Tax Attitudes and Optimal Income Taxation

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Abstract

Recent studies have put forward evidence that individuals not only have independent (personal) but also interdependent (interpersonal) reasons to pay taxes. Besides standard objective reasons to explain individuals' tax behavior and compliance (e.g., the tax system), there are also subjective, person-bound factors such as taxpayers' preferences and relationship with others. This paper studies optimal labor and capital income taxation under asymmetric information in a two-type OLG model when individuals' tax concerns matter. Individuals' attention to these concerns can range from full attention to complete inattention. In addition to consumption and leisure, individuals obtain utility from their own tax payments and the average tax payments in the economy. Tax concerns affect the policy choices via two novel channels: (i) the average (interdependent) degree of tax concern and (ii) the individual (independent) tax concerns differences between the low-ability type and the mimicker. Under plausible assumptions, the combination of these two effects might either amplify or reduce the marginal tax increase of the low-ability type due to the self-selection constraint. Another aim of the paper is to compare the optimal tax policy when agents may hide part of their income and have different intergenerational concerns toward taxes. Numerical simulations explore the theoretical results further.

Keywords: Optimal taxation, Social preferences, Tax affinity, Pro-social behavior.

JEL Classification: D03, D60, H21, H23.

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1 Introduction

In the United States, Americans perceive the taxpaying responsibility in moral terms, a fellowship they share with the community (Williamson (2015)). A majority of the American public consistently regard the income tax they pay to be fair (Gallup (2019)), and, according to Alm and Torgler (2006), individuals in the United States have the highest tax morale (an individual's intrinsic willingness to pay taxes) across several developed countries and the highest rates of tax compliance (The Cost of Tax Abuse 2011). Perhaps most surprising, filing out income tax forms is claimed to be enjoyed by a third of Americans (Pew Research Center for the People and the Press 2013). In fact, recent studies have put forward evidence that individuals not only have independent (personal) but also interdependent (interpersonal) reasons to pay taxes. That is, besides the standard objective reasons to explain individuals' tax behavior and compliance (e.g., the tax system, auditing probability, use of taxes revenue), there are also subjective, person-bound factors such as taxpayers' preferences and relationship with others that help us understand individuals' behavior towards taxation better. In this context, an important policy question is how taxpaying non-pecuniary motives affect the design of optimal taxes. The possibility agents may hide part of their income and different intergenerational concerns toward taxes leads to a non-trivial question. Hence, we investigate how the introduction of tax concerns modifies the optimal nonlinear labor and capital income taxes using a two-type OLG model with tax evasion opportunities.

In this paper, we first present empirical evidence based on surveys to illustrate that there are independent and interdependent aspects of individuals tax attitudes and behavior. Next, we present a two-agent static model where agents have preferences over consumption and leisure as well as over independent and interdependent tax preferences - personal (own tax payments) and interpersonal (average tax payments in the economy), respectively. Agents awareness of their tax preferences ranges from full attention to complete inattention. Since data reveals that individuals might differ with respect to their tax attitudes and behavior - while some might view taxpaying and taxation in general favorably others have strong opposition to it - we allow agents to have positive (utility) or negative (disutility) preferences toward taxes, which we call tax conformity and tax opposition, respectively. Agents are heterogeneous with respect to their work ability, which is not observable by the government. The planner's goal is to redistribute from the high-ability to the low-ability type, respecting the self-selection constraints to characterize the optimal labor income taxation. We then extend the model to allow agents to hide, at a resource cost, part of their income and avoid taxation. And finally, we consider an overlapping generations (OLG) model with individuals living for two periods in order to understand how independent and interdependent

tax preferences across generations might affect the design of optimal labor income and capital tax policies.

There is now growing empirical evidence on tax attitudes across the world. Focusing on the United States and using data from the National Survey of Americans' Views on Taxes, we present evidence on individual's tax preferences: individuals care about the amount of taxes they pay, how much others pay and about tax policy in general. When asked about the amount of federal taxes participants pay, subjects think that they and their family either *pay more* (45 percent) or *about their fair share* (48 percent) in federal taxes. They are most bothered by *the feeling that some wealthy people get away not paying their fair share* (51 percent) and *the complexity of the tax system* (32 percent). Our data also reveals interesting information about an individual's behavior regarding known actions taken to reduce one's tax burden. Individuals who believe they pay *more* or *less than their fair share* (relative to those that think they pay about a fair amount) are more likely to avoid taxes. In particular, individuals who think they pay *the fair amount* of federal taxes are 3.59 percent less likely to reduce their labor supply in order to pay less taxes. On the other hand, those that see themselves as paying *more than the fair share* are 3.82 percent more likely to *work less* if it meant that they would pay less in taxes.

To gain intuition, we first consider a static model with two ability types and asymmetric information between the private sector and the government. When individuals care about tax payments, the planner must recognize not only that high-ability individuals mimic the labor supply of low-ability individuals, but also that labor supply choice also affects tax payments and, consequently, the marginal labor income tax. Compared to earlier literature (e.g., Stiglitz (1982)), allowing for *independent* and *interdependent* preferences over taxes, i.e., individuals care for the amount of taxes they pay and for an aggregate measure of taxes paid by others in the economy, might either amplify or reduce the marginal tax increase of the low-ability type due to the self-selection constraint. The overall effect depends on the interation of three components. First, the standard self-selection constrain effect (the high-ability type mimicker willingness to consume as thelow-ability type). Second, the *independent* tax concern, i.e., the fact that a high-ability type might mimic the low-ability type marginal rate of substitution between labor income tax payments and consumption, weighted by whether both types are attentive to their tax preferences. And finally, the *tax interdependence effect* to capture the potential differences in the relative income tax concerns of high-ability mimickers and their non-mimickers counterparts. In this static model, the optimal marginal labor income tax of high-ability agents is equal to zero, reinforcing the non-distortion at the top result.

Next, we allow for the fact that individuals can hide a fraction of their earnings at a

resource cost. We find that the policy rules for marginal income taxation for the less skilled take the same form as in the previous model without evasion possibilities; but the trade-off associated with tax preferences and consumption have their effects intensified. This occurs because high-ability mimickers now have three different possibilities to fool tax authorities, and the optimal marginal income tax in both types must address all of those components. Moreover, the interdependent component of tax preferences now brings tax-relative concerns for those different mimickers. The optimal policy for the most skilled proposes a subsidy to make it less attractable for them to mimic the less skilled individuals. An additional policy must be introduced to capture efficiency-enhancing characteristic on misreporting costs on the part of the government.

Last, we introduce the possibility of an intergenerational tax preferences using an OLG model economy. A new generation is born every period with individuals living for two periods. These members of a generation work during the first period of their life (when young) and do not work during the second period (when old). We keep the same benchmark set up with two types of individuals with respect to their work ability. Each type values leisure when young, given by a time endowment less the hours of work. She also cares about her consumption and tax payments in both periods of life. This allows us to characterize the optimum capital taxes in a environment that agents are concerned not only with their consumption and leisure but their taxes and the amount of taxes paid by different generations in each time period. They make tax payments on their labor and capital incomes and they have preferences with respect to other agents taxes, different from the positional preferences literature that have focus on agents' positional preferences with respect to consumption (Aronsson and Johansson-Stenman (2008),Aronsson and Johansson-Stenman (2010)). Similar to optimal labor income taxes, optimum capital taxes also calls for distortions to address both independent and interdependent tax preferences. A positive interdependent effect of capital taxes should reduce marginal capital income taxes in both types. More importantly, no distortion should be imposed on those whose marginal rate of substitution between consumption today versus tomorrow is equal to the interest rate.

While our paper relates to several branches of literature (which we discuss below), it is unique in several important ways and it makes three distinct contributions to the optimum income taxation literature. First, we use traditional tax surveys to document that not only individuals care about their tax payments but also to the others. More importantly, we show that this personality trait can explain their tax payment decision. This leads us to model tax preferences on consumer's preferences in such way that she cares not only with her tax payments but also to her peers, which runs closely to the independent versus interdependent self-construal personality trait defined in Markus and Kitayama (1991) adding to Djanali

and Sheehan-Connor (2012). Second, as argued in Hungerman (2014) the decision to donate (paying taxes here) may be crowded out with hidden income, and we introduce the possibility to evade tax on the part of consumers to capture potential additional distortion on optimal tax structure. Last, as interdependent tax preferences is a general concept that could involve differeent generations, we also bring into play a dynamic model that allows us to look at both income and capital tax concerns. Different from Aronsson and Johansson-Stenman (2008),Aronsson and Johansson-Stenman (2010) and Abel (2003), our focus is different, since we are interested on individuals that derive non-negligible utility from the relative amount of tax paid due to their pro-social tendencies.

Relation to the Literature: Tax behavior is not a function purely of individual choice: individuals might look to others in order to decide what is acceptable, reasonable, expected within the social context in which the action is made (Cullis and Lewis, 1997).[1] Moreover, whether positive or negatively related to other individuals taxpaying decisions in the society, individuals might also be concerned about the intentions that others have in making their choices, how they self-identify and see themselves in society. For instance, Bénabou and Tirole (2006) argue that individuals behave pro-socially to signal their good traits to themselves and present a model to address self-identity in explaining pro-social behavior. The reciprocity theory put forward an explanation for why individuals act in a more altruistic manner in response to the friendly behavior of others and in a hostile manner to unfriendly behaviors (Rabin (1993), Dufwenberg and Kirchsteiger (2004), and Falk and Fischbacher (2006)).

In fact, personality traits, defined as patterns of thoughts, feelings, and behavior that predict how individuals respond to circumstances, have drawn attention from economists because of their potential as stable characteristics that influence behavior directly (Almlund et al., 2011). Psychologically, one important individual difference that might predispose how people respond to taxation concerns self-construal, a culturally-relevant difference in how individuals define the self in relation to others. According to Markus and Kitayama (1991), Western cultures prioritize the individual over the group, and individuals seek independence, autonomy, and separateness from others. In East Asian cultures, the group is prioritized over the individual, and individuals seek to fit into the group and maintain harmony in the group. On one hand, individuals with more independent self-construal view the self as being

[1]Tax compliance can be approached from many perspectives: it can be viewed as a problem of public finance, law enforcement, labor supply or ethics, or a combination of all these (Andreoni et al., 1998). According to the traditional economic approach of tax compliance (e.g., Allingham and Sandmo, 1972), taxes are paid or evaded strategically. However, many studies have noted that levels of tax compliance and evasion are far different than a risk-return model would predict (Skinner and Slemrod, 1985; Slemrod, 1992; Torgler, 2007; Alm et al., 2010).

unique and independent of others, leading to behaviors that maximize gains for the self, rather than for others. On the other hand, those with interdependent self-construal view themselves as connected to and motivationally-oriented toward others, defining the self by external, situational factors, e.g., groups, relationships, communities (Cross et al., 2011).

Taxpayers may enjoy not only the contribution of their tax payments made to the community, but also the feeling of being an active and law-abiding citizen. Empirical findings have suggested that individuals' decisions to hide income are interdependent - relationship between non-pecuniary costs and society's attitude towards evasion (Gordon, 1989; Alm and Torgler, 2006; Christian and Alm, 2014). Non-pecuniary benefits of taxpaying may also help explain honest behavior and attitudes toward taxation. Through a controlled experiment, Djanali and Sheehan-Connor (2012) provide support for the tax affinity hypothesis, under which individuals derive non-negligible utility from the amount of tax paid due to their pro-social tendencies. Historically, citizens' support for the income tax has always been correlated with their support for the government (Fox (2001)). For instance, the high tax rates during World War II were accepted by virtually all citizens regardless of income level, occupation, or political affiliation. Survey results have indicated that the majority of respondents "don't mind paying taxes" especially when the statements are framed in ways that highlight the benefits of taxes (e.g. 2003 Public Interests Project cited in Bostrom (2005)).

Since awareness of individual's own and others' tax payments play an important role in our analysis, we rely on recent progress in behavioral public finance that emphasizes the implications of inattention for a variety of economic problems (Bordalo et al. (2013), Caplin and Dean (2015), Chetty (2015); Chetty et al. (2009),Koszegi and Szeidl (2013)).[2] Particularly relevant to our paper Farhi and Gabaix (2015) allows for agent's misperception of taxes among a wide range of behavioral biases.

Our paper is also related to a large pro-social behavior literature on private contributions to a public good (charitable donations) and joint provision of public goods. Andreoni (1990) introduces the "warm glow" motive for giving into the impure altruism model (Andreoni (1989)). The main argument is that an individual receives some private good benefit from the act of giving itself in addition to the higher utility derived directly from others' well-being. Other than pure altruism, charitable behavior can be motivated by a desire to obtain psychological benefits such as self-reward, negative state relief, or guilt reduction (see Bierhoff, 2002) - underlying motivations that may cause the ultimately egoistic warm glow. In fact, hiding income is an action that is beneficial to the individual but socially costly. Hungerman (2014) focuses on the warm-glow model of crowd out and shows that

[2]Mullainathan et al. (2012) offer a rich overview of behavioral public finance. See also Gabaix (2014); Farhi and Gabaix (2015) and references therein.

with hidden income, stronger warm glow will lead to greater crowd out, not less

Besides two key motives for giving - an altruistic (or public good) and the warm-glow motives - an individual's charitable giving decisions are also related to how others participate as well. Giving decisions are often poisoned by the potential for crowd out: efforts by one party to increase provision of the good may reduce, or crowd out, provision from others. Andreoni (1989) noted that the altruistic model of giving to a public good predicts that others' donations will crowd out one's own, whereas crowd-out may be limited if individuals obtain "warm glow" utility from their own donation; a result recently validated by Ottoni-Wilhelm et al. (2017). On the other hand, there is also empirical evidence that suggests individual contributions can be positively influenced by the contributions of others (see, for instance, Glazer and Konrad (1996); Harbaugh (1998)).. Unlike the prestige motive for giving where individuals use charitable contributions to signal social status, the competitive warm-glow motive is just an example of "keeping up with the Joneses" preferences - individuals measure their warm-glow from giving against the giving of others.

