every month by the same amount up to 35 months, if the delinquent taxpayers' residential address is known; and 47 months, if the address is unknown (SARS, 2016: 14).

Table 1: Administrative non-compliance penalties

Assessed loss or taxable income for previous year	Fine
Assessed loss	R250

R0 - R250 000	R250
R250 001 - R500 000	R500
R500 001 - R1 000 000	R1 000
R1 000 001 - R5 000 000	R2 000
R5 000 001 - R10 000 000	R4 000
R10 000 001 - R50 000 000	R8 000
Above R50 000 000	R16 000

Source: SARS (2016: 15)

Apart from fixed-amount penalties, taxpayers are also liable to a percentage-based administrative penalty levied based on the nature of the offence and upon whether the offence is a standard case, obstructive or repeated. However, the law (the Tax Administration Act) does not provide a definition of 'standard' and obstructive offences; rather it is the prerogative of the Commissioner of SARS to determine. Notwithstanding this, the law is explicit on the penalty rates applicable to each offence. Substantial under-declaration of income carries a penalty of 10% and 20% for standard and repeated cases, respectively. The penalty is calculated as a multiple of unpaid taxes. In cases of gross negligence, a taxpayer is levied a penalty that is equal to the amount evaded. Deliberate tax evasion carries a penalty equivalent to 150% of the unpaid taxes for standard cases. For repeated cases, the penalty is double the evaded tax. Thus, depending on the gravity of the offense, understatement penalties vary between 10% and 200% of the unpaid taxes. Table 2 details how understatement penalties are applied.

Table 2: Understatement penalty rates

Behaviour	**Standard case**	**If obstructive or if it is a repeat case**
Substantial understatement	10%	20%
Reasonable care not taken in completing return	25%	50%
No reasonable grounds for tax position taken	50%	75%

Gross negligence	100%	125%
Intentional tax evasion	150%	200%

Source: SARS (2016: 15)

In addition to administrative and underpayment penalties, a delinquent taxpayer is liable to a non-compliance interest of 9.75% per annum. This penalty is levied for both late- and under-payment. Depending on the gravity of the default, failure to comply with the requirements of the tax laws may constitute a criminal offence. Examples of criminal offences include intentionally evading, claiming undue refunds, or assisting a taxpayer in such endeavours (SARS, 2016: 15). If convicted, the offender pays a fine and/ or is incarcerated. Depending on the nature of the offence. For instance, over the 2014/15 fiscal year, 256 taxpayers were convicted in cases involving R196 million. They were fined R9.6 million and given an effective 256 year in jail (SARS, 2015: 1). Their crimes cut across several tax bases, including income tax and VAT. Over the same period, of all the cases SARS referred to the National Prosecuting Authority (NPA), 92% were convicted. Such a high conviction rate could be an indication that SARS has a high capacity to detect tax evasion. In its pursuit to enforce compliance, the government also exploits high profile tax evasion cases to reinforce its strict stance against non-compliance. For instance, Bishop Tutu's son, Trevor was sentenced to 1 year in prison for tax evasion, in 1999 (Cummings *et al.*, 2009: 449).

In view of the foregoing discussion, it is clear that South Africa relies heavily on the deterrence approach, employing high audit rates, stringent financial penalties and severe jail sentences. Put differently, tax evasion is treated as a serious offence as evidenced by the presence of a strict penalty structure. In terms of the deterrence approach, there is positive relationship between enforcement measures and compliance; that is, the more stringent the enforcement measures are, the higher the level of compliance is realised. A detailed overview of the deterrence approach is given in next Section.

3. Theoretical foundations of the economic deterrence framework

The standard economic deterrent theory stems from the economics-of-crime model developed by Becker (1968). In this model, it is argued that crime is an economic activity that can be countered by punishing the offender. Becker argues that the severity of punishment and the probability of being punished are equally effective tools to control bad behaviour. From this economics-of-crime model, Allingham & Sandmo (1972) developed the deterrence model that

explains tax compliance dynamics. The model was later extended by Yitzhaki (1974) (hereafter abbreviated A-S &Y).

The A-S &Y model views individuals as homogenous, egoistic and utility maximisers whose decision to pay taxes is arrived at after evaluating the gains of successful evading against the costs of detection and punishment. It is therefore argued that an individual evades whenever the benefits of cheating outweighs the risk of detection and the accompanying punishment. The central argument of this model is that an individual complies due to fear of detection and punishment, implying that the more stringent deterrent measures are, the more compliant taxpayers become.

In its simplest form, the model can be illustrated as follows:[1] Assume an individual receives a fixed gross income (Y) which is supposed to be declared to tax authority for tax purposes. The reported income is taxed at rate (t). Furthermore, assume that the individual declares (X) amount of income, implying that his/ her undeclared income is ($Y - X$). Although no taxes are paid on unreported income, the individual may be audited for under-reporting at a fixed and random probability of (p), where $0 < p < 1$. Once audited, all unreported income is detected and the delinquent individual pays a penalty (α), where $\alpha > 1$. The penalty is calculated as a multiple of the evaded tax amount. Accordingly, when evasion is undetected, the individual's net income (W) would be the difference between gross income and the tax paid from declared income, and can be expressed as;

$$W = Y - tX \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In the event that the evaded amount is detected, the individual's net income (Q) becomes gross income minus paid taxes, minus the fine on unpaid taxes. That is;

$$Q = Y - tX - \alpha[t(Y - X)] \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

With the probability of detection, p, the individual chooses to declare X to maximise his/her expected utility, $E[U(Y)]$, expressed as;

$$E[U(Y)] = (1 - p)U(W) + pU(Q) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3),$$ 'where E is the expectation operator and $U(Y)$ is the utility function of only income' (Alm, Jackson & Mckee, 2009).

[1] The illustration follows the one by Alm, Jackson & Mckee (2009)

Assuming that the individual is risk-averse, then that the utility function would be concave. This implies that the first and second order conditions will be satisfied; and are respectively expressed by equations (4) and (5) as follows;

$$pt(\alpha - 1)U'(Q) - (1 - p)tU'(W) = 0 \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

$$p[t(\alpha - 1)]^2 U''(Q) + (1 - p)t^2 U''(W) < 0 \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Equation 4 is the basic deterrent (or portfolio) model of tax compliance. Undertaking a total differentiation of this equation allows us to see the effect of each parameter on compliance. For instance, total differentiation of the first-order equation with respect to the probability of audit, and penalty rate produces equations (6) and (7), respectively.

$$\frac{\partial X}{\partial p} = -\left[\frac{t(\alpha-1)U'(Q)+tU'(W)}{pt^2(\alpha-1)^2U''(Q)+(1-p)t^2U''(W)}\right] \ldots\ldots\ldots\ldots \quad (6)$$

$$\frac{\partial X}{\partial \alpha} = -\left[\frac{ptU'(Q)}{pt^2(\alpha-1)^2U''(Q)+(1-p)t^2U''(W)}\right] \ldots\ldots\ldots\ldots \quad (7)$$

Equations (6) and (7) show that increases in the probability of audit and the penalty rate increase declared income (or discourage tax evasion).

