The Journal of Socio-Economics xxx (2010) xxx–xxx

Contents lists available at ScienceDirect

The Journal of Socio-Economics

journal homepage: www.elsevier.com/locate/soceco

Targeting occupations with varying reputations to increase tax revenue☆

Adam Forest[a,*], Erich Kirchler[b]

[a] Milgard School of Business, University of Washington, Tacoma, 1900 Commerce St., Tacoma, WA 98402, USA
[b] Faculty of Psychology, University of Vienna, Universitaetsstrasse 7, A-1010 Vienna, Austria

ARTICLE INFO

Article history:
Received 30 April 2009
Received in revised form 5 February 2010
Accepted 11 February 2010

JEL classification:
A13
C25
H26
H30
K42

Keywords:
Deterrence
Occupation
Ordered probit
Reputation
Tax compliance
Tax evasion

ABSTRACT

If the government's goal is to raise tax revenue in a cost-effective manner, which (if any) occupation categories could be targeted with a higher probability of an audit to yield increased revenue? Looking beyond mere *opportunity to evade* (e.g., self-employment) and starting from the premise that taxpayers in certain occupations evade more than others, the issue is whether these taxpayers respond to a change in the audit rate. Theory suggests that compliance increases in response to higher audit rates; the occupations with the higher evaders could therefore be targeted. This theory is tested by drawing a connection between occupation, reputation, and tax compliance. We assume that taxpayers in occupations with high need for reputation respond to a lower extent to increased tax audits than taxpayers whose achievement does not depend on reputation. The results support the effectiveness of raising tax revenue by targeting specific occupations, non-managers, with a higher probability of an audit.

1. Introduction

Theory suggests that a rise in the probability of a tax audit should trigger increased compliance by individuals. Allingham and Sandmo (1972) and Srinivasan (1973) provide the foundation for this assumption. To back up the theory, Dubin et al. (1990) offer empirical evidence on a macro-economic level of the positive relation between audit rates and compliance. With evidence from laboratory experiments, both Spicer and Thomas (1982) and Alm et al. (1992) similarly find that – holding other determinants of compliance constant – increasing audit activities increase compliance.

With a contrary view, some scholars have alluded to a flaw in assuming that high audit rates will decrease evasion, rather, audits can have opposite than the intended effects (Andreoni et al., 1998). Slemrod et al. (2001, p. 482) concluded that *high-income* taxpayers might not respond because of "a perception that an audit will not automatically detect and punish all evasion ..." With such a perception, any taxpayer incentive (to reduce the chance of an audit by reporting truthfully) diminishes as the probability of audit approaches one.[1] Pestieau and Possen (1991) find a similar *theoretical* result for taxpayers deemed less risk averse (i.e., entrepreneurs); tax revenue initially increases with the audit probability, but then revenue starts to fall for sufficiently high audit probabilities. Moreover, audits and imposed pressure upon taxpayers through coercive power practiced by authorities not only signal distrust to taxpayers but can lead to reactance and non-cooperation (Kirchler, 2007).

A particularly interesting question regards the effect of audits on different occupational groups whose achievement heavily depends on their reputation. For instance, Arachi and Santoro (2007) discuss the differential effect of audits and enforcement strategies on different business sectors (see also Ashby et al., 2009a,b). One criterion for different effects on different occupational groups may be due to varying dependence on reputation. If the success of a particular occupational group depends on reputation, then being caught evading taxes may bear the risk of being socially blamed and stigmatized. Social stigmatization may be even more of a deterrent to evasion than the menace of audits (Porcano and Price, 1993). Those occupational groups that depend on reputation may cooperate by paying their tax share because evasion bears the risk of social

☆ For helpful comments and suggestions on previous versions, we thank Jay Helms, Douglas Holtz-Eakin, Peter Lindert, Steve Sheffrin and seminar participants at the 2001 Southern Economic Association Annual Conference and at Syracuse University.

* Corresponding author.
E-mail address: foresta@u.washington.edu (A. Forest).

[1] See Slemrod et al. (2001, p. 480).

1053-5357/$ – see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.socec.2010.02.006

blaming; increased audit probabilities would not affect tax honesty. On the other hand, those occupational groups who are not dependent on reputation and tempted to evade taxes would defer only if audit probability and detection of evasion probability are high or increased. The findings in this paper are consistent with these assumptions showing that greater enforcement may not necessarily yield greater revenue from all groups of taxpayers, but targeting specific groups may be effective. This paper explores the theoretical and empirical connection between an individual's occupation, and the potential reaction to increased scrutiny by tax authorities.

2. Occupation, reputation, and audit rates

As reported in *The Wall Street Journal*, "States Publicize Late Taxpayers' Names Online," (January 8), 2004:

"Threatening public humiliation may be a nasty way to collect overdue taxes. But growing numbers of states are finding it can be a remarkably effective way to raise badly needed cash."[2]

Recognizing that taxpayers respond to threats of public humiliation (e.g., Wenzel et al., 2008), this paper focuses on the hypothesis that different occupation categories respond differently to such threats, i.e., the importance of a good reputation varies with different occupations. The question posed is whether tax authorities could increase tax revenue by targeting specific occupations.

