Tax Preferences, Hidden Income and Optimal Income Taxation

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Abstract

We integrate tax preferences and hidden income at a resource cost with the optimal income taxation literature. We study a model with two skill types not observable by the government. Agents value consumption, leisure, and tax payments â their own (independent) and the economyâs average (interdependent tax preferences). Tax preferences, previously neglected, modify the standard marginal rate of substitution between consumption and leisure. And the marginal income tax facing the low and high-skilled can be either positive or negative, depending on agentsâ tax preferences. Hidden income can be discouraged by a policy implemented at a cost higher than its marginal cost.

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

JEL Classification: D03, D60, H21, H23.

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1 Introduction

In this paper, we characterize the optimal nonlinear labor income taxation in the presence of tax preferences when income is either perfect or imperfectly observed by the government. We develop a two-agent model where individuals have preferences over consumption and leisure as well as independent and interdependent tax preferences, i.e., the agent's tax payments and the average tax payment in the economy, respectively. We assume that agents are heterogeneous with respect to their work ability, which is not observable by the government. In our model, agents are either fully aware or inattentive to their tax preferences. The planner's welfare problem is to maximize the agents welfare and to redistribute income from the high-ability to the low-ability type, subject to self-selection constraints; taxes are functions of the individuals' earnings. We follow the *Mirrleesian* approach (Mirrlees, 1971) to characterize the optimal tax system in the presence of tax preferences and when labor income taxes cannot be explicitly conditioned on the individual' productivity or labor supply. In the presence of tax preferences, the planner must recognize that high-ability individuals might not only mimic the low-ability individuals labor supply, but also that their labor supply choices affect the individuals' tax payments and, consequently, the optimal marginal labor income tax.

Compared to the earlier literature, e.g., Stiglitz (1982), and in an environment without hidden income, agents' tax preferences affect the marginal tax rate of low-ability types in two key dimensions. First, tax preferences change the the marginal rate of substitution between consumption and leisure and can either amplify or reduce the marginal tax increase of the low-ability type due to the self-selection constraint. Second, interdependent tax preferences introduce an (atmospheric) externality on the optimal marginal tax rate of low-ability individuals. Despite tax preferences, the high-ability individuals face a zero optimal marginal tax rate and it is not optimal to distort their labor supply. The reason is twofold. First, the social planner can choose consumption and labor optimally, which have opposite effects and imply no distortions at the top. And, second, by choosing the optimal taxes the government is indirectly affecting the size of the externality.

Next, we characterize the optimal marginal income taxes when agents can hide part of their income at a resource cost, which implies a disutility for the individuals. In this environment,

the government only observes the individual's reported income and it cannot disentangle whether the individual is misreporting her labor supply, a fraction of her income or both. Besides the type-specific labor income taxes, the government also has a policy at its disposal to curb evasion by increasing the agent's resource cost of hiding income. The optimal marginal tax of low-ability individuals is such that the planner corrects for two key elements related to the behavior of a high-ability mimicker: (i) the optimal tax is designed so that it prevents a high-ability individual to pretend to be a low-ability agent and (ii) it takes into account that these decisions have implications for the resource costs associated with hidden income of both low-ability and (mimicker) high-ability individuals.

In our model, the individual's attempt to hide income raises two interesting issues. First, by hiding a fraction of their income, individuals can increase their disposable income. Second, when individuals hide part of their income their decisions affect the aggregate measure of taxes in the economy, which is valued by agents when making their optimal allocation choices. In a hidden income environment, the trade-off between tax preferences and consumption in the optimal marginal income tax of low-ability individuals is stronger (relative to the benchmark without hidden income). The reason for this effect relies on the fact that high-ability now can mimic low-ability types in three dimensions (labor supply, hidden income and both), which the planner must take into account when designing the optimal policy. Moreover, if we account for the interdependent tax preferences of high-ability mimickers, we can show that it might be optimal to subsidize high-ability individuals to prevent that they mimic low-ability agents.

Our paper makes at least three distinct contributions to the optimal nonlinear income taxation literature. First, we motivate our study by providing evidence of tax preferences to develop a model in which individuals not only care about their tax payments but also the tax payments made by others in the economy. It is important to highlight the distinctions between our approach and the (consumption) positional preferences perspective, e.g., Aronsson and Johansson-Stenman (2010). Aronsson and Johansson-Stenman (2013) assume that people care about their relative consumption and leisure and they find that leisure-induced consumption visibility makes the income tax more regressive in terms of ability. In this case, the optimal consumption choice is directly connected

to the amount of taxes paid, but the authors do address people's intrinsically motivations either to pay or avoid taxes. Notice that through the agent's budget constraint, the amount of tax paid is increasing in consumption: a worker cannot enjoy more consumption without paying more tax. The labor-leisure allocation is not simply a problem of choice between consumption and tax, in which case the worker would prefer to pay less taxes, but rather a problem of choice between leisure and a restricted set of bundles of consumption and tax (Djanali and Sheehan-Connor, 2012). In our model, we acknowledge that agents may derive utility from consumption as well as from (theirs and others) tax payments, which allows us to disentangle between personal (selfish) and interpersonal (e.g., individuals pay and care about taxes due to a sense of duty or fellowship) motives for the optimal design of taxes.

Second, our approach of hidden income (tax evasion) and tax preferences finds support in previous studies. 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". As Alm and Torgler (2006) point out, tax morale, the shared cultural norm of taxpaying plays an important role in tax compliance. If people doubt that others are chipping in, they are more likely to start free-riding themselves. Moreover, the distinction between personal and interpersonal tax behavior motives can be linked to the the social psychology concept of independent versus interdependent self-construal. According to Markus and Kitayama (1991), self-construal is a personality trait related to how people mentally represent the self as independent from others or interdependent with them. Individuals with more independent self-construal view the self as being unique and independent of others, leading to behaviors that maximize gains for the self, rather than for others. This personality trait can potentially be linked, for instance, to empirical findings that suggest that evasion decisions are interdependent (Gordon, 1989; Christian and Alm, 2014).

And finally, our study also makes a contribution to the optimal enforcement literature. We show that the marginal benefit of enhancing tax administration to increase compliance can be larger than its marginal cost. The optimal distortion in the resource cost due to tax administration requires an augmented factor to its marginal cost to capture the correspondent response for leisure and income

evasion choices. The increase in the marginal resource cost for the low-ability individual must be even larger to make it less attractable for high-ability agents to mimic them. The (atmospheric) externally acts to reduce the marginal distortion on allocations. We also study the case of an incomplete tax system, i.e., the situation where the government has no policy instruments to fight tax evasion.

This paper is related to a large pro-social behavior literature on private contributions to a public good (charitable donations) and the provision of public goods. According to Andreoni (1989), a person is impurely altruistic when both her gift to the public good and the total amount of the public good are arguments of her utility function. We depart from this voluntary contribution interpretation, possibly motivated by warm-glow motives (Andreoni, 1990), to a compulsory contribution via the payment of taxes. In our model, the notion of impure altruism is manifested by the individual's preferences for her own tax payments and the total (average) amount of taxes paid in the economy. In other words, the extent to which individuals are impure altruistic is affected by the government and its tax policy rather than by the individuals actions.

The paper is divided as follows. In Section 2 we present literature and empirical evidence on tax preferences. In Section 3 we present a two-agent model. Agents have preferences over consumption, leisure as well as independent and interdependent tax preferences. In this section, we investigate how the introduction of tax preferences changes the traditional optimal nonlinear labor income tax. In Section 4, we extend the model to allow agents to hide a fraction of their income at a resource cost. Section 5 concludes the paper.

2 Evidence on Tax Preferences

There is an extensive literature in economics that studies and presents evidence that tax behavior is not a purely a function of individual's choice: individuals might look to others in order to decide what is acceptable, reasonable, and expected within the social context in which the action is made (Cullis and Lewis, 1997). In fact, recent studies have provided 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 better understand individuals' behavior towards taxation.

Many studies have noted that levels of tax compliance and evasion are far different than a risk-return model would predict (e.g., Allingham and Sandmo, 1972; Slemrod, 1992; Andreoni et al., 1998; Torgler, 2007; Alm et al., 2010). 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 they present a model to address self-identity in explaining pro-social behavior. The reciprocity theory puts forward an explanation for why individuals act in a more altruistic (hostile) manner in response to the (un)friendly behavior of others.[1]

There is also empirical evidence that suggests individual public good contributions can be positively influenced by the contributions of others (see, for instance, Glazer and Konrad, 1996; Harbaugh, 1998). Individuals evaluate the utility from their own charitable contribution relative to the contributions made by their peers, and individuals observe themselves as being relatively generous, an extension of the warm-glow motive to include a competitive element (Krause, 2011). 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. Aronsson et al. (2016) 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' 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.

According to Alm and Torgler (2006), compared to people in other countries, Americans are

[1]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. Duncan et al. (2020) find evidence of a positive and significant effect of publicity on value-added tax (VAT) payments for the month of blitzes (unexpected tax verification activities taking place within a short period of time.

exceptionally willing to pay their taxes, have the highest tax morale and rates of tax compliance. A majority of the American public consistently regard the income tax they pay to be fair (Gallup, 2019). Perhaps most surprising, filing out income tax forms is claimed to be enjoyed by a third of Americans (Pew, 2013). In fact, taxpayers may enjoy not only their contribution to the community through their tax payments, but also the feeling of being an active and law-abiding citizen. Based on a survey conducted across the United States, Williamson (2015) concludes that Americans' attitudes about taxes are shaped by their sense of fellowship with other people in the political community and their feelings of representation by the government. Results from the 2003 Public Interests Project Survey, cited in Bostrom, 2005, 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.