4. Literature review

The debate over the effect of deterrence factors have long been in existence. Although there is some convergence among theoretical studies on the effect of deterrence factors on tax compliance, empirical evidence is diverse. This section shows the diversity of empirical findings, particularly on the deterrent effects of audits and penalties on compliance. Essentially, the effect of audits and penalties on compliance is three-pronged; some found audits and penalties to have a positive effect on compliance, others established that these measures reduce compliance, while other researchers found audits and penalties to have no (or minimal) effect on compliance. This study therefore reviews existing literature based on this classification (i.e. the effects of audits and penalties).

4.1 Evidence of deterrence measures increasing compliance

Dubin, Graetz & Wilde (1990) use cross sectional data from the Taxpayer Compliance Measurement Program (TCMP) to examine the effect of audits in the US. They find that the decline in audit rates from 2.5% to 1.14% between 1977 and 1986 deprived the government of

US$15.5 billion, which is approximately 4% of the PIT revenue collected in 1986 (Dubin *et al.*, 1990: 404). Relatedly, Alm, Jackson & McKee (2004) suggest that a continual decline in audit rates in the US in the 1960s led to a corresponding decline in tax revenue by US$7.2 billion through evasion. Although Dubin *et al.* (1990) and Alm *et al.* (2004) established a positive correlation between audit rates and compliance, these studies did not establish the deterrent effect of audits on compliance, by income type (salaried and non-salaried), which is more informative.

Slemrod, Blumenthal & Christian (2001) conducted a field experiment to examine how differences in taxpayers' perceptions over audits affect tax compliance in Minnesota. In the study, letters were sent to a group of taxpayers and they were advised that their returns (which they were going to submit) would be thoroughly audited. The reaction of taxpayers in the treatment group was matched against the control group (which never received the letter nor received any audit information). The study established that the effect of audit threats depends on taxpayers' opportunities to evade as well as their level of income. More specifically, the low to medium income earners complied more in response to audit threats. Conversely, high-income taxpayers reduced their compliance levels; perhaps in anticipation that their significant share of the evaded taxes would not be detected. The authors however attribute their findings to a number of experimental shortcomings that included failure to explicitly measure evasion.

Using experimental data, Park & Hyun (2003) examine the determinants of tax compliance in Korea. The experiment was run with 15 undergraduate students. The study establishes that both penalty and audits increase compliance. However, the penalty is found to play a more significant role than audits. Contrary to Slemrod *et al.* (2001), Park & Hyun (2003) find that disparity in individuals' income levels has no effect on compliance. However, the study does not indicate the type personal income taxpayers who were examined. Furthermore, considering that the study used a very small sample, it could be necessary to verify these findings using a large sample size.

Kleven, Knudsen, Kreiner, Pedersen & Saez (2011) explore how audits and threat-of-audit influence individual taxpayers' compliance in Denmark, using a sample of 42 800 taxpayers, and comparing self-reporters and third-party reporters. The experiment was undertaken in two years and in two stages. In the first year, 21 400 randomly selected taxpayers were audited without any prior information to the exercise. In the second year, subjects were randomly assigned to three different treatment groups. The first group was served with letters threatening

that everyone was going to be audited. The second treatment group was served with letters indicating that half of subjects were going to be audited. The last group was not served with any letter. The study further establishes that both audits and threats-of-audits significantly increase compliance among self-reporters.

Engida & Baisa (2014) explore the determinants of tax compliance behaviour in Mekelle City in Ethiopia. They use cross-sectional survey data from a sample of 102 respondents drawn from a group of hard-to-tax taxpayers. The study establishes that audit rates were the main factor that influences tax compliance behaviour. Although the study uses data from real taxpayers, its sample size is relatively small, which may compromise the reliability of the findings. It would be even more informative to establish the effects of audits by taxpayers' behaviour, and by type of income.

Asnawi (2016) explores the effect of deterrent measures and taxpayers' ethics on compliance in Indonesia. The study employed a conventional controlled laboratory experiment with 56 subjects. The experiment encapsulates the ethics treatment using a multi-ethical scale design (i.e. an ethical film) that captures the Indonesia's tax conditions. Subjects watched the ethical video before responding to questions on ethics on the computer. Other treatments consists of questions that reflect the audit strategy, audit rate and perceived probability. Subjects were categorised in two groups based on the audit strategy – fixed and random strategies. In order to vary the degree of audit perception, some were informed of the probability of audit (while some were not). The probability of audit ranged between 10 and 30%. The study establishes that high audit perceptions incentivises taxpayers to comply.

4.2 Evidence on deterrence measures reducing compliance

Gangl, Torgler, Kirchler & Hofmann (2014) conduct a field experiment exploring the effect of stringent enforcement (i.e. close supervision and frequent audits) on tax compliance in Austria. Their population sample was composed of 1721 newly established small firms operating in sectors prone to high non-compliance. Companies in the treatment group were constantly supervised and monitored by an auditor who would give some guidance on how to complete tax returns and also to explain to taxpayers the benefits of paying taxes. Taxpayers were also informed that they would be audited on a monthly basis, throughout the year. In contrast, firms in the control group were purposely neither approached nor audited. The study finds that extreme enforcement (close supervision and frequent audits) reduces compliance, even in cases

of strong and cordial taxpayer-tax authority relationships. It is argued that excessive enforcement reduces taxpayers' intrinsic motivation to comply, causing them to evade.

Modugu & Anyaduba (2014) examine the impact of audits and penalties (among other factors) on the level of compliance. Using survey data of companies from five regional zones of Nigeria, the study finds a positive but weak relationship between audit rates and the level of compliance. Furthermore, penalties were found to have a significant and negative effect on compliance, implying that increases in penalties reduce compliance (Modugu & Anyaduba, 2014: 212).

Wahl, Kastlunger & Kirchler (2010) use laboratory and online experiments to investigate how compliance is influenced by enforcement (audits and penalties). The study made two findings. First, it is established that there is a negative correlation between enforcement and voluntary compliance, arguing that excess enforcement reduces honest taxpayers' intrinsic motivation to comply. Second, an increase in enforcement is found to discourage dishonest taxpayers from evading, thereby increase enforced compliance. In a related study, Mohdali, Isa & Yusoff (2014) conducted drop-off and online surveys to investigate the effect of threat of punishment (comprised of audits and penalties) on tax compliance behaviour in Malaysia. The study finds that apart from triggering honest taxpayers to evade, audits and penalties have no impact on voluntary compliance (Mohdali *et al.*, 2014: 291). However, both Wahl *et al.* (2010) and Mohdali *et al.* (2014) do not establish clear parameters within which compliance declines as a result of increasing enforcement measures.