We assume that managers are more dependent (than others) on reputation for success in their chosen occupation. This general proposition is not new; in *The Theory of Moral Sentiments* (Smith, 1976 [6th ed. 1790], p. 63), Adam Smith states that "[t]he success of . . . [most] people . . . almost always depends upon the favour and good opinion of their neighbours and equals . . ."[3] "Good" managers are expected to display a high degree of honesty.[4]

If managers were audited and found to have evaded taxes, and if evasion was made public, then their reputation would likely suffer. By contrast, if non-managers were audited and found to have evaded taxes, their career would not necessarily be harmed. For example, a salesperson may be successful, despite a poor personal reputation, as long as the reputation of the product they are selling is not tarnished. Assuming non-managers have less to lose if caught evading and shamed in public, they are less sensitive to government enforcement efforts and evade more than managers who may risk harming their reputation if caught evading. We hypothesize that targeting non-managers that are less dependent on reputation with a higher probability of an audit would reduce their tendency to evade more.[5]

Let "taxpayer" refer to filers (i.e., individuals who file a tax return).[6] In this paper, "tax evasion" refers to a taxpayer knowingly failing to report their correct taxable income. For example, a taxpayer may be considered a tax evader by knowingly (i) overstating deductions or expenses (e.g., medical, charitable, or business deductions), or (ii) leaving some reportable income off of a tax return.

If the government's goal is to raise tax revenue in a cost-effective manner, which (if any) occupation categories should be targeted with a higher probability of an audit? We proceed to analyze a theoretical model similar to the one presented by Allingham and Sandmo (1972) and Yitzhaki (1974); each taxpayer chooses the amount of income to declare (x) in order to maximize their expected utility ($E(U)$):

$$E(U) = (1-p)\cdot u(w-\theta\cdot x) + p\cdot u(w-\theta\cdot x - F\cdot\theta\cdot(w-x)-s). \quad (1)$$

In Eq. (1), $p \equiv$ probability of being audited by tax authorities; $w \equiv$ actual income; $\theta \equiv$ income tax rate; $F \equiv$ fine rate; $s \equiv$ reputation-loss variable equals zero if reputation does not matter (i.e., non-manager), and is greater than zero otherwise (i.e., manager).

The proposed connection between reputation and occupation is new, i.e., if occupation success is dependent on a good reputation, then the magnitude of tax evasion should be less than if occupation success is not dependent on a good reputation. Therefore, as a policy matter, occupations and the connected relevance of reputation could be used as a distinguishing factor in categorizing groups to be targeted for income tax audits.

Deriving the condition for a person to declare less than their actual income (i.e., evade), for both a manager and a non-manager, yields the following comparison assuming (i) $u' > 0$ (derivative with respect to income is positive, i.e., more income is preferred), and (ii) $u'' < 0$ (second derivative with respect to income is negative, implying risk aversion):

$$p\cdot F < \underbrace{\left[p + (1-p)\cdot\frac{u'(w\cdot(1-\theta))}{u'(w\cdot(1-\theta)-s)}\right]}_{(Manager:\ u'(w\cdot(1-\theta))<u'(w\cdot(1-\theta)-s))} < \underbrace{1}_{(Non-manager:\ u'(w\cdot(1-\theta))=u'(w\cdot(1-\theta)-s))}. \quad (2)$$

Eq. (2) illustrates that the minimum expected fine necessary to cause managers to declare their actual income (*i.e.*, $x = w$) is less than the minimum expected fine necessary to cause non-managers to declare their actual income. The tax authority could, for example, impose the same fine (F) on all evaders, but increase the probability of an audit (p) for those (e.g., non-managers) with an occupation where success is not dependent on a good reputation and keep constant the audit probability for those fearing loss of reputation if caught cheating. The issue is whether such an action to target occupations will achieve a greater level of income declared. Theoretically the answer is yes.

To combat the higher expected evasion by non-managers, raising the audit rate may be effective.[7] Assuming decreasing absolute risk aversion[8]:

$$\underbrace{\left.\frac{\partial x}{\partial p}\right|_{s=0}}_{(Non-manager)} < \underbrace{\left.\frac{\partial x}{\partial p}\right|_{s>0}}_{(Manager)}. \quad (3)$$

Eq. (3) in words: if reputation matters (i.e., $s > 0$), then an individual is more sensitive to a change in the probability of an audit. Therefore

[2] Herman (2004, p. D1).

[3] For more recent theoretical discussions, see Akerlof (1980), Bernheim (1994), and Fershtman and Weiss (1998). See also Becker (1976), Chapter 12, "A Theory of Social Interactions."

[4] For a discussion of social norms (e.g., managers are honest because they believe most managers are honest), see Wenzel (2004, p. 225).

[5] An argument can be made that harm to reputation is unlikely, due to the "confidentiality" of tax noncompliance investigations (see Mason and Calvin (1978, p. 75, 87), and Klepper and Nagin (1989, p. 131)); but we assume that "confidentiality" is not guaranteed. See Merry (1997 [1984]) for a discussion of gossip. The Internal Revenue Code §6103(h)(4) (disclosure in judicial and administrative tax proceedings), and §6103(k)(6) (disclosure by certain officers and employees for investigative purposes) tend to diminish the expectation of "confidential" tax investigations. United States Code Service, Title 26, Internal Revenue Code (2008).

[6] As discussed later, due to data limitations, nonfilers were dropped from the sample analyzed.

[7] A similar argument could be made for levying different fines (rather than changing the audit rate) depending on the occupation category.

[8] See Allingham and Sandmo (1972, pp. 327–328).

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006

if reputation matters to managers, then the audit rate need not be as high in order to obtain the desired response.[9]

There are some arguments that discount the deterrent effect of high audit rates (or fines).[10] In a different context, Cole et al. (1998) discuss the theoretical ineffectiveness of sanctions against individuals with less to lose (e.g., non-managers who are less dependent on a good reputation for occupation success). Cowell (1990, pp. 149–150) states that "[a] policy of frightening people into obedience to the state just does not seem right." First, some of the theoretical "results are very sensitive to the conventional assumptions ... that individual taxpayers are 'rational,' risk averse, and accurately informed about the risks involved. The results may not hold up very well in a world of heterogeneous individuals, where both taxpayers and government agencies may make mistakes." Second, "[t]here may well be some room for an increase in penalties, but legislators should recognize that it may not be possible to push them very far without violating the public's sense of what is fair and reasonable." An empirical analysis of whether specific occupations should be targeted with a higher probability of an audit is covered next.