Gallup data from poll surveys on taxes show that 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*.[2] 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.[3] The Comprehensive Taxpayer Attitude Survey (CTA), sponsored by the Internal Revenue Service (IRS) Oversight Board, is an additional tool to capture (American) taxpayers' tax compliance attitudes. Implemented annually, CTA aims to compare taxpayer's perceptions and behavior towards tax payments across the years and also reinforces 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".

Finally, to gain further insights on how Americans, in particular, understand their tax preferences 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-

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

[3]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 fairly 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. See 2019 Taxpayer Attitude Survey, Internal Revenue Service Oversight Board (https://www.treasury.gov/IRSOB/reports/Documents/IRSOB%20Taxpayer%20Attitude%20Survey%202019.pdf).

Harvard. Our data reveal that Americans believe that they and their family either *pay more* (45 percent) or *about their fair share* (48 percent) in federal taxes (Table A1, Appendix A.1). Individuals surveyed 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).

Using the binary answers to the seven alternative measures people might have used to pay less taxes, as described in Table A2, Appendix A.1, we construct three avoidance indexes, namely, Avoidance I, Avoidance II and Avoidance. In questions 61 and 69 participants were asked specific decisions people make to pay less in taxes.[4] 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.

Table I reports the marginal effects of probit regressions:

$$Prob\left(Avoidance_i = 1/x_i\right) = \Phi\left(x_i'\beta\right)$$
$$Prob\left(Avoidance_i = 0/x_i\right) = 1 - \Phi\left(x_i'\beta\right),$$

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. We find evidence 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 A2. 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*

[4]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? Possible answers: Buy something on the Internet instead of from a local store; Donate more to charity; Work less. Q69. Have you EVER (ITEM) IN PART because it meant you would pay less in taxes? Possible answers: Chosen to buy a house instead of renting; 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; Put money in a retirement account.

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. $***p < 0.01, **p < 0.05, *p < 0.1$.

than the fair share in federal income tax.

We find that individuals who believe they pay *more* or *less than their fair share* (relative to those who think they pay about a fair amount) are more likely to avoid taxes (Table I). 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.

Individuals that believe they pay *more than the fair share* also choose to purchase houses (instead of renting) to avoid taxes and in locations with lower tax liabilities. 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*. Participants that claim to be paying *more than the fair share* have a larger probability of *buying a house instead of renting* (5.9 percent) and of *choosing to live somewhere other than where they work* (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.

3 A Model of Tax Preferences

3.1 Introducing the basic model

We begin by presenting a general model - an economy with only one private and one public good, two types of agents (low and high ability types) and no evasion. Agents are heterogeneous with respect to their work ability. The low-ability individual ($i = 1$) is less productive than the high-ability type ($i = 2$). There are n^i type-i members and $N = \sum_i n^i$ is the total number of individuals in this economy. A type-i individual values consumption c^i and leisure z^i, which is given by the time endowment (normalized to 1) less the hours of work, l^i, i.e., $z^i = 1 - l^i$. Labor income $w^i l^i$ can be allocated to consumption and the payment of a non-linear tax $T^i\left(w^i l^i\right)$, where w^i is the type-i wage rate.

We assume agents have preferences over consumption and leisure as well as over tax payments. Tax preferences can be associated to an intrinsic 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, as discussed in Section 2. On the other had, individuals might experience a disutility for paying taxes - tax payments are associated with social pressure or guilt. 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 preferences related to tax payments.

In our model, individuals care about their own tax payments, i.e., agents have (independent) preferences over the amount of taxes $T^i\left(w^i l^i\right)$ they pay. In addition, 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. That is, individuals' (interpersonal) preferences might also depend on an aggregate measure of taxes paid in the economy, $\overline{T}\left(w^1l^1, w^2l^2\right) = \overline{T}\left(T^1\left(w^1l^1\right), T^2\left(w^2l^2\right)\right)$. For simplicity and without loss of generality, we consider the average (*per capita*) tax payments, defined as $\overline{T} = \frac{1}{N}\sum_i n^i T^i\left(w^i l^i\right)$, as the reference measure.

Hence, the utility function of a type-i individual is as follows

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

where the exogenously 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 tax 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. Notice that the term $T^i\left(w^i l^i\right)$ enters twice in the agent's preferences, equation (1), once as a 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 $m_T^i = 0$ and $m_{\overline{T}}^i = 1$ we have a purely tax interdependent agent, i.e., $U^i = u^i\left(c^i, z^i, m_{\overline{T}}^i \overline{T}\left(w^1l^1, w^2l^2\right)\right)$. This individual does not care about her own tax payments *per se*, but she values the average (*per capita*) tax payments, which she contributes to (group conformity or social customs). On the other hand, if $m_T^i = 1$ and $m_{\overline{T}}^i = 0$, the agent is purely tax independent individual and she only cares about her contribution to the public good. Such preferences $U^i = u^i\left(c^i, z^i, m_T^i T^i\left(w^i l^i\right)\right)$ would exhibit a "warm/cold-glow" motive from paying taxes. The $m_T^i = m_{\overline{T}}^i = 0$ case is standard case in the literature (Stiglitz, 1982).

Before solving the type-i agent's utility maximization problem, it is important to point out that our model is, to a large extent, related to Andreoni (1989)'s impure altruism approach of donations to public goods. According to Andreoni (1990) a person is impurely altruistic when both her gift to the public good and the total amount of the public good are arguments of her utility function. We

depart from this voluntary contribution, possibly motivated by warm-glow motives, to a mandatory contribution via payments of taxes. In our model, the notion of impure altruism is manifested by the individual's preferences for her own tax payments and the total amount of taxes paid. In other words, the extent to which individuals are impure altruistic is determined by the government and its tax policy rather that by individuals themselves as in Andreoni (1989).

A type-i individual chooses c^i, l^i to maximize her utility, equation (1), subject to the following budget constraint

$$c^i = w^i l^i - T^i\left(w^i l^i\right),$$

which yields the following condition

$$\frac{u_c^i - m_T^i u_{T^i}^i}{\left(u_z^i - m_T^i u_{T^i}^i w^i\right)(1/w^i)} = \frac{1}{1 - T^{i\prime}(\cdot)} \tag{2}$$

where $u_c^i = \partial u^i/\partial c^i$, $u_z^i = \partial u^i/\partial z^i$, $u_{T^i}^i = \partial u^i/\partial T\left(w^i l^i\right)$, and $T^{i\prime}(\cdot) = T^{i\prime}\left(w^i l^i\right)$ is the marginal labor income tax rate.

There are two important implications of equation (2). First, tax preferences modify the traditional marginal rate of substitution between consumption and labor ($MRS_{c,l}$). For a given wage rate $w^i > 1$ and a negative (positive) marginal utility of tax payments ($u_{T^i}^i < 0$), accounting for tax preferences implies a decrease (increase) in the slope of the $MRS_{c,l}$ curve. In other words, if an individual values her tax payments, it implies that she is willing to consume more in exchange for less (more) leisure (labor), i.e., the $MRS_{c,l}$ curve is flatter. Second, equation (2) highlights the role of the impure altruism notion in the context of our model. Differently than donations, individuals do not choose tax payments directly, i.e., they are not choice variables, but rather indirectly through the consumption-labor trade-off.

We assume that the production sector consists of identical competitive firms producing a homogeneous good. A representative firm profit maximization problem is as follows:

$$\Pi_t = F\left(L^1, L^2\right) - w^1 L^1 - w^2 L^2,$$

where we assume the production function to be linear in its arguments and given by $F\left(L^1, L^2\right) =$

$(\theta^1 L^1 + \theta^2 L^2)$, 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 $w^i = F_{L^i}\left(L^1, L^2\right) = \theta^i$, for $i = 1, 2$.

The economy's resource constraint is given by

$$F\left(L^1, L^2\right) = \sum_{i=1}^{2} \left(n_t^i c_t^i\right) + G, \tag{3}$$

where G is an exogenously given government spending requirement, such that the government revenue constraint is given by $G = \sum_{i=1}^{2} n^i T^i \left(w^i l^i\right)$.

3.2 Optimal Taxation: The Role of Tax Preferences

In order to study the planner's decision problem, we assume that the government faces a general social welfare function as follows:

$$W = W\left(n^1 U^1, n^2 U^2\right)$$

which is increasing in each argument. The informational assumptions are conventional. Although an agent's ability is private information, we assume that the government is able to observe income. Following most earlier literature on the self-selection approach to optimal taxation, we assume that the government wants to redistribute from the high-ability to the low-ability type. Hence, the government's goal is to prevent the high-ability type from pretending to be a low-ability type and the self-selection constraint that may bind is as follows: $U^2 \geq \widehat{U}^2$. More precisely,

$$u^2\left(c^2, z^2, m_T^2\left(w^2 l^2 - c^2\right), m_{\overline{T}}^2 \overline{T}\right) \;\geq\; \widehat{u}^2\left(c^1, 1 - \phi l^1, m_T^2\left(w^2 \phi l^1 - c^1\right), m_{\overline{T}}^2 \overline{T}\right), \tag{4}$$

where $\phi = w^1/w^2 = \theta^1/\theta^2$ is the wage ratio.