4.3 Evidence of deterrence measures having no effect on compliance

Alm, Jackson & Mckee (1992) employ a series of laboratory experiments to establish the effect of audit and penalty rates, among other variables on personal income taxpayers' compliance in the U.S. The results show that both audits and penalties increase compliance. Nevertheless, the significance level of the coefficients were very low. The authors attribute the low significance in penalty rates to low chances of detecting non-compliance, arguing that it would require extreme extents of risk aversion to trigger high responses in penalty rates. This implies that increases in penalty rates can be effective in dissuading taxpayers from cheating only when the degree to detect non-compliance is significant. Given the challenges in raising the detection rates, there is limited scope to improve compliance through penalties. Alm *et al.* (1992: 110) conclude by suggesting that greater penalties may be largely ineffective in enhancing compliance and have therefore recommended governments to pursue a range of other

compliance-enhancement mechanisms. Although, findings from this study seem plausible, it is worth noting that the experimental exercise was undertaken with an admittedly small sample of 40 subjects. It is possible that these findings are compromised by the sample size. For more statistical power, it would be imperative to run such an experiment with a bigger sample size.

Devos (2004) employed a time-series analysis to investigate the impact of penalties in mitigating tax evasion in selected Anglo-Saxon countries, including the UK, New Zealand and Australia. This study was undertaken following the introduction of a raft of changes to the penalty structure of the region's tax system. These changes include the introduction of new penalties and the imposition of harsher sanctions for existing offences. Based on annual reports from tax authorities and other regulatory agencies, the study established that neither the presence nor the increase in penalties have a direct effect on compliance. Devos (2004: 32) therefore concluded that a penalty is an insignificant compliance-enhancement strategy.

From the above-discussed studies, it is clear that empirical evidence on the effect of deterrence measures, particularly, penalties and audits is diverse, and is largely based on developed country applications. Hence, evidence from developing countries is limited, particularly also for South Africa. Furthermore, existing research have largely been focusing on personal income in its broad nature (i.e. combined salaried and non-salaried income). Considering that tax evasion varies with the type of income, examining the efficacy of deterrence factors basing on aggregated income may conceal some important evidence. More precisely, such an approach (of using aggregated data) is susceptible to produce spurious results, and could be one of the likely sources of divergence in empirical findings. With the divergence in empirical evidence, coming up with an effective compliance-enforcement mechanism remains a challenge. It is against this backdrop that this study seeks to investigate compliance behavioural responses to changes in audit and penalty rates for both salaried and non-salaried taxpayers. Such a disaggregation of the effects of deterrent measures by taxpayers' behaviour, and by type of income (salaried and non-salaried income) can contribute to tax policy design on the use of audits and penalties to increase tax compliance.

5. Empirical methodology

Tax evasion is an illegal behaviour, as such it is concealed; making it difficult to observe (or get reliable data on) evasion in a naturally occurring world. Due to the scarcity of detailed and reliable data on taxpayers' behaviour, it is difficult to observe or examine taxpayers' behavioural responses to changes in tax parameters, particularly with happenstance data. In

light of these challenges, this study employs a conventional laboratory experiment to investigate individual taxpayers' behavioural responses to changes in audit and penalty rates. As highlighted in Chapter 4, experimental methods have long been applied in the analysis of tax compliance. They allow for the introduction of factors suggested by theory to be tested individually and independently in a controlled environment, providing an investigator with a better opportunity to generate reliable data on compliance behaviour.

5.1 Experimental design

The experimental setting for this study replicates the essential features of the voluntary reporting system of South Africa's PIT. The experimental design is developed from the one used by Alm, Deskins & McKee (2009) in examining individual taxpayers' compliance responses to changes in the proportion of income that is reported to the tax authority. In this study, subjects will have two forms of income, endowment[2] and earned (salaried) income. The endowment is randomly assigned to subjects at the beginning of the experiment. Subjects then earn some additional income by performing a simple task of counting the number of ones in a grid in the shortest possible time. The amount earned is determined by one's performance in the task. Subject's income (i.e. endowment plus earned income) is only known by its holder. Both incomes are supposed to be reported to the tax authority for tax purposes and are levied at the same tax rate, which is fixed at 30%.[3] Subjects then fill in a tax return where they would choose how much of their endowment and salaried income to report. The tax liability is calculated based on the proportions of reported salaried and non-salaried income. Importantly, tax is paid only on reported income.

Participants are however subject to random audits, which are meant to uncover any misreported income. The audit rates are pre-announced to the subjects. These audits are limited to the present round. As in Alm *et al.* (2009), audits are determined by a virtual bingo cage displayed on every participant's computer screen. More specifically, after every tax period, a box with ten red and white balls appears on the screens (see Figure 1 in Appendix A). These balls would

[2] Endowment represents one's income that is non-salaried.

[3] Tax rate is pegged at 30% because the majority (over 60%) of South Africa's individual taxpayers fall within the R70 000 – R350 000 taxable income band, the majority of whom are liable to a 30% tax rate (see NT & SARS, 2016: 39). Furthermore, a number of studies (e.g. Alm, Mckee & Beck, 1990; Alm, Martinez & Wallace, 2009; Asnawi, 2016) used the 30% tax rate. Applying the same rate would therefore allow findings from this study comparable with other studies'.

bounce for a while before one pops out of the box. If a red ball pops out, the subject would be audited. Conversely, a white ball popping out implies no audit (see Figure 2).

Subjects are informed that any salaried income that is undeclared will be detected with certainty in the event of an audit, while any endowment income that is undeclared will be discovered in an audit, but only with some known and pre-announced probability, which is fixed at 50%[4]. The disparity in detection rates reflects the productivity of audits by the type of income (Alm *et al.*, 2009: 128). In South Africa, salaried and non-salaried individual taxpayers' compliance rates are 99.9% and 49.7% respectively (see Section 3.6.3). Hence, fixing the detection rates for salaried and non-salaried income at 100% and 50%, respectively. Intuitively, the discrepancy in compliance rates can largely be attributed to the difference in detectability between these incomes. The salary payments usually leave trails of trade. On the contrary, non-salaried income is largely transacted in cash, leaving no trade traces. Thus, it is relatively more difficult to detect misreporting on non-salaried income (see Ahmed & Rider, 2013; Paulus, 2015). Further, unlike salaried income, which is reported through a third party, non-salaried income is self-reported, thereby providing non-salaried income taxpayers more opportunities to misreport. Accordingly, the disparity in the detection rates captures the fundamental elements of third-party and self-reporting systems (see Alm *et al.*, 2009: 128–129). If an under-statement is detected, the delinquent taxpayer pays a penalty. The penalty is calculated as a multiple of unpaid taxes of the audited round.