Earlier studies have examined the policy implications of donations to charity, i.e., voluntary contributions to a public good, in models of optimal taxation (e.g., Feldstein, 1980; Warr, 1983, Saez, 2004 and Diamond, 2006, Blumkin and Sadka 2007). Recently, Aronsson, Johansson-Stenman and Wendner (2019) investigate tax policy responses to charitable giving, examining the potential roles that the warm glow of giving and status concerns – defined in terms of relative consumption and relative charitable giving – may play for people's behavior and public policy. They argue that the transaction cost associated with charitable giving and on the degrees of consumption and charitable giving positionality are key for the optimal marginal taxation.

The paper is divided as follows. Section 2 presents empirical evidence on tax concerns and data from the National Survey of Americans' Views on Taxes. A two-agent static model where agents have preferences over consumption and leisure as well as over independent and interdependent tax preferences is presented in 3. We investigate how the introduction of tax concerns modifies the optimal nonlinear labor income tax. In Sections 4 and 5 we extend the model to allow agents to hide, at a resource cost, part of their income and avoid taxation and for different intergenerational concerns toward taxes, respectively. Numerical simulations to explore the theoretical results further are presented in Section 6 and Section 7 concludes the paper.

2 Evidence on Tax Attitudes and Tax Behavior

People in a particular country share certain fundamental values and concerns that shape their tax attitudes: fellowship with other citizens, their feelings of representation by the

government, and their beliefs about when work is fairly rewarded (Williamson (2015)). But the information people have, from the media or from their taxpaying experience, can mislead them about which tax policies fit their preferences. This dynamic shapes individuals' beliefs about why one should pay taxes, how much one should pay, who does pay enough in taxes, and where tax revenues should go.

We focus on the United States, although there is now growing empirical evidence on tax attitudes across the world. Compared to people in other countries, Americans are exceptionally willing to pay their taxes (Alm and Torgler (2006)). The 2014 Taxpayer Attitude Survey, sponsored by the Internal Revenue Service (IRS) Oversight Board, reveals that 95 percent of the individuals surveyed *mostly* or *completely* agreed that "it is every American's civic duty to pay their fair share of taxes".[3] Americans vote for tax increases and, in the United States, tax-increasing ballot measures have grown markedly more popular over the past forty years (Williamson (2015)). Perhaps most astonishing, a third of Americans even claim to enjoy filing out their income tax forms (Pew Research Center for the People and the Press, 2013).

According to Gallup data from poll surveys on taxes since 1943, when individuals are asked if they consider the amount of federal income tax they pay as *too high*, *about right* or *too low*, roughly sixty percent of the respondents believe the tax they pay to be *too high*.[4] The survey also asks whether taxpayers believe they are paying their *fair share* of income tax in comparison to the amount paid by a reference group. The majority of the American public consistently believes their tax responsibilities to be *fair*. Although the reference group might not be the same for each respondent, the proportion of respondents that answer they are paying their *fair share* ranges from 51 to 90 percent. A respondent's perception regarding the amount of taxes paid by others reveals striking differences depending on the income group being asked about. Close to 30 (60) percent of the respondents believe low-income individuals pay a *fair share* (*too much*) of federal income tax. For the middle-income group, this perception is faily split: 50 percent are seen to be paying their *fair share*, while 50 percent think people in this group pay *too much* in taxes). On the other hand, 77 percent of the respondents believe that individuals in the high-income group pay *too little* in federal income taxes. It is important to keep in mind, however, as Williamson (2015) points out, that fact that people believe one should pay one's *fair share* of taxes does not imply that they agree on what that fair share should be.

Studies have put forward evidence that individuals not only have independent (personal)

[3]See survey at (https://www.treasury.gov/IRSOB/reports/Documents/IRSOB%20Taxpayer%20Attitude%20Survey%202014.pdf). Internal Revenue Service Oversight Board. 2014. 2014 Taxpayer Attitude Survey

[4]Data available at: http://www.gallup.com/poll/1714/taxes.aspx.

but also interdependent (interpersonal) reasons to pay taxes. Based on a survey and interviews conducted across the United States, Williamson (2015) argues that Americans' attitudes about taxes are shaped by three values: their sense of fellowship with other people in the political community, be that the city, state or nation; their feelings of representation by the government; and their beliefs about work and how it is and should be rewarded. It is clear that Americans perceive the taxpaying responsibility in moral terms - as a result of the fellowship they share with the community or the country. Almost all of the interviewees in her survey believe their lives are tied to the broader society, and therefore they must contribute to the wider social good with their tax dollars.

Individuals' tax attitudes and behavior can be related to their perceptions of others in this regard. However, tax attitudes are distinct from actual taxpaying. Attitudes are not actions, and so should not be confused, for instance, with tax compliance - whether one follows the law or evades taxes (Williamson (2015)). To the extent that taxation has a significant free rider problem - most benefits accrue to an individual whether or not s/he personally contributes - an individual's attitude and behavior regarding taxpaying and tax avoidance can be associated to independent motives - e.g., data from the IRS 2014 Taxpayer Attitude Survey has revealed that for 60 percent of respondents the *fear of an audit* had a great influence on whether they report and pay their taxes honestly - as well as to interdependent motives - people tended to respond harshly to both legal tax avoidance and illegal tax evasion.

Tax evasion is morally unacceptable and people are willing to fulfill their civic responsibilities if they think others are doing their part, a sentiment Levi (1997) calls "ethical reciprocity." - "Americans are proud to pay taxes, except when they think others are cheating" (Williamson (2015)). Close to 40 percent of the IRS 2014 Taxpayer Attitude Survey respondents reported that their *belief neighbors pay* taxes had a *great deal* or *somewhat an influence* on whether they report and pay their taxes honestly. In fact, tax morale (the shared cultural norm of taxpaying) plays an important role in tax compliance (Alm and Torgler (2006)). If people doubt that others are chipping in, they are more likely to start free-riding ourselves.

National Survey of Americans' Views on Taxes

In order to gain further insights and understanding of how Americans, in particular, perceive tax attitudes and behavior we explore data from the National Survey of Americans' Views on Taxes, a project sponsored by the National Public Radio (NPR), the Kaiser Family Foundation and the Kennedy School-Harvard. The results of this project are based on a nationwide telephone survey, which was conducted between February 5 and March 17, 2003 collecting information from a random representative sample of 1,339 respondents 18 years of

age or older.[5] The survey included questions about individuals' tax attitudes and behavior as well as many background individuals characteristics such as political views, whether the respondent owns a house and/or stocks, gender, age, income, marriage status, schooling years, race and region they live in. Here, we focus on the answers to four questions (Question 18, 22, 61 and 69) and complete descriptive statistics are presented in the Appendix.

The richness of this dataset allow us to investigate further how particular tax attitudes might affect individuals' taxpaying behavior as well tax avoidance perception. In order to capture individuals' potential interdependent and independent attitudes toward taxation we consider questions from the National Survey of Americans' Views on Taxes, respectively: "I'm going to read you a list of groups. Please tell me if you think they pay more than their fair share, less than their fair share, or about their fair share in federal taxes." (Question 18) and "Which of the following bothers you most about taxes: (the large amount you pay in taxes,) (the complexity of the tax system,) or (the feeling that some wealthy people get away not paying their fair share)?" (Question 22).

The majority of the respondents think that high-income families pay less than their fair share (Table III, Appendix). On the other hand, 59 percent of the people surveyed believe middle-income families pay more than their fair share. Low-income people are seen to be paying about their fair share by 40 percent of the respondents, while this proportion is smaller for middle- and high-income families, 34 and 25 percent, respectively. Participants think that they and their family either *pay more* (45 percent) or *about their fair share* (48 percent) in federal taxes. The respondents are most bothered by *the feeling that some wealthy people get away not paying their fair share* (51 percent) and *the complexity of the tax system* (32 percent).

The survey also explored individual's behavior regarding known actions taken to reduce one's tax burden. Answers to Question 61 ("Here are some decisions that some people make in part because of taxes. In the LAST YEAR did you (ITEM) IN PART because it meant that you would pay less in taxes?") reveal that more than 80 percent of the respondents did not *Buy something on the Internet instead of from a local store, Donate more to charity* or *work less to avoid taxes* (Table IV, Appendix). Along the same lines, another question asked if participants had avoided taxes by other means: "Have you EVER (ITEM) IN PART because it meant you would pay less in taxes." (Question 69). Responses are strongly negative to alternatives such as *Bought or sold a stock or a bond you otherwise wouldn't have bought or sold, Chosen to live somewhere other than where you work and Chosen to buy a house instead of renting*, 90, 88 and 73 percent said *no*, respectively. Fourty percent reported

[5]More details about the survey's methodology and results can be found at https://www.npr.org/news/specials/polls/taxes2003/20030415_taxes_survey.pdf

they had *put money in a retirement account*, in part because it meant they would pay less in taxes.

Using the binary answers to the seven alternative measures people might have used to pay less taxes, as described in Table IV, Appendix, we construct three avoidance indexes, namely, Avoidance I, Avoidance II and Avoidance. If a participant had answered *yes* to at least one of the options in question 61 (question 69), the index Avoidance I (Avoidance II) assumes the value one, and zero otherwise. Finally, the index Avoidance III has value zero if both Avoidance I and II are equal to zero, and one is at least one of them is equal one.

We run probit regressions in which the avoidance indexes as well as the individual answers are endogenous variables, one at a turn, and answers to questions 18 and 22 are the explanatory variables, along with the participant's individual characteristic, according to the following model: $Prob\left(Avoidance_i = 1/x_i\right) = \Phi\left(x_i'\beta\right)$ and $Prob\left(Avoidance_i = 0/x_i\right) = 1 - \Phi\left(x_i'\beta\right)$, where x_i is a vector containing variables that aim to capture (i) respondents' (interdependent) tax perceptions about others tax payments, i.e., if they pay *more, less than or about their fair share*), (ii) a variable that might capture individual's independent tax preferences (what bothers them the most about taxes) and (iii) control variables such as education, income, gender, ethnicity, marital status, and political preference; and $\Phi(\cdot)$ denotes the cumulative function of a normal distribution.

Table I reports the marginal effects of each particular regression. The overall conclusion we can draw from these results, in particular, Panel I (Q.61) - Avoidance I index, Table I, is that individuals who believe they pay *more* or *less than their fair share* (relative to those that think they pay about a fair amount) are more likely to avoid taxes by means of one of the measures listed in Table IV. In other words, the probability an individual is undertaking actions to reduce his/her tax burden is higher if one thinks that he or she is paying *more* or *less than the fair share* in federal income tax.

More specifically, and relevant to our discussion in Section 3, individuals who think they pay *the fair amount* of federal taxes are 3.59 percent less likely to reduce their labor supply in order to pay less taxes. On the other hand, those that see themselves as paying *more than the fair share* are 3.82 percent more likely to *work less* if it meant that they would pay less in taxes. We estimate that an individual who considers him(her)self to be paying *less than* his/her *fair share* in taxes is associated with a (14.2 percent) larger probability to undertake an action to avoid taxes (Avoidance I). This effect seems to be lead by an increase of 16.6 percent in the probability to *donate to charity* in order to pay less taxes. This effect is consistently estimated to be negative for those that understand to be paying their *fair share*. The interpretation for answers to question 69, Panel II - Avoidance II index, Table I, follows along the same lines. Participants that claim to be paying *more than*

Table I: Tax Interdependence Attitudes and Avoidance Decision I

Panel I (Q.61) Individual thinks s/he is paying[1]	Buy Online	Donate to Charity	Work Less	Avoidance I	Avoidance III
More	0.0460**	0.00625	0.0382**	0.0577**	0.00546
	(0.0206)	(0.0218)	(0.0152)	(0.0280)	(0.0278)
Fair	-0.0371*	-0.0176	-0.0359**	-0.0706**	-0.00629
	(0.0203)	(0.0216)	(0.0147)	(0.0276)	(0.0276)
Less	0.0346	0.166**	0.00929	0.1420*	0.1060
	(0.0605)	(0.0722)	(0.0431)	(0.0805)	(0.0679)
Panel II (Q.69)	Buy a House (not Rent)	Bought or Sold Stocks	Residence Location	Retirement Account	Avoidance II
More	0.0591**	0.00359	0.0300*	0.0155	-0.0218
	(0.0255)	(0.0183)	(0.0172)	(0.0274)	(0.0301)
Fair	-0.0620**	-0.0139	-0.0269	0.00472	0.0199
	(0.0252)	(0.0182)	(0.0169)	(0.0273)	(0.0299)
Less	0.115	0.145**	-0.0193	0.113	0.156**
	(0.0747)	(0.0665)	(0.0433)	(0.0743)	(0.0725)

Notes: Question 61 - "Here are some decisions that some people make in part because of taxes. In the LAST YEAR did you (ITEM) IN PART because it meant that you would pay less in taxes?"; Question 69 - "Have you EVER (ITEM) IN PART because it meant you would pay less in taxes."; National Survey of Americans' Views on Taxes. 1: More than, about or less than the fair share. See Table A1 for a complete description of variables. Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$.

the fair share have a larger probability of *buying a house instead of renting* (5.9 percent) and of *chosing to live somewhere other than where they wor*k (3 percent) to pay less taxes. Regarding the overall Avoidance III index, results are not statistically significant regardless what respondents think of their tax payments.[6]

3 A Model of Tax Attitudes

The mail goal of this section is to introduce a simple version of our model with independent and interdependent tax preferences. Once the intuition is clear we will them extend it to allow agents to hide part of their income and then, in a two-period overlapping generations

[6]Participants who answered that *the large amount they pay in taxes* is what bothers them the most (Q.22) are 8 percent more likely to engage in activities that can potentially reduce the amount of taxes they have to pay. In other words, the more an individual is troubled by the amount of taxes she pays, the more likely she is to engage in activities that would potentially lead to pay less taxes (see Table V Appendix).

structure, consider the role of intergenerational tax preferences.