Given that the government only observes income, i.e., $w^i l^i$, a type-2 mimicker chooses $\widehat{l^2} = \phi l^1$, such that $w^1 l^1 = w^2 l^2$. Hence, the social planner problem in the Lagrangian form is written as

$$\mathcal{L} \;=\; W\left(n^1 U^1, n^2 U^2\right) + \lambda\left(U^2 - \widehat{U}^2\right) + \gamma\left[F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i c^i - G\right], \tag{5}$$

where U^1, U^2, and $\widehat{U}^2$ are defined according to equations (1) and (4), respectively, λ and γ are the Lagrange multipliers associated with the self-selection constraint, equation (4), and the economy's resource constraint, equation (3), respectively.

Since $T^i(\cdot)$, $i = \{1, 2\}$, represent a general labor income taxes, we follow the convention in the earlier literature and we use the allocations c and l instead of the parameters of the tax functions, as direct decision variables in the optimal tax problem (see, e.g., Aronsson and Johansson-Stenman, 2010). The first order conditions with respect to c^1, c^2, l^1, and l^2 of the social planner's problem, equation (5), are presented in Appendix A.2. Manipulation of the low-ability type ($i = 1$) first order conditions imply the following equilibrium condition

$$\frac{\left(u_z^1 - m_T^1 u_T^1 w^1\right)\left(1/w^1\right)}{\left(u_c^1 - m_T^1 u_T^1\right)} = \frac{1 + \lambda\left(\frac{\left(\widehat{u}_z^2 - m_T^2 \widehat{u}_T^2 w^2\right)\left(1/w^2\right)}{n^1\left(\gamma + \partial\mathcal{L}/\partial\overline{T}\right)}\right)}{1 + \lambda\left(\frac{\widehat{u}_c^2 - m_T^2 \widehat{u}_T^2}{n^1\left(\gamma + \partial\mathcal{L}/\partial\overline{T}\right)}\right)} \tag{6}$$

where $u_{\overline{T}}^i = \partial u^i / \partial \overline{T}$, and

$$\frac{\partial\mathcal{L}}{\partial\overline{T}} = \frac{1}{N}\left[\sum_{i=1}^{2}\left(\frac{\partial W}{\partial\left(n^i U^i\right)}\right) n^i m_{\overline{T}}^i u_{\overline{T}}^i + \lambda m_{\overline{T}}^2\left(u_{\overline{T}}^2 - \widehat{u}_{\overline{T}}^2\right)\right] \tag{7}$$

The term $\partial\mathcal{L}/\partial\overline{T}$ represents the overall effect on agents' welfare of changes in the society's tax reference $\overline{T}(w^1 l^1, w^2 l^2)$. These *tax interdependence effects* affect the welfare of low-ability individuals in two key dimensions. The term $\sum_{i=1}^{2}\left(\partial W/\partial\left(n^i U^i\right)\right) n^i m_{\overline{T}}^i u_{\overline{T}}^i$ 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*. The second term of equation (7), i.e., $\lambda m_{\overline{T}}^2\left(u_{\overline{T}}^2 - \widehat{u}_{\overline{T}}^2\right)$, captures the role played by the self-selection constraint, equation (4), on the *tax interdependence effect* . It takes into account the potential differences in the relative income tax concerns of high-ability mimickers and their non-mimickers counterparts.[5]

Using first-order conditions of the planner's problem and the low-ability type utility maximization problem, equations (6) and (2), respectively, and after some manipulation (Appendix A.2),

[5]If preferences are separable in $\overline{T}$, we expect $u_{\overline{T}}^2$ to be equal to $\widehat{u}_{\overline{T}}^2$ and, hence, this term would be zero. Otherwise, for some degree of complementarity between the interdependent tax preferences and leisure (e.g., $l^2 > \widehat{l^2}$), we expect $u_{\overline{T}}^2 < \widehat{u}_{\overline{T}}^2$, and, hence, a small second order effect.

we obtain that the marginal tax rate of the low-ability individual is positive. That is,

$$
\begin{aligned}
T^{1'}\left(w^1 l^1\right) &= 1 - \frac{1+\lambda\left(\frac{\left(\widehat{u}_z^2 - m_T^2\widehat{u}_T^2 w^2\right)\left(1/w^2\right)}{n^1\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)}{1+\lambda\left(\frac{\widehat{u}_c^2 - m_T^2\widehat{u}_T^2}{n^1\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)} \\
&= \left(1 - \widehat{MRS}_{z,c}^{2M}\right)\frac{\lambda\widehat{u}_c^2}{n^1\gamma + \partial\mathcal{L}/\partial\overline{T} + \lambda\widehat{u}_c^2} \qquad (8)
\end{aligned}
$$

where $\widehat{MRS}_{z,c}^{2M} = \left(\widehat{u}_z^2 - m_T^2\widehat{u}_T^2 w^2\right)\left(1/w^2\right)/\left(\widehat{u}_c^2 - m_T^2\widehat{u}_T^2\right)$ is the marginal rate of substitution between leisure and consumption of the high-ability mimicker.

To better understand how independent and interdependent tax preferences affect the optimal taxation of low-ability individuals, consider the standard case where agents do not care about their tax payments or any measure of aggregate tax revenues, i.e., in our notation, $m_T^i = m_{\overline{T}}^i = 0$, $\forall i$. In this case, the marginal tax rate of the low-ability individual takes into account only the traditional self-selection constraint, equation (4). That is, $T^{1'}\left(w^1 l^1\right) = \left(1 - \widehat{MRS}_{z,c}^{2}\right)[\lambda\widehat{u}_c^2/(n^1\gamma + \lambda\widehat{u}_c^2)]$, where $\widehat{MRS}_{z,c}^{2} = \widehat{u}_z^2\left(1/w^2\right)/\widehat{u}_c^2$ - a result analogous to Stiglitz (1982). Moreover, if preferences do not differ between ability types, $u_z^1\left(1/w^1\right)/u_c^1 = MRS_{z,c}^1 > \widehat{MRS}_{z,c}^2$, the contribution of the self-selection constraint is to increase the marginal labor income tax rate of the low-ability type.

The agents' tax preferences affect the marginal tax rate of the low-ability type, equation (8), in two dimensions. First, they change the marginal rate of substitution between consumption and leisure. If we assume that the individual's marginal independent tax preferences are positive, the marginal utility of tax payments $u_{T^i}^i > 0$ appears in the numerator and in the denominator of the marginal rate of substitution between leisure and consumption $\widehat{MRS}_{z,c}^{2M}$, subtracting the standard terms u_z and u_c, respectively. Hence, the marginal utility of independent tax preferences acts to reduce the marginal rate of substitution between leisure and consumption as long as $MRS_{z,c}^{1M} = \left(u_z^1 - m_T^1 u_T^1 w^1\right)\left(1/w^1\right)/\left(u_c^1 - m_T^1 u_T^1\right)$ is greater than one. This is the case because the term associated with leisure is multiplied by the wage, which is higher for high-ability individuals implying that this term is greater than one. More formally, if $m_T^2\widehat{u}_T^2$ is positive, the mimicker's marginal rate of substitution between leisure and consumption $\widehat{MRS}_{z,c}^{2M}$ is positive as long as $MRS_{z,c}^1$ is greater than 1.

Second, tax preferences introduce an (atmospheric) externality in the optimal marginal tax rate of low-ability individuals, the term $\partial\mathcal{L}/\partial\overline{T}$, equation (7). Given that it only appears in the denominator of equation (8), it acts to reduce the marginal tax rate of low-ability individuals. Of particular interest is the high-ability individuals interdependent tax preferences $u^2_{\overline{T}}$. For instance, if high-ability individuals do not care about the average tax payments in the economy, i.e., $u^2_{\overline{T}} = \widehat{u}^2_{\overline{T}} = 0$ or $m^2_T = 0$, this reduces the overall welfare effect $\partial\mathcal{L}/\partial\overline{T}$ and, hence, imposes a larger optimal marginal tax rate $T^{1'}(w^1 l^1)$ on low-ability individuals. In this case, $T^{1'}(w^1 l^1)$ is only affected by how much the low-ability individuals care about the aggregate measure of tax revenue, i.e., $(\partial W/\partial(n^1 U^1))\, n^1 m^1_{\overline{T}} u^1_{\overline{T}}$, and the mimicker's marginal utility of leisure $(\widehat{u}^2_z)$ and consumption $(\widehat{u}^2_c)$. The intuition is simple. An increase in the marginal income taxes creates an incentive for agents to decrease their labor supply, further reducing consumption, and makes it even more less interesting for high-ability individuals to mimic the low-ability type.

The resulting optimal low-ability marginal labor income tax rate, equation (8), takes into account the fact that high-ability agents might be tempted to mimic the low-ability not only in the standard margin (i.e., the consumption-leisure bundle), but also in the consumption-taxes paid margin. In other words, given that agents differ with respect to their labor productivity, tax preferences affect the consumption versus leisure trade-off of a high-ability mimicker via her marginal utility of leisure $(\widehat{u}^2_z - m^2_T \widehat{u}^2_T w^2)(1/w^2)$ and her marginal utility of consumption $(\widehat{u}^2_c - m^2_T \widehat{u}^2_T)$.

