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Tax Avoidance and Excess Burden of Income Tax*

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Abstract Our main objective in this paper is to show that income taxation creates an extra burden or distortion when tax avoidance is available. We present a labor supply model with endogenous asset portfolio choice and show that tax avoidance by trading assets impacts labor supply response and total excess burden of income tax. In our model individuals are allowed to change their asset portfolio to reduce their tax liabilities, and this distortion is the main source of the higher efficiency cost in our model. Furthermore, we show that ignoring the avoidance responses leads to biased results when estimating the labor supply distortion and welfare cost of a tax reform. Progressivity of a given tax system is predicted to be less than the formal tax code due to tax avoidance through tax arbitrage.

Keywords Asset Choice, Tax Avoidance, Excess Burden, Tax Arbitrage, Progressivity

JEL Classification H2, H21, J22, G11

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1. INTRODUCTION

Labor supply and its response to an income tax change has been studied extensively in public finance literature. Great deal of studies has investigated labor supply choice and how this choice is affected by tax reform. One of the specific areas that has attracted scholars' attention is efficiency loss due to tax. The standard labor supply models consider distortions in consumption baskets, in response to a tax increase, as the source of inefficiency. This is because individuals are forced to change optimal consumption basket by switching from highly taxed goods to lightly taxed goods such as leisure. Thus, optimal taxation literature seeks to find tax structure that minimizes these costs. However, as a response to taxation, individuals do not only change their consumption baskets but also may change their asset portfolio. Most of the labor supply and optimal taxation literature abstracts from issues of tax planning and tax arbitrage. When tax avoidance through asset trading is an option, labor supply predictions and the efficiency cost of tax will be different than what traditional analysis predicts. Taxation will induce some people to choose a sub-optimal asset portfolio. Therefore, it is necessary to take individuals' portfolio choices into account in order to correctly estimate the labor supply response and the deadweight loss of an income tax. This paper takes a wholistic approach to cost of taxation by embedding asset trading and tax arbitrage in traditional models. Individuals in our model can adjust their taxable income not only by changing labor supply but also by changing their asset portfolio. So, the main objective of this paper is to show that distortion of optimal asset portfolio due to tax causes an extra efficiency loss.

Tax avoidance can broadly be defined as one's efforts and activities to reduce one's tax liability. One example is to pay a tax professional to alert one to the tax deductibility of activities already undertaken. Another example is to change the legal form of a given behavior, such as reorganizing a business from a C corporation to an S corporation, re-characterizing ordinary income as capital gain, or renaming a consumer loan as a home equity loan. A third example is tax arbitrage, when economically equivalent, but differentially-taxed, positions are held simultaneously long and short, thereby producing tax savings. Finally, re-timing a transaction to alter the tax year it falls under is another example of avoidance. In this study, we focus on tax arbitrage as a method of reducing one's tax liability. In their empirical study, Altshuler and Gentry (1995) show the prevalence of tax arbitrage behavior in the U.S. economy. They show that in the group of tax returns with only mortgage interest deductions, 20 percent of returns receive tax-exempt interest, 46 percent receive retirement contributions, and 25 percent receive capital gains. They conclude that instead of reducing the principal of their mortgages as a means of saving through house equity, some taxpayers choose to buy tax-exempt bonds, contribute to retirement accounts, or own other assets that generate capital gains. Auerbach and Slemrod (1997) find in their study of the U.S. Tax Reform Act of 1986, which cut the top marginal rates by about 20 percent, that the most responsive decisions were financial and accounting activities. They claim that these activities primarily serve the purpose of affecting reported income, while activities like labor supply, savings, and investment seemed to respond very little to tax reform. Auerbach *et al.* (1998) find evidence that tax avoidance increased after Tax Reform Act of 1986 in U.S. and that it increased most for high-income, high-wealth taxpayers. As many as one-third of the wealthiest taxpayers were able to realize their gains without immediate tax in the early 1990s. In their study of the Swedish tax reform of 1990-91, Agell *et al.* (1998) find that labor supply appeared unresponsive despite marginal rate cuts between 24 and 27 percentage points for large groups of full-time employees. They argue that the rich reduce their effective marginal tax by tax avoidance activities. In addition to these studies, there are recent empirical studies on tax avoidance. Akcigit *et al.* (2016) study the effect of tax rates on international migration as a tool for income tax avoidance. Using data from the US and European Patent Offices, they find that top tax rates significantly affect "superstar" inventors' international mobility. Piketty *et al.* (2014) also evaluate the response of tax avoidance to tax rate changes using top incomes. In their empirical work, they decompose the total behavioral response of top incomes to top tax rates into labor supply, tax avoidance, and compensation bargaining as three channels. Brys (2010) argues that before the tax reform of 2010, taxpayers in the Netherlands faced considerable incentives and opportunities to engage in tax-arbitrage behavior. He claims that tax arbitrage behavior undermined the progressivity of the Dutch income tax system and it limited the possibilities for the authorities to raise tax revenues. Sørensen (1994) discusses dual income tax system in Nordic countries. He says that proportional (as opposed to progressive) taxation of capital income eliminates the opportunities for certain forms of tax arbitrage that rely on exploitation of differences in the marginal tax rates faced by different individual taxpayers.

Our purpose in this paper is to explore the excess burden or welfare cost of income tax and labor supply behavior when individuals engage in tax arbitrage to reduce their tax liabilities.[1] We set up a static labor supply model where in-

[1]Excess burden, welfare cost and deadweight loss of taxation refer to the same thing and in this paper we use these terms interchangeably.

dividuals not only decide how much to work but also how much to avoid taxes through asset trading. Then, we analyze how big the labor supply response and the excess burden of income tax are in comparison to standard models. Previous studies have incorporated tax avoidance into the basic labor supply model in a number of ways. Mayshar (1991), Feldstein (1999) and Slemrod (2001) are canonical studies that recognize tax avoidance in traditional labor supply model. In Feldstein (1999) tax avoidance takes the form of consumption of goods that are tax favored. He incorporated tax deduction or exclusions in utility function, which also includes leisure and non-favored consumption. The deadweight loss estimated through TAXSIM is significantly greater than that of Harberger's classic 1964 estimate. Feldstein argues that this is mainly caused by underestimated labor supply elasticity. Mayshar and Slemrod work with two-good labor supply model, and they introduce a general tax avoidance technology that lacks a specified structural model. For example, in Slemrod (2001) individuals can reduce their tax liabilities at a certain cost through tax avoidance. Slemrod investigates the comparative statistics and compares elasticity of labor supply with traditional estimates that ignore tax avoidance. Slemrod and Yitzhaki (2002) summarizes the literature on tax evasion and avoidance. While they do not present a model of tax avoidance, they discuss various approaches of introducing tax avoidance into traditional models. Agell and Persson (2000) examine how tax avoidance, in the form of trade in well-functioning asset markets, affects the basic labor supply model. They show that studies ignoring tax avoidance may easily come up with biased estimates of the tax responsiveness of the labor supply of high-wage individuals. McClure (2020) develops a dynamic structural model to quantify the costs of tax avoidance. In the model, the firm trades off tax savings with tax-audit risk, financial-reporting benefits, and non-tax costs. McClure shows that non-tax costs have a large impact on firms' tax planning and can explain why firms appear to under-utilize tax strategies. In their recent study, Yousefi *et al.* (2020) set up a model which assumes a small open economy with endowed households who can choose between three methods of importing: legally with paying full tariffs, exempted imports, and illegal trading. They try to quantify deadweight loss of customs tax with evasion and avoidance opportunities. Their results show that welfare implications of tariff raise is larger in an environment with evasion and avoidance.