3.1 Introducing the basic model

Consider an economy with only one private good and one public good. Agents are heterogeneous with respect to their work ability. The low-ability type ($i = 1$) is less productive than the high-ability type ($i = 2$). And, there are n^i type-i members, $N = \sum_i n^i$ is the total number of individuals in this economy. A type-i individual values consumption c^i and leisure z^i, given by a time endowment, normalized to 1, less the hours of work, l^i. She allocates her labor income $w^i l^i$ between consumption and payment of non-linear taxes $T^i(w^i l^i)$, where w^i is the wage rate.

We assume agents have preferences over consumption and leisure as well as over tax payments, which are divided into independent (personal) and interdependent (interpersonal) tax preferences. First, we assume agents have (independent) preferences over the amount of taxes $T^i(w^i l^i)$ they pay. In other words, individuals care either in positive or in a negative way about their own tax payments For instance, tax preferences can be associated to an intrinsically motivation to pay taxes, a desire for a "warm glow" - people feel good because they pay taxes due to a sense of duty, fellowship or sympathy (citations - Besley NBERWilliamson (2015)). On the other had, individuals might experience the opposite, i.e., a disutility for paying taxes - tax payments are associated with social pressure or guilt (a "cold-glow" effect). Notice that the issue here is not whether individuals pay or not taxes (there is no avoidance in the model yet), but rather about their attitudes toward and preferences related to tax payments.

Second, agents (interpersonal) preferences might also depend on an aggregate measure of taxes paid in the economy, $\overline{T}(w^1 l^1, w^2 l^2) = \overline{T}(T^1(w^1 l^1), T^2(w^2 l^2))$. The measure $\overline{T}$ is meant as a reference point and, although we do not disregard other measures, we will consider the average (*per capita*) tax payments defined as $\overline{T} = \frac{1}{N}\sum_i n^i T^i(w^i l^i)$ as our benchmark. Agents might care for or have either positive or negative views regarding the total or *per capita* amount of tax collected, the size of the government, the distribution of tax collected across income distribution or any other broader views/attitudes towards taxes (Andreoni (1990)). In line with studies of tax politics that have focused on tax attitudes and tax opposition - anti-tax ideologues and rhetoric (CITATION), allowing for (independent, interdependent) tax preferences we can potentially capture conflicting attitudes toward taxes and taxation in general, as well as their implications for optimal tax policy. Our modelling approach is flexible enough to capture the case of, for instance, an individual might believe in paying taxes as a civic duty but she prefers a smaller government (less taxation in general).[7]

[7]Williamson (2015) points out that Republicans, despite decades of anti-tax rhetoric from party leaders, believe in paying taxes. And the fact that Republicans appear to be more negative about taxation may be,

Hence, the type-i utility function can then be written as

$$U^i = u^i\left(c^i, z^i, m_T^i T^i\left(w^i l^i\right), m_{\overline{T}}^i \overline{T}\left(w^1 l^1, w^2 l^2\right)\right) \quad (1)$$

where the exougenously given parameter $m_T^i \in [0,1]$ captures the individual awareness of her own tax payments or for the possibility that agents might not be fully attentive/aware of their own positional preferences. Following Farhi and Gabaix (2015), full attention (rationality) corresponds to $m_T^i = 1$, and full inattention to $m_T^i = 0$. Similarly, $m_{\overline{T}}^i \in [0,1]$ represents the degree to which agents are attentive to the average (*per capita*) tax payments in the economy

The function u^i is assumed to be strictly quasi-concave and increasing in the first arguments, i.e., consumption and leisure. Regarding the other arguments, four cases are possible as summarized in the Table II. We will use the term *tax conformity* to represent individuals with positive attitudes/preferences towards taxes, $T^i\left(w^i l^i\right)$ and $\overline{T}$; and *tax opposition,* otherwise. Whereas individuals take the average tax collected $\overline{T}$ as given, one person's increase in tax payments might have a positive or a negative externality on others depending on their own preferences over taxes in general, i.e., *tax conformity* or *tax opposition*, respectively.[8]

Table II: Tax Independence vs. Interdependence: Affinity, Hostility

			Interdependent Preferences ($m_{\overline{T}}^i = 1$)	
			Tax Conformity $u_{\overline{T}(\cdot)}^i > 0$	Tax Opposition $u_{\overline{T}(\cdot)}^i < 0$
Independent Preferences ($m_T^i = 1$)	Tax Conformity	$u_{T^i}^i > 0$	Tax Sympathetic	Tax Funder
	Tax Opposition	$u_{T^i}^i < 0$	Tax Free-rider	Anti-tax

Note: $u_{T^i}^i = \partial u^i / \partial T\left(w^i l^i\right)$; $u_{\overline{T}(\cdot)}^i = \partial u^i / \partial \overline{T}$.

An agent can have positive preferences towards taxes (*conformity*, $u_{T^i}^i, u_{\overline{T}(\cdot)}^i > 0$), both

in part, a result of their opposition to the (Democrat) administration during her research. Asked how they feel about being a taxpayer, 21% of Williamson (2015) survey respondents had only strongly positive things to say, compared to 29% who had only strongly negative things to say. These positive comments typically emphasize people's sense of civic duty and responsibility. Democrats are about seven percentage points more likely describe being a taxpayer in positive terms (p=.02). Moreover, 26% of Republicans have at least one positive thing to say, compared to 35% of Democrats.

[8]The distinction between relative and absolute formulations of utility is pertinent for welfare implications, which we explore in Section 6.

taxes by herself and the average tax payments, $T^i(w^i l^i)$ and $\overline{T}(\cdot) = \overline{T}(w^1 l^1, w^2 l^2)$, respectively. We call these individuals *tax sympathetic*. On the other extreme, it is possible however that agents have a hostile attitude towards taxes (*opposition*, $u^i_{T^i}, u^i_{\overline{T}(\cdot)} < 0$). They neither like to pay taxes nor are sympathetic to large tax collection; we denote them *anti-tax* agents. In between, *tax free-rider* agents - those that might experience disutility regarding paying taxes ($u^i_{T^i} < 0$) but enjoy the fact that others pay taxes ($u^i_{\overline{T}(\cdot)} > 0$) - and *tax funders* - $u^i_{T^i} > 0$ and $u^i_{\overline{T}(\cdot)} < 0$.

Notice that $T^i(w^i l^i)$ enters the the function twice, once as part of the private good and again as part of the public good $\overline{T}$. This is meant to capture the fact that an individual own tax payments has properties of a private good that are independent of its properties as a public good. The representation of preferences, equation (1) is general enough to capture different types of agents with respect to their own tax payments and payments by others. If $m^i_T = 0$ and $m^i_{\overline{T}} = 1$ we have a purely interdependent agent. i.e., $U^i = u^i\left(c^i, z^i, m^i_{\overline{T}}\overline{T}(w^1 l^1, w^2 l^2)\right)$, the individual cares nothing for her own tax payments *per se*. In this case, the agent values the average (*per capita*) tax payments, which she is part of it, say for group conformity or social customs. On the other hand, if $m^i_T = 1$ and $m^i_{\overline{T}} = 0$, the agent is purely independent, caring nothing at all for what others in the economy are paying. Preferences of this kind, i.e., $U^i = u^i(c^i, z^i, m^i_T T^i(w^i l^i))$, would exhibit a "warm/cold-glow" motive from paying taxes. The $m^i_T = m^i_{\overline{T}} = 0$ case is standard.

Each individual solves the maximization problem

$$\begin{aligned} &\max_{c^i, l^i} u^i\left(c^i, z^i, m^i_T T^i\left(w^i l^i\right), m^i_{\overline{T}}\overline{T}\left(w^1 l^1, w^2 l^2\right)\right) \\ &\text{subject to } c^i = w^i l^i - T^i\left(w^i l^i\right) \end{aligned}$$

which implies the following equilibrium condition

$$u^i_c\left(1 - m^i_T T^{i\prime}\left(w^i l^i\right)\right) w^i - u^i_z + u^i_{T^i} m^i_T T^{i\prime}\left(w^i l^i\right) w^i \;=\; 0$$

where $u^i_c = \partial u^i/\partial c^i$, $u^i_z = \partial u^i/\partial z^i$, $u^i_{T^i} = \partial u^i/\partial T(w^i l^i)$, and $T^{i\prime}(w^i l^i)$ is the marginal labor income tax rate.

The production sector consists of identical competitive firms producing a homogeneous good with constant returns to scale. Given these characteristics, the number of firms is not important and will be normalized to one for notational convenience. A representative firm maximization profit is as follows $\Pi_t = F(L^1, L^2) - w^1 L^1 - w^2 L^2$, where the production function is given by $F(L^1, L^2) = f(\theta^1 L^1 + \theta^2 L^2)$, where $L^i = n^i l^i$ is the total number of hours of work supplied by ability-type i; θ^1 and θ^2 are positive constants. The firm maximizes

profits which imply $w^i = F_{L^i}\left(L^1, L^2\right) = \left(\frac{\partial f\left(\theta^1 L^1 + \theta^2 L^2\right)}{\partial\left(\theta^1 L^1 + \theta^2 L^2\right)}\right)\theta^i$, for $i = 1, 2$. In this economy, output is used for private consumption only. Hence, the economy's resource constraint is given by $F\left(L^1, L^2\right) = \sum_{i=1}^{2}\left(n_t^i c_t^i\right)$.

3.2 Optimal Taxation: The Role of Tax Concerns

We assume that the planner wants to redistribute from the high-ability to the low-ability type,but preventing the high-ability type from pretending to be a low-ability type. Although an agent's ability is private information, we assume that the government is able to observe income. In this case, the self-selection constraint ($U^2 \geq \widehat{U}^2$) that may bind is as follows

$$u^2\left(c^2, z^2, m_T^2 T^2\left(w^2 l^2\right), m_{\overline{T}}^2 \overline{T}\right) \quad \geq \quad \widehat{u}^2\left(c^1, 1-\phi l^1, m_T^2 T^1\left(w^2 \phi l^1\right), m_{\overline{T}}^2 \overline{T}\right) \tag{2}$$

where $\phi = w^1/w^2 = \theta^1/\theta^2$ is the wage ratio, which is a constant following the firm's problem. The expression on the right-hand side of the weak inequality of equation (2) is the utility of the mimicker. In what follows, a $\widehat{\ }$ above a variable refers to the mimicker. Given that the government only observe income, i.e., $w^i l^i$,a type-2 mimicker will choose $\widehat{l^2} = \phi l^1$, such that $w^1 l^1 = w^2 l^2$. Although the mimicker enjoys the same consumption as the low-ability type in each period, she enjoys more leisure (as the mimicker is more productive than the low-ability type).

The social planner problem in the Lagrangean form is written as

$$\mathscr{L} \quad = \quad W\left(n^1 U^1, n^2 U^2\right) + \lambda\left(U^2 - \widehat{U}^2\right) + \gamma\left[F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i c^i\right] \tag{3}$$

where $W(\cdot)$ is a general social welfare function, λ and γ are the Lagrange multipliers associated with the self-selection constraint, equation (2), and the economy's resource constraint, respectively.