Each subject would be confined to his/ her computer that is in a cubicle. This is meant to deter participants from communicating, and accessing each other's information displayed on screens. Subjects are also informed that the investigator will not be observing their compliance decisions. The investigator will therefore not be moving around the laboratory room during the exercise. These features are meant to crowd out any potential peer and experimenter effects that may confound subjects' behavioural responses (Alm, Deskins & McKee, 2006: 8). More so, subjects are informed through consent forms that no personal identification will be collected. More precisely, for the purpose of this study, they will be identified by numbers which they are randomly assigned. Hence, ensuring that their responses are anonymous.

In order to cater for individuals' intrinsic factors that may influence subjects' tax compliance decisions, explicit tax terms (context terms) are employed. This also helps to prevent subjects from regarding the experiment as a mere game (see Torgler, Schaffner & Macintyre, 2009).

[4] Experimental instruction sheets are in Appendix B.

More precisely, contextualisation of the experimental setting provides for the necessary extent of parallelism to the real world, which is key when it comes to the external validity of experimental results.

The experimental exercise is composed of 4 sessions, each made up of 10 rounds. 200 subjects expected to participate in this exercise in groups of 50. That is, each session is expected to run with 50 different participants; implying that the overall experimental exercise is expected to produce 2 000 observations. In session 1 (the control session), the audit and penalty rates are maintained at 10% and 1.5, respectively. They are fixed at these levels in all the first 5 rounds of the rest of the sessions. In session 2, the penalty rate is increased to 3.0 in round 6 and maintained at that level through to round 10. In session 3, the audit rate is increased to, and maintained at 30% from round 6 to round 10. In session 4, the audit and penalty rates are increased to 30% and 3.0, respectively, from round 6 to 10. Thus, the probability of audit and penalty rate respectively vary from 10% to 30% and 1.5 to 3.0. Parameters for the sessions are summarised in Table 3 below.

Table 3: Parameters of the Experimental Design

Session	**Rounds**	**Audit rate**	**Probability of Detection (Salaried income)**	**Probability of Detection (Non-salaried income)**	**Penalty rate**	**Tax rate**
1	1-10	10%	100%	50%	1.5	30%
2	1-5	10%	100%	50%	1.5	30%
	6-10	10%	100%	50%	3.0	30%
3	1-5	10%	100%	50%	1.5	30%
	6-10	30%	100%	50%	1.5	30%
4	1-5	10%	100%	50%	1.5	30%
	6-10	30%	100%	50%	3.0	30%

All sessions are computerised, hence subjects' tax liabilities, tax owed and penalties (if any) are automatically calculated and displayed on the screen. A tax calculator is displayed on the computer screen and it provides subjects with opportunities to view the earnings implications

of their reporting decisions (if audited and if not audited) before making the final decision[5]. Further, subjects may view their previous reporting before making another decision. To make sure that subjects understand the exercise, two practice sessions are done at the beginning of the experiment, allowing them to seek clarity before working on the actual rounds. They are informed that their performance in the practice sessions do not contribute towards payment.

Despite subjects' participation in 10 rounds, only one round counts towards earnings. This is determined by rolling a 10-sided die at the end of the exercise. Thus, all rounds have an equal chance of being selected and no one knows in advance which one will be chosen. Subject's net income (i.e. after-tax income) for a round is represented by the following equation:

$$Net\ income = Y - tY\left(Sr_s + er_e\right) - AftY\left[S\left(1 - r_s\right) + De\left(1 - r_e\right)\right],$$

Where:

- Y = gross income (i.e. salaried plus endowment income),
- t = tax rate,
- S = share of salaried income in gross income,
- r_s = share of salaried income reported by the subject,
- e = share of non-salaried income (endowment) in the gross income = $(1 - S)$.
- r_e = share of non-salaried income reported by the subject,
- A = dummy variable, 1 the if subject is audited and 0 if otherwise,
- f = penalty (fine) rate on undeclared taxes, and
- D = dummy variable, 1 if the subject is detected for underreporting non-salaried income, and 0 if otherwise.

Once the payment round is determined, subjects are paid their earnings in cash. Subjects' payoffs depend on one's performance, and the size of the parameters in a session. Subjects will also complete a demographic questionnaire, at the end of the experiment. This helps to capture subjects' socio-economic and demographic data, which is essential in empirical analysis (see Torgler & Schaltegger, 2005; Alm *et al.*, 2009; Alm, Bernasconi, Susan, Lee & Wallace, 2016).

[5] Figure 3 provides a screenshot of the tax calculator.

The experiment is conducted at Stellenbosch University with undergraduate students drawn from different disciplines[6]. All participants had no prior exposure to laboratory experiments. They were recruited via class presentations. Those interested to participate signed up via a Web link.

5.2 Behavioural hypotheses and Analytical approach

The deterrent model postulates that an individual complies to avoid the consequential sanctions of evasion. In other words, audits and penalties are expected to reduce the expected value of evasion, causing taxpayers to increase their compliance levels. The afore-outlined experimental setting allows for the investigation of a number of behavioural hypotheses. Of most interest is the effect of audits and penalties on both salaried and non-salaried taxpayers. Hence, the first four hypotheses are:

Hypothesis 1: *There is a positive relationship between audit rates and salaried income tax compliance.*

Hypothesis 2: *There is a positive relationship between penalty rates and salaried income tax compliance.*

Hypothesis 3: *Non-salaried individual taxpayers increase their compliance levels when exposed to higher penalty rates.*

Hypothesis 4: *Non-salaried individual taxpayers increase their compliance levels when subjected to higher audit rates.*

The last hypothesis pertains to the effect of previous tax years (or rounds) on compliance in subsequent years. The standard tax evasion model (the deterrent model) suggests that previous rounds do not influence compliance in subsequent rounds, arguing that there is independence between rounds. In contrast, Alm *et al.,* (2009) opined that there is a possibility that individuals' current actions (behaviour) may be influenced by their past experiences. The effect of previous rounds on subsequent rounds remains therefore an empirical question. In light of

[6]There has been mixed 'perceptions' regarding the external validity of findings from experiments carried out with student subjects. However, there is now some overwhelming evidence (e.g. Plott, 1987; Alm & Jacobson, 2007; Alm, Martinez-vasquez & Torgler, 2010; Alm, Bloomquist & Mckee, 2013; Alm *et al.*, 2015; Choo, Myles & Fonseca, 2014) that show no significant differences in behavioural responses between students and non-student subjects in an experiment (see section 4.5).

this, the fifth hypothesis focusses on whether being audited in the current tax year has a bearing on compliance in the subsequent year.