3. Empirical analysis

Using an ordered probit econometric model, the relative marginal effect of an increased perceived probability of an audit can be determined. Comparing the marginal effects for different occupation categories will suggest which occupations should be targeted to yield the greatest increase in tax revenue. To preview the results, empirical findings support the theory that increasing the probability of an audit will reduce evasion, but only for specific occupation categories.

3.1. Data

The data set to be used is from a survey, conducted by Louis Harris and Associates, and commissioned by the U.S. Internal Revenue Service: *1987 Taxpayer Opinion Survey*.

"In the summer of 1987 Harris interviewers spread out across the United States to 200 scientifically selected communities, randomly choosing households in pre-designated neighborhoods. The 2003 taxpayers they interviewed are a representative national sample, projectable to all taxpayers in the country. Of these 2003, 1756 were designated as taxpayers that had filed in the last two years [tax year 1985 or 1986] or were planning to file this year [tax year 1986].

Harris asked taxpayers about their views on tax reform, about their feelings concerning the U.S. tax system, their experience with and impressions of the Internal Revenue Service, their views about tax evasion, and many other relevant topics. The answers they gave – in interviews that averaged an hour and a quarter each – represent a comprehensive assessment of how citizens feel about Federal income taxes."[11]

This survey data has been used in tax compliance research by Sheffrin and Triest (1992) and Smith (1990, 1992), but the connection between occupation and income tax evasion (other than focusing on the opportunity to evade) has not been examined. Since the survey results use occupation categories (e.g., manager/professional, sales, etc.) to describe the "main provider"[12] in the respondent's household, the data can be used to determine the relationship between specific occupation categories and the probability of evasion.

Responses to the following occupation question (Harris, 1988, question no. 108) were matched and recorded using the 1980 Bureau of the Census Occupational Classification System: "What kind of work does/did [the main provider in the household] *normally* do?" Respondents were classified into, and dummy variables were created for, the following occupation categories: managerial and professional specialty (*MG*), sales (*SA*), and administrative support, including clerical (*CL*).[13]

For various reasons (e.g., taxpayers "refused" to respond, or did not file or plan to file a tax return for 1986), the sample was reduced to 1474 observations (2003 minus the 529 observations deleted). Although the original data set does include responses by nonfilers, they were dropped from the sample since nonfilers were never asked the direct questions (i.e., have you overstated a deduction or understated income?) used to construct the evasion variable (*EV*). In addition, nonfilers have been estimated to be a relatively minor part of the tax evasion problem.[14]

There were three topics that yielded an especially large number of "don't know" responses: (i) perceived probability of an audit (*PA*), (ii) perceived percent of taxpayers that cheat (*CT*), and (iii) household income (*IS*). Forty percent of the respondents answered "don't know" to the following perceived probability of an audit question (Harris, 1988, question no. 71):

> As you may know, an *audit* is when you have to go to an IRS office or they come to your house or business or they may correspond with you, and you are asked to prove your deductions or answer questions about your tax return. The question I have is: out of every 100 taxpayers at your income level, how many or what percent do you think were *audited* last year? (Answers: 0 to 100%).

Thirty-two percent (32%) of the respondents answered "don't know" to the following taxpayers cheat question (Harris, 1988, question no. 64a):

> By the way, about what percent of taxpayers would you say try to cheat on their taxes to some extent? (Answers: 0 to 100%).

Nineteen percent (19%) of the respondents answered "don't know/no answer/refused" to the following income question (Harris, 1988, question no. 116):

> Looking at this card and considering all sources of income, what was the approximate total income of *your own* before taxes in 1986 ...

If married, 21% of the respondents answered "don't know/no answer/refused" to this income question (Harris, 1988, question no. 117):

> And now look at the card again and tell me the letter that was the *total* amount of your own income *plus* your spouse's income in 1986.

In an effort to minimize the amount of data omitted due to "don't know" responses, for three variables (*PA*), (*CT*), and (*IS*), the

[9] For a theoretical discussion of the optimal probability and magnitude of fines, see Kaplow (1992). See Lott (1992, p. 162) for an analogous argument: "If wealthy individuals suffer a larger reduction in income and a greater penalty from any given stay in prison in terms of forgone opportunity costs, optimal penalties predict that they should face a lower probability of imprisonment."

[10] See Dubin, Graetz and Wilde (1990, p. 395) and Kaplow (1992, p. 10) regarding the limitations of increasing fines.

[11] Harris (1988, p. 1). Note that this survey only includes the 48 contiguous states, not Hawaii and Alaska.

[12] Harris (1988, question no. 107).

[13] Other categories such as farming, forestry, fishing, mechanics, construction, laborers, etc., represent the omitted category.

[14] The Internal Revenue Service estimates that nonfilers accounted for only $7.2 billion of the $84.9 billion tax gap for tax year 1987 U.S. Department of the Treasury (1988, p. 2)).

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006

Table 1
Descriptive statistics for *1987 Taxpayer Opinion Survey* data: Non-dummy variables.