The first order conditions for c^1, c^2, l^1, and l^2 are, respectively:

$$\frac{\partial W}{\partial\left(n^1 U^1\right)} n^1 u_c^1 - \lambda \widehat{u}_c^2 - \gamma n^1 \quad = \quad 0 \tag{4}$$

$$\frac{\partial W}{\partial\left(n^2 U^2\right)} n^2 u_c^2 + \lambda u_c^2 - \gamma n^2 \quad = \quad 0 \tag{5}$$

$$\begin{aligned} \frac{\partial W}{\partial\left(n^1 U^1\right)} n^1\left(-u_z^1 + u_{T^1}^1 m_T^1 T^{1\prime}\left(w^1 l^1\right) w^1\right) + \Omega_T^1\left(\frac{\partial \mathscr{L}}{\partial \overline{T}}\right) + \gamma n^1 w^1 & \\ + \phi\lambda\left(\widehat{u}_z^2 - \widehat{u}_{T^1}^2 m_T^2 T^{1\prime}\left(w^2 \phi l^1\right) w^2\right) \quad = \quad 0 & \end{aligned} \tag{6}$$

$$\left[\frac{\partial W}{\partial\left(n^2 U^2\right)} n^2 + \lambda\right]\left(-u_z^2 + u_{T^2}^2 m_T^2 T^{2\prime}\left(w^2 l^2\right) w^2\right) + \Omega_T^2\left(\frac{\partial \mathscr{L}}{\partial \overline{T}}\right) + \gamma n^2 w^2 \quad = \quad 0 \tag{7}$$

where $u^i_{\overline{T}} = \partial u^i / \partial \overline{T}$, $\Omega^i_T = \left(\partial \overline{T} / \partial T^i \left(w^i l^i\right)\right) T^{i'} \left(w^i l^i\right) w^i$ and

$$\frac{\partial \mathscr{L}}{\partial \overline{T}} = \sum_{i=1}^{2} \left(\frac{\partial W}{\partial \left(n^i U^i\right)} \right) n^i m^i_{\overline{T}} u^i_{\overline{T}} + \lambda m^2_{\overline{T}} \left(u^2_{\overline{T}} - \widehat{u}^2_{\overline{T}}\right) \tag{8}$$

We will refer to the derivative $\partial \mathscr{L} / \partial \overline{T}$ as measuring the *tax interdependence effect*, since it reflects the overall welfare effect of a change in the level of the (aggregate) reference tax payments $\overline{T}(w^1 l^1, w^2 l^2)$, *ceteris paribus*. The *interdependence effect* of taxes paid in the economy affects individual's welfare differently and it can be decomposed into two terms. The first term, $\sum_{i=1}^{2} \left(\partial W / \partial \left(n^i U^i\right)\right) n^i m^i_{\overline{T}} u^i_{\overline{T}}$, where $m^i_{\overline{T}} = 1$, for $\forall i$, captures the externality of the interdependent tax concern - a weighted effect of agents' marginal utility with respect to the aggregate measure of tax payments on the *tax interdependence effect*.

To better understand the sign of the first term of equation (8), it will be helpful to refer back to Table II. If both agents care positively about $\overline{T}$, i.e., $u^1_{\overline{T}} > 0$ and $u^2_{\overline{T}} > 0$, *ceteris paribus*, increasing the average income tax collected in the economy would make all individuals with tax interdependence preferences better-off. This would be the case if individuals are either *tax sympathetic* or *tax free riders* as presented in Table II. However, it is possible that some individuals might be actually worse-off while others are better-off with a $\overline{T}(\cdot)$ increase - *tax unfriendly* ($u^j_{\overline{T}} < 0$) but *tax sympathetic* ($u^i_{\overline{T}} > 0$) individuals, respectively. Notice then that the sign of the first term of equation (2) can be either positive or negative being determined by the combination of marginal utilities. When both agents have positive (negative) interdependent tax preferences this term is positive (negative). If their preferences are different, i.e., *conformity* versus *opposition*, the marginal utilities will be weighted by the number of agents of each type and their respectively social weight.

The second term of equation (8), $\lambda m^2_{\overline{T}} \left(u^2_{\overline{T}} - \widehat{u}^2_{\overline{T}}\right)$ captures the role played by the self-selection constraint, equation (2), on the *tax interdependence effect* $\partial \mathscr{L} / \partial \overline{T}$. This term takes into account the potential differences in the relative income tax concerns of high-ability mimickers and their non-mimickers counterparts. If preferences are separable in $\overline{T}$ and other terms, we expect that $u^2_{\overline{T}}$ is equal to $\widehat{u}^2_{\overline{T}}$ and, hence, this term would be zero. Otherwise, for any degree of complementarity between the interdependent tax preferences and consumption (or leisure), we would have $u^2_{\overline{T}} < \widehat{u}^2_{\overline{T}}$. Nevertheless, this would be a second order effect which we expect to be small.

In order to characterize the optimal labor income taxes and allow comparisons with the exisiting literature, we define a type-i agent, $i = 1, 2$ (and mimicker) marginal rates of substitution between leisure (z) and consumption (c) as $MRS^i_{z,c} = u^i_z / u^i_c$. Similarly, $MRS^i_{T^i,c} = u^i_{T^i} / u^i_c$ is a type-i agent, $i = 1, 2$, marginal rate of substitution between labor

income tax payments (T^i) and consumption (c). Since $T^i(\cdot)$ are general labor income taxes, we follow the convention in earlier literature and we will use c^1, l^1, c^2, l^2 instead of the parameters of the tax functions, as direct decision variables in the optimal tax problem.

Combining the planner's first-order conditions with respect to c^1, l^1 and equation (10) for type-1 agent, we obtain an expression for the marginal labor income tax rate of the low-ability types as follows:

$$T^{1'}\left(w^1 l^1\right) = \frac{\left(\frac{\lambda^*}{n^1 w^1}\right)\left(MRS^1_{z,c} - \phi\widehat{MRS}^2_{z,c}\right)}{1 + \left(\frac{\lambda^*}{n^1}\right)\left(m^1_T MRS^1_{T^1,c} - m^2_T \widehat{MRS}^2_{T^2,c}\right) + \left(\frac{1}{\gamma n^1}\right)\left(\frac{\partial \mathscr{L}}{\partial \overline{T}}\right)\left(\frac{\partial \overline{T}}{\partial T^1(w^1 l^1)}\right)} \quad (9)$$

where $\phi = w^1/w^2 = \theta^1/\theta^2$ is the wage ratio, $\lambda^* = \lambda \widehat{u}^2_c/\gamma$ and $\partial\mathscr{L}/\partial\overline{T}$ is defined in equation (8).

To understand how tax concerns might affect the optimal taxation of low-ability individuals, consider the standard case where agents do not care about their tax payment or any measure of the aggregate tax revenues, i.e., $m^i_T = m^i_{\overline{T}} = 0$, $\forall i$; or, in other words, agents do not have preferences that include a combination of both *independent* and *interdependent* preferences over taxes. In this case, the marginal tax rate of the low-ability individual takes into account only the self-selection constraint, equation (2). That is, $T^{1'}(w^1 l^1) = (\lambda^*/n^1 w^1)\left(MRS^1_{z,c} - \phi\widehat{MRS}^2_{z,c}\right)$, a result analogous to results derived in earlier literature (e.g., Stiglitz (1982)). With $MRS^1_{z,c} > \widehat{MRS}^2_{z,c}$, which applies if the preferences do not differ between ability types, the contribution of the self-selection constraint is to increase the marginal labor income tax rate of the low-ability type.

However, allowing for *independent* and *interdependent* preferences over taxes, i.e., individuals care for the amount of taxes they pay and for an aggregate measure of taxes paid by others in the economy, the denominator of equation (9) reflects the fact that individuals' tax preferences might either amplify or reduce the marginal tax increase due to the self-selection constraint. In designing the optimal marginal labor tax of low-ability individuals the planner must recognize that if high-ability individuals mimic the labor supply of low-ability individuals, this labor supply choice also affects tax payments $T^i(w^i l^i)$ and, consequently, the marginal labor income tax.

The term $\left(m^1_T MRS^1_{T^1,c} - m^2_T \widehat{MRS}^2_{T^2,c}\right)$ compares the marginal rates of substitution between tax payments and consumption of a low-ability individual and a type-2 high-ability mimicker. Recall that through the budget constraint, the amount of taxes paid is decreasing in consumption and a worker cannot enjoy more consumption without paying less tax, which in our model would happen through the labor supply decision. Hence, an individual's labor supply choice affects not only the traditional margin, the marginal rate of substitution

between leisure and consumption ($MRS_{z,c}$), but also a second, novel one: the marginal rate of substitution between tax payments and consumption ($MRS_{T^i,c}$). In this case, the labor-leisure allocation is a problem of choice between leisure and a restricted set of bundles of consumption and tax payments (Djanali and Sheehan-Connor (2012)).

If both agents have similar preferences and those are separable in labor then we should expect to have $MRS^1_{T^1,c} = \widehat{MRS}^2_{T^2,c}$. Without leisure separability in (similar) preferences, one has to make assumptions about the degree of the complementarity between tax versus consumption and leisure. We argue that the degree of complementarity between consumption and leisure is greater than the later and tax payments; which would lead us to expect that $MRS^1_{T^1,c} > \widehat{MRS}^2_{T^2,c}$. In this case, even when individuals are motivated to pay taxes only by warm(cold)-glow, the optimal marginal labor income tax is smaller (larger) than otherwise. In fact, this particular characteristic of individuals reduces the marginal burden on low-ability individuals, because marginal taxes reduce the incentive to increase labor supply. Hence, by reducing taxes at the margin for the low-ability type (increasing the amount of taxes paid), the planner would make it less attractable for high-ability individuals to mimic the low type. The optimal marginal labor income tax of low-ability individuals would still be positive, but lower than it would be without tax concerns.

For extreme cases, the term $\left(m^1_T MRS^1_{T^1,c} - m^2_T \widehat{MRS}^2_{T^2,c}\right)$ is unambiguously positive if high-ability agents cares nothing for their own tax payments, i.e., $m^2_T = 0$ while $m^1_T = 1$, implying that, given $\partial\mathscr{L}/\partial\overline{T}$, the contribution of the self-selection constraint to increase the marginal labor income tax rate of the low-ability type $T^{1'}(w^1 l^1)$ is diminished. On the other extreme, if $m^1_T = 0$ and $m^2_T = 1$, this term is negative and $T^{1'}(w^1 l^1)$ is smaller.

The last term in the denominator of $T^{1'}(w^1 l^1)$, equation (9), represents the effect of interdependence taxes concerns, equation (8), on the optimal taxation of low-ability agents. As discussed before, the sign of this term and, consequently, its effect on the low-ability individual's optimal marginal labor income tax will depend on individuals' tax interdependent preferences, weighted by each type social weight and members. If $\partial\mathscr{L}/\partial\overline{T}_t > 0$, i.e., if a marginal increase in the reference tax payment produces an overall increase in the economy's welfare, then we must observe lower marginal income taxes for both types due to this component. The intuition is simple. A reduction of marginal income taxes creates an incentive for agents to increase their labor supply and, consequently, more taxes are collected in a less distortionary way.

The sign of this term is clear if we consider extreme cases regarding the attention parameter $m^i_{\overline{T}}$. For instance, if the low-ability type does not care about the aggregate measure of tax revenue, i.e., $m^1_{\overline{T}} = 0$, but the high-ability type does ($m^2_{\overline{T}} = 1$), the first term of equation (8) simplifies to $\left(\frac{\partial W}{\partial(n^2 U^2)}\right) n^2 u^2_{\overline{T}}$, which will be either positive if $u^2_{\overline{T}} > 0$, or negative otherwise

($u^2_{\overline{T}} < 0$). If, for instance, $m^i_{\overline{T}} = 0$, $\forall i$, that is, neither agents care for the aggregate measure of tax payments, there are no *interdependent* preferences and, hence $\left(\partial \mathscr{L}/\partial \overline{T}\right) = 0$. In this case, the optimal marginal labor income tax is as discussed above. On the other hand, if $m^i_{\overline{T}} = 1$, $\forall i$, and both agents are tax hostile, i.e., *opposition*, $u^i_{T^i}, u^i_{\overline{T}} < 0$, the *interdependence effect* acts to amplify the increase in the marginal labor income tax of low-ability types due to the self-selection constraint. The opposite would occur if agents are tax sympathetic (*conformity*, $u^i_{T^i}, u^i_{\overline{T}} > 0$). Finally, notice that the *interdependence effect* $\partial \mathscr{L}/\partial \overline{T}$ on the optimal marginal tax $T^{1'}\left(w^1 l^1\right)$ is weighted by the low-ability individual own contribution to the aggregate tax measure, which is represented by $\left(\partial \overline{T}/\partial T^1\left(w^1 l^1\right)\right)$ and assumed to be positive.

In a similar way, to obtain the optimal marginal labor income tax rate of the high-ability types, we combine the planner's first-order conditions with respect to c^2, l^2 and equation (10) for type-2 agent, which yields $T^{2'}\left(w^2 l^2\right) = -\left(1/\gamma n^2 w^2\right)\Omega^2_T\left(\partial \mathscr{L}/\partial \overline{T}\right)$, where $\Omega^2_T = \left(\partial \overline{T}/\partial T^2\left(w^2 l^2\right)\right) T^{2'}\left(w^2 l^2\right) w^2$. If agents have *independent* and *interdependent* preferences over taxes, we argue that the terms $\left(1/\gamma n^2 w^2\right)$, $\left(\partial \overline{T}/\partial T^2\left(w^2 l^2\right)\right)$ and $\left(\partial \mathscr{L}/\partial \overline{T}\right)$ are not zero and hence, the optimal marginal labor income tax of high-ability agents is equal to zero, i.e., $T^{2'}\left(w^2 l^2\right) = 0$.