Despite tax preferences, high-ability individuals face a zero optimal marginal tax rate and it is optimal not to distort the labor supply of these agents, i.e., $T^{2'}(w^2 l^2) = 0$.[6] In particular and despite interdependent tax preferences, the (atmospheric) externality term $\partial\mathcal{L}/\partial\overline{T}$ does not imply distortionary taxes on all individuals. The reason is twofold. First, the social planner can choose consumption and labor (c_i, l_i) optimally such that the externality effect cancels out, rendering no distortions at the top. And, second, by choosing the optimal taxes the government is indirectly choosing the size of the externality $\overline{T}$ such that $T^{2'}(w^2 l^2) = 0$.

In other words, by acknowledging independent and interdependent tax preferences, it is possible

[6]This result must be interpreted with caution. It means no distortion over and above their already modified marginal rate of substitution between consumption and leisure. High-ability individuals with tax preferences already are willing to exchange consumption and leisure in different rates compared to traditional *Mirleessian* individuals. If individuals dislike tax payments, their marginal rate of substitution leads to smaller consumption units in exchange for one unit of leisure compare to those with $m_T = 0$.

to modify the marginal rate of substitution between leisure and consumption. The marginal utilities and the marginal rate of substitution reflect now the fact that individuals' tax preferences can either amplify or reduce the marginal tax increase due to the self-selection constraint. Hence, when 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 their labor supply choice also affects tax payments $T^i\left(w^i l^i\right)$ and, consequently, the marginal labor income tax. The following proposition summarizes our results.

Proposition 1. *Consider an economy where individuals have independent and interdependent tax preferences. If the planner's goal is to redistribute income from the high-ability to the low-ability type while preventing the high-ability type to act as a low-ability type, the optimal marginal labor income tax rate of the low-ability type is positive, i.e.,* $T^{1'}\left(w^1 l^1\right) > 0$*, equation (6). And, it is optimal not to distort the high-ability type and the marginal income tax is zero, i.e.,* $T^{2'}\left(w^2 l^2\right) = 0$.

Proof. See Appendix A.1. ■

4 A Model of Tax Preferences and Hidden Income

4.1 Introducing hidden income

In this section we study the optimal labor income taxation when labor income is not perfectly observed and agents can hide a portion e^i of their income $w^i l^i$. As in Chetty (2009), in order to hide a fraction of her income the agent must incur a resource cost. This cost is represented by a disutility $D^i\left(e^i w^i l^i; \delta^i\right)$, where δ^i is the government evasion policy. The main goal of this δ^i policy is to curb evasion by increasing the agent's tax evasion resource cost $D(\cdot)$. This can be broadly interpreted as the government's audit administration and policy instruments to fight tax evasion. We focus our analysis on the more interesting case of an interior solution, where it is possible to impose a resource cost on both types of agents, i.e., the government has a type-specific δ^i policy. Let A be the unit cost to implement the policies δ^i, $i = 1, 2$.

Taking prices (w^i) and policies (T^i, δ^i) as given, a type-i agent utility maximization problem

$$\begin{aligned} \max_{c^i, e^i, l^i} \quad & u^i\left(c^i, z^i, m_T^i\left(w^i l^i - c^i\right), m_{\overline{T}}^i \overline{T}\right) - D^i\left(e^i w^i l^i; \delta^i\right) \\ \text{s.t.} \quad & c^i = w^i l^i - T^i\left(\left(1 - e^i\right) w^i l^i\right) \end{aligned} \tag{9}$$

implies the following equilibrium conditions:

$$\frac{\left(u_c^i - m_T^i u_{T^i}^i\right)}{\left(u_z^i - m_T^i u_{T^i}^i w^i\right)(1/w^i)} = \frac{1}{1 - T^{i\prime}\left(w^i l^i\right)} \tag{10}$$

$$u_c^i - \frac{u_z^i}{w^i} = D_e^i\left(e^i w^i l^i; \delta^i\right) \tag{11}$$

where $\overline{T} = \overline{T}\left(T^1\left(\left(1 - e^1\right) w^1 l^1\right), T^2\left(\left(1 - e^2\right) w^2 l^2\right)\right)$ and $D_e^i = \partial D^i\left(e^i w^i l^i; \delta^i\right) / \partial e^i$. First, notice that from the individual's point of view, tax preferences and resource cost associated with hidden income do not change the optimal trade-off between consumption and leisure, i.e., equation (10) is similar to equation (2) of the agent's problem without hidden income resource cost. That is, a non-zero marginal income tax still captures the distortions between the individuals' optimal consumption and leisure decisions, even when hidden income is possible.

Second, equation (11) represents the trade-off between the marginal disutility of hiding income and the (net) utility of consumption and (labor) leisure. Because consumption and labor are linked through the agent's budget constraint and her tax preferences, equation (11) highlights the fact that a change in the individual's taxable income that increases the marginal utility of consumption (u_c^i) must be counterbalanced by an increase in her marginal utility of leisure (u_z^i / w^i) - LHS of equation (11). In equilibrium, this difference must equate the disutility of the resource cost of hiding income - RHS of equation (11) - and all three choice variables (c^i, z^i, e^i) are related to each other. Compared to our benchmark model without hidden income (Section 3), this additional equilibrium condition plays an important role in the planner's problem and, hence, in the optimal marginal labor income tax rate of both low- and high-ability types. We discuss the implications in the next section.[7]

[7]Note that in our setup, as is in any tax evasion model, individuals can only decide to decrease their tax payments (a one-sided decision tax problem); they cannot, by assumption, pay more than the amount required by

4.2 Optimal Taxation: Tax Preferences and Hidden Income

In this section, we characterize the optimal marginal income taxes when agents have tax preferences and they can hide part of their income at a resource cost. This environment creates a different challenge for the planner when designing the optimal policies. Since the government only observes the individual's reported income $(1-e^i)\,w^i l^i$, it cannot disentangle whether the individual is misreporting her labor supply, a fraction of her income or both. We assume that a type-2 individual chooses the amount of hidden income optimally (as *per* her type), but then adjust her labor supply accordingly, i.e., $l^2 = \left[\left(1-e^1\right)\phi l^1\right] / \left(1-e^2\right)$, to fool the government. Hence, when evasion is possible, the planner faces the following self-selection constraint:

$$U^2 - D^2\left(e^2 w^2 l^2; \delta^2\right) \;\geq\; \widehat{U}^2 - \widehat{D}^2\left(e^2 w^2 \phi\left(\frac{1-e^1}{1-e^2}\right) l^1; \delta^1\right), \tag{12}$$

where U^2 is given by equation (1) and

$$\widehat{U}^2 \;=\; \widehat{u}^2\left(c^1, 1-\phi\left(\frac{1-e^1}{1-e^2}\right) l^1, m_T^2\left(w^2\phi\left(1-e^1\right) l^1 - c^1\right), m_{\overline{T}}^2 \overline{T}\right) \tag{13}$$

The expression on the right-hand side of the weak inequality of equation (12) represents the utility of the mimicker and, as before, variables marked with a $\widehat{\ }$ refer to the mimicker. Given that a mimicker is now choosing the optimum level of income to hide, the self-selection constraint highlights the fact that she might, at the optimum, work more if $e^1 < e^2$ (or less if $e^1 > e^2$) to compensate a higher (lower) level of utility due to her hidden income.[8]

the government. In the context of tax preferences, this assumption implies an additional margin for those individuals that already dislike tax payments.

[8] As Blomquist et al. (2016) point out, tax avoidance breaks the link between labor supply and reported income. They show that an agent reducing his reported income to escape taxes might no longer forego a publicly provided labor complement, because he can lower his income by avoiding more rather than working less.

Hence, the social planner problem in the Lagrangian form is written as

$$\begin{aligned}\mathcal{L} &= W\left[n^1\left(U^1 - D^1\left(e^1 w^1 l^1;\delta^1\right)\right), n^2\left(U^2 - D^2\left(e^2 w^2 l^2;\delta^2\right)\right)\right] \\ &+ \lambda\left[U^2 - D^2\left(e^2 w^2 l^2;\delta^2\right) - \left(\widehat{U}^2 - D^2\left(e^2 w^2 \phi\left(\frac{1-e^1}{1-e^2}\right) l^1;\delta^1\right)\right)\right] \\ &+ \gamma\left(F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i c^i - A\sum_{i=1}^{2} n^i \delta^i - G\right) \end{aligned} \tag{14}$$

where $W(\cdot)$ is a general social welfare function, U^i, $i = 1, 2$ is given by equation (1), λ, γ are the Lagrange multipliers associated with the self-selection constraints, respectively, and $\widehat{U}^2$ as in equation (13).

From the solution of the planner's problem combined with the agents' equilibrium conditions we can characterize the optimal marginal income tax rates of low- and high-ability individuals. Proposition 2 summarizes our results.