We contribute to the relevant literature by considering tax arbitrage as a means to avoid tax and also by combining it with standard labor supply models. The current study builds upon the literature by introducing tax arbitrage and asset trading as a method of tax avoidance and differs from Feldstein (1999) and

Slemrod (2001) in the way avoidance is incorporated into the model. The model we use is similar to Agell and Persson (2000) in the sense that agents take advantage of tax arbitrage opportunities to lower their tax liabilities. However, our focus is on the excess burden of tax rather than labor supply, and asset returns are uncertain in our model unlike Agell and Persson (2000). To our knowledge, this is the first study that analyzes excess burden of income tax in the existence of tax arbitrage with uncertain asset returns.

We show that failure to account for tax avoidance leads to biased predictions about the labor supply response and excess burden of income tax. The main mechanism that connects labor supply and tax avoidance works as follows: Through asset trading, taxpayers can reduce their tax liabilities, which include labor income and asset income. So, when there is higher income tax, an individual switches to tax-exempt assets and can reduce her tax liability. This causes the effect of a tax change on labor supply to be modest. We find that the substitution effect between leisure and consumption will be smaller in our model because effective marginal tax change will be less than the statutory tax change. Also, taxation leads to sub-optimal asset allocation and this causes the excess burden of tax to be greater than what standard models predict. When we allow asset returns to be endogenous and assume that supply of the assets is fixed, the total excess burden in the economy will be the same as standard models. However, when the supply of assets increases with its price, the excess burden will be greater than what standard models estimate but smaller than our estimate for the perfectly elastic asset supply case.

The rest of the paper is organized as follows. In section 2, a simple tax avoidance model is presented with two riskless assets. In section 3, the return on tax-exempt asset is assumed to be uncertain. Section 4 presents some general equilibrium aspects. Finally, section 5 concludes the paper.

2. A SIMPLE TAX ARBITRAGE MODEL

We assume that the individual earns an hourly wage of w, supplies labor ℓ and is endowed with H hours time. The twice continuously differentiable and quasi-concave utility function is in the form $U(c, H-\ell)$. Individuals are supposed to pay tax on their taxable income B, with the income tax schedule of $T(B)$. In addition to classic choice of leisure and income we assume that individuals can engage in trading assets with different tax status. This implies that individuals optimize not only their leisure choice but also choose optimum asset allocation. We further assume that individuals are endowed with an initial wealth W, that is supposed to be allocated between a fully taxable asset (D) and a tax-exempt asset (X).[2] So, $W = X + D$.

We let r_D denote the interest rate on taxable claims, and r_X the interest rate on tax-exempt claims. We first start our analysis by assuming that both assets are risk-free. Later in section 3, we relax this assumption and impose uncertainty into the model. We may think of the tax-exempt asset as representing tax shelters like some retirement savings (e.g., Roth IRA and Roth 401(k)), municipal bonds, etc., while the taxable asset represents ordinary bank lending, positive or negative.[3] We assume that $r_D > r_X$ so that agents have a trade off between buying a taxable asset with higher return and buying a tax-exempt asset with low return.[4] This will induce some individuals who face a high marginal tax rate to trade assets and reduce their tax liability (so-called "tax avoidance"). There is a constraint on short sales of the tax-exempt asset, but people may go short in the taxable asset. This assumption guarantees that agents cannot take advantage of arbitrage without decreasing their tax liability. Selling tax-exempt asset and buying taxable asset will not reduce the tax liability. If we let taxpayers buy a negative amount of X and a positive amount of D, they will be increasing their consumption level without avoiding taxes. Furthermore, without any constraint on X, in equilibrium, all individuals will trade assets until their taxable incomes are equal.[5]

The taxable income and budget constraint of individuals can be written as

[2] In this static model, individuals are able to choose between a fully taxable asset (D) and a tax-exempt asset (X) when a wealth (W) is given exogenously. In this way, some differential taxes on these two assets can make the individuals' asset choices distorted, which then creates excess burden.

[3] The Roth IRA and Roth 401(k) are popular tax-exempt accounts while the traditional IRA and 401(k) are the most common tax-deferred accounts in the United States. According to a survey that Statista conducted about accounts used for retirement savings in the U.S. 2020 for more than 2,000 Americans, 19% of the respondents held a Roth IRA; 20% traditional IRA; and 54% 401(k) plan as a tax-favored account for retirement savings (see for more details https://www.statista.com/statistics/542709/accounts-used-for-retirement-savings-usa/). Municipal bonds are sold by local governments. To encourage local public projects, municipal bonds are exempt from federal tax, and some, but not all, municipal bonds are also exempt from state and local tax.

[4] Municipal bonds pay relatively low interest, but they are popular with taxpayers in high tax brackets, because they help reduce their tax burden while still earning the interest that is free from taxes.