A key distinction between the marginal labor income tax of a low- and high-ability type is the fact that the marginal tax of the former takes into account the fact that a high-ability agent (type $i = 2$) might be tempted to mimic a low-ability individual (type $i = 1$). Given that agents differ with respect to their labor productivity, a high-ability type attempt to mimic a low-ability labor supply is manifested, in our model, in two dimensions, namely, the tradeoff between leisure and consumption and labor income tax payments $T\left(w^i l^i\right)$ and consumption. The following proposition summarizes our findings.

Proposition 1. *In an economy where individuals have indepedent tax affinity (hostility) attitudes, the less skilled is expected to face lower (larger) optimal marginal income taxes than otherwise for redistributive reason. Interdependent affinity (hostility) preferences act generating a positive (negative) impact on aggregated welfare leading to lower (larger) marginal income taxes.*

4 A Model of Tax Attitudes and Hidden Income

4.1 Introducing hidden income

In this section we study optimal taxation when labor income is not perfectly observed and agents can hide a portion e^i of the income $w^i l^i$ earned. Hiding income is costy and a fraction $\delta\left(D^i\right)$ is lost. We assume that individuals bear a resource cost to hide income

which is indirectly affected by government policies D^i, e.g., auditing procedures, size of the tax administration. To keep our model tractable, we assume that $\delta\left(D^i\right) = D^i$.[9] Here the underline assumption is that the government can influence the agent's decision to hide income through policy. However, a policy that would ultimately reduce hidden income to zero is costly and assumed to be unfeasible (Chetty (2009); Keen and Slemrod (2017)).[10]

The type-i agent takes prices (w^i) and policies $(T^i, D^i, \overline{T})$ as given and her utility maximization problem is as follows

$$\begin{aligned}&\max_{c^i,z^i,l^i} u^i\left(c^i, z^i, m_T^i T^i\left(\left(1-e^i\right)w^i l^i\right), m_{\overline{T}}^i \overline{T}\right)\\ &\text{s.t. } c^i = w^i l^i - T^i\left(\left(1-e^i\right)w^i l^i\right) - D^i e^i w^i l^i\end{aligned}$$

where $\overline{T} = \overline{T}\left(T^1\left(\left(1-e^1\right)w^1 l^1\right), T^2\left(\left(1-e^2\right)w^2 l^2\right)\right)$ imply the following equilibrium conditions - the first-order conditions with respect to hours of work and amount evaded, respectively:

$$\begin{aligned}u_c^t\left[(1-D^i e^i)w^i - T^{i'}\left(\left(1-e^i\right)w^i l^i\right)\left(1-e^i\right)w^i\right] - u_z^i & \\ +u_{T^i}^i m_T^i T^{i'}\left(\left(1-e^i\right)w^i l^i\right)\left(1-e^i\right)w^i &= 0 \qquad (10)\\ u_c^i\left[D^i w^i l^i - T^{i'}\left(\left(1-e^i\right)w^i l^i\right)w^i l^i\right] + u_{T^i}^i m_T^i T^{i'}\left(\left(1-e^i\right)w^i l^i\right)w^i l^i &= 0 \qquad (11)\end{aligned}$$

Notice the fact that agents can hide part of their income to avoid paying taxes has consequences for the choices of consumption and leisure. If, on one hand, hidden income reduces the taxable income, allowing the agent, for instance, to consume more, on the other hand, she can work less, which might lead her to evade less. These additional tradeoffs will play an important role in the planner's problem and in the solution for the optimal marginal labor income tax rate of both low- and high-ability types as we discuss below.

4.2 Optimal Taxation: The Role of Hidden Income

In this section, we follow the same approach described in Section 3 to characterize a optimal "evasion" policy, along with the optimal marginal income tax.[11] Given the government's

[9] Allowing for different functional forms would only complicate the discussion but not improving the intuition of the results. Results available upon request.

[10] Our concealment cost parameter, is at the control of the tax administration, in the same spirit of Keen and Slemrod (2017). In other words, we allow for administrative interventions that affect the private resource cost in a way that the government can choose the amount each individual would have to spend to avoid taxes, the enforcement elasticity of tax revenue. Just to keep as simple as possible, we forego the cost of such enforcement.

[11] Another approach would be to assume that the government has no policies to directly affect agent's decision in this regard, characterizing an incomplete tax problem for lack of an appropriate instrument to tackle tax avoidance. Chari and Kehoe (1999) define an economy's tax system as complete if the number of

goal of redistribution from the high-ability to the low-ability type, while preventing that the former mimics the later, the possibility that agents hide part of their income creates additional challenges for the planner when designing the optimal policies. The government only observes the individual's reported income $(1-e^i)\,w^i l^i$, and it cannot disentangle whether the individual is misreporting her labor supply, a fraction of her income or both. In other words, high-ability agents might attempt to fool the government by reporting an income equal to that of a low-ability type, i.e., $(1-e^1)\,w^1 l^1 = (1-e^2)\,w^2 l^2$, either through a manipulation of her labor supply and/or her hidden income - with unobservable and hidden income, agents can mimic each other by misreporting their productivity but hide income according to their types, truthfully report their income but mimic the hidden portion, or misreport both income and hidden portion.

Self-selection constraints that capture these three possibilities must be present in the planner's problem to properly characterize the optimal marginal labor income taxes. To easy notation, we will index the self-selection constraint with $j = 1, 2, 3$. The first self-selection constraint ($j = 1$), equation (2), represents the case when the high-ability (type-2) agent mimics both the low-ability (type-1) agent's labor supply and the fraction of income hidden. In this case, $e^2 = e^1$, and $l^2 = \phi l^1$. Alternatively, the type-2 individual might choose the amount of hidden income optimally (as per her type), but then adjust her labor supply accordingly, i.e., $l^2 = \left[(1-e^1)\,\phi l^1\right]/(1-e^2)$, to fool the government (self-selection $j = 2$). And finally, the mimicker could freely choose her labor supply l^2 and adjust the fraction of income hidden to $e^2 = 1 - \left[(1-e^1)\,\phi l^1\right]/l^2$ such that the reported income of both types is seen by the government as the same (self-selection $j = 3$).

Hence, the planner faces now the following self-selection constraints, respectively:

$$U^2 \geq \widehat{U}_1^2, \tag{12}$$

$$U^2 \geq \widehat{U}_2^2, \tag{13}$$

$$U^2 \geq \widehat{U}_3^2, \tag{14}$$

tax rates the social planner can select is equal to the number of commodities in question, and incomplete if the number of tax instruments is smaller than the number of commodities. We present the solution of this problem in the Appendix.

where $U^2 = u^2\left(c^2, 1-l^2, m_T^2 T^2\left((1-e^2)w^2 l^2\right), m_{\overline{T}}^2 \overline{T}\right)$, and

$$\begin{aligned}
\widehat{U}_1^2 &= \widehat{u}_1^2\left(c^1, 1-\phi_1 l^1, m_T^2 T\left((1-e^1)w^2\phi l^1\right), m_{\overline{T}}^2\overline{T}\right), \\
\widehat{U}_2^2 &= \widehat{u}_2^2\left(c^1, 1-\phi\left(\frac{1-e^1}{1-e^2}\right)l^1, m_T^2 T\left((1-e^2)w^2\left(\phi\left(\frac{1-e^1}{1-e^2}\right)l^1\right)\right), m_{\overline{T}}^2\overline{T}\right), \\
\widehat{U}_3^2 &= \widehat{u}_3^2\left(c^1, 1-l^2, m_T^2 T\left(\left(\phi\left(1-e^1\right)\frac{l^1}{l^2}\right)w^2 l^2\right), m_{\overline{T}}^2\overline{T}\right).
\end{aligned}$$

The expressions on the right-hand side of the weak inequality in equations (12)-(14) represent the utility of the mimicker and, as before, variables with a $\widehat{\ }$ above a variable refers to the mimicker. Although the mimicker enjoys the same consumption and evasion as the low-ability type in each period, she enjoys more leisure (as the mimicker is more productive than the low-ability type). For the second self-selection constraint, $j = 2$, since the mimicker is choosing the optimum level of income to hide, she might end up working more if $e^1 < e^2$ (or less, if $e^1 > e^2$) to compensate the larger (smaller) utility due to hidden income. Lastly, the third self-selection constraint ($j = 3$) captures the fact that as type-2 mimicker is choosing her labor supply optimally, the lower l^2 is, the lower the fraction of her income e^2 she will have to hide such that her reported income is identical to type-1's income.

The social planner problem in the Lagrangean form is written as

$$\begin{aligned}
\mathscr{L} &= W\left(n^1U^1, n^2U^2\right) + \sum_{j=1}^{3}\lambda_j\left(U^2 - \widehat{U}_j^2\right) \\
&+ \gamma\left[F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i\left(c^i + D^i e^i w^i l^i\right)\right]
\end{aligned} \tag{15}$$

where $W(\cdot)$ is a general social welfare function, λ_j, $j = 1, 2, 3$, and γ are the Lagrange multipliers associated with the self-selection constraints, equations (12)-(14), and the economy's resource constraint, respectively.

Following the same steps as in Section 3.2, the optimal marginal labor income taxes of low-ability and high-ability agents are, respectively:

$$T^{1\prime}\left(\left(1-e^1\right)w^1 l^1\right) = \frac{\left(\frac{1}{(1-e^1)w^1}\right)\sum_{j=1}^{3}\left(\frac{\lambda_j^*}{n^1}\right)\left(MRS_{z,c}^1 - \phi_j\widehat{MRS}_{jz,c}^2\right)}{\left[\begin{array}{l} 1+\sum_{j=1}^{3}\left(\frac{\lambda_j^*}{n^1}\right)\left(m_T^1 MRS_{T^1,c}^1 - m_T^2\widehat{MRS}_{jT^2,c}^2\right) \\ +\left(\frac{1}{(1-e^1)w^1}\right)\left(\frac{1}{\gamma n^1}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{T}}\right)\left(\frac{\partial\overline{T}(\cdot)}{\partial T^1((1-e^1)w^1 l^1)}\right) \end{array}\right]} \tag{16}$$

$$T^{2\prime}\left(\left(1-e^2\right)w^2 l^2\right) = \frac{-\left(\frac{1}{(1-e^2)w^2}\right)\left(\frac{\lambda_3^*}{n^2}\right)\widehat{MRS}_{3z,c}^2}{1+\left(\frac{1}{(1-e^2)w^2}\right)\left(\frac{1}{\gamma n^2}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{T}}\right)\left(\frac{\partial\overline{T}(\cdot)}{\partial T^2((1-e^2)w^2 l^2)}\right)} \tag{17}$$

where $\lambda_j^* = \lambda_j \widehat{u}_{jc}^2/\gamma$; $\widehat{u}_{jc}^2$, $\widehat{u}_{jz}^2$, $\widehat{u}_{jT^2}^2$ are the marginal utility of consumption, leisure, tax payments, respectively and $\widehat{MRS}_{jz,c}^2 = \widehat{u}_{jz}^2/\widehat{u}_{jc}^2$, $\widehat{MRS}_{jT^2,c}^2 = \widehat{u}_{jT^2}^2/\widehat{u}_{jc}^2$ represent the marginal rate of substitution between leisure and consumption and the marginal rate of substitution between labor income tax payments and consumption of type-2 mimicker according to the self-selection $j = 1, 2, 3$, respectively. Recall that $\phi = w^1/w^2 = \theta^1/\theta^2$ and the variables ϕ_j are defined as follows: $\phi_1 = \phi$, $\phi_2 = \phi\left(1 - e^1\right)/\left(1 - e^2\right)$, $\phi_3 = 0$. The term $\partial\mathscr{L}/\partial\overline{T_t}$ is now defined as

$$\frac{\partial \mathscr{L}}{\partial \overline{T}} = \sum_{i=1}^{2} \left(\frac{\partial W}{\partial \left(n^i U^i\right)} \right) n^i m_{\overline{T}}^i u_{\overline{T}}^{it} + \sum_{j=1}^{3} \lambda_j m_{\overline{T}}^2 \left(u_{\overline{T}}^2 - \widehat{u}_{j\overline{T}}^2 \right) \tag{18}$$

Compared to the situation where agents do not hide part of their income, equation (9), the optimal marginal tax rate on the low-ability labor income now, equation (16), takes into account and corrects for the possibility that a high-ability agent mimics the low-ability behavior regarding her hidden income, as well as her labor supply - self-selection constraints, equations (12)-(14). In particular, notice that the numerator and the denominator have two additional terms precisely to capture the two additional self-selection constraints, equations (13)-(14).

If preferences do not differ between ability types, which implies that $MRS_{z,c}^1 > \phi_2 \widehat{MRS}_{2z,c}^2$, where $\phi_2 = \phi\left(1 - e^1\right)/\left(1 - e^2\right)$, the contribution of the second self-selection constraint (type-2 mimics only type-1 labor supply), equation (13), is to increase the marginal labor income tax rate of the low-ability type on top of (besides) the increase due to the first self-selection constraint (type-2 mimics type-1 labor supply and hidden income), equation (12) - $MRS_{z,c}^1 > \phi \widehat{MRS}_{1z,c}^2$. Because the high-ability agent can choose her labor supply l^2 truthfully, but adjust the fraction of income she hides, self-selection $j = 3$, equation (14), the optimal marginal tax rate on the low-ability only takes into account the marginal rate of substitution between consumption and leisure of this type, i.e., $\lambda_3^* MRS_{z,c}^1$. The counterpart of this marginal rate of substitution, the term $\lambda_3^* \widehat{MRS}_{3z,c}^2$, is taken into account by the planner and affects the optimal marginal labor income tax of the high-ability agent, as we will discuss below.