Proposition 2. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income at a resource cost, the optimal marginal labor income tax rate of low- and high-ability individuals are, respectively*

$$T^{1\prime}(\cdot) = \frac{1}{n^1\left(\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}}\right) + \widehat{\lambda}_c^2}\left[\left(\frac{\partial W}{\partial n^1 w^1}\right) n^1 D_l^1 e^1 + \lambda\frac{(1-e^1)}{(1-e^2)} e^2 \widehat{D}_l^2 + \left(\widehat{\lambda}_c^2 - \widehat{\lambda}_z^2\right)\right], \tag{15}$$

$$T^{2\prime}(\cdot) = \frac{1}{n^2\left(\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}}\right)}\left[\left(\frac{\partial W}{\partial n^2 w^2}\right) n^2 D_l^2 e^2 + \lambda D_l^2 e^2\right], \tag{16}$$

where $\widehat{\lambda}_c^2 = \widehat{u}_c^2 - m_T^2 \widehat{u}_T^2$, $\widehat{\lambda}_z^2 = \frac{\left(1-e^1\right)}{\left(1-e^2\right)}\left[\frac{1}{w^2}\widehat{u}_z^2 - \left(1-e^2\right) m_T^2 \widehat{u}_T^2\right]$ *and* $\partial\mathcal{L}/\partial\overline{T}$ *as in equation (7).*

Proof. See Appendix A.3 ■

The optimal marginal tax rate of low-ability individuals, equation (15), still takes into account the fact that high-ability individuals might mimic their low-ability counterparts. The novelty here

is how tax preferences affect the design of this optimal tax rate. Notice that when agents can hide a fraction of their income, high-ability individuals can misreport their labor supply which affects not only their consumption and leisure choices, more precisely, their marginal utilities $\widehat{u}_c^2$ and $\widehat{u}_z^2$, but also their tax payments via $\widehat{u}_T^2$. These trade-off are captured by the terms $\widehat{\lambda}_c^2$ and $\widehat{\lambda}_z^2$. In this environment, two other elements affect the optimal marginal tax rate of low-ability agents through the hidden income resource cost. First, for a given fraction of the low-ability individual's hidden income e^1, the optimal marginal tax accounts for the welfare loss due to an increase in the labor supply of the low-ability individual, which is represented by the term $\left(\frac{\partial W}{\partial n^1 w^1}\right) n^1 D_l^1 e^1$. And second, the low-ability optimal marginal tax rate also takes into account the high-ability mimicker resource cost and the associated adjustment of her hidden income e^2. In line with the self-selection constraint argument, this is expressed by the term $\lambda \frac{\left(1-e^1\right)}{\left(1-e^2\right)} e^2 \widehat{D}_l^2$. Equation (15) shows that the optimal marginal tax of low-ability individuals is such that the planner corrects for two key elements related to mimicker behavior: (i) the optimal tax is designed so that it prevents a high-ability individual to pretend to be a low-ability agent and (ii) it takes into account that these individuals optimal decisions have implications for the resource costs associated with hidden income of both the (honest) low-ability and the (mimicker) high-ability individuals.

As in the benchmark case without hidden income (Section 3), tax preferences introduce an (atmospheric) externality on the optimal marginal tax rate of low-ability individuals, the term $\partial \mathcal{L} / \partial \overline{T}$, equation (7). Given that it only appears in the denominator of equation (15), it acts to reduce the marginal tax rate of low-ability individuals. However, this term is now accompany by the (mimicker) high-ability augmented marginal utility of consumption $\widehat{u}_c^2$. In other words, $T^{1'}(\cdot)$ is now affected by both the interdependent and independent tax preferences parameters, $m_{\overline{T}}^i$, $i = 1, 2$ and m_T^2, respectively.

We can fully characterize the optimal marginal tax rate of high-ability individuals when they can hide a fraction of their income at a resource cost. For a given optimal level of evasion (e^2), equation (16) shows that the optimal marginal tax rate is designed such that it takes into account the high-ability agent's marginal (resource) cost of hiding a fraction of her income, i.e., $\left(\partial W / \partial n^2 w^2\right) n^2 D_l^2 e^2$, and it's marginal effect on the self-selection constraint $\lambda n^2 D_l^2 e^2$. As in the

case of the optimal marginal labor income tax of low-ability individuals, the (atmospheric) externality ($\partial\mathcal{L}/\partial\overline{T}$) appears in the denominator of equation (16). If both types have positive marginal utility of (interdependent) taxes, i.e., $u^i_{\overline{T}} > 0$, for $i = \{1, 2\}$, which implies that $\partial\mathcal{L}/\partial\overline{T} > 0$, then the optimal policy is to decrease the marginal tax rate of the high-ability individuals. On the other hand, if $u^i_{\overline{T}} < 0$, for $i = \{1, 2\}$, the (atmospheric) externality is negative, i.e., $\partial\mathcal{L}/\partial\overline{T} < 0$, and it is optimal to increase the marginal tax rate. Notice that the optimal marginal tax rate of high-ability individuals depend on how the low-ability individual perceives the average tax payments, which is represented by the term $u^1_{\overline{T}}$.

Proposition 3 presents our results regarding the optimal evasion policies δ^i, for $i = 1, 2$, which aim to curb evasion by affecting the agents' resource cost D of hiding income.

Proposition 3. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income at a resource cost, the optimal evasion policies aimed at low- and high-ability individuals are as follows, respectively:*

$$D^1_{\delta^1} = -\gamma A \left(\frac{\lambda^1_z + D^1_e}{\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}} + \lambda\frac{\widehat{\lambda^2_c}}{n^1}} \right) + \lambda \frac{\widehat{D}^2_{\delta^1}}{n^1} \left(\frac{\lambda^1_z + D^1_e}{\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}} + \lambda\frac{\widehat{\lambda^2_c}}{n^1}} \right) \tag{17}$$

$$D^2_{\delta^2} = -\gamma A \left(\frac{\lambda^2_z + D^2_e}{\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}} \right) \tag{18}$$

where $\partial\mathcal{L}/\partial\overline{T}$ as in equation (7), $\lambda^z_1 = (u^1_z - m^1_T u^1_T w^1)\left(\frac{1}{w^1}\right)$, $\lambda^2_z = (u^2_z - m^2_T u^2_T w^2)\left(\frac{1}{w^2}\right)$ and $\widehat{\lambda^2_c} = (\widehat{u}^2_c - m^2_T \widehat{u}^2_T)$.

Proof. See Appendix A.3. ■

First, notice that the marginal distortion imposed on both low- and high-ability individuals by the evasion policies δ^i, $i = \{1, 2\}$, equations (43)-(44), is different than the marginal cost γA of these policies, as established in the literature of optimal of tax systems (Slemrod and Yitzhaki, 1987; Keen and Slemrod, 2017; Moore and Slemrod, 2021). For instance, for high-ability individuals, equation (44), the marginal cost of this evasion policy must be weighted by two terms.

First, the marginal utility of leisure λ_2^z, which captures the trade-off between evasion and work in the household utility maximization problem. Second, the disutility associated to the act of hiding income, i.e., the individual's marginal resource cost of evasion, D_e^2. Similar to the optimal design of marginal labor income taxes, the (atmospheric) externality term $\partial\mathcal{L}/\partial\overline{T}$ appears in the denominator of the optimal evasion policy, acting to reduce the distortion of associated with these policies.

The optimal marginal evasion policy of low-ability individuals follows along the same lines of the policy directed to high-skilled individuals except for one additional term $\widehat{D}_{\delta^1}^2$. This term is associated to the fact that high-ability individuals might mimic low-ability individuals, self-selection constraint multiplier λ, and the planner must take it into account when designing the optimal evasion policy of low-ability individuals. In an environment like ours where labor income is not perfectly observed by the government and agents can hide a portion of their income at a resource cost, it is optimal to increase the optimal evasion policy of these individuals in order to prevent high-ability individuals mimicking behavior. Notice that the marginal utility of consumption of the mimicker ($\widehat{\lambda_c^2}$) dampens this effect as to account for the trade-off consumption and evasion of a high-ability pretending to be a low-ability individual. Second, this result highlights that strengthening the tax administration to increase compliance can achieve optimum levels of evasion in our environment and we must take into consideration consumption, evasion and labor responses (at the margin) to characterize the optimal tax system.

4.3 Optimal Taxation in an Incomplete Tax System

In this section, we briefly discuss the situation where the government has no policy instruments to address tax evasion, i.e., $D_{\delta^i}^i$ is not available. In this case the tax system is incomplete.[9] The

[9] Chari and Kehoe (1999) define an economy's tax system as complete if the number of 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.

planner's problem is now as follows

$$\begin{aligned}\mathcal{L} &= W\left[n^1\left(U^1 - D^1\left(e^1 w^1 l^1\right)\right), n^2\left(U^2 - D^2\left(e^2 w^2 l^2\right)\right)\right] \\ &+ \lambda\left[U^2 - D^2\left(e^2 w^2 l^2\right) - \left(\widehat{U}^2 - D^2\left(e^2 w^2 \phi\left(\frac{1-e^1}{1-e^2}\right) l^1\right)\right)\right] \\ &+ \gamma\left(F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i c^i - G\right) \\ &+ \sum_{i=1}^{2} \eta_i\left(D^{i'}\left(e^i w^i l^i\right) - u_c^i + \frac{u_z^i}{w^i}\right) \end{aligned} \tag{19}$$

where, due to the incompleteness of the tax system, two additional constraints must be added to the planner's problem to account for the fact that the government has no instruments to affect the agents' decision to hide part of their income. The Lagrange multipliers η_i, $i = 1, 2$ are associated to the first-order conditions of the type-i agent with respect to e_i, equation (11).