Hypothesis 5: *Audited in the previous tax year do not influence compliance in the subsequent year.*

The afore-mentioned hypotheses, particularly on the deterrent effects of audits and penalty rates are supported by comparing and contrasting expected values an individual derives from either reporting all income or not reporting any income. In this regard, let us assume that an individual is risk-neutral and egocentric, such that his/her choice on whether to pay or evade taxes is meant to maximise expected value from the compliance gamble. His/ her expected value from reporting all income (EV Compliance) equals $(1-p)(Y-tD)+p\big(Y-tD-ft(Y-D)\big)$, where p is the probability of being audited; Y is the true income; t is the tax rate; D is the declared amount; and f is the fine rate on unpaid taxes. On the other hand, the expected value derived from not complying (EV Evading) is $(1-p^*)Y+p^*(Y-ftY)$, where p^* is the effective probability that an individual is discovered for non-compliance (see Alm, Bloomquist & Mckee, 2013). These expected values provide a benchmark on which course of action to take between complying and evading. More precisely, an individual is expected to choose the bundle that provides more gains (Alm *et al.*, 2009: 132).

Table 4 below shows the difference between expected values from compliance and expected values from non-compliance, for both salaried and non-salaried income. The calculations are based on parameters from the experimental design. Importantly, these expected value figures are based on a hypothetically gross income of R100.The differences in expected values indicate whether an individual should comply or evade. A negative difference between the expected value from complying and the expected value from evading implies that it is more beneficiary to evade than to comply. The opposite holds for a positive difference between these expected values.

Table 4: Effects of audits, detections and penalties on expected values

Salaried Income				
Tax Rate	**Audit Rate**	**Penalty Rate**	**Probability of Detection**	**EV Compliance *less* EV Evading**
30	10	1.5	100	-22.5
30	10	3	100	-18.0

30	30	1.5	100	-7.5
30	30	3	100	6.0
Non-Salaried Income				
Tax Rate	**Audit Rate**	**Penalty Rate**	**Probability of Detection**	**EV Compliance *less* EV Evading**
30	10	1.5	50	-26.3
30	10	3	50	-24.0
30	30	1.5	50	-18.8
30	30	3	50	-12.0

It is evident from Table 4 above that a risk-neutral individual would evade in most cases, as reflected by negative discrepancies between the expected value from complying and that from evading. Plausibly, the expected value from evading declines as deterrent parameters increase, leading to a positive discrepancy between expected value from compliance and the expected value from non-compliance. Hence, depicting a negative relationship between non-compliance and deterrent measures (audit and penalty rates). It is also explicit that expected values derived from evading vary between the two incomes. Evading on salaried income yields less value than evading on non-salaried income. A rational individual would therefore evade more on non-salaried income. The discrepancy between these expected values is attributed to the disparity of detection rates between these incomes.

In order to examine these conjectures, this study employs a descriptive statistical analysis on results from the experiment. Subjects' compliance (i.e. compliance rate) is defined as the ratio of reported income to total income. To establish specific causal inferences between compliance and audits and penalties, the study employs some econometric models.

The econometric models for this study consists of the following Panel regression equation:

$$Y_{i,t_{s,r}} = \beta_0 + \beta_1 Nonsalincomeshare_{i,t_{s,r}} + \beta_2 Audit_{t_{s,r}} + \beta_3 Penalty_{t_{s,r}} + \beta_4 Audit_{t_{s,r}} * Penalty_{t_{s,r}} + \beta_5 Auditprev_{i,t_{s,r}} + \beta_6 X_i + \lambda_{t_{s,r}} + \mu_i + \varepsilon_{i,t_{s,r}}$$

Where:

- *Y* denotes subject *i*'s compliance rate in period *t*, where *t* is composed of sessions (*s*) and rounds (*r*).
- *Nonsalincomeshare* is the share of non-salaried income in the gross income.
- *Audit* is a binary variable for the audit rate; equal to 1 if the probability of audit is high, and 0 if otherwise.

- *Penalty* is a binary variable for the penalty rate; equal to 1 if the penalty rate is high, and 0 if otherwise.
- *Audit*Penalty* is an interaction variable for the audit and penalty rates.
- *Auditprev* is a binary variable for subjects' audit experiences. It takes 1 if the subject was audited in the previous round, and 0 if otherwise,
- *X* is a vector of socio-economic and demographic variables,
- λ is a set of *T*-1 categorical variables that capture the potential of non-linear period effects,
- μ are random effects that control for unobservable individual characteristics,
- β_k is the coefficient for variable *k* and
- ε is the 'traditional' error term with a zero mean and constant variance.

The dependent variable (compliance rate) takes three forms: compliance on non-salaried income, compliance on salaried income, and compliance on total income. This allows for the examination of the effect of tax parameters on compliance for both forms of personal income.

6. Data analysis and Findings

The experiment was conducted with 24 subjects, each participating in one session of 10 rounds, producing 240 individual observations. The average age of the participants was 19 years. The racial composition for the sample was as follows: 36% white, 29% black, 25% coloured and 10% other races. Of the total subjects, 21% were Catholics, 13% Protestants, while 4% were Baptists. Table A1 (in Appendix A) provides summary statistics for the population sample.

In session 1 audit and penalty rate are kept at modest levels and subjects fully reported 50% of their non-salaried income and 79% on salaried incomes. In session 2, average compliance rates declined to 32% on non-salaried income, and 75% on salaried income. The average compliance rate on total income (salaried plus non-salaried income) declined to 53%. The decline in compliance rates entails an increase in the penalty rate on unreported income. This finding suggests that there is a negative relationship between compliance and penalty rate. From this finding, the hypothesis that an increase in penalty rates increase compliance is rejected.

In session 3, the average compliance rates increased to 57% and 89% for non-salaried and salaried incomes, respectively. The overall compliance rate increased to 72%. The increase in compliance rates was in response to an increase in the probability of audit, implying that there

is a positive relationship between audits and compliance. From this finding, we do not reject the hypothesis that individual taxpayers comply more when subjected to higher audit rates.

Following an increase in both audit and penalty rates in session 4, subjects increased their compliance rates on both incomes, relative to the baseline session. The mean compliance rates increased to 59% on non-salaried income and 88% on salaried income. Although the average compliance rates increased, the increase is less than that witnessed in session 3 where only audit rates were increased. This suggests that audit rate is a more effective compliance-enhancement policy instrument than the combination of high audits and penalty rates. Table A2 presents the summary information on the average compliance rates per session (treatment) and by type of income.

On average, subjects fully reported 51% of the non-salaried income and 83% of the salaried income across all treatments. The mean overall compliance rate is 65%. Descriptive statistics for the overall compliance rates are depicted in Table A3. Subjects' compliance rates per round explicitly show that non-salaried income bears higher evasion rates than salaried income (see Figure 4). This can be attributed to the fact that non-salaried income have a relatively low detection rate than salaried income, causing taxpayers to evade more on income that is relatively difficult to detect.

To understand treatments effects at individual level, the afore-outlined Panel Regression model is employed. Table A4 presents the regression results. The study establishes that there is a negative relation between income and compliance. The relationship is however weak on salaried income compliance. It is also established that male taxpayers comply more than female taxpayers do.