The two additional self-selection constraints also alter the denominator of equation (16), relative to equation (9). The fact that individuals have *independent tax* preferences and care positively (negatively) for the tax payments they make, besides the possibility that high-ability types might mimic the low ability behavior regarding labor supply and hidden income, leads the planner to reduce (increase) the low-ability type marginal labor income tax. In other words, an increase in the marginal tax rate, equation (16), due to differences between $MRS_{z,c}^1$ and $\widehat{MRS}_{jz,c}^2$, can be counteracted by adjustments in the marginal tax rate

due to differences between $m^1_T MRS^1_{T^1,c}$ and $m^2_T \widehat{MRS}^2_{jT^2,c}$ via the self-selection constraints, equations (12)-(14) when agents are tax conformable (*conformity*, $u^i_{T^i} > 0$) with respect to their own tax payments. On the other hand, such increase would be reinforced if agents are tax hostile (*opposition*, $u^i_{T^i} < 0$).[12] As before and assuming $m^i_{\overline{T}} = 1$, $\forall i$, the *interdependence effect*, measure by the term $\partial \mathscr{L}/\partial \overline{T}$, acts to amplify (lessen) the increase in the marginal labor income tax of low-ability types if both agents are (conformable) hostile to taxes, i.e., (*conformity*, $u^i_{\overline{T}} > 0$) *hostility*, $u^i_{\overline{T}} < 0$.

Introducing the possibility of hidden income in the model allows us to fully characterize the optimal marginal tax rate of the high-ability individual. The numerator of equation (17) accounts for the fact that, in trying to mimic the low-ability reported income, the high-ability agent adjusts the portion of income she hides. To discourage such behavior, it is optimal for the planner to reduce the marginal labor income tax of high-ability agents by $-\left(1/\left(1-e^2\right)w^2\right)\left(\lambda^*_3/n^2\right)\widehat{MRS}^2_{3z,c}$. Notice that this is also the case if we assume agents have positive (*conformity*, $u^i_{\overline{T}} > 0$) preferences towards average tax payments $\overline{T}$, which implies a positive *interdependence effect*, i.e., $\partial \mathscr{L}/\partial \overline{T} > 0$. If, on the other hand, agents are *interdependent* hostile towards taxes ($\partial \mathscr{L}/\partial \overline{T} < 0$), the planner might not reduce the marginal tax as much or even increase it.

Proposition 2. *The possibility of evading income adds mimicking alternatives for the skilled individual. The optimal marginal income taxes for the less skilled now can be even lower (larger) than without evasion when individuals present independent tax affinity (hostitlity). Interdepednent tax affinity (hostility) still acts reducing (increasing) tax progressivity on both types. The optimal marginal income tax for the skilled one calls for a subsidy to discourage her for mimicking.*

Notice that if $e^i = 0$, we can disregard the self-selection constraints, equations (13)-(14), and the solution of the planner's problem, i.e., the low-ability marginal labor income tax, is as in equation (9), and zero marginal income taxes for skilled ones.

4.3 Optimal (linear) concealment cost

We had assumed that the resource cost to hide income (δ) is a (linear) function of the government's policy that would affect it, i.e., $\delta(D^i) = D^i$, and this cost and the policy itself were treated as exogenous given. However, it is possible that through this policy instrument

[12] Notice that the differences of marginal rates of substitution (tax payments and consumption) of a honest low-ability and a mimicker high ability appear in the denominator of equation (16) for all three self-selection constraints, while the the difference of marginal rates of substitution (leisure and consumption) regarding the third self-selection constraint is split between the two marginal tax rates, equations (16) and (17). This is the case because while leisure is different depending on the behavior of the mimicker, the reported income is the same and equal to the one reported by the low-ability type.

the government can influence the (resource) cost for the agents (and their decision) to hide part of their taxable income.

We characterize the optimal "evasion" policy instruments for both low- and high-ability types as the solution to the planner's problem to maximize agents' welfare when agents hide income at a resource cost as follows:

$$D^1 = \frac{\left(1-m_T^1 MRS^1_{T^1,c}\right)\left(\frac{1}{n^1 w^1 l^1}\right)\left(\lambda_2^* \phi\left(\frac{l^1}{1-e^2}\right)\widehat{MRS}^2_{2z,c} - \left(\frac{1}{\gamma}\right)\Omega_D^1\left(\frac{\partial \mathscr{L}}{\partial \overline{T}}\right)\right)}{1+\sum_{j=1}^{3}\left(\frac{\lambda_j^*}{n^1}\right)\left(m_T^1 MRS^1_{T^1,c} - m_T^2 \widehat{MRS}^2_{jT^2,c}\right)} \tag{19}$$

$$D^2 = \frac{\left(1-m_T^2 MRS^2_{T^2,c}\right)\left(\frac{1}{n^2 w^2 l^2}\right)\left(\lambda_2^* \phi\left(\frac{l^1}{1-e^2}\right)\widehat{MRS}^2_{2z,c} - \left(\frac{1}{\gamma}\right)\Omega_D^2\left(\frac{\partial \mathscr{L}}{\partial \overline{T}}\right)\right)}{1+m_T^2 MRS^2_{T^2,c}} \tag{20}$$

where $\Omega_D^1 = \left(\partial \overline{T}(\cdot)/\partial T^1\left(\left(1-e^1\right)w^1 l^1\right)\right) T^{*1'}\left(\left(1-e^1\right)w^1 l^1\right) w^1 l^1$

Equations (19)-(20) are the result of combining household's equilibrium equations (28) with planner's first order conditions with respect to the evasion level. First notice that since we are assuming away any costs for the government to implement these policies, they are expressed in welfare terms. In this sense, the optimal "evasion" policies reflect the fact the planner weights the benefits for each agent type to evade a portion of her taxable income and the concealment cost to untruthfully report her income taxes such that it maximizes the agent's welfare.

The optimal "evasion" policy has three main components. First, independent and interdependent tax preferences, i.e., $MRS^i_{T^i,c}$ and $\Omega_D^i\left(\partial \mathscr{L}/\partial \overline{T}\right)$, respectively, imply an intuitive result: when agents are tax conformable (hostile), the optimal "evasion" policy is smaller (larger). Another component of these policies is the mimicker willingness to evade ($\widehat{MRS}^2_{2z,c}$). Because in our setup skilled individuals can evade to mimick less skilled agents, the optimal policy is to increase the concealment (resource) cost not for one type only but for both types, a novelty compared to the existing literature. And finally, the self-selection constraints ($m_T^1 MRS^1_{T^1,c} - m_T^2 \widehat{MRS}^2_{jT^2,c}$) act, as in the optimal income tax, to reduce (increase) the cost for less skilled if both types have independent tax conformity (hostility).

5 Implication for Intergenerational Taxation

In order to understand how independent and interdependent tax preferences across generations might affect the design of optimal policies, we consider an overlapping generations (OLG) model with individuals living for two periods. Each time period t, a new generation is born. This generation, called generation t, is denoted by its date of birth. These individuals live for two periods. The members of generation t work during the first period of

their life (when young, t) and do not work during the second period (when old, $t+1$). The goal is to identify how the planner would take into account potential differences across types and generations with respect to their tax preferences when choosing the optimal taxation of individuals born in period t. In this section, we focus on new notation and avoid repeating terms already defined whenever it would not lead to confusion.

As in Sections 3 and 4, we assume that agents born in period t are heterogeneous with respect to their work ability - an asymmetric information between the private sector and the government. The low-ability type (type $i=1$) is less productive than the high-ability type (type $i=2$), and there are n_t^i type-i members of generation t (individuals of ability-type i who were born at the beginning of period t).

A type-i individual born in the period t values leisure when young, z_t^i, given by a time endowment, normalized to 1, less the hours of work, l_t^i. She also cares about her consumption when young and when old, c_t^i and x_{t+1}^i, respectively. We assume that the agent does not work when old, hence all available time is allocated to leisure. Agents make payments $T_t^i\left(w_t^i l_t^i\right)$ on their labor income $w_t^i l_t^i$, where w_t^i is the wage rate, and payments $Q_{t+1}^i\left(s_t^i r_{t+1}\right)$, where s_t^i and r_{t+1} are the agent's savings in period t and the market interest rate in period $t+1$, respectively. We assume that agents can only hide a fraction e_t^i of the labor income $w_t^i l_t^i$ earned, which is costly and a fraction D_t^i is lost (Section 4), but not their savings earnings.[13]

Agents' preferences include a combination of both independence and interdependence preferences over taxes, both labor and savings income. Let the economy aggregate measure of labor income tax payments and the aggregate measure of tax payments on savings return be defined as follows, respectively

$$\begin{aligned}
\overline{T}_t &= \overline{T}_t\left(\begin{array}{l} T_t^1\left(\left(1-e_t^1\right)w_t^1 l_t^1\right), T_t^2\left(\left(1-e_t^2\right)w_t^2 l_t^2\right), \\ T_{t-1}^1\left(\left(1-e_{t-1}^1\right)w_{t-1}^1 l_{t-1}^1\right), T_{t-1}^2\left(\left(1-e_{t-1}^2\right)w_{t-1}^2 l_{t-1}^2\right)\end{array}\right) \qquad (21)\\
\overline{Q}_{t+1} &= \overline{Q}_{t+1}\left(Q_{t+1}^1\left(s_t^1 r_{t+1}\right), Q_{t+1}^2\left(s_t^2 r_{t+1}\right), Q_t^1\left(s_{t-1}^1 r_t\right), Q_t^2\left(s_{t-1}^2 r_t\right)\right) \qquad (22)
\end{aligned}$$

Notice that an agent's i reference measures $\overline{T}_t(\cdot)$ and $\overline{Q}_{t+1}(\cdot)$ can be modeled in different ways, and we allow for agents to consider not only contemporaneous tax payments by all types in the economy, but also payments made by agents in the previous period as part of their reference point. The goal is to capture, to some extent, a measure of social norm with respect to attitudes towards taxation not only within a particular type of agent in the economy but also across different types and form of taxation. Nevertheless, agents treat these reference levels $\overline{T}_t$ and $\overline{Q}_{t+1}$ as exogenously. This is a departure from the literature that have mainly focus on agents positional preferences with respect to consumption - agents

[13] We assume that with third-part reporting, savings tax is much harder to avoid in a closed economy as it is our setup.

compare their own consumption with a measure of reference consumption. In our economy, we assume that tax payments $T_t^i\left(w_t^i l_t^i\right)$ and $Q_{t+1}^i\left(s_t^i r_{t+1}\right)$ are positional goods, whereas private consumption (the consumption of which is denoted c when young and x when old) and leisure are non positional. Later, we explore the implications of alternative reference measures for optimal taxation.

An ability-type i born in the beginning of period t,

$$U_t^i = u_t^i\left(c_t^i, z_t^i, x_{t+1}^i, m_T^i T_t^i\left(\left(1-e_t^i\right)w_t^i l_t^i\right), m_Q^i Q_{t+1}^i\left(s_t^i r_{t+1}\right), m_{\overline{T}}^i \overline{T}_t, m_{\overline{Q}}^i \overline{Q}_{t+1}\right) \quad (23)$$

subject to first and second periods - young (t) and old (t+1) - budget constraints, respectively

$$c_t^i = w_t^i l_t^i - T_t^i\left(\left(1-e_t^i\right)w_t^i l_t^i\right) - D_t^i e_t^i w_t^i l_t^i - s_t^i \quad (24)$$

$$x_{t+1}^i = s_t^i\left(1+r_{t+1}\right) - Q_{t+1}^i\left(s_t^i r_{t+1}\right) \quad (25)$$

where the reference levels $\overline{T}_t$ and $\overline{Q}_{t+1}$ are defined in equations (21) and (22), $m_T^i, m_Q^i \in [0,1]$ and $m_{\overline{T}}^i, m_{\overline{Q}}^i \in [0,1]$ are attention parameters associated to independent and interdependent tax preferences, which allows for the possibility that agents might not be fully attentive to their own tax preferences. The first-order conditions with respect to hours of work, amount evaded and savings are respectively:

$$\begin{aligned} u_c^{it}\left[\left(1-D_t^i e_t^i\right)w_t^i - T_t^{i'}\left(\left(1-e_t^i\right)w_t^i l_t^i\right)\left(1-e_t^i\right)w_t^i\right] - u_z^{it} & \\ + u_{T^i}^{it} m_T^i T_t^{i'}\left(\left(1-e_t^i\right)w_t^i l_t^i\right)\left(1-e_t^i\right)w_t^i &= 0 \quad (26) \\ u_c^{it}\left[D_t^i w_t^i l_t^i - T_t^{i'}\left(\left(1-e_t^i\right)w_t^i l_t^i\right)w_t^i l_t^i\right] + u_{T^i}^{it} m_T^i T_t^{i'}\left(\left(1-e_t^i\right)w_t^i l_t^i\right)w_t^i l_t^i &= 0 \quad (27) \\ -u_c^{it} + u_x^{it}\left(1+r_{t+1} - Q_{t+1}^{i'}\left(s_t^i r_{t+1}\right)r_{t+1}\right) + u_{Q^i}^{it} m_Q^i Q_{t+1}^{i'}\left(s_t^i r_{t+1}\right)r_{t+1} &= 0 \quad (28) \end{aligned}$$

where $u_z^{it} = \partial u_t^i / \partial z_t^i$, $u_x^{it+1} = \partial u_t^i / \partial x_{t+1}^i$, and $u_{Q^i}^{it} = \partial u_t^i / \partial Q_{t+1}\left(s_t^i r_{t+1}\right)$; $Q_{t+1}^{i'}\left(s_t^i r_{t+1}\right)$ is the marginal capital income tax rate.