Variable description	Sample				Survey
	Mean[a]	S.D.	Min.	Max.	Mean[b]
Regressands					
(EV_{UNDER}) Understate income 0 ⇒ definitely have not 3 ⇒ definitely have	0.52	0.88	0.00	3.00	0.50
(EV_{OVER}) Overstate deductions 0 ⇒ definitely have not 3 ⇒ definitely have	0.45	0.76	0.00	3.00	0.43
(*EV*) Either: understate income, or overstate deductions 0 ⇒ definitely have not 3 ⇒ definitely have	0.73	0.96	0.00	3.00	
Regressors					
(*CT*) Perceived percent of taxpayers cheat[c]	0.41	0.22	0.01	0.42	
(*IS*) Scaled income (including spouse)[d]	2.69	1.74	0.25	7.50	
(*PA*) Perceived probability of an audit[e]	0.09	0.10	0.00	1.00	0.09
(*AE*) Age	45.12	17.03	18.00	89.00	45.73
(*EC*) Education[f]	5.92	1.77	1.00	9.00	5.48

[a] $N = 1474$.
[b] Mean reported (from those who answered the question), if any, by Harris (1988). Where no mean was reported by Harris (1988), we compute a mean using the frequencies reported.
[c] This variable is the response to the question: "By the way, about what percent of taxpayers would you say try to cheat on their taxes to some extent?" Harris (1988, question no. 64a). The response is divided by 100. A dummy variable is coded "1" if a mean value is substituted for a "don't know" response, "0" otherwise.
[d] This variable is the highest value response from two questions: "Looking at this card and considering all sources of income, what was the approximate total income of *your own* before taxes in 1986?" and "Now look at the card again and tell me . . . the *total* amount of your own income *plus* your spouse's income in 1986." Harris (1988, question nos. 116 and 117). Survey participants were asked to specify the total income, within a certain range. The mean of the range, divided by 10,000, is used as the scaled income variable (*IS*). A response of "$75,000 or more" is assigned a numerical code of 7.5. A dummy variable is coded "1" if a mean value is substituted for a "don't know/no answer/refused" response, "0" otherwise.
[e] This variable is the response to the question: "As you may know, an *audit* is when you have to go to an IRS [Internal Revenue Service] office or they come to your house or business or they may correspond with you, and you are asked to prove your deductions or answer questions about your tax return. The question I have is: out of every 100 taxpayers at your income level, how many or what percent do you think were *audited* last year?" Harris (1988, question no. 71). A response of "less than 1%" is treated as 0%. The response is divided by 100. A dummy variable is coded "1" if a mean value is substituted for a "don't know" response, "0" otherwise.
[f] This variable is the response to the question: "What was the last grade of school you completed?" Harris (1988, question no. 110). For example, 5 ≡ high school graduate, 8 ≡ four-year college graduate.

mean values were calculated from those that responded (other than "don't know"). These mean values were then substituted for the "don't know" responses and three dummy variables were added to the model as mean-value-substitution indicators.[15]

Tables 1 and 2 report both the (reduced) sample means and the (original) survey means/frequencies for most of the variables. A comparison reveals little difference.

The evasion variables reflect the taxpayers' level of agreement with the following two statements:

Harris (1988, question no. 48) (understates income):

"Within the past five years or so, do you think you might have left some reportable income off your federal tax returns—even *just a minor amount*? Would you say you definitely have, probably have, probably have not, or definitely have not?"

Harris (1988, question no. 47) (overstates deductions):

"By the same token, within the past five years or so, do you think you might have overstated any deductions or expenses – like medical, charitable or business deductions, and so forth – even by *just a small amount*? Would you say you definitely have, probably have, probably have not, or definitely have not overstated any?"

Individual responses to both questions 48 and 47 are used separately (EV_{UNDER} and EV_{OVER}), and are also combined to form one

Table 2
Descriptive statistics for *1987 Taxpayer Opinion Survey* data: Dummy variables.

Variable description	Sample mean[a]	Survey frequency[b]
(*ID*) Itemized deductions[c]	0.51	0.52
(*SF*) Self-employed (either spouse)[d]	0.18	
(*MG*) Occupation: manager/professional	0.24	0.19
(*SA*) Occupation: sales	0.12	
(*CL*) Occupation: clerical[e]	0.13	
(*OW*) Own home[f]	0.60	0.62
(*MR*) Married[g]	0.62	0.55
(*ME*) Male	0.52	0.47

[a] $N = 1474$.
[b] Frequency reported, if any, by Harris (1988).
[c] This variable is the response to the question: "Do you itemize your deductions using schedule A, or don't you itemize deductions?" Harris (1988, question no. 4g). The numerical code for the dummy variable (*ID*) is "1" if the taxpayer response was "yes", "0" otherwise.
[d] This variable combines the responses from two questions: "(Are/Were) you *self*-employed?" and "(Is/Was) your spouse *self*-employed?" Harris (1988, question nos. 109a and 109b). The numerical code for the dummy variable (*SF*) is "1" if the taxpayer response was "yes" to either question, "0" otherwise.
[e] Other categories such as farming, forestry, fishing, mechanics, construction, laborers, etc., represent the omitted category. A matched response is assigned a numerical code "1", "0" otherwise; e.g., the dummy variable (*CL*) is set equal to "1" if the respondent declared that the main provider in the household normally does clerical work. All other dummy variables are coded similarly.
[f] This variable is the response to the question: "Do you own your own home or are you renting?" Harris (1988, question no. 119a). The numerical code for the dummy variable (*OW*) is "1" if the taxpayer response was "own", "0" otherwise.
[g] This variable is the response to the question: "Is/was your spouse self-employed?" Harris (1988, question no. 109b). The numerical code for the dummy variable (*MR*) is "1" if the taxpayer responded, "0" otherwise.