Proposition 4. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income without any policy to combat evasion, the optimal marginal labor income tax rate of the low-ability and and the high-ability types are, respectively*

$$T^{1'}\left(\left(1-e^1\right) w^1 l^1\right) = \frac{\left(\widehat{\lambda}_l^2 - \widehat{\lambda}_c^2\right) - D_{el}^1 e^1\left(\frac{\partial W}{\partial n^1 w^1}\right) n^1 + n^1\left(\eta_{1c} - \eta_{1l}\right)}{\widehat{\lambda}_c^2 + n^1\left(\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}} + \eta_{1c}\right)} \tag{20}$$

$$T^{2'}\left(\left(1-e^2\right) w^2 l^2\right) = \frac{-D_{el}^2 e^2\left[\left(\frac{\partial W}{\partial n^2 w^2}\right) n^2 + \lambda\right] + n^2\left(\eta_{2c} - \eta_{2l}\right)}{n^2\left(\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}} + \eta_{2c}\right)} \tag{21}$$

where $\widehat{\lambda}_c^2$, η_{1c}, η_{1l}, $\widehat{\lambda}_l^2$, η_{2c}, and η_{2l} are defined in the Appendix A.3 and $\partial\mathcal{L}/\partial\overline{T}$ as in equation (28).

Proof. See Appendix A.4. ■

Equations (47) and (48) show that because the planner does not have the instruments to fight evasion directly, the optimal marginal tax rate on the low and high-ability agents $T^{i'}(\cdot)$,

$i = 1, 2$ have to account for the incompleteness of the tax system, via the first-order conditions of the type-i agent with respect to e_i, equation (11), as well as the effects of the optimal choice of e_i on the other allocations c_i and l_i. Consider, for instance, $T^{1'}(\cdot)$, equation (47). With the possibility of hidden income high ability's mimicking behavior manifests in two dimensions: (i) in the traditional self-selection constraint $\left(\widehat{\lambda}_l^2 - \widehat{\lambda}_c^2\right)$ and (ii) via the incompleteness of tax system constraint $(n^1(\eta_{1c} - \eta_{1l}))$.

5 Conclusion

In this paper, we characterize the optimal labor income taxation under different assumptions regarding 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, which modify the standard marginal rate of substitution in a nontrivial way. Agents are heterogeneous with respect to their work ability, which is not observable by the government. Agents can hide a portion of their income at a resource cost. Compared to the earlier literature, tax preferences might either amplify or reduce the marginal tax increase of the low-ability type. The overall effect depends on the standard self-selection constraint effect, 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 (independent tax concern), and an effect that captures the potential differences in the relative income tax concerns of high-ability mimickers and their non-mimickers counterparts (interdependent tax concern). When individuals can hide a fraction of their earnings at a resource cost, the link between consumption and tax payments' concern is broken. Tax evasion has a novel effect on the optimal marginal income tax as it affects the aggregate measure of taxes and what people take into account and care about when making their optimal decisions. We find that the trade-off associated with tax preferences and consumption have their effects intensified in the optimal marginal income tax of low-ability individuals. The marginal income tax of high-ability types is different than zero and it is optimal to subsidize this type in order to make it less interesting for them to mimic the low-ability individuals.

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A Appendix

A.1 National Survey of Americans' Views on Taxes

This Appendix provides additional 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. 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. 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 questions 18, 22, 61 and 69 (Tables A1, A2, A3). For example, "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). Complete descriptive statistics are available upon request.

Table A1: Selected Questions: National Survey of Americans' Views on Taxes.

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.

The majority of the respondents think that high-income families pay less than their fair share (Table A1). 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 A2). 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. Forty percent reported they had *put money in a retirement account*, in part because it meant they would pay less in taxes.

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 (Table A3).

Table A2: Selected Questions: National Survey of Americans' Views on Taxes.

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 A3: 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; $***p < 0.01, **p < 0.05, *p < 0.1$.

A.2 A Model of Tax Preferences

Proposition 1. *Consider an economy where individuals have independent and interdependent tax preferences. If the planner's goal is to redistribute income from the high-ability to the low-ability type while preventing the high-ability type to act as a low-ability type, the optimal marginal labor income tax rate of the low-ability type is positive, i.e.,* $T^{1'}\left(w^1 l^1\right) > 0$*, equation (6). And, it is optimal not to distort the high-ability type and the marginal income tax is zero, i.e.,* $T^{2'}\left(w^2 l^2\right) = 0$.

Proof. The social planner problem in the Lagrangian form is written as

$$\mathcal{L} = W\left(n^1 U^1, n^2 U^2\right) + \lambda\left(U^2 - \widehat{U}^2\right) + \gamma\left[F\left(L^1, L^2\right) - \sum_{i=1}^{2} n^i c^i - G\right], \tag{22}$$

where $W(\cdot)$ is a general social welfare function, γ and λ are the Lagrange multipliers associated

with the economy's resource constraint and the self-selection constraint

$$u^2\left(c^2, z^2, m_T^2\left(w^2 l^2 - c^2\right), m_{\overline{T}}^2 \overline{T}\right) \geq \widehat{u}^2\left(c^1, 1-\phi l^1, m_T^2\left(w^2 \phi l^1 - c^1\right), m_{\overline{T}}^2 \overline{T}\right) \tag{23}$$

respectively, where $\phi = w^1/w^2 = \theta^1/\theta^2$ is the wage ratio and $\overline{T} = \sum_{i=1}^{2} n^i \left(w^i l^i - c^i\right)/N$, $N = n^1 + n^2$.

Since $T^i(\cdot)$ represent general labor income taxes, we follow the convention in the earlier literature and we 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. The first order conditions for c^1, c^2, l^1, and l^2 are, respectively:

$$\frac{\partial W}{\partial\left(n^1 U^1\right)} n^1\left[u_c^1 - m_T^1 u_T^1\right] - \lambda\left[\widehat{u}_c^2 - m_T^2 \widehat{u}_T^2\right] - \gamma n^1 - n^1\left(\frac{\partial \mathcal{L}}{\partial \overline{\overline{T}}}\right) = 0 \tag{24}$$

$$\frac{\partial W}{\partial\left(n^2 U^2\right)} n^2\left[u_c^2 - m_T^2 u_T^2\right] + \lambda\left[u_c^2 - m_T^2 u_T^2\right] - \gamma n^2 - n^2\left(\frac{\partial \mathcal{L}}{\partial \overline{\overline{T}}}\right) = 0 \tag{25}$$

$$\begin{aligned} -\frac{\partial W}{\partial\left(n^1 U^1\right)} n^1\left(u_z^1 - m_T^1 u_T^1 w^1\right) + n^1 w^1\left(\frac{\partial \mathcal{L}}{\partial \overline{\overline{T}}}\right) + \gamma n^1 w^1 & \\ +\phi\lambda\left(\widehat{u}_z^2 - m_T^2 \widehat{u}_T^2\left(w^2\phi\right)\right) &= 0 \end{aligned} \tag{26}$$

$$\begin{aligned} -\frac{\partial W}{\partial\left(n^2 U^2\right)} n^2\left(u_z^2 - m_T^2 u_T^2 w^2\right) + n^2 w^2\left(\frac{\partial \mathcal{L}}{\partial \overline{\overline{T}}}\right) + \gamma n^2 w^2 & \\ -\lambda\left(u_z^2 - m_T^2 u_T^2 w^2\right) &= 0 \end{aligned} \tag{27}$$

where $u_{\overline{T}}^i = \partial u^i / \partial \overline{T}$, and

$$\frac{\partial \mathcal{L}}{\partial \overline{\overline{T}}} = \frac{1}{N}\left[\sum_{i=1}^{2}\left(\frac{\partial W}{\partial\left(n^i U^i\right)}\right) n^i m_{\overline{T}}^i u_{\overline{T}}^i + \lambda m_{\overline{T}}^2\left(u_{\overline{T}}^2 - \widehat{u}_{\overline{T}}^2\right)\right] \tag{28}$$

Dividing (26) by (24)

$$\frac{\left(u_z^1 - m_T^1 u_T^1 w^1\right)\left(1/w^1\right)}{\left(u_c^1 - m_T^1 u_T^1\right)} = \frac{1+\lambda\left(\frac{\left(\widehat{u}_z^2 - m_T^2 \widehat{u}_T^2 w^2\right)\left(1/w^2\right)}{n^1\left(\gamma + \partial\mathcal{L}/\partial\overline{\overline{T}}\right)}\right)}{1+\lambda\left(\frac{\widehat{u}_c^2 - m_T^2 \widehat{u}_T^2}{n^1\left(\gamma + \partial\mathcal{L}/\partial\overline{\overline{T}}\right)}\right)} < 1 \tag{29}$$

To see this, we follow Stiglitz (1982) and define

$$\alpha^i = \frac{\left(u_z^i - m_T^i u_T^i w^i\right)\left(1/w^i\right)}{\left(u_c^i - m_T^i u_T^i\right)},$$

and

$$\nu = \frac{\lambda\left(\widehat{u}_c^2 - m_T^2 \widehat{u}_T^2\right)}{n^1\left(\gamma + \left(\partial\mathcal{L}/\partial\overline{\overline{T}}\right)\right)}$$

Then, equation (29) can be rewritten as

$$\alpha^1 \;=\; \frac{1+\widehat{\alpha}^2\nu}{1+\nu} = \widehat{\alpha}^2 + \frac{1-\widehat{\alpha}^2}{1+\nu}.$$

Since, by assumption $\alpha^1 > \widehat{\alpha}^2$, it therefore follows that $\widehat{\alpha}^2 < \alpha^1 < 1$. And, combined with the type-1 agent equilibrium condition this implies that the marginal tax rate faced by the less able individual is positive. That is, $T^{1'}\left(w^1 l^1\right) > 0$.