5.1 Optimal Labor Income and Savings Marginal Taxes

The planner's problem in the Lagrangean form is written as

$$\begin{aligned} \mathscr{L} &= W\left(n_0^1 U_0^1, n_0^2 U_0^2, n_1^1 U_1^1, n_1^2 U_1^2, ...\right) \\ &+ \sum_t \sum_{j=1}^{3} \lambda_{jt}\left(U_t^2 - \widehat{U}_{jt}^2\right) \quad (29) \\ &+ \sum_t \gamma_t\left[F\left(L_t^1, L_t^2, K_t\right) + K_t - \sum_{i=1}^{2}\left(n_t^i c_t^i + n_{t-1}^i x_t^i\right) - \sum_{i=1}^{2}\left(D_t^i n_t^i e_t^i w_t^i l_t^i\right) - K_{t+1}\right] \end{aligned}$$

where λ_{jt}, $j = 1, 2, 3$, and γ_t are the Lagrange multipliers associated with the self-selection constraints, similarly to equations (12)-(14) and presented in the Appendix to improve readibility, and the economy's resource constraint, respectively.

The solution to the planner's problem, equation 29, is a composed of six policy instruments, namely the optimal marginal taxes on labor and capital income and "evasion" policy for both low- and high-ability types. The expressions for the marginal labor income tax rates and "evasion" policy of both types are presented in the Appendix.

When we consider the implications of intergenerational tax preferences, the optimal marginal labor income tax rate for the low- and high-ability types are similar to the ones presented in equations (16)-(17), except for the effect of interdependence taxes concerns, term $\partial\mathscr{L}/\partial\overline{T}_t$, which is now defined as

$$\begin{aligned}\frac{\partial\mathscr{L}}{\partial\overline{T}_t} &= \sum_{i=1}^{2}\left(\frac{\partial W}{\partial\left(n_t^i U_t^i\right)}\right) n_t^i m_{\overline{T}}^i u_{\overline{T}}^{it} + \sum_{i=1}^{2}\left(\frac{\partial W}{\partial\left(n_{t+1}^i U_{t+1}^i\right)}\right) n_{t+1}^i m_{\overline{T}}^i u_{\overline{T}}^{it+1} \\ &+ \sum_{j=1}^{3}\lambda_{jt} m_{\overline{T}}^2\left(u_{\overline{T}}^{2t} - \widehat{u}_{j\overline{T}}^{2t}\right) + \sum_{j=1}^{3}\lambda_{jt+1} m_{\overline{T}}^2\left(u_{\overline{T}}^{2t+1} - \widehat{u}_{j\overline{T}}^{2t+1}\right) \qquad (30)\end{aligned}$$

The generational interdependence taxes concerns acts to establish a link between agents preferences across time. In particular, a type-i agent, when making her decisions, cares not only for the amount of taxes she pays but also for the amount others pay. In an overlapping generation model, the amount paid by others also includes the taxes paid by a generation before hers and this fact affects the the optimal marginal tax rate of the current generation. At the same time, how much agents pay today influence the future generation decisions either if their see taxes in a positive or negative way. This intergeneration effect of tax preferences is capture by the term $\partial\mathscr{L}/\partial\overline{T}_t$, equation (17). To some extent, the time t optimal marginal tax is somehow "internalizing" the future effect of current generation interdependence tax preferences on the future generation (a present value of this "future" effect). The following proposition summarizes our findings:

From the planner's and type-i agent's problem, we combine the first-order conditions with respect to x^i, s^i to find the optimal marginal capital income tax rate for the low- and

high-ability agents as follows, respectively

$$Q_{t+1}^{1'}\left(s_{t+1}^{1}r_{t+1}\right) = \frac{\left[(1+r_{t+1})-MRS_{c,x}^{1}\right]/r_{t+1}}{\left[\begin{array}{l} 1+\sum_{j=1}^{3}\left(\frac{\lambda_{j}^{**}}{\gamma_{t}n_{t}^{1}m_{Q}^{1}}\right)\left(m_{Q}^{1}MRS_{Q^{1},x}^{1}-m_{Q}^{2}\widehat{MRS}_{jQ^{2},x}^{2}\right) \\ +\left(\frac{1}{\gamma_{t}n_{t}^{1}}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{Q}_{t+1}}\right)\left(\frac{\partial\overline{Q}_{t+1}}{\partial Q_{t+1}^{1}\left(s_{t}^{1}r_{t+1}\right)}\right) \end{array}\right]} \tag{31}$$

$$Q_{t+1}^{2'}\left(s_{t+1}^{2}r_{t+1}\right) = \frac{\left[(1+r_{t+1})-MRS_{c,x}^{2}\right]/r_{t+1}}{1+\left(\frac{1}{\gamma_{t}n_{t}^{2}}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{Q}_{t+1}}\right)\left(\frac{\partial\overline{Q}_{t+1}}{\partial Q_{t+1}^{2}\left(s_{t}^{2}r_{t+1}\right)}\right)} \tag{32}$$

where $\lambda_{j}^{**}=\lambda_{j}\widehat{u}_{jx}^{2}/\gamma$; $\widehat{u}_{jc}^{2}$, $\widehat{u}_{jx}^{2}$, $\widehat{u}_{jQ^{2}}^{2}$, $\widehat{MRS}_{jc,x}^{2}=\widehat{u}_{jc}^{2}/\widehat{u}_{jx}^{2}$, $\widehat{MRS}_{jQ^{2},x}^{2}=\widehat{u}_{jQ^{2}}^{2}/\widehat{u}_{jx}^{2}$ represent the marginal utility of consumption in period t, consumption in period $t+1$, capital income tax payments, the marginal rate of substitution between consumption in t and $t+1$ and the marginal rate of substitution between capital income tax payments and $t+1$ consumption of type-2 mimicker according to the self-selection $j=1,2,3$. And the interdependent effect regarding the aggregate measure of capital taxation is defined as follows

$$\begin{aligned}\frac{\partial\mathscr{L}}{\partial\overline{Q}_{t+1}} &= \sum_{i=1}^{2}\frac{\partial W}{\partial\left(n_{t}^{i}U_{t}^{i}\right)}n_{t}^{i}m_{Q}^{i}u_{\overline{\Phi}(\cdot)}^{it}+\sum_{i=1}^{2}\frac{\partial W}{\partial\left(n_{t+1}^{i}U_{t+1}^{i}\right)}n_{t+1}^{i}m_{Q}^{i}u_{\overline{\Phi}(\cdot)}^{it+1} \\ &+ \lambda_{t}m_{Q}^{2}\left[u_{\overline{Q}(\cdot)}^{2t}-\widehat{u}_{\overline{Q}(\cdot)}^{2t}\right]+\lambda_{t+1}m_{\Phi}^{2}\left[u_{\overline{Q}(\cdot)}^{2t+1}-\widehat{u}_{\overline{Q}(\cdot)}^{2t+1}\right]\end{aligned} \tag{33}$$

The denominator of equation (31) captures the self-selection constraint with respect to the marginal rate of substitution between paying savings taxes in period $t+1$ versus tomorrow's consumption. This term is also expected to have a positive sign for $\left[m_{Q}^{1}MRS_{Q^{1},x}^{1}-m_{Q}^{2}\widehat{MRS}_{jQ^{2},x}^{2}\right]$ which decreases the optimal marginal capital taxes for low skilled individuals. The numerator of equation (31) and the equation (32) has two pieces: the first one captures the difference between the marginal rate of substitution between today versus tomorrow consumption and the (market) interest rate $(1+r_{t+1})$, i.e., $[(1+r_{t+1})-MRS_{c,x}^{it}]$. This first term explains that government must to conduct the marginal rate of substitution between today versus tomorrow's consumption comparing it to the market interest rate. The larger $MRS_{c,x}^{i}$ with respect to $(1+r_{t+1})$, the lower the optimal marginal tax on savings. This result can be clearer understood from consumers optimization according to the following rule $MRS_{c,x}^{i}-(1+r_{t+1})=-\Phi_{t+1}'\left(s_{t}^{i}r_{t+1}\right)r_{t+1}(1-MRS_{\bar{Q},x}^{i})$. The government reduces (increases) the optimum tax on savings at the margin to stimulate (discourage) savings and to increase the amount of capital savings collected. This suggests that optimal policy drives consumers away from the market interest rate. Our second expression denotes the relative tax affinity

concern as acts decreasing the optimum marginal capital taxes. We summarize our findings in the following proposition.

Proposition 3. *We should not impose distortion on savings decision if marginal rate of substitution between consumption today versus tomorrow equals to interest rate. The larger that MRS the lower the tax/subsidy to accomplish future consumption. Again, interdependent tax affinity (hostility) calls for a reduction (increase) on the optimal marginal savings tax for both types. Self-selection constraints leads to an increase (reduction) optimal marginal savings tax on the less skilled if both individuals have independent tax affinity (hostility).*

6 Numerical Exercise

Sections 3, 4, and 5 presented results that were derived based on general functions and planner's problem to achieve optimal (Pareto-efficient) allocations. We obtained policy rules for marginal taxation of labor income and capital income (Section 5). These optimal rules are the necessary conditions for maximizing a planner's social welfare function where a redistribution scheme is assumed. However, in order to quantify the optimal allocations of consumption, leisure and savings and the levels of marginal and average taxation, we need to clearly define the functional form assumptions underlying the individual utility functions, in particular the tax preferences components, firm's technology and the specific social welfare function we use. Our goal with several numerical exercises is not to try to mimic real world economies, but rather to illustrate how optimal taxes and redistribution policies vary with key parameters of the model and across policy objectives.

All individuals of ability $i = 1, 2$ are assumed to have a common utility function as follows:

$$\begin{aligned} U_t^i &= \ln\left(c_t^i\right) + \eta \ln\left(1 - l_t^i\right) + \mu \ln\left(1 + m_T^i T_t^i\left(\left(1 - e_t^i\right) w_t^i l_t^i\right) - \varphi m_{\overline{T}}^i \overline{T}_t\left(\cdot\right)\right) \\ &\quad + \beta\left[\ln\left(x_{t+1}^i\right) + \chi \ln\left(1 + m_Q^i Q_{t+1}^i\left(s_t^i r_{t+1}\right) - \psi m_{\overline{Q}}^i \overline{Q}_{t+1}\right)\right] \end{aligned} \tag{34}$$

where the aggregate measures of labor income and capital taxation are defined as their respective averages

$$\overline{T}_t = \frac{\sum_{i=1}^2 n_t^i T_t^i\left(\left(1 - e_t^i\right) w_t^i l_t^i\right) + \sum_{i=1}^2 n_{t-1}^i T_{t-1}^i\left(\left(1 - e_{t-1}^i\right) w_{t-1}^i l_{t-1}^i\right)}{N_t + N_{t-1}} \tag{35}$$

$$\overline{Q}_{t+1} = \frac{\sum_{i=1}^2 n_t^i Q_{t+1}^i\left(s_t^i r_{t+1}\right) + \sum_{i=1}^2 n_{t-1}^i Q_t^i\left(s_{t-1}^i r_t\right)}{N_t + N_{t-1}} \tag{36}$$

Throughout our numerical exercises the parameters η, μ, χ, φ, ψ and β are assumed to be fixed parameters and the same for low- and high-ability individuals. The parameters η

represents the individual's weight on the utility from leisure. In equation (34), we allow for the fact that the individual's weights on labor income and capital income tax preferences (μ and χ, respectively) migh not be the same; i.e., individuals might view and care differently about these two types of taxation. And, the parameters φ and ψ represent the degree of labor income tax positionality and the degree of capital income tax positionality, respectively. We define these parameters as follows:

$$\begin{aligned} \varphi &= \\ \psi &= \end{aligned}$$

The agent i's problem is to maximize (34) subject to (24)-(25). From the first order conditions with respect to consumption when young, work hours, amount evaded, savings and consumption when old and assuming interior solution we obtain the following equilibrium expressions:

$$\begin{aligned} MRS &= \\ MRS &= \end{aligned}$$

Our approach to the planner's problem assumes a welfarist government and, following earlier literature, we assume a utilitarian social welfare function defined as $W = n^1 U_t^1 + n^2 U_t^2$. As discussed in Section 4.2 to the government only observes the individual's reported income, and agents can mimic each other by misreporting their productivity but hide income according to their types, truthfully report their income but mimic the hidden portion, or misreport both income and hidden portion. The three self-selection constraints take the following form:

$$U_t^2 \geq \widehat{U}_{1t}^2, \tag{37}$$

$$U_t^2 \geq \widehat{U}_{2t}^2, \tag{38}$$

$$U_t^2 \geq \widehat{U}_{3t}^2, \tag{39}$$

where U_t^2 is defined in equation (34), $i = 2$, and

$$\begin{aligned}
\widehat{U}_{1t}^2 &= \ln\left(c_t^1\right) + \eta \ln\left(1 - \phi_1 l_t^1\right) + \mu \ln\left(1 + m_T^2 T_t^2 \left(\left(1 - e_t^1\right) w_t^2 \phi_1 l_t^1\right) - \varphi m_{\overline{T}}^2 \overline{T}_t\left(\cdot\right)\right), \\
&+ \beta\left[\ln\left(x_{t+1}^2\right) + \chi \ln\left(1 + m_Q^2 Q_{t+1}^2 \left(s_t^2 r_{t+1}\right) - \psi m_{\overline{Q}}^2 \overline{Q}_{t+1}\right)\right] \\
\widehat{U}_{2t}^2 &= \widehat{u}_2^2\left(c^1, 1 - \phi\left(\frac{1 - e^1}{1 - e^2}\right) l^1, m_T^2 T\left(\left(1 - e^2\right) w^2 \left(\phi\left(\frac{1 - e^1}{1 - e^2}\right) l^1\right)\right), m_{\overline{T}}^2 \overline{T}\right), \\
\widehat{U}_{3t}^2 &= \widehat{u}_3^2\left(c^1, 1 - l^2, m_T^2 T\left(\left(\phi\left(1 - e^1\right) \frac{l^1}{l^2}\right) w^2 l^2\right), m_{\overline{T}}^2 \overline{T}\right).
\end{aligned}$$

Our baseline parameters are summarized in Table **??**.