A higher penalty rate has a positive relationship with non-salaried income compliance, and a negative relationship with salaried income compliance. However, the relationship is statistically weak for both incomes. This implies that penalty rate is not an effective compliance-enhancement strategy. Even in cases where a high penalty rate is jointly applied with a high audit rate, the change in compliance rates (for both incomes) is not significantly different from the level of compliance realised when a lower penalty rate is jointly implemented with a lower audit rate. The insignificance of a higher penalty rate (even when applied jointly with a higher audit rate) suggests that it is more judicious for authorities to consider other tax policy measures other than 'excessive' penalty rates.

The study further establishes that an individual taxpayer complies more when the audit rate is high. The effect is more on non-salaried income than on salaried income. The difference in the extent of on the impact of audits rates could be due the difference in the level of detectability between these incomes. Intuitively, a high audit rate increases the probability of detection. Since non-salaried income has a lower detectability rate, an increase in audit rates would have a higher effect on non-salaried income than on salaried income.

The study also establishes that previous rounds influence compliance level in subsequent rounds. More precisely, current compliance rate for a taxpayer who was audited in the preceding round are higher than that of a previously unaudited taxpayer. This suggests that being audited causes a taxpayer to anticipate for another audit in the subsequent tax period. This anticipation reduces the expected value on evasion, causing the taxpayer to increase compliance. The effect is higher on non-salaried income than on salaried income.

7. Conclusion

In its 2014 interim report, the Davis Tax Committee suggested that South Africa loses a substantial amount of revenue through evasion. To enhance compliance, the government has made several changes to existing tax penalty structures, and introduced new ones as well. The question arises whether these deterrence measures effectively reduce evasion. International empirical evidence on the efficacy of such policies are mixed, and are mainly drawn from developed country applications. Hence, evidence from developing countries are limited, particularly also for South Africa.

This study employs a conventional laboratory experiment to examine taxpayers' behavioural responses to changes in audits and penalties as deterrent measures to non-compliance. Our results indicate that the effect of high penalty rates is not significantly different from the effect of low penalty rates. We also find that threats for higher audit rates increase compliance, and the impact is higher on non-salaried income. A taxpayer complies even more when he/ she was audited in the preceding tax year. These results suggest that the effectiveness of the deterrence policy is highly dependent on the frequency of audits and the tax authority's ability to detect underreporting.

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Appendix A

Table A1: Descriptive statistics

Observations	240
Mean age	19
Percentage white	36
Percentage black	29
Percentage coloured	25
Percentage Catholic	21
Percentage Baptist	4
Percentage Protestant	13
Percentage No religion	25
Percentage of who do not know their religion	4
Percentage of did not disclose their religion	4
Other religion	29
Percentage Male	50
Percentage real taxpayers	17
Percentage South Africans	100%

Table A2: Average compliance rates per session

Session	**Non-salaried income**	**Salaried income**	**Total income**
1	0.50	0.79	0.63
2	0.32	0.75	0.53
3	0.57	0.89	0.72
4	0.59	0.88	0.73

Table A3: Descriptive statistics for Compliance Rates

	Observations	**Mean**	**Standard Deviation**	**Min**	**Max**
Compliance rate on non-salaried income	240	0.51	0.39	0	1
Compliance rate on salaried income	240	0.83	0.33	0	1
Overall compliance rate	240	0.65	0.32	0	1

Table A4: Regression results

	Non-salaried income compliance		Salaried income compliance		Overall PIT compliance	
	OLS Model	**Random Effect Model**	**OLS Model**	**Random Effect Model**	**OLS Model**	**Random Effect Model**
Share of non-salaried income in total income	-0.519 (0.252)**	-0.519 (0.252)**	-0.021 -0.272	-0.021 -0.272	-0.616 (0.208)***	-0.616 (0.208)***
High audit rate	0.265 (0.068)***	0.265 (0.068)***	0.175 (0.069)**	0.175 (0.069)**	0.206 (0.056)***	0.206 (0.056)***
High penalty rate	0.028 -0.068	0.028 -0.068	-0.044 -0.069	-0.044 -0.069	-0.016 -0.056	-0.016 -0.056
Audited in previous round	0.268 (0.041)***	0.268 (0.041)***	0.187 (0.042)***	0.187 (0.042)***	0.231 (0.034)***	0.231 (0.034)***
High audit rate * High penalty rate	0.005 -0.116	0.005 -0.116	0.015 -0.117	0.015 -0.117	0.047 -0.096	0.047 -0.096
Male taxpayer	0.378 (0.087)***	0.378 (0.087)***	0.151 (0.089)*	0.151 (0.089)*	0.274 (0.072)***	0.274 (0.072)***
Religion Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Ethinicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Annual household income Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.074 (0.274)***	1.074 (0.274)***	0.962 (0.280)***	0.962 (0.280)***	1.173 (0.226)***	1.173 (0.226)***
R-squared	0.541	0.541	0.337	0.337	0.547	0.547
N	240	240	239	239	240	240
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Wald chi2	254.48	254.48	109.19	109.19	260.64	260.64
Sigma	0.275	0.275	0.267	0.267	0.221	0.221
Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01						

Note: Results from the OLS and Random Effects models are identical for each type of income.