[15] Although the "imputation" literature covers many different techniques to remedy missing data problems, all techniques are subject to criticism. In a comparison of many approaches, Paul et al. (2008) found mean imputation (with a dummy variable) to perform better than expected from the technical literature.

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006

Table 3
Ordered probit regression results: $y_i^* = \boldsymbol{\beta}' \boldsymbol{x}_i + \varepsilon_i$.

Variable[a]	Coefficient[b]		
y_i^* (evasion):	Understate income	Overstate deductions	Understate or overstate
x_i:			
Constant	−0.686 (*−3.435*)	−1.239 (*−5.923*)	−0.487 (*−2.665*)
(*CT*) Perceived percent of taxpayers cheat[c]	0.614 (*4.252*)	0.668 (*4.425*)	0.633 (*4.670*)
(*IS*) Scaled income[d]	0.139 (*1.928*)	0.080 (*1.119*)	0.085 (*1.314*)
(IS^2) (Scaled income)^2	−0.022 (*−2.443*)	−0.002 (*−0.198*)	−0.008 (*−0.965*)
(*ID*) Itemized deductions	0.065 (*0.845*)	0.194 (*2.501*)	0.133 (*1.868*)
(*SF*) Self-employed	0.232 (*2.614*)	0.016 (*0.177*)	0.133 (*1.619*)
(*PA*) Perceived probability of an audit[e]	0.321 (*0.907*)	0.159 (*0.370*)	0.392 (*1.140*)
(*MGPA*) Interaction: manager · audit	−0.861 (*−1.380*)	−1.013 (*−1.084*)	−0.667 (*−1.015*)
(*SAPA*) Interaction: sales · audit	−2.955 (*−2.215*)	0.248 (*0.362*)	−1.015 (*−1.472*)
(*CLPA*) Interaction: clerical · audit	−2.845 (*−2.392*)	−0.891 (*−0.847*)	−2.054 (*−2.169*)
(*AE*) Age	−0.011 (*−4.578*)	−0.007 (*−3.030*)	−0.009 (*−4.414*)
(*EC*) Education	0.041 (*1.832*)	0.073 (*3.208*)	0.049 (*2.416*)
(*OW*) Own home	−0.139 (*−1.633*)	0.017 (*0.204*)	−0.072 (*−0.911*)
(*MR*) Married	0.069 (*0.825*)	−0.003 (*−0.038*)	0.054 (*0.716*)
(*ME*) Male	0.264 (*3.773*)	0.119 (*1.647*)	0.229 (*3.537*)

[a] See Tables 1 and 2 for variable descriptions. $N = 1474$.
[b] In parentheses, the *z*-statistic is the parameter estimate divided by its asymptotic standard error, i.e., the null hypothesis is that the coefficient equals zero.
[c] The dummy variable (coded "1" if a mean value is substituted for a "don't know" response, "0" otherwise) is not reported.
[d] The dummy variable (coded "1" if a mean value is substituted for a "don't know/no answer/refused" response, "0" otherwise) is not reported.
[e] The dummy variable (coded "1" if a mean value is substituted for a "don't know" response, "0" otherwise) is not reported.

variable (*EV*) indicating the *highest level* of admitted evasion. For example, if the response to question no. 48 is "probably have not," but the response to question no. 47 is "definitely have," then the combined fictitious response was inferred: "definitely have evaded".

As a preliminary review, we check whether managers'/professionals' mean evasion (*EV*) response is less (closer to 0 ≡ definitely have not evaded) than the other occupation categories. In other words, we check whether managers/professionals are less responsive, to an increase in the probability of an audit, merely because they evade less in general. This is not necessarily the case. The sample mean evasion (*EV*) response (with 0 ≡ have not evaded, and 3 ≡ definitely have evaded) for managers/professionals (*MG*) is .84 and greater than the other categories (sales = .73, clerical = .61, omitted = .72).

Since the mean evasion (*EV*) response was 0.73 (closer to 0 ≡ definitely have not evaded, than to 3 ≡ definitely have evaded) in Table 1, the average participant in the sample responded that he/she probably has not evaded, but believes that 41% of taxpayers do try to cheat. The average participant was 45 years old (*AE*), a high school graduate (*EC*), with a 1986 household income of almost $27,000, and not a manager/professional (from Table 2, managers/professionals were only 24% of the sample participants).

3.2. Results and discussion

An ordered probit regression is used to analyze the factors that influence tax evasion (*EV*). Table 3

reports the ordered probit estimation results.[16] In analyzing the results, we focus on the signs of the coefficients and the statistical significance of the regressors. With the ordered probit model, the marginal effects for a change in the value of a regressor can be computed for every dependent variable category. For example, if a taxpayer's age (*AE*) increases, we can calculate the marginal effect on the probabilities that an average taxpayer definitely has *not* evaded, probably has *not* evaded, probably *has* evaded, and definitely *has* evaded.

As a formal matter, the sign of the marginal effects for the extreme categories (e.g., "definitely has *not* evaded" and "definitely *has* evaded") will be of opposite signs. The marginal effect sign for the category assigned the high numerical code will have the same sign as that of the regression coefficient. To simplify the analysis marginal effects are discussed, with respect to the extreme dependent variable categories, in an informal manner. To capture statistical significance, the table also contains the *z*-statistics (coefficient divided by standard error).

Continuing with the example for age (*AE*), the negative coefficients in Table 3 are statistically significant and imply that older taxpayers are more likely to respond that they definitely have not evaded. This negative relation between age (*AE*) and evasion (*EV*) has been found in several previous studies (for a review see Kirchler, 2007) and is expected here, assuming older Americans are less apt to challenge the legal limits of the tax laws.