Regarding the high ability individual, if we divide equation (27) by equation (25), we see that:

$$\frac{\left(u_z^2 - m_T^2 u_T^2 w^2\right)\left(1/w^2\right)}{\left(u_c^2 - m_T^2 u_T^2\right)} \;=\; \frac{1-\lambda\left(\frac{\left(u_z^2 - m_T^2 u_T^2 w^2\right)\left(1/w^2\right)}{n^2\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)}{1-\lambda\left(\frac{u_c^2 - m_T^2 u_T^2}{n^2\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)}$$

which combined with the type-2 agent equilibrium condition implies that

$$1 - T^{2'}\left(w^2 l^2\right) = \frac{\left(u_z^2 - m_T^2 u_T^2 w^2\right)\left(1/w^2\right)}{u_c^2 - m_T^2 u_T^2)} \;=\; \frac{1-\lambda\left(\frac{\left(u_z^2 - m_T^2 u_T^2 w^2\right)\left(1/w^2\right)}{n^2\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)}{1-\lambda\left(\frac{u_c^2 - m_T^2 u_T^2}{n^2\left(\gamma+\partial\mathcal{L}/\partial\overline{T}\right)}\right)} = 1$$

Hence, the marginal tax rate faced by the more able individual is zero, i.e., $T^{2'}\left(w^2 l^2\right) = 0$. ■

A.3 A Model of Tax Preferences and Hidden Income

Proposition 2. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income at a resource cost, the optimal marginal labor income tax rate of low- and high-ability individuals are, respectively*

$$T^{1'}(\cdot) = \frac{1}{n^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) + \widehat{\lambda}_c^2}\left[\left(\frac{\partial W}{\partial n^1 w^1}\right) n^1 D_l^1 e^1 + \lambda\frac{\left(1-e^1\right)}{\left(1-e^2\right)} e^2 \widehat{D}_l^2 + \left(\widehat{\lambda}_c^2 - \widehat{\lambda}_z^2\right)\right], \tag{30}$$

$$T^{2'}(\cdot) = \frac{1}{n^2\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right)}\left[\left(\frac{\partial W}{\partial n^2 w^2}\right) n^2 D_l^2 e^2 + \lambda D_l^2 e^2\right], \tag{31}$$

where $\widehat{\lambda}_c^2 = \widehat{u}_c^2 - m_T^2\widehat{u}_T^2$, $\widehat{\lambda}_z^2 = \frac{\left(1-e^1\right)}{\left(1-e^2\right)}\left[\frac{1}{w^2}\widehat{u}_z^2 - \left(1-e^2\right)m_T^2\widehat{u}_T^2\right]$ *and* $\partial\mathcal{L}/\partial\overline{T}$ *as in equation (7).*

Proof. When agents can hide a fraction of their income, the planner faces the following self-selection constraint:

$$U^2 - D^2\left(e^2 w^2 l^2; \delta^2\right) \;\geq\; \widehat{U}^2 - \widehat{D}^2\left(e^2 w^2 \phi\left(\frac{1-e^1}{1-e^2}\right) l^1; \delta^1\right), \tag{32}$$

where U^2 is given by equation

$$U^i \;=\; u^i\left(c^i, z^i, m_T^i T^i\left(w^i l^i\right), m_{\overline{T}}^i \overline{T}\left(w^1 l^1, w^2 l^2\right)\right) \tag{33}$$

and

$$\widehat{U}^2 = \widehat{u}^2\left(c^1, 1-\phi\left(\frac{1-e^1}{1-e^2}\right)l^1, m_T^2\left(w^2\phi\left(1-e^1\right)l^1 - c^1\right), m_{\overline{T}}^2\overline{T}\right) \tag{34}$$

The social planner problem in the Lagrangian form is written as

$$\begin{aligned}\mathcal{L} &= W\left[n^1\left(U^1 - D^1\left(e^1w^1l^1;\delta^1\right)\right), n^2\left(U^2 - D^2\left(e^2w^2l^2;\delta^2\right)\right)\right] \\ &+ \lambda\left[U^2 - D^2\left(e^2w^2l^2;\delta^2\right) - \left(\widehat{U}^2 - D^2\left(e^2w^2\phi\left(\frac{1-e^1}{1-e^2}\right)l^1;\delta^1\right)\right)\right] \\ &+ \gamma\left(F\left(L^1,L^2\right) - \sum_{i=1}^{2}n^ic^i - A\sum_{i=1}^{2}n^i\delta^i - G\right)\end{aligned} \tag{35}$$

where $W(\cdot)$ is a general social welfare function, U^i, $i=1,2$ is given by equation (33), λ, γ are the Lagrange multipliers associated with the self-selection constraints, respectively, $\widehat{U}^2$ as in equation (34), and A is the unit cost to implement the policies δ^i, $i=1,2$.

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

$$\frac{\partial W}{\partial\left(n^1U^1\right)}n^1\left[u_c^1 - m_T^1u_T^1\right] - \lambda\left(\widehat{u}_c^2 - m_T^2\widehat{u}_T^2\right) - n^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) = 0 \tag{36}$$

$$\frac{\partial W}{\partial\left(n^2U^2\right)}n^2\left[u_c^2 - m_T^2u_T^2\right] + \lambda\left(u_c^2 - m_T^2u_T^2\right) - n^2\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) = 0 \tag{37}$$

$$\begin{aligned}&\frac{\partial W}{\partial\left(n^1U^1\right)}n^1\left[\left(u_z^1 - m_T^1u_T^1w^1\right) + D_l^1e^1w^1\right] \\ &+\lambda\left(\frac{\left(1-e^1\right)}{\left(1-e^2\right)}\frac{1}{w^2}\widehat{u}_z^2 - \left(1-e^1\right)m_T^2\widehat{u}_T^2 - \frac{\left(1-e^1\right)}{\left(1-e^2\right)}e^2D_l^2\right) - n^1w^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) = 0\end{aligned} \tag{38}$$

$$\begin{aligned}&\frac{\partial W}{\partial\left(n^2U^2\right)}n^2\left[\left(u_z^2 - m_T^2u_T^2w^2\right) + D_l^2e^2w^2\right] \\ &+\lambda\left(u_z^2 - m_T^2u_T^2w^2 + D_l^2e^2w^2\right) - n^2w^2\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) = 0\end{aligned} \tag{39}$$

where $D_l^i = \partial D^i\left(e^iw^il^i\right)/\partial l^i$.

Dividing equation (38) by equation (36), we obtain

$$\frac{\left(u_z^1 - m_T^1u_T^1w^1\right)\left(1/w^1\right)}{\left(u_c^1 - m_T^1u_T^1\right)} = \frac{n^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) - D_{el}^1e^1\left(\frac{\partial W}{\partial\left(n^1U^1\right)}\right)n^1 + \widehat{\lambda}_l^2}{n^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) + \widehat{\lambda}_c^2} \tag{40}$$

Equation (40) combined with the type-1 agent equilibrium condition implies that the optimal marginal labor income tax of low-ability agents is as follows:

$$T^{1'}(\cdot) = \frac{1}{n^1\left(\gamma + \frac{\partial\mathcal{L}}{\partial\overline{T}}\right) + \widehat{\lambda}_c^2}\left[\left(\frac{\partial W}{\partial n^1w^1}\right)n^1D_l^1e^1 + \lambda\frac{\left(1-e^1\right)}{\left(1-e^2\right)}e^2\widehat{D}_l^2 + \left(\widehat{\lambda}_c^2 - \widehat{\lambda}_z^2\right)\right], \tag{41}$$

where $\widehat{\lambda}_c^2 = \widehat{u}_c^2 - m_T^2\widehat{u}_T^2$, $\widehat{\lambda}_z^2 = \frac{\left(1-e^1\right)}{\left(1-e^2\right)}\left[\frac{1}{w^2}\widehat{u}_z^2 - \left(1-e^2\right)m_T^2\widehat{u}_T^2\right]$ and $\partial\mathcal{L}/\partial\overline{T}$ as in equation (7).