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TO BE COMPLETED

7 Conclusion

The recent theory on optimal income tax focuses on positional preferences where individuals care about others consumption or utility levels (Aronsson and Johansson-Stenman (2008, 2010), Aronsson and Johansson-Stenman (2018)) . On the other hand, a broader literature on warm-glow models address individuals that present pro-social behavior and how one should optimally tax them (Andreoni (1990); Djanali and Sheehan-Connor (2012); Hungerman (2014)). This paper aims to fill the gap of this literature by presenting a model that contains an individual with pro-social behavior with respect to her relative tax payment. She feels joyful by paying her fair share of taxes. Although such extension seems to be exotic we can find supportive evidence of such behavior in Markus and Kitayama (1991) where they introduce the concept of self-construal individual that first recognizes the environment that she lives in before taking into attention herself. In our model this means paying taxes as anyone else must enter her utility function. We also allow for having individuals without such concern as we parameterize such personality characteristic.

Next, we characterize the optimum general income (labor and capital) taxes in a economy with types of individuals, skilled and unskilled, where both can have a particular feature of pro-social behavior, a concept we call relative tax affinity concern.The introduction of this concern in general reduces income and capital tax progressivity (lower marginal income taxes) which seems to (ex-post) reasonable. What this captures is that when individuals care about their share of tax payment (with respect to others), tax authorities find less reward distorting labor supply decisions. Rather, a different tax scheme including larger demogrant could be implemented. Alternatively one might think that as this individual is affected by her share of contribution to the society, increasing the total contribution or her perception

of such share might have positive impacts on tax collection. This strand of research is to be advanced.

Appendix

AI. DATA

Below we present our descriptive statistics

Table A1- Descriptive Statistics

	More than Fair Share		Fair share		Less than fair share	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Avoidance	0.68	0.47	0.67	0.47	0.82	0.39
Avoidance I	0.37	0.48	0.31	0.46	0.49	0.51
Online Shop	0.19	0.39	0.15	0.35	0.20	0.40
Donation	0.20	0.40	0.19	0.39	0.36	0.48
Labor Supply	0.10	0.30	0.06	0.24	0.09	0.29
Avoidance II	0.60	0.49	0.60	0.49	0.78	0.42
Own House	0.34	0.48	0.28	0.45	0.42	0.50
Stocks	0.13	0.34	0.12	0.32	0.27	0.45
Location	0.12	0.33	0.09	0.29	0.09	0.29
Retirement	0.50	0.50	0.49	0.50	0.60	0.50
Education*	4.68	1.67	4.88	1.66	5.27	1.83
Taxes not problem	0.79	0.41	0.92	0.28	0.89	0.32
1 child	0.16	0.37	0.15	0.35	0.13	0.34
2 children	0.16	0.36	0.13	0.34	0.11	0.32
3 children	0.07	0.25	0.06	0.25	0.07	0.25
4 children	0.02	0.13	0.02	0.15	0.02	0.15
5 children	0.01	0.08	0.01	0.09	0.00	0.00
6 children	0.00	0.07	0.00	0.04	0.00	0.00
Republican	0.39	0.49	0.39	0.49	0.29	0.46
Democrat	0.41	0.49	0.44	0.50	0.56	0.50
Independent	0.08	0.27	0.06	0.23	0.07	0.25
None party	0.11	0.31	0.09	0.29	0.07	0.25
single	0.14	0.35	0.17	0.38	0.09	0.29
divorced	0.14	0.34	0.08	0.27	0.16	0.37
Living	0.04	0.21	0.04	0.20	0.09	0.29
married	0.59	0.49	0.63	0.48	0.58	0.50
widow	0.06	0.24	0.05	0.22	0.07	0.25
separated	0.02	0.15	0.02	0.15	0.02	0.15
19-29 y.o.	0.12	0.33	0.18	0.38	0.13	0.34
30-49 y.o.	0.48	0.50	0.46	0.50	0.36	0.48
50-64 y.o.	0.26	0.44	0.21	0.41	0.42	0.50
65+	0.12	0.33	0.14	0.34	0.09	0.29
Hispanic	0.08	0.28	0.09	0.29	0.02	0.15
white	0.72	0.45	0.80	0.40	0.93	0.25
black	0.13	0.34	0.07	0.26	0.02	0.15
asian-american	0.03	0.16	0.01	0.10	0.00	0.00
other	0.02	0.13	0.02	0.13	0.02	0.15

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Table III: Title here..

Q18: I'm going to read you a list of groups. Please tell me if you think they pay more than their fair share, less than their fair share, or about their fair share in federal taxes.

	Pay more than their fair share	Less than their fair share	About their fair share
a. High-income families	15	57	25
b. Middle-income families	59	3	34
c. Low-income families	36	20	40
d. You and your family	45	3	48

Q22. Which of the following bothers you most about taxes?

	The large amount you pay in taxes	The feeling that some wealthy people get away not paying their fair share	The complexity of the tax system
Total	14	51	32

Note: "Don't Know" and Refused not reported.

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AII. THEORETICAL MODEL

Let the following constraints:

$$U^2 \geq \widehat{U}^2_{1t}, \tag{40}$$

$$U^2 \geq \widehat{U}^2_{2t}, \tag{41}$$

$$U^2 \geq \widehat{U}^2_{3t}, \tag{42}$$

Table IV: ..Title..

Q61. Here are some decisions that some people make in part because of taxes. In the LAST YEAR did you (ITEM) IN PART because it meant that you would pay less in taxes?

	Yes	No	Don't know
Buy something on the Internet instead of from a local store	14	85	1
Donate more to charity	16	83	1
Work less*	9	84	1

Q69. Have you EVER (ITEM) IN PART because it meant you would pay less in taxes

	Yes	No	Don't know
Chosen to buy a house instead of renting	26	73	1
Bought or sold a stock or a bond you otherwise wouldn't have bought or sold	9	90	1
Chosen to live somewhere other than where you work	11	88	1
Put money in a retirement account	40	60	-

Note: Retired/didn't work: 7 percent.

Table V: Tax Interdependence Attitudes and Avoidance Decision II

	Avoidance	Avoidance I	Avoidance II
More	-0.0846**	- 0.0782*	-0.0849**
	(0.0363)	(0.041)	(0.047)
Fair	-0.0843**	-0.0748*	-0.0848**
	(0.0364)	(0.0409)	(0.0408)
Less	- 0.0872**	-0.0929**	-0.0793*
	(0.0357)	(0.261)	(0.0406)

Std errors in parentheses; $***p < 0.01, **p < 0.05, *p < 0.1$.

where

$$
\begin{aligned}
U^2 &= u^2\left(c_t^2, 1-l_t^2, x_{t+1}^2, m_T^2 T_t\left(\left(1-e_t^2\right) w_t^2 l_t^2\right), m_Q^2 Q_{t+1}\left(s_t^2 r_{t+1}\right), m_{\overline{T}}^2 \overline{T}_t(\cdot), m_{\overline{Q}}^2 \overline{Q}_{t+1}(\cdot)\right), \\
\widehat{U}_1^2 &= \widehat{u}_1^2\left(c_t^1, 1-\phi l_t^1, x_{t+1}^1, m_T^2 T_t\left(\left(1-e_t^1\right) w_t^2 \phi l_t^1\right), m_Q^2 Q_{t+1}\left(s_t^1 r_{t+1}\right), m_{\overline{T}}^2 \overline{T}_t(\cdot), m_{\overline{Q}}^2 \overline{Q}_{t+1}(\cdot)\right), \\
\widehat{U}_2^2 &= \widehat{u}_2^2\left(\begin{array}{l} c_t^1, 1-\phi\left(\frac{1-e_t^1}{1-e_t^2}\right) l_t^1, x_{t+1}^1, m_T^2 T_t\left(\left(1-e_t^2\right) w_t^2\left[\phi\left(\frac{1-e_t^1}{1-e_t^2}\right) l_t^1\right]\right), \\ m_Q^2 Q_{t+1}\left(s_t^1 r_{t+1}\right), m_{\overline{T}}^2 \overline{T}_t(\cdot), m_{\overline{Q}}^2 \overline{Q}_{t+1}(\cdot) \end{array}\right), \\
\widehat{U}_3^2 &= \widehat{u}_3^2\left(\begin{array}{l} c_t^1, 1-l_t^2, x_{t+1}^1, m_T^2 T_t\left(\left[\phi\left(1-e_t^1\right) \frac{l_t^1}{l_t^2}\right] w_t^2 l_t^2\right), \\ m_Q^2 Q_{t+1}\left(s_t^1 r_{t+1}\right), m_{\overline{T}}^2 \overline{T}_t(\cdot), m_{\overline{Q}}^2 \overline{Q}_{t+1}(\cdot) \end{array}\right).
\end{aligned}
$$

The optimal marginal labor income taxes are as follows

$$T_t^{1'}\left(\left(1-e_t^1\right)w_t^1 l_t^1\right) = \frac{\left(\frac{1}{\left(1-e_t^1\right)w_t^1}\right)\sum_{j=1}^{3}\left(\frac{\lambda_{jt}^*}{n_t^1}\right)\left(MRS_{z,c}^{1t}-\phi_j\widehat{MRS}_{jz,c}^{2t}\right)}{1+\sum_{j=1}^{3}\left(\frac{\lambda_{jt}^*}{n_t^1}\right)\left(m_T^1 MRS_{T^1,c}^{1t}-m_T^2\widehat{MRS}_{jT^2,c}^{2t}\right)} + \left(\frac{1}{\left(1-e_t^1\right)w_t^1}\right)\left(\frac{1}{\gamma n_t^1}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{T}}\right)\left(\frac{\partial\overline{T}}{\partial T^1\left(\left(1-e_t^1\right)w_t^1 l_t^1\right)}\right) \tag{43}$$

$$T_t^{2'}\left(\left(1-e_t^2\right)w_t^2 l_t^2\right) = \frac{-\left(\frac{1}{\left(1-e_t^2\right)w_t^2}\right)\left(\frac{\lambda_{3t}^*}{n_t^2}\right)\widehat{MRS}_{3z,c}^{2t}}{1+\left(\frac{1}{\left(1-e_t^2\right)w_t^2}\right)\left(\frac{1}{\gamma n_t^2}\right)\left(\frac{\partial\mathscr{L}}{\partial\overline{T}}\right)\left(\frac{\partial\overline{T}(\cdot)}{\partial T^2\left(\left(1-e_t^2\right)w_t^2 l_t^2\right)}\right)} \tag{44}$$

where $\lambda_j^* = \lambda_j\widehat{u}_{jc}^2/\gamma$; $\widehat{u}_{jc}^2$, $\widehat{u}_{jz}^2$, $\widehat{u}_{jT^2}^2$, $\widehat{MRS}_{jz,c}^2 = \widehat{u}_{jz}^2/\widehat{u}_{jc}^2$, $\widehat{MRS}_{jT^2,c}^2 = \widehat{u}_{jT^2}^2/\widehat{u}_{jc}^2$ represent the marginal utility of consumption, leisure, tax payments, the marginal rate of substitution between leisure and consumption and the marginal rate of substitution between labor income tax payments and consumption of type-2 mimicker according to the self-selection $j = 1, 2, 3$. Recall that $\phi = w^1/w^2 = \theta^1/\theta^2$ and the variables ϕ_j are defined as follows: $\phi_1 = \phi$, $\phi_2 = \phi\left(1-e^1\right)/\left(1-e^2\right)$, $\phi_3 = 0$.

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