A cursory check of some of the other variables in Table 3 suggests that males (*ME*) and taxpayers with more years of education (*EC*) are relatively more likely to respond that they definitely have evaded. Also this gender effect has frequently been found in empirical investigations (Braithwaite, 2009; Kirchler, 2007). Higher levels of education (*EC*) may enable taxpayers to engage in more sophisticated methods to avoid paying taxes. Likewise, the greater the perception that others cheat, the greater the likelihood a taxpayer responds that they definitely have evaded. This cheating variable (*CT*) is included as a proxy for unfairness of the tax system (i.e., the perception that all taxpayers are not paying their fair share).

Both self-employment (*SF*) and itemized deductions (*ID*) are included to control for the *opportunity to evade*; both coefficients are positive (as expected). Self-employment is a significant factor in understating income; itemizing (*ID*) is a significant factor in overstating deductions. Indeed, the opportunity of taxpayers to evade, has repeatedly been found to highly correlate with evasion (for a review see Kirchler, 2007).

According to Internal Revenue Service estimates, underreported income is the greatest problem. For tax year 1987, underreported income ($48.3 billion) made up 86% of the estimated tax gap by indi-

[16] The ordered probit model, in its general form, is discussed by both Greene (1997, pp. 926-931) and Maddala (1983, pp. 46-49). An alternative specification with multiplicative heteroscedasticity of the following form was also estimated: $\sigma_i^2 = \sigma^2 \cdot (e^{\alpha \cdot IS_i})^2$ where $\sigma^2 = 1$, and IS_i is scaled income for individual *i*. Since ($\alpha = 0$) indicates a homoscedastic disturbance, the heteroscedastic specification would be justified if the null hypothesis (H_0: $\alpha = 0$) could be rejected; we could not reject the null hypothesis and do not report the results. See Greene (1995, p. 470) and Greene (1997, p. 565) for a discussion of multiplicative heteroscedasticity.

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006

vidual filers ($56.3 billion) (U.S. Department of the Treasury (1988, p. 2)). With this in mind, to determine whether targeting specific occupation categories may help reduce evasion, we concentrate on the "Understate Income" column of Table 3.

Table 3 estimates indicate that taxpayers with higher incomes (*IS*) are more likely to respond that they definitely have understated income. The issue is whether, at a given income level and controlling for the opportunity to evade, raising the probability of an audit is an effective deterrent to certain occupation categories.

The key variable for our analysis is the taxpayer's perceived probability of an audit. This variable may be more informative than any measure of the actual probability of an audit. Erard and Feinstein (1994) suggest that filers typically overestimate the probability of an audit. Even if the perceived measure is not equal to the actual measure, it is still informative to know how individuals react if the probability of an audit rises. Whether a particular individual, believes that the probability is rising from 5% to 10%, or 12% to 14%, is not necessarily important. But it is important to know if a *perceived* rise in the probability of an audit will help increase compliance. "Actual characteristics of sanctions such as severity, certainty, or even simple possibility may be important only to the extent that they generate particular kinds of beliefs about the consequences of deviance ... It is possible that the effectiveness of sanctions hinges on the perceived certainty of their imposition, a factor which may vary from individual to individual and from social group to social group." Tittle and Logan (1973, p. 380).

An unexpected result is the positive but statistically insignificant coefficient on the probability of an audit variable. This result, although counterintuitive, has been generated in prior studies (e.g., Andreoni et al., 1998). Fischer et al. (1992, p. 38) conclude that "[a] critical analysis of the literature does not provide strong evidence that increasing detection probability affects compliance."[17] For example, Dubin and Wilde (1988), with 1969 IRS data, find a significant negative relationship between audit rate and compliance for a high income nonbusiness (no Schedule C [nonfarm business income] or Schedule F [farm business income]) audit class.[18]

Instead of merely focusing on deterrence, in this paper we test if members of specific occupation categories (i.e., managers/professionals) are more sensitive to a change in the probability of an audit. In other words, if managers/professionals were targeted with a higher probability of an audit, would greater tax revenue be forthcoming? To answer this, our analysis turns to a 3-way relationship between (i) occupation categories, (ii) probability of an audit, and (iii) evasion.

The key result is that managers/professionals may not respond to an increase in the probability of an audit; i.e., increased tax revenue would not necessarily be forthcoming by targeting managers/professionals. The manager/professional interaction (*MGPA*) coefficient is negative (as expected), but it is *not* statistically significant. An intuitive explanation is that, consistent with the theoretical model presented at the beginning of this paper, managers/professionals (for whom reputation is a key factor for success in their occupation) are more sensitive to the existing audit rate and may have already responded with a high level of compliance. Therefore there may be little room for managers/professionals to increase their compliance in response to an increase in the audit rate.

In contrast, the sales (*SAPA*) and clerical (*CLPA*) interaction coefficients, in the "Understate Income" column, are both also negative (as expected), but *are* statistically significant. In response to a higher audit rate, the sales and clerical taxpayers may have more wiggle room to increase their compliance. Targeting these occupations may yield greater tax revenue. For example, Table 4 compares the probabilities of an average taxpayer responding that they definitely have not understated income. Given an average perceived probability of an audit ($\overline{PA}$), a mere change in occupation, to sales or clerical, increases the response probability by .07. In other words, occupations in which reputation is not a key factor react, whereas managers/professionals may not.

Table 4
Probability of Response: "Definitely have not understated income".