Figure 1: Virtual bingo cage

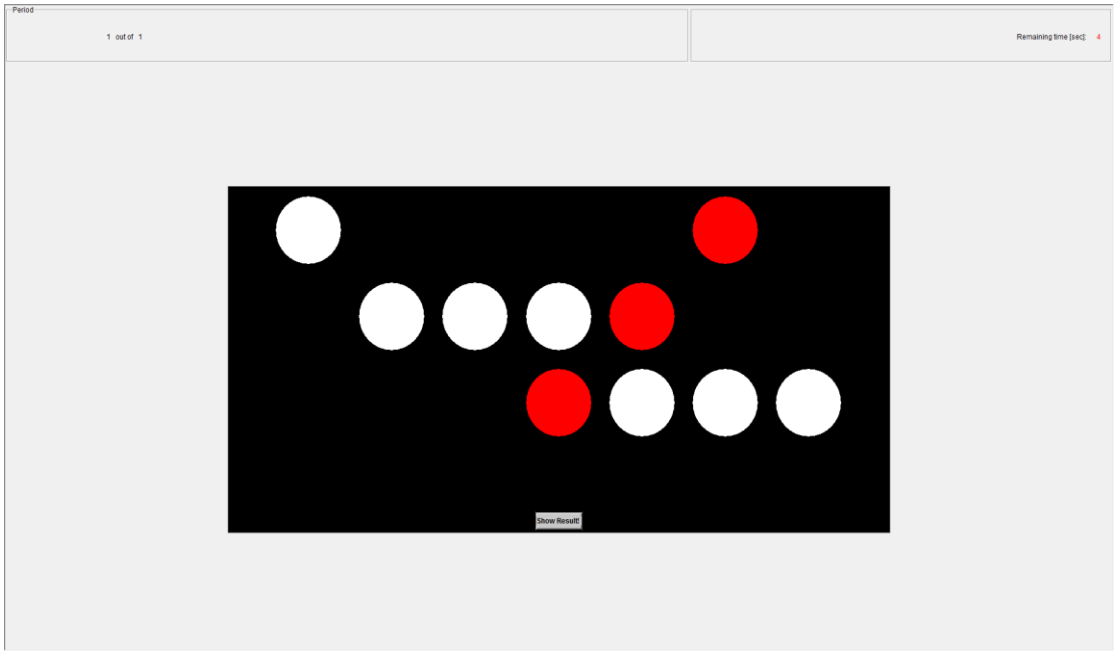

Figure 2: Audit outcome

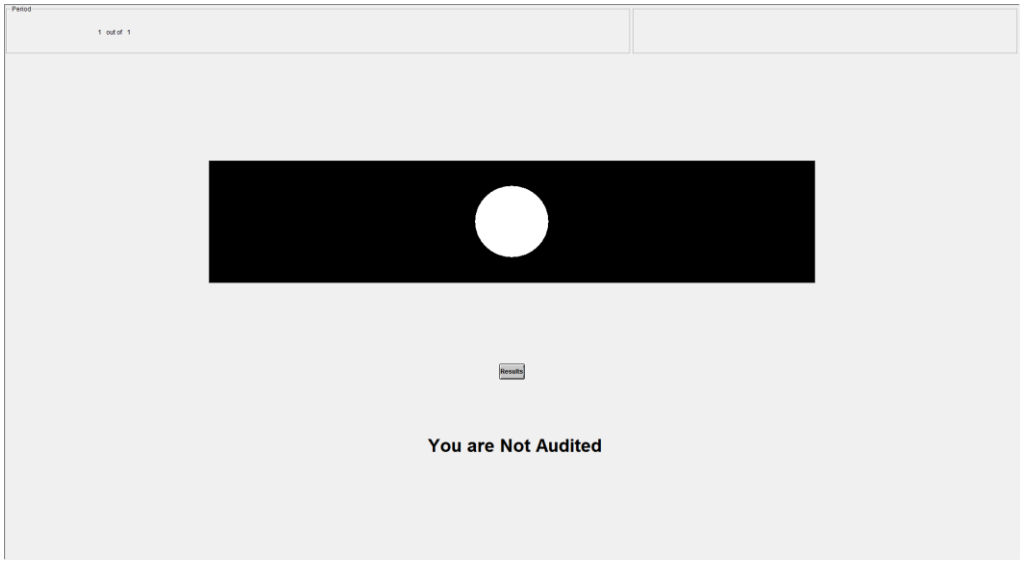

Figure 3: Tax calculator

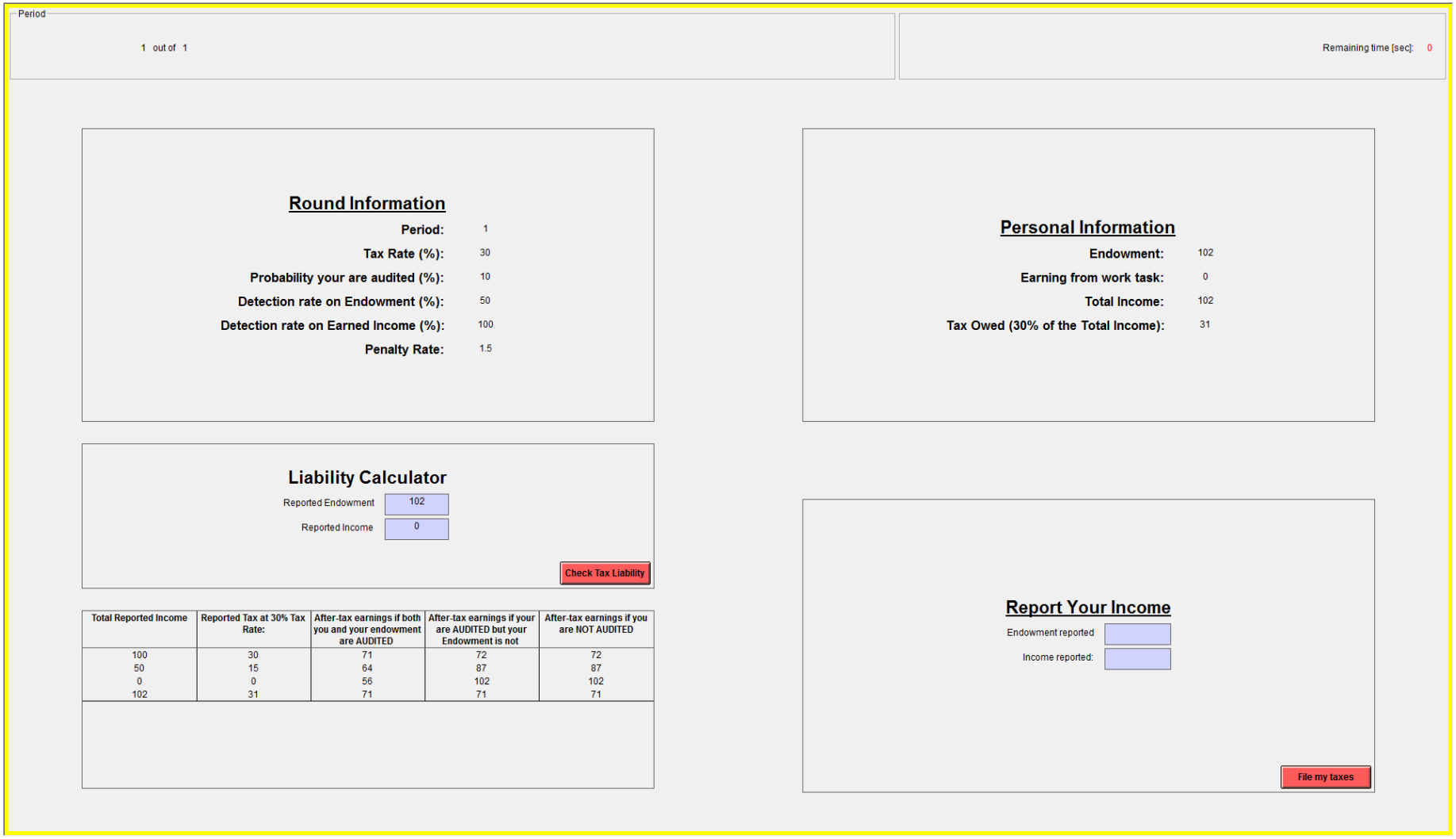

Figure 4: Compliance rate patterns per subject

Appendix B: Experimental Instructions

Instructions for Sessions 1 & 3

This is an experiment about economic decision making. The study will last no more than 1 hour. You will receive R30 for your participation and will have the opportunity to increase this amount based on the decisions you make. Your earnings will be paid to you in cash at the end of the study. Your decisions and payments will be kept private.