To obtain the optimal marginal labor income tax of high-ability agents, we divide equation (39) by equation (37) and combine the resulting expression with the type-2 agent equilibrium condition. Hence, the optimal marginal tax rate faced by the more able individual is as follows:

$$T^{2'}(\cdot) = \frac{1}{n^2\left(\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}}\right)}\left[\left(\frac{\partial W}{\partial n^2 w^2}\right) n^2 D_l^2 e^2 + \lambda D_l^2 e^2\right]. \tag{42}$$

■

Proposition 3. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income at a resource cost, the optimal evasion policies aimed at low- and high-ability individuals are as follows, respectively:*

$$D_{\delta^1}^1 = -\gamma A\left(\frac{\lambda_z^1 + D_e^1}{\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}} + \lambda\frac{\widehat{\lambda_c^2}}{n^1}}\right) + \lambda\frac{\widehat{D}_{\delta^1}^2}{n^1}\left(\frac{\lambda_z^1 + D_e^1}{\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}} + \lambda\frac{\widehat{\lambda_c^2}}{n^1}}\right) \tag{43}$$

$$D_{\delta^2}^2 = -\gamma A\left(\frac{\lambda_z^2 + D_e^2}{\gamma + \frac{\partial \mathcal{L}}{\partial \overline{T}}}\right) \tag{44}$$

where $\lambda_1^z = \left(u_z^1 - m_T^1 u_T^1 w^1\right)\left(\frac{1}{w^1}\right)$, $\lambda_z^2 = \left(u_z^2 - m_T^2 u_T^2 w^2\right)\left(\frac{1}{w^2}\right)$ *and* $\widehat{\lambda_c^2} = (\widehat{u}_c^2 - m_T^2 \widehat{u}_T^2)$, *and* $\partial\mathcal{L}/\partial\overline{T}$ *as in equation (7).*

Proof. The planner's problem, equation (35), first-order conditions with respect to δ^1 and δ^2 are, respectively:

$$\frac{\partial W}{\partial\left(n^1 U^1\right)} n^2 D_{\delta^2}^2 - \lambda \widehat{D}_{\delta^1}^2 + \gamma n^1 A = 0 \tag{45}$$

$$\frac{\partial W}{\partial\left(n^2 U^2\right)} n^2 D_{\delta^2}^2 + \lambda D_{\delta^2}^2 + \gamma n^2 A = 0 \tag{46}$$

where $D_{\delta^i}^i = \partial D^i\left(e^i w^i l^i; \delta^i\right)/\partial\delta^i$ and $\widehat{D}_{\delta^1}^2 = \partial D^i\left(e^2 w^2\left(\frac{1-e^1}{1-e^2}\right)\phi l^1; \delta^1\right)/\partial\delta^1$. Combining equations (11) and (45), we obtain the optimal evasion policy $D_{\delta^1}^1$ aimed at low-ability individuals, equation (43). Similarly, the manipulation of equations (11) and (46) leads to equation (44), i.e., the optimal evasion policy $D_{\delta^2}^2$ aimed at high-ability individuals. ■

A.4 Hidden Income and Incomplete Tax System

Proposition 4. *In an economy where individuals have independent and interdependent tax preferences, labor income is not perfectly observed by the government and agents can hide a portion of their income, the optimal marginal labor income tax rate of the low-ability and and the high-ability*

types are, respectively

$$T^{1'}\left(\left(1-e^1\right)w^1l^1\right)=\frac{\left(\widehat{\lambda}_l^2-\widehat{\lambda}_c^2\right)-D_{el}^1e^1\left(\frac{\partial W}{\partial n^1w^1}\right)n^1+n^1\left(\eta_{1c}-\eta_{1l}\right)}{\widehat{\lambda}_c^2+n^1\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{T}}+\eta_{1c}\right)} \tag{47}$$

$$T^{2'}\left(\left(1-e^2\right)w^2l^2\right)=\frac{-D_{el}^2e^2\left[\left(\frac{\partial W}{\partial n^2w^2}\right)n^2+\lambda\right]+n^2\left(\eta_{2c}-\eta_{2l}\right)}{n^2\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{T}}+\eta_{2c}\right)} \tag{48}$$

where where $W(\cdot)$ *is a general social welfare function,* $\widehat{\lambda}_c^2=\lambda\left(\widehat{u}_c^2-m_T^2\widehat{u}_T^2\right)$, $\eta_{1c}=\eta_1\frac{1}{n^1}\left(-u_{cc}^1+\frac{u_{zc}^1}{w^1}\right)$, $\eta_{1l}=\eta_1\frac{1}{n^1}\left(D_{el}^1e^1w^1-u_{cz}^1+\frac{u_{zz}^1}{w^1}\right)$ *and* $\widehat{\lambda}_l^2=\lambda\left(\frac{\left(1-e^1\right)}{\left(1-e^2\right)}\frac{1}{w^2}\widehat{u}_z^2-\left(1-e^1\right)m_T^2\widehat{u}_T^2-\frac{\left(1-e^1\right)}{\left(1-e^2\right)}e^2D_l^2\right)$, *and* $\partial\mathcal{L}/\partial\overline{T}$ *as in equation (28). The Lagrange multipliers* λ *and* γ *are the Lagrange multipliers associated with the self-selection constraint and the economy's resource constraint, and* η_i, $i=1,2$ *are associated to the first-order conditions of the type-i agent with respect to* e_i, *equation (11) in the main text.*

Proof. The social planner problem in the Lagrangian form is written as

$$\begin{aligned}\mathcal{L} &= W\left[n^1\left(U^1-D^1\left(e^1w^1l^1\right)\right),n^2\left(U^2-D^2\left(e^2w^2l^2\right)\right)\right]\\ &+ \lambda\left[U^2-D^2\left(e^2w^2l^2\right)-\left(\widehat{U}^2-D^2\left(e^2w^2\phi\left(\frac{1-e^1}{1-e^2}\right)l^1\right)\right)\right]\\ &+ \gamma\left(F\left(L^1,L^2\right)-Z-\sum_{i=1}^2n^ic^i\right)\\ &+ \sum_{i=1}^2\eta_i\left(D^{i'}\left(e^iw^il^i\right)-u_c^i+\frac{u_z^i}{w^i}\right)\end{aligned} \tag{49}$$

where $W(\cdot)$ is a general social welfare function, λ and γ are the Lagrange multipliers associated with the self-selection constraint, equations (32) and (34), and the economy's resource constraint, respectively. Due to the incompleteness of the tax system, two additional constraints must be added to the planner's problem to account for the fact that the government has no instruments to affect the agents' decision to hide part of their income. The Lagrange multipliers η_i, $i=1,2$ are associated to the first-order conditions of the type-i agent with respect to e_i, equation (11).

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

$$\begin{aligned}
\frac{\partial W}{\partial\left(n^1U^1\right)}n^1\left[u_c^1-m_T^1u_T^1\right]-\lambda\left(\widehat{u}_c^2-m_T^2\widehat{u}_T^2\right)& \\
-n^1\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_1\frac{1}{n^1}\left(u_{cc}^1-\frac{u_{zc}^1}{w^1}\right)\right) &= 0 \qquad (50)\\
\frac{\partial W}{\partial\left(n^2U^2\right)}n^2\left[u_c^2-m_T^2u_T^2\right]+\lambda\left(u_c^2-m_T^2u_T^2\right)& \\
-n^2\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_2\frac{1}{n^2}\left(u_{cc}^2-\frac{u_{zc}^2}{w^2}\right)\right) &= 0 \qquad (51)\\
\frac{\partial W}{\partial\left(n^1U^1\right)}n^1\left[\left(u_z^1-m_T^1u_T^1w^1\right)+D_l^1e^1w^1\right]& \\
+\lambda\left(\frac{\left(1-e^1\right)}{\left(1-e^2\right)}\frac{1}{w^2}\widehat{u}_z^2-\left(1-e^1\right)m_T^2\widehat{u}_T^2-\frac{\left(1-e^1\right)}{\left(1-e^2\right)}e^2D_l^2\right)& \\
-n^1w^1\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_1\frac{1}{n^1}\left(D_{el}^1e^1w^1-u_{cz}^1+\frac{u_{zz}^1}{w^1}\right)\right) &= 0 \qquad (52)\\
\frac{\partial W}{\partial\left(n^2U^2\right)}n^2\left[\left(u_z^2-m_T^2u_T^2w^2\right)+D_l^2e^2w^2\right]& \\
+\lambda\left(u_z^2-m_T^2u_T^2w^2+D_l^2e^2w^2\right)& \\
-n^2w^2\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_2\frac{1}{n^2}\left(D_{el}^2e^2w^2-u_{cz}^2+\frac{u_{zz}^2}{w^2}\right)\right) &= 0 \qquad (53)
\end{aligned}$$

where $D_l^i=\partial D^i\left(e^iw^il^i\right)/\partial l^i$ and $D_{el}^i=\partial D_l^i\left(e^iw^il^i\right)/\partial e^i$.

Dividing equation (52) by equation (50), we obtain

$$\frac{\left(u_z^1-m_T^1u_T^1w^1\right)\left(1/w^1\right)}{\left(u_c^1-m_T^1u_T^1\right)} = \frac{n^1\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_{1l}\right)-D_{el}^1e^1\left(\frac{\partial W}{\partial\left(n^1U^1\right)}\right)n^1+\widehat{\lambda}_l^2}{n^1\left(\gamma+\frac{\partial\mathcal{L}}{\partial\overline{\overline{T}}}+\eta_{1l}\right)+\widehat{\lambda}_c^2} \qquad (54)$$

Equation (54) combined with the type-1 agent equilibrium condition implies the optimal marginal labor income tax of low-ability agents, equation (47). To obtain the optimal marginal labor income tax of high-ability agents, we divide equation (53) by equation (50) and combine the resulting expression with the type-2 agent equilibrium condition. Hence, the optimal marginal tax rate faced by high-ability individuals is given by equation (48). ■