Occupation: Sales (*SA*): Prob ($EV_{UNDER} = 0$) = $1 - \Phi(\boldsymbol{\beta}' \bar{x}_{SA})$ Occupation: Clerical (*CL*): Prob ($EV_{UNDER} = 0$) = $1 - \Phi(\boldsymbol{\beta}' \bar{\boldsymbol{x}}_{CL})$		
SA (or *CL*) = 0	*SA* (or *CL*) = 1	Change
.63	.70	+.07

Notes: 1. The vector $\bar{x}_{SA}$ consists of sample means, except for the occupation dummy variables: if $SA = 0$ then Manager (MG) = $\frac{\overline{MG}}{1-\overline{SA}}$ and Clerical (CL) = $\frac{\overline{CL}}{1-\overline{SA}}$; if $SA = 1$ then Manager (MG) = 0 and Clerical (CL) = 0. 2. The vector $\bar{x}_{CL}$ consists of sample means, except for the occupation dummy variables: if $CL = 0$ then Manager (MG) = $\frac{\overline{MG}}{1-\overline{CL}}$ and Sales (SA) = $\frac{\overline{SA}}{1-\overline{CL}}$; if $CL = 1$ then Manager (MG) = 0 and Sales (SA) = 0. 3. $\Phi(\bullet)$ is the standard normal cumulative distribution function.

4. Conclusion

For a given level of income and controlling for the opportunity to evade, the goal was to determine if raising the probability of an audit on specific occupation categories would be an effective method to increase tax revenue. The results suggest that if the Internal Revenue Service (IRS) announced that audits would (in general) increase (causing taxpayers' perceived probability of an audit to increase), then the *average* taxpayer may not respond with increased compliance. On the other hand, if instead of a general increase in the probability of an audit, the IRS targeted specific occupations, tax revenue may rise.

It is argued that tax compliance not only depends on audit probability and fines but also on loss of reputation in case of audit and detection of evasion. Occupational groups that risk their reputation in case of detected evasion are assumed to be more concerned about the consequences of audits in case of evasion and will, thus, be less likely to evade taxes as compared to occupational groups whose achievement is less dependent on reputation. In particular, targeting non-managers and threatening them with a higher audit probability may yield increased tax revenue. Consistent with the theoretical argument presented in this paper, non-managers who are less dependent on reputation for success in their chosen occupation react with higher cooperation if audit probability is increased. Managers, on the other hand, who are more dependent on reputation for success, do not react more cooperatively when audits are announced to be more frequent. As a result, for a given probability of audit, non-managers may be less compliant than managers. Therefore to increase compliance, non-managers should face a higher probability of an audit.

We used existing data from the *Taxpayer Opinion Survey* to generate estimates for compliance and relied on respondents self reports. The method might be criticized both because of self reports which can be biased due to social desirability tendencies and for challenges in accounting for confounding influences. In particular, reputation as a necessary prerequisite for achievement was not assessed directly. Behavioral economics often gains data under highly controlled laboratory situations. Undoubtedly, future research would gain from applying a multi-method approach. To strengthen our assumptions, a laboratory experiment could

[17] Fischer et al. (1992, p. 7) draw a distinction between audit and detection: "an audit may fail to detect a taxpayer's noncompliance."
[18] With 1979 Internal Revenue Service data, Tauchen et al. (1993) find the opposite, i.e., a positive (statistically significant) relation between audits and higher income reports for the highest-income group.

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006

be designed in which audit probability and need for reputation are manipulated as independent variables, while other determinants of compliance are kept constant. This approach would allow investigation of causal effects in a more controlled way, with the shortcoming, however, of risking high artificiality and limited external validity. The results of our study offer a promising start to investigate the importance of reputation and limitations of the effects of audits.

In conclusion, audits (and fines) are assumed to be an efficient tool to enhance tax compliance. However, a differential perspective must be taken, and besides audits and fines, a series of other determinants of compliance need to be taken into consideration if strategies to fight evasion shall be effective.