[5] We do not impose a non-negativity constraint on taxable asset (D). In general, especially relatively rich people can easily get bank loans. However, some individuals might be constrained with short selling the taxable assets in reality. For a general discussion of how capital market imperfections and government regulations affect the scope for tax arbitrage, see Stiglitz (1983).

follows:[6]

$$B = r_D(W - X) + w\ell \tag{1}$$

$$c = r_X X + r_D(W - X) + w\ell - T(B) \tag{2}$$

So, the maximization problem becomes

$$\begin{aligned} \max_{X,\ell,c} \quad & U(c, H - \ell) \\ \text{s.t.} \quad & (1),\ (2) \text{ and } X \geq 0 \end{aligned} \tag{3}$$

In the standard labor supply model, the individual optimizes with respect to ℓ only, while treating asset choice X as a constant. In our model the individual optimizes with respect to both ℓ and X. First order conditions from eq. (3) are

$$\frac{U_L}{U_c} = w[1 - T'(B)] \tag{4}$$

$$\begin{aligned} r_X - r_D[1 - T'(B)] &\leq 0 \quad \text{if } X = 0 \\ &= 0 \quad \text{if } X > 0 \end{aligned} \tag{5}$$

where U_L and U_c are the first derivatives of utility function with respect to leisure ($L = H - \ell$) and consumption respectively. First, consider the case of an interior solution (i.e. $X > 0$). For these individuals, denoted by superscript "A" for "avoider", tax avoidance is driven to the point where the after-tax marginal return on the taxable asset equals to return on tax-exempt asset:

$$r_D[1 - T'(B)] = r_X \tag{6}$$

Since everyone faces the same asset yields r_D and r_X in a competitive capital market, eq. (6) implies that all individuals at an interior portfolio equilibrium will have the same marginal tax rate. For avoiders, tax avoidance will thus transform the nonlinear statutory tax schedule into an effective linear schedule with slope $1 - r_X/r_D$. For future reference it is important to note that this implies that

$$\frac{U_L^A}{U_c^A} = w\frac{r_X}{r_D} \tag{7}$$

[6]Note that the tax function is progressive (i.e., its slope increases with taxable income (B)), and it applies to income from taxable asset as well as labor income throughout the model.

Eq. (7) implies that the effective tax wedge for avoiders is determined in asset markets. The tax system affects work incentives only to the extent that the tax function $T(.)$ affects the relative return on taxable and tax-exempt assets. Assuming that marginal tax rate is a monotone function of taxable income, all avoiders report the same taxable income:

$$B^A = T'^{-1}(1 - r_X/r_D) \tag{8}$$

Monotonicity of marginal tax function helps us to get taxable income in closed form. However, it is not a critical assumption for the results we get.[7] When two individuals face different marginal tax rates, they can make a profit from trading assets. The one with the low income sells the tax-exempt asset and purchases the taxable asset, while the one with the high income does the opposite. This process continues until taxable incomes are equalized, and total tax payments minimized. However, because of the constraint on short sales the process of tax arbitrage might be cut short. People with relatively low taxable incomes, who face an incentive to go short in the tax-exempt asset, will find that the non-negativity constraint prevents them from doing so. For this group of people all wealth will be invested in the taxable asset, and their labor supply will be determined in exactly the same way as is predicted by the standard labor supply model. Non-avoiders decide on work hours while treating their asset portfolio as exogenous. This accounts for the fact that they – unlike avoiders – face a tax system where the marginal tax rate is an increasing function of their labor income. In sum, for tax avoiders, we have the response functions as below:

$$\begin{aligned} \ell^A &= \ell^A(w, W) \\ X^A &= X^A(w, W) \end{aligned} \tag{9}$$

To derive the labor supply function of non-avoiders, henceforth denoted by superscript "NA", we set $X = 0$ in eq. (4).

$$\begin{aligned} \ell^{NA} &= \ell^{NA}(w, W) \\ X^{NA} &= 0 \end{aligned} \tag{10}$$

For a given utility function and tax system, r_X and r_D, wage rate (w) and initial wealth (W) determines whether individuals are avoiders or not. Using eq. (5),

[7] In the U.S. marginal tax function is not strictly increasing but rather it is piecewise linear. For such a tax system, eq. (6) implies that all avoiders will be in the same tax bracket even though they might have different taxable incomes. That's why it will not affect our results.

define $\phi(w,W)$ such that

$$\phi(w,W) = r_X - r_D[1 - T'(w\ell^{NA} + r_D W)]$$

Everybody with $\phi(w,W) > 0$ avoids and behaves according to eq. (9), while everybody with $\phi(w,W) < 0$ does not avoid and behaves according to eq. (10). It is easy to check if $\phi(w,W)$ is increasing in w and W for fixed value of ℓ^{NA}. So, with all else equal, higher income taxpayers are more likely to avoid tax. Also note that taxable income of tax avoiders is determined by the curvature of the tax function and by the relative return on tax-exempt and taxable assets. Parameters from tax avoiders' utility functions play no role. This follows directly from eq. (8). As a corollary, one can show that the choice of actually becoming an avoider does depend on the utility function. This follows from the definition of $\phi(w,W)$ because it includes ℓ^{NA} term from utility function in it.

2.1. WELFARE LOSS

Our main interest is the labor supply and excess burden implications of tax arbitrage model compared to standard models. Since we start with a relatively unrealistic model (no uncertainty in asset returns), for now, we give a brief overview of labor supply and excess burden implications of our simple model. For any arbitrary tax reform, the labor supply of a tax avoider is only affected by an income effect. This result holds for any individual who is at an interior portfolio equilibrium both before and after the tax reform. This conclusion follows directly from the first order condition in eq. (7). A tax reform generates a substitution effect only if it affects the wedge imposed between the marginal rate of substitution on the left-hand-side and the marginal rate of transformation on the right-hand-side. Because this wedge is determined in asset markets, and equal to $1 - r_X/r_D$, a tax reform can have no direct impact on the wedge.

It is straightforward to compute the welfare loss associated with tax system $T(.)$. In an equilibrium without taxation, what lump-sum deduction (EV) would be equivalent to the introduction of a tax?[8] For endogenous asset portfolio choice model, define $V^T(w,W)$ as indirect utility obtained in taxation equilibrium and $V^{NT}(w,W)$ as indirect utility obtained in no-tax equilibrium. Then, EV of taxa-

[8]To calculate the actual welfare loss we need to subtract tax revenue from equivalent variation. However, ignoring tax revenue doesn't affect our results.

tion is obtained from

$$V^{NT}(w,W) = \underset{\ell,c}{\text{Max}} \quad U(c, H-\ell) \qquad (11)$$
$$\text{s.t.} \quad c = r_D W + w\ell - EV$$

such that $V^{NT}(w,W) = V^{T}(w,W)$. The budget constraint recognizes that $X = 0$ (no tax-exempt asset) for everybody in the absence of taxation. Since $r_D > r_X$, and there is no tax, no one will invest in the low-yielding asset.[9]

Consider next, how the welfare cost is computed if endogeneity of asset choice is not recognized. Suppose that there is complete information about the utility function and all variables including consumption, leisure, and asset holdings. To estimate the welfare cost of taxation in the standard labor supply model (i.e. asset choice is exogenous), define $V'^{NT}(w,W)$ as indirect utility obtained in no-tax equilibrium. Then, EV' of taxation is obtained from

$$V'^{NT}(w,W) = \underset{\ell,c}{\text{Max}} \quad U(c, H-\ell) \qquad (12)$$
$$\text{s.t.} \quad c = r_X\bar{X} + r_D(W-\bar{X}) + w\ell - EV'$$

such that $V'^{NT}(w,W) = V^{T}(w,W)$, where $\bar{X}$ is the optimal tax-exempt asset holding in taxation equilibrium. Since the asset choice is treated as exogenous in the optimization problem, the asset income that appear in the budget constraint, $r_X\bar{X} + r_D(W-\bar{X})$, is the one that is observed in the equilibrium with taxation. So, comparing the two models in terms of efficiency cost of income tax (i.e. equivalent variations), we can state that: Calculations of the welfare cost of income taxation that treat asset choice as exogenous imply that the perceived welfare cost, EV', will be less than the true welfare cost, EV, by an amount given by $EV = EV' + (r_D - r_X)\bar{X}$.[10] We will use the same method of calculating the excess burden in the next section.

It is true that theoretically and practically, capital income may be taxed differently than labor or ordinary income. However, in our model, the avoidance is performed through investing in taxable and tax-exempt assets, which yield interest income, but not capital gains. In most developed countries, interest income

[9] When tax rate is zero, there should not be any supply for the tax-exempt asset since there is no demand. The analysis would be the same when tax rate is very small but not zero. Our goal is to show that when tax rates decrease, individuals will re-optimize their asset portfolio buying more taxable asset. Missing this point will result in underestimating the excess burden of the tax.

[10] The proof follows directly from equalizing the budget constraints in the optimization problems (11) and (12). By definition, $V'^{NT}(w,W)$ should be equal to $V^{NT}(w,W)$. If the budget constraints in eq. (11) and eq. (12) are equalized, the indirect utilities in no tax equilibrium will be equal.

is treated as a part of the ordinary income and taxed at the same rate with labor income. For example, in the U.S., investment income such as interest and rent is considered ordinary income and will generally be taxed according to the ordinary income tax rate. Interest income from holding U.S. Savings and Treasury bonds, corporate bonds, mutual funds/ETFs, certificates of deposit (CDs), checking and savings accounts, money market accounts and loans made to others and interest income from pass-through businesses such as partnerships or S-corporations are taxed at a regular rate.[11] In U.K., tax on any interest is at one's usual rate of income tax, although up to £5,000 of interest is tax exempt.[12]

On the other hand, capital gains tax is a tax on the profit when one sells an asset that is increased in value. Capital gains tax rates are different than ordinary income tax rates in most countries. For example, it is 20% in U.S., 30% in Sweden, 25% in Germany, and 10% or 20% depending on income level in U.K.[13] In countries like Australia, Italy, Denmark and Norway, capital gains are subject to normal personal income tax rates.

Assuming that labor income and interest income are subject to different tax rates, the main results (i.e., eq. (7)) do not hold. Individuals' optimal choice of labor supply and asset portfolio will be independent from each other. Optimal labor supply choice will be as in the case of standard models, and labor supply will be affected by labor income tax changes. The optimal portfolio choice with a constant asset tax rate of τ_A will be quite straightforward. The choice between taxable and tax-exempt assets will be determined by r_X, r_D and τ_A. If $r_X > (1-\tau_A)r_D$, then individuals will buy tax-exempt assets only. On the other hand, if $r_X < (1-\tau_A)r_D$, then individuals will buy taxable assets only. The different tax treatment of labor and interest income would remove the avoidance opportunity and the results of this paper would be irrelevant. Therefore, we can say that the set up and the results in this paper apply mostly in countries with same treatment of interest income and labor income.

3. UNCERTAINTY IN ASSET RETURNS

The model that we develop above yields some restrictive results with the assumption of two riskless assets. One of the unrealistic results in Section 2 is that all individuals involved in tax arbitrage end up having the same effective

[11] https://www.irs.gov/taxtopics/tc403

[12] https://www.gov.uk/apply-tax-free-interest-on-savings

[13] https://taxsummaries.pwc.com/quick-charts/capital-gains-tax-cgt-rates, https://www.gov.uk/capital-gains-tax/rates

marginal tax rate and the same taxable income. In addition to this, any tax rate change results in an income effect and no substitution effect. In this section we relax the assumption that assets are riskless. Specifically, we assume that there are two states of the world. At the end of the period, assets yield a "high" return in one state of the world and a "low" return in the other. The timing in economy is as follows: At the beginning of the period individuals have perfect information regarding their wage rates, initial endowments and tax rates. They decide how many assets to buy and how much labor to supply at the beginning of the period. At the end of the period gains from asset holdings are realized. With the probability of p, the "high" state (denoted by superscript "1") is realized. Asset returns in the "high" state are r_X^1 for the tax-exempt asset and r_D^1 for the taxable asset. With the probability of $(1-p)$ the "low" state (denoted by superscript "2") is realized. Asset returns in the "low" state are r_X^2 for the tax-exempt asset and r_D^2 for the taxable asset. With these assumptions about asset returns, individuals will not buy assets for diversification purposes since high state and low state are not asset specific.[14] In the current setting, tax-exempt and taxable assets are no longer perfect substitutes.[15] In other words, individuals do not trade assets only by considering their relative return, and they also take the risk they bear into account while making their portfolio. We also assume that $r_X^1 < r_D^1$ and $r_X^2 < r_D^2$. That is, the return on taxable assets is greater in both states of the world. Again, with this assumption agents have a trade off between buying a taxable asset with a higher return and buying a tax-exempt asset with low return no matter which state occurs.

Contingent taxable income (B) and consumption (c) of individuals can be written as follows:

$$B^1 = w\ell + (W-X)r_D^1$$
$$B^2 = w\ell + (W-X)r_D^2$$

$$c^1 = r_X^1 X + (W-X)r_D^1 + w\ell - T(B^1)$$
$$c^2 = r_X^2 X + (W-X)r_D^2 + w\ell - T(B^2)$$

[14]Making more general assumptions for the asset returns and allowing individuals to buy asset for diversification purposes will not affect our main findings as long as the expected return on taxable asset is greated than the expected return on tax-exempt asset. Our simplifying assumption makes the calculations easier. For more information about portfolio distortion of corporate tax with more general assumption about diversification, see Desai and Dharmapala (2009).

[15]In an exceptional case, where relative returns of taxable and tax-exempt assets in high and low state are equal, two assets will still be perfect substitutes.

Individuals maximize their expected utility.

$$\max_{X,\ell,c^1,c^2} \quad pU(c^1, H-\ell) + (1-p)U(c^2, H-\ell) \tag{13}$$
$$\text{s.t.} \quad c^1 = r_X^1 X + (W-X)r_D^1 + w\ell - T(B^1)$$
$$c^2 = r_X^2 X + (W-X)r_D^2 + w\ell - T(B^2)$$
$$X \geq 0$$

First order conditions (FOC) for X and ℓ respectively are

$$pU_c^1[r_X^1 - r_D^1(1-T'(B^1))] + (1-p)U_c^2[r_X^2 - r_D^2(1-T'(B^2))] \leq 0 \quad \text{if } X = 0$$
$$= 0 \quad \text{if } X > 0 \tag{14}$$

$$p[wU_c^1(1-T'(B^1)) - U_L^1] + (1-p)[wU_c^2(1-T'(B^2)) - U_L^2] = 0 \tag{15}$$

U_c^1 and U_c^2 are first derivatives of the utility function with respect to c in the "high return" state and the "low return" state respectively. Likewise, U_L^1 and U_L^2 are first derivatives of the utility function with respect to leisure (L) in the "high return" state and "low return" state, respectively. From eq. (14) we can get the condition for becoming an avoider. We rewrite eq. (14) for $X = 0$.

$$pU_c^1 r_X^1 + (1-p)U_c^2 r_X^2 < pU_c^1 r_D^1(1-T'(w\ell + Wr_D^1)) + (1-p)U_c^2 r_D^2(1-T'(w\ell + Wr_D^2)) \tag{16}$$

The left-hand side of eq. (16) is the expected marginal utility from buying one unit of a tax-exempt asset (X), while the right-hand side is the expected marginal utility from buying a taxable asset (D). If an individual spends all his initial wealth (W) on D and the expected marginal utility of D is still greater than that of X, then the individual does not buy any X in equilibrium. In other words, he does not avoid any tax through asset trading. When carefully examined, it can be seen that when initial wealth (W) increases, everything else being equal, eq. (16) is less likely to be satisfied.[16] Hence, as people become richer they are more likely to be avoiders. This result appears consistent with the old saying among tax professionals that "the poor evade and the rich avoid," meaning that

[16] U_c^1 and U_c^2 are common in both sides of eq. (16). On the right hand side $(1-T'(.))$ term is extra. As W increase, it is easy to check the marginal tax, $T'(.)$, to increase and $(1-T'(.))$ term to decrease. Thus, the right hand side will increase more slowly or fall more rapidly compared to the left hand side of the equation.

the rich tend to reduce their taxes through legal "avoidance" measures such as tax arbitrage, while those with lower incomes (sometimes) attempt more outright evasion. Given parameter values p, r_D^1, r_D^2, r_X^1, r_X^2, the utility and tax functions define a function $\phi(w,W)$ such that

$$\phi(w,W) = [pU_c^1 r_X^1 + (1-p)U_c^2 r_X^2] - [pU_c^1 r_D^1(1-T'(w\ell + Wr_D^1)) + (1-p)U_c^2 r_D^2(1-T'(w\ell + Wr_D^2))] \quad (17)$$

Individuals with $\phi(w,W) > 0$ will become avoiders while individuals with $\phi(w,W) \leq 0$ will not avoid any tax. For avoiders, eq. (14) holds with equality. That is, for taxpayers who buy a positive amount of X in equilibrium, expected marginal utility from buying 1 unit of X and 1 unit of D are equal. With uncertainty in asset returns, taxable income is now contingent upon different states of the world. Furthermore, taxable income (B^1, B^2) depends on preferences as well as the tax function and other parameters. One of the restrictive results in section 2 is that every avoider has the same taxable income. Imposing uncertainty into the model leads to a more generalized result. Depending on individuals' preferences over risk, initial endowment and wage rate, the taxable income of avoiders will be different. Without uncertainty the two assets are perfect substitutes, so individuals fully take advantage of tax arbitrage opportunities. With uncertainty, tax-exempt and taxable assets are no longer perfect substitutes.

3.1. WELFARE LOSS AND LABOR SUPPLY IMPLICATIONS

Over the years, one of the main applications of labor supply analysis has been predicting how tax reform affects hours of labor supply, tax revenue, and excess burden. In the context of the major tax reforms that were implemented in the past, a number of studies have assessed the direction and magnitude of these effects.[17] Consider a tax reform that increases the progressivity of the tax function $T(.)$. What are the implications for the labor supply of avoiders?

The labor supply response to a change in tax system will have different implications with contingent asset returns. In section 2, we find that tax changes do not affect marginal tax, and thus tax changes have only an income effect on labor supply. In this section, we see in eq. (14) that marginal tax, $T'(B^{1,2})$, depends on preferences and the tax function itself, $T(.)$. When tax function changes, the marginal tax that people face will change as well. Labor supply

[17] See for example, Ziliak and Kniesner (1999) and Auerbach and Slemrod (1997) for US tax reform and Agell *et al.* (1998) for Swedish tax reform.

will not only be affected by the income effect but also by the substitution effect. This is in line with what standard labor supply models (with exogenous asset choice) suggest. However, the magnitude of the labor supply response to tax change in our model will be different than what standard models predict. To find the labor supply response in both models, define $m^1 = T'(B^1)$ and $m^2 = T'(B^2)$ as current marginal tax rates in both states. Likewise, define $Z^1 = r_X^1 X + (W - X) r_D^1$ and $Z^2 = r_X^2 X + (W - X) r_D^2$ as non-labor income in both states. With non-labor income and current marginal taxes we can write the labor supply function as $\ell(w, W, m^1, m^2, Z^1, Z^2)$. Now, we totally differentiate labor supply function, marginal tax, and non-labor income to get

$$\mathrm{d}\ell = \ell_w \mathrm{d}w + \ell_W \mathrm{d}W + \ell_{m^1} \mathrm{d}m^1 + \ell_{m^2} \mathrm{d}m^2 + \ell_{Z^1} \mathrm{d}Z^1 + \ell_{Z^2} \mathrm{d}Z^2 \tag{18}$$

$$\begin{aligned} \mathrm{d}m^1 &= T''(B^1)[\mathrm{d}w\ell + \mathrm{d}\ell w + \mathrm{d}W r_D^1 - \mathrm{d}X r_D^1] \\ \mathrm{d}m^2 &= T''(B^2)[\mathrm{d}w\ell + \mathrm{d}\ell w + \mathrm{d}W r_D^2 - \mathrm{d}X r_D^2] \end{aligned} \tag{19}$$

$$\begin{aligned} \mathrm{d}Z^1 &= \mathrm{d}X(r_X^1 - r_D^1) + \mathrm{d}W r_D^1 \\ \mathrm{d}Z^2 &= \mathrm{d}X(r_X^2 - r_D^2) + \mathrm{d}W r_D^2 \end{aligned} \tag{20}$$

Assume that the initial wealth and the wage rate are fixed or they do not change with tax. Then $\mathrm{d}w = \mathrm{d}W = 0$. In standard models asset choice is exogenous and does not respond to tax changes. This means $\mathrm{d}X = 0$. However, as a result of increased tax progressivity, our model suggests that individuals will buy more X to avoid some of the tax liability. With higher taxes the marginal return on X will be greater and thus individuals will demand more of it. Hence, the change in X will be positive, $\mathrm{d}X > 0$. So, the marginal tax rate change $\mathrm{d}m^1$, $\mathrm{d}m^2$ will be smaller in our model. This is easy to see from eq. (19).[18] Then we have $\mathrm{d}m^1 < \mathrm{d}m^1_{std}$, $\mathrm{d}m^2 < \mathrm{d}m^2_{std}$. Here, $\mathrm{d}m^1_{std}$ and $\mathrm{d}m^2_{std}$ are marginal tax rate changes in standard models while $\mathrm{d}m^1$, $\mathrm{d}m^2$ are marginal tax rate changes in our model. Also, note that $\mathrm{d}Z^1 = \mathrm{d}Z^2 = 0$ in standard models since $\mathrm{d}X = 0$, while $\mathrm{d}Z^1, \mathrm{d}Z^2 < 0$ in our model (see eq. (20) and note that $r_D^1 > r_X^1$ and $r_D^2 > r_X^2$). Now let us compare the labor supply response in both models. Let $\mathrm{d}\ell_{std}$ be the labor supply response in standard models and $\mathrm{d}\ell$ be the labor supply response in our model. Then rewriting eq. (18) for our model and standard models, we get

$$\mathrm{d}\ell_{std} = \ell_{m^1} \mathrm{d}m^1_{std} + \ell_{m^2} \mathrm{d}m^2_{std} \tag{21}$$

[18] Our model allows individuals to be able to reduce the statutory marginal tax unlike standard models. So it is intuitive to have a smaller effective marginal tax change in our model.

$$\mathrm{d}\ell = \ell_{m^1}\mathrm{d}m^1 + \ell_{m^2}\mathrm{d}m^2 + \ell_{Z^1}\mathrm{d}Z^1 + \ell_{Z^2}\mathrm{d}Z^2 \tag{22}$$

Subtracting one from the other yields the following:

$$\begin{aligned}\mathrm{d}\ell_{std} - \mathrm{d}\ell = \ell_{m^1}(\mathrm{d}m^1_{std} - \mathrm{d}m^1) + \ell_{m^2}(\mathrm{d}m^2_{std} - \mathrm{d}m^2)\\ - \mathrm{d}X[\ell_{Z^1}(r^1_X - r^1_D) + \ell_{Z^2}(r^2_X - r^2_D)]\end{aligned} \tag{23}$$

Suppose that $\ell_{m^1}, \ell_{m^2} < 0$. That means increasing the marginal tax will lead to a decrease in labor supply for standard models, $\mathrm{d}\ell_{std} < 0$. In other words, labor supply function is upward sloping. Also, note that $\ell_{Z^1}, \ell_{Z^2} < 0$ since we assume that leisure is normal good. Then, the first two terms will be negative and the last term will be positive in the right-hand side of eq. (23). Thus, the whole right-hand side will be negative. This implies $\mathrm{d}\ell > \mathrm{d}\ell_{std}$. In other words, our model suggests that the labor supply response of a tax increase will be less negative (more modest) than standard models, or it may be positive, or even zero. There are two reasons for getting this result. One reason is that tax increase creates a smaller substitution effect in our model. This is trivial since marginal tax rate change will be smaller in our model, as we showed above. Another reason for having a different labor supply response is that non-labor income is affected by tax changes in our model. When the tax rates increase, individuals will substitute away from taxable assets to tax-exempt assets. This will cause non-labor income to decrease as we showed above in eq. (20). So, there is a non-labor income effect which will cause labor supply to increase. Therefore, an increase in the progressivity of the tax system may cause labor supply response to be positive, negative or zero depending on the magnitude of the different effects.

Now suppose that $\ell_{m^1}, \ell_{m^2} > 0$. That means that increasing the marginal tax will lead to an increase in labor supply for standard models, $\mathrm{d}\ell_{std} > 0$. Eq. (22) implies that the labor supply response in our model will be positive too, $\mathrm{d}\ell > 0$. The first two terms in the right-hand side of eq. (23) will now be positive and the third term is negative. So, it is ambiguous whether $\mathrm{d}\ell$ or $\mathrm{d}\ell_{std}$ is bigger.

Much of the interest in the standard labor supply model rests on the view that a correctly estimated (compensated) labor supply elasticity is a vital input when calculating the welfare cost of taxation. However, as first argued by Feldstein (1999), when people optimize along several margins at the same time, the elasticity of the labor supply becomes a potentially misleading indicator of the welfare cost of taxation. In estimating excess burden of income tax with avoidance opportunities, the partial equilibrium model we present in this section is a special case in Feldstein (1999). However, specifically modeling tax avoidance through tax arbitrage helps us understand a real life avoidance practice better. Moreover, when we allow asset returns to be affected by tax policy in the next section, income tax may not have extra burden with avoidance.

In section 2, we found that excess burden of taxation is greater in our tax arbitrage model compared to standard models because asset choice behavior is also distorted in our tax arbitrage model. With uncertainty in the asset returns, we have similar results. To find the excess burden of taxation for the tax arbitrage model (where asset choice is endogenous), define $V^T(w,W)$, as the indirect utility achieved in taxation equilibrium. Let EV^1 and EV^2 denote the state dependent lump-sum deductions from consumption in no-tax equilibrium. We find EV^1 and EV^2 from the following maximization problem. Let $V^{NT}(w,W)$ be the indirect utility function obtained from

$$\max_{\ell,c^1,c^2} \quad pU(c^1,H-\ell)+(1-p)U(c^2,H-\ell) \tag{24}$$
$$\text{s.t.} \quad c^1 = r_D^1 W + w\ell - EV^1$$
$$c^2 = r_D^2 W + w\ell - EV^2$$

such that $V^T(w,W) = V^{NT}(w,W)$. Since the return of the taxable asset is greater in both states, without taxation, individuals will not buy any tax-exempt assets (X) and will buy taxable asset (D) with all of their endowments. It would be more practical to have a single measure of excess burden rather than having a state dependent excess burden. That's why we define EV as the certainty equivalent of subtracting EV^1 in "high" state and EV^2 in "low" state from consumption. EV is calculated by using the following equation:

$$pU(r_D^1W+w\ell^*-EV^1,H-\ell^*)+(1-p)U(r_D^2W+w\ell^*-EV^2,H-\ell^*) \tag{25}$$
$$= pU(r_D^1W+w\ell^*-EV,H-\ell^*)+(1-p)U(r_D^2W+w\ell^*-EV,H-\ell^*)$$

where ℓ^* is the labor supply in equilibrium.

Now let us see what would be the excess burden for a standard model (where asset choice is exogenous). We assume there is perfect information about the asset choice in taxation equilibrium. Again, let EV'^1 and EV'^2 be the lump-sum deduction from consumption in "high" and "low" states respectively. Following maximization problem yields EV'^1 and EV'^2 for a standard labor supply model. Let $V'^{NT}(w,W)$ be the indirect utility function obtained from

$$\max_{\ell,c^1,c^2} \quad pU(c^1,H-\ell)+(1-p)U(c^2,H-\ell) \tag{26}$$
$$\text{s.t.} \quad c^1 = r_X^1\bar{X}+(W-\bar{X})r_D^1+w\ell-EV'^1$$
$$c^2 = r_X^2\bar{X}+(W-\bar{X})r_D^2+w\ell-EV'^2$$

such that $V^T(w,W) = V'^{NT}(w,W)$. This implies that the indirect utility obtained in problems (24) and (26) must be the same. Note that $\bar{X}$ shows the amount of tax-exempt asset held in taxation equilibrium. Individuals do not change their asset portfolio in standard models when there is no tax because asset income is assumed to be exogenous. Again, let EV' be the certainty equivalent of deducting EV'^1 in "high" state and EV'^2 in "low" state from consumption. Similarly, we can find EV' from the following equation:

$$\begin{aligned} &pU(r_X^1\bar{X} + (W-\bar{X})r_D^1 + w\ell'^* - EV'^1, H - \ell'^*) \\ &\quad + (1-p)U(r_X^2\bar{X} + (W-\bar{X})r_D^2 + w\ell'^* - EV'^2, H - \ell'^*) \\ &= pU(r_X^1\bar{X} + (W-\bar{X})r_D^1 + w\ell'^* - EV', H - \ell'^*) \\ &\quad + (1-p)U(r_X^2\bar{X} + (W-\bar{X})r_D^2 + w\ell'^* - EV', H - \ell'^*) \end{aligned} \tag{27}$$

where ℓ'^* is the labor supply in equilibrium for standard models.

Next, we find a relationship between state dependent deductions in two models. Carefully examining the maximization problems (24) and (26), we can state that with the following characterization the two maximization problems become the same and thus yield the same utility level.

$$\begin{aligned} EV^1 &= EV'^1 + (r_D^1 - r_X^1)\bar{X} \\ EV^2 &= EV'^2 + (r_D^2 - r_X^2)\bar{X} \end{aligned}$$

and

$$\ell^* = \ell'^*$$

With these equations, the left-hand sides of eqs. (25) and (27) are equal. Hence, the right-hand side of these equations will be equal to each other as well:

$$\begin{aligned} &pU(r_D^1 W + w\ell^* - EV, H - \ell^*) + (1-p)U(r_D^2 W + w\ell^* - EV, H - \ell^*) \\ &= pU(r_X^1\bar{X} + (W-\bar{X})r_D^1 + w\ell'^* - EV', H - \ell'^*) \\ &\quad + (1-p)U(r_X^2\bar{X} + (W-\bar{X})r_D^2 + w\ell'^* - EV', H - \ell'^*) \end{aligned} \tag{28}$$

Our goal is to compare EV and EV'. The second term of the utility function (leisure) is equal in both sides since $\ell^* = \ell'^*$. So, we concentrate on the first terms (consumption). Since $r_D^1 > r_X^1$ and $r_D^2 > r_X^2$, we have the following:

$$\begin{aligned} r_D^1 W + w\ell^* &> r_X^1\bar{X} + (W-\bar{X})r_D^1 + w\ell'^* \\ r_D^2 W + w\ell^* &> r_X^2\bar{X} + (W-\bar{X})r_D^2 + w\ell'^* \end{aligned}$$

Now eq. (28) holds if and only if $EV > EV'$. Thus, we show that excess burden in our model is greater than that of standard models. The difference in excess burdens in different models is caused by the asset portfolio being exogenous in standard models. The extra burden in our model reflects the expected amount of asset income that would have been gained had the individuals been allowed to choose their asset portfolio in standard models with no tax. To the extent that taxation leads to an equilibrium with an inefficient asset allocation, an analysis that ignores this fact underestimates the welfare cost of taxation. This result is similar to Feldstein (1999) which finds the excess burden of taxation to be ten times greater than "Harberger Triangle" in the existence of avoidance. In his study tax avoidance is through changes in the form of compensation (e.g., employer paid health insurance) and through changes in the patterns of consumption (e.g., owner occupied housing).

4. GENERAL EQUILIBRIUM CONSIDERATIONS

In previous sections we assumed that both taxable and tax-exempt assets were in infinite supply. That is why the tax system changes did not affect the asset returns. In an open economy, it might appear reasonable to assume that asset yields are independent of domestic tax policy. But in an economy where the supplies of taxable and tax-exempt assets are less than perfectly elastic, it seems reasonable to proceed under the assumption that domestic tax policy affects the relative asset yield. For simplicity, we do not consider the uncertainty in asset returns here. We assume that there is no uncertainty in the asset returns as in section 2. It is straightforward to introduce endogenous asset yields in our model. A basic observation is that, although there are two assets in the model, there is only one independent equilibrium condition. Thus, we can only solve for relative asset returns.[19] For now, assume that the tax-exempt asset (X) is in fixed supply, denoted by $\bar{S}$ (Later we relax this assumption).[20] This would be the case if X is, for example, land. Then, we integrate the asset demand function in eq. (9) over all tax avoiders to obtain market demand for the tax-exempt asset, and we solve

[19] In this section, we introduce flexible (less than perfectly inelastic) supply of asset. Indeed, we find demand function for asset in the previous sections. So, we use it along with supply and the market equilibrium condition to find relative rate of returns, r_X/r_D.

[20] Since the total initial wealth in our model is fixed, assuming that only tax-exempt asset is fixed implicitly means assuming fixed supply for taxable asset.

for the value of r_X/r_D that makes demand equal to supply:

$$\int\limits_{\phi(w,W)>0} X^A(w,W,r_X/r_D)\mathrm{d}F(w,W) = \bar{S} \tag{29}$$

where $F(w,W)$ is the joint cumulative distribution function of wages and initial wealth. Using eq. (29), we can examine how tax reform affects the relative asset yield. With this information we can proceed to examine the implications for labor supply, tax revenue, and the welfare cost of taxation.

First, we compare our finding here with what we find in section 2 because in this section we assume asset returns are riskless just like in section 2. When the tax system affects the relative asset yield, tax reform also creates substitution effects for those who engage in tax avoidance. In the standard model, the labor supply of high-wage individuals tends to decrease because of a negative substitution effect. In our model, with an endogenous asset yield, the labor supply of tax avoiders is affected by a negative substitution effect because increased statutory tax progressivity leads to a decrease in r_X/r_D. When statutory tax progressivity increases, there is an increased demand for the tax-exempt asset. But as the tax-exempt asset is in fixed supply, this excess demand must be choked down by a relative return adjustment that makes it less favorable to own the tax-exempt asset. In the process the effective marginal tax rate that confronts tax avoiders will increase.

Another important deviation from our previous analysis concerns the computation of the welfare cost of taxation. When the tax-exempt asset is in fixed supply, it is no longer the case that tax avoidance imposes an excess burden which is additional to the standard labor supply distortion. Although people still engage in asset trade to avoid taxation, no real resource costs are used up in the process. At the individual level, some people will hold more of the asset, and some will hold less than they would have in the absence of taxation. These effects will, however, average out in the aggregate.[21]

Clearly, the assumption that assets are in fixed supply is not a realistic one. Let us assume that the supply of the tax-exempt asset is neither perfectly inelastic nor perfectly elastic. Specifically, let us say the supply function of the tax-exempt asset is $S(r_X/r_D)$. Again, to find the asset return ratio in equilibrium, we equalize

[21] This result is in contrast with Feldstein (1999) which finds the excess burden of taxation to be ten times greater than "Harberger Triangle" in the existence of avoidance. The difference is caused by general equilibrium model versus partial equilibrium model in Feldstein (1999). In general equilibrium model relative price of leisure and deductables are dependent upon income tax.

the demand and supply:

$$\int_{\phi(w,W)>0} X^{A}(w,W,r_X/r_D)\mathrm{d}F(w,W) = S(r_X/r_D) \tag{30}$$

Now let us try to see the effect of increased tax progressivity on labor supply and excess burden. First, there will be a substitution effect on labor supply. When the progressivity of the tax system increases, the demand for the tax-exempt asset will increase. In equilibrium, relative asset return, r_X/r_D, will decrease. Since supply is not fixed, the overall number of tax-exempt assets traded will go up. Marginal taxes for many individuals will go up but it will be less than the statutory progressivity. Second, the welfare cost of taxation will be greater than that of standard labor supply models. There will be more tax-exempt assets held by individuals after the increase in tax progressivity. There might be some individuals with relatively less initial wealth who sell the tax-exempt asset, but there will be more people who will buy more tax-exempt assets after the increase in progressivity. Thus, tax arbitrage will create an extra burden in the economy as a whole, but it will be less than the perfectly elastic asset supply case (i.e. as in section 2).

Until now, our analysis has been limited to a closed economy. Indeed, a developed financial market in a country is well connected with developed financial systems of other countries. Hence, people would be more interested in how the tax arbitrage behaviors change and, consequently, how it affects the excess burden of income tax in an open economy. In order to discuss further the changes occurring in an open economy context, we consider as a benchmark case a general equilibrium in a closed economy as in the above. In contrast to a closed economy, an open economy introduces capital mobility. Thus, it gets easier for the individuals to access the financial markets, and the supplies of tax-exempt assets (X) and taxable assets (D) get more elastic in the open economy. For this reason, when the government increases the progressivity of income tax in a country, the individuals can buy more tax-exempt assets to reduce their marginal tax rate and avoid their tax liabilities. The individuals' labor supplies, meanwhile, can be more modest due to more reduction in their effective marginal tax rate. Consequently, the excess burden of income tax can increase further because of this behavioral change in an open economy. Furthermore, suppose that the capital mobility is perfect. Then, since the supplies of the tax-exempt assets and the taxable assets are perfectly elastic, the tax arbitrage behavioral changes occurring in the open economy become very close to those of the closed economy analyzed in section 2. In this case, the domestic tax policy no longer affects the asset yields (r_X and r_D) in the open economy. In sum, the tax arbitrage behaviors can be more changed, and in consequence the welfare cost of income taxation becomes more increased, as the openness of a country gets larger.

5. CONCLUSION

What keeps people working, given the very high marginal tax rates that can be observed for some countries? The traditional answer has been that labor supply is rather inelastic. Our proposed answer is different. With the tax avoidance technologies that became increasingly available in the last few decades, those who care about incentives need not pay those high tax rates.

This paper fills a gap in the public finance literature by exploring labor supply distortion and its magnitude when individuals avoid income tax. We formalize the idea that high marginal tax rates could be circumvented by people with access to modern financial markets, and we state some implications for the empirical analysis of labor supply. We show that the standard approach of analyzing labor supply, which treats asset choice as exogenous, may give a very biased impression of how progressive income taxation affects hours supply, efficiency, income distribution and tax revenue. The standard approach overestimates the negative-hours response of people with high wages (i.e. avoiders) to an increase in tax progressivity. It also overstates the extent of income redistribution that takes place and the revenue gains for the government. By neglecting the role of portfolio adjustments, the standard approach also underestimates (subject to the qualifications discussed in section 5) the overall efficiency losses imposed by high marginal tax rates.

There might also be real resource costs associated with tax avoidance (e.g. money and time spent for avoidance activities). Furthermore, avoidance responses are not the only behavioral responses to increasing tax rates. Higher marginal taxes may also induce taxpayers to evade some of their tax liability. These costs should also be considered when correctly estimating the dead-weight loss of an income tax. Our paper does not take these costs into account. Nevertheless, from our work, one can get an idea about the direction of the bias in traditional labor supply studies which treat asset income exogenously.

We believe that the mechanisms analyzed in the present paper are quite relevant in countries with high marginal tax rates, non-uniform capital taxation, and developed financial markets. In countries with less developed financial markets, lower marginal tax rates, and/or uniform capital taxation, there is less scope for avoidance. Also, our model is a single-period one, and it does not account for the fact that there is an intertemporal dimension to many tax arbitrage strategies (e.g. the postponed taxation associated with pension plans). Developing models that explore the implications of such alternative mechanisms certainly seem like a worthwhile exercise.

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