The decisions made in this experiment are tax reporting decisions. In each round, you will be given some endowment income. You will earn some additional income by performing a simple task of counting the number of ones in grid, in the shortest possible time. The amount earned is determined by one's performance in the task. Thus, in each round, you will be possessing two types of incomes (earned and endowment income). How your decisions affect your earnings is explained below.

In each round, you will have to report your income (i.e. both incomes) to a tax authority and pay taxes on reported income. The tax rate is 30%. Thus, your taxes will be 0.30* (reported income). After you submit your taxes, there is a chance that you will be audited by the tax authority. The probability of audit will be announced. A computer will use a random number generator to decide whether the audit will occur. If audited, any unreported salaried income is detected; and any undeclared endowment income may detected but at a pre-announced probability of 50%. That is, if you are audited, there is a 100% chance that all unreported salaried income is detected; and a 50% chance that all unreported endowment income is detected.

If unreported income is detected, you will be required to pay a fine on the unpaid taxes. You will pay a fine of 1.5 times the unpaid taxes. In other words, if you have unreported income and is detected, a penalty which equals 1.5*0.3*(actual income - reported income) will be subtracted from your after-tax-income to get your final income for the round.

How your earnings will be determined

If you are not audited, your earnings for the round will be

Actual income – 0.30 (reported income)*

If you are audited, your earnings for the round will depend on the penalty rate and be

Actual income minus taxes paid minus penalty for undisclosed income, i.e.

Earnings = actual income – 0.30(reported income) – 1.5*0.3 (actual income-reported income)* or simply, *actual income – reported tax – 1.5*(tax owed – reported tax).*

Examples

These examples will demonstrate the type of decision you will be making and how your earnings will be determined.

Example 1. Suppose your income for the round is R50 and that you report R50 as your income and the penalty rate is 1.5 times the unpaid tax. Then you will pay 0.30*R50.00 = R15.00 in taxes. Thus, your tax owed is R15.00.

If not audited, your earnings for the round will be R50 – R15.00 = R35.00

If audited, your earnings for the round will be R50 – R15.00 = R35.00

Example 2. Suppose your income for the round is R50.00, and that you report R30.00 as your income, and the penalty rate is 1.5 times the unpaid tax. Then your tax owed will be 0.30*R50.00 = R15.00; Tax reported will be 0.30*R30 = R9.00.

If not audited, your earnings for the round will be R50 – R9.00 = R41.00

If audited and detected all unreported income of R20.00, (where R20 = R50 – R30), you will be required to pay 1.5 times the unpaid tax. Your earnings for the round will be R50 – R9.00 – 1.5(R15.00 – R9.00) = R32.00

The experiment will have 10 rounds, but only one of these will count for payment. At the end of the experiment, a 10-sided die will be rolled to determine which round will count for payment. After the round is selected for payment, you will be paid in cash your earnings in that round. Each round is equally likely to be selected, but you will not know in advance which one will be chosen.

If you have any questions, please raise your hand and one of us will come to your desk to answer it.

Instructions for Sessions 2 & 4

This is an experiment about economic decision making. The study will last no more than 1 hour. You will receive R30 for your participation and will have the opportunity to increase this amount based on the decisions you make. Your earnings will be paid to you in cash at the end of the study. Your decisions and payments will be kept private.

The decisions made in this experiment are tax reporting decisions. In each round, you will be given some endowment income. You will earn some additional income by performing a simple task of counting the number of ones in grid, in the shortest possible time. The amount earned is determined by one's performance in the task. Thus, in each round, you will be possessing two types of incomes (earned and endowment income). How your decisions affect your earnings is explained below.

In each round, you will have to report your income (i.e. both incomes) to a tax authority and pay taxes on reported income. The tax rate is 30%. Thus, your taxes will be 0.30* (reported income). After you submit your taxes, there is a chance that you will be audited by the tax authority. The probability of audit will be announced. A computer will use a random number generator to decide whether the audit will occur. If audited, any unreported salaried income is detected; and any undeclared endowment income may detected but at a pre-announced probability of 50%. That is, if you are audited, there is a 100% chance that all unreported salaried income is detected; and a 50% chance that all unreported endowment income is detected.

If unreported income is detected, you will be required to pay a fine on the unpaid taxes. You will pay a fine that ranges between 1.5 and 3 times the unpaid taxes. In other words, if you have unreported income and is detected, a penalty which equals 1.5*0.3*(actual income - reported income) or 3.0*0.3*(actual income - reported income) will be subtracted from your after-tax-income to get your final income for the round.

How your earnings will be determined

If you are not audited, your earnings for the round will be

Actual income – 0.30 (reported income)*

If you are audited, your earnings for the round will depend on the penalty rate and be

Actual income minus taxes paid minus penalty for undisclosed income, i.e.

Earnings = actual income-0.30(reported income)-1.5*0.3 (actual income-reported income)* or simply, *actual income – reported tax – 1.5*(tax owed – reported tax).*

If the penalty rate is 3.0, your earnings will be, *actual income – reported tax – 3.0*(tax owed – reported tax).*

Examples

These examples will demonstrate the type of decision you will be making and how your earnings will be determined.

Example 1. Suppose your income for the round is R50 and that you report R50 as your income and the penalty rate is 1.5 times the unpaid tax. Then you will pay 0.30*R50.00 = R15.00 in taxes. Thus, your tax owed is R15.00.

If not audited, your earnings for the round will be R50 – R15.00 = R35.00

If audited, your earnings for the round will be R50 – R15.00 = R35.00

Example 2. Suppose your income for the round is R50.00, and that you report R30.00 as your income, and the penalty rate is 1.5 times the unpaid tax. Then your tax owed will be 0.30*R50.00 = R15.00; Tax reported will be 0.30*R30 = R9.00.

If not audited, your earnings for the round will be R50 – R9.00 = R41.00

If audited and detected all unreported income of R20.00, (where R20 = R50 – R30), you will be required to pay a fine, which is a multiple of the unpaid tax.

If the penalty is 1.5, your earnings for the round will be R50 – R9.00 – 1.5(R15.00 – R9.00) = R32.00

*If the penalty is 3.0, y*our earnings for the round will be R50 – R9.00 – 3.0(R15.00 – R9.00) = <u>R23.00</u>

The experiment will have 10 rounds, but only one of these will count for payment. At the end of the experiment, a 10-sided die will be rolled to determine which round will count for payment. After the round is selected for payment, you will be paid in cash your earnings in that round. Each round is equally likely to be selected, but you will not know in advance which one will be chosen.

If you have any questions, please raise your hand and one of us will come to your desk to answer it.