References

Akerlof, G.A., 1980. A theory of social custom, of which unemployment may be one consequence. Quarterly Journal of Economics 94, 749–775.
Allingham, M.G., Sandmo, A., 1972. Income tax evasion: a theoretical analysis. Journal of Public Economics 1, 323–338.
Alm, J., McClelland, G.H., Schulze, W.D., 1992. Why do people pay taxes? Journal of Public Economics 48, 21–38.
Andreoni, J., Erard, B., Feinstein, J.S., 1998. Tax compliance. Journal of Economic Literature 45, 143–159.
Arachi, G., Santoro, A., 2007. Tax enforcement for SMEs: lessons from the Italian experience? eJournal of Tax Research 5, 225–243.
Ashby, J.S., Haslam, S.A., Webley, P., 2009a. The distinct role of group-central and group-peripheral norms in taxpaying behaviour. Journal of Socio-Economics 38, 230–237.
Ashby, J.S., Webley, P., Haslam, A.S., 2009b. The role of occupational taxpaying cultures in taxpaying behaviour and attitudes. Journal of Economic Psychology 30, 216–227.
Becker, G.S., 1976. The Economic Approach to Human Behavior. The University of Chicago Press, Chicago, IL.
Bernheim, B.D., 1994. A theory of conformity. Journal of Political Economy 102, 841–877.
Braithwaite, V., 2009. Defiance in Taxation and Governance. Edward Elgar, Cheltenham, UK.
Cole, H.L., Mailath, G.J., Postlewaite, A., 1998. Class systems and the enforcement of social norms. Journal of Public Economics 70, 5–35.
Cowell, F.A., 1990. Cheating the Government: The Economics of Evasion. MIT Press, Cambridge, MA.
Dubin, J.A., Graetz, M.J., Wilde, L.L., 1990. The effect of audit rates on the federal individual income tax, 1977-1986. National Tax Journal 43, 395–409.
Dubin, J.A., Wilde, L.L., 1988. An empirical analysis of federal income tax auditing and compliance. National Tax Journal 41, 61–74.
Erard, B., Feinstein, J.S., 1994. The role of moral sentiments and audit perceptions in tax compliance. Public Finance, Supp 49, 70–89.
Fershtman, C., Weiss, Y., 1998. Why do we care what others think about us? In: Ben-Ner, A., Putterman, L. (Eds.), Economics, Values, and Organization. Cambridge University Press, New York, pp. 133–150.
Fischer, C.M., Wartick, M., Mark, M.M., 1992. Detection probability and taxpayer compliance: a review of the literature. Journal of Accounting Literature 11, 1–46.
Greene, W.H., 1995. LIMDEP Version 7.0 User's Manual. Econometric Software, Inc.
Greene, W.H., 1997. Econometric Analysis, 3rd ed. Macmillan Publishing Company.
Harris, L., Associates, 1988. 1987 Taxpayer Opinion Survey. U.S. Department of The Treasury, Internal Revenue Service, document 7292, pp. 1–88.
Herman, T., 2004. States publicize late taxpayers' names online. The Wall Street Journal (January 8), D1.
Kaplow, L., 1992. The optimal probability and magnitude of fines for acts that definitely are undesirable. International Review of Law and Economics 12, 3–11.
Kirchler, E., 2007. The Economic Psychology of Tax Behaviour. Cambridge University Press, Cambridge, UK.
Klepper, S., Nagin, D., 1989. The criminal deterrence literature: implications for research on taxpayer compliance. In: Roth, J.A., Scholz, J.T. (Eds.), Taxpayer Compliance, vol. 2. University of Pennsylvania Press, Philadelphia, PA, pp. 127–155.
Lott Jr., J.R., 1992. An attempt at measuring the total monetary penalty from drug convictions: the importance of an individual's reputation. Journal of Legal Studies 21, 159–187.
Maddala, G.S., 1983. Limited Dependent and Qualitative Variables in Econometrics. Cambridge University Press.
Mason, R., Calvin, L.D., 1978. A study of admitted income tax evasion. Law & Society Review 13, 73–89.
Merry, S.E., 1997 [1984]. Rethinking gossip and scandal. In: Klein, D. (Ed.), Reputation: Studies in the Voluntary Elicitation of Good Conduct. University of Michigan Press, Ann Arbor, MI, pp. 47–74.
Paul, C., Mason, W.M., McCaffrey, D., Fox, S.A., 2008. A cautionary case study of approaches to the treatment of missing data. Statistical Methods and Applications 17, 351–372.
Pestieau, P., Possen, U.M., 1991. Tax evasion and occupational choice. Journal of Public Economics 45, 107–125.
Porcano, T.M., Price, C.E., 1993. The effects of social stigmatization on tax evasion. Advances in Taxation 5, 197–217.
Sheffrin, S.M., Triest, R.K., 1992. Can brute deterrence backfire? Perceptions and attitudes in taxpayer compliance. In: Slemrod, J. (Ed.), Why People Pay Taxes: Tax Compliance And Enforcement. University of Michigan Press, Ann Arbor, MI, pp. 193–218.
Slemrod, J.B., Blumenthal, M., Christian, C., 2001. Taxpayer response to an increased probability of audit: evidence from a controlled experiment in Minnesota. Journal of Public Economics 79, 455–483.
Smith, A., 1976 [6th ed. 1790]. In: Raphael, D.D., Macfie, A.L. (Eds.), The Theory of Moral Sentiments. Oxford University Press, New York.
Smith, K.W., 1990. Integrating three perspectives on noncompliance: a sequential decision model. Criminal Justice And Behavior 17, 350–369.
Smith, K.W., 1992. Reciprocity and fairness: positive incentives for tax Compliance. In: Slemrod, J. (Ed.), Why People Pay Taxes: Tax Compliance and Enforcement. University of Michigan Press, Ann Arbor, MI, pp. 223–250.
Spicer, M.W., Thomas, J.E., 1982. Audit probabilities and the tax evasion decision: an experimental approach. Journal of Economic Psychology 2, 241–245.
Srinivasan, T.N., 1973. Tax evasion: a model. Journal of Public Economics 2, 339–346.
Tauchen, H.V., Witte, A.D., Beron, K.J., 1993. Tax compliance: an investigation using individual taxpayer compliance measurement program (TCMP) data. Journal of Quantitative Criminology 9, 177–202.
Tittle, C.R., Logan, C.H., 1973. Sanctions and deviance: evidence and remaining questions. Law & Society Review 7, 371–392.
U.S. Department of the Treasury, Internal Revenue Service, 1988. Income Tax Compliance Research: Gross Tax Gap Estimates and Projections for 1973-1992 (publication 7285). U.S. Department of the Treasury, Washington, D.C.
United States Code Service, Title 26, Internal Revenue Code, 2008. LexisNexis.
Wenzel, M., 2004. An analysis of norm processes in tax compliance. Journal of Economic Psychology 25, 213–228.
Wenzel, M., Okomoto, T.G., Feather, N.T., Platow, M.J., 2008. Retributive and restorative justice. Law and Human Behavior 32, 375–389.
Yitzhaki, S., 1974. A note on income tax evasion: a theoretical analysis. Journal of Public Economics 3, 201–202.

Please cite this article in press as: Forest, A., Kirchler, E., Targeting occupations with varying reputations to increase tax revenue. J. Socio-Econ. (2010), doi:10.1016/j.socec.2010